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(71) Applicant: **S. C. JOHNSON HOME STORAGE, INC.** [US/US]; 1525 Howe Street, Racine, WI 53403 (US).

(72) Inventors: **SAAD, Zain, E., M.**; 4233 Pleasant Lane, Racine, WI 53405 (US). **SMITH, David, A.**; 765 Weston Hills Drive, Brookfield, WI 53045 (US). **PRICE, William, D.**; 5200 Nakoma Drive, Midland, MI 48640 (US). **DAWKINS, Richard**; 1383 Savoy Lane, Saginaw, MI 48604 (US). **STANOS, Lawrence, C.**; 5119 Natalie Court, Midland, MI 48640 (US).

(74) Agents: **CHAPMAN, Kristin, L.** et al.; S. C. Johnson & Son, Inc., Patent Section, 1525 Howe Street, Racine, WI 53403 (US).

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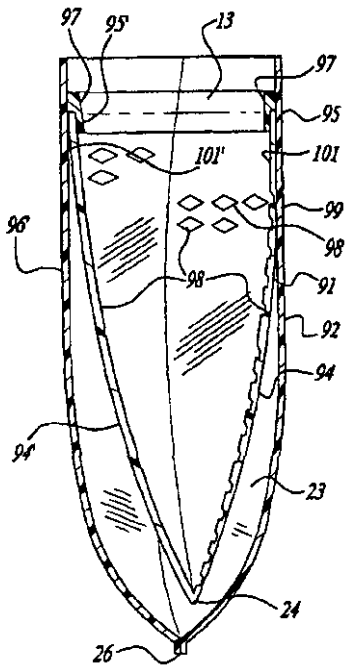
(54) Title: MULTI-LAYERED FREEZER STORAGE BAG



(57) **Abstract:** The present invention provides a freezer bag (10) comprising a multi-layered bag having at least one liner film (14) and an outer support bag (12). The liner film(s) have a first sidewall (32) and a second sidewall (321) attached along respective lateral edges forming edge seals (18, 181), each sidewall having a top edge, the outer support bag having two sidewalls (32, 321) attached together along respective lateral edges forming edge seals, each sidewall having top edges defining the opening

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to the multi-layered bag and the support bag having a folded edge (20) defining the bottom of the multi-layered bag, the top edge of at least one liner film being attached to an inner surface of the respective sidewall of the support bag wherein the liner film(s) are thermoplastic.

MULTI-LAYERED FREEZER STORAGE BAG

TECHNICAL FIELD

The invention generally concerns the packaging of food, particularly meat. The invention was made during attempts to make improved functional "freezer bags" for repackaging and freezer storing uncooked red meat by the ultimate consumer in a manner that reduces so called "freezer burn". Other aspects of the invention include methods for preparing the freezer bags and materials and methods for using the bags, for example.

BACKGROUND ART

Reclosable plastic storage bags are relatively old in the art. Today, plastic bags are typically available to the public in cartons identified for specific recommended "end use" (such as Storage Bags, Heavy Duty Freezer Bags, Vegetable Bags, Trash Bags). Often the bag itself is labeled by "end use", e.g., "ZIPLOC® BRAND Heavy Duty Freezer Bags".

The term "freezer bag" is hereby defined as a bag having significant functional utility in the storage of food in a freezer. "Freezer Bags" are typically available in the following sizes: 2 gallon; 1 gallon; pleated 1/2 gallon; quart; and pint.

The term "freezer burn" is hereby defined as the name for the dehydration that occurs when unpackaged or improperly packaged food is stored in the low humidity atmosphere of a freezer (see "Packaging Foods With Plastics", by Wilmer A. Jenkins and James P. Harrington, published in 1991 by Technomic Publishing Co., In., at page 305). Consumers typically describe freezer burn in terms of three main visual attributes: ice crystal formation, product dehydration and color change.

Freezer burn has remained a major complaint among consumers despite the commercial success of thick plastic freezer bags. In the short term, freezer burn can be a reversible process. In the long term, however, freezer burn causes a complex deterioration of food quality involving undesirable texture changes followed by chemical changes such as degradation of pigments and oxidative rancidity of lipids. Taste, aroma, mouth feel and color can all be ruined. Freezer burn of raw red meat is particularly critical because of its impact upon the color of the meat.

Aforementioned "Packaging Foods With Plastics" provides an excellent state of the art summary, with all the information on (commercial) "packaging fresh red meat collected in Chapter Seven". Curiously, the book does not appear to mention freezer burn, apart from defining it in the glossary.

Additional reference information is provided in "Keeping Food Fresh", an article in "Consumer Reports" for March 1994, at pages 143 - 147. The article contains a general overview of food storage products. More particularly, the article attempts to answer questions as to which packaging material (plastic, aluminum, waxed paper, bags, wraps or reusable containers) do the best job of (1) keeping food fresh for "the long haul", (2) at lowest overall cost, and (3) with minimum adverse environmental impact. It "top rates" ZIPLOC® Pleated Freezer Bags (at page 145). It points out that food stored in plastic containers can suffer from freezer burn if the container contains too much air. Concerning "wraps" (plastic films and freezer papers), interestingly it advised against double wrapping because of cost and environmental reasons and it was specifically noted that "our tests showed that double wrapping doesn't afford much extra protection anyway".

The patent literature contains descriptions of various types of bags having liners or double walls including some space between the walls. Some of these patents relate to the transportation and storage of food. U.S. Patent No. 4,211,091 (Campbell) concerns an "Insulated Lunch Bag". U.S. Patent No. 4,211,267 (Skovgaard) describes a "Carrying Bag" for "getting home with frozen food before it thaws. U.S. Patent No. 4,797,010 (assigned to Nabisco Brands) discloses a duplex paper bag as a "reheatable, resealable package for fired food". U.S. Patent No. 4,358,466 (assigned to The Dow Chemical Company) relates to an improved "Freezer to Microwave Oven Bag". The bag is formed of two wing shaped pouches on each side of an upright spout. U.S. Patent No. 5,005,679 (Hjelle) concerns "Tote Bags Equipped With A Cooling Chamber". All of these food bags appear to have very thick food contacting walls compared to the invention described hereinafter. None of these patents appear to focus on freezer burn.

A more recent development in the art is disclosed in U.S. Patent No. 5,804,265 which is assigned to S.C. Johnson Home Storage, Inc. This patent discloses an unique bag within a bag design specifically intended, although not

limited in use, to controlling freezer burn. While tests show that this bag within a bag embodiment is clearly an advancement over other known storage bags, improvements in terms of product efficiency and material cost savings, among others, are desirable.

DISCLOSURE OF THE INVENTION

In its broadest scope, the present invention provides a freezer bag comprising a multi-layered bag including an outer support bag and an inner liner. The outer support bag includes two sidewalls attached together along respective lateral edges forming edge seals, said sidewalls having top edges which define an opening to the multi- layered bag and a folded edge defining the bottom of the multi-layered bag. The inner liner generally includes at least one sidewall which is attached along at least one edge to an inner surface of the respective sidewall of the outer support bag. The inner liner also includes at least one free or discontinuous edge as opposed to all closed edges which gives rise to an inner bag.

The present invention further relates to a process for making multi-layered bags having an outer support bag and at least one inner liner comprising the steps of forwarding a first thermoplastic film having a first thickness and a first transverse web width, forwarding a second thermoplastic film including two separate sheets having a second total thickness and a second total transverse web width, the second transverse web width being smaller than the width of the first thermoplastic film, overlaying the second thermoplastic film onto the first thermoplastic film between the edges of the first film, attaching the second thermoplastic film to the first thermoplastic film, folding the films in the transverse direction and seal cutting the folded films to form a multi-layered bag.

The present invention also relates to a process for making multi-layered bags having an outer support bag and at least one inner liner comprising the steps of forwarding a first thermoplastic film having a first thickness and a first transverse web width, forwarding a second thermoplastic film including two separate sheets, the second film preferably having a second thickness and a second transverse web width which is smaller than the width of the first thermoplastic film, perforating or

slitting the second thermoplastic film, overlaying the second thermoplastic film onto the first thermoplastic film between the edges of the first film, attaching the second thermoplastic film to the first thermoplastic film, folding the films in the transverse direction and seal cutting the folded films to form a multi-layered bag.

Another process in accordance with the teachings of the present invention related to heat sealing at least two film webs comprising the steps of providing at least first and second film including at least one sheet, said webs capable of being heat sealed together, perforating or slitting the second thermoplastic film, overlaying the second film web onto the first film web, providing at least one sealing band of material having a temperature, mass and heat capacity sufficient to heat seal the second thermoplastic film to the first thermoplastic film and applying said band of sealing material to the overlaid film webs. Preferably, the band seal is compressed between rollers after having been applied.

Yet another process in accordance with the present invention relates to heat sealing at least two film webs comprising the steps of providing at least a first film and a second film including multiple sheets, said webs capable of being heat sealed together, perforating or slitting the second thermoplastic film, overlaying the multiple sheets of said second film web onto the first film web, providing at least one sealing band of material having a temperature, mass and heat capacity sufficient to heat seal the second thermoplastic film to the first thermoplastic film and applying said band of sealing material to the overlaid film webs. Preferably, the band seal is compressed between rollers after having been applied.

Further according to the present invention, there is a process for attaching at least two film webs comprising the steps of providing at least first and second film webs having first and second widths respectively, perforating or slitting the second film web, overlaying the second film web onto the first film web between parallel edges of the first film web, providing at least one sealing band of material capable of being heat sealed to at least a portion of both film webs and applying said sealing band of material along and over parallel edges of the second film web.

Still another process according to the teachings of the present invention relates to a process for attaching at least two film webs comprising the steps of providing at least a first film web having a first web width and a second film

including multiple sheets wherein the total of the multiple sheets gives a second web width, perforating or slitting the second film web, overlaying the multiple sheets of the second film web onto the first film web between parallel edges of the first film web, providing at least one sealing band of material capable of being heat sealed to at least a portion of both film webs and applying said sealing band of material along and over parallel edges of the second film web.

Further according to the present invention is an apparatus for making multi-layered bags having an outer support bag and at least an inner liner comprising means for forwarding a first thermoplastic film web having a first thickness and a first transverse web width between parallel edges, means for forwarding a second thermoplastic film web having a second thickness and a second transverse web between parallel edges, means for perforating or slitting said second thermoplastic film, and if necessary adjusting the width of the second web to be smaller than the width of said first web, means for overlaying the second thermoplastic film web onto the first thermoplastic film web between the parallel edges of the first film web, means for attaching the second thermoplastic film web to the first thermoplastic film web along parallel edges of the second thermoplastic film, means for folding the films in the transverse direction and means for seal cutting the folded films to form multi-layered bags.

Further according to the present invention there is an apparatus for attaching at least two film webs comprising means for providing at least a first film web having a first web width and a second film web including multiple sheets wherein the total of all the sheets gives a second web width, having first and second widths respectively, means for overlaying the second film web onto the first film web, means for providing at least one sealing band of material capable of being heat sealable to at least a portion of both film webs and means for applying said sealing band of material along and over parallel edges of the second film web.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1a is a front elevational view of a first reclosable multi-layered bag embodiment;

Fig. 1b is a cross-sectional view of Fig. 1a including a perforated inner liner;

Fig. 1c is a magnified view of the inner liner of Fig. 1b;

Fig. 1d is a cross-sectional view of the inner liner of Fig. 1a after tearing along the perforations;

Fig. 1e is a first elevational view of an alternative embodiment of Fig. 1a;

Fig. 2a is a front elevational view of a second reclosable multi-layered bag embodiment;

Fig. 2b is a cross-sectional view of Fig. 2a including a perforated inner liner;

Fig. 2c is a magnified view of the inner liner of Fig. 2a;

Fig. 2d is a cross-sectional view of the inner liner of Fig. 2a after tearing along the perforations;

Fig. 2e is a front elevational view of an alternative embodiment of Fig. 2a;

Fig. 3a is a front elevational view of a third reclosable multi-layered bag embodiment;

Fig. 3b is a cross-sectional view of the multi-layered bag of Fig. 3a;

Fig. 3c is a cross-sectional side view of the bag of Fig. 3a including two pieces of meat separated by the inner liner;

Fig. 4a is a front elevational view of a fourth reclosable multi-layered bag embodiment;

Fig. 4b is a cross-sectional view of the multi-layered bag of Fig. 4a;

Fig. 4c is a cross-sectional side view of the bag of Fig. 4a including a piece of meat;

Fig. 5a is a front elevational view of a multi-layered bag having a textured inner liner;

Fig. 5b is a cross-sectional view taken along line 5b-5b of Fig. 5a;

Fig. 5c is an enlarged cross-sectional view of a blanket seal for attaching the top edges of the liner bag to the sidewalls of the support bag;

Fig. 5d is an enlarged cross-sectional view of another embodiment of a

blanket seal for attaching the top edges of the liner bag to the sidewalls of the support bag;

Figs. 6a - 6f are enlarged cross-sectional and plan views of various preferred embossing patterns for embossing the inner liner;

Fig. 7 is a diagrammatic flow diagram for a process of the present invention for making freezer bags having a common edge seal between the inner liner and the outer bag;

Fig. 8 is an isometric view of one process for preparing and blanket sealing multi-layered bags of the present invention; and

Figure 8a is a sectional view of the multi-layered bag panel produced in the apparatus of Fig. 8;

Fig. 9 is a cross-sectional view of a first apparatus of making the multi-layered bags of the present invention;

Fig. 10 is an isometric view of another apparatus for preparing and blanket sealing multi-layered bags of the present invention;

Fig. 10a is a topographical view of the first and second webs of a multi-layered bag produced via the apparatus of Fig. 10;

Fig. 10b is a sectional view of the multi-layered bag panel produced via the apparatus of Fig. 10;

Fig. 11 is an isometric view of yet another apparatus for preparing and blanket sealing multi-layered bags of the present invention;

Fig. 11a is a topographical view illustrating the second web as two separate sheets.

Fig. 11b is a sectional view of the multi-layered bag panel produced via the apparatus of Fig. 11;

Fig. 12 is an isometric view of a further apparatus for preparing and blanket sealing a multi-layered bag of the present invention; and

Fig. 12a is a sectional view of the multi-layered bag panel produced via the apparatus of Fig. 12

DETAILED DESCRIPTION OF INVENTION

Referring to Figs. 1a - 1e, a multi-layered bag in accordance with the teachings of the present invention is shown. The multi-layered bag 10 generally comprises an outer bag 12 and an inner liner 14. The outer bag 12 is defined by side sealed edges 18 and 18' as well as a folded edge 20 occurring along a first end (bottom) 22 of the outer bag. Provided along a second end (top) 24 of the outer bag is a reusable closure 16, including for example mating male and female members, for releasably closing the multi-layered bag. The inner liner 14 includes side edges 26 and 26', which according to the embodiment of Fig. 1a, share a common edge seal with the outer bag as illustrated by reference numerals 18 and 18'. Optionally, free standing (not sealed) or may be the side edges 26 and 26' of the inner liner may be sealed separately from the side edges of the outer base as demonstrated in Fig. 1e.

Referring particularly to Figs. 1b and 1d, the inner liner 14 includes two sidewalls 32 and 32' which are formed upon slitting the inner liner 14, the first ends 30 and 30' of the two sidewalls 32 and 32' are sonically welded or otherwise attached to the inner surfaces 34 and 34' of the outer bag 12. As illustrated, while not required, it is preferable that the sidewalls 32 and 32' generally extend almost the entire length of the multi-layered bag 10.

Referring to Fig. 1c, the inner liner is shown to be perforated at lateral lines x and z occurring along the crotch 40 such that upon exerting sufficient pressure on the inner liner, the liner is torn along at least one of the perforation lines such that the sidewalls 32 and 32' are no longer continuous as shown most clearly with reference to Fig. 1d.

As shown in various figures, the inner liner is generally separable from the side walls 36 and 36' of the outer bag 12 except for those embodiments wherein common edge seals are employed. As will be illustrated with regard to additional figures contained herein, as the closure 16 is pulled apart to form an opening 38 foodstuffs are placed into the multi-layered bag between the layers 32 and 32'.

Among the numerous closures 16 which may be employed, examples of preferred reusable closures and information on their manufacture can be found in U.S. Patent Nos. 4,561,109; 4,363,345; 4,528,224; 5,070,854 and 5,804,265, all of

which are hereby incorporated by reference. Other possible closure systems include adhesives, velcro, mechanical closures, slide lock closures, draw string with string or tape, fold lock top, magnetic closures, dead fold closures (i.e., aluminum foil, wire folded, tape), heat seals, staples, handle strings, cable ties or twist ties, among others.

Interestingly, by tearing the inner liner along the perforations, pre-slitting the inner liner or forming the inner liner or web from multiple sheets as will be described in greater detail below, vent holes which were noted as being preferable according to U.S. Patent No. 5,804,265, can be eliminated. As such, air which can be trapped between the inner and outer bags of the aforementioned patent is no longer a concern.

Referring to Figs. 2a - 2e, an alternative multi-layered bag in accordance with the teachings of the present invention is shown. It should be noted that the same reference numerals will be utilized for identical components described under the embodiments of Figs. 1a - 1e and 2a - 2e, respectively.

In essence, the only difference between the embodiments of Figs. 1a - 1e and those of Figs. 2a - 2e lie in the construction of the crotch 40 of each embodiment. As illustrated with reference to Figs. 2b and 2c, the crotch 40' includes a single lateral perforation line x. In contrast, the crotch 40 of Figs. 1a - 1e includes multiple lateral perforation lines x and z respectively, provided along an excess of inner liner material. As shown in Figs. 2a and 2e, the lateral side seals between the outer bag and inner liner, if present, may be common or spaced apart.

By inserting foodstuff 44 through the opening 38 as shown most clearly in Fig. 2d, the perforation line x becomes torn to provide the separated sidewalls 32 and 32' of the inner liner 14. Depending on the shape of the foodstuff, the first end 22 of the multi-layered bag 10 will generally conform to the shape of the foodstuff, i.e., become more rounded.

Referring to Figs. 3a - 3c, still another multi-layered bag in accordance with the teachings of the present invention is illustrated. The outer bag 12 is essentially the same as disclosed with regard to the previously discussed embodiments. However, first end 30 of the inner liner 14 is the only portion which is attached to the inner surface 34 of the outer bag. The second end 30' is free standing. The length

of the inner liner is sufficiently long so that second end 30' of the inner liner approaches the second end 24 of the multi-layered bag. By providing an elongated continuous inner liner 14 as shown most clearly with reference to Fig. 3c, multiple foodstuff pieces 44 and 44' can be inserted into the bag wherein the foodstuff pieces are separated by sidewall 32'. Under this embodiment, it is preferable that the foodstuff be stored with the bag laying horizontally with the first sidewall 36 of the outer bag being disposed against the refrigerator or freezer bottom (not shown). By disposing the multi-layered bag of Figs. 3a - 3c in this manner, the inner liner 14 may substantially conform to the shape of the foodstuffs thereby protecting against undesirable conditions such as freezer burn, for example.

Referring to Figs. 4a - 4c, a still further embodiment of the multi-layered bag is shown. Disposed within outer bag 12 is a truncated inner liner 14 which is attached along a first end 30 to the inner wall 34 of the outer bag. The free end 30' of the inner liner terminates in proximity to the first end (bottom) 22 of the outer bag. Again, by disposing the bag in a horizontal position, the inner liner 14 may conform generally to the shape of the foodstuff 44 which is highly desirable. While Fig. 4a illustrates that the inner liner 14 may share a common side seal along one or both sidewalls with the outer bag, it is also possible that the inner liner 14 suspends freely within the outer bag excepting for the attachment 30.

Referring to Figs. 5a and 5b, a preferred embodiment of the multi-layered bag in accordance with the teachings of the present invention is shown. According to this embodiment, the inner liner 14 preferably includes a textured surface 50. By texturing or embossing the film of the inner liner, the liner exhibits improved performance attributed to an increase in the surface area of the film which in turn provides greater cling to the foodstuff surface than is exhibited by a smooth film. Additionally, this texturing or embossing effectively reduces the overall stiffness of the inner liner which improves cling as well. Among the numerous patterns and shapes which are available: diamonds, honeycombs, squares, spheres, triangles, cones, pyramids and the like as illustrated with reference to Figs. 6a - 6f have demonstrated good performance. The textured or embossed patterns as herein described also provide channeling of air away from the foodstuff as the inner liner comes in contact with the foodstuff, thus further conforming to the shape of the

foodstuff. The density of the textured elements which are typically in a specific pattern may be from about 6 to 50 units per linear inch of the surface of the inner liner and preferably from about 10 to about 20 units per linear inch of the surface of the liner. The textured surfaces will generally include a plurality of protrusions which extend inwardly. Various geometrically shaped protrusions are further illustrated with reference to Figs. 6a - 6f.

The method of attaching the inner liner to the outer bag may be any method which is known in the art, i.e., mechanical and/or adhesive, for example. The inner liner may, for example, be attached continuously and uniformly along the top edges or attached in a discontinuous or intermittent manner along the top edges. Useful examples of attaching the inner liner include by way of non-limiting example, hot air seam sealing, extrusion lamination, heated bar heat sealing, ultrasonic sealing, heated rollers or belt, adhesive film strips, infrared scaling, radio frequency sealing or vibration welding, by way of non-limiting example. The inner liner may also be attached to the support bag during manufacture by post applying closure profiles onto and over edges of the inner liner. A hinge type blanket seal as illustrated with reference to Figs. 5c and 5d. This so-called hinge type blanket seal is described in detail in U.S. Patent No. 5,804,265 which has been incorporated by reference.

Generally, the outer support bag and inner liner of the multi-layered bags of the present invention are made from a thermoplastic material or a blend of thermoplastic materials and can be comprised of the same or different material. The films may be made by a conventional cast or blown film process. Useful thermoplastics include, for example, polyolefins such as high density polyethylene (HDPE), low density polyethylene (LDPE), linear low density polyethylene (LLDPE), and polypropylene (PP); thermoplastic elastomers such as styrenic block copolymers, polyolefin blends, elastomeric alloys, thermoplastic polyurethanes, thermoplastic copolyesters and thermoplastic polyamides; polymers and copolymers of polyvinyl chloride (PVC), polyvinylidene chloride (PVDC), saran polymers, ethylene/vinyl acetate copolymers, cellulose acetates, polyethylene terephthalate (PET), ionomer (Surlyn), polystyrene, polycarbonates, styrene acrylonitrile, aromatic polyesters, linear polyesters, thermoplastic polyvinyl alcohols and useful materials listed hereinbefore that may be used to make an inner film

layer. Preferably, the outer support bag and the liner bag are both made of polyethylene and more preferably from a blend of low density polyethylene (LDPE) (about 0.92 density) and linear low density polyethylene (LLDPE) (about 0.925 density). Preferably, the inner liner film has a density of less than 0.930 g/cc.

Generally, the film of the inner liner has a Transverse Direction 2 Percent Secant Modulus (TDSM) of less than 40,000 pounds per square inch (psi) (2.75 x 10^8 Pa) and preferably less than 27,000 psi (1.86 x 10^8 Pa) as determined in accordance with ASTM D 832-83, Method A with a jaw gap of 4 inches, a specimen width of 1 inch, an initial strain rate of 0.25 inches/inch/minute, and a crosshead speed of 1 inch/minute. The modulus of a film in either the transverse or machine direction of the film is generally a measurement of the stiffness of the film. Typically, thermoplastic polyolefin films that are prepared by cast film processes that are known in the art have a TDSM of from about 20,000 to about 40,000 psi. Examples of commercially available resins that would result in cast or blown films having these tensile properties include, for example, LDPE 748 and LDPE 690 from The Dow Chemical Company.

Another useful characteristic of the film of the inner liner is the Z number as defined by the formula PxTDSM where t is the thickness of the film in mils and TDSM is the transverse direction modulus as defined above. The Z number describes the relative stiffness of the film as a function of the film's thickness and modulus. Generally, the inner liner has a Z number of less than 60,000 mil^3 psi. Preferably, the inner liner has a Z number of less than 20,000 mil^3 psi more preferably from about 2,000 to about 10,000 mil^3 psi and, even more preferably, from about 3,000 to about 6,000 mil^3 psi.

Preferably, the outer support bag has a Z value in a range of from about 50,000 to about 150,000 mil^3 psi 5.6 to 16.9 mm^3.kPa).

Generally, the outer support bag will have a nominal sidewall thickness of from about 1 to about 4 mils, preferably from about 1.3 to about 3.0 mils and, more preferably, from about 1.5 to about 2.0 mils. Nominal thickness refers to the thickness of the film prior to any surface treatment such as scoring, texturing, embossing and the like.

Generally, the inner liner will have a nominal sidewall thickness of from about 0.3 to about 1.0 mil and preferably has a nominal sidewall thickness of from about 0.5 to about 0.7 mil.

Preferably, the inner surface of the inner liner has a contact angle in the range of from 65° to 75° at 20° C relative to raw beef meat juice as determined by advancing contact angle determination using a contact goniometer f, for example, Model No. A-100, available from Rame-Hart. Contact angle is defined as the angle formed between a horizontal substrate and a line tangent to the surface of a drop of liquid at the point where the surface of the liquid drop meet the horizontal substrate. The contact angle is a function of the surface tension of the liquid. The lower degree of contact angle indicates a higher degree of wetting or adhesion of the liquid to the substrate.

The method of measuring the contact angle is as follows: 1) drops of the liquid to be measured (about 1 microliter) are placed on the measuring surface (liner bag film) of the contact goniometer; 2) The contact angles are measured on both sides of each of five drops; 3) Step two is repeated on different sections of the inner surface and the results are averaged to determine a mean contact angle. Examples of film that have a contact angle of between 65° to 75° at 20° C relative to a raw beef meat juice include a blend of LDPE and LLDPE available from The Dow Chemical Company.

The multi-layered bag of the present invention may also be made of films having different colors so to highlight the liner within a bag structure to the consumer. For example, the inner liner and support bag may be of a different color or tint or each or both may be opaque or clear.

The multi-layered bag of the present invention may also contain an inner liner and/or an outer bag that comprises a film or substrate that has been corona treated to improve the wetting characteristic of the film and thereby improve the meat adhering and/or printing characteristic of the film. Preferably, the inside surface or food contacting surface of the inner liner is corona treated. Useful teachings describing the process of corona treating plastic films are described in U.S. Patent No. 5,328,705, incorporated herein by reference.

The multi-layered bags of the present invention may also have a printed area on the support and/or the inner liner. Printed areas are used as a write-on surface or a write-on patch to record information relating to the contents of the bag.

While not bound by any particular theory, it is believed that the means by which the multi-layered bags of the present invention prevent freezer burn of meats is that the inner liner film clings and conforms to the surface of the meat and therefore prevents moisture loss and excludes air from the meat surface. Excluding moisture loss and air from the meat surface reduces the formation of ice crystals that lead to freezer burn or dehydration of the meat.

Referring to Fig. 7, a diagrammatic flow diagram for carrying out a process of manufacturing multi-layered bags in accordance with the teachings of the present invention is provided. As shown in the step illustrated by box 300, the inner liner film or second film (whether one sheet or multiple sheets) may be extruded or supplied from an unwind stand. Extrusion of the liner film may be by blown or cast extrusion of thermoplastic material as is known in the art. Step illustrated by box 310 provides that the support or first thermoplastic film is extruded having zipper type closure profiles on each respective film edge. The extrusion may be either convention cast or blown film. An example of an integral cast film process is described in U.S. Patent No. 4,263,079, incorporated herein by reference. Preferably, both of the films are cast extruded.

Next, as illustrated by box 320, the inner film may be slit or perforated wherein the inner liner is formed from a single sheet. In the step illustrated by box 330, the inner or second film is added or overlaid onto the first film. The second film is aligned such that the edges of the second film are between the closure profiles of the first film. The overlaying and alignment of the second film onto the first film is done using conventional guide means such as rollers and nip rolls. In step illustrated by box 335, the parallel edges of the liner or second film are heat sealed to the support or first film. The films may be heat sealed together using conventional heat sealing means such as a heated bar sealer, a hot air sealer, extrusion lamination, heated rollers and belts and the like. In step illustrated by box 340, the attached films web is folded and the closure profiles are joined. The web may be folded by conventional folding means known in the art. In step illustrated by

box 350, the folded film web is seal cut to form bags, the bags are stacked and the stacked bags are packed into a container. The attached films may be folded and seal cut into bags as described in U.S. Patent No. 5,062,825, incorporated herein by reference. Preferably, the male and female closure elements are interlocked after folding of the films and prior to seal cutting. The finished bags may be stacked, delivered and then packed into containers as described in U.S. Patent Nos. 5,302,080; 5,108,085 and 5,185,987, incorporated herein by reference.

Either one or both of the first and second films may be textured by, for example, embossing. Either or both of the film webs may be corona treated prior to or after being attached together. Preferably, the second thermoplastic film is corona treated and embossed prior to overlaying the second film onto the first thermoplastic film.

The second or liner film web may be perforated or slit prior to being overlaid onto the first or support film web using a process and an apparatus similar to that described in U.S. Patent No. 5,405,561.

An apparatus employed to carry out a preferred process for making the film web used for making multi-layered bags of the present invention is shown in Fig. 8 and an apparatus for attaching the two film webs is shown in Fig. 9. Fig. 8 is a schematic side view of the process providing and attaching film webs 400 and Fig. 9 is an isometric view of a process for attaching the film webs together prior to forming bags. Hereinafter, due to the high degree of similarity in the apparatuses employed to form the multi-layered bags of the present invention, whenever possible, identical references numerals will be employed for identical components.

Referring to Fig. 9, process 400 generally comprises a means for providing a support or first film web 410, a means for providing a liner or second film web 430, tension control means 440, means for perforating or slitting the second film web at 460 and a sealing or attaching means shown generally as 450. Means 410 generally comprises an extrusion means 412 in extrusion alignment with a cast roll 416 to form a support or first film web 414. The means for providing the first film web may also be any means known in the art and may be an extrusion process as described in U.S. Patent No. 5,049,223. Film web 414 passes through a conventional gauge control means 418 to a corona treatment means 420 wherein

the first film web 414 is corona treated as described hereinbefore, to prepare the film for later optional printing.

A liner or second film web 432 is provided by a roll or unwind stand 431. The second film 432 may also be provided by a conventional blown or cast film process as is known in the art. The second film web has a transverse web width that is smaller than the transverse web width of the first film web 414. Film webs 414 and 432 are fed in to tension control means such as nip rolls 440 so as to match the strain of each of the films. Matching the strain of the films is described hereinafter in more detail.

While the second film web may be supplied in a pre-perforated roll as shown in Fig. 8, it is also possible to perforate or slit the web as it approaches the rollers 472 as shown in other embodiments. The first and second film webs 414 and 432 are aligned and overlaid at roll 434 forming web 436. Web 436 is fed into a sealing means shown generally as 450. Web 436 changes orientation at roll 438 and is fed into sealing means 450. Sealing means 450 generally comprises an extrusion means or extruder 452, roll 454 and compression roll 456. A preferred sealing means is shown in Fig. 8 and described below. Extruder 452 provides a sealing band 458. Sealing band 458 is fed onto web 436 and overlaps the parallel edge of liner or second film 432. The sealing band 458 on web 436 passes between roll 454 and compression roll 456 and forming a blanket seal. Extrusion means or extruder 456 provides closure profiles 460. Closure profiles 460 are attached to the opposed parallel edges of the first film 414 as described in U.S. Patent No. 5,049,223, forming a web having a blanket seal and closure profiles, web 462. Web 462 having closure profiles is then folded, sealed and cut, stacked and packed as shown and described in Fig. 7. Either or both of the film webs may be textured or corona treated as described hereinbefore.

The second thermoplastic film or liner film may be attached to the first thermoplastic film or support film by means of an extruded blanket seal over or underlap the side edges of the liner film, hot air hem sealing, extrusion lamination (extruded thermoplastic film between the film layers), hot melt adhesive (placed over or under the edge of the top film layer), ultrasonic sealing, heated rollers or belts, adhesive film strips, infrared sealing, radio frequency sealing or vibration

welding. Use of any of the above means of attaching two film webs largely depends on the chemical and physical characteristics of the film webs. Preferably, the liner film is attached to the support film using an extruded hinge type blanket seal 97 as shown in Fig. 5c and hereinafter described. The process shown in Fig. 7 may be a continuous process or a step process. Preferably, the process is continuous.

Fig. 10 shows a process for attaching the second thermoplastic film web 432 to the first thermoplastic film web 414 and is indicated generally as process 450a. Referring to Fig. 10 in attaching a second thermoplastic film web 432 to a first thermoplastic film web 414 along parallel edges 470 of the second thermoplastic film web 432 to a first thermoplastic film web 414 along parallel edges 470 of the second thermoplastic film web according to the present invention, the second thermoplastic film web 432 is aligned with and overlaid onto a first thermoplastic film web 414 forming film web 436. The film webs pass between nip rolls 472 and pass under a sealing band extruder 452. A sealing band 458 of molten thermoplastic material is extruded onto the advancing webs in the machine direction so as to overlap the edge 470 of the second film web and thereby contact and attach to both film webs securing the films together. The attached film webs are fed through a set of compression or pinch rolls 454, 456 forming a blanket seal 459. A conventional second sealing band extruder is used to seal the opposite parallel edge of the second film web to the first film web. Film web 436 having a blanket seal 459 then passes through conventional guide rolls 474 and 476 so to orient the web 436 for folding and seal cutting to form bags.

The blanket seal 459 may be either a hinge type blanket seal 97 (Fig. 5c) or a heat seal type blanket seal 110 (Fig. 5d). Some of the advantages of the blanket sealing process include films may be attached continuously at a relatively high process rate, the blanket seal appears strong and aesthetically pleasing to consumers, the process is insensitive to other process variations and it does not produce a film tail as does other processes known in the art.

Generally, the sealing bands may be applied in any fashion so as to attach the two films together. Preferably, the first thermoplastic film has mateable male and female closure elements along opposing edges of the film web and the sealing

bands are applied equidistant from their respective closure profiles. More preferably, the sealing bands are applied equidistant from the respective edges of the first thermoplastic film such that mateable male and female closure elements may be applied to the support or first thermoplastic film after the film webs are attached.

Generally the sealing band may be made from any suitable thermoplastic material or combination of thermoplastic materials that are heat sealable to at least the portions of the thermoplastic films to be joined. Preferably, the sealing band is polyethylene and , more preferably, low density polyethylene. An example of a suitable commercially available LDPE useful in the present invention is LDPE 748, *commercially available from the Dow Chemical Company.*

When forming a hinge type blanket seal, the width of the sealing band may generally range from about 3 mm to the width of the support or first film web. Preferably, the width of the sealing band ranges from about 3 to about 76 mm and, more preferably, has a width of from about 6 to about 19 mm.

Generally, the sealing band used to form a hinge type blanket seal has a thickness of from about 13 to 254 microns (0.5 to 10 Mils) and preferably has a thickness of from about 25 to about 51 microns (1 to 2 mils) and more preferably from about 25.5 microns to about 38.2 microns (1.0 to 1.5 mils).

The sealing bands may be tinted, colored or textured so to highlight the liner within a bag structure to the consumer.

Since the sealing band normally does not heat seal the second film to the first film, the sealing band may advantageously be used to attach films that otherwise could not be heat sealed together. However, if the sealing band temperature, heat capacity and mass are sufficient and the liner film has an *appropriate thickness and sealing temperature, the extruded sealing band will* transfer enough heat through the liner film to heat seal it to the support film.

Generally, the width of the liner or second film web is less or smaller than the width of the first film web so that any portion of the seal band does not hang over the edge of the first film web after being applied. Preferably, the width of the liner or *second film is smaller than that of the width of the first film such that male and*

female closure profiles may be attached along opposed parallel edges of the first film web.

Generally, it is known in the art that to attach two webs together, it is desirable to match the percent stretch or strain in the two webs at the point they are joined. Matching the strain avoids a cross direction curling (CD Curl) phenomenon from occurring when the tension is released. In the machine direction, the tension in each web can be related as follows:

In the elastic region:

$$o = Ee = \frac{T}{t}$$

Where:

o = stress (psi)

E = modulus of elasticity (psi)

e = strain (in/in)

T = tension (PLI)

t = thickness (in)

Rearranging gives:

$$\epsilon = \frac{o}{E} = \frac{T}{tE}$$

To avoid machine direction (MD) puckering when an inner liner film is attached to an outer film.

$$\text{Set } \epsilon_{\text{Liner}} = \epsilon_{\text{Outer film}}$$

$$T_{\text{Liner}} = T_{\text{Outer}} \cdot \frac{t_{Liner} \cdot E_{Liner}}{t_{Outer} \cdot E_{Outer}}$$

For elastic films, it is known in the art that a material under tension in the machine direction will contract or "neck in" in the cross direction as a function of a material property known as Poisson's ration v. Poisson's ratio is a ratio of lateral strain to axial strain and is typically about 0.3 for polyethylene. Using Poisson's ration to relate the lateral strain to the axial strain and following a similar derivation

as above, the conditions required to match CD strain and avoid MD curl is as follows:

$$T_{Liner} = T_{Outer} \cdot \left[\frac{V_{outer} \cdot t_{Liner} \cdot E_{Liner}}{V_{Liner} \cdot t_{Outer} \cdot E_{Outer}} \right]$$

In practice, it is generally desirable to match the strain in both the machine and cross directions. The puckering can be minimized by a variety of means, including attaching webs that are similar in modulus and/or attaching webs that are similar in Poisson's ratio.

For a given set of materials, the puckering can be minimized by running at low tension where the films are attached so there will be less recovery. Depending on the application, the cross direction puckering can sometimes be considered insignificant compared to the machine direction.

Thus, it is desirable to maintain a relatively low tension in both webs and have matched machine direction strain in the webs at the point where they are joined. It is generally known in the art that a recommended tension in the machine direction range to effectively transport webs is from 10 - 25% of the yield tension, measured in PLL film tracking may become less precise at tensions below 10% of the yield tension. While the MD tension in each web can be maintained from 0 - 100% of the yield point, it has been found that above 25% of the yield point, there is a danger of localized thin spots in the web actually exceeding the yield point of the film, resulting in non-elastic stretching. It has been found that for successful attachment of extruded sealing bands, the tension is preferably run in the range of 2 - 15% of the yield tension in the machine direction.

For the preferred embodiment, it has been found advantageous to use lightweight idler rolls with low friction bearings, to minimize the drag between the liner film supply point and the point where a blanket seal is applied. Even then, the tension in the liner film at the supply point is often so low that there becomes a trade off between low enough tension to avoid puckering or stretching and high enough tension for adequate tracking. As a result, the embodiment shown in Fig. 9 has a set of nip rolls between the two web supply points and the point where a blanket seal is applied. Then the tension in the two webs can be matched at somewhat higher, for example, 15% of the yield point tension prior to the nip rolls.

Nip rolls allow different tension control zones. The strain in the webs can be matched by appropriate tension control between the supply points and the nip roll. The compression roll is run at slightly lower speed that the nip rolls so to release some of the MD tension, reducing it to the desired 2 - 15% range for blanket band sealing. A second set of nip rolls could optionally be added such that each web would run through a separate nip and could have separate tension control just prior to joining of the separate film webs as shown in Fig. 8.

Referring back to the process shown in Fig. 9, the tension of the liner or second thermoplastic film is generally controlled in the range of from about 0.05 to about 1 pound per linear inch width (PLI) (0.6 mil PE) by using a set of compressing or nip rollers 440 as is known in the art. In the preferred embodiment, each of the film webs pass through nip rolls so to match the strain on each of the films. Thus, the tension of each of the film webs may be different in order to match the strain on each of the films. Alignment of the liner or second film may be accomplished by using conventional edge guiding systems and/or edge trimming of the film web to width.

Referring again to Fig. 8, the tension of the combined films is generally controlled in the range of from about 0.02 to about 2.0 PLI (PE films) after the sealing band is applied to avoid stretching of the warm bands. The tension of the combined film webs may be controlled by conventional nip rollers 472. Stretching of the blanket bands may produce a "wave" and/or puckering in the final product.

Referring to Fig. 10, an alternate process according to the present invention for heat sealing at least two film webs comprises the steps of providing at least first and second film webs capable of being heat sealed together, overlaying the second film web onto the first film web, providing at least one sealing band of material having a temperature, mass and heat capacity sufficient to heat seal the second thermoplastic film to the first thermoplastic film and applying said band of sealing material to the overlaid film webs. This process is the same as the process shown in Fig. 8 except that the sealing band extruder 452 may be placed above any portion of the film web 436 so to heat seal the film webs together in the machine direction at any point across the web. Preferably, the sealing band is compressed between rollers 454, 456 after having been applied. Multiple sealing band

extruders 452 are used to provide multiple sealing bands 458 along the machine direction of the film web so as to form multiple heat seal type blanket bands as shown in Fig. 5d. The film webs may be provided by extrusion or from an unwind stand. The film webs to be heat sealed may be made of any thermoplastic materials capable of being heat sealed together including those materials described hereinbefore. The film webs may have the same width or be of different widths. Generally, the sealing band may be made of any extrudable material capable of heat sealing to film webs together. Preferably, the sealing band is made from thermoplastic materials including, for example, LDPE 748, available from The Dow Chemical Company.

Generally, the sealing band has a temperature, heat capacity and mass sufficient to heat seal two films together. Generally, the temperature of the sealing band is the temperature at which the particular material may be extruded without degrading.

Generally, the thickness of the film to be heat sealed should be of a thickness so as to allow heat transfer from the sealing band to the film to heat seal the film to the underlying film web. Generally, the thickness of the sealing band used to form a heat seal type blanket seal may range from about 0.5 to about 10 mil. Preferably, the sealing band for a heat seal type blanket seal has a thickness of from about 1.5 to about 3.0 mil and, more preferably, has a thickness of from about 1.5 to about 2 mil.

Generally, the width of the sealing band used to form a heat seal type blanket seal ranges from about 3 mm to the width of the support or first film web, preferably the width of the sealing band ranges from about 3 to about 76 mm and, more preferably, has a width of from about 6 to about 19 mm. As shown in the sectional view of Fig. 8a, the second film 432 of the resulting panel is bonded underneath the respective blanket seals 459.

Referring to Fig. 12, another process according to the present invention for attaching at least two film webs comprises the steps of providing at least first and second film webs having first and second widths respectively, the second width being smaller than the first width, optionally perforating or slitting the second film, overlaying the second film web onto the first film web between parallel edges of the

first film web, providing at least one band of sealing material and applying said band of sealing material along and over parallel edges of the second film web. Preferably, the sealing band 458 is applied to the fill webs by one or more extruders 452. Extruders 452 may be placed at any point above the film webs so to be capable of attaching the film webs together by forming a hinge type blanket seal in the machine direction. For example, multiple extruders 452 may be staggered above the parallel edges of three or more film webs so to attach the film webs together in succession. Preferably, the sealing band 452 is compressed between rollers 454, 456 after having been applied to the parallel edges of the film web or webs.

Preferably, the sealing bands 458 used to form hinge type blanket seals are applied equidistant from the respective edges of the first thermoplastic film. Generally, the sealing band may be made from any suitable thermoplastic material or combination of thermoplastic materials that are heat sealable to at least the portions of the film webs to be joined. The film webs to be joined may be, for example, thermoplastic as described hereinbefore, non-thermoplastic, fabrics, non-woven, co-extruded films and the like. The film substrates are attached together by the sealing band as shown in Fig. 5c.

When forming a hinge type blanket seal, the width of the sealing band may generally range from about 3 mm to the width of the support or first film web, preferably the width of the sealing band ranges from about 3 to about 76 mm and, more preferably, has a width of from about 6 to about 19 mm.

Generally, the sealing band used to form a hinge type blanket seal has a thickness of from about 13 to about 254 microns (0.5 to 10 mils) and, preferably, has a thickness of from about 25 to about 51 microns (1 to 2 mils) and, more preferably, from about 25.5 microns to about 38.2 microns (1.0 to 1.5 mils).

Referring to Figs. 10, 10a and 10b, the multi-layered bag is substantially similar to that of Fig. 8 except that the inner liner 432 is in the form of a single perforated sheet having an enlarged web width. The sheet or film, as it is otherwise referred to, is folded over as it advances through rollers 472 to be subsequently torn along the perforations.

Referring to Figs. 11, 11a and 11b, the main difference between this and other embodiments shown is that the inner liner is formed from two separate and distinct sheet rolls rather than a single sheet which is perforated or slit. As the two sheets are advanced through rollers 472, the sheets are overlapped as demonstrated most clearly in Fig. 11b.

Finally, as illustrated in Figs. 12 and 12a, although preferable in terms of bag strength, it is entirely possible to adhere the inner sheet(s) to the outer surfaces 482 of blanket seals 459 rather than the inner surface 480 as is normally done when blanket seals are employed in lieu of heat sealing or other previously enumerated sealing techniques.

While it will be apparent that the preferred embodiments of the invention disclosed are well calculated to fulfill the objects stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the spirit thereof.

INDUSTRIAL APPLICABILITY

CLAIMS:

1. A multi-layered bag comprising an outer bag and at least one inner liner, the outer bag having two sidewalls including inner and outer surfaces, said sidewalls being attached together along respective lateral edges defining the opening to the multi-layered bag and a folded edge defining the bottom of the multi-layered bag, the inner liner including at least one side wall having a top edge attached to the inner surface of said outer bag and at least one free edge.

2. The multi-layered bag of Claim 1 wherein the tip edge of the inner liner is attached to the inner surface of the outer bag and is spaced from the opening of the multi-layered bag.

3. A multi-layered bag according to Claim 1 wherein the sidewalls of the inner liner have a nominal thickness of from 0.3 to 1.0 mil.

4. A multi-layered bag according to Claim 3 wherein the inner liner comprises a thermoplastic film having a Transverse Direction 2 percent Secant Modulus (TDSM) of less than 40,000 psi when determined in accordance with ASTM D 832-83, Method A, having a jaw gap of 4 inches for specimens having a 1 inch width, except that the Initial Strain Rate is 0.25 inches per inch per minute with a cross head speed of 1 inch per minute.

5. A multi-layered bag according to Claim 4 wherein the inner liner comprises a thermoplastic film having a Z number of less than 60,000 mil^3 psi wherein Z is (t^3) x (TDSM) where t is the thickness of the film in mils and TDSM is the transverse direction secant modulus in accordance with ASTM D 83283, Method A, having a jaw gap of 4 inches for specimens having a 1 inch width, except that the Initial Strain Rate is 0.25 inches per inch per minute with a crosshead speed of 1 inch per minute.

6. A multi-layered bag according to Claim 4 wherein the Z number of the inner liner is less than 20,000 mil^3 psi.

7. A multi-layered bag according to Claim 3 wherein the outer bag comprises a film having a Z value in a range of from 50,000 to 150,000 mil^3 psi.

8. A multi-layered bag according to Claim 7 wherein the inner liner comprises a thermoplastic film comprising homopolymers and copolymers of ethylene.

9. A multi-layered bag according to Claim 1 wherein the top edge of the inner liner is attached to a sidewall of the outer bag by a hinge type blanket seal or a heat seal type blanket seal.

10. A multi-layered bag according to Claim 1 wherein the inner liner is textured.

11. A multi-layered bag according to Claim 1 wherein the outer bag has mateable male and female closure elements along opposed inner surfaces.

12. A multi-layered bag according to Claim 11 wherein the inner liner is additionally attached to the outer bag along lateral edges of the common edge seals.

13. A multi-layered bag according to Claim 12 wherein the top edge of the inner liner is attached to a sidewall of the outer bag by a blanket seal.

14. A multi-layered bag according to Claim 13 wherein the inner surface of the sidewall of the inner liner is corona treated.

15. The multi-layered inner bag of Claim 1 wherein the edge seals of the inner liner are separate from the edge seals of the outer bag.

16. The multi-layered bag of Claim 1 wherein the top edge of the inner liner is attached to a sidewall of the support bag by hot melt adhesive or a hot air hem seal.

17. The multi-layered bag of Claim 1 wherein the inner liner has a color that is different from the color of at least part of the support bag.

18. The multi-layered bag of Claim 1 wherein the inner liner includes a first sheet attached along the inner surface of a first sidewall and a second sheet attached along the inner surface of a second sidewall, said first and second sheets being discontinuous.

19. A process for making a multi-layered bag having an outer bag and an inner liner, said process comprising the steps of:

forwarding a first thermoplastic film web having a thickness of greater than 1 mil and a first transverse web width between parallel edges;

forwarding at least a second thermoplastic film web having a thickness of less than 2 mil and a second transverse web width between parallel edges, the second transverse web width being smaller than the width of the first thermoplastic film;

perforating or slitting said second thermoplastic film;

overlaying the second thermoplastic film web onto the first thermoplastic film web between the parallel edges of the first film web;

attaching the second thermoplastic film web to the first thermoplastic film web along parallel edges of the second thermoplastic film;

folding the films in the transverse direction; and

seal cutting the folded films to form a multi-layered bag.

20. The process of Claim 19 including the step of applying mateable male and female closure elements along opposed parallel edges of the first thermoplastic film web.

21. The process according to Claim 19 wherein the films are attached by applying a hinge type blanket seal or a heat seal type blanket seal.

22. The process according to Claim 19 wherein said first thermoplastic film web has mateable male and female closure elements along opposed parallel edges and said second thermoplastic film web is overlaid onto said first thermoplastic film web between said closure elements.

23. The process of Claim 19 wherein said second thermoplastic film web is corona treated.

24. The process of Claim 19 wherein said second thermoplastic film webs are polyethylene.

25. The multi-layered bag of Claim 19 wherein the inner liner includes a first sheet attached along the inner surface of a first sidewall and a second sheet attached along the inner surface of a second sidewall.

26. A process for making a multi-layered bag having an outer bag and an inner liner, said process comprising the steps of:

forwarding a first thermoplastic film web having a thickness of greater than 1 mil and a first transverse web width between parallel edges;

forwarding at least a second thermoplastic film web including first and second sheets having a thickness of less than 2 mil and a second total transverse web width which is smaller than the width of the first thermoplastic film;

overlaying the second thermoplastic film web onto the first thermoplastic film web between the parallel edges of the first film web;

attaching the second thermoplastic film web to the first thermoplastic film web along parallel edges of the second thermoplastic film;

folding the films in the transverse direction; and

seal cutting the folded films to form a multi-layered bag.

27. The process of Claim 26 including the step of applying mateable male and female closure elements along opposed parallel edges of the first thermoplastic film web.

28. The process according to Claim 26 wherein the films are attached by applying a hinge type blanket seal or a heat seal type blanket seal.

29. The process according to Claim 26 wherein said first thermoplastic film web has mateable male and female closure elements along opposed parallel edges and said second thermoplastic film web is overlaid onto said first thermoplastic film web between said closure elements.

30. The process of Claim 26 wherein said second thermoplastic film web is corona treated.

31. The process of Claim 26 wherein said second thermoplastic film webs are polyethylene.

32. A process for heat sealing at least two film webs comprising the steps of:

providing at least first and second film webs capable of being heat sealed together;

perforating or slitting said second film web;

overlaying the second film web onto the first film web, providing at least one sealing band of material having a temperature, mass and heat capacity sufficient to heat seal the second thermoplastic film to the first thermoplastic film; and

providing at least one sealing band of material capable of being heat sealable to at least a portion of both film webs; and

applying said sealing band of material along and over parallel edges of the second film web.

33. The process of Claim 32 further comprising the step of passing the sealing bands through compression rolls.

34. A process for attaching at least two film webs comprising the steps of:

providing a first film web having a first width and a second film web including first and second sheets, said second film web having a second total width;

overlaying the second film web onto the first film web between parallel edges of the first film web;

providing at least one sealing band of material capable of being heat sealable to at least a portion of both film webs; and

applying said sealing band of material along and over parallel edges of the second film web.

35. The process of Claim 34 further comprising the step of passing the sealing bands through compression rolls.

36. An apparatus for making multi-layered bags having at least an inner liner bag and an outer support bag comprising:

means for forwarding a first thermoplastic film web having a thickness of greater than 1 mil and a first transverse web width between parallel edges;

means for forwarding at least a second thermoplastic film web having a thickness of less than 2 mil and a second transverse web width between parallel edges, the second transverse web width being smaller than the width of the first thermoplastic film;

means for perforating or slitting said second transverse web;

means for overlaying the second thermoplastic film web onto the first thermoplastic film web between parallel edges of the first thermoplastic film;

means for folding the films in the transverse direction; and

means for seal cutting the folded films to form bags.

37. An apparatus for making multi-layered bags having at least an inner liner bag and an outer support bag comprising:

means for forwarding a first thermoplastic film web having a thickness of greater than 1 mil and a first transverse web width between parallel edges;

means for forwarding a second thermoplastic film web including two disconnected sheets having a thickness of less than 2 mil;

means for overlaying the second thermoplastic film web onto the first thermoplastic film web;

means for folding the films in the transverse direction; and

means for seal cutting the folded films to form bags.

38. A process for heat sealing at least two film webs comprising the steps of: providing at least first and second film webs capable of being heat sealed together;

perforating or slitting said second film web;

overlaying the second film web onto the first film web, providing at least one sealing band of material having a temperature, mass and heat capacity sufficient to heat seal the second thermoplastic film to the first thermoplastic film; and

providing at least one sealing band of material capable of being heat sealable to at least a portion of both film webs; and

applying said sealing band of material along and over parallel edges of the second film web.

39. The process of Claim 38 further comprising the step of passing the sealing bands through compression rolls.

40. A process for heat sealing at least two film webs comprising the steps of: providing at least first and second film webs capable of being heat sealed together;

providing at least one sealing band of material capable of being heat sealable to at least a portion of the first and second film webs to said first film web;

overlaying the second film web onto the first film web; and

applying said sealing band of material along and over parallel edges of the second film web.

41. The process of Claim 40 further comprising the step of passing the sealing bands through compression rolls.

42. The process of Claim 40 further comprising the step of perforating or slitting the second film web prior to being applied to said first film web.

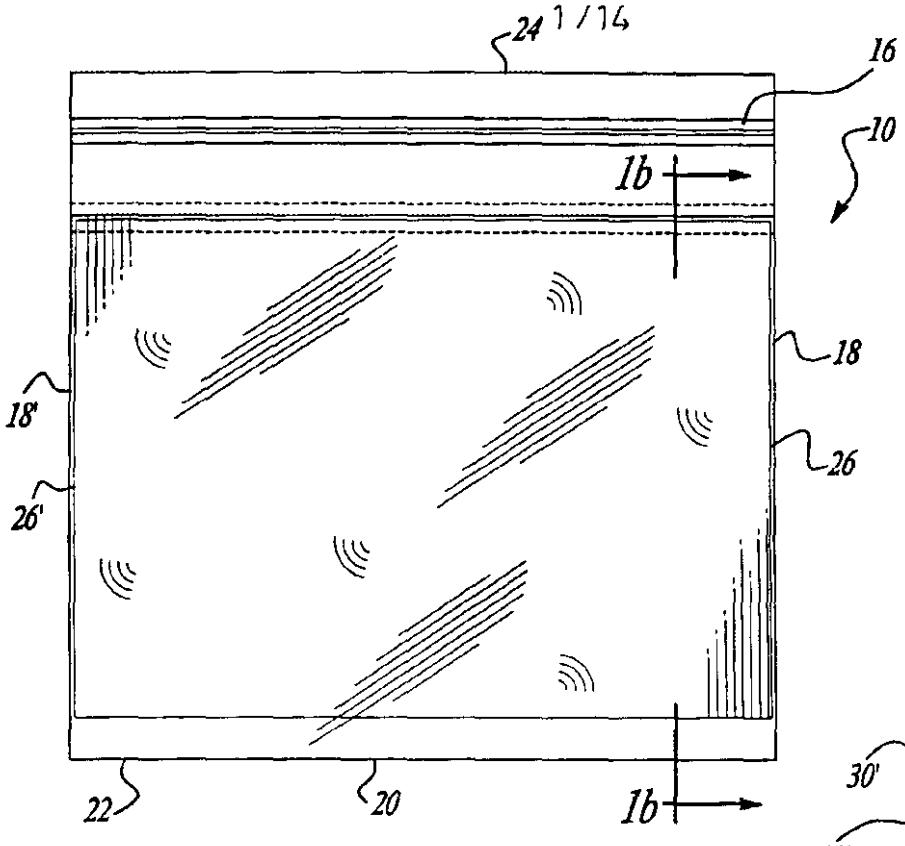


Fig-1a

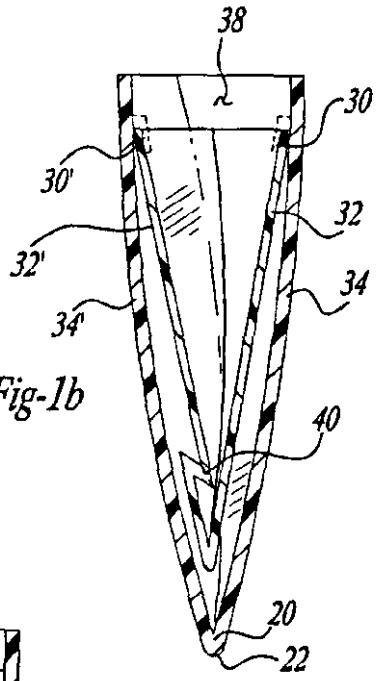


Fig-1b

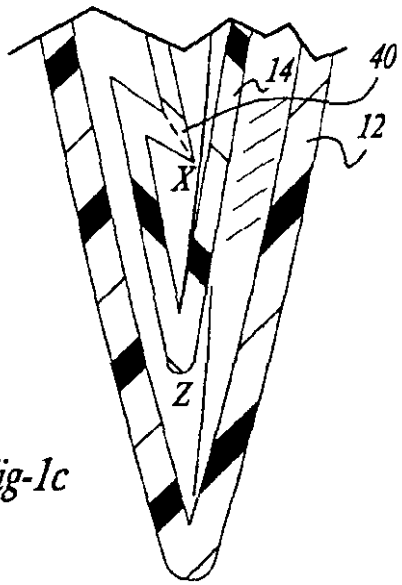


Fig-1c

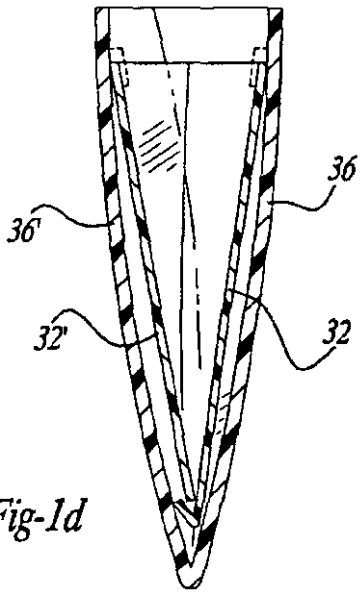


Fig-1d

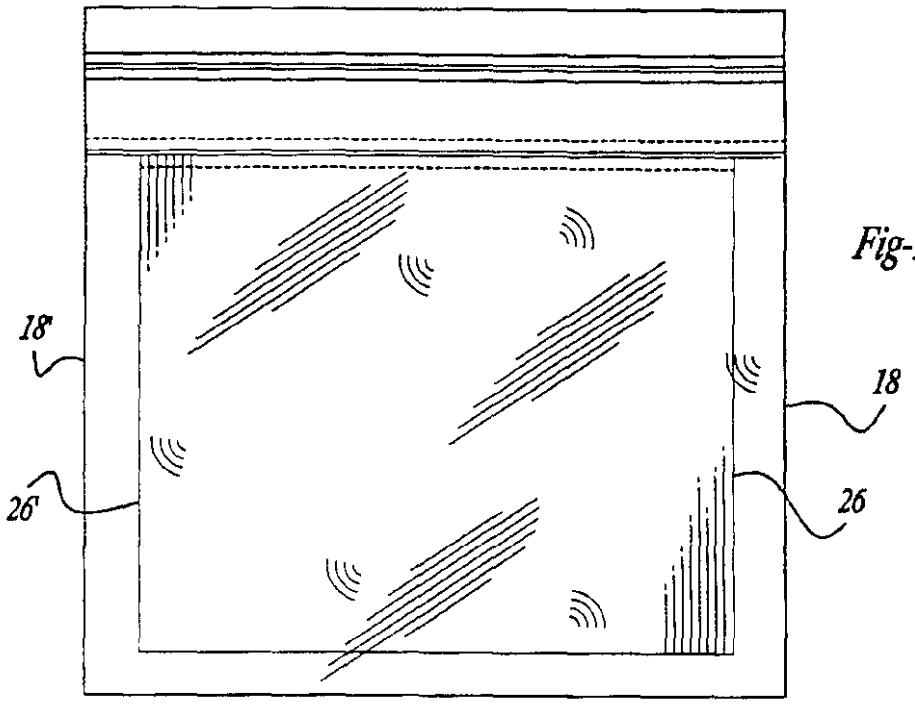


Fig-1e

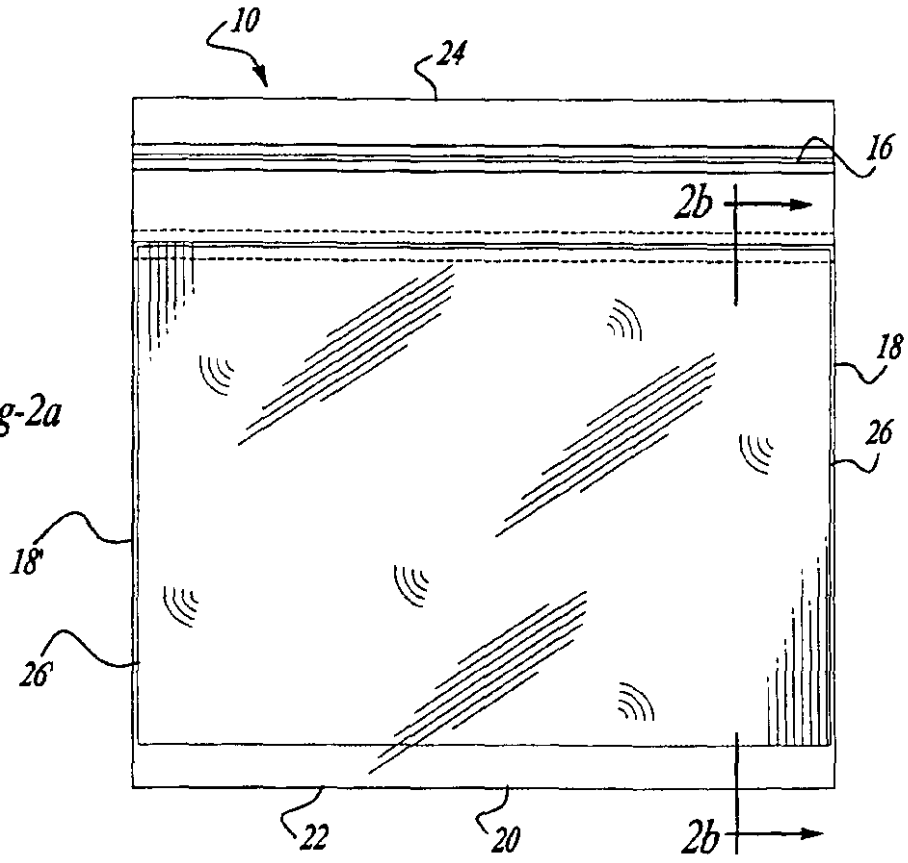


Fig-2a

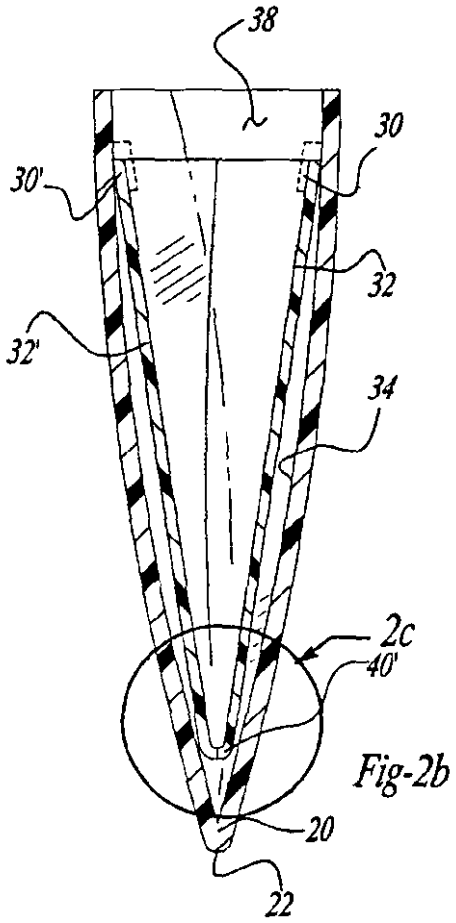
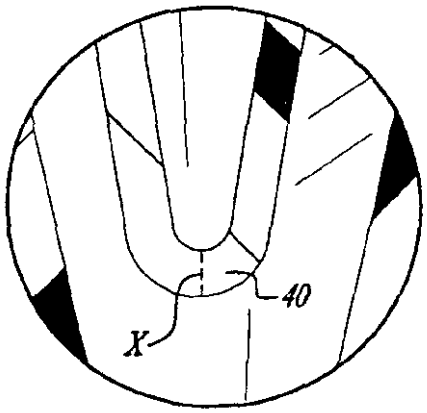


Fig-2b



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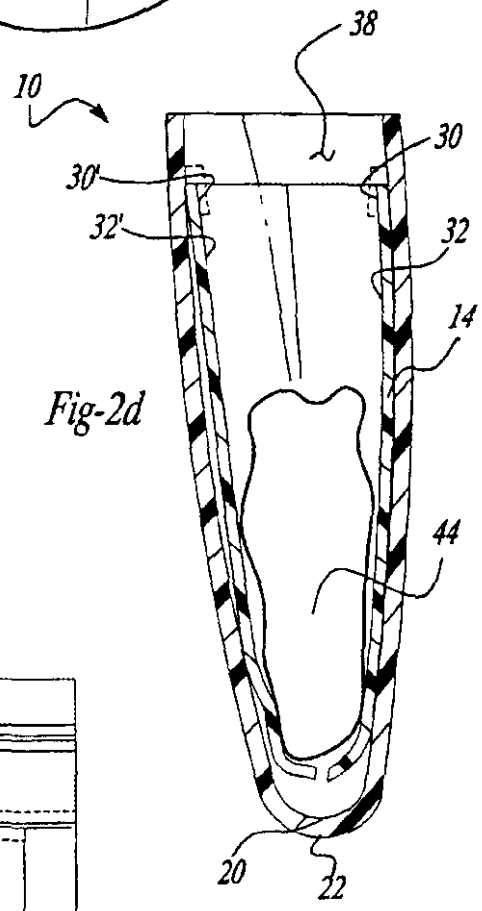

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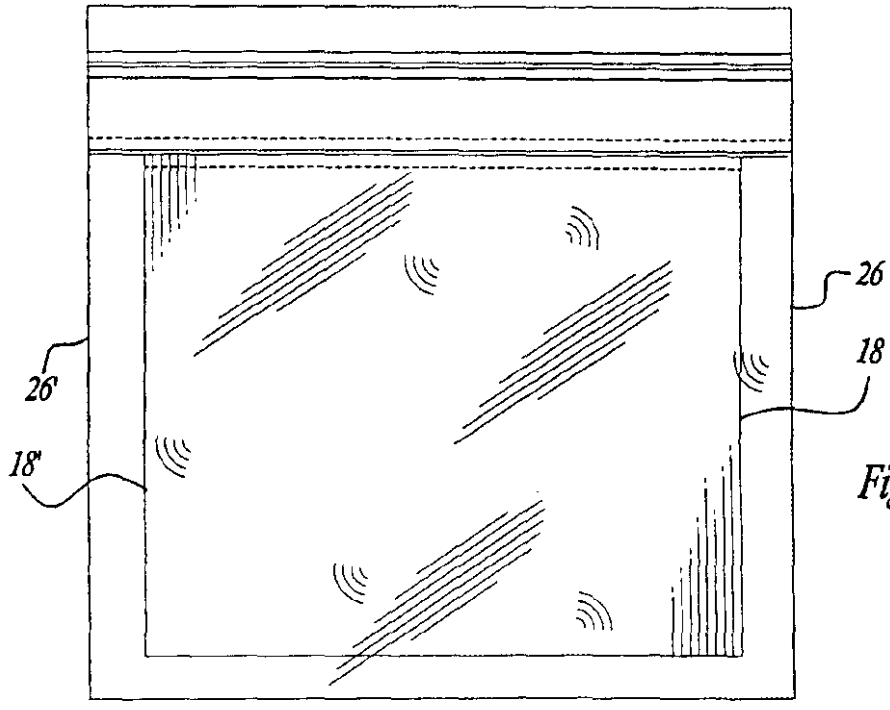
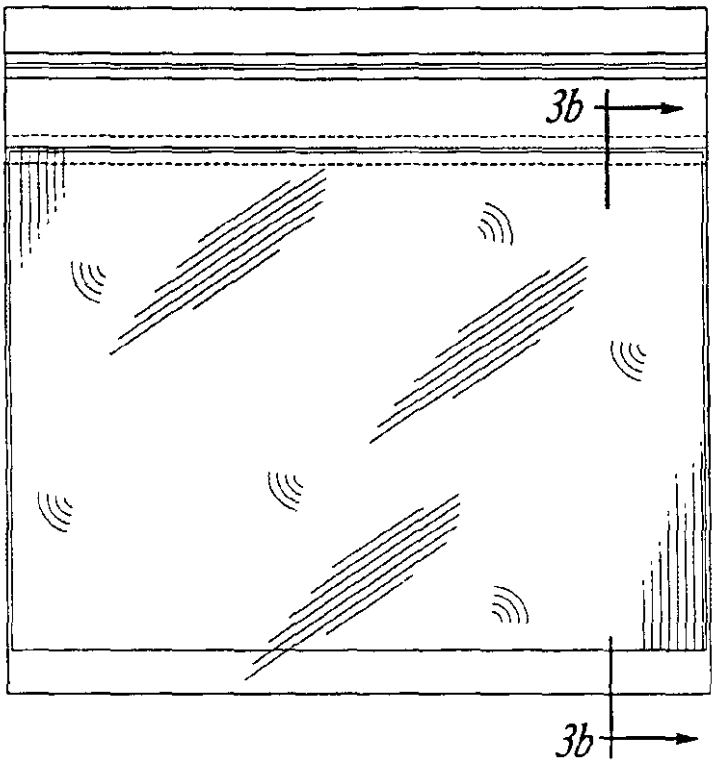


Fig-2e



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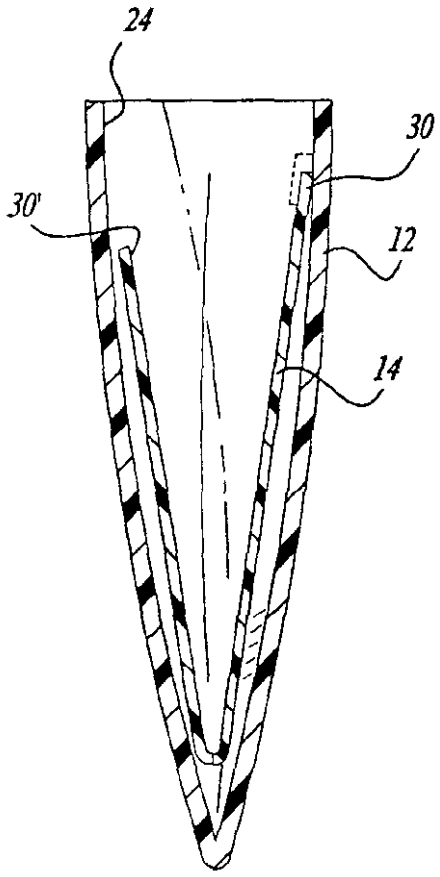

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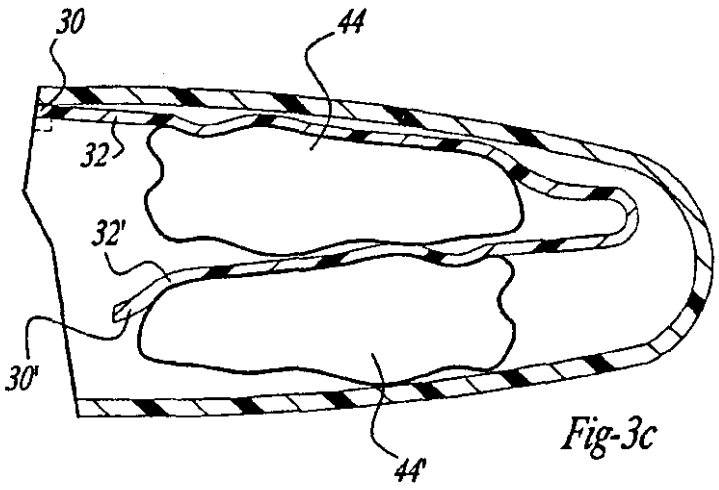
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Fig-3c

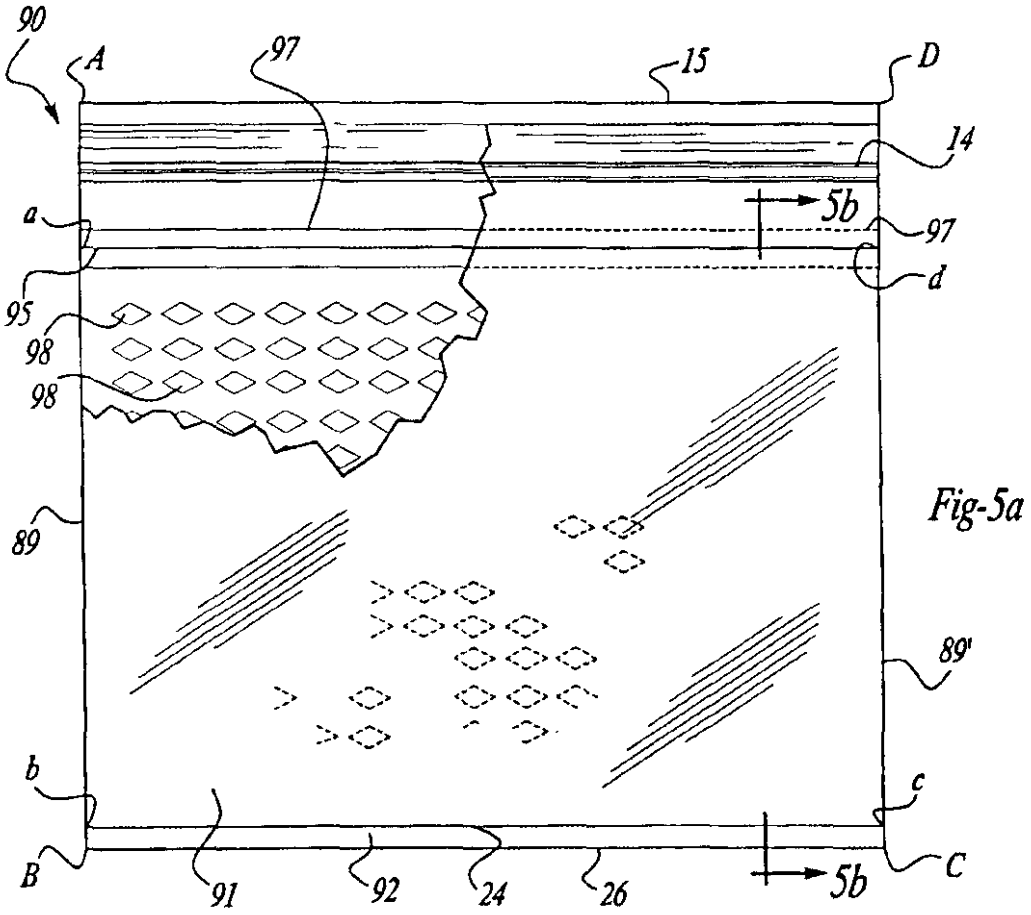
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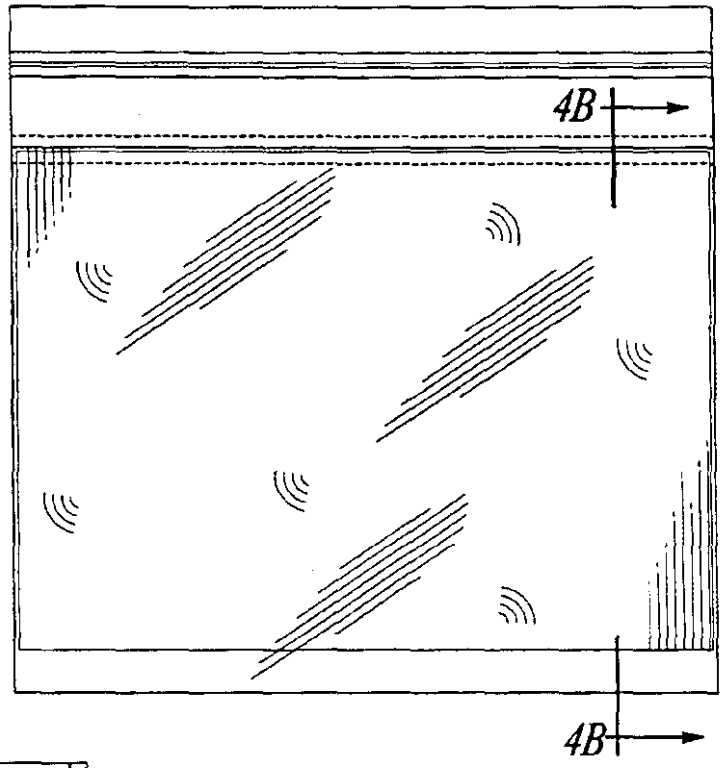
Fig-5a



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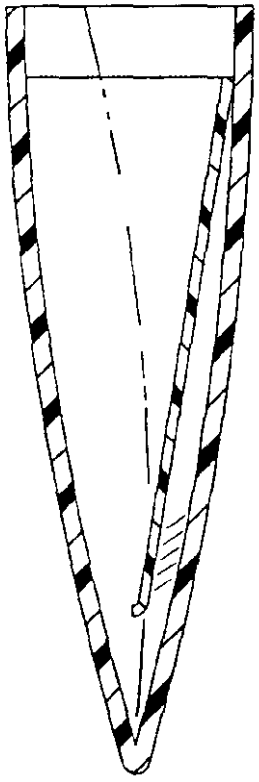

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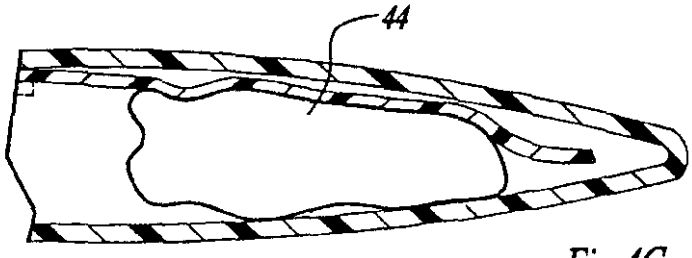

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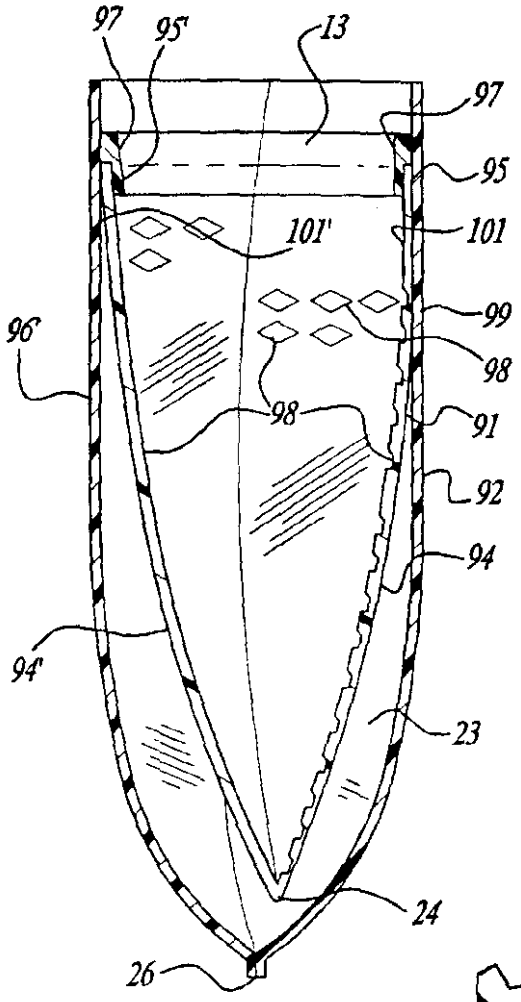

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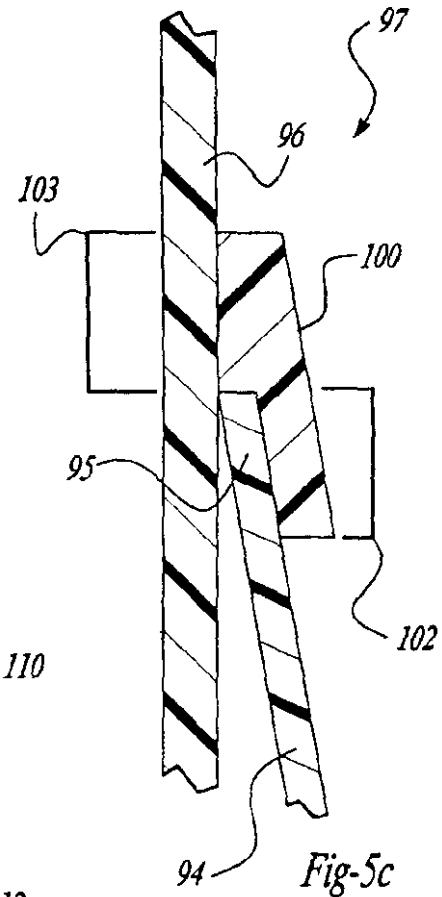

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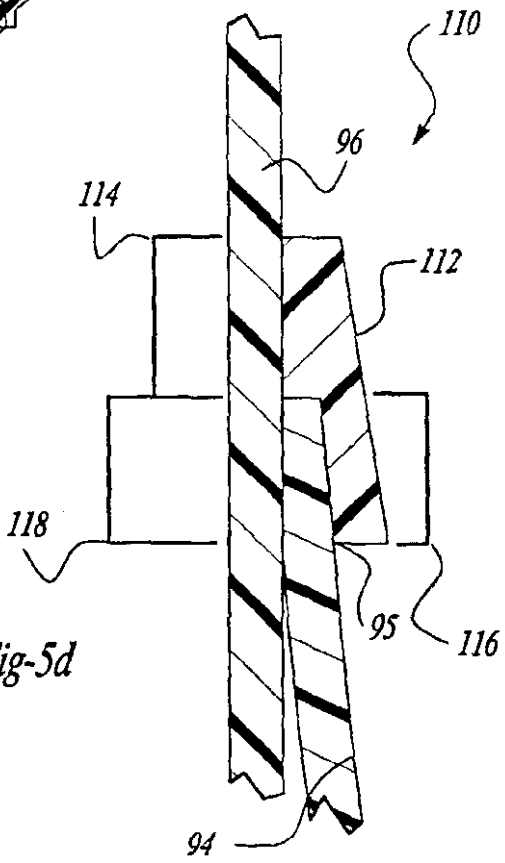

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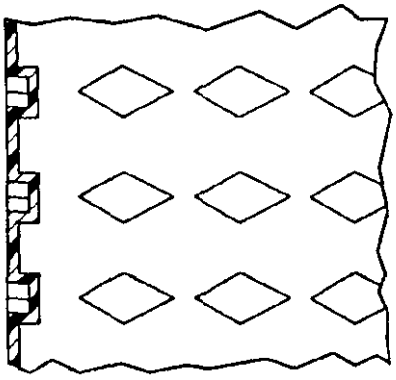
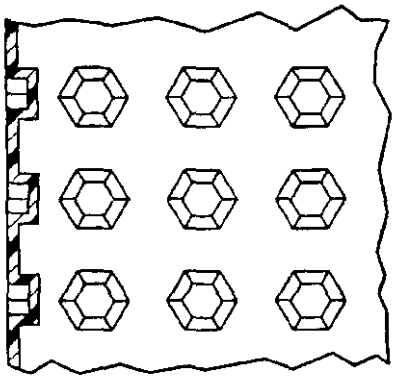


Fig-6a



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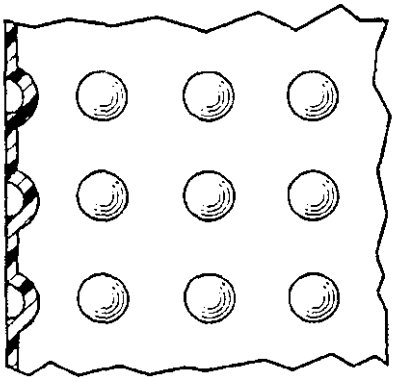

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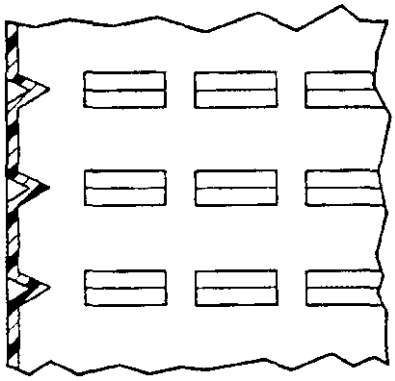

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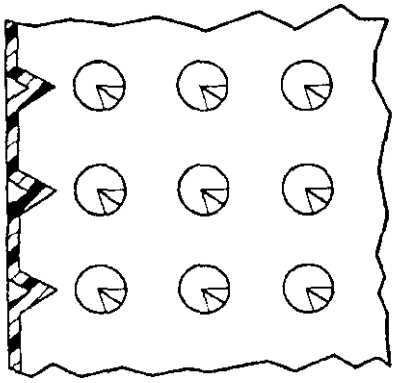

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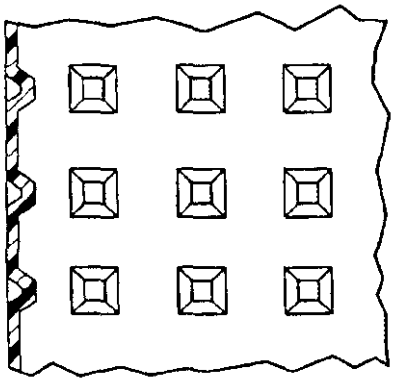

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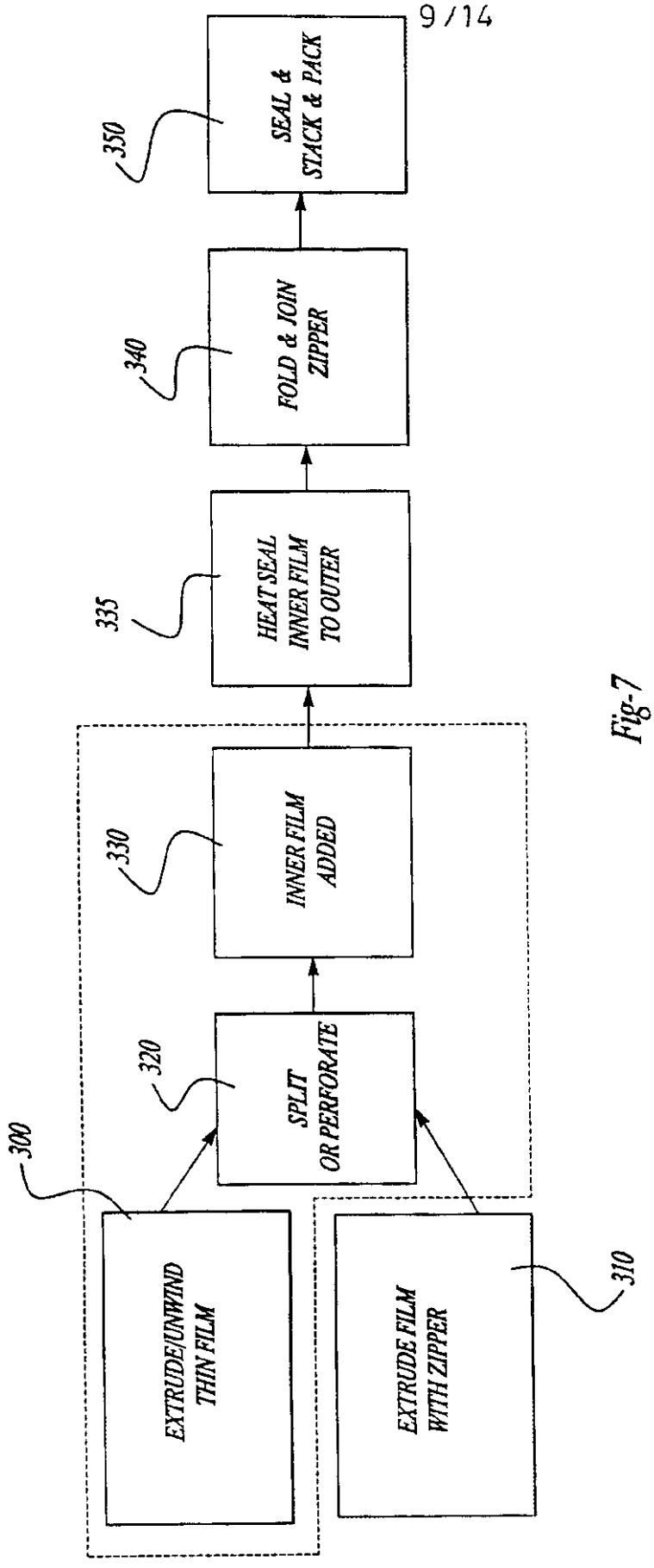
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EXTRUDE/UNWIND THIN FILM
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EXTRUDE FILM WITH ZIPPER
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SPLIT OR PERFORATE
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INNER FILM ADDED
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HEAT SEAL INNER FILM TO OUTER
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FOLD & JOIN ZIPPER
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SEAL & STACK & PACK

Fig-7

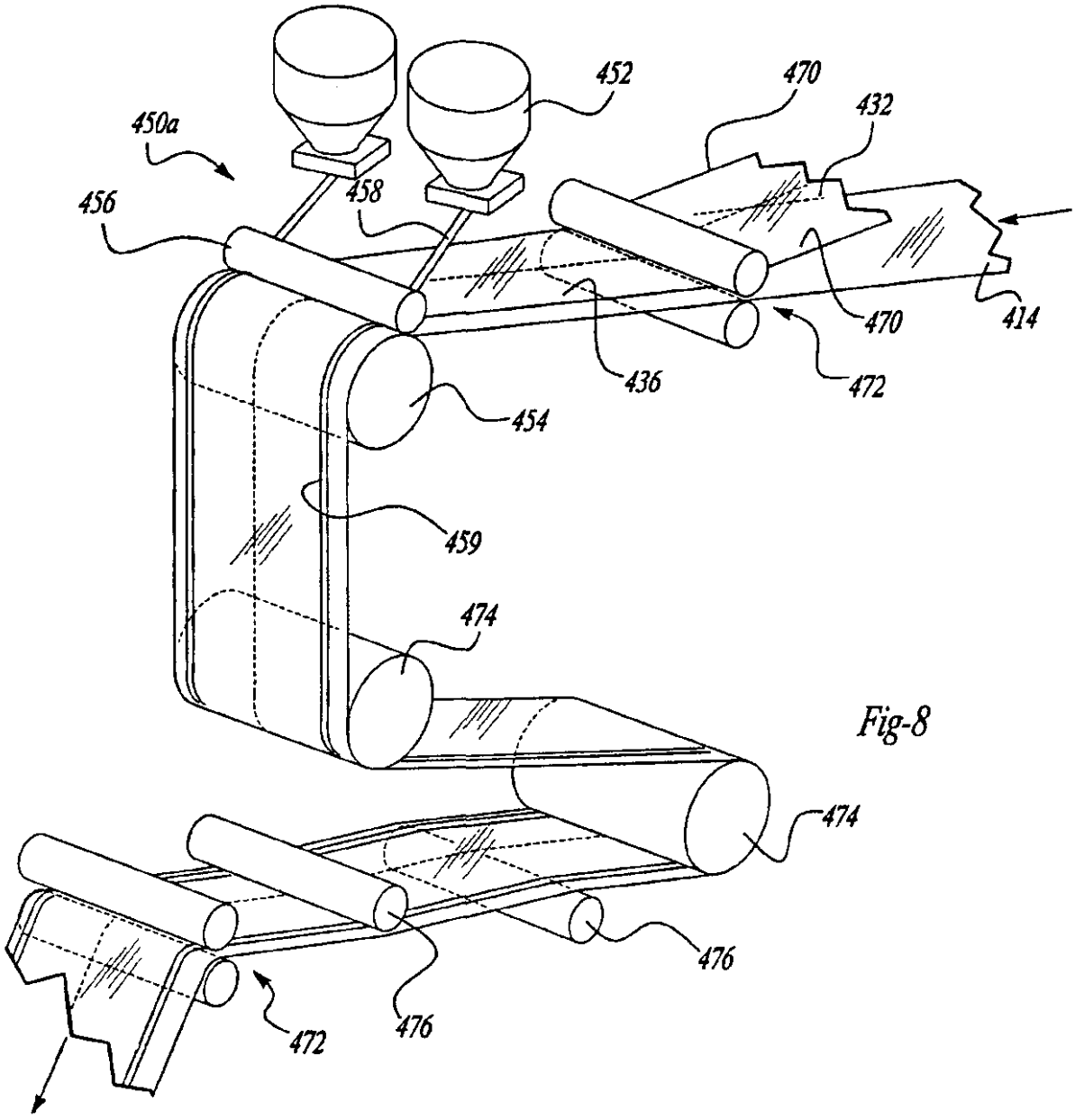
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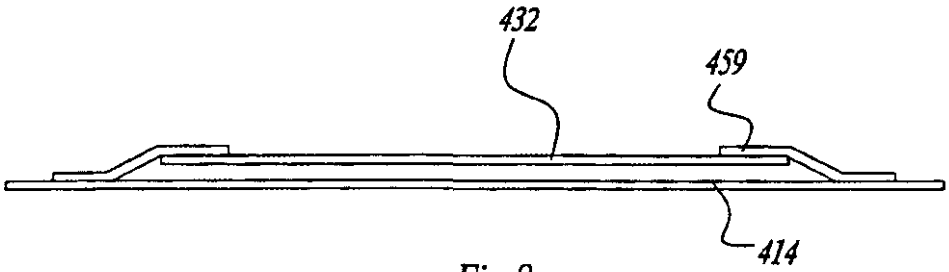
Fig-8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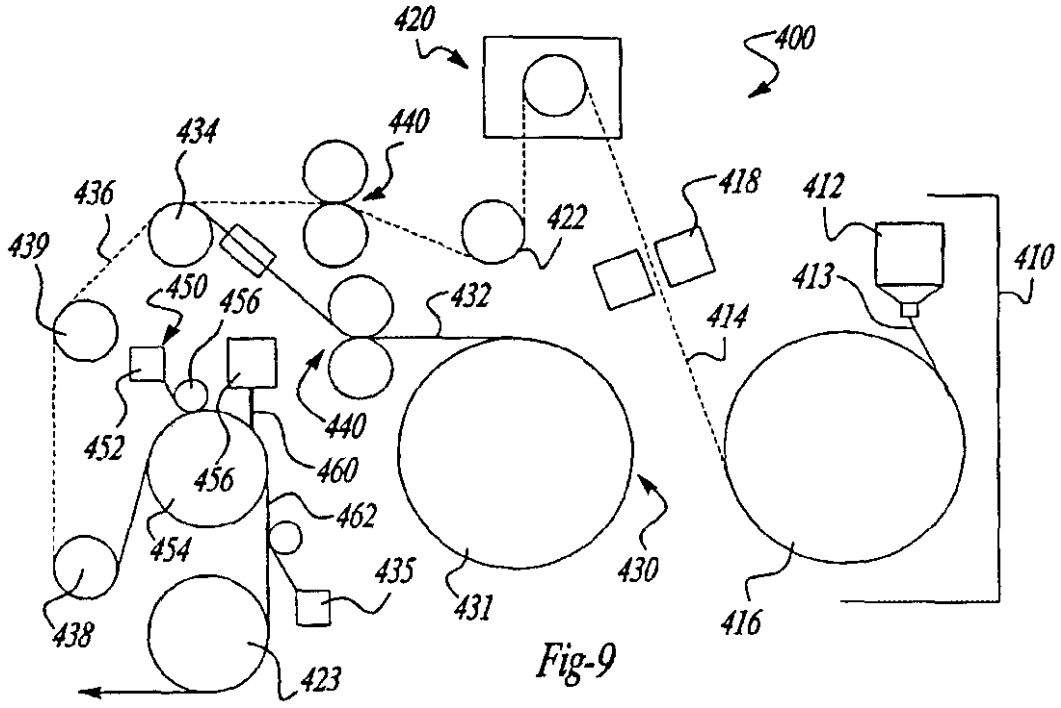
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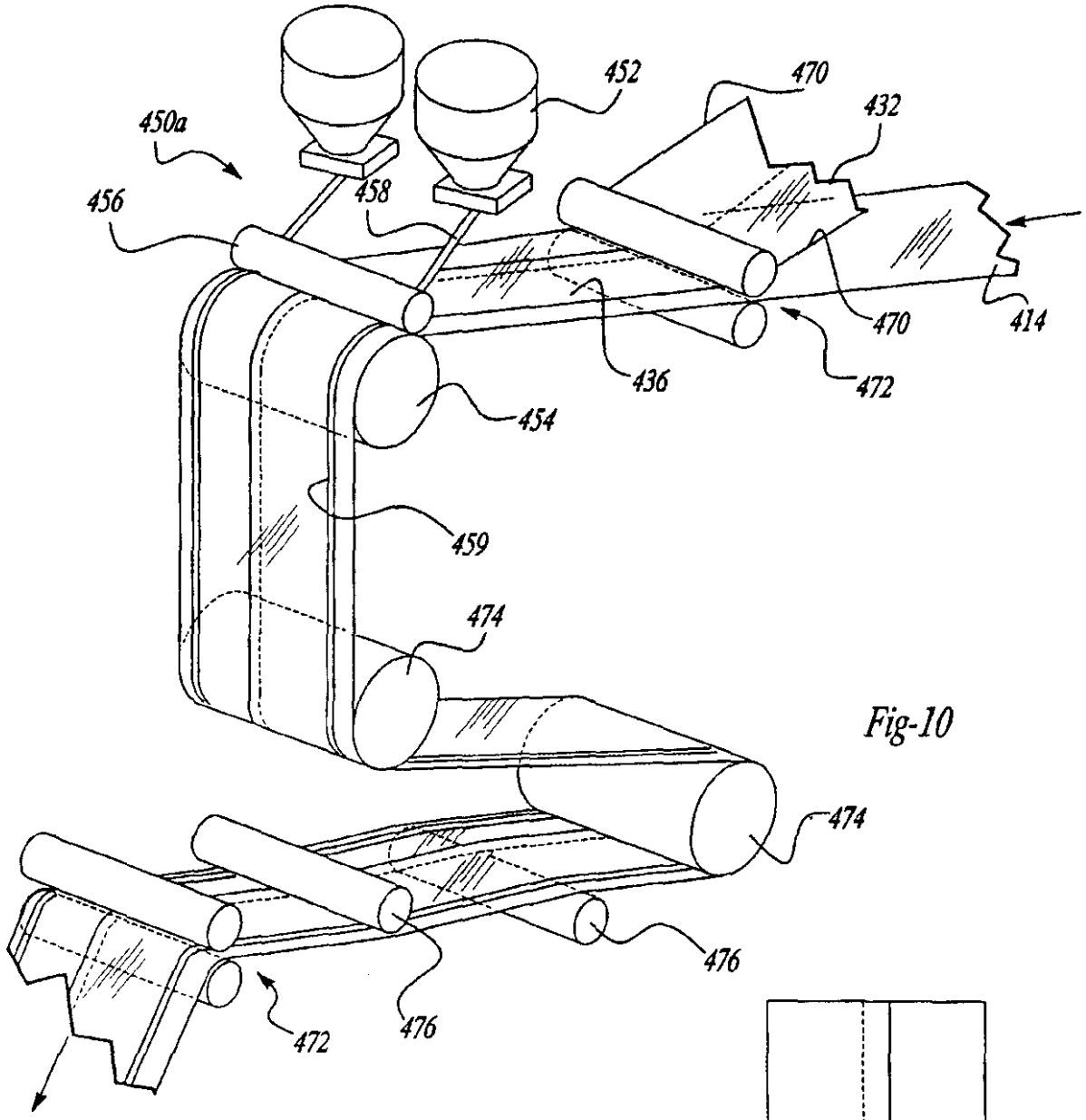
Fig-9



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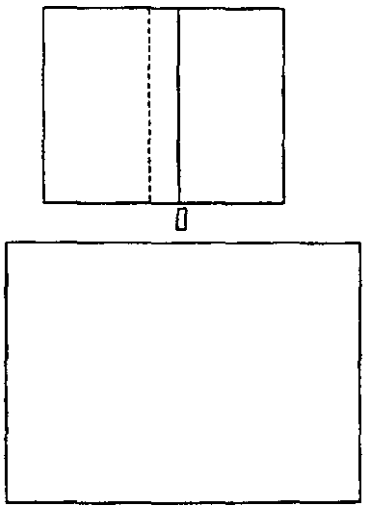
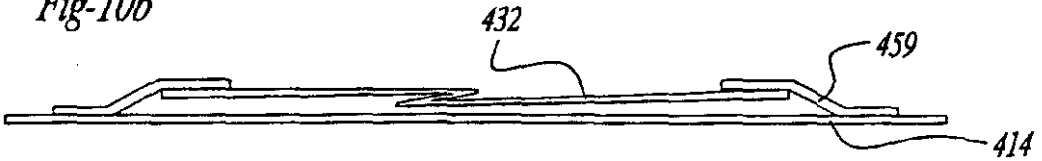


Fig-10a

Fig-10b



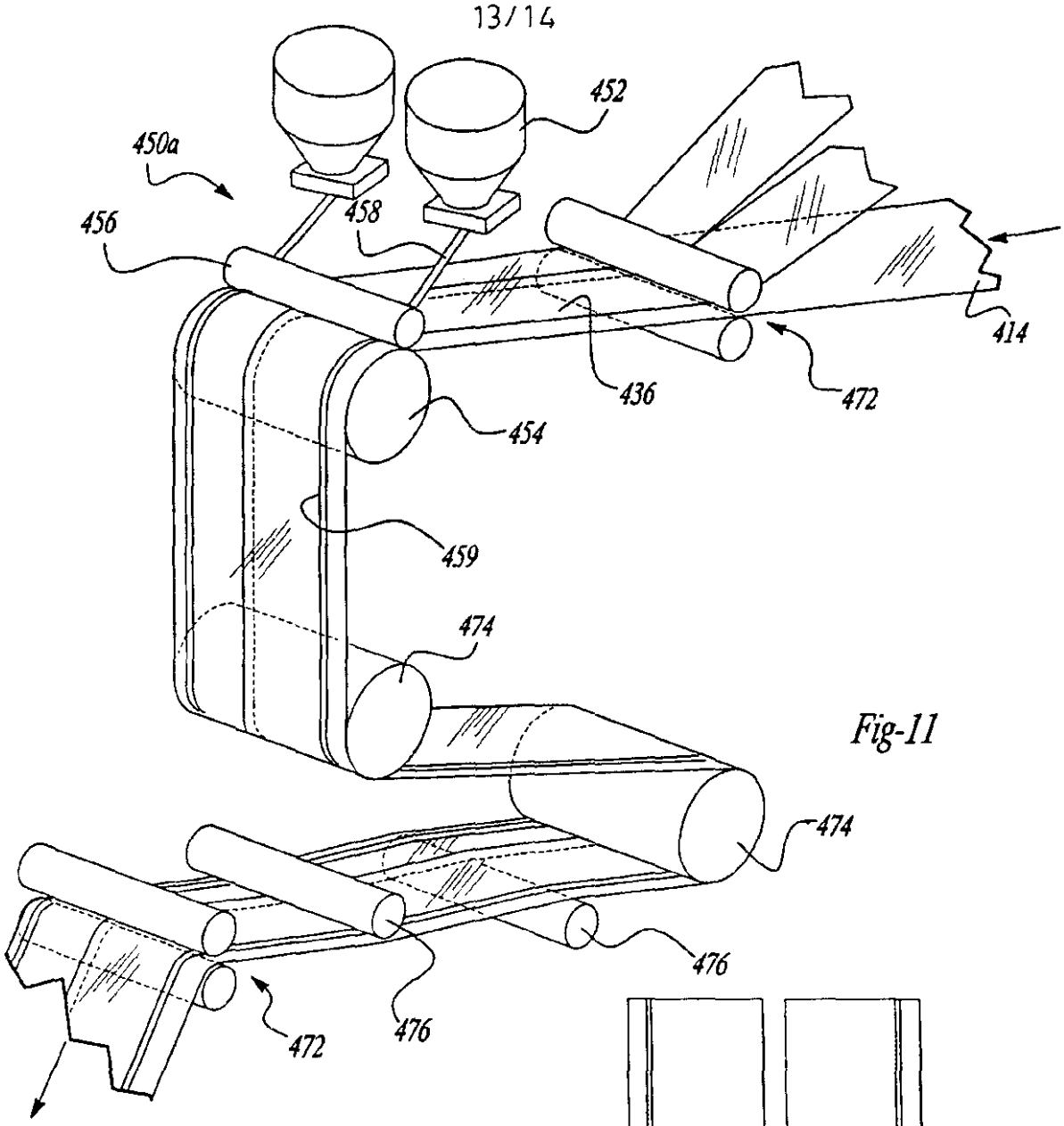


Fig-11

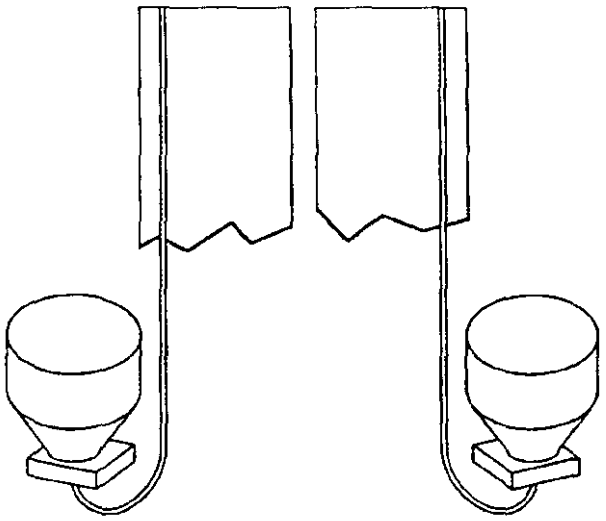


Fig-11a

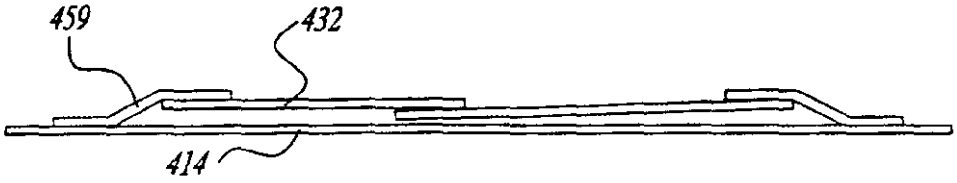


Fig-11b

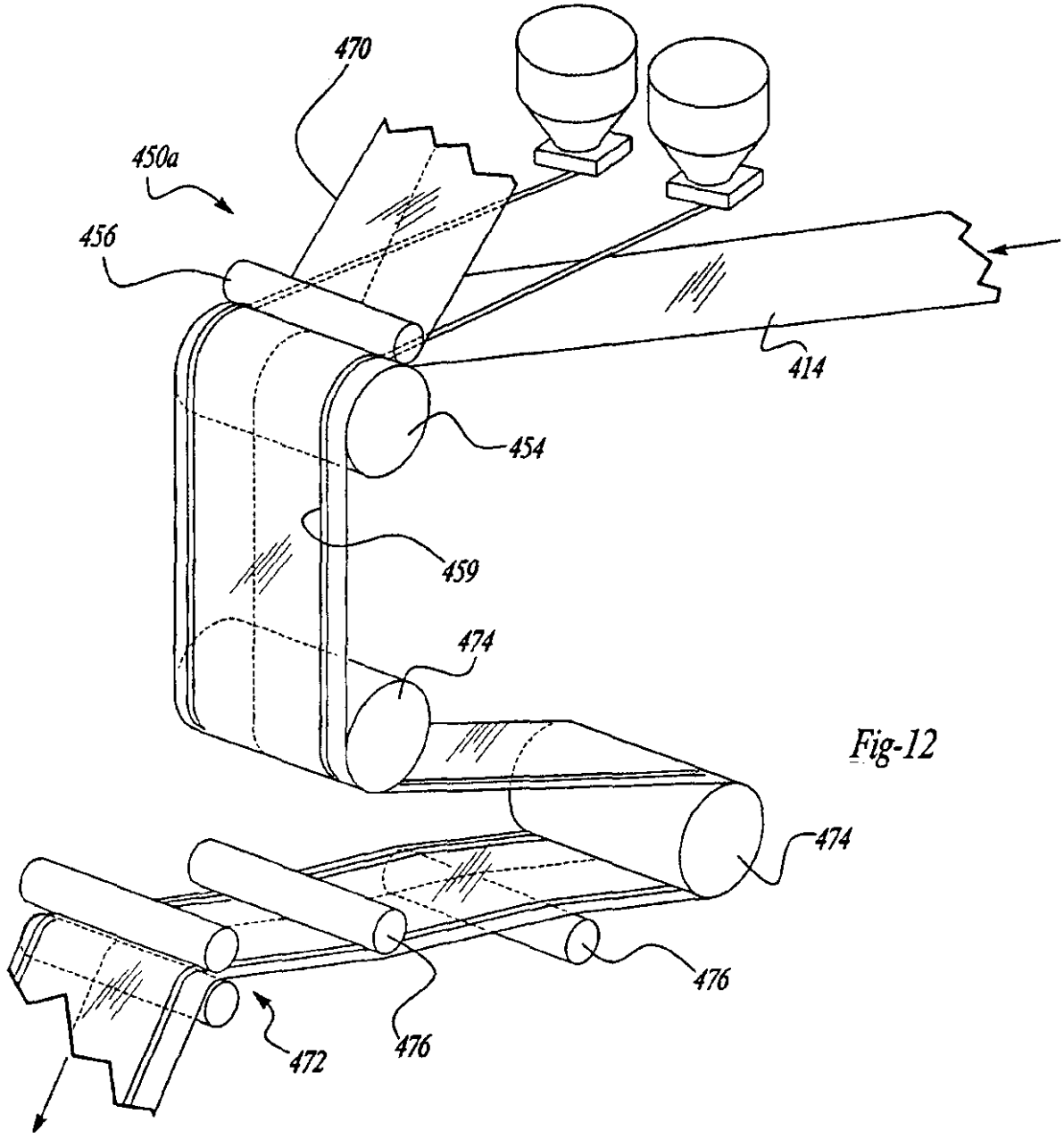


Fig-12

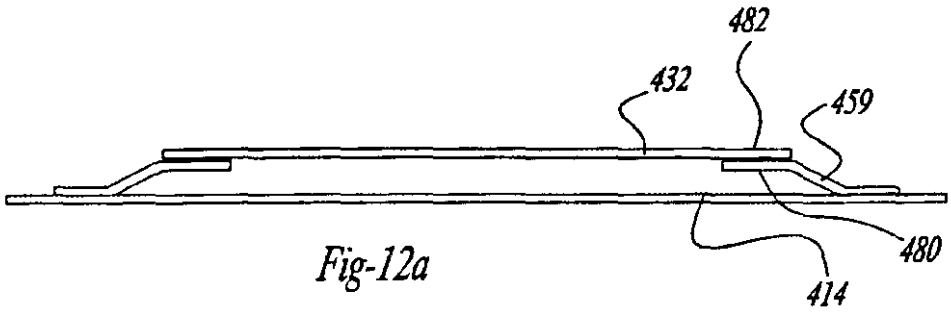


Fig-12a

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[71]申请人 S·C·约翰逊家贮公司
地址 美国威斯康辛
[72]发明人 扎因·E·M·萨阿德
戴维·A·史密斯 威廉·D·普赖斯
理查德·道金斯
劳伦斯·C·斯塔诺斯

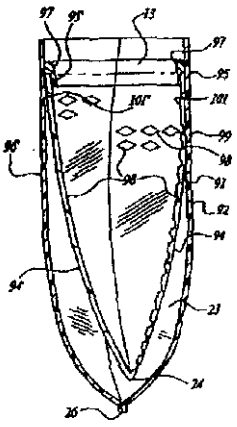
[74]专利代理机构 中国国际贸易促进委员会专利商标事务所
代理人 王宪模

权利要求书6页 说明书21页 附图页数14页

[54]发明名称 多层的冷冻贮存袋

[57]摘要

一种冷冻袋(10),由多层袋构成,它具有至少一个内衬膜(14)和一个外支承袋(12),上述内衬膜具有沿形成封边的相应侧边(18、181)连接在一起的第一侧壁(32)和第二侧壁(321),每个侧壁都具有顶边。上述的外支承袋具有两个沿形成封边的相应侧边连接在一起的侧壁(32、321),每个侧壁具有形成多层袋开口的顶边,所述支承袋具有形成多层袋底部的折叠边(20),至少一个内衬膜的顶边被连接到支承袋相应侧壁的内表面上,其中,内衬膜是热塑性材料。



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权 利 要 求 书

1. 一种多层袋，它具有一个外袋和至少一个内衬，上述外袋具有两个含有内表面和外表面的侧壁，沿相应侧边连接起来的该两侧壁形成多层袋的开口和一个形成多层袋的底部的折叠边，上述内衬具有至少一个具有与上述外袋的内表面相连接的顶边和至少一个自由边的侧壁。

2. 根据权利要求 1 的多层袋，其特征在于，上述内衬的顶边固定在上述外袋的内表面上，并且与多层袋的开口之间隔有距离。

3. 根据权利要求 1 的多层袋，其特征在于，上述内衬的侧壁的公称厚度为 0.3～1.0 密耳。

4. 根据权利要求 3 的多层袋，其特征在于，上述内衬是一种热塑性薄膜，该薄膜的横向 2%正割模量（TDSM）小于 40000 磅/英寸^2，该值按 ASTM D 832－83 的方法 A 测定，夹头之间的间距为 4 英寸，试样宽度为 1 英寸，只是其初始应变速率为 0.25 英寸/（英寸·分钟），十字头移动速度为 1 英寸/分钟。

5. 根据权利要求 4 的多层袋，其特征在于，上述内衬是一种热塑性薄膜，该薄膜的 Z 值小于 60000 密耳^3·磅/英寸^2，所述的 Z 值为：$t^3\times$（TDSM），式中 t 是单位为密耳的薄膜厚度，TDSM 是横向正割模量，后者按 ASTM D 832－83 的方法 A 测定，其夹头之间的间距为 4 英寸，试样宽度为 1 英寸，只是其初始应变速率为 0.25 英寸/英寸·分钟，十字头移动速度为 1 英寸/分钟。

6. 根据权利要求 4 的多层袋，其特征在于，其内衬的 Z 值小于 20000 密耳^3·磅/英寸^2。

7. 根据权利要求 3 的多层袋，其特征在于，上述外袋是一种薄膜，其 Z 值为 50000～150000 密耳^3·磅/英寸^2。

8. 根据权利要求 7 的多层袋，其特征在于，上述内衬是一种热塑性薄膜，该薄膜是乙烯的均聚物和共聚物。

9. 根据权利要求 1 的多层袋，其特征在于，上述内衬的顶边通

过一种折叶式覆盖封条或一种热封式覆盖封条固定在上述外袋的侧壁上。

10. 根据权利要求 1 的多层袋，其特征在于，上述的内衬带有纹理。

11. 根据权利要求 1 的多层袋，其特征在于，上述外袋沿其相对的内表面上分别具有可相匹配的凸形和凹形的闭合件。

12. 根据权利要求 11 的多层袋，其特征在于，上述内衬沿公共封边的侧边附加固定在外袋上。

13. 根据权利要求 12 的多层袋，其特征在于，上述内衬的顶边通过覆盖封条固定在外袋的侧壁上。

14. 根据权利要求 13 的多层袋，其特征在于，上述内衬的侧壁的内表面经过电晕处理。

15. 根据权利要求 1 的多层袋，其特征在于，上述内衬的封边与外袋的封边是独立的。

16. 根据权利要求 1 的多层袋，其特征在于，上述内衬的顶边通过热熔粘结剂或热空气缝焊固定在支承袋的侧壁上。

17. 根据权利要求 1 的多层袋，其特征在于，上述内衬的颜色与上述外袋的至少一部分的颜色不同。

18. 根据权利要求 1 的多层袋，其特征在于，上述内衬具有一层沿第一侧壁之内表面固定的第一薄膜和一层沿第二侧壁之内表面固定的第二薄膜，上述的第一薄膜和第二薄膜是不连续的。

19. 一种制造具有一个外袋和一个内衬的多层袋的方法，该方法包含如下步骤：

向前送入一条第一热塑性膜带，该膜带的厚度大于 1 密耳，其两平行边之间的距离为第一膜带横向带宽；

向前送入至少一条第二热塑性膜带，该膜带的厚度小于 2 密耳，其两平行边之间的距离为第二膜带横向带宽，该第二膜带横向带宽小于上述的第一热塑性膜带的宽度；

在上述的第一热塑性膜带上打孔或开切口；

将上述第二热塑性膜带叠放在上述第一热塑性膜带上的所述两平行边之间；

将上述的第二热塑性膜带沿其平行边固定在第一热塑性膜带上；

沿横向折叠上述的膜带；和

封切上述的折叠好的膜带而制成多层袋。

20. 根据权利要求 19 的方法，其特征在于，还包含如下步骤：沿第一热塑性膜带的相对的平行边分别加上可相匹配的凸形和凹形的闭合件。

21. 根据权利要求 19 的方法，其特征在于，上述的膜带采用折叶式覆盖封条或热封式覆盖封条相连接。

22. 根据权利要求 19 的方法，其特征在于，上述的第一热塑性膜带沿其相对的平行边上分别带有可相匹配的凸形和凹形的闭合件，上述的第二热塑性膜带叠放在上述第一热塑性膜带上的上述闭合件之间。

23. 根据权利要求 19 的方法，其特征在于，上述的第二热塑性膜带经过电晕处理。

24. 根据权利要求 19 的方法，其特征在于，上述的第二热塑性膜带是聚乙烯制的。

25. 根据权利要求 19 的多层袋，其特征在于，上述的内衬具有一层沿第一侧壁的内表面固定的第一薄膜和一层沿第二侧壁的内表面固定的第二薄膜。

26. 一种制造含有一个外袋和一个内衬的多层袋的方法，该方法包含如下步骤：

向前送入一条第一热塑性膜带，该膜带的厚度为大于 1 密耳，其两平行边之间的距离为第一膜带横向宽度；

向前送入至少一条具有第一薄膜和第二薄膜的第二热塑性膜带，上述薄膜的厚度小于 2 密耳，并且，第二膜带横向的总宽度小于上述第一热塑性膜带的宽度；

将上述第二热塑性膜带叠放在上述第一热塑性膜带上两平行边

之间；

沿上述第二热塑性膜带的平行边将第二热塑性膜带固定在上述的第一热塑性膜带上；

沿横向折叠上述的膜带；和

封切上述的折叠好的膜带而成为多层袋。

27. 根据权利要求 26 的方法，其特征在于，还包含如下步骤：沿上述的第一热塑性膜带的相对平行边分别加上可相匹配的凸形和凹形闭合件。

28. 根据权利要求 26 的方法，其特征在于，上述的膜带采用折叶式覆盖封条或热封式覆盖封条相连接。

29. 根据权利要求 26 的方法，其特征在于，上述的第一热塑性膜带沿其相对的平行边分别带有可相匹配的凸形和凹形的闭合件，上述的第二热塑性膜带叠放在上述第一热塑性膜带上的上述闭合件之间。

30. 根据权利要求 26 的方法，其特征在于，上述的第二热塑性膜带经过电晕处理。

31. 根据权利要求 26 的方法，其特征在于，上述的第二热塑性膜带是聚乙烯制的。

32. 一种热封至少两条膜带的方法，包含如下步骤：

提供可以热封在一起的至少一条第一膜带和一条第二膜带；

对上述第二膜带打孔或开切口；

将上述第二膜带叠放在上述第一膜带上，提供至少一条其材料的温度、质量和热容都足以将上述第二热塑性膜带热封在上述第一热塑性膜带上的封合带；和

提供至少一条其材料可热封到两膜带的至少一部分上的封合带；和

沿上述第二膜带的平行边缘将上述封合材料带铺贴在上述第二膜带上。

33. 根据权利要求 32 的方法，其特征在于，还包含如下步骤：

使上述封合带通过压辊。

34. 一种将至少两条膜带相连接的方法，包含如下步骤：

提供一种具有第一宽度的第一膜带和一种具有第一薄膜和第二薄膜的第二膜带，该第二膜带具有第二总宽度；

将上述第二膜带叠放到第一膜带上的平行边之间；

提供至少一条可热封到上述的两种膜带的至少一部分上的封合材料带；和

沿上述第二膜带的平行边将上述的封合材料带铺贴在第二膜带上。

35. 根据权利要求 34 的方法，其特征在于，还包含如下步骤：使上述的封合带通过压辊。

36. 一种制造含有至少一个内衬袋和一个外支承袋的多层袋的设备，该设备具有：

用于向前送入第一热塑性膜带的装置，所述膜带的厚度大于 1 密耳，其平行边之间的距离为第一膜带横向宽度；

用于向前送入至少一条第二热塑性膜带的装置，所述膜带的厚度小于 2 密耳，其平行边之间的距离为第二膜带横向宽度，该第二膜带横向宽度小于上述第一热塑性膜带的宽度；

用于对上述第二横向膜带打孔或开切口的装置；

用于将上述第二热塑性膜带叠放到上述第一热塑性膜带上的平行边缘之间的装置；

用于沿横向折叠上述膜带的装置；和

用于封切上述折叠好的膜带而成为多个多层袋的装置。

37. 一种制造含有至少一个内衬袋和一个外支承袋的多层袋的设备，它具有：

用于向前送入第一热塑性膜带的装置，所述的膜带的厚度大于 1 密耳，其平行边之间的距离为第一膜带横向宽度；

用于向前送入第二热塑性膜带的装置，所述的膜带具有两个厚度小于 2 密耳的不相连接的薄膜；

用于将上述第二热塑性膜带叠放到上述第一热塑性膜带上的装置；

用于沿横向折叠上述膜带的装置；和

用于将上述折叠好的膜带封切成多层袋的装置。

38. 一种热封至少两条膜带的方法，包含如下步骤：

提供可以热封在一起的至少一条第一热塑性膜带和一条第二热塑性膜带；

在上述的第二膜带上打孔或开切口；

将上述第二膜带叠放在上述第一膜带上，提供至少一条其温度、质量和热容都足以将上述第二热塑性膜带热封到上述第一热塑性膜带上的封合材料带；和

提供至少一条能热封到上述两种膜带的至少一部分上的封合材料带；和

沿上述第二膜带的平行边缘将上述的封合材料带铺贴在上述第二膜带上。

39. 根据权利要求 38 的方法，其特征在于，还包含如下步骤：使上述的封合带通过压辊。

40. 一种热封至少两条膜带的方法，包含如下步骤：

提供可热封在一起的至少一条第一膜带和第二膜带；

提供至少一条可热封到上述第一和第二膜带的至少一部分上的封合材料带；

将上述的第二膜带叠放到上述的第一膜带上；和

沿上述第二膜带的平行边缘将上述的封合材料带铺贴在上述第二膜带上。

41. 根据权利要求 40 的方法，其特征在于，还包含如下步骤：使上述封合带通过压辊。

42. 根据权利要求 40 的方法，其特征在于，还包含如下步骤：在上述的第二膜带叠放到上述第一膜带上之前先对它打孔或开切口。

说　　明　　书

多层的冷冻贮存袋

技术领域

本发明总的涉及食品尤其是肉类的包装。本发明力图制造改进的由终端用户重新包装和冷冻贮存鲜肉、以减少所谓的“冻灼”的功能性“冷冻袋”。本发明的其他方面包括例如制备冷冻袋的方法和材料以及使用冷冻袋的方法。

背景技术

现有技术中的可重新闭合的塑料贮存袋是比较老式的了。如今，公众通常可获得的塑料袋都以卡片标明推荐的具体“终端用途”（例如贮存袋、负重冷冻袋（Heavy Duty Freezer Bags）、蔬菜袋、废料袋）。这些塑料袋本身常常标有其“终端用途”例如“ZIPLOC®BRAND 负重冷冻袋”。

本文的术语“冷冻袋”指的是在冷冻室中贮存食品时具有重要功能用途的袋子。通常供应的“冷冻袋”有如下容量：2 加仑；1 加仑；褶式的 1/2 加仑；1 夸脱；和 1 品脱。

本文的术语“冻灼”是指在冷冻室的低湿度环境下贮存未包装的或包装不正确的食品时发生的食品脱水的名称（见 Wilmer A. Jenkins and James P. Harrington 所著的《用塑料包装食品（Packaging Foods With Plastics）》P305，该书由 Technomic Publishing Co., In.1991 年出版）。消费者通常根据 3 个主要的目视属性来描述冻灼现象：形成冰晶体，产品脱水和颜色变化。

尽管采用厚的塑料冷冻袋在商业上是成功的。但是，冻灼仍然是消费者主要抱怨的问题。在短期内，冻灼可以是一种可逆过程。但是，在长时期内，冻灼可引起复杂的食品质量变坏的过程，包括不希望有的组织结构变化、随之又发生化学变化例如颜色的减退和脂类的氧化酸败。食品的味道、香味、口感和颜色全都破

坏了。鲜肉的冻灼尤其关键，因为冻灼会影响肉的颜色。

上面提到的书《用塑料包装食品》的第七章对现有技术的现状作了很好的说明，有关于（商业上）“鲜肉包装”的全部信息。奇怪的是，该书似乎没有提到冻灼问题，只是在其词汇表中解释了一下。

在 1994 年 3 月出版的《消费者报告》（Consumer Reports）P143～147 刊登的论文“食品保鲜（Keeping Food Fresh）”中提供了另外的参考资料。该论文对贮存食品的制品作了总的评述。较具体地说，该论文力图回答有关的包装材料（塑料、铝箔、蜡纸、袋子、外包装或可重复使用的容器）哪一种能做到（1）长程运输中食品保持新鲜，（2）总的成本最低，和（3）对环境的有害影响最小的问题，文中对 ZIPLOC®褶式冷冻袋有极高的评价（见 P145），它指出，在塑料容器中贮存食品，如果容器中含有大量空气的话，食品可能会冻灼。关于“包裹材料”（塑料薄膜和冷冻纸），上述论文有趣地建议不要双层的包裹，因为成本高了，对环境也有影响，文中特别提到“我们的试验表明，双层包裹无论如何也没有对食品起到更大的保护作用”。

专利文献中说明过各种类型的具有内衬或者说双层壁（壁之间有一定间隙）的袋子。这些专利中有的涉及食品的运输和贮存。美国专利 4211091（Campbell）公开了一种“隔离的便餐食品袋（Insulated Lunch Bag）”。美国专利 No.4211267（Skovgaard）公开了一种用于“在冷冻食品解冻前将它带回家”的“携物袋（Carrying Bag）”。美国专利 No.4797010（转让给 Nabisco Brands）公开了一种“用作包装烧烤食品的可重新加热和重新密封”的双层纸袋。美国专利 No.4358466（转让给 The Dow Chemical Company）公开了一种改进的“可用于微波炉的冷冻袋（Freezer to Microwave Oven Bag）”，这种袋子由两个位于直立出口之两侧的翼形袋构成。美国专利 No.5005679（Hjelle）公开了一种“带有冷却室的手提袋（Tote Bags Equipped with A Cooling

Chamber）”。上述的所有食品袋与食物接触的壁几乎都比下面要说明的本发明的厚得多。上述的专利几乎都没有注意到冻灼问题。

美国专利 No.5804265（转让给 S.C. Johnson Home Storage, Inc.）公开了一种现有技术的更新发展。该专利公开了一种具体想要控制冻灼（虽然在应用中不限于此）的结构独特的袋子。试验表明，该实施例的袋子比其他现有技术的贮存袋有明显的进步，但是还希望再有所改进，其中包括生产效率和材料成本方面。

发明内容

本发明在广义范围内提供了一种冷冻袋，它由具有一个外支承袋和一个内衬的多层袋构成。上述的外支承袋具有两个沿构成封边的相应侧边连接在一起的侧壁，该侧壁具有形成多层袋的开口的顶边和形成多层袋的底部的折叠边。上述内衬通常具有至少一个沿至少一边固定到上述外支承袋的相应侧壁的内表面上的侧壁。该内衬还具有至少一条与所有形成一个内袋的封闭边相对的自由边或者说不连续边。

本发明进一步涉及一种制造具有一个外支承袋和至少一个内衬的多层袋的工艺，包含如下步骤：送入具有第一厚度和第一横向带宽的第一热塑性膜带；送入包含两条独立薄膜的第二热塑性膜带，该膜带具有第二总厚度和第二横向总带宽，该第二横向带宽小于第一热塑性膜带的宽度；将第二热塑性膜带叠放在第一热塑性膜带上的两边缘之间；将第二热塑性膜带固定在第一热塑性膜带上；沿横向折叠上述的膜带；和封切上述的折叠好的膜带而形成多层袋。

本发明还涉及一种制造具有一个外支承袋和至少一个内衬的多层袋的工艺，包含如下步骤：送入具有第一厚度和第一横向带宽的第一热塑性膜带；送入具有两条独立的薄膜的第二热塑性膜带，该第二膜带最好具有第二厚度和比第一热塑性膜带的宽度小的第二横向带宽；对第二热塑性膜带打孔或开切口；将第二热塑

性膜带叠放到第一热塑性膜带上的两边缘之间；将第二热塑性膜带固定到第一热塑性膜带上；沿横向折叠上述膜带；和封切上述的折叠好的膜带而形成多层袋。

本发明的另一种工艺涉及热封至少两条膜带的工作，该工艺包含如下步骤：至少提供一条第一膜带和一条至少具有一个薄膜的第二膜带，上述两种膜带可以热封在一起；对第二膜带打孔或开切口；将第二膜带叠放在第一膜带上；提供至少一条其温度、质量和热容都足以将第二热塑性膜带热封到第一热塑性膜带上的封闭材料带；和将上述封闭材料带铺贴到叠置后的膜带上。上述封合带铺贴好后最好在压辊之间压一下。

本发明的又一种工艺涉及热封至少两条膜带的工作，包含如下步骤：至少提供一条第一膜带和一条具有多条薄膜的第二膜带，上述膜带可以热封在一起；对第二热塑性膜带打孔或开切口；将上述第二膜带的多条薄膜叠放在第一膜带上；提供至少一条其温度、质量和热容都足以将上述第二热塑性膜带热封到第一热塑性膜带上的封闭材料带；将上述封闭材料带铺贴到叠放好的膜带上。上述封合带铺贴好后最好在压辊之间压一下。

另外，按照本发明，还有一种连接至少两条膜带的工艺，包含如下步骤：至少提供分别具有第一宽度和第二宽度的第一膜带和第二膜带；对第二膜带打孔或开切口；将第二膜带叠放在第一膜带上的两平行边之间；提供一条能热封到两条膜带的至少一部分上的封闭材料带；和将上述封闭材料带沿第二膜带的两平行边铺贴在第二膜带上。

本发明的再一种工艺涉及连接至少两条膜带的工艺，包含如下步骤：至少提供一条具有第一带宽的第一膜带和一条具有多条薄膜的第二膜带，该多条薄膜宽度的总和就是第二膜带的宽度；对第二膜带打孔或开切口；将第二膜带的多条薄膜叠放在第一膜带上的两平行边之间；提供至少一条可热封到上述两种膜带的至少一部分上的封闭材料带；和将上述的封闭材料带沿上述第二膜

带的两平行边铺贴在第二膜带上。

另外，按照本发明提供一种用于制造具有一个外支承袋和至少一个内衬的多层袋的设备，该设备具有：用于传送具有第一厚度和其平行边之间的第一横向带宽的第一热塑性膜带的装置；用于传送具有第二厚度和其平行边之间的第二横向带宽的第二热塑性膜带的装置；用于对第二热塑性膜带打孔或开切口的装置，而且，如有必要，可将第二膜带的宽度调节到小于上述第一膜带的宽度；用于将第二热塑性膜带叠放在第一热塑性膜带上两平行边之间的装置；用于沿第二热塑性膜带的两平行边将其固定在第一热塑性膜带上的装置；用于沿横向折叠上述膜带的装置；和用于封切（seal cutting）上述折叠好的膜带而形成多层袋的装置。

再者，按照本发明还提供一种用于将至少两条膜带相连接的设备，该设备具有：用于至少提供一条具有第一带宽的第一膜带和一条具有多条薄膜的第二膜带的装置，其中，多条薄膜的总宽度就是第二带宽，所述第一和第二膜带分别具有第一和第二宽度；用于将第二膜带叠放到第一膜带上的装置；用于提供至少一条可热封到上述两种膜带的至少一部分上的封闭材料带的装置；和将上述封闭材料带沿第二膜带的两平行边铺贴在第二膜带上的装置。

附图说明

图 1a 是一种可重复闭合的多层袋的第一实施例的前正视图；

图 1b 是图 1a 的剖视图，具有一个打孔的内衬；

图 1c 是图 1b 的内衬的放大图；

图 1d 是图 1a 的内衬沿打孔线撕开后的剖视图；

图 1e 是图 1a 的替代实施例的简单正视图；

图 2a 是一种可重复闭合的多层袋的第二实施例的前正视图；

图 2b 是图 2a 的剖视图，具有一个打孔的内衬；

图 2c 是图 2a 的内衬的放大图；

图 2d 是图 2a 的内衬沿打孔线撕开后的剖视图；

图 2e 是图 2a 的一个替代实施例的前视图；

图 3a 是一种可重复闭合的多层袋的第三实施例的前正视图；

图 3b 是图 3a 的多层袋的剖视图；

图 3c 是图 3a 的多层袋的剖视图。其中装有两块由内衬隔开的肉块；

图 4a 是可重复闭合的多层袋的第四实施例的前正视图；

图 4b 是图 4a 的多层袋的剖视图；

图 4c 是图 4a 的多层袋的侧剖视图，其中装有一块肉；

图 5a 是具有带纹理的内衬的多层袋的前正视图；

图 5b 是沿图 5a 的 5b - 5b 线的剖视图；

图 5c 是用于将内衬袋的顶边固定到支承袋的侧壁上的覆盖封条的放大剖视图；

图 5d 是用于将内衬袋的顶边固定到支承袋的侧壁上的覆盖封条（blanket seal）的另一个实施例的放大剖视图；

图 6a ~ 6f是用于对内衬进行压花处理的各种优选的压花花样的放大剖视图和平面图；

图 7 是本发明的制造内衬与外袋之间具有公共封闭边的冷冻袋的工艺的简单流程图；

图 8 是一种制备和覆盖封闭本发明的多层袋的工艺的轴测图；

图 8a 是在图 8 的设备上制成的多层袋嵌条（panel）的剖视图；

图 9 是制造本发明的多层袋的第一种设备的剖视图；

图 10 是另一种制备和覆盖封闭本发明的多层袋的设备的轴测图；

图 10a 是用图 10 的设备制造的多层袋的第一和第二嵌条（panel）的展开图（topographical view）；

图 10b 是用图 10 的设备制造的多层袋膜带的剖视图；

图 11 是又一种制备和覆盖封闭本发明的多层袋的设备的轴

测图；

图 11a 是由两个分开的薄膜构成的第二膜带的展开图；

图 11b 是由图 11 的设备制成的多层袋嵌条（panel）的剖视图；

图 12 是再一种用于制造和覆盖封闭本发明的多层袋的设备的轴测图；和

图 12a 是由图 12 的设备生产的多层袋嵌条（panel）的剖视图。

具体实施方式

参看图 1a～1e，图中示出按照本发明内容的多层冷冻袋。该多层冷冻袋 10 通常具有一个外袋 12 和一个内衬 14。外袋 12 由侧封闭边 18 和 18′以及沿外袋第一端（底端）22 的折叠边 20 限定。沿外袋的第二端（上端）24 设置一个用于打开多层袋的可反复使用的闭合件 16，该闭合件 16 具有例如相匹配的凸件和凹件。上述内衬 14 具有侧边 26 和 26′，按照图 1a 的实施例，上述侧边 26 和 26′与外袋的标号为 18 和 18′的侧边共用一个公共封边。上述内衬也可以是独立式的（不焊合），或者像图 1e 所示那样，使其侧边 26 和 26′独立于外袋的相应侧边进行焊合。

具体参看图 1b 和 1d，内衬 14 具有两个在撕开内衬 14 时形成的侧壁 32 和 32′，该两侧壁 32 和 32′的第一端 30 和 30′用超声焊接法（sonically welded）或其他方法固定到外袋 12 的内表面 34 和 34′上。如图所示，虽然不要求，但是侧壁 32 和 32′最好是大致延伸过多层袋 10 的几乎整个长度。

参看图 1c，内衬 14 在沿末弯角 40 处的侧线 X 和 Z 上打孔，因此，当对内衬施加足够压力时，内衬可沿至少一条打孔线撕开，从而使侧壁 32 和 32′不再是连续了，这一点在图 1d 看得很清楚。

如图 1a ～ 1e 所示，内衬 14 通常与外袋 12 的侧壁 36 和 36′分开（采用共用封边的实施例除外）。从所示附图可以看出，当拉开闭合件 16 时，便形成开口 38，通过口 38 可将食品置入多层

袋的内侧壁 32 与 32′之间。

在众多可采用的闭合件中，美国专利 No.4561109、4363345、4528224、5070854 和 5804265 公开了一些优选的可重复使用的闭合件的实例及其制造信息。上述全部专利的内容纳入本文作为参考。其他可用的闭合系统有：粘结剂、维可牢尼龙搭扣（Velcro）、机械封合件、滑锁封合件、采用绳或带的抽束带、折叠锁紧的顶部、磁力闭合件、死褶闭合件（即铝箔、折叠金属丝、带子）、热封、U 形钉、手拉绳、系绳或捻绕等。

有益的是，通过沿上述打孔线撕开内衬、预先在内衬上开切口或用多张薄膜做成内衬或者说膜带（下面将较详细说明），可以不设美国专利 No.5804265 中备加注意的排气孔。因为这样的话就不用再担心在上述专利中存在的外袋与内衬之间存有空气的问题。

参看图 2a～2e，图中示出本发明的另一种多层袋。应当注意，在图 1a～1e 和 2a～2e 实施例中，所述的相同零件分别用相同的标号表示。

图 1a～1e 的实施例与图 2a～2e 的实施例之间本质上的差异仅在于它们的末弯角 40 的结构不同。如图 2b 和 2c 所示。末弯角 40′只有一条横向打孔线 X，与此不同，图 1a～1e 的末弯角 40 则分别具有多条沿多余的内衬料设置的横向打孔线 X 和 Z。如图 2a～2e 所示，外袋与内衬之间的侧向封边（如果有的话）可以是共用的或者是独立的。

当从开口 38 放入食料 44 时（从图 2d 可看得更清楚），打孔线 X 则被撕开而形成内衬 14 的分离的侧壁 32 和 32′。根据食料形状的不同，多层袋 10 的第一端 22 会大致贴合食料的形状，也就是变得更圆滑一些。

参看图 3a～3c，图中示出本发明的又一种多层袋。其外袋 12 实质上与上面所述实施例的外袋是一样的。但是，内衬 14 的第一端 30 是唯一固定到外袋内表面 34 上的部分，其第二端 30′是自由

端。内衬的长度足以使其第二端 30′接近多层袋的第二端 24。通过做出长形的连续内衬 14（从图 3c 可更清楚地看出），可将多种食料块 44 和 44′置入袋内，其中食料块由侧壁 32′隔开。在本实施例中，食料最好用水平放置的袋来贮存，其外袋的第一侧壁 36 靠在致冷机或冷冻机的底板（未示出）上。按上述方式放置图 3a～3c 的多层袋，内衬 14 便可大致贴合食料的形状，从而可防止出现不希望有的状态例如冻灼。

参看图 4a～4c，图中示出再一个多层袋的实施例。外袋 12 内设置一个沿其第一端 30 固定到外袋的内壁 34 上的不完全的内衬 14，该内衬的自由端 30′位于外袋的第一端（底部）22 附近。而且，通过水平地放置多层袋，内衬 14 可以基本上贴合食料 44 的形状，这是很希望的。虽然图 4a 示出内衬 14 与外袋 12 可共用沿一个侧壁或两个侧壁的共同侧封，但是，也可以用焊接 30 之外的手段将内衬 14 自由地悬挂在外袋内。

参看图 5a 和 5b，图中示出本发明的多层袋的优选实施例。按照该实施例，内衬 14 最好具有一个带纹理的表面 50。内衬薄膜带有纹理或者压花，有利于增大膜的表面积，比光滑的表面更紧贴食料的表面，从而提高了内衬的性能。另外，上述的纹理或压花有效地降低了内衬的总体刚度，这也有利于提高其对食料的粘合性。在众多现行的花样或者说形状中，已证明菱形、蜂窝状、方形、球形、三角形、锥形、棱锥体和图 6a～6f 所示的形状具有良好的性能。上述的纹理或压花花样也可在内衬与食料相接触时形成空气离开食料的通道，从而使内衬更贴合食料的形状。在具体花样中，纹理单元在内衬表面上的线密度通常是每英寸约 6～50 个单元，最好是约为 10～20 个单元，带纹理的表面通常具有多个向内伸出的凸部。图 6a～6f 进一步示出各种几何形状的凸部。

将内衬固定到外袋上的方法，可以是现有技术中公知的任何方法，也就是例如粘结法和/或机械法。例如，内衬可以连续而均匀地沿顶边固定住，或按断续的或者说间歇性的方式沿顶边固定

住。固定内衬方法的可用实例（非限定性实例）有：热空气缝焊（hot air seam sealing）、挤出层合、加热棒热封、超声焊接、加热辊或加热带、粘附膜条带、红外定标（infrared scaling）、射频焊合或振动焊合。也可以在制造过程中在内衬的边缘上或边缘上方粘上闭合件后再将内衬固定到支承袋上。图 5c 和 5d 示出一种折叶式的覆盖封条，在美国专利 No.5804265 中详细说明过这种所谓的折叶式的覆盖封条，其内容已纳入本文作为参考。

本发明的多层袋的外支承袋和内衬通常由热塑性材料或热塑性材料的混合物制成，并且可以是同一种材料或不同的材料。上述的薄膜可以由传统的平挤薄膜工艺或吹膜工艺制成。可以采用的热塑性材料例如有：聚烯烃，例如高密度聚乙烯（HDPE）、低密度聚乙烯（LDPE）、线性低密度聚乙烯（LLDPE）和聚丙烯（PP）；热塑性弹性体，例如苯乙烯嵌段共聚物（styrenic block copolymers）、聚烯烃混合物、弹性体合金（elastomeric alloys）、热塑性聚氨酯、热塑性共聚多酯、热塑性聚酰胺；以及聚氯乙烯（PVC）的聚合物和共聚物、聚偏二氯乙烯（PVDC）、莎纶聚合物、乙烯/醋酸乙烯共聚物、乙酸纤维素、聚对苯二甲酸乙二醇酯、离子交联聚合物（Surlyn）、聚苯乙烯、聚碳酸酯、苯乙烯丙烯晴、芳族聚酯、线性聚酯、热塑性聚乙烯醇和前面列出的可用于制造内衬膜层的材料。外支承袋和内衬袋都优选聚乙烯来制造，更好是采用低密度聚乙烯（LDPE）（密度约 0.92）与线性低密度聚乙烯（LLDPE）（密度约 0.925）的混合物来制造。内衬膜的密度最好小于 0.930g/cc。

内衬膜的横向 2%正割模数 TDSM 一般小于 40000 磅/英寸^2（2.75×10^8Pa），最好是小于 27000 磅/英寸^2（1.86×10^8Pa），上述模量按 ASTM D 832－83 的方法 A 测定，夹头间距 4 英寸，试样宽度 1 英寸，初始形变速率为 0.25 英寸/英寸/分钟，十字头移动速度为 1 英寸/分钟。内衬膜沿横向或膜的加工方向的模量通常是膜的刚性的度量。由现有技术公知的平挤薄膜工艺制成的热塑

性聚烯烃膜的 TDSM 约为 20000～40000 磅/英寸^2，市场上可获得的可制造具有上述拉伸性能的平挤膜或吹膜的树脂的实例有例如 The Dow Chemical Company 供应的 LDPE 748 和 LDPE 690。

内衬膜的另一个有用的特征量是由公式 P×TDSM 计算的 Z 值，式中 t 是膜的厚度（密耳），TDSM 是上述的横向模量。Z 值体现膜的与其厚度和模量有关的相对刚性。内衬的 Z 值一般小于 60000 密耳^3·磅/英寸^2，优选为小于 20000 密耳^3·磅/英寸^2，更好是约为 2000～10000 密耳^3·磅/英寸^2，最好是约为 3000～6000 密耳^3·磅/英寸^2。

外支承袋的 Z 值最好约为 50000 ～ 150000 密耳^3·磅/英寸^2（5.6～16.9mm^{3}kPa）。

外支承袋的公称侧壁厚度一般约为 1～4 密耳，优选约为 1.3～3.0 密耳，更好是约为 1.5～2.0 密耳。上述的公称厚度指的是膜在任何表面处理（例如刻痕、做纹理、压花等）之前的厚度。

内衬的公称侧壁厚度一般约为 0.3～1.0 密耳，最好约为 0.5～0.7 密耳。

内衬的内表面在 20℃时相对于生牛肉汁的接触角最好为 65°～75°，该接触角是用一种接触测角器 f（例如 Rame－Hart 公司供应的 A－100 型量角仪）按超前接触角测定法（advancing contact angle determination）测定的。接触角的定义是在液滴表面与水平基板相遇处水平基板与液滴表面的切线之间形成的角度。接触角是液体的表面张力的函数。接触角较小表示液体对基板的浸润或附着程度较大。

测量接触角的方法如下：1）在接触测角器的检测表面（内衬袋膜）上放置几滴（约 1 微升）待测液滴；2）在 5 个液滴的每滴之两侧测量接触角；3）在内衬的不同部位重复上述的步骤 2），并对测量结果计算平均值，得出平均接触角。相对于生牛肉汁在 20℃时的接触角为 65°～75°的内衬膜的实例有 The Dow Chemical Company 供应的 LDPE 和 LLDPE 的混合物膜。

本发明的多层袋也可用不同颜色的膜来制造，以便让消费者注意到袋结构中的内衬。例如，可将内衬和外袋做成不同颜色，或者将它们中的一个或二者都做成透明的或不透明的。

本发明的多层袋也可包含一个内衬和/或一个由经过电晕处理以改善膜的浸润性从而改善膜对肉的附着性和/或膜的印刷性的膜或者说基层制成的外袋。内衬的内表面或者说接触食品的表面最好经过电晕处理。美国专利 No.5328705 公开过电晕处理塑料薄膜的可用方法，其内容纳入本文作为参考。

本发明的多层袋的外袋和/或内衬上还设有印刷区，该印刷区作用记录表面或者说记录小区，以说明有关袋内食品的信息。

虽然尚未有具体的理论加以确定，但是，可以认为，本发明的多层袋作为防止肉类冻灼的方法在于内衬薄膜可依附在并贴合到肉的表面上，从而防止水分损失并且空气可从肉的表面排除。防止水分损失并使空气从肉的表面排除就可减少会导致肉冻灼或脱水的冰晶体的形成。

参看图 7，该图示出按本发明制造多层袋的工艺流程图。在方框 300 所示的步骤中，挤出内衬膜或者说第二膜（一张薄膜或多张薄膜），或者由松卷台供应上述的内衬膜。内衬膜的挤出可按现有技术公知的热塑性材料吹膜法或平挤法进行。方框 310 示出的步骤是挤出每边都带有拉锁式闭合件的外支承膜或者说第一热塑性膜。上述的挤出工艺可采用常规的平挤法或吹膜法。美国专利 No.4263079 公开过一种整体平挤膜工艺的实例，其内容纳入本文作为参考。外袋膜和内衬膜最好都用平挤法制成。

下一个工步是方框 320 所示，对内衬膜开切口或者打孔，其中内衬是由单层薄膜制成的。在方框 330 所示的工步中，将内衬膜或者说第二膜加到或者说叠加到第一膜上。第二膜应对齐到要使其边缘位于第一膜的闭合件之间，第二膜叠加和对准第一膜的操作可采用普通的导引装置例如辊轮和压辊来进行。在方框 335 所示的工步中，将内衬膜或者说第二膜的平行边缘热封到支承膜

或者说第一膜上。可采用普通的热封手段例如加热棒封合机、热空气封合机、挤出层合机、加热辊（或带）等将上述两种膜热封在一起。在方框 340 所示的工步中，将封好的膜带折叠起来，并锁紧闭合件。上述膜带的折叠可采用现有技术公知的普通方法进行。在方框 350 所示的工步中，将折叠好的膜带封切成袋子，将这些袋子堆叠起来，然后置入包装容器内。美国专利 No.5062825 公开过将封好的膜带折迭起来并封切成袋子的方法，其内容纳入本文作为参考。在膜带折叠后和封切之前最好将闭合件的凹件和凸件互锁。美国专利 No.5302080、5108085 和 5185987 公开过将制成的袋子堆叠、运送然后置入包装容器内的方法，其内容纳入本文作为参考。

可通过例如压花处理使上述的第一膜带和第二膜带或其中之一带上纹理，可以在上述两种膜带焊合在一起之前或之后对两种膜带或其中之一种膜带进行电晕处理。最好是在第二热塑性膜叠置在第一热塑性膜上之前对第二热塑性膜进行电晕处理和压花处理。

可以采用类似于美国专利 No.5405561 所述的方法和装置在第二膜带或者说内衬膜带叠置到第一膜带或者说支承膜带之前对它进行打孔或开切口。

图 8 示出一种用于实施本发明的制造多层袋用的膜带的优选工艺的设备，图 9 则示出一种将两种膜带连接到一起的装置。图 8 是提供和连接膜带的过程 400 的简单侧视图，图 9 是在制成多层袋之前将膜带连接在一起的过程的轴测图。由于用于制备本发明的多层袋的设备十分相似，故下面对于相同的零件尽可能采用相同的标号表示。

参看图 9，工艺过程 400 通常含有：提供支承膜带或者说第一膜带的装置 410；提供内衬膜带或者说第二膜带的装置 430；张拉控制装置 440；对第二膜带打孔或开切口的装置 460；和总的以标号 450 表示的封合或者说连接装置。装置 410 通常具有一种与

平挤辊（cast roll）416呈挤压对准的挤出装置412，用于制备支承膜带或者说第一膜带414。提供第一膜带的装置也可以是现有技术中公知的任何装置，并且可以是如同美国专利No.5049223所述的挤出装置。膜带414通过一种普通的标准控制装置418，进入电晕处理装置420，在这里对第一膜带进行如前所述的电晕处理，以便制成其后可随意印刷的膜带。

由一个辊子或者说松卷工位431提供内衬膜带或者说第二膜带432。该第二膜带432也可通过现有技术中公知的普通吹膜或平挤膜工艺来提供。上述第二膜带的横向宽度小于第一膜带414的横向宽度。将膜带414和432喂入张拉控制装置例如压辊440，以便使两种膜带的应变相匹配。关于薄膜的应变匹配问题下面将较详细说明。

虽然第二膜带可以由一个预打孔辊供给（见图8），但是也可以像其他实施例所示那样在膜带靠近辊子472时打孔或开切口。上述的第一膜带414和第二膜带432在辊子434处对齐和叠置而形成膜带436，将该膜带436送入封合装置450内。膜带在辊子438处改变方向再送入封合装置450中。该封合装置450通常具有一个挤出装置或者说挤出机452、一个辊子454、和一个压辊456。图8示出一种优选的封合装置，下面说明之。挤出机452供给一种封合带458，该封合带458送到膜带436上并层叠在内衬膜或者说第二膜432的平行边缘上，膜带436上的封合带458从辊子454与压辊456之间通过，形成一种覆盖封条。挤出装置或者说挤出机452提供闭合件460，该闭合件460如同美国专利No.5049223所述那样固定在第一膜带414的相对的平行边缘上，形成一种带有覆盖封条和闭合件的膜带462，然后按图7所示将具有闭合件的膜带462折叠、封合和切割、堆叠和包装。上述两种膜带或者其中的一种可如上所述进行纹理处理或电晕处理。

可以通过在内衬膜带侧边的上方或底下铺上挤出的覆盖封条、热空气缝焊、挤压层合（在膜层之间加上挤出的热塑性膜）、

热熔粘结剂（置于上膜层边缘之上或之下）、超声波封合法、加热辊或加热带、粘附膜条带、红外线封合、射频封合或振动封合将第二热塑性膜带或者说内衬膜带连接到第一热塑性膜带或者支承膜带上。采用任一种上述的连接两种膜带的方法都与膜带的化学性质和物理性质密切相关。最好采用一种挤出的折叶式覆盖封条 97（见图 5c）将内衬膜带连接到支承膜带上（下面再加说明）。图 7 所示的工艺过程可以是连续的工艺过程或者是步进式过程。最好是连续的工艺过程。

图 10 示出一种将第二热塑性膜带 432 连接到第一热塑性膜带 414 上的工艺，总的以标号 450a 表示。参看图 10，按本发明在将第二热塑性膜带 432 沿其平行边缘 470 连接到第一热塑性膜带 414 上时，第二热塑性膜带 432 与第一热塑性膜带 414 相对齐且叠置在其上面，而形成膜带 436。膜带在压辊 472 之间通过，再通过封合带挤出机 452 的下方，将一条熔融的热塑性材料的封合带 458 挤压在沿机器运行方向前进中的上述膜带上，使之搭接在第二膜带的边缘 470 上，从而使两种膜带相接触并连接起来，将它们固定在一起。将连接好的膜带送过一组压辊或者说夹送辊 454、456，而形成覆盖封条 459。可采用常规的第二封合带挤压机将第二膜带的相对的平行边缘封合在第一膜带上。然后使带有覆盖封条 459 的膜带 436 通过普通的导引辊 474 和 476，以使膜带 436 定向，以便折叠和封切成多层袋。

上述的覆盖封条 459 可以是折叶式覆盖封条 97（图 5c），或者是热封式覆盖封条 110（图 5d），上述的覆盖封合法的一些优点是：可以连续地并且较高效率地连接两种膜带；覆盖封合看起来较牢固；外观上使用户较为喜欢；这种方法对其他工艺变量不敏感；并且不会像现有技术中所知的其他方法那样产生膜尾料。

一般来说，上述封合带可以用任何方式铺贴在膜带上而将两种膜带固定在一起。第一热塑性膜带最好沿其相对两边分别具有相匹配的凸形和凹形闭合件，而封合带最好与相应的闭合件等距

离铺贴。更好的是，封合带与第一热塑性膜带相应边缘的距离相等，从而使相匹配的凸形和凹形闭合件可在两种膜带固定在一起之后加到支承膜带或者说第一热塑性膜带上。

上述封合带一般可用任何合适的可热封到待连接的热塑性膜带的至少一部分上的热塑性材料或热塑性材料的混合物来制造。这种封合带优选用聚乙烯，更好的是低密度聚乙烯。可用于本发明的商业供应的合适的 LDPE 实例是 The Dow Chemical Company 大量供应的 LDPE 748。

当形成折叶式的覆盖封合时，封合带的宽度范围通常约为 3mm 到支承膜带或者说第一膜带的宽度，其优选宽度约为 3～76mm，更好是宽度约为 6～19mm。

用于形成折叶式覆盖封合的封合带的厚度一般约为 13～254 微米（0.5～10 密耳），优选的厚度约为 25～51 微米（1～2 密耳），更好是，厚度约为 25.5～38.2 微米（1.0～1.5 密耳）。

封合带可以着色或压出纹理，以便使用户注意到多层袋结构中的内衬。

由于封合带通常并不使第二膜带热封在第一膜带上，所以封合带可有利地用于将两种不能热封在一起的膜带相连接起来。但是，如果封合带的温度、热容和质量足够，并且内衬膜具有合适的厚度和温度，那么，挤出的封合带可将足够的热量传给内衬膜带而将它热封在支承膜上。

内衬膜带或者说第二膜带的宽度一般小于第一膜带的宽度，所以，封合带在铺贴之后其任何部分都不会突出到第一膜带的边缘之外。内衬膜带或者说第二膜带的宽度最好比第一膜带的宽度小到可将凸形和凹形闭合件沿第一膜带的相对平行边固定在第一膜带上。

现有技术中一般都知道，为了将两种膜带连接在一起，最好使两种膜带连接部位的伸展率或者说应变率相匹配。上述的使应变量相匹配可防止在张力松开时发生横向卷曲（CD Curl）现象。

在沿机器运行的方向上，各膜带上的张力可建立如下关系：

在弹性区内：

$$\sigma=Ee-\frac{T}{t}$$

式中 σ—应力（磅/英寸^2）

E—弹性模量（磅/英寸^2）

e—应变量（英寸/英寸）

T—张力（磅/线性英寸（PLi））

t—厚度（英寸）

重新整理得出：

$$\varepsilon=\frac{\sigma}{E}-\frac{T}{tE}$$

为了避免在内衬膜带连接到外膜带上时发生沿机器运行方向的起皱，设定

$$\varepsilon_{内衬}=\varepsilon_{外膜}$$

$$T_{内衬}=T_{外膜}\cdot\frac{t_{内衬}\cdot E_{内衬}}{t_{外膜}\cdot E_{外膜}}$$

对于弹性膜来说，现有技术中都知道，在沿机器方向的拉伸下材料将发生沿横向的收缩或者说“颈缩”，这与称为泊松比 v 的材料性质有关。泊松比 v 是横向应变与轴向应变之比，对于聚乙烯来说 v 一般约为 0.3。应用建立侧向应变与轴向应变的关系的泊松比并遵循上述类似的推导，可得出要求横（CD）方向应变相匹配并避免沿机器运行方向（MD）起皱的条件如下：

$$T_{内衬}=T_{外膜}\left[\frac{V_{外膜}\cdot t_{内衬}\cdot E_{内衬}}{V_{内衬}\cdot t_{外膜}\cdot E_{外膜}}\right]$$

实际上，通常希望沿机器运行方向和横向的应变都相匹配。通过各种方法包括采用两种弹性模量相同的膜带相连接和/或采用两种泊松比相同的膜带相连接，可以最大限度地减小上述的起皱现象。

对于给定的一组材料，可通过使两种膜带相连接处保持低的张力而使恢复更少，可将起皱减至最少。根据用途不同，有时可将横向起皱看作不如机器运行方向的起皱重要。

因此，最好在两条膜带中保持较小的张力，而且使两膜带连接处沿机器运行方向的应变相匹配。在现有技术中通常都知道，为了有效地传送膜带，推荐的沿机器运行方向的张力为其拉伸屈服强度的 10～25%，在张力小于 10%的屈服强度下测出的同相环路（PLL）膜带的轨迹精度较差。虽然两种膜带中的 MD 张力可保持在屈服强度值的 0～100%，但是，业已发现，当高于屈服强度的 25%时，膜带上可能出现局部薄点，说明实际张力已超过膜带的屈服强度，引起非弹性拉伸，这是危险的。业已发现，为了成功地固定挤出的封合带、沿机器运行方向的张力最好为膜带屈服强度的 2～15%。

对于优选实施例，认为采用具有低摩擦轴承的轻质无载托辊是有利的，可最大限度地减小内衬膜供给部位与铺贴覆盖封条的部位之间的牵拉。尽管这样，在内衬膜供给部位处的张力常常选择较低，成为在足以防止起皱或拉伸的低张力值与足以得到合适的轨迹的高张力值之间的折衷选择。结果，在图 9 所示的实施例中，在两种膜带供应点与施加覆盖封条的点之间设置一组压辊。这样，两种膜带中的张力在到达压辊之前可在稍高的张力例如拉伸屈服强度的 15%下相匹配。上述压辊可设置在不同的张力控制区。通过适当控制供应点与压辊之间的张力可使两种膜带中的应变相匹配。压辊在稍低的速度下转动，这样便可减去一些 MD 张力，使其降至所需的覆盖带封闭的 2～15%。还可随意地加设第二组压辊，使每条膜带通过一个独立的辊隙，并且如图 8 所示，在刚好使两条独立的膜带接合之前进行独立的张力控制。

再返回参看图 9 的工艺，内衬膜或者说第二热塑性膜的张力通常采用现有技术已知的一组压辊或者说压辊 440 将其控制在大约 0.05～1 磅/线性英寸宽度（PLI）（0.6 密耳，PE 膜）。在优选实施例中，每条膜带通过压辊而使每条膜带中的应变相匹配。因此，每条膜带所受的张力可以是不同的，以便使每条膜带中的应变相匹配。采用普通的边缘导引机构和/或对膜带宽度方向的边缘

进行修整可以使内衬或者说第二膜带沿宽度方向对准。

再参看图 8，组合膜带在铺贴上封合带后其张力一般控制在大约 0.02～2.0 磅/线性英寸（PE 膜）以防止温热的膜带伸长。组合膜带的张力可通过普通的压辊 472 加以控制。覆盖封合带的伸长可使成品出现“波纹”和/或起皱。

参看图 10，本发明的热封至少两条膜带的另一种工艺包含如下步骤：至少制备出可热封在一起的第一膜带和第二膜带；将第二膜带叠置在第一膜带上；制备至少一条封合带，其材料的温度、质量和热容要足以将第二热塑性膜带热封到第一热塑性膜带上；和将上述材料的封合带铺贴在上述的层叠膜带上。本工艺与图 8 所示的工艺相同，只是其封合带挤出机 452 可置于膜带 436 之任何部位的上方，以便在膜带的任一横向点上沿机器运行方向将两种膜带热封在一起。上述封合带铺贴后最好通过辊子 454 与 456 之间而受压。可采用多台封合带挤出机 452 来制备多条沿膜带的机器运行方向的封合带 458，以便形成多个如图 5d 所示的热封式覆盖封合带。上述膜带可通过挤出机供应，或由松卷台（unwind stand）供应。热封的膜带可由任何可热封在一起的热塑性材料包括前面所述的材料来制造。上述膜带的宽度可以是相同的或者是不相同的。上述的封合带一般由任何可与膜带热封在一起的可挤压的材料制成。该封合带最好由热塑性材料包括例如 The Dow Chemical Company 供应的 LDPE 748 来制造。

封合带的温度、热容和质量通常要足以将两种膜带热封在一起。一般来说，封合带的温度就是特定的材料可以挤出但又不会降解的温度。

待热封的膜带的厚度通常应能使热量从封合带传导至膜带而将其热封到下层膜带上。用于形成热封式覆盖封条的封合带的厚度一般为 0.5～10 密耳，该厚度优选值约为 1.5～3.0 密耳，更好是约为 1.5～2.0 密耳。

用于形成热封式覆盖封条的封合带的宽度一般为 3mm 至支

承膜带或者说第一膜带的宽度，该封合带的优选宽度约为 3~76mm，更好是约为 6～19mm。如图 8a 的剖视图所示，成品膜带中的第二膜带 432 被封合在相应的覆盖封条 459 的下面。

参看图 12，本发明的连接至少两条膜带的另一种工艺包含如下步骤：至少制备分别具有第一和第二宽度的第一膜带和第二膜带，上述的第二宽度小于上述的第一宽度，也可以在第二膜带上打孔或开切口；将第二膜带叠置在第一膜带上的两平行边缘之间；制备至少一条封闭材料带；和将上述封闭材料带沿第二膜带的平行边缘铺贴在该膜带上。上述封合带 458 最好通过一台或多台挤出机 452 铺贴在承接膜带上。挤出机 252 可以置于膜带上方的任何部位，以便能够通过形成沿机器运行方向的折叶式覆盖封条而将两种膜带连接在一起。例如，可将多台挤出机 452 交错排列在 3 条或者多条膜带的平行边缘的上方，依次将膜带连接在一起。封合带 458 铺贴到膜带或多条膜带的平行边缘上之后，最好在辊子 454、456 之间受压。

用于形成折叶式覆盖封条封合带 458 最好分别与第一热塑性膜带的边缘等距离的地铺贴。上述封合带通常可由任何可热封到待连接膜带中的至少一部分上的合适的热塑性材料或热塑性材料的混合料来制造。待连接的膜带可以是例如前面所述的热塑性膜、非热塑性膜、织物、非织物、共挤压膜（co-extruded film）等。采用图 5c 所示的封合带将基膜连接在一起。

在形成折叶式覆盖封合时，封合带的宽度范围通常可以是 3mm 至支承膜带或者说第一膜带的宽度，该宽度的优选值约为 3～76mm，更好是 6～19mm。

用于形成折叶式覆盖封条的封合带的厚度一般约为 13～254 微米（0.5～10 密耳），其优选值约为 25～51 微米（1～2 密耳），更好是大约 25.5～38.2 微米（1.0～1.5 密耳）。

参看图 10、10a 和 10b，图中所示的多层袋与图 8 所示的基本相似，只是其内衬 432 是一种膜带宽度加大的单层打孔薄膜。

该薄膜或者说膜带（正如其他实施例所述的，在移过辊子 472 时被折叠起来，并且随后沿打孔线撕开。

参看图 11、11a、11b，本实施例与其他实施例的主要差别是，内衬是由两个独立的有所不同的薄膜形成而不是由打孔或开切口的单层薄膜形成。当两种薄膜移过辊子 472 时，薄膜便重叠起来（在图 11b 可看得很清楚）。

最后，如图 12 和 12a 所示，虽然从袋的强度来说是有利的。但是，完全可以将内衬粘附到覆盖封条 459 的外表面 482 上而不是粘在内表面 480 上，正如通常在采用覆盖封条代替热封或前面列举的其他封合技术时所做的那样。

显然可以确信，上述本发明的优选实施例能实现上述本发明的目的，但是应当明白，在不违背本发明的精神的情况下允许对本发明进行改型、改进和改变。

说 明 书 附 图

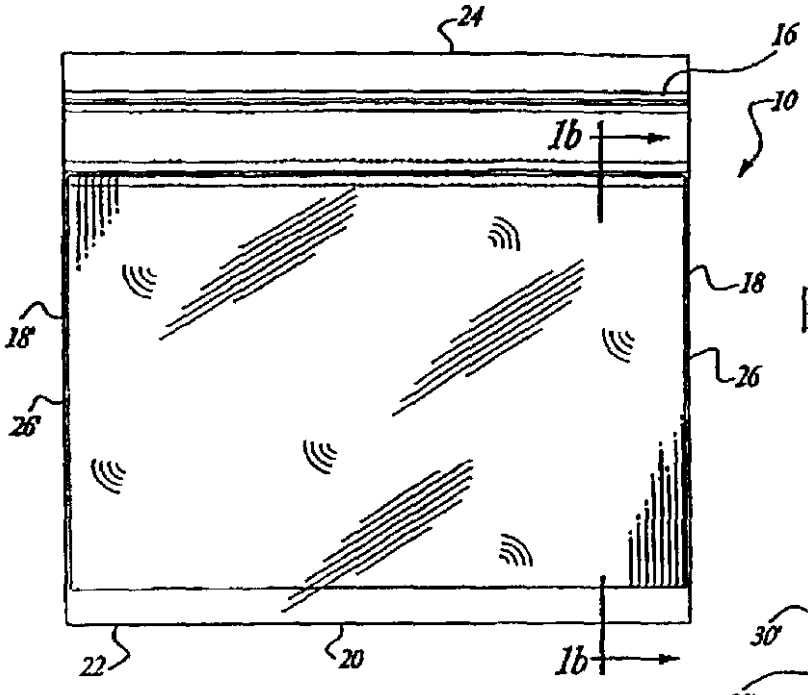


图 1a

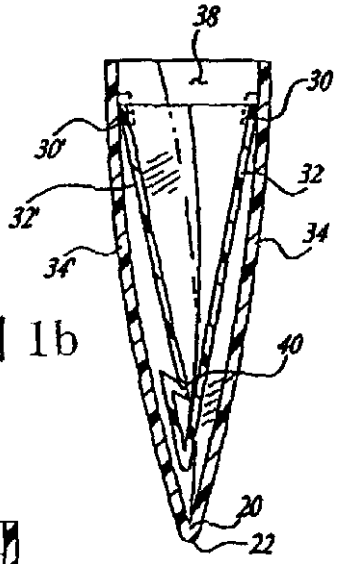


图 1b

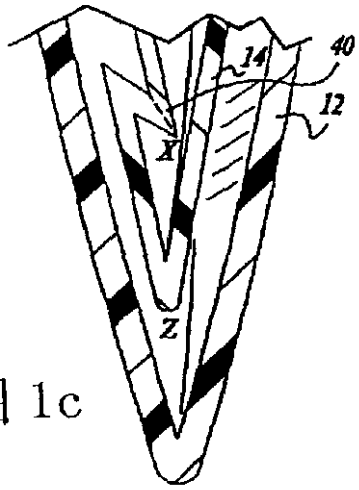


图 1c

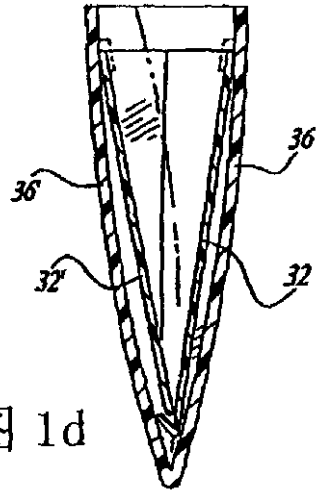


图 1d

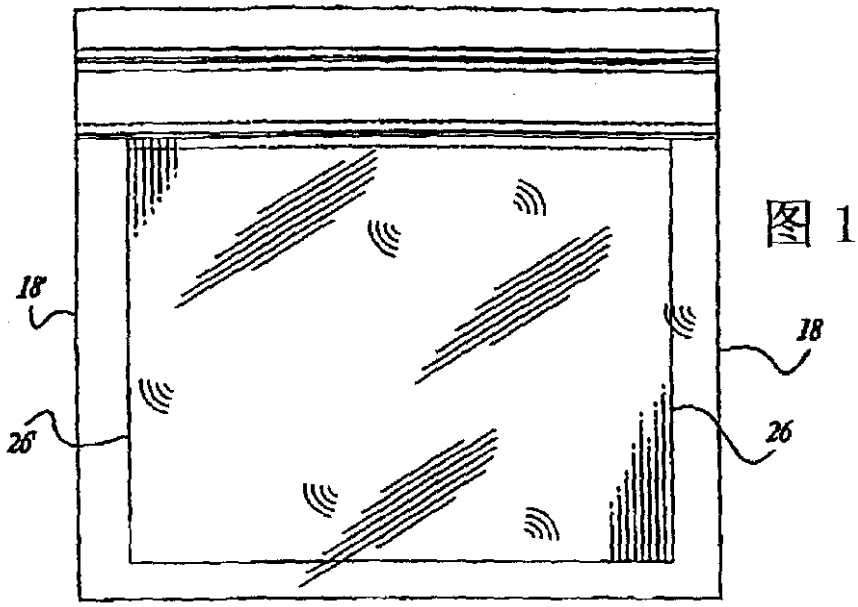


图 1e

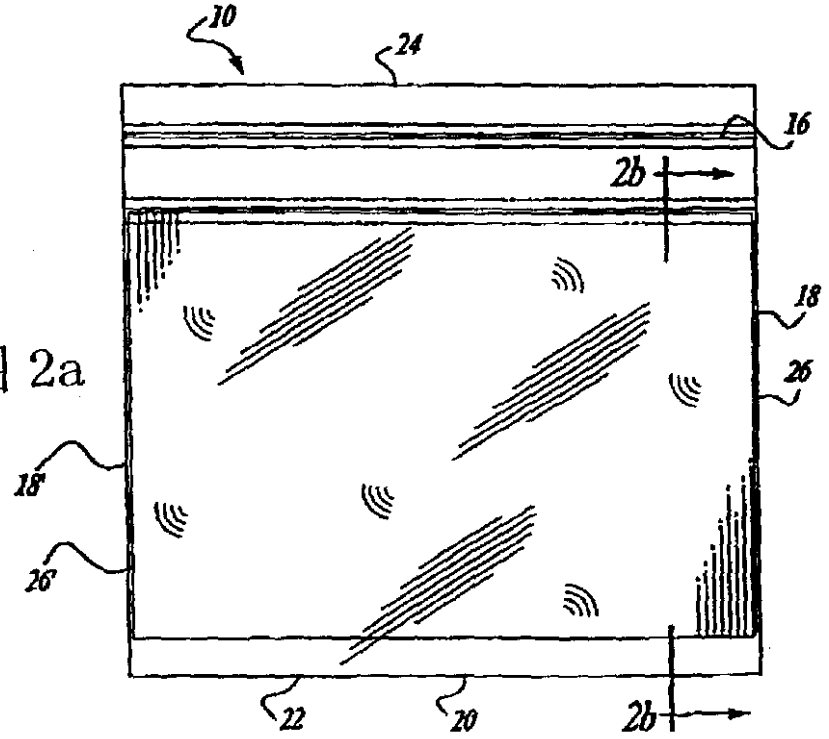


图 2a

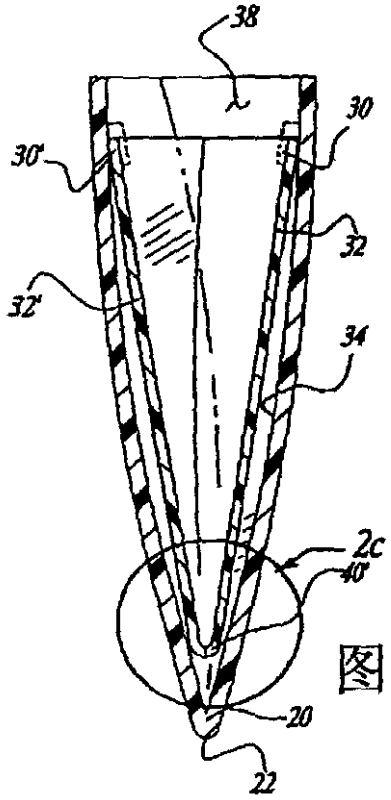


图 2b

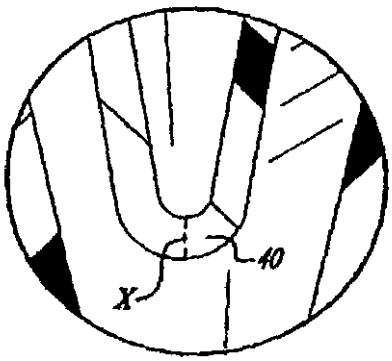


图 2c

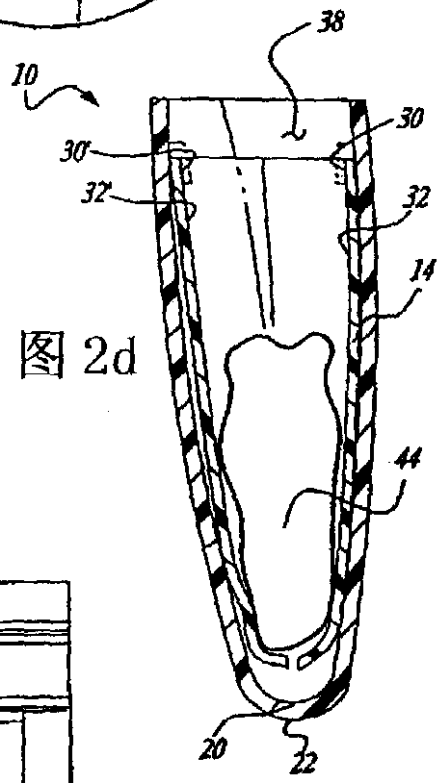


图 2d

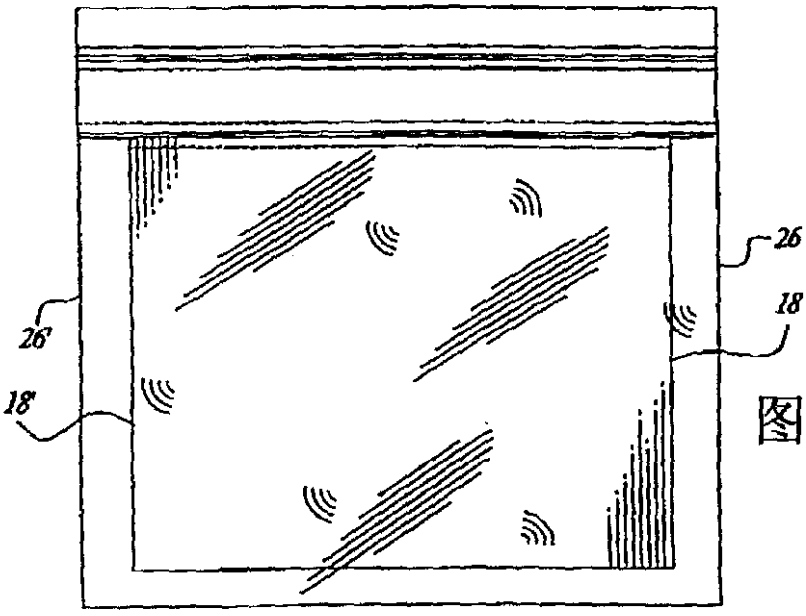


图 2e

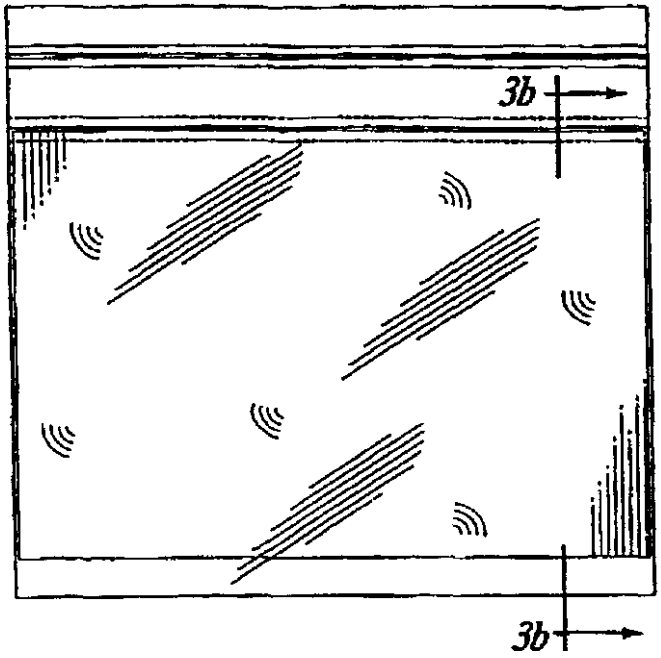


图 3a

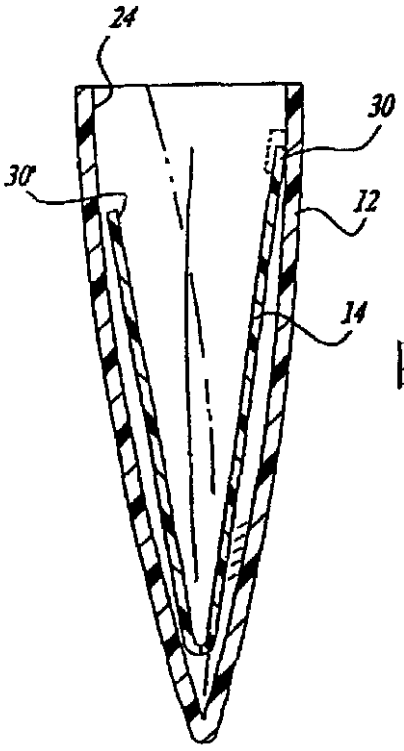


图 3b

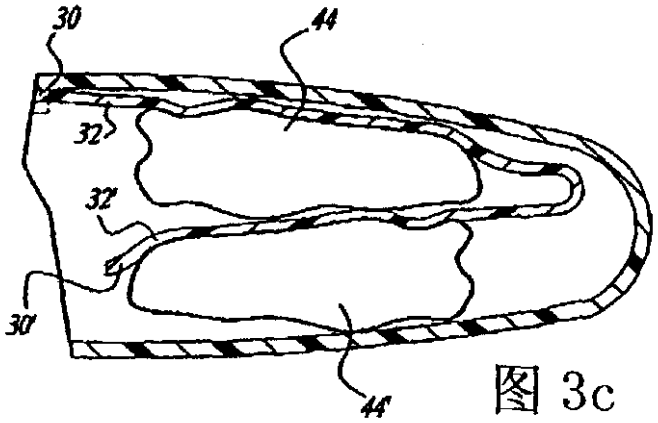

30
44
32
32'
30'
44'

图 3c

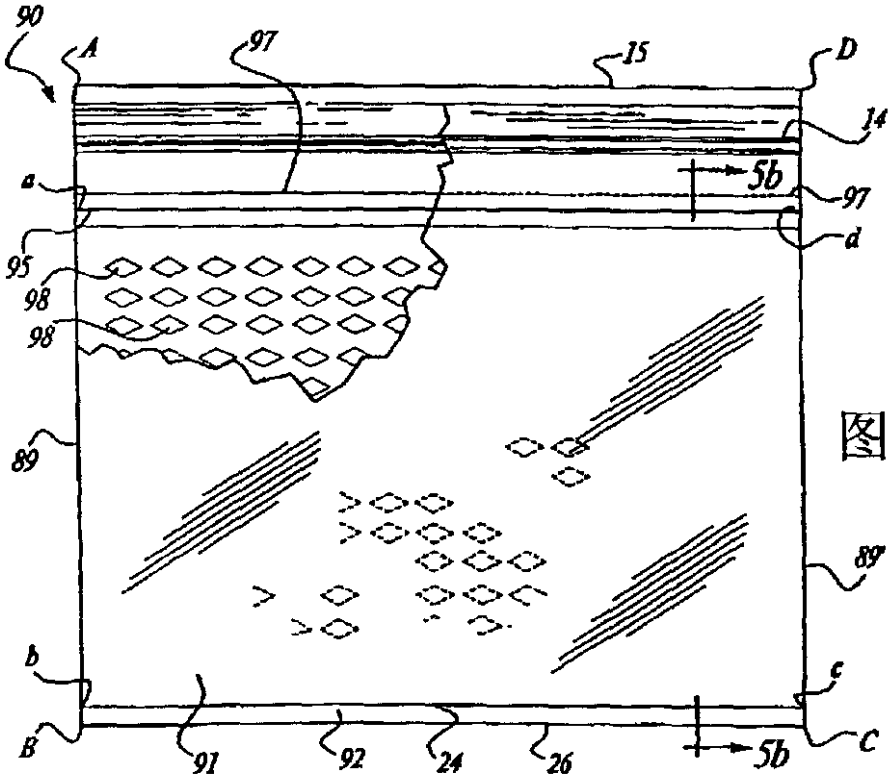
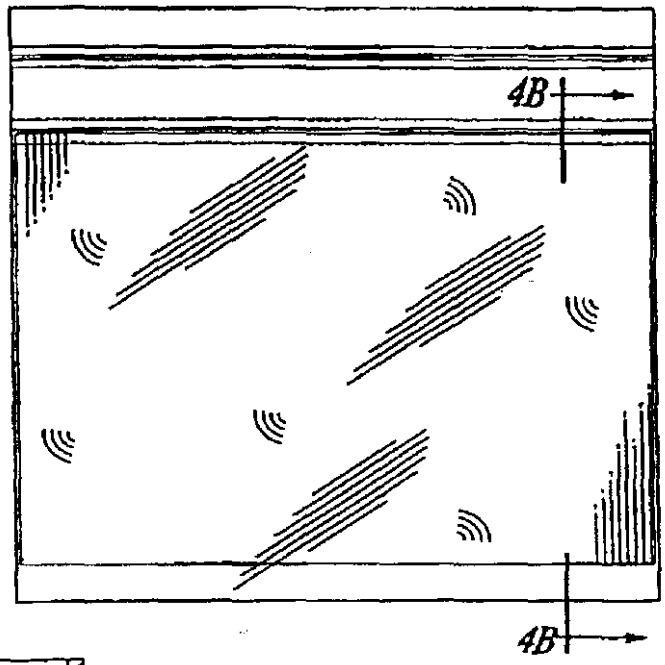

90
A
97
15
D
14
a
5b
97
d
95
98
98
89
89'
b
c
B
91
92
24
26
5b
C

图 5a

图 4a



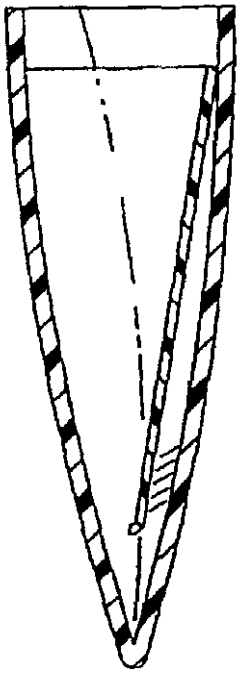


图 4B

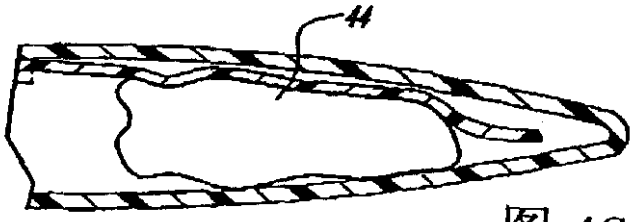


图 4C

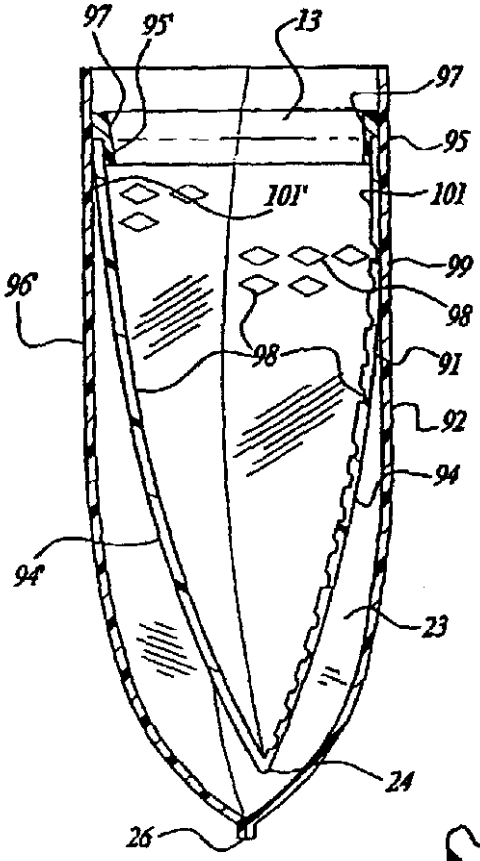


图 5b

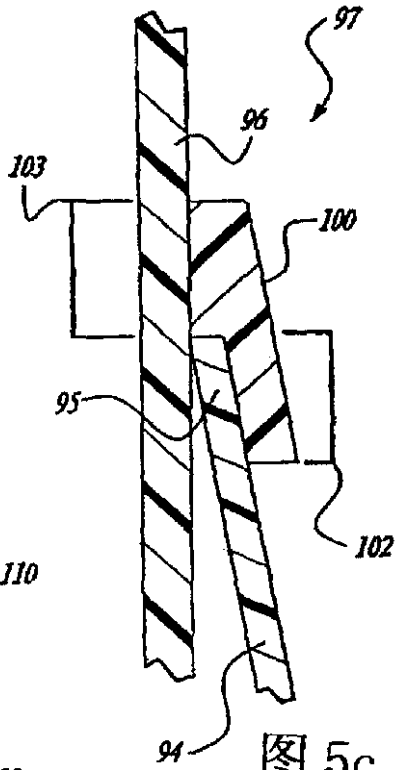


图 5c

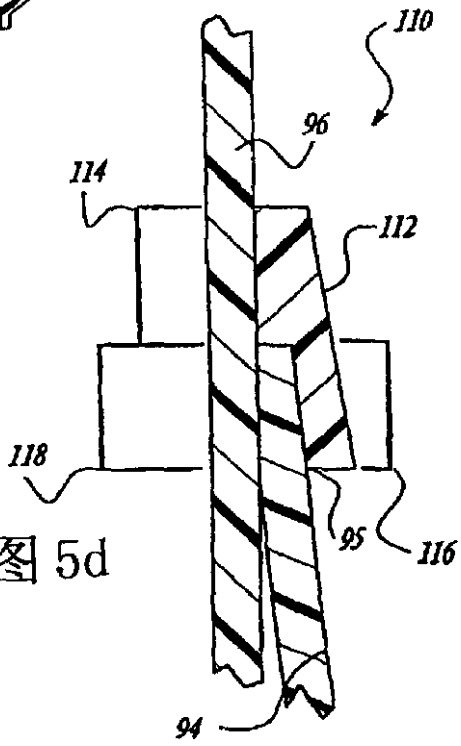


图 5d

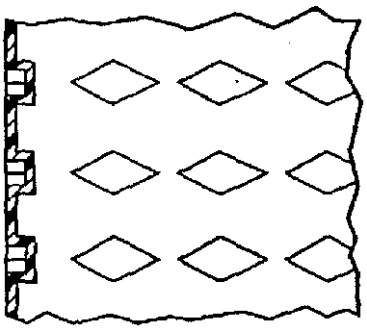


图 6a

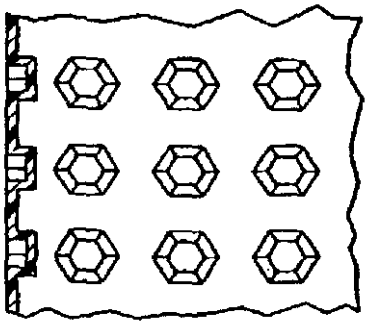


图 6b

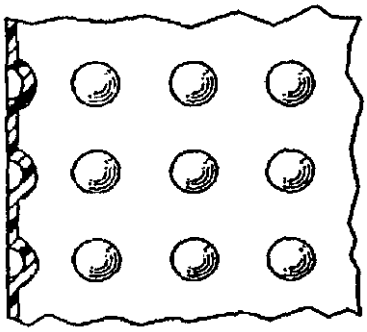


图 6c

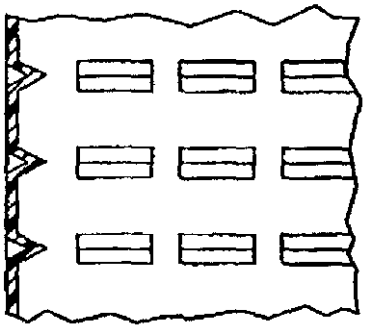


图 6d

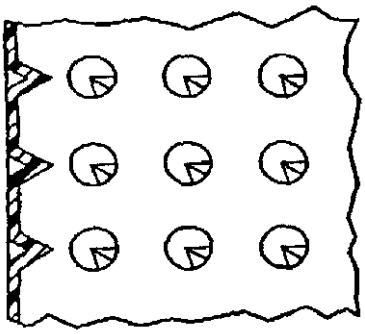


图 6e

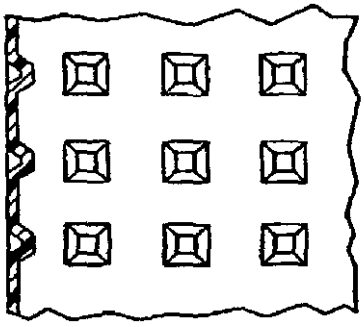


图 6f

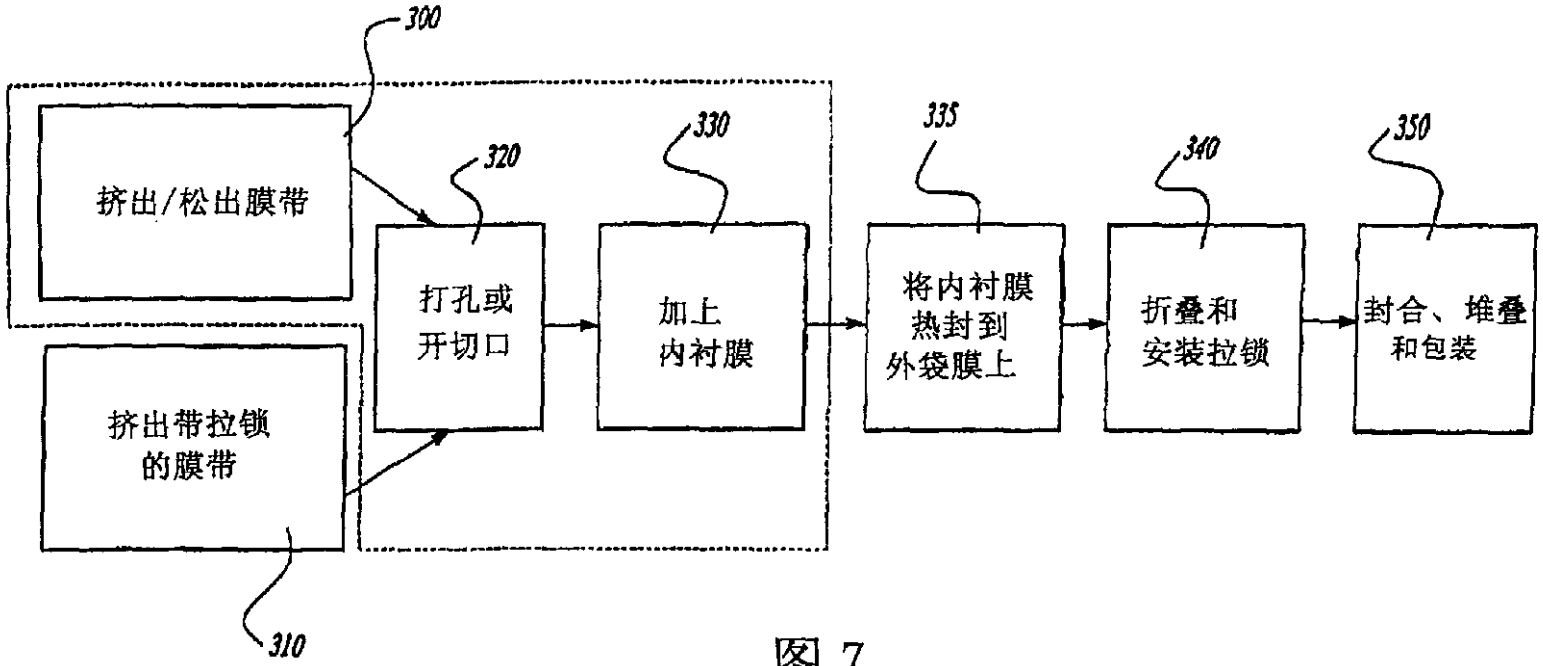

300
挤出/松出膜带
320
打孔或
开切口
330
加上
内衬膜
335
将内衬膜
热封到
外袋膜上
340
折叠和
安装拉锁
350
封合、堆叠
和包装
挤出带拉锁
的膜带
310

图 7

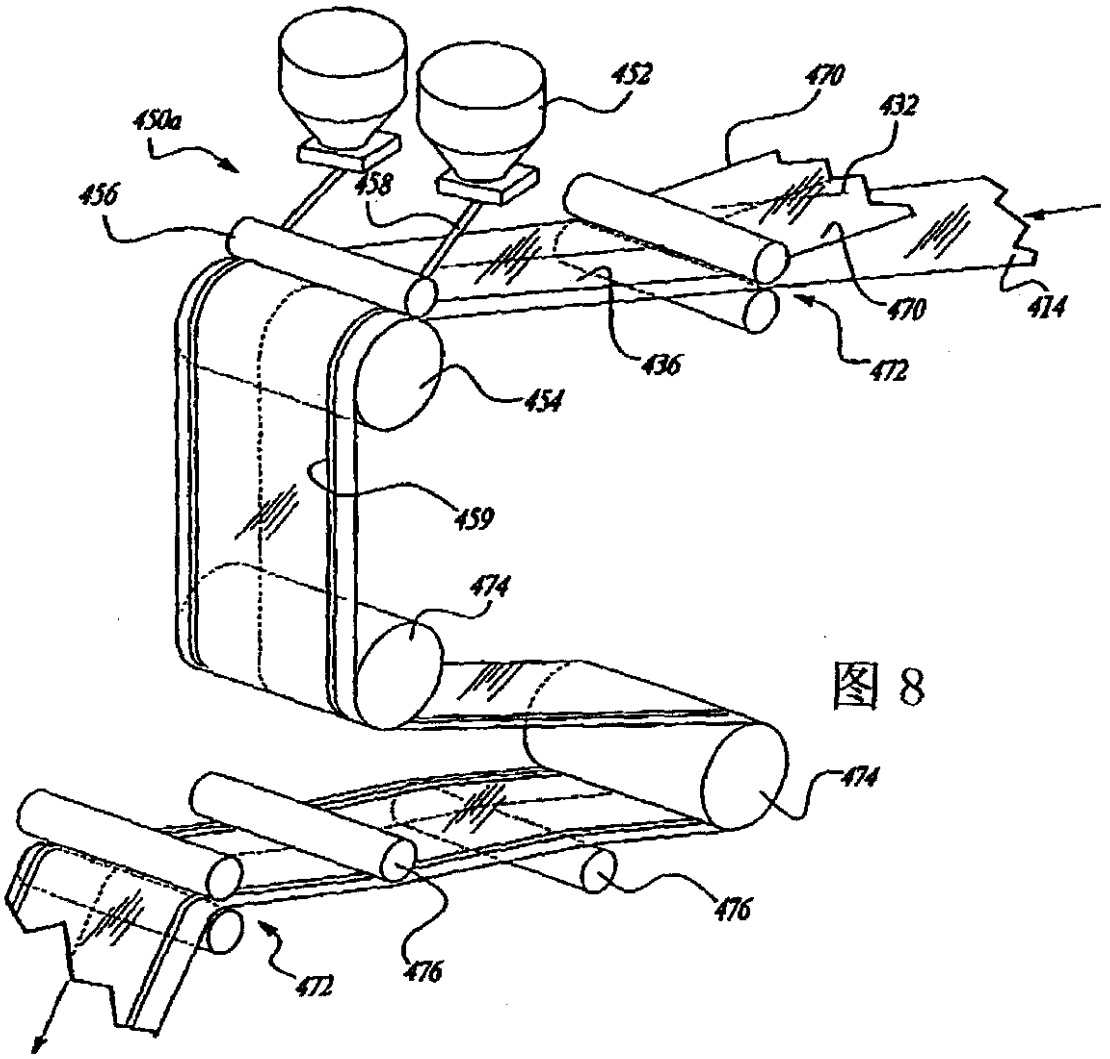

452
470
432
450a
458
456
470
414
436
472
454
459
474
474
476
476
472

图 8

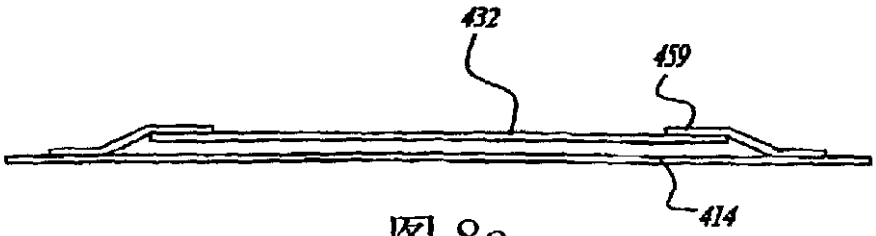

432
459
414

图 8a

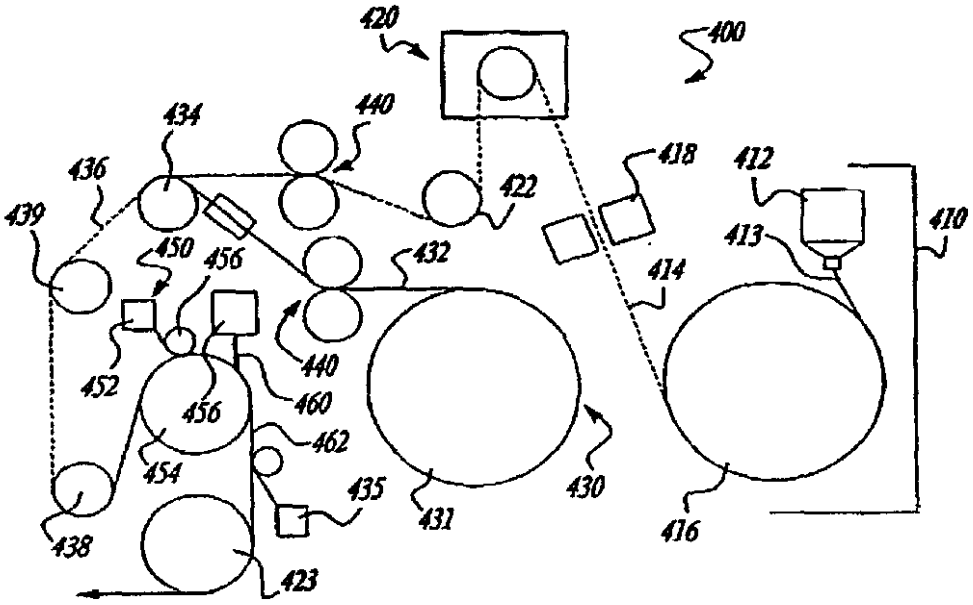

420
400
434
440
436
418
412
422
439
450
456
432
413
410
414
452
440
460
456
462
454
435
431
430
438
423
416

图 9

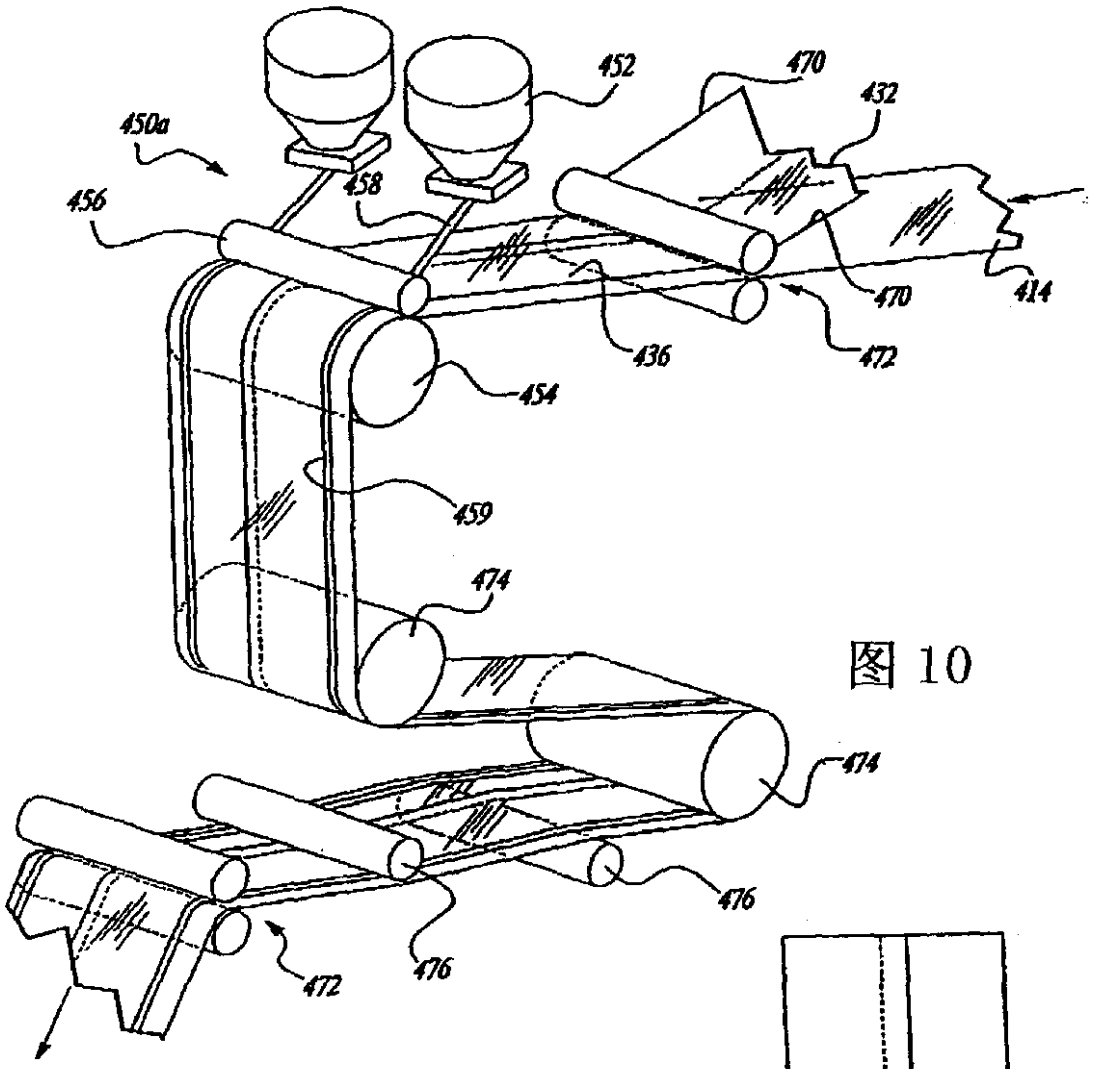


图 10

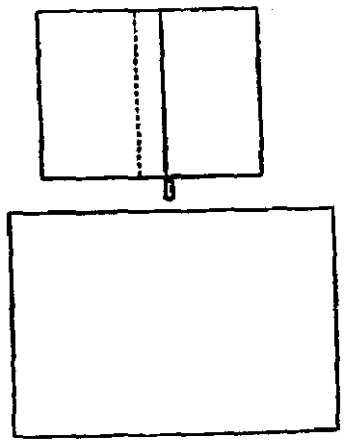


图 10a

图 10b

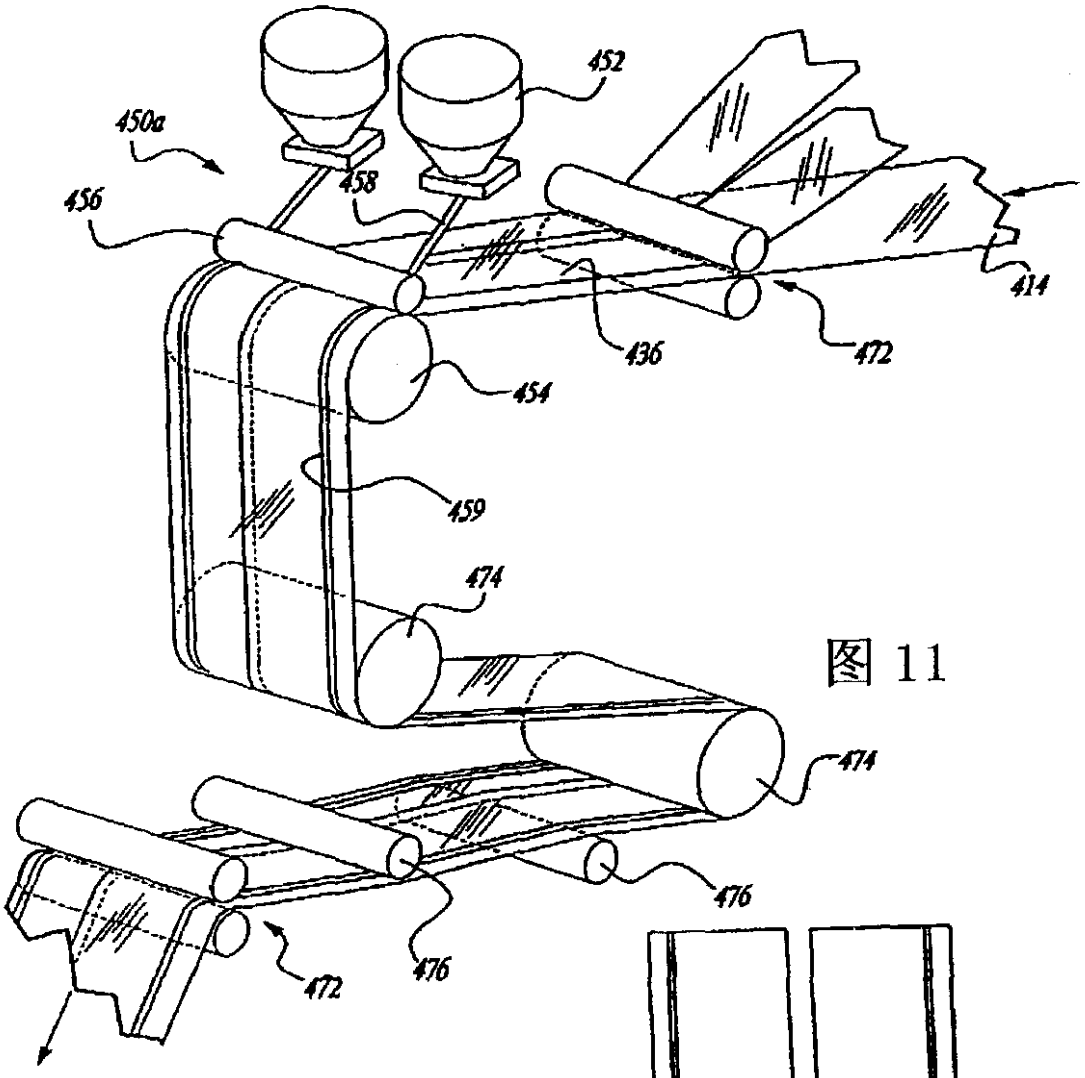


图 11

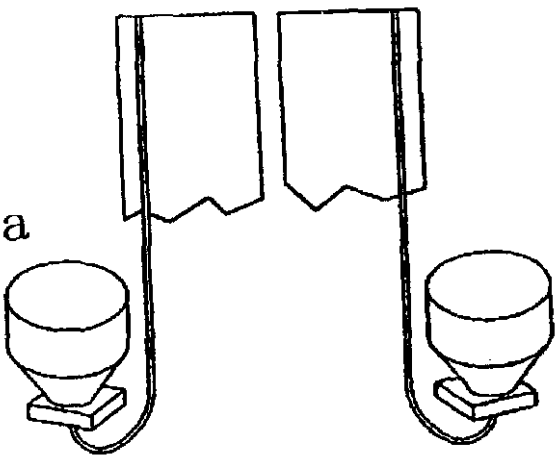


图 11a

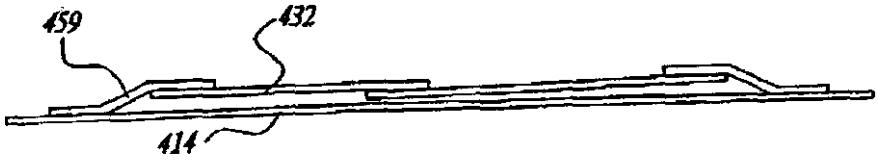


图 11b

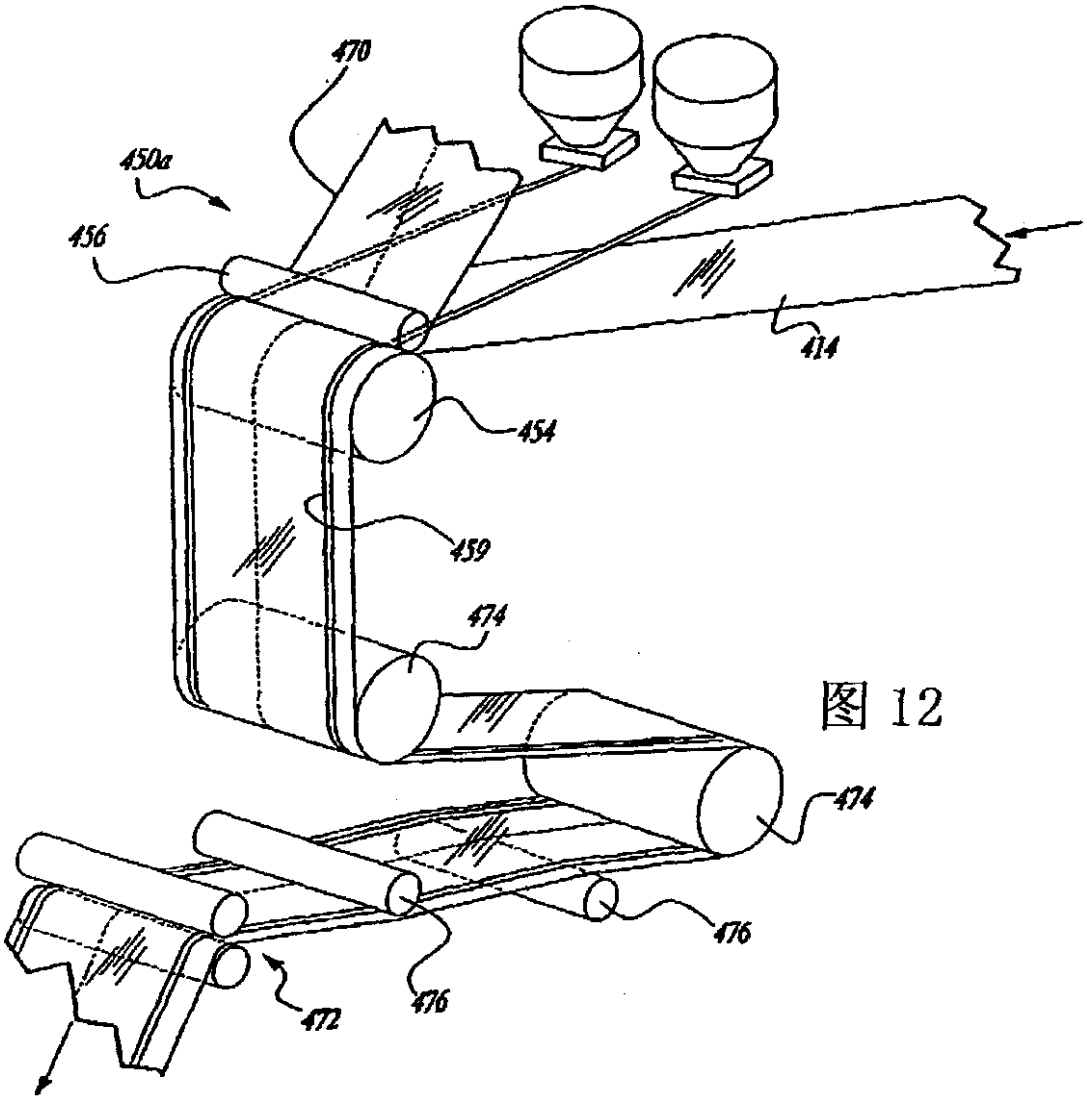


图 12

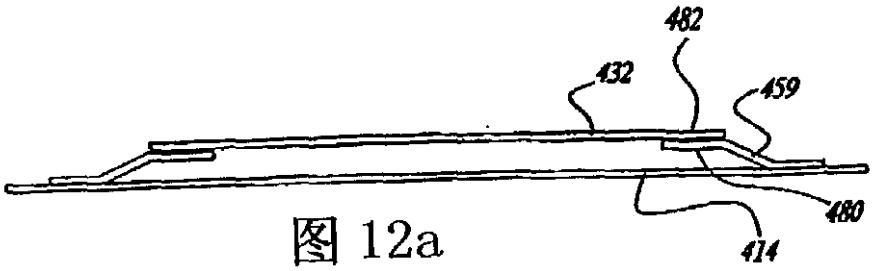


图 12a