

TITLE OF THE INVENTION

LAMINATED FILM ROLL FOR TIGHTLY SEALED PLASTIC BAG AND
TIGHTLY SEALED PLASTIC BAG USING THE SAME

DETAILED DESCRIPTION OF THE INVENTION

FILED OF THE INVENTION

This invention relates to a laminated film roll
for use in the production of a tightly sealed plastic bag
5 for packaging foodstuffs and the like, and to a tightly
sealed plastic bag produced from said film roll. More
particularly, this invention relates to a laminated film
roll so fabricated that a bag produced therefrom can be
opened with the force of finger tips while retaining the
10 practical strength normally expected of any bag, and to
an easily openable tightly sealed plastic bag produced
from said film roll.

BACKGROUND ART

Plastic films and laminated films made of
15 superposed layers of plastics, aluminum foil or other
metals, paper and other materials are light in weight,
excel in airtightness, and possess high strength and ease
of handling. Bags made of such films can be tightly
sealed simply by heat-sealing without particularly
20 requiring use of any adhesive agent. Owing to these
merits, the films have been recently used extensively to
produce tightly sealed bags for various commodities such
as foodstuffs, pharmaceutical products, and sundries
which come in various forms such as liquid, powder,
25 paste, and solid.

In such a tightly sealed bag as described above, the strong point owned by the material of the bag ironically offers resistance to tearing and renders the bag hardly openable. Generally, the film for use in the
5 tightly sealed bag is tough but, once a cut is inflicted in the bag, is liable to propagate the cut. When one point somewhere in the edge of the bag is cut in advance, therefore, the bag can be opened by the force of finger tips applied so as to widen the cut.

10 Thus, the method of making a bag by heat-sealing the edge portion of a film roll having been slit so as to become fit to the dimension of the bag to be made and forming an I notch of not less than 2 mm in length in the transverse direction in advance somewhere
15 in the heat-sealed edge of the bag, the method of forming a V notch instead of the I notch somewhere in the edge of a bag of such a film, the method of forming a plurality of through holes at constant intervals along the edge line of the edge portion by means of a sharp cutlery,
20 etc. have been devised.

The above-mentioned prior arts, however, have the following disadvantages.

Thus, the method of forming an I notch is disadvantageous in that the notch formed in the edge of a
25 bag cannot be found readily. In the method of forming a V notch, it is somewhat easy to find the notch formed in the bag but, when this method is employed where a large number of bags are produced and packed, there is a

possibility that V-shaped film scraps resulting from the insertion of V notches will scatter, adhere to the packed products, and deteriorate the factory environment.

Moreover, in any of the methods described above, since
5 the point for starting a tear in the bags is formed at a specific location, it does not always turn out to be an advantageous location, but there is a possibility that a tear will propagate in an unexpected direction and induce an unexpected spilling of the contents. Further, since
10 the notches are generally large in size (at least 2 mm in length), the notch inserted before its fabrication into a bag renders the film readily tearable and even prevents the film from being effectively fabricated into a bag.

Although the method of forming through holes
15 has a merit that tearing of the bag can be started from any arbitrary position of the edge of tightly sealed bag, this method entails the same problem as in the above-described V-shaped notch that film scraps resulting from making through holes scatter. Further, the scraps can
20 cause clogging of cutlery and thereby make the tear-starting effect unstable.

Besides the various problems described above, the conventional bags have a general problem that the unevenness in film thickness causes irregularity in
25 rolling tension, which often results in the formation of telescope-like shape in the course of handling to make troubles in the subsequent bag-producing step.

Thus, it has been desired to develop a tightly

sealed bag which overcomes the disadvantages described above, is free from forming any scrap of cut film, allows no mingling of foreign matters into its interior, retains the practical strength of the film and can be opened with
5 the force of finger tips from any arbitrary position, and a film roll for use in production of tightly sealed bags which is not liable to the formation of telescope-like shape of roll form in the course of handling.

SUMMARY OF THE INVENTION

10 This invention has been attained as a result of extensive studies aiming at providing a tightly sealed bag which overcomes the disadvantages described above, is free from forming any scrap of cut film, allows no mingling of foreign matters into its interior, retains the
15 practical strength of the film and can be opened with the force of finger tips from any arbitrary position, and a film roll for use in production of tightly sealed bags which is not liable to the development of telescope-like shape in the course of handling.

20 Thus, this invention in its first aspect concerns a laminated film roll for use in the production of tightly sealed bags produced by winding a laminated film having on one surface of the film a part convexly deformed relative to the direction of film thickness and
25 having a number of cuts continuously provided in the longitudinal direction of the laminated film on the both lateral edges of the laminated film, wherein:

said cuts are formed by pressing fine pseudo-triangular protrusions against the film, and

the relation between the diameter R_1 of the film roll in its central part relative to lateral length and
5 the diameter R_2 of the film roll in both lateral edge portions satisfies:

$$R_2/R_1 = 1.003 \text{ to } 1.01.$$

Further, this invention in its second aspect concerns a tightly sealed bag produced by heat-sealing the edge
10 portions of the laminated film unwounded said laminated film roll, wherein:

said heat-sealing of edge portions is carried out on the edge line of the tightly sealed bags or so as to leave non-sealed part on the terminal edge portion,
15 and

a majority of the cuts formed on one surface of a bag does not coincide in location with the cuts formed on the other confronting surface of the bag.

BRIEF DESCRIPTION OF THE DRAWINGS

20 FIG. 1 is a view illustrating the protrusions in the processing tool for forming cuts on the film of this invention in a magnified state;

FIG. 2 is a sectional view illustrating one example of the process for forming said protrusions;

25 FIG. 3 is a perspective view illustrating the processing disk;

FIG. 4 is a sectional view of the cut;

FIG. 5 is a plan view of a laminated film to which cuts have been imparted;

FIG. 6 is a front view illustrating the laminated film roll of this invention;

5 FIGS. 7, 8, 9 are perspective views illustrating the tightly sealed bag of this invention; and

FIG. 10 is a sectional view illustrating the sealed portion of the tightly sealed bag in a magnified state;

10 wherein the marks in the drawings have the following meanings:

- 1 --- through cut,
- 9 --- metal surface,
- 10 --- protrusion,
- 15 11 --- depression,
- 12 --- bluff surface,
- 13 --- processing roll,
- 16 --- substrate layer,
- 17 --- heat-sealed layer,
- 20 19 --- sloped surface,
- 20 --- flat metal surface,
- 21 --- cut,
- 22 --- angle line, and
- 23 --- edge line.

25 BEST EMBODIMENT FOR PRACTICE OF THE INVENTION

The laminated film of this invention may be any laminated films regardless of the kind of materials, so

far as they can give a tightly sealed bag when heat-sealed and withstand impacts normally exerted during circulation and storage. Preferably, laminated films prepared by laminating one or more of mono- or bi-axially oriented films of nylon, polyester, polypropylene and the like are used. Since these films are tough and excel in the propagating property of inflicted cut, the effect of this invention can be exhibited effectively. In making a bag therefrom, heat-sealable other plastic film is usually laminated additionally and used. As said heat-sealable other plastic film, olefin resins such as low density polyethylene and the like and polyethylene type copolymer resins such as ethylene-vinyl acetate copolymer resin and the like are used. Although the heat-sealing temperature varies depending on the pressure of pressing, duration of pressing, and the thickness and kind of the film, it is in the range of 80° to 180°C, and usually 120° to 150°C. The material of the heat seal layer is desired to assume a completely molten state or at least a half-molten state at the temperature of the heat-sealing described above.

The laminated film of this invention has, in its both lateral edge portions, a number of cuts continuously provided in the longitudinal direction. The cuts are formed by pressing fine protrusion of pseudo-triangular form as shown in FIG. 1. The pseudo-triangular protrusions may be minute blade edges provided on the circumferential surface of metallic roll or the

plane of metallic board. For example, pseudo-triangular cuts 21 are inflicted on metal surface 20 and the portions of metal surface having been separated from the remaining area of metal surface by the cutting are made to stand up while using the bases of the pseudo-triangles as axes, as illustrated in FIGS. 1 and 2, whereby the protrusions 10 project out of the metal surface to leave the cut portions as depressions 11. The depression-side surface of the protrusions 10 or the bluff surface 12 preferably makes an angle of not smaller than 60° and not greater than 90° relative to the metal surface. After aligning such protrusions linearly in at least one row, the metal is hardened. FIG. 3 is a perspective view illustrating processing roll 13 wherein such protrusions are provided on the circumferential surface.

When the protrusions 10 illustrated in FIG. 1 are pressed against a film, the edges of the bluff surfaces 12 function as cutting edges, so that the edges of the bluff surfaces 12 will be straightly inserted into the film, while the outer sloped surfaces 19 will expand the portions of the film by the pressure exerted. As a result, the portions of the film which have admitted the insertion of the bluff surfaces 12 remain flat and the portions which have admitted the outer sloped surfaces 19 are deformed aslant downwardly and strained and come to differ from the level of the remaining portions of the film as illustrated in FIG. 4. The film is provided with the strained portions and the undeformed portions with

the cuts therebetween. When the film is heat-sealed, the strained portions of the film are almost returned to their original state to coincide with the level of the remaining portions of the film, but they still possess
5 the internal strain remaining therein and, because of the internal strain, the strength of the film is lowered. Consequently, there is exhibited an important effect that the film is readily torn with the force of fingers from the bordering portion between the strained portion and
10 the unstrained portion. Unlike the injuries inflicted by insertion of conventional cutting edges, cracks run from the opposite terminals of the through cuts produced as described above. These cracks are highly effective in starting tears in the film.

15 The tool used in this invention is desired to be made of a rigid material including a hardened steel and ceramics such as silicon carbide, titanium carbide, and silicon nitride. Tools shaped from a metallic material and subsequently coated with a film of silicon
20 carbide or titanium carbide by the method of CVD or PVD also exhibit outstanding wear-resistance and provide a sharp cutting for a long time.

Being provided with through cuts in the edge portions of a film by means of the tool described above,
25 the laminated film of this invention has convexly deformed portions on one surface relative to the direction of thickness of the film, as illustrated in FIG. 4. The deformed portions have a slender shape wherein the

longitudinal length is greater than the lateral length and its longitudinal length is not greater than 0.5 mm, preferably not greater than 0.3 mm and not smaller than 0.1 mm. As illustrated in FIG. 5, the cuts are aligned
5 in the transverse direction relative to the edge line, and the distances L_1 between the adjacent cuts in the longitudinal direction of the laminated film are not smaller than 1.0 mm and not greater than 2.0 mm. When the length of the through cuts exceeds 0.5 mm, the bag
10 produced from such a film is not good in appearance and the film is low in strength and not easy to handle. A length of the through cuts smaller than 0.1 mm is undesirable because tearability of the film is unstable and R_2 mentioned later is small. When distance L_1 between
15 the through cuts exceeds 2.0 mm, the easy-opening positions are too coarsely distributed so that the effect of this invention that the bag can be opened from anywhere is lost. When L_1 is smaller than 1.0 mm, distribution of the through cuts is too dense so that strength
20 of the film is deteriorated and R_2 is too great which makes the film not easy to handle.

In this invention, the distance L_2 between the through cut rows also plays an important role. As expressed in terms of distance between the center lines
25 of cut rows, L_2 must be at least equal to the length of each cut. When the distance L_2 is smaller than the length of each cut, the density of cuts per unit area is too high, which deteriorates film strength and increases R_2 to

make the film not easy to handle.

The laminated film thus obtained is wound into a roll and used for making bags. As illustrated in FIG. 6, the laminated film roll of this invention is so shaped
5 that the diameter R_1 of the central part relative to lateral length of the roll is smaller than the diameter R_2 of both lateral terminal parts. This is due to that each cut formed in the both lateral terminal parts has a convexly deformed portion on one surface relative to the
10 direction of thickness of the film. Owing to this, in the laminated film roll, the winding tension is evenly applied to both edge portions of the roll and thereby the formation of telescope-like shape in the course of handling due to uneven winding tension caused by nonuniform
15 section or the like can be prevented.

Herein, R_1 is dependent on the thickness of laminated film to be wound and the length of winding, and R_2 is dependent on the density of cuts and the pressing pressure at the time of forming the cuts.

20 It is necessary that R_1 and R_2 are so related as to satisfy $R_2/R_1 = 1.003$ to 1.01 . When this ratio is smaller than 1.003 , the effect of preventing the formation of telescope-like shape in roll form is impractically small. When the ratio exceeds 1.01 , both the
25 terminal portions of the film are excessively extended to cause a zigzag movement of film at the time of making bags or a defective sealing, even though the effect of preventing the formation of telescope-like shape in roll

form is sufficient. Further, the bag produced from such a film is not good in appearance.

In order to satisfy the relation $R_2/R_1 = 1.003$ to 1.01, the conditions should be selected while
5 considering the constitution (thickness and material quality) of laminated film and controlling the shape, size, height and density of tool edges, the pressing pressure of edges, the winding tension, the pressure of pressing roll in the course of winding, etc. If
10 necessary, the process should be practiced in a small scale in advance to select appropriate conditions.

This invention in its second aspect concerns a tightly sealed bag produced from the above-described laminated film roll. As for the form of the bag, 3-side
15 sealed type as illustrated in FIG. 7, 4-side sealed type as illustrated in FIG. 8, etc. can be referred to. Apart from them, the 3-side sealed type as illustrated in FIG. 9 can also be referred to.

The tightly sealed bag has 3 or 4 sealed
20 portions. At least one of the sealed portions is formed by extending the film from one laminated film roll, inflicting cuts thereon, superposing both the edge portions of a film carrying the cuts, and heat-sealing the edge portions, or by extending two films from two
25 laminated film rolls, superposing the edge portions of the two films and heat-sealing them. In any of these cases, as illustrated in FIG. 10, the cuts present in one surface of bag and the cuts present in the other surface

of the bag, confronting one another, do not coincide in position. This discordance makes it possible to prevent the unexpected breakage of bag in handling and to exhibit effectively the effect that the bag can be opened from
5 anywhere with the force of finger tips.

Generally speaking, sealed portion of a bag is so constructed as to form a heat-sealed portion in the terminal edge of the bag or as to form a heat-sealed portion while leaving a non-sealed portion in the
10 terminal edge. The tightly sealed bag of this invention may be according to any of these two embodiments.

WORKING EXAMPLES

EXAMPLE 1

A processing roll provided with densely
15 aggregate pseudo-triangular small protrusions on its circumferential surface was pressed against a laminated film made of a biaxially oriented nylon film having a thickness of 15 μ as a substrate layer and a low-density polyethylene film having a thickness of 60 μ as a heat-
20 sealing layer to impart through cuts for starting a tear to the film. Subsequently, the centers of the cuts were slit to give a film roll of 70 mm width $\times$ 1,000 m having through cuts in its lateral edge portions. The length of the through cut was 0.5 mm, its L_1 was 1.5 mm, and its L_2
25 was 0.5 mm. The diameter R_1 of the central portion of this film roll was 300 mm, the diameter R_2 of both terminal portions was 302 mm, and $R_2/R_1 = 1.007$. Thus,

the winding tension was exerted uniformly on both the edge portions of the roll, so that the formation of telescope-like shape in the course of handling due to unevenness of winding tension caused by nonuniform

5 section or the like could be suppressed to the minimum.

Using the cut-carrying film roll, a 3-side type of tightly sealed bag containing WASABI (horse raddish) paste was prepared while filling a WASABI (horse raddish) paste by means of form-fill-seal machine.

10 The bag thus obtained was an easy opening type tightly sealed bag which could easily be opened with the force of finger tips because through cuts were imparted to the edge of the longitudinal sealed portion.

EXAMPLE 2

15 A processing roll provided with densely aggregate pseudo-triangular small protrusions on its circumferential surface was pressed against a laminated film made of a biaxially oriented polyester film having a thickness of 12 μ as a substrate layer, a low-density
20 polyethylene layer having a thickness of 15 μ and an aluminum foil having a thickness of 7 μ as intermediate layers and a low-density polyethylene film having a thickness of 30 μ as a heat-sealing layer to impart through cuts for starting a tear to the film. Subse-
25 quently, the centers of the cuts were slit to give a film roll of 100 mm width $\times$ 1,000 m having through cuts in its lateral edge portions. The length of the through cut was

0.5 mm, its L_1 was 1.5 mm, and its L_2 was 0.5 mm. The diameter R_1 of the central portion of this film roll was 280 mm, the diameter R_2 of both terminal portions was 282.5 mm, and $R_2/R_1 = 1.009$. Thus, the winding tension
5 was exerted uniformly on both the edge portions of the roll, so that the formation of telescope-like shape in the course of handling due to unevenness of winding tension caused by nonuniform section or the like could be suppressed to the minimum. Using the cut-carrying film
10 roll, a 3-side type of tightly sealed bag containing a stock powder paste was prepared while filling a stock powder paste by means of form-fill-seal machine.

The bag thus obtained was an easy opening type tightly sealed bag which could easily be opened with the
15 force of finger tips because through cuts were imparted to the edge of the longitudinal sealed portion.

EFFECT OF THE INVENTION

According to this invention, a laminated film roll not liable to the formation of telescope-like shape
20 in the course of handling can be obtained. Using the laminated film roll, there can be obtained a tightly sealed bag which is free from forming any scrap of cut film, allows no mingling of foreign matters into its interior, retains the practical strength of the film and
25 can be opened with the force of finger tips from any arbitrary position.



WHAT IS CLAIMED IS:

1. A laminated film roll for use in the production of tightly sealed bags produced by winding a laminated film having on one surface of the film a part of convex deformation relative to the direction of film thickness and having a number of cuts continuously provided in the longitudinal direction of the laminated film on the both lateral edges of the laminated film, wherein:

said cuts are formed by pressing fine pseudo-triangular protrusions against the film, and

the relation between the diameter R_1 of the film roll in its central part relative to lateral length and the diameter R_2 of the film roll in both lateral edge portions satisfies:

$$R_2/R_1 = 1.003 \text{ to } 1.01.$$

2. A laminated film roll for use in the production of tightly sealed bag according to Claim 1, wherein said laminated film is a laminated film prepared by laminating mono- or bi-axially oriented film to make one or more layers.

3. A laminated film roll for use in the production of tightly sealed bag according to Claim 1 or 2, wherein said cut is approximately perpendicular to the edge line of the laminated film and has a slender shape in which the longitudinal length is greater than lateral length, the longitudinal length of said cut is not smaller than 0.1 mm and not greater than 0.5 mm, the distance between the neighboring cuts in the longitudinal direction of



laminated film is not smaller than 1.0 mm and not greater than 2.0 mm, and the distance between the cut rows is at least equal to the length of each cut as expressed in terms of the distance between center lines of the cut rows.

4. A tightly sealed bag of which sealed portion is formed by heat-sealing the edge portions of a laminated film unwound from the laminated film roll of Claims 1 to 3, wherein said heat-sealing is carried out on the edge line of the tightly sealed bag or so as to leave a non-sealed portion in the terminal edge portion, and a majority of the cuts on one side of a bag do not coincide with the cuts on the other confronting side of the bag in the position of cuts.

5. A tightly sealed bag according to Claim 4, wherein the cuts are approximately perpendicular to the edge line of the tightly sealed bag and have a slender shape in which the longitudinal length is greater than the lateral length.