GUSSETED POLYMERIC BAG HAVING STEPPED BOTTOM HOT AIR SEALED

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ABSTRACT

The present invention concerns a gusseted flexible bag. In one embodiment, the flexible bag of the present invention is formed from the tube of material having a front side and a rear side. A pair of laterally disposed opposing gusset folds are formed in the tube along its sides. Each of the folds has a longitudinal crease. The bag further has a rear side flap extending from the rear side of the bag across the width of the tube which is folded over onto and hot air sealed to the front side of the tube of material. The gussets each have a slit approximate a first end of the tube thereby forming a front side flap. A front side flap may also be manufactured, if desired, which is then folded over when the rear side flap is folded so that the front side flat rests under the rear side flap. The rear side flap is hot air sealed to the front side of the bag with the front side flap being sealed theretbetween. In the preferred embodiment the tube of material comprises polypropylene film on the exterior of the tube and woven polypropylene film on the interior of the tube.
Laminated Polypropylene Tubes - folding process

Laminated Polypropylene Tubes - prefolded

12 Laminated Polypropylene Tubes - surface removed

12 Laminated Polypropylene Tubes - surface sliced

Laminated Polypropylene Tubes - gusset slit
GUSSETED POLYMERIC BAG HAVING STEPPED BOTTOM HOT AIR SEALED

CROSS-REFERENCE TO RELATED APPLICATIONS


BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention pertains to a polypropylene woven bag with a pinch bottom seal for the containment and storage of animal feed, pet food and other similar types of contents. More particularly, the invention relates to a woven polypropylene bag that may include a variety of seals for the bottom and/or top of the bag, including a pinch seal.

[0004] 2. Description of the Prior Art

[0005] Manufacturers of plastic bags have known for some time to use adhesives to seal the bottom portion of the bag. In particular, the bottom portions of paper bags have been sealed using hot melt adhesive. As is noted in U.S. patent application Ser. No. 11/441,517, filed May 26, 2006, which is the parent of the present application, hot melt adhesives may be used to seal pinch bottom bags. However, for certain applications in which the bottom seal of the bag is severely tested by heavy weight loads, the hot melt adhesive seals sometimes fail. Similarly, use of hot melt adhesives for sealing reclosable fastener profiles to bags can be found in U.S. Pat. No. 4,341,575. Moreover, examples of pinch bottom bags, apparatuses, and methods of manufacturing pinch bottom bags are seen in U.S. Pat. Nos. 6,623,162; 6,599,016; 6,367,976; 6,328,471; 5,791,485; 5,553,943; 5,474,383; 5,021,209; 4,610,651; 4,567,987; 4,550,442; 4,515,273; and 4,344,558. Hot air sealing of polypropylene to polyethylene using VISTAMAX polypropylene based co-polymer may be found in U.S. Patent Publication No. 2012/0070103, but the principal sealing method disclosed therein is heat activated adhesive.

BRIEF SUMMARY OF THE INVENTION

[0006] The present invention concerns a gusseted flexible bag, a method of manufacturing the bag, an apparatus for manufacture of said bags, closure devices for such bags and methods of sealing the bag.

[0007] In one embodiment, the flexible bag of the present invention is formed from a tube of material having a front side and a rear side. A pair of laterally disposed opposing gusset folds are formed in the tube along its sides. Each of the folds has a longitudinal crease. The bag further has a rear side flap extending from the rear side of the bag across the width of the tube which is folded over onto the front side of the tube of material. The gussets each have a slit proximate a first end of the tube thereby forming the rear side flap. The rear side flap is hot air sealed to the front side of the bag. In the preferred embodiment the tube of material comprises polypropylene film on the exterior of the tube and woven polypropylene film on the interior of the tube. In a preferred embodiment the woven polypropylene film on the inner surface of the rear side flap is sealed to the biaxially oriented polypropylene (B.O.P.P.) film on the outside surface of the tube of material. In a preferred embodiment, the polypropylene and woven polypropylene are hot air sealed at a temperature of 375-550° F.

[0008] The rear side flap of the flexible bag has a length of 1.75”+/−0.25 inch and the front side flap has a length of 1.5”+−0.5 inch. The tube of material preferably has a thickness from 5 mm to as much as 50 mm in thickness. The polypropylene film from which the tube of materials is made can be from 5 to 25 mm in thickness and the woven polypropylene film similarly can be from 5 to 25 mm in thickness. The woven polypropylene film is sealed to the polypropylene film on the interior of the bag across substantially all of the inside surface of the B.O.P.P. The polypropylene film is preferably biaxially oriented polypropylene. One means of sealing the polypropylene film to the woven polypropylene film is by means of an intermediate layer of polyethylene and ethylene vinyl acetate. Alternatively the front side flap may be sealed by a means of hot melt adhesive to the rear side flap.

[0009] In an alternative embodiment of the invention the front and rear sides of the tube of material are reversed so that the front side flap is sealed to the rear side of the tube. Further, and in an additional alternative embodiment of the invention a pair of laterally disposed opposing gusset folds are again formed in the tube along its sides. Each of the tubes has a longitudinal crease. The bag of the present invention has a front side flap extending from the front side of the bag across the width of the tube which is folded over and hot sealed to the rear side of the tube of material. The gussets each have a slit proximate a first end of the tube thereby forming the rear side flap.

[0010] In another embodiment, the flexible bag of the present invention is formed from a tube of material having a front side and a rear side. A pair of laterally disposed opposing gusset folds are formed in the tube along its sides. Each of the folds has a longitudinal crease. The bag further has a rear side flap extending from the rear side of the bag across the width of the tube which is folded over onto and hot air sealed to the front side of the tube of material. The gussets each have a slit proximate a first end of the tube thereby forming a front side flap. The front side flap during manufacture is then folded over when the rear side flap is folded so that the front side flat rests upon the rear side flap. The rear side flap is hot air sealed to the front side of the bag with the front side flap being sealed therewith. In the preferred embodiment the tube of material comprises polypropylene film on the exterior of the tube and woven polypropylene film on the interior of the tube. In a preferred embodiment the woven polypropylene film on the inner surface of the rear side flap is sealed to the woven polypropylene film on the inside surface of the front side flap.

[0011] An additional feature of the invention is a method of sealing a bag formed from a tube of material and having a front side and a rear side and a pair of opposing and inwardly
tending gusset folds. Each of the folds has a longitudinal crease. The method comprises the steps of opening the tube of material so as to separate the front side from the rear side. Each of the creases is slit proximate a first end of the tube parallel to the longitudinal axis of the crease thereby obtaining front and rear plies. A strip of material is trimmed from the front surface of the tube and from the gussets proximate the first end of the tube so as to form a bottom flap. The bottom flap is then folded over the top surface of the bag and hot air is applied to seal the bottom flap to the top surface of the bag. The tube may then be cut so as to form a bag sealed at one end. The tube of material preferably comprises woven polypropylene on the inside and polypropylene film on the outside. In one embodiment the top flap and bottom flap may be plasma treated prior to folding and heat sealing to each other in order to facilitate the sealing of the flaps to each other as well as increasing the seal strength. Alternatively, hot melt may be applied to the top flap and the bottom flap so that when folded and compressed against each other and heat sealed the hot melt adhesive melts and seals the bag walls to each other. As an additional alternative, the top flap and bottom flap may be ultrasonically sealed to each other. Again, an additional alternative is to corona treat the top and bottom flaps so as to facilitate sealing of the flaps to each other. Additionally, a score line may be formed along the front side of the tube so as to facilitate folding of the top flap over onto the top wall of the bag. The hot air may be directed against the outside of the bottom flap by means of nozzle which is pressed against the top flap during manufacture of the bag, thereby causing the heat to radiate through the top flap and seal the top flap to the bottom flap.

[0012] An alternative method of sealing a bag formed from a tube of material and having a front side and a rear side and a pair of opposing and inwardly tending gusset folds is also disclosed. Each of the folds has a longitudinal crease. The method comprises the steps of opening the tube of material so as to separate the front side from the rear side. Each of the creases is slit proximate a first end of the tube parallel to the longitudinal axis of the crease thereby obtaining front and rear plies. A strip of material is trimmed from the front surface of the tube and from the gussets proximate the first end of the tube so as to form a top flap and a bottom flap. The slits are longer than the strip of material so as to create the top flap after the strip of material has been removed. The top flap is then folded over itself towards the remainder of the tube, i.e., the front surface of the bag. The bottom flap is then folded over the top flap and hot air is applied to seal the top flap to the bottom flap so as to seal both to the top of the bag. Additionally, the bottom flap may extend beyond the top flap so as to seal the top flap to the front surface of the tube. The tube may then be cut so as to form a bag sealed at one end. The tube of material preferably comprises woven polypropylene on the inside and polypropylene film on the outside.

[0013] An additional feature of the invention is an apparatus for manufacturing bags comprising polypropylene and woven polypropylene. The apparatus includes an unwind for unwinding a web of laminated polypropylene and woven polypropylene. A folder folds the web of polypropylene into a tube. A sealer seals the edges of the web of film of polypropylene and woven polypropylene together so as to form a tube. Alternatively, the woven polypropylene can be formed as a tube and a tube of polypropylene film coextruded around the woven polypropylene and sealed to the woven polypropylene contained therein. Gusset forming plows form gussets in the lateral sides of the tube of polypropylene and woven polypropylene. An opener, preferably using a blast of air, opens one end of the tube of polypropylene and woven polypropylene. A slitter then slits the gussets in the tube of polypropylene. A trimmer trims the slit portions of the first end of the tube. In one embodiment a score line may be formed across the tube to facilitate folding of a top flap of the tube over onto itself. A picker then removes the slit portion of the tube from the remainder of the tube. In one embodiment, a folder folds the flap formed by the trimming of the tube, i.e., the top flap 180° back onto the top surface of the tube. A folder then folds the bottom flap of the tube over onto the folded top flap and compresses the top flap against the bottom flap. A hot air sealer seals the top and bottom flaps together so as to form a heat seal of the first end of the tube. A cutter then cuts the tube a desired distance from the first end of the tube; i.e., at a second end as to form a bag sealed at its first end and open at its second end.

[0014] In an alternative embodiment of the invention a method of sealing the bag is disclosed which is formed from a tube of material and having a rear side and a front side and a pair of opposing and inwardly tending gusset folds. Each of the folds has a rear and front longitudinal crease. The method comprises the steps of opening the tube of material so as to separate the rear side from the front side. Each of the creases is slit proximate a first end of the tube along the longitudinal axis of the crease thereby obtaining front and rear plies. A strip of material is trimmed from the rear surface of the tube and from the gussets proximate the first end of the tube so as to form a bottom flap after the strip of material has been removed. The bottom flap is then folded over itself towards the remainder of the tube i.e., the top surface of the bag. Hot air is applied to seal the bottom flap to the top surface so as to seal the top of the bag. The tube may then be cut so as to form a bag sealed at one end. The tube of material preferably comprises woven polypropylene on the inside and polypropylene film on the outside. The folding of the bottom flap results in the woven polypropylene on the bottom flap being heat sealed to the B.O.P.P. on the top flap.

[0015] In an additional alternative embodiment there is not a bottom flap folded over itself towards the remainder of the tube i.e., the bottom surface of the bag. In this embodiment the top flap is folded over and sealed to the bottom surface of the bag.

[0016] The invention further includes an alternative embodiment in which the apparatus for manufacturing bags holds the bottom flap of the tube over onto itself and there is not a top flap. The bottom flap is then sealed to the front surface of the bag using hot air sealing.

[0017] The bag of the present invention has a width of 13.5"+/−3.25 inch, a length of 27.25"+/−6.75" and cross-section at each gusset fold of 5"+/−1.25 inch. The bag of the present invention has a first and second panel and a stepped end. The stepped end includes side gussets of the composite tube which are longer than the first panel and second panel of the composite tube and a flap which extends longer than the side gussets. An inverted zipper assembly having an inverted first flange is bonded to the first panel to form a seal there between. The stepped end is then folded over and bonded to the inverted second flange of the zipper assembly to form a seal there between. The first flange of the bag is bonded to a portion of the first panel and a portion of the first panel which is adjacent to the stepped end. The first panel may be creased and the first inverted flange is bonded to a portion of the first panel whereby the portion of the first panel between the crease and the edge of the first panel is adjacent to the stepped end.
In an additional alternative embodiment of the invention a flexible bag is formed from the tube consisting essentially of a material having an outer layer of polypropylene and an inner layer of woven polypropylene that are directly sealed to one another over the entire surface area of the outer layer and the inner layer. The tube has a front side and a rear side. A pair of opposing inward tending gusset folds are formed in the tube, each of the folds having front and a rear vertical crease. The bag has at least one sealed closure formed by a method comprising the steps of slitting each of the front creases along the longitudinal axis thereof, thereby obtaining front and rear plies. A first rearward fold is formed by rearwardly folding the rear ply together with the rear vertical crease, such that the inner surface of the rear ply is visible. A second rearward fold is then formed by rearwardly folding the first fold wherein the inner surface of the rear ply lies against the rear side of the bag. The method further includes the step of applying hot air to the surface of the rear ply so as to seal the inner surface to the rear side of the bag and applying hot air to the outer surface of the rear ply so as the seals at first rearward fold to set second rearward fold. The invention further includes a bag form of the tube consisting essentially of a polyolefin material and having a front and a rear side. A pair of laterally opposing inward tending gusset folds are formed in the tube, each having front and rear vertical creases. The bag is formed by the method of parting the material longitudinally along the front crease, rolling the rear ply resulting from said step of parting along with the portion of the bag proximate to the rear ply, such that a surface of said rear ply opposes the rear side of the bag. The surface of the rear ply is then heat sealed to the rear side of the bag. The material has an outer layer of polypropylene and an inner layer of woven polypropylene that are each directly sealed to one another over the entire surface area of the outer and inner layers. In an alternative embodiment, the bag may be constructed of a polyolefin material having a front side and a rear side. A pair of opposing inward tending gusset folds is formed in the tube, each of the folds having front and rear vertical creases and each of the folds being between the front side and the rear side of the tube. At least one sealed closure is constructed having a front ply and a rear ply. The front ply and the rear ply are separated by a pair of slits along the front creases along the longitudinal axis thereof and the rear ply has an inner and outer surface. A first rearward fold causes the outer surface of the rear ply to oppose a first portion of the rear side of the bag. A second rearward fold causes the inner surface of the rear ply to oppose a second portion of the rear side of the bag. The material has an outer layer of polypropylene and an inner layer of woven polypropylene that are each directly sealed to one another over the entire surface of the outer layer and the inner layer. In a preferred embodiment, the inner surface is hot air sealed to the rear ply. The bag is preferably hot air sealed at a temperature between 375 and 550 degrees Fahrenheit.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0019] Embodiments are disclosed herein with reference to the accompanying drawings. In the drawings, like reference numbers indicate identical or functionally similar elements.

[0020] FIG. 1A is a perspective view of a tube of material.

[0021] FIG. 1B is a perspective view of an expanded tube of material.

[0022] FIG. 1C is a perspective view of an expanded and slit tube of material.

[0023] FIG. 1D is a perspective view of an expanded tube of material with a strip of material removed.

[0024] FIG. 1E is a perspective view of an expanded tube of material with a strip of material removed.

[0025] FIG. 1F is a perspective view of a tube of material with a strip of material removed.

[0026] FIG. 1G is a perspective view of a tube of material with a partially-folded flap.

[0027] FIG. 1H is a perspective view of a tube of material with a folded flap.

[0028] FIG. 2A is a sectional view of the lateral side of a tube of material.

[0029] FIG. 2B is a sectional view of the lateral side of a tube of material.

[0030] FIG. 2C is a sectional view of the lateral side of a tube of material with a gusset slit.

[0031] FIG. 2D is a sectional view of the lateral side of a tube of material with a strip of material separated.

[0032] FIG. 2E is a sectional view of the lateral side of a tube of material with a separated strip of material.

[0033] FIG. 2F is a sectional view of the lateral side of a tube of material with a fold.

[0034] FIG. 3A is a sectional view of the central portion of a tube of material.

[0035] FIG. 3B is a sectional view of the central portion of a tube of material with a separated strip of material.

[0036] FIG. 3C is a sectional view of the central portion of a tube of material with a strip of material removed.

[0037] FIG. 3D is a sectional view of the central portion of a tube of material with a fold.

[0038] FIG. 4A is a perspective view of an expanded tube of material with a strip of removed and a gusset slit.

[0039] FIG. 4B is a perspective view of an expanded tube of material with a partially-folded flap.

[0040] FIG. 4C is a perspective view of an expanded tube of material with a folded top flap.

[0041] FIG. 4D is a perspective view of an expanded tube of material with a partially-folded bottom flap.

[0042] FIG. 4E is a perspective view of an expanded tube of material with a folded bottom flap.

[0043] FIG. 5 is a schematic view of a portion of an assembly for forming a bag from a tube of material using a hot air sealer.

[0044] FIG. 6 is a schematic view of a portion of an assembly for forming a bag from a tube of material using adhesive.

[0045] FIG. 7 is a schematic view of a portion of an assembly for forming a bag with a reclosable-fastener from a tube of material.

[0046] FIG. 8 is a perspective view of a bag sealed with an inverted zipper assembly.

[0047] FIG. 9 is a perspective view of an expanded tube of material prior to being sealed with a rearward fold.

DETAILED DESCRIPTION OF THE INVENTION

[0048] The various embodiments of the present disclosure and their advantages are best understood by referring to FIGS. 1A through 9 of the drawings. The elements of the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the disclosure. Throughout the drawings, like numerals are used for like and corresponding parts of the various drawings.
The drawings represent and illustrate examples of the various embodiments of the disclosure, and not a limitation thereof. It will be apparent to those skilled in the art that various modifications and variations can be made in the present disclosures without departing from the scope and spirit of the disclosure as described herein. For instance, features illustrated or described as part of one embodiment can be included in another embodiment to yield a still further embodiment. Moreover, variations in selection of materials and/or characteristics may be practiced to satisfy particular desired user criteria. Thus, it is intended that the present disclosure covers such modifications as come within the scope of the features and their equivalents.

FIGS. 1A through 1F generally depict a flexible bag 10 in accordance with one embodiment of the claimed invention. As shown in FIG. 1A, a flexible bag 10 of the present invention is formed from a tube of material 12 having a front side 14 and a rear side 16. As will be understood by one of skill in the art, the front side 14 can also be referred to as a top side while the rear side 16 could also be referred to as the bottom side of the tube 12. The tube 12 has an interior surface 36 and an exterior surface 38. A pair of laterally disposed opposing gusset folds 18 and 20 are formed in the tube 12 along its lateral sides. As shown in FIG. 1B, each of the folds 18 and 20 has an inward longitudinal crease 22 and 24. With reference to FIG. 1C, the gussets 18 and 20 each have a slit 28 proximate a first end 30 of the tube 12. Each slit 28 is created parallel to the longitudinal axis of each crease 22 and 24. As shown in FIGS. 1D and 1E, a strip of material 26 is trimmed and removed from the front side 14 and the gusset folds 18 and 20 at the first end 30 of the tube of material 12, thereby forming a rear side flap 34. As shown in FIG. 1F, the rear side flap 34 extends across the width of the tube. With reference to FIG. 1G, the rear side flap 34 and a portion of the front side 14 including the gusset folds 18 and 20 is folded over onto the front side 14 of the tube of material 12. As shown in FIG. 1H, the rear side flap 34 is hot air sealed to the front side 14 of the bag 10.

In an alternative embodiment of the invention, the bag 10 is substantially as described above except the front side 14 and rear side 16 of the tube of material 12 are reversed so that a front side flap is sealed to the rear side 16 of the tube.

Another embodiment of a flexible bag 10 made in accordance with the present invention is shown in FIGS. 4A through 4E. As described above and depicted in FIG. 4A, a flexible bag is formed from a tube of material 12 having a front side 14 and a rear side 16. A pair of laterally disposed opposing gusset folds 18 and 20 are formed in the tube 12 along its sides. Each of the folds 18 and 20 has an inward longitudinal crease 22 and 24. The bag 10 further has a rear side flap 34 extending across the width of the tube 12. A slit 28 is formed in each of the gussets 18 and 20 proximate the front side 14 of a first end 30 of the tube 12 thereby forming a front side flap 32. As shown in FIGS. 4B and 4C, the front side flap 32 is folded over against the front side 14 of the tube of material 12. As shown in FIGS. 4D and 4E, the rear side flap 34 is also folded over so that the front side flap 32 rests between the rear side flap 34 and the front side 14 of the bag 10. The rear side flap 34 is hot air sealed to the front side 14 of the bag 10 with the front side flap 32 being sealed therebetween.

In a preferred embodiment, the tube of material 12 comprises polypropylene film on the exterior surface 38 of the tube 12 and woven polypropylene film on the interior surface 36 of the tube 12. The polypropylene film forming the interior side is further preferably biaxially oriented polypropylene (B.O.P.P.). The woven polypropylene film forming the inner surface 36 of the bag 10 is sealed to the polypropylene film forming the exterior surface 38 of the bag across substantially all of the interior surface of the polypropylene film. The woven polypropylene film on the inner surface 36 of the rear side flap 34 is sealed to the polypropylene film on the outer surface 38 of the front side 14 of the tube of material 12. Alternatively, the rear side flap 34 may be sealed by a means of hot melt adhesive to the front side 14 of the bag 10. In a preferred embodiment, the woven polypropylene film on the inner surface 36 of the rear side flap 34 is sealed to the woven polypropylene film on the inner surface 36 of the front side flap 32. In a preferred embodiment, the polypropylene and woven polypropylene are hot air sealed at a temperature from 375 to 550° F. In an alternative embodiment, the polypropylene film forming the outer surface 38 of the bag 10 and the woven polypropylene film forming the interior surface 36 of the bag 10 are sealed together by means of an intermediate layer of polyethylene and ethylene vinyl acetate. In the preferred embodiment, the rear side flap 34 of the flexible bag 10 has a length of 1.755+/-0.25 inches and the front side flap 32 has a length of 1.50+/-0.5 inches. The tube of material 12 preferably is between 5 mm and 50 mm in thickness. The polypropylene film forming the outer surface 38 of the tube of materials 12 is from 5 to 25 mm in thickness and the woven polypropylene film forming the inner surface 36 of the tube 12 similarly can be from 5 to 25 mm in thickness.

Returning to FIGS. 1A through 1H, an additional feature of the present invention is a method of sealing a bag 10. As described above and with reference to FIG. 1A, the method begins with a tube of material 12 having a front side 14 and a rear side 16 and a pair of opposing and inwardly tending gusset folds 18 and 20. Such tube of material is created through conventional means. Each of the folds 18 and 20 has a longitudinal crease 22 and 24, respectively. First, as
shown in FIG. 1B, the tube of material 12 is opened so as to separate the front side 14 from the rear side 16. Next, as shown in FIG. 1C, each of the creases 22 and 24 is slit proximate a first end of the tube 30 parallel to the longitudinal axis of the crease 22 or 24, thereby obtaining a front ply 28 and a rear ply 60. As shown in FIGS. 1D and 1E, a strip of material 26 is trimmed from the front surface 14 of the tube 12 and from the gussets 18 and 20 proximate the first end 30 of the tube 12 so as to form a rear side flap 34. Next, as shown in FIG. 1F, the tube 12 is flattened. With reference to FIGS. 1G and 1H, the rear side flap 34 is then folded over the front surface 14 of the bag 10 and hot air is applied to seal the rear side flap 34 to the front surface 14 of the bag 10. The tube 12 may then be cut so as to form a bag 10 sealed at one end 30. The tube of material 12 preferably comprises woven polypropylene on the interior surface 36 and polypropylene film on the exterior surface 38.

[0057] With reference to FIG. 1A, an alternative method of sealing a bag 10 formed from a tube of material 12 and having a front surface 14 and a rear surface 16 and a pair of opposing and inwardly tending gusset folds 18 and 20 is also disclosed. Each of the folds 18 and 20 has a longitudinal crease 22 and 24, respectively. As shown in FIG. 1B, the method comprises the steps of opening the tube of material 12 so as to separate the front side 14 from the rear side 16. As shown in FIG. 1C, each of the creases is slit 28 proximate the rear side 16 of a first end 30 of the tube 12 parallel to the longitudinal axis of each crease 22 and 24. As shown in FIG. 1D, a strip of material 26 is trimmed from the front surface 14 of the tube 12 and from the gussets 18 and 20 proximate the first end 30 of the tube 12 so as to form a front flap 32. As shown in FIG. 1A, a second pair of opposing slits 28 are formed proximate the front side 14 of the first end 30 of the tube 12 parallel to the longitudinal axis of each crease 22 and 24, so as to form a front flap 32. Alternatively, the pair of slits 28 proximate the front side 14 of the tube 12 can be formed prior to removal of the strip of material 26, in which case the slits 28 proximate the front side 14 of the tube 12 will be longer than the strip of material 26 so as to create the front flap 32 after the strip of material 26 has been removed. The separated portion of the front side 14 comprising the front flap 32 may be referred to as a front ply. Similarly, the separated portion of the rear side 16 comprising the rear flap 34 may be referred to as the rear ply. As shown in FIGS. 4B and 4C, the front flap 32 is then folded over itself towards the front surface 14 of the remainder of the tube 12. As shown in FIGS. 4D and 4E, the rear flap 34 is then folded over the front flap 32 and the front flap 32 is sealed to the bottom flap 34 through the application of hot air, so as to seal both flaps 32 and 34 to the front surface 14 of the bag 10. Additionally, the rear flap 34 may extend beyond the front flap 32 so as to seal the front flap 32 to the front surface 14 of the tube 12. The tube 12 may then be cut opposite the first end 30 so as to form a bag 10 sealed at one end 30. The tube of material 12 preferably comprises woven polypropylene on the interior surface 36 and polypropylene film on the exterior surface 38.

[0058] In an alternative embodiment, the front side 14 and rear side 16 may be reversed, so that a rear flap is folded over onto the rear side and a front flap is folded over the rear flap onto the rear side. As will be understood by one of skill in the art, the front side may also be referred to as the top side, while the rear side may also be referred to as the bottom side.

[0059] In one embodiment the front flap 32 and rear flap 34 may be plasma treated prior to folding and heat sealing to each other in order to facilitate the sealing of the flaps 32 and 34 to each other as well as increasing the seal strength. Alternatively, hot melt may be applied to the front flap 32 and the rear flap 34 so that when folded and compressed against each other and heat sealed the hot melt adhesive melts and seals the flaps to each other and to the front surface 14 of the bag. As an additional alternative, the front flap 32 and rear flap 34 may be ultrasonically sealed to each other. Again, an additional alternative is to corona treat the front and rear flaps 32 and 34 so as to facilitate sealing of the flaps to each other. Optionally, a score line may be formed along the front side 14 of the tube 12 so as to facilitate folding of the front flap 32 over onto the front surface 14 of the bag 10. Additionally, hot air may be directed against the outside of the rear flap 34 by means of a nozzle which is pressed against the front flap 32 during manufacture of the bag, thereby causing the heat to radiate through the front flap 32 and seal the front flap 32 to the rear flap 34.

[0060] An additional feature of the invention is an apparatus for manufacturing bags comprising polypropylene and woven polypropylene. The apparatus includes an unwinder for unwinding a web of laminated polypropylene and woven polypropylene. A folder folds the web of polypropylene into a tube. A sealer seals the edges of the web of film of polypropylene and woven polypropylene together so as to form a tube 12. Alternatively, the woven polypropylene can be formed as a tube and a tube of polypropylene film coextruded around the woven polypropylene and sealed to the woven polypropylene contained therein. Gusset forming plows form gussets in the lateral sides of the tube 12 of polypropylene and woven polypropylene. The tubes 12 are then stacked into a stack of tubes 40.

[0061] With reference to FIG. 5, a stack of tubes 40 is then provided to an opener 82 which opens one end 30 of the tube 12 of polypropylene and woven polypropylene, preferably using a blast of air. In one embodiment, the opener 82 comprises a blower tube. A gusset slitter 84 then slits the gussets 18 and 20 in the tube 12 of polypropylene. A trimmer 86 trims the slit portions of the first end 30 of the tube 12 so as to form a front flap 32, a rear flap 34, or both. In one embodiment, only a single pair of slits are made parallel to the longitudinal axis of the crease of each gusset fold 18 and 20, thereby producing a single flap (either a front flap 32 or a rear flap 34). In an alternative embodiment, each gusset fold 18 and 20 has both a front outward crease and a rear outward crease. Both creases are slit along the longitudinal axis of the fold, thereby producing both a front flap 32 and a rear flap 34. Optionally, a score line may be formed across the tube 12 to facilitate folding of a front flap 32 or a rear flap 34 of the tube 12 over onto itself. A picker 88 then removes the slit portion 26 of the tube 12 from the remainder of the tube. The picker 88 for example can use suction to remove the slit portion 26. In one embodiment, to create a bag 10 such as that depicted in FIGS. 4A through 4E, folder 76 folds the front flap 32 formed by the trimming of the tube 12 180° back onto the front surface 14 of the tube 12. A folder 76 then folds the rear flap 34 of the tube 12 over onto the folded front flap 32 and compresses the front flap 32 against the rear flap 34. A hot air sealer 90 seals the top flap 64 and bottom flap 66 of the folded tube 42 together so as to form a heat seal at the first end 30 of the tube 12. As will be understood by one of skill in the art, alternatively, the front side 14 and rear side 16 could be reversed, such that the rear flap 34 is folded back 180° to the rear side 16 of the tube 12. In another embodiment, there is only a single flap, which is folded over and sealed to the opposite surface of the bag. For
example, if there is only a front flap 32, it will be folded over and sealed to the rear surface 16 of the bag. Optionally, the tube 12 can be perforated after being sealed by a perforator 44. A cutter 92 then cuts the tube 12 a desired distance from the first end 30 of the tube 12 so as to form a bag 10 sealed at its first end 30 and open at the other end. Optionally, a stacker/collator 46 stacks each bag 10.

[0062] With reference to FIG. 6, in an alternative embodiment, the apparatus treats the tubes 12 with plasma using a plasma treater 48 before applying adhesive using adhesive applicer 50, thereby producing a bag sealed with adhesive. In one embodiment, the adhesive used is glue. Other possible adhesives will be readily recognized by those of skill with the art.

[0063] Preferably, the tube of material 12 preferably comprises woven polypropylene on the inside 36 and polypropylene film on the outside 38, where the polypropylene film is B.O.P.P. The folding of the rear flap 34 results in the woven polypropylene on the rear flap 34 being heat sealed to the B.O.P.P. on the front flap 32.

[0064] In a preferred embodiment, the bag has a width of 13”+/−3.25 inch, a length of 27.25”+/−6.75” and cross-section at each gusset fold of 5”+/−1.25 inch.

[0065] With reference to FIG. 7, in yet another embodiment of the present invention, an apparatus for installing a reclosable fastener is provided. A stack of laminated polypropylene tubes 40 is provided to a reclosable fastener positioner 56, which positions a reclosable fastener, such as an inverted zipper assembly 104 shown in FIG. 8. A sealer, such as a hot air sealer 90, then attaches the reclosable fastener to the tube 12 to produce a bag with a reclosable fastener. As will be clear to one of skill in the art, such an apparatus could be either used in combination with those apparatuses described hereinabove or individually. Optionally, each bag 10 is stacked by a stacker/collator 46.

[0066] With reference to FIG. 8 and the disclosure of U.S. patent application Ser. No. 12/817,079, the disclosure of which is incorporated herein in its entirety, the bag of one embodiment of the present invention has a first panel 98 and a second panel 100 and a stepped end 102. The stepped end 102 includes side gussets 18 and 20 of the composite tube 12 which are longer than the first panel 98 and second panel 100 of the composite tube 12 and a flap 34 which extends longer than the side gussets 18 and 20. An inverted zipper assembly 104 having an inverted flange 106 is bonded to the first panel 98 to form a seal there between. The stepped end 102 is then folded over and bonded to the inverted second flange 108 of the zipper assembly 102 to form a seal there between. The first flange 106 is bonded to a portion of the first panel 98 which is adjacent to the stepped end 102. Optionally, the first panel 98 has a crease 110 and the first inverted flange 106 is bonded to a portion of the first panel 98 between the crease 110 and the edge of the first panel 98 adjacent to the stepped end 102.

[0067] With reference to FIG. 9 and U.S. patent application Ser. No. 13/011,620, the disclosure of which is incorporated herein in its entirety, in an alternative embodiment of the invention, a flexible bag is formed from a tube 12 consisting essentially of a material having an outer layer 38 of polypropylene and an inner layer 36 of woven polypropylene that are directly sealed to one another over the entire surface area of the outer layer 38 and the inner layer 36. The tube 12 has a front side 14 and a rear side 16. A pair of opposing inward tending gusset flaps 18 and 20 are formed in the tube, each of the folds 18 and having front outward vertical crease 64 and a rear outward vertical crease 66. The bag 10 has at least one sealed closure formed by a method comprising the steps of slitting 28 each of the front creases 64 along the longitudinal axis thereof, thereby obtaining a front ply 58 and a rear ply 60. As shown in U.S. patent application Ser. No. 13/011,620, a first rearward fold is formed by rearwardly folding the rear ply 60 together with the rear vertical crease 66, such that the inner surface 36 of the rear ply 60 is visible. A second rearward fold is then formed by rearwardly folding the first fold wherein the inward surface of the rear ply 36 lies against the outer surface 38 of the rear side 16 of the bag 10. The method further includes the step of applying hot air to the surface of the rear ply so as to seal the inner surface to the rear side of the bag and applying hot air to the outer surface of the rear ply so as to seal at first rearward fold to set second rearward fold.

[0068] In an alternative embodiment, a bag is formed by rolling the rear ply 60 resulting from the parting along the front vertical creases 64 with the rear portion of the bag proximate to the rear ply 60, such that the outer surface 38 of the rear ply 60 opposes the rear side 16 of the bag 10. The rear ply 16 is then heat sealed to the rear side 16 of the bag 10.

[0069] As shown in FIG. 9 and FIGS. 4-7 of U.S. patent application Ser. No. 13/011,620, in an alternative embodiment, the bag may be constructed of a polyolefin material having a front side and a rear side. A pair of opposing inward tending gusset folds is formed in the tube, each of the folds having front and rear vertical creases and each of the folds being between the front side and the rear side of the tube. At least one sealed closure is constructed having a front ply and a rear ply. The front ply and the rear ply are separated by a pair of slits along the front creases along the longitudinal axis thereof and the rear ply has an inner and outer surface. A first rearward fold causes the outer surface of the rear ply to oppose a first portion of the rear side of the bag. A second rearward fold causes the inner surface of the rear ply to oppose a second portion of the rear side of the bag. The material has an outer layer of polypropylene and an inner layer of woven polypropylene that are each directly sealed to one another over the entire surface of the outer layer and the inner layer. In a preferred embodiment, the inner surface is hot air sealed to the rear ply. The bag is preferably hot air sealed at a temperature between 375 and 550 degrees Fahrenheit.

[0070] While particular embodiments of the present disclosure have been described, it will be understood, however, that the present disclosure is not limited thereto, since modifications may be made by those skilled in the art, particularly in light of the foregoing teachings. It is, therefore, contemplated by the following claims to cover any such modifications that incorporate those features or those improvements that embody the spirit and scope of the present disclosure.

1. A flexible bag formed from a tube of material and having a front side and a rear side, and a pair of opposing gusset folds, each of said folds having a longitudinal crease and a slit proximate a first end of the tube and a strip of the material removed from the front side of the bag proximate the end of the tube, thereby forming a rear side flap which is folded over to the front side of the bag.

2. The flexible bag of claim 1 wherein said tube of material comprises polypropylene film and woven polypropylene film.
3. The flexible bag of claim 2 wherein the bag has an inner surface of woven polypropylene and an outer surface of polypropylene.

4. The flexible bag of claim 2 wherein said woven polypropylene film on said inner surface of said bag is sealed to said polypropylene film on said outer surface of said bag.

5. The flexible bag of claim 2 wherein said rear side flap has a length of 1.5''+/-0.5 inches.

6. The flexible bag of claim 1 wherein said tube of material is 5 millimeters to as much as 50 millimeters in thickness.

7. The flexible bag of claim 2 wherein said polypropylene film is 5+/−20 millimeters in thickness and said woven polypropylene film is 5+/−20 millimeters in thickness.

8. The flexible bag of claim 2 wherein said woven polypropylene film is sealed to said polypropylene film across substantially all of the inside surface of the woven polypropylene film.

9. The flexible bag of claim 2 wherein said polypropylene film is biaxially oriented polypropylene.

10. The flexible bag of claim 2 wherein said polypropylene film is sealed to said woven polypropylene film by means of an intermediate layer of polyethylene and ethylene vinyl acetate.

11. The flexible bag of claim 1 and further comprising a reclosable fastener assembly disposed proximate the top of said bag on the inside surface thereof which may be selectively used to manually open and close said bag.

12. The flexible bag of claim 11 wherein said reclosable fastener assembly is disposed within said bag and said bottom surface of said bag has a series of perforations providing access to said reclosable fastener assembly from the exterior of said bag.

13. The flexible bag of claim 11 wherein said bag has a score line on the inner surface of said bag proximate said reclosable fastener assembly for providing selective manual access to said reclosable fastener assembly for the manual opening and closing of said reclosable fastener assembly and thereby providing access to the contents of said bag.

14. The flexible bag of claim 1 wherein said tube of material comprises an exterior layer of heat sealable polymer for facilitating heat sealing of the front and rear flaps of said bag.

15. The flexible bag of claim 14 wherein said heat sealable polymer comprises a blend of polyethylene and ethylene vinyl acetate.

16. A method of sealing a bag, formed from a tube of material and having a front side and a rear side and a pair of opposing inwardly tending gusset folds, each of said folds having a longitudinal crease said method comprising the steps of:

- opening said tube of material so as to separate said front side from said rear side;
- slitting a portion of each of said creases proximate a first end of said tube parallel to the longitudinal axis of said crease thereby obtaining said front and rear plies;
- trimming a strip of material from the rear surface of said tube and from the gussets proximate said first end of said tube so as to form a bottom flap;
- removing the trimmed material;
- folding the bottom flap over itself towards the remainder of the tube;
- hot air sealing said bottom flap to the bag so as to seal the bottom of said bag;
- cutting across said tube so as to form a bag sealed at one end.

17. The method of claim 16 wherein said tube of material comprises woven polypropylene on the inside of said tube and polypropylene film on the outside of said tube, said folding of said bottom flap resulting in the woven polypropylene on the bottom flap being heat sealed to the polypropylene on the outside of the tube.

18. The method of claim 16 wherein said bottom flap is plasma treated prior to folding and heat sealing to each other.

19. The method of claim 16 further comprising forming a score line along the rear side of said tube so as to facilitate folding of said bottom flap over onto the top wall of said bag.

20. The method of claim 19 wherein said hot air is directed against the outside of said bottom flap by means of a nozzle which is pressed against the bottom flap during manufacture of said bag.

21. A bag manufactured by the process of claim 16.

22. An apparatus for manufacturing bags comprising polypropylene and woven polypropylene, said apparatus comprising:

- an unwinder for unwinding a web of laminated polypropylene and woven polypropylene;
- a folder for folding said web of polypropylene into a tube;
- a sealer for sealing the edges of said web of film of polypropylene and woven polypropylene together so as to form a tube;
- gusset forming plows for forming gussets in the lateral sides of said tube of polypropylene and woven polypropylene;
- an opener for opening said tube of polypropylene and woven polypropylene in a first end;
- a slitter for slitting said gussets in said tube of polypropylene;
- a trimmer for trimming said slit portions of said first end of said tube;
- a picker for removing said slit portion from the remainder of said tube;
- a folder for folding said bottom flap of said tube over onto the top surface of said tube and compressing said bottom flap against said top surface;
- a hot air sealer for heating said bottom flap so as to form a heat seal of the first end of the tube;
- a cutter for cutting said tube a desired distance from said first end of said tube so as to form a bag sealed at its first end and open at its second end.

23. The bag of claim 1 having a width of 13 inches+/−3.25 inches, a length of 27.25 inches+/−6.75 inches, and cross-section at each gusset fold of 5 inches+/−1.25 inches.

24. A flexible bag formed from a tube of material and having a front side and a rear side, and a pair of opposing gusset folds, each of said folds having a longitudinal crease, said bag having a rear side flap extending from the rear side of the tube across the width of the tube and folded over onto the front side of the tube of material, the gussets each having a slit proximate a first end of the tube whereby forming a front side flap which is folded over when the rear side flap is folded with the rear side flap being hot air sealed to the front side of the bag with the front side flap being sealed therebetween.

25. The flexible bag of claim 24 wherein said tube of material comprises polypropylene film and woven polypropylene film.

26. The flexible bag of claim 25 wherein the bag has an inner surface of woven polypropylene and an outer surface of polypropylene.
27. The flexible bag of claim 25 wherein said woven polypropylene film on said inner surface of said rear side flap is sealed to said woven polypropylene film on said inside surface of said front side flap.

28. The flexible bag of claim 24 wherein said rear side flap has a length of 1.75+/-0.25 inches and said front side flap has a length of 1.5+/-0.5 inches.

29. The flexible bag of claim 24 wherein said tube of material is 5 millimeters to as much as 50 millimeters in thickness.

30. The flexible bag of claim 25 wherein said polypropylene film is 5+/-20 millimeters in thickness and said woven polypropylene film is 5+/-20 millimeters in thickness.

31. The flexible bag of claim 25 wherein said woven polypropylene film is sealed to said polypropylene film across substantially all of the inside surface of the woven polypropylene film.

32. The flexible bag of claim 25 wherein said polypropylene film is biaxially oriented polypropylene.

33. The flexible bag of claim 25 wherein said polypropylene film is sealed to said woven polypropylene film by means of an intermediate layer of polyethylene and ethylene vinyl acetate.

34. The flexible bag of claim 24 wherein said front side flap is sealed by means of hot melt adhesive to said rear side flap.

35. The flexible bag of claim 24 and further comprising a reclosable fastener assembly disposed proximate the top of said bag on the inside surface thereof which may be selectively used to manually open and close said bag.

36. The flexible bag of claim 34 wherein said reclosable fastener assembly is disposed within said bag and said bottom surface of said bag has a series of perforations providing access to said reclosable fastener assembly from the exterior of said bag.

37. The flexible bag of claim 34 wherein said bag has a score line on the inner surface of said bag proximate said reclosable fastener assembly for providing selective manual access to said reclosable fastener assembly for the manual opening and closing of said reclosable fastener assembly and thereby providing access to the contents of said bag.

38. The flexible bag of claim 24 wherein said tube of material comprises an exterior layer of heat sealable polymer for facilitating heat sealing of the bottom and top flaps of said bag.

39. The flexible bag of claim 38 wherein said heat sealable polymer comprises a blend of polyethylene and ethylene vinyl acetate.

40. A method of sealing a bag, formed from a tube of material and having a front side and a rear side and a pair of opposing inwardly tending gusset folds, each of said folds having a longitudinal crease said method comprising the steps of:

- opening said tube of material so as to separate said front side from said rear side;
- slitting a portion of each of said creases proximate a first end of said tube parallel to the longitudinal axis of said crease thereby obtaining said front and rear plies;
- trimming a strip of material from the front surface of said tube and from the gussets proximate said first end of said tube so as to form a top flap and a bottom flap;
- removing the trimmed material;
- folding the top flap over itself towards the remainder of the tube;
- folding the bottom flap over the folded top flap;
- hot air sealing said top flap to said bottom flap so as to seal the bottom of said bag;
- cutting across said tube so as to form a bag sealed at one end.

41. The method of claim 40 wherein said tube of material comprises woven polypropylene on the inside of said tube and polypropylene film on the outside of said tube, said folding of said top flap and said bottom flap resulting in the woven polypropylene on the top flap being heat sealed to the woven polypropylene on the bottom flap.

42. The method of claim 40 wherein said top flap and said bottom flap are plasma treated prior to folding and heat sealing to each other.

43. The method of manufacture of claim 40 wherein heat melt is applied to said top flap and said bottom flap so that when folded, compressed against each other and heat sealed said hot melt adhesive melts and seals said bag walls to each other.

44. The bag of claim 40 wherein said top flap and said bottom flap are ultrasonically sealed to each other.

45. The method of claim 40 further comprising forming a score line along the front side of said tube so as to facilitate folding of said top flap over onto the top wall of said bag.

46. The method of claim 45 wherein said hot air is directed against the outside of said bottom flap by means of a nozzle which is pressed against the top flap during manufacture of said bag.

47. A bag manufactured by the process of claim 40.

48. An apparatus for manufacturing bags comprising polypropylene and woven polypropylene, said apparatus comprising:

- an unwinder for unwinding a web of laminated polypropylene and woven polypropylene;
- a folder for folding said web of polypropylene into a tube;
- a sealer for sealing the edges of said web of film of polypropylene and woven polypropylene together so as to form a tube;
- gusset forming plows for forming gussets in the lateral sides of said tube of polypropylene and woven polypropylene;
- an opener for opening said tube of polypropylene and woven polypropylene in a first end;
- a slitter for slitting said gussets in said tube of polypropylene;
- a trimmer for trimming said slit portions of said first end of said tube;
- a picker for removing said slit portion from the remainder of said tube;
- a folder for folding a flap formed by the trimming of said tube 180° back on the top surface of said tube;
- a folder for folding the bottom flap of said tube over onto the folded top flap and compressing said top flap against said bottom flap;
- a hot air sealer for heating said top and bottom flaps together so as to form a heat seal of the first end of the tube;
- a cutter for cutting said tube a desired distance from said first end of said tube so as to form a bag sealed at its first end and open at its second end.

49. The bag of claim 24 having a width of 13.13+/-3.25 inches, a length of 27.25 inches+/-6.75 inches, and cross-section at each gusset fold of 5 inches+/-1.25 inches.
50. A bag, comprising:
a tube having a polymeric woven tubular layer enclosed by
a polymeric non-woven tubular layer, and having a first
panel and a second panel and a stepped end, the stepped
end including side gussets of the composite tube which
are longer than the first panel and a second panel of the
tube and having a flap extending longer than the side gussets;
an inverted zipper assembly having an inverted first flange
bonded to the first panel to form a seal therebetween, and
an inverted second flange;
the stepped end being folded over and bonded to said
inverted second flange of the zipper assembly to form a
seal therebetween.
51. The bag of claim 50, wherein the first flange is bonded
to a portion of the first panel, wherein the portion of the first
panel is adjacent to the stepped end.
52. The bag of claim 50 wherein the first panel is creased
and the first inverted flange is bonded to a portion of the first
panel, wherein the portion of the first panel is between the
crease and an edge of the first panel adjacent to the stepped
end.
53. A flexible bag formed from a tube consisting essentially
of a material and having a front side and a rear side, and a pair
of opposing, inward-tending gusset folds, each of said folds
having front and rear vertical creases, said bag having at least
one sealed closure formed by a method comprising the steps of:
a. slitting each of said front creases along the longitudinal
axis thereof, thereby obtaining front and rear plies;
b. forming a first rearward fold by rearwardly folding said
rear plies together with said rear vertical creases such
that an inner surface of said rear ply is visible; and
c. forming a second rearward fold by rearwardly folding
said first fold wherein said inner surface of said rear ply
lays against said rear side of said bag;
d. said material having an outer layer of polypropylene and
an inner layer of woven polypropylene that are each
directly sealed to one another over the entire surface area
of the outer layer and the inner layer.
54. The bag of claim 53, wherein said method further
comprises the step of applying hot air to the surface of said
rear ply so as to seal said inner surface to said rear side of said
bag and applying hot air to the outer surface of said rear ply so
as to seal said first rearward fold to said second rearward fold.
55. A bag formed from a tube consisting essentially of a
polyolefin material and having a front side and a rear side, and
a pair of lateral, opposing, inward tending gusset folds, each
of said folds having front and rear vertical creases, said bag
formed by a method comprising the steps of:
a. parting said material longitudinally along said front
crease;
b. rolling a rear ply resulting from said step of parting along
with said rear portion of said bag proximate to said rear
ply such that a surface of said rear ply opposes the rear
side of said bag; and
2. heat sealing said surface of said rear ply to the rear side
of said bag;
d. said material having an outer layer of polypropylene and
an inner layer of woven polypropylene that are each
directly sealed to one another over the entire surface area
of the outer layer and the inner layer.
56. A flexible bag comprising:
a tube consisting essentially of a polyolefin material
comprising:
a front side;
a rear side;
a pair of opposing, inward-tending gusset folds, each of
said folds having front and rear vertical creases and each
of said folds being between said front side and said rear
side;
at least one sealed closure comprising:
a front ply and a rear ply, said front ply and said rear ply
being separated by a pair of slits along said front creases
along longitudinal axis thereof, and said rear ply having
an outer and inner surface;
a first rearward fold causing said outer surface of said rear
ply to oppose a first portion of the rear side of the bag;
and
a second rearward fold causing said inner surface of said
rear ply to oppose a second portion of the rear side of the
bag;
said material having an outer layer of polypropylene and
an inner layer of woven polypropylene that are each
directly sealed to one another over the entire surface area
of the outer layer and the inner layer.
57. The flexible bag of claim 57 further comprising hot air
sealing said inner surface to said rear ply.
58. The method of claim 56 wherein said bag is hot air
sealed at a temperature of between 375 and 550° F.
59. The method of claim 50 wherein said bag is hot air
sealed at a temperature of between 375 and 550° F.