A flat-bottom plastic bag produced from an extruded length of gusseted and thermoplastic material including the steps of sealing and severing a length of such material to provide a closed bottom; folding the upper portion of each gusset inwardly toward the center of the bag to create triangular portions at the bottom of each gusset, the bottom corners of the bag tapering inwardly with the taper being determined by the outer leg of each triangular portion; opening the folded gusset portions to a flattened position, each triangular portion being folded simultaneously along a median line and the inwardly tapered bottom configuration of the bag being retained; folding the tapered bottom portion of the bag upwardly toward the front of the bag thereby creating a transverse fold line extending from edge to edge of the bag, the height of this folded portion being substantially identical to the height of the folded median line of each triangular portion, the height of this median line being substantially identical to the depth or width of the gusset; and opening said upwardly folded portion, for packing and/or shipping purposes, to a plane contiguous to that of the remainder of the bag. The invention also contemplates the novel bag produced by the above method.
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REVERSE FOLD SELF-OPENING PLASTIC SQUARE BOTTOM BAG

This application is a division of application Ser. No. 243,946 filed Apr. 14, 1972 and now U.S. Pat. No. 3,799,042.

This invention relates to reverse fold self-opening plastic square bottom bags.

Essential requirements of bags of the character with which we here are concerned are that the bags must include a substantially rectangular and flat-bottom surface and the gauge or thickness of the thermoplastic sheet material employed must be such that the bag walls will be self-sustaining; thus, the bag will stand erect, resting securely upon its flat bottom, when in opened position and filled or partially filled.

An important end use of such bags is as a carry-out bag of various sizes for the replacement of paper bags commonly used in the grocery and super market industries. Present practices in these fields require that the paper bags utilized be of double-wall manufacture, or that two bags of heavy weight paper (one inside the other) be employed, thereby seeking to eliminate the hazards of bottom or sidewall breaks occasioned by over-loading, wet groceries or other goods, and other influences that provide stresses or conditions beyond the tolerance of the paper stock. Mounting costs in connection with the provision of paper carry-out bags which will withstand satisfactorily the adverse conditions referred to hereabove provide continually increasing problems and the present invention is directed to the solution thereof.

Bags of the character with which we here are concerned are commercially available to a degree; however, problems inherent to known methods of manufacture (particular reference is had to the folding of the bag so that it will open readily and stand upon its flat bottom when filled or partially filled) have added materially to the costs. It is a major object of the present invention to provide a novel method of manufacture and folding whereby such bags can be produced with greater economy than has been known heretofore.

It is further object of the present invention to provide a plastic bag which will be moisture-proof and will have adequate wall strength to withstand interior stresses which will be encountered.

It is still further object of the present invention to provide a novel plastic bag having a flat, substantially rectangular bottom surface, whereby the bag may be opened readily and stand erect to permit the convenient utilization thereof for all commercial purposes where bags may be desirable including along a filling and check-out line.

A still further object of the invention is the production of a bag of the character with which we here are concerned from a continuous length or tube of heat-sealable thermoplastic material which has been extruded and flattened to provide a gusset at each side thereof, external transverse sealing and severance or perforation between adjacent bags being accomplished after the formation of such gussets.

It is an additional important object of the invention to provide a bag of the character under discussion which may be produced with particular economy, can compete successfully with prior art paper bags, and may be used with particular ease in grocery and super market operations, or the like.

Further objects and advantages of the invention will be readily apparent from the following description, taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a fragmentary perspective view of the bottom portion of a flat bottom plastic bag produced in accordance with the present invention;

FIG. 2 is a transverse sectional view, on an enlarged scale, taken on the line 2—2 of FIG. 1;

FIG. 3 is a plan view of a length of gusseted, thermoplastic tubular material, sealed along the bottom edge thereof and illustrating the initial step of the novel method of the present invention;

FIG. 4 is a transverse sectional view, on an enlarged scale, taken on the line 4—4 of FIG. 3.

FIG. 5 is a fragmentary sectional view of the lower extremity of the bag, illustrating the second step of the present method, the open portion of each gusset having been folded inwardly toward the center of the bag;

FIG. 6 is a detail transverse section view, on an enlarged scale, taken on the line 6—6 of FIG. 5;

FIG. 7 is a fragmentary plan view, similar to FIG. 5 and illustrating the third step of the method, the folded gusset portions having been opened outwardly and returned to the original positions thereof;

FIG. 8 is a transverse detail sectional view on an enlarged scale taken on the line 8—8 of FIG. 7;

FIG. 9 is a plan view of the lower extremity of the bag, similar to FIGS. 5 and 7, illustrating the fourth step of the present method, the closed bottom of the bag having been folded upwardly to a plane immediately above that of the remainder of the bag;

FIG. 10 is a detail vertical sectional view on an enlarged scale taken on the line 10—10 of FIG. 9; and
FIG. 11 is a plan view similar to FIG. 9, illustrating the final step of the present method, the upwardly folded bottom portion of the bag having been returned to a plane contiguous to that of the bag proper.

As shown in the drawings, particular reference being had to FIG. 3, the tube 10 of the present invention has been heat-sealed transversely along the bottom edge and seared, forming a length of seamless thermoplastic tubing produced by an extrusion process and flattened as is well-known in this art. The severed bag includes a front wall 11 and a rear wall 12 united along the longitudinal thereof by gussets 13 and 16 as is well known in this art. Gusset 13 is constituted by an upper portion 14 and a lower portion 15; similarly, the opposed gusset 16 is constituted by an upper portion 17 and a lower portion 18.

The thermoplastic material or tube is heat-sealed transversely from edge to edge thereof, as indicated at 19, and then severed, thereby providing a bottom closure for the initial bag and an open mouth edge for the next adjacent bag, the invention contemplated the successive production of bags from a continuous length of tubing. It will be noted that the transverse seal 19 securely unites or welds the bottom edges of the front and rear walls of panels 11 and 12 to each other and that this seal also includes the gusseted portions 13 and 16. Thus, in the central portion of the sealed tube there are two layers of thermoplastic material, constituting the front and rear walls of the bag; however, in the outer portions of the seal 19 there are four layers of thermoplastic material, constituted by the two opposed layers 14 and 15 of the gusset 13 and the comparable layers 17 and 18 of the gusset 16 which are heat-sealed between the front and rear walls 11 and 12.
The bottom-sealed bag 10 is then placed upon a suitable support and the upper portion of each edge gusset is folded reversely toward the center of the bag, to the position illustrated in FIG. 5 of the drawings. This folding operation creates a double-walled triangular portion 20 along the lower extremity of the gusset 13 and a companion double-walled triangular portion 21 along the lower extremity of the gusset 16. The lower wall of each of the triangular portions 20 and 21 is constituted by the tubular material on both sides of the opposed extremities of the sealed bottom portion; the upper wall of each triangular portion is contiguous with the lower wall thereof and is constituted by the immediately adjacent portion of the associated gusset.

The vertical center line of the outer surface or wall of each of these triangular portions is constituted by an extremity of the sealed bottom edge 19 and the bottom corners of the bag are inwardly tapered as indicated by the outer folded edge 22 of the gusset triangle 20 and the outer folded edge 23 of the triangle 21. In this reverse folding operation of the upper portion or edge of the gussets, a vertical crease or fold line 24 is created along the front wall of the bag in alignment with the center or depth fold of the gusset 13 and a similar vertical crease or fold line 25 is created along the front bag wall in alignment with the center or depth fold of the gusset 16.

The next step of the present process is disclosed in FIG. 4 of the drawings where the gussets 13 and 16 are opened outwardly and returned to their original positions. It will be noted however that this same opening or return folding operation also extends across the two triangular portions 20 and 21 and, as shown clearly in FIG. 8 of the drawings, the extremity of the sealed bottom edge 19 within each triangular portion assumes a vertical position centrally of the respective gusseted portions 13 and 16.

The halves of the folded triangular portions 20 and 21 are mirror images of each other. Thus, the triangular portion 20 has an angular edge 26 extending at right angles with respect to the edge 22 and the upper extremities of these triangular portions are contiguous with the folded edge 27 which is parallel to the bottom seal 19 and extends the full width of the gusset 13. Similarly, the triangular portion 22 has an angularly directed folded edge 28 also disposed as a right angular or 90° relationship with respect to the folded edge 23 and the upper extremities of the edges 28 and 23 are contiguous with the folded line 29 extending across the full width of the gusset 16 and also disposed in parallel relationship with respect to the sealed bottom 19.

The lower extremity of the sealed bag is then folded upwardly and transversely from edge to edge, as indicated at FIG. 9 of the bag, to create a folded line 30 extending across the entire front wall of the bag and a companion fold line 31 extending across the entire rear wall of the bag, the location or plane of these fold lines 30 and 31 being in the identical plane as the folded edges of the triangular portions 27 and 29, respectively, of the triangular portions 20 and 21.

This completes the folding step required to produce the bag of the present invention. However, for convenience in packing and shipping, the bottom folded portion of the bag is first straightened to the plane of the remainder of the bag as illustrated more particularly in FIG. 11 of the drawings.

A simple grasping of one wall of the bag mouth and a swinging, opening operation, will produce a self-sup-poting flat-bottom plastic bag, when an article or the like will have been placed therein, the lower portion of which is illustrated in FIG. 1 of the drawings.

It will be understood that the formation of the transverse fold lines 30 and 31, and the location of these fold lines, is critical since the distance between the bottom seal 19 and these transverse fold lines which are parallel to said bottom sealed edge must be substantially identical to the depth of the gussets 13 and 16, simultaneously produces contiguous fold lines 32 and 33 which extend, respectively, across the associated gussets.

This is illustrated more particularly in FIGS. 1 and 2 of the drawings where, it will be observed, the flat bottom of the opened bag is defined by (a) the fold line 30 extending across the bag front wall 11, (b) the fold line 31 extending across the bag rear wall 12, (c) a fold line 32 extending across the gusset 13, and (d) the fold line 33 extending across the gusset 16. The vertical edges of the opened bag are defined by the edge folds of the opened gussets 13 and 16 and the depth of the opened bag is determined by the width of the flat bottom portion which is identical to that of the fully opened or extended gussets.

In practice, highly satisfactory flat-bottom plastic bags have been produced from blown tubular film having a thickness or gauge on the order of 3 mils. Where the tube as blown has a circumference on the order of 36½ inches, a bag having a width of 11½ inches with 3½ inches lay-flat gussets is particularly suitable for present purposes. The sealed and severed tube, prior to the bottom-forming operation, has a length on the order of 21 inches and, when bottom forming will have been completed, a flat bottom having a width of 11½ inches and a depth of 6½ inches (approximately twice the depth of the lay-flat gusset) is created. Such a bag can be snapped open, as is customary in bagging operations, with particular ease, and, when provided from 3-mil film, will have self-sustaining walls and will remain erect and open during the filling operation.

Where the heat seal can be accomplished in 1½ seconds, the film blowing, gusseting and flattening, and bag forming can be completed in line as a continuous operation. Alternately the gusseted flat tube may be provided in roll form or sealed and severed lengths may be fed to the apparatus from a stacked supply thereof. While the continuous method of operation will make for improved economy, under any of these circumstances a superior flat-bottom plastic bag can be provided with sufficient economy to compete more favorably with paper bags manufactured in accordance with present-day practices.

The plastic bag will have greater strength, complete resistance to rupture under stresses vastly in excess of those to be expected under normal conditions, and will be fluid-proof as against both internal and external adverse influences. Bags of this character may be manufactured with equal facility through a particularly wide range of sizes with appropriate adjustment of the apparatus to compensate for bag width, length, and gusset depth.

Any thermoplastic film having satisfactory properties of strength, stiffness and heat sealability can be used in accordance with this invention, such as polyolefins, polyamides (nylon), polystyrene, polystyrene, and the like. Polypropylene and polyethylene are preferred. Linear high density polyethylene having
a density in the range of about 0.945 to 0.960 is especially preferred.

Typical properties of films found to be satisfactory for the present invention are:

<table>
<thead>
<tr>
<th>Property</th>
<th>M.D.</th>
<th>T.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus, p.s.i. (1% secant)</td>
<td>110,000-150,000</td>
<td>140,000-220,000</td>
</tr>
<tr>
<td>Tensile, p.s.i.</td>
<td>3,000-6,000</td>
<td>2,000-5,000</td>
</tr>
<tr>
<td>Elongation, percent</td>
<td>300-600</td>
<td>140-700</td>
</tr>
</tbody>
</table>

The thickness of the film is not critical and will vary with the other properties depending on the desired stiffness and strength of the bag. Economy will be another factor which determines how thick the film will be. Typical thicknesses are in the range of about 1.0 to about 5.0 mils.

While the invention has been exemplified in some detail in connection with plastic bags of substantial size and produced from material having a relatively thick gauge, it will be understood that the present inventive concept is applicable equally to any gusseted bag of the character with which we here are concerned without regard to the size thereof or the gauge of the thermoplastic material or film from which such bags are produced.

Further, it is within the purview of the invention that such reverse fold plastic bags may be in the form of a continuous roll where a perforation or the like is provided immediately adjacent each bottom heat seal and successive bags can be separated from the prefabricated endless roll or length, with particular convenience, as required. Such a length of prefabricated bags also could be packaged in either flat or roll form in a dispenser box for convenient home or commercial use.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof. Thus, the invention is not considered limited by that which is shown in the drawings and described in the specification, and reference is had to the claims for summaries of the essentials of the invention, novel features of constructions, and novel methods of operation, for all of which protection is desired.

What is claimed is:

1. A flat-bottom bag produced from thermoplastic material including front and rear walls united along each longitudinal edge by a gusset, said bag having been heated sealed transversely and severed adjacent one extremity to provide a bag having a closed bottom and an open mouth, each bottom corner of said bag including an upwardly directed double-walled triangular portion folded along a vertical median line thereof, said median line being in a plane substantially identical to the plane of the inner edge of the associated gusset, the median line of each folded double-walled triangular portion being constituted by an included extremity of the transverse bottom seal and said bag having inwardly tapered corner portions defined by the overlying edges of said folded double-walled triangular portions, and fold lines extending across the front and rear walls to provide the longitudinal edges of the flat bottom of said bag, the spacing of each of said transverse fold lines from the bag sealed bottom edge being substantially identical to the depths of said gussets.

2. A flat bottom bag comprising a length of seamless tubular thermoplastic film having top and bottom edges and four axial fold lines therein to provide front and rear walls united along each longitudinal edge by a gusset, the bottom edge of said tubular film being heat-sealed to provide a bag having a closed bottom and an open mouth, the bottom seal being folded inwardly at the mid-point of each gusset toward the center of the bag to create an inwardly directed double wall triangular portion folded along a vertical median line of each bottom corner of the bag, said vertical median line being substantially coplanar with the inner edge of the associated gusset, the vertical median line of each folded double wall triangular portion being constituted by the included extremity of the bottom seal, said bag having inwardly tapered corner portions defined by the overlying edges of said folded double wall triangular portions, and transverse fold lines extending across the front and rear walls to provide the longitudinal edges of the flat bottom of the bag, the spacing of each of said transverse fold lines from the bag sealed bottom edge being substantially identical to the depth of said gusset.

3. The flat bottom bag of claim 2 wherein each gusset has an additional axial fold line at the mid-point thereof and parallel to said four axial fold lines.