Dec. 19, 1967 P. J. DE STEFANO ETAL 3,358,903

PAPER BAGS HAVING LEAK-PROOF SEAMS

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FIG. 1

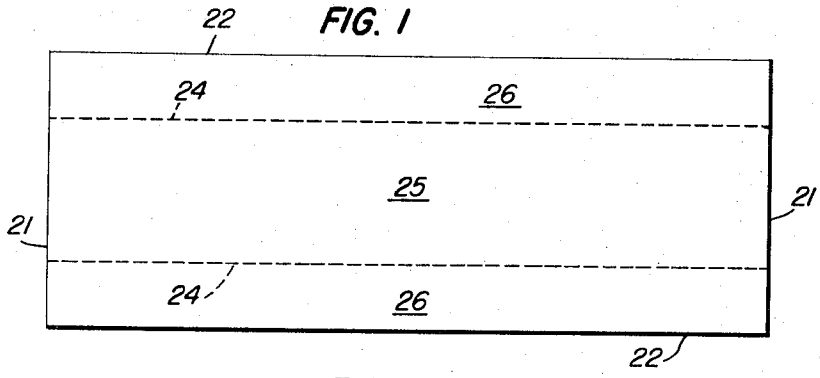


FIG. 4b

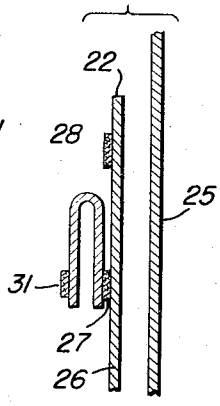


FIG. 2

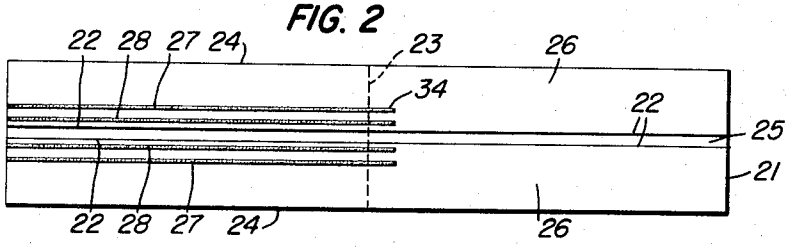


FIG. 3

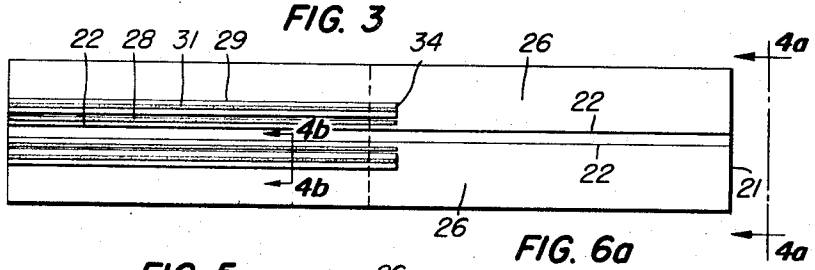


FIG. 4a

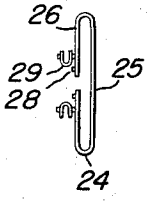


FIG. 5

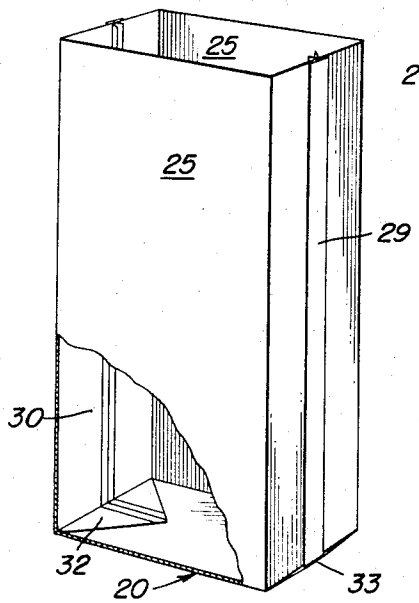


FIG. 6a

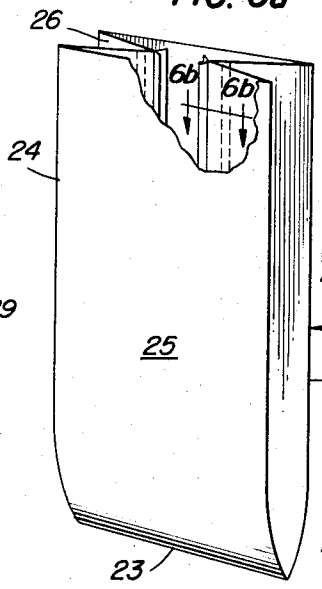
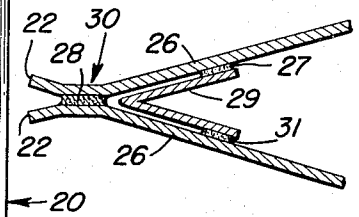


FIG. 6b



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Dec. 19, 1967 P. J. DE STEFANO ETAL 3,358,903

PAPER BAGS HAVING LEAK-PROOF SEAMS

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FIG. 7

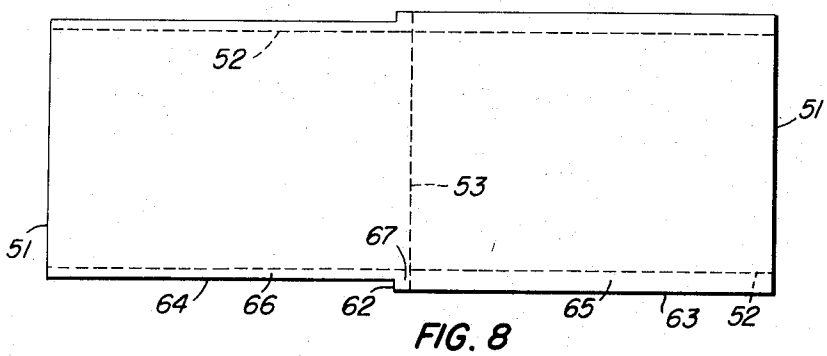


FIG. 8

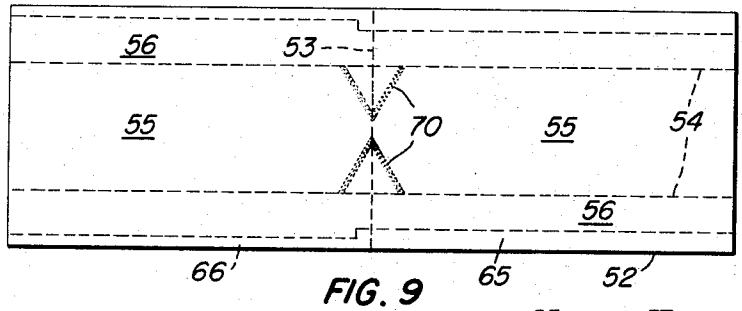


FIG. 9

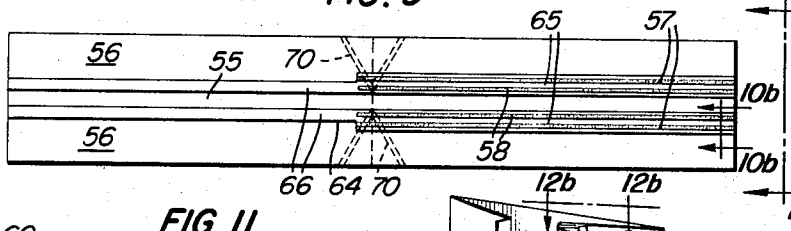


FIG. 10b

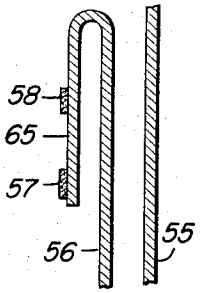


FIG. 10a

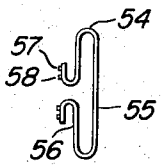


FIG. 11

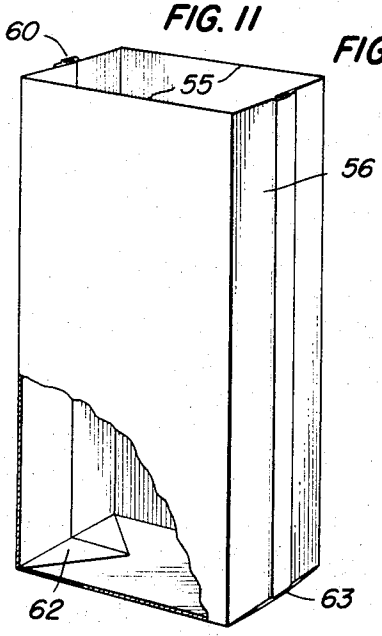


FIG. 12a

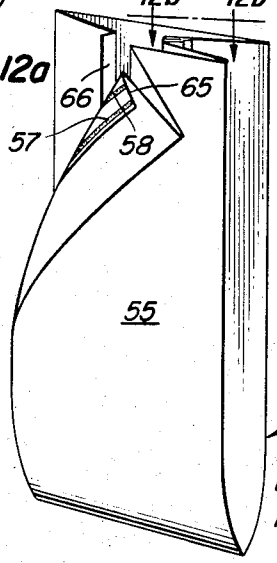
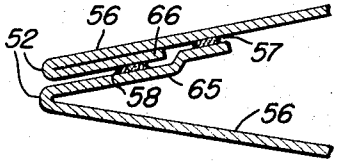


FIG. 12b



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PAPER BAGS HAVING LEAK-PROOF SEAMS

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FIG. 13

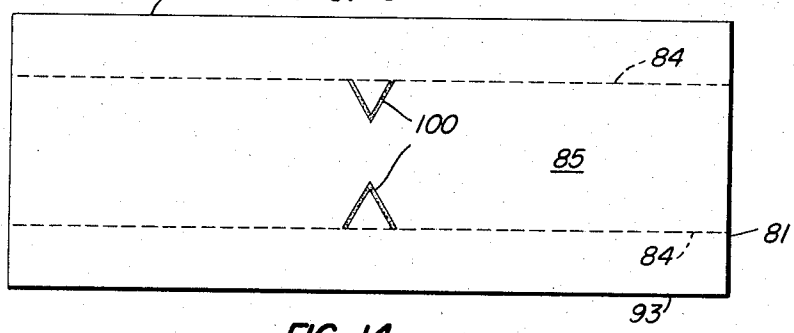


FIG. 17b

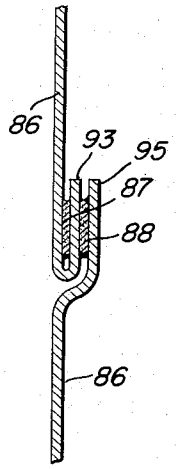


FIG. 14

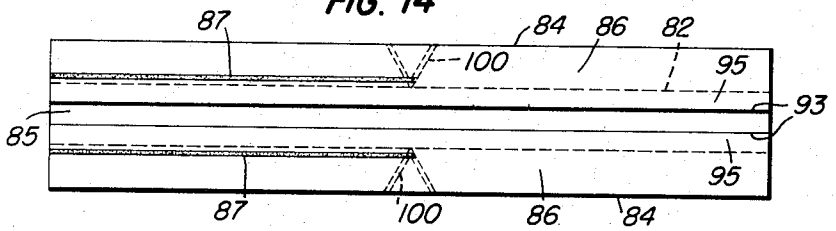


FIG. 15

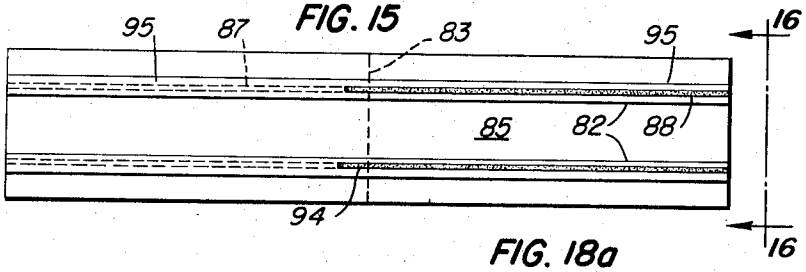


FIG. 16

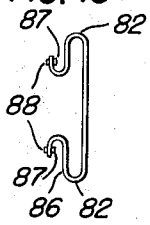


FIG. 18a

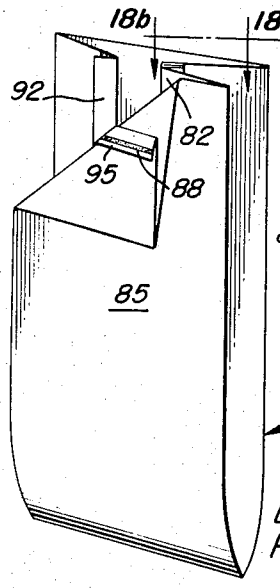


FIG. 17a

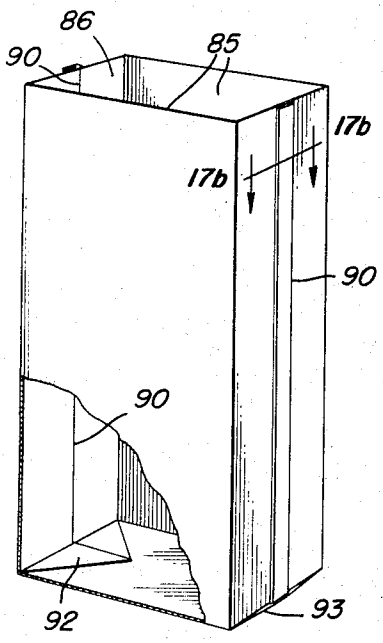
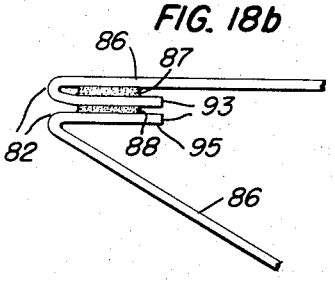


FIG. 18b



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Dec. 19, 1967 P. J. DE STEFANO ETAL 3,358,903

PAPER BAGS HAVING LEAK-PROOF SEAMS

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FIG. 19

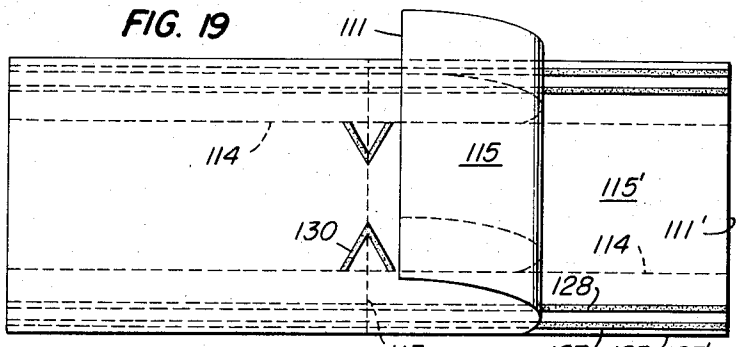


FIG. 20

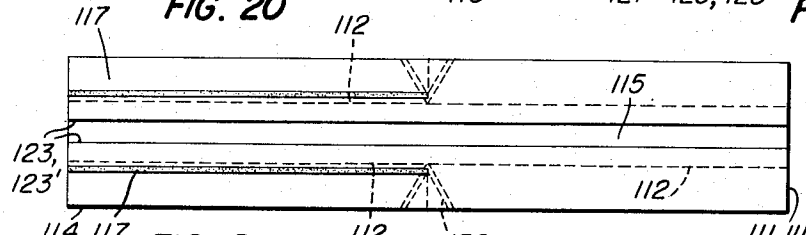


FIG. 21a

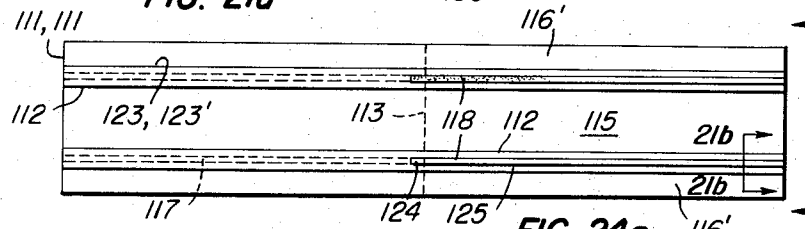


FIG. 21b

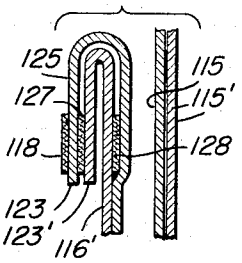


FIG. 24b

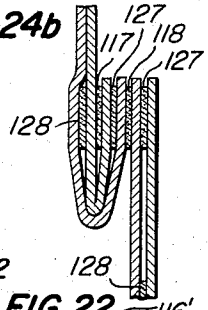


FIG. 22

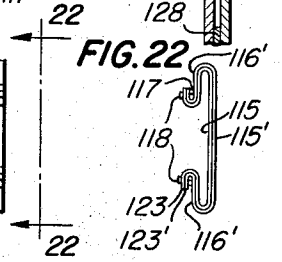


FIG. 24a

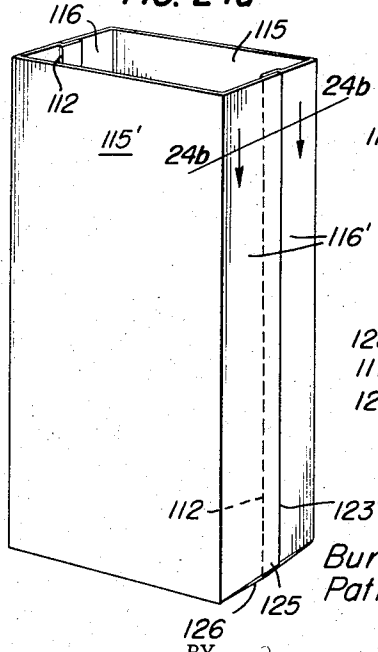


FIG. 23a

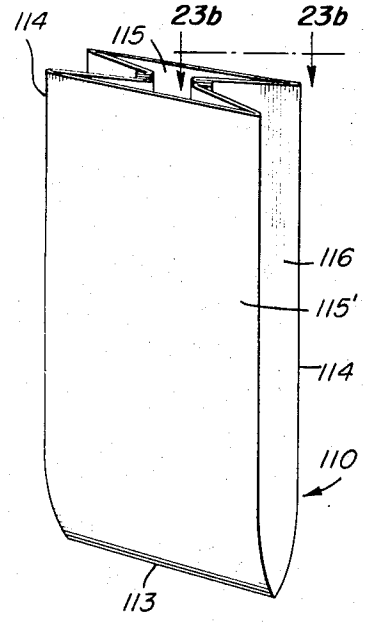
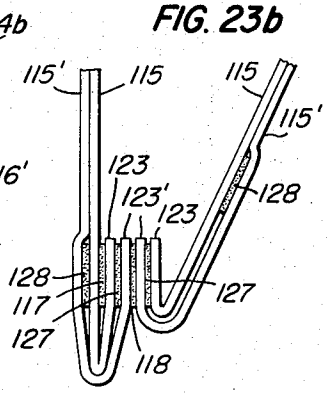


FIG. 23b



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United States Patent Office 3,358,903
Patented Dec. 19, 1967

3,358,903

PAPER BAGS HAVING LEAK-PROOF SEAMS

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Filed Mar. 31, 1966, Ser. No. 539,036
4 Claims. (Cl. 229—53)

ABSTRACT OF THE DISCLOSURE

A leak-proof paper bag having a seamless bottom and a compound seam along each side, each compound seam being formed of an adhesively joined primary seam and at least one adhesively joined secondary seam, the adhesive of each primary seam being exposed to the interior of the bag and the adhesive of each secondary seam being shielded from the interior of the bag by the primary seam.

This invention relates to paper bags having leak-proof capabiilty. It more particularly relates to paper bags of end-over-end construction, having a seamless bottom and a leak-proof compound seam along each side. It specifically relates to bags of this type in which each compound side seam is cooperatively formed by an adhesively joined primary seam that is in contact with bag contents and an adhesively joined secondary seam that is shielded from contact with bag contents by the primary seam.

Leak-resistant and leak-proof paper bags, having a capacity of twenty gallons, for example, are particularly useful for refuse collection in restaurants, airplanes, and other food-dispensing locations. Moreover, bags having truly leak-proof characteristics are greatly needed in hospitals where leakage of infectious material must be completely avoided.

The prior art shows that end-over-end paper bags which have a side seam along each side gusset and a seamless bottom have been known for many years. For example, J. McCullough in U.S. 224,934 showed a bag of this type which has overlapped side seams of an unprotected shear-joint type that are formed by reverse folding of an extended flap along each side of one bag wall and applying to this flap a single line of adhesive from bottom fold to end of flap. J. C. Hellema in U.S. 2,203,726 also described a bag of this sort with seams having unprotected shear joints and a seamless bottom having triangular pockets glued thereto. G. O. Blowers in U.S. 286,896 and W. P. Flowers in U.S. 775,268 described bags having seamless bottoms, which are inwardly folded when flat, and side seams formed from unprotected peel joints which project inwardly. A. C. Campbell in U.S. 227,147 showed a bag having a seamless, inwardly-folded bottom and outwardly folded sides with shear-joint side seams.

A peel joint is herein defined as an adhesive juncture of juxatposed bag walls that is subject to being peeled open by a transversely-applied force. A shear joint is herein defined as an adhesive juncture of juxtaposed bag walls that is subject to rupture in shear by a transversely-applied force.

These bags and others in the prior art have difficulty in maintaining a liquid-tight seal. There is a pronounced tendency to leak through random openings in the side seams, which are under transverse tensile stresses, and along the bottom corners at the intersections of the bottom fold and the side seam folds, which tend to open at the exposed ends of the side seam folds.

The instant invention creates leak-proof capabitity within reasonable probability limits for single-ply bags under usual manufacturing conditions by: (a) in all three embodiments, completely filling the regions along

the bottom corners with extra sealing material, (b) in two embodiments, decreasing the probability of a leak caused by a random skip in adhesive application by depositing a secondary line of adhesive in back-up position to the primary line of adhesive which is in contact with bag contents, and (c) in two embodiments, stress-relieving the primary line of adhesive along a side seam by transferring crosswise tensile stresses to the secodary line of adhesive which is shielded from contact with contents of the bag. A multi-ply embodiment is also shown that uses the side-seam construction of one of the single-ply embodiments.

The primary line of adhesive in this invention is generally applied to form a primary peel joint which may project inwardly or outwardly and in all embodiments shields the secondary line of adhesive from the bag contents. The secondary line of adhesive is applied to form a secondary shear joint along at least one bag wall in parallel to tht primary peel joint in the three single-ply embodiments of this invention that are shown in the drawings. In two of the embodiments, the secondary shear joint entirely sustains transversely-applied loads, thus protecting the primary peel joint. In the third embodiment, the primary peel joint is converted to a shear joint that sustains transversely-applied loads in series with the secondary shear joint.

Each embodiment is shown on a separate sheet of drawings. FIGURES 1 through 6 show a tape embodiment having tape-protected primary seams. Each primary seam is formed by evenly mating the edges of the opposed side walls to make a peel joint which is protected by an overlapping tape that is adhesively joined in shear to the outer surfaces of both wall members on the tension sides of said peel joint, whereby the tape sustains all transverse tensile loads through shear joints that are shielded from the bag contents and that function as secondary leakage barriers. Thus, secondary lines of adhesive holding the tape to wall members of the bag form a pair of shear joints straddling the peel joint. Each shear joint is normally shielded from the bag contents but can function as a back-up seal for the peel joint. The peel joint formed by the primary line of adhesive is completely protected from transverse tensile stresses.

FIGURES 7 through 12*a* show an overlap embodiment wherein the primary seam is initially formed by adhesively conjoining opposed wall members to make an outwardly-projecting peel joint, with one wall member extended past the peel joint as a flap, and wherein the secondary seam is formed by overlapping said flap against the other wall member and adhesively conjoining said flap and said wall member to make a shear joint that sustains transverse tensile forces. The secondary shear joint is normally shielded from the contents of the bag but can function as a back-up seal for the peel joint.

FIGURES 13*a* through 18*b* show a lap embodiment wherein the primary seam is formed by evenly mating the inner surfaces of the opposed side walls to make an outwardly projecting peel joint that is changed to a shear joint by lapping said primary seam against the outer surface of one side wall and adhesively conjoining the juxtaposed surfaces to form a secondary seam as a shear joint that sustains transverse tensile forces in series with the primary seam. The secondary shear joint is completely shielded from the contents of the bag.

FIGURES 19 through 24*b* show the lap embodiment of FIGURES 13*a* through 18*b* for two-ply bags.

FIGURE 1 is a plan view of the blank from which the tape embodiment of the bag is made, with longitudinal fold lines indicated.

FIGURE 2 is a plan view of the blank shown in FIGURE 1 after folding. Twin lines of adhesive have been

applied longitudinally along each flap from one end (corresponding to a top edge of the finished bag) to, and slightly past, the transverse fold line (corresponding to the bottom of the finished bag before filling).

FIGURE 3 is a plan view of the blank shown in FIGURE 2 with a longitudinally folded tape placed on top of the outer line of adhesive and with another line of adhesive on the tape.

FIGURE 4*a* is a side view of FIGURE 3, looking in the direction of the arrows **4***a*—**4***a* in FIGURE 3, and shows the folded tape on each flap.

FIGURE 4*b* is a cross-sectional enlargement of the indicated area in FIGURE 3, looking in the direction of the arrows **4***b*—**4***b* in FIGURE 3.

FIGURE 5 is a perspective view of a finished bag, as if tightly filled, which shows a bottom flap through the cutaway area.

FIGURE 6*a* is a perspective view of a finished bag, as if empty.

FIGURE 6*b* is an enlarged cross-sectional view of the joints in a side seam looking in the direction of the arrow **6***b*—**6***b* in FIGURE 6*a*.

FIGURE 7 is a plan view of the blank needed for the overlap embodiment of the invention. Longitudinal fold lines are indicated which delineate recessed flaps.

FIGURE 8 shows the blank of FIGURE 7 after longitudinally folding the recessed flaps beneath the blank, with additional longitudinal fold lines indicated and with V-shaped lines of adhesive applied on each side of the transverse fold line.

FIGURE 9 shows the plan view of FIGURE 8 after longitudinally folding a second time, thereby exposing the recessed flaps of FIGURE 7, and applying twin lines of adhesive along the wider part of these flaps from one end (corresponding to a top edge of the finished bag) to the transverse fold line and slightly beyond.

FIGURE 10*a* is a side view of FIGURE 9, looking in the direction of the arrows **10***a*—**10***a* in FIGURE 9.

FIGURE 10*b* is an enlarged cross-sectional view of the blank of FIGURE 9, looking in the direction of the arrows **10***b*—**10***b* in FIGURE 9.

FIGURE 11 is a perspective view of a finished bag, as if tightly filled, with a bottom corner flap shown through the cutaway area.

FIGURE 12 is a perspective view of a finished bag, as if empty, with one flap folded back to show the relationship of flaps and adhesive joints.

FIGURE 12*b* is an enlarged cross-sectional view of the joints in a side seam, looking in the direction of the arrows **12***b*—**12***b* in FIGURE 12*a*.

FIGURE 13 is a plan view of the blank needed for this embodiment. Longitudinal fold lines and V-shaped lines of adhesive have been applied on each side of the bottom area.

FIGURE 14 shows the blank of FIGURE 13 after the longitudinal folds have been made, with single lines of adhesive applied to each flap, from one top edge to a position slightly past the center fold, and with additional secondary fold lines indicated.

FIGURE 15 is the plan view of FIGURE 14 after the secondary folds have been made and with additional adhesive applied to the flaps from one top edge to a position slightly past the center fold.

FIGURE 16 is a side view of FIGURE 15, looking in the direction of the arrows **16**—**16** in FIGURE 15.

FIGURE 17*a* is a perspective view of a finished bag, as if tightly filled, with a corner flap exposed through a cutaway portion.

FIGURE 17*b* is an enlarged cross-sectional view of the joints in a side seam, looking in the direction of the arrows **17***b*—**17***b* in FIGURE 17*a*.

FIGURE 18*a* is a perspective view of the finished bag, with one flap folded back to show the flap relationship along a side seam.

FIGURE 18*b* is an enlarged cross-sectional view of the joints in a side seam, looking in the direction of the arrows **18***b*—**18***b* in FIGURE 18*a*.

FIGURE 19 is a plan view of a two-walled blank needed to manufacture the embodiment shown in FIGURES 13 through 18*b* in dual-wall form. Longitudinal fold lines and V-shaped lines of adhesive have been applied to the uppermost ply on each side of the bottom area.

FIGURE 20 shows the blank of FIGURE 19 after the longitudinal folds have been made, with single lines of adhesive applied to each flap, from one top edge to the center fold, and with secondary longitudinal fold lines indicated.

FIGURE 21*a* shows the blank of FIGURE 20 after the secondary longitudinal folds have been made and with additional adhesive applied to the flaps from one top edge to a position slightly past the center fold.

FIGURE 21*b* is an enlarged cross-sectional view of a flap area, looking in the direction of the arrows across line **21***b*—**21***b* in FIGURE 21*a*.

FIGURE 22 is a right side view of FIGURE 21*a*.

FIGURE 23*a* is a perspective view of a finished bag.

FIGURE 23*b* is an enlarged cross-sectional view of a compound seam, looking in the direction of arrows **23***b*—**23***b* in FIGURE 23*a*.

FIGURE 24*a* is a perspective view of a finished bag, as if tightly filled.

FIGURE 24*b* is an enlarged cross-sectional view of a compound seam, looking in the direction of the arrows **24***b*—**24***b* in FIGURE 24*a*.

The tape embodiment **20** shown in FIGURES 1 through 6*b* is formed from the bag blank shown in FIGURE 1, having ends **21** and side edges **22**. Longitudinal score lines **24**, that delineate side wall members **26** and front and back wall members **25**, are added. The blank is folded along longitudinal score lines **24** to produce the folded blank shown in plan view in FIGURES 2 and 3 and in side view in FIGURE 4*a*. A bottom score line **23** is made transversely to longitudinal score lines **24** in the center of the bag blank.

Dual lines of adhesive **27**, **28** are applied to the surface of the blank in parallel near each side edge **22**. Both adhesive lines **27**, **28** may be applied from one end **21** to bottom score line **23** and beyond through springback distance **34**, as shown clearly in FIGURE 2. However, adhesive line **27**, which is farther from edge **22**, is preferably terminated about ¼–1" short of bottom score line **23**, yet adhesive line **28** must be applied as shown in FIGURE 2.

It is necessary that springback distance **34** beyond bottom line **23** be at least equal to the longitudinal length of bag under stress because of bottom folding. This distance **34** is proportional to thickness and stiffness of the paper used.

A tape **29**, doubled longitudinally upon itself, is applied upon each line of adhesive **27**, as shown in FIGURES 3, 4*a*, and 4*b*, so that each line of adhesive **28** that is nearest to edge **22** is not covered. Tape **29** should not extend beyond adhesive line **27**. Each line of adhesive **28** is the primary line of adhesive for forming an inwardly-projecting primary peel joint, constituting the primary seam. Upon the exposed surface of folded tape **29**, an additional line of adhesive **31** is applied from end to end.

The blank is then folded end-over-end about transverse score line **23** so that the primary lines of adhesive **28** and secondary lines of adhesive **27**, **31** contact the opposed portions of side wall members **26** and form an inwardly projecting primary seam **30**, on each side of front and back wall members **25**, that is straddled by a pair of secondary seams of shear-joint type which are formed by secondary lines of adhesive **27**, **31**.

The bag thus produced is shown in FIGURE 6*a* in a slightly opened condition. FIGURE 6*b* shows the compound seam with primary seam **30**, formed by primary line of adhesive **28**, and the secondary shear joints formed

by secondary lines of adhesive **27** and **31**. FIGURE 5 shows the tape embodiment **20** of the instant invention in its fully opened condition. At each side of the substantially flat bottom **33**, a triangular corner flap **32** extends inwardly but is not necessarily joned to any surface of the bag.

The overlap embodiment **50** of this invention, shown in FIGURES 7 through 12*b*, is formed from the blank shown in FIGURE 7, having ends **51** and sides **63**, **64** that are separated by transverse step **62**. Close to sides **63**, **64** are longitudinal score lines **52** that delineate overlap flap **65** and lap flap **66**.

After flaps **65**, **66** are folded beneath the blank, as shown in FIGURE 8, a second pair of longitudinal score lines **54** are made that delineate side wall members **56** and front and back wall members **55**. A central bottom score line **53**, transverse to longitudinal score lines **54**, is made, and a pair of V-shaped bottom adhesive lines **70** are added, each having a base on a score line **54** and a distance to apex equalling the transverse distance between score lines **52** and **54**. The longitudinal distance between transverse bottom score line **53** and transverse step **62** equals springback distance **67** that is proportional to thickness and stiffness of the paper used.

The side wall members **56** are then folded on top of front and back wall members **55**, as shown in FIGURE 9, so that lap flap **66** and overlap flap **65** are uppermost, as shown in FIGURE 10*a*. Dual lines of adhesive **57**, **58** are next applied onto overlap flap **65**, from transverse step **62** to end **51**, so that they straddle the end of flap **66**, i.e., flap **66**, if extended, would be appproximately midway between adhesive lines **57**, **58**. These adhesive lines are clearly shown in FIGURE 10*b*. However, experience has shown that adhesive line **57**, which is closer to side **63**, is preferably terminated very slightly short of transverse bottom score line **53**, with consequent movement of transverse step **62** to bottom score line **53**. Primary adhesive line **58** must nevertheless be extended as shown through the springback distance **67** shown in FIGURE 9.

When the blank is folded end-over-end about fold line **53**, adhesive line **58** forms primary seam **60** of peel-joint type, that is never allowed to assume a normal position midway between wall members **56** because it is held down by overlap flap **65** which is attached through a shear joint, formed by secondary line of adhesive **58**, to the adjacent wall member **56**.

The bag thus produced is shown in FIGURE 12*a* in slightly opened condition. FIGURE 12*b* shows the compound seam produced by the primary line of adhesive **58** forming a peel joint **60** which protects a shear joint, formed by secondary line of adhesive **57**, from the bag contents. FIGURE 11 shows bag made according to the overlap embodiment **50** in fully opened condition. At each side of the substantially flat bottom **63**, a triangular corner flap **62** is fastened to bottom **63** with V-shaped adhesive lines **70**.

The lap embodiment **80** of this invention, shown in FIGURES 12 through 18*b*, is formed from the blank shown in FIGURE 13 that has ends **81** and straight side edges **93**. Longitudinal score lines **84** delineate front and back walls **86**, **85**. Along transverse central bottom score line **83**, V-shaped bottom adhesive lines **100**, each having a distance to apex that is less than the transverse distance between a longitudinal score line **84** and edge **93**, are added inwardly of each score line **84**.

After folding upwardly along score lines **84**, as shown in FIGURE 14, longitudinal score lines **82** are made in each flap produced, delineating side wall members **86** between score lines **84** and **82**. A secondary line of adhesive **87** is added longitudinally onto each flap from one end **81** to center fold line **83** and slightly beyond. Each edge flap **95** is then folded onto side wall members **86**, and a primary line of adhesive **88** is added onto each flap **95** from one end **81** to the center fold line **83** and a springback distance **94** beyond. This distance **94** should be no less than the springback distance which is characteristic for the paper forming each wall member **86**.

The blank is then folded end-over-end about score line **83** so that each flap **95**, having primary line of adhesive **87** on one side and secondary line of adhesive **88** on the other side, is pressed between adjacent wall members **86** to form back-to-back shear joints, as shown clearly in FIGURES 16*b* and 17*b*.

The bag thus produced is shown in FIGURE 18*a* in slightly opened condition, with the compound seam formed of back-to-back shear joints shown in FIGURE 18*b*. FIGURE 17*a* shows the bag made according to the lap embodiment **80** of the invention in fully opened condition. At each side of the substantially flat bottom **103**, a triangular corner flap **92** is fastened to bottom **103** with V-shaped adhesive lines **100**.

The two-ply lap embodiment, shown in FIGURES 19 through 24*b*, is formed from the two-ply blank shown in FIGURE 19 that has ends **111**, **111'**, and straight side edges **123**, **123'**. Dual lines of adhesive **127**, **128** conjoin the plies near edges **123**, **123'**. Inward adhesive lines **128** reinforce outward adhesive **127** and diffuse transverse stresses. Longitudinal score lines **84** delineate front and back walls **116**, **116'**, **115**, **115'**. Along transverse central bottom score line **113**, V-shaped bottom adhesive lines **130**, each having a distance to apex that is substantially equal to the transverse distance between a longitudinal score line **114** and edge **113**, are added inwardly of each score line **114**.

After folding upwardly along score lines **114**, as shown in FIGURE 21*a*, longitudinal score lines **112** are made in each flap produced, delineating side wall members **116**, **116'** between score lines **114** and **112**. A secondary line of adhesive **117** is added longitudinally onto each flap from one end **111**, **111'** to center fold line **113**. Each edge flap **125** is then folded onto side wall members **116'**, and a primary line of adhesive **118** is added onto each edge flap **125** from one end **111**, **111'** to the center fold line **113** and a springback distance **124** beyond. This springback **124** depends upon the stiffness of the multiply wall members **116**, **116'**. Inward adhesive lines **128** may be omitted on the side of the blank beneath primary adhesive line **118** as seen in FIGURE 21*a*, so that they extend only from the top edge **111**, **111'** of the finished bag to the central bottom score line **113**.

The blank is then folded end-over-end about score line **113** so that each flap **125**, having primary line of adhesive **117** on one side and secondary line of adhesive **118** on the other side, is pressed between adjacent wall members **116**, **116'** to form back-to-back shear joints, as shown clearly in FIGURES 21*b*, 22, and 24*b*.

The bag thus produced is shown in FIGURE 23*a* in slightly opened condition, with the compound seam formed of back-to-back shear joints shown in FIGURE 23*b*. FIGURE 24*a* shows the bag made according to the lap embodiment **110** of the invention in fully opened condition. At each side of the substantially flat bottom **113**, a triangular corner flap is fastened to bottom **133** with V-shaped adhesive lines **130**.

The very similar construction shown in FIGURES 19 through 24*b* is particularly noteworthy for the dual interply lines of adhesive **127**, **128** that hold plies **115** and **115'** together. As shown in FIGURE 19, these adhesive lines **127**, **128** can be extended from one end **111**, **111'** to the other, but it is often satisfactory if inner lines **128** are extended only halfway, to transverse central bottom score line **113**.

Any of the secondary lines of adhesive of the secondary seams can be a water-resistant adhesive, but the primary lines of adhesive of the primary seams must be a waterproof adhesive if the bag is to be leakproof toward aqueous contents.

Bags of these three single-ply embodiments **20**, **50**, **80**

can be leak-resistant or leak-proof, depending upon treatment of the paper forming the blank. If the paper is simply treated for water resistance, there will be no leakage through seams, but a small amount of water can pass through the paper walls. If the paper is made waterproof, as by coating with an impervious film, such as polyethylene, there will be substantially no leakage. Seventeen inches of water, for example, has been successfully maintained in a suspended bag made of water-proof paper.

We claim:

1. A paper bag with leak-proof capability that has a seamless bottom and a leak-proof compound seam along each side, each compound seam comprising:

(a) a primary seam of peel-joint type that is formed by adhesively conjoining the edges of opposed bag walls, the adhesive being exposed to the interior of the bag and the seam being protected from transversely applied loads, and

(b) a secondary seam of shear-joint type that is parallel to the primary seam and is formed by adhesive juncture with a bag wall on the tension side of the primary seam, the adhesive being shielded from the interior of the bag by the primary seam, said secondary seam being capable of functioning as a secondary leakage barrier and of entirely sustaining transversely applied loads.

2. The paper bag of claim 1 wherein a secondary seam is on each side of each primary seam, said secondary seam being formed by an overlapping tape that straddles the primary seam and is adhesively joined in shear to the outer surfaces of both bag walls on the tension sides of the primary seam, whereby the tape and the secondary seams are capable of cooperatively functioning as a secondary leakage barrier.

3. The paper bag of claim 1 wherein said primary seam projects outwardly with the edge of one bag wall extending substantially past the edge of the other bag wall as a flap that is adhesively joined to the other bag wall on the tension side of the primary seam to form the secondary seam and enclose the primary seam, whereby the flap and the secondary seam are capable of cooperatively functioning as a secondary leakage barrier.

4. A multi-ply paper bag that has a seamless bottom and a leak-proof compound seam along each side, each compound side seam comprising:

(a) an outwardly projecting primary seam of peel-joint type that is formed by adhesively conjoining the evenly mated inner surfaces of the opposed side walls, the adhesive being exposed to the interior of the bag,

(b) an outward adhesive line that conjoins adjacent plies in back-to-back relationship with said primary seam and on each side thereof,

(c) a secondary seam of shear-joint type that is shielded from the interior of the bag by said primary seam and is formed by lapping said outwardly projecting primary seam against the outer surface of one bag wall and adhesively conjoining the juxtaposed surfaces, whereby the primary seam is converted to shear-joint construction in back-to-back relationship to the primary seam and sustains transversely applied loads in series with the secondary seam, and

(d) an inward adhesive line, for diffusing transverse stresses, that conjoins adjacent plies of the side wall in back-to-back relationship to the secondary seam.

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