ABSTRACT OF THE DISCLOSURE

A silt-proof industrial bag having a heat-sealed rectangular-shaped bottom closure formed by a pair of overlapping opposed side flaps and a pair of infolded end flaps. The side flaps and the end flaps are heat sealed directly to each other in their common areas of overlap. In addition, a portion of the edges of the side and end flaps adjacent the corners of the bag are infolded over the end flaps and heat sealed to the end and side flap.

Field of the invention

This invention relates to the production of bags from heat sealable thermoplastic film and more particularly to industrial type, heavy duty, silt-proof, vented bags suitable for shipping bulk quantities of commodities. Furthermore, this invention is an improvement over the bag of U.S. 3,220,601, issued Nov. 30, 1965, to H. E. Kasting.

Thermoplastic film of proper thickness has adequate impact, tear and tensile strengths for use as a bag forming material in the construction of heavy duty bags useful for packaging and shipping bulk quantities of the order of 50 to 100 pounds of granular commodities such as fertilizers, molding powders, portland cement, dyes and pigments, and food stuffs such as sugar, beans, flour and the like. In contradistinction to the older conventional bag forming material such as woven fabric or multi-ply paper, a thermoplastic film provides superior protection against vermin, accidental wetting of the packaged commodity, loss or gain in moisture content and minimum loss of finely-divided materials by siftng through seams or closures.

However, thermoplastic film bags have performed well when the product packaged therein was granular and non-dusting. However, such a bag has proven to be unsuitable for packaging fine, dusting materials, due to the small holes found in the corners of the bag. These holes which are a function of bag construction unfortunately permit leakage of finely-divided material and limit bag product application. Hence, there is lacking a desirable thermoplastic industrial bag that would permit entrapped air to escape and at the same time be silt proof for finely-ground products without any sacrifice to bag strength.

Summary

The present invention provides an industrial bag which permits entrapped air to escape but at the same time is silt proof for finely-ground products and exhibits high bag strength.

Broadly, the present invention provides a silt-proof industrial bag having a heat-sealed rectangular-shaped bottom closure formed by a pair of overlapping opposed side flaps and a pair of infolded end flaps. The side flaps and the end flaps are heat sealed directly to each other in their common areas of overlap. In addition thereto, a portion of the edges of the end and side flaps adjacent the corners of the bag are infolded over the end flaps and heat sealed to the end and side flap.

In the drawing:

FIG. 1 is an elevational view of a preferred flattened bag blank cut from a length of tubular thermoplastic film and slitted at each end to form a plurality of flaps of a configuration such that the flaps can be sealed together in overlapping relationship.

FIG. 2 is a development view of the bottom closure forming portion of the open bag blank of FIG. 1 illustrating the fold lines of the end and side flaps.

FIG. 3 is a bottom view of the bag of FIG. 1 after the end flaps and the side flaps have been folded.

FIG. 4 is a bottom view of the bag of FIG. 3 illustrating the heat seals applied to form the bottom end closure.

FIG. 5 is an enlarged fragmentary view of the bottom closure of the bag of FIG. 3 illustrating the position of the heat seal in relation to the folded silt.

FIG. 6 is an elevational view of a flattened bag blank cut from a length of a tubular thermoplastic film and slitted at each end to form a plurality of flaps of a configuration such that the flaps can be sealed together in overlapping relationship and which illustrates an alternative embodiment of the present invention.

FIG. 7 is a development view of the bottom closure forming portion of the open bag blank of FIG. 6 illustrating the fold lines of the end and side flaps.

FIG. 8 is a bottom view of the bag of FIG. 6 after the end and side flaps have been folded.

FIG. 9 is a bottom view of the bag of FIG. 8 illustrating the heat seals applied thereto.

Referring to FIG. 1, a bag blank 10 having longitudinal flattened edges 11, 11' are square end cut from a length of heat sealable, flattened tubular thermoplastic film, as for example, the mono olefin polymers such as polyethylene, polypropylene, olefin copolymers such as ethylene propylene copolymer and ethylene alkyl acrylate copolymers; and vinyl polymers such as rigid and plasticized polyvinyl chloride, poly vinylidene chloride and the like. The tubular film is preferably seamless tubing such as is formed by the blown tube process as, for example, by the process described by Fuller in U.S. Patent No. 2,661,975. The tubular film can also be flat film as formed by slot extrusion or calendaring and thereafter sealed together along its longitudinal marginal edges to form tubing. If desired, the tubular film can be oriented in various conventional manners to impart improved physical properties. Both sides of the flattened tubing 10 are die cut at each end as shown in FIG. 1 to form a pair of identical bottom forming closure side flaps 12, 14 (FIG. 2) and a pair of end flaps 16, 18 (FIG. 2). Preferably, the die cuts are so made as to provide opposing side flaps 12, 14 with side edges 13, 15 running diagonally away from the flattened edges 11, 11' and with side edges 13', 15' running parallel away from the flattened edges 11, 11' whereby the flaps maximum width dimension lies along the square cut edge 22 being substantially coextensive with the width of the flattened bag blank, as for example, about 95% of the bag blank width and the minimum width dimension lies between the interior die cut termini 24 and 25. One end of the inwardly directed sides of side flaps 12, 14 and 12', 14' can be a continuous straight diagonal cut extending from square cut edge 22 to interior termini 24, the diagonal being at an angle of about 35° to 55° with respect to flattened edge 11. Preferably, for ease in manipulation and folding alignment the die cut is made with a diagonal cut portion 26, 26' being at an angle of about 45° with respect to flattened edge 11. Although each corner of the bag can have this straight diagonal cut it is preferred to provide the other end of side flaps 12, 14 and 12', 14' with a
continuous parallel cut 23, 23' extending from square cut edge 22 and terminating at one end to a cut portion 27, 27' running diagonally from flattened edge 11. This cut assists in forming a valve or closing the bag. The continuous straight parallel cut 23, 23' can be used in all four corners of the bag as shown in FIG. 6. Hence, die cuts 23a, 23b, 23c and 23d and die cut 25a, 25b, 25c and 25d correspond to die cuts 23 and 25, respectively of the bag of FIG. 1. Furthermore, as shown in FIG. 7 and FIGS. 16a, 16b and side flaps 12, 14 correspond to end flaps 16, 18 and side flaps 12, 14 of FIG. 2. However, the resulting configuration is L-shaped when the side flaps are outfolded (FIG. 7).

The film material extending between the cuts in the side flaps 12, 14 constitutes a tongue portion, these portions being subsequently overlapped and heat sealed together to form a seal resistant in shear to load stress. The end flaps 16 and 18 as are apparent in FIG. 1, have diagonally and parallel cut side edges complementary to the diagonal and parallel edges of side flaps 12, 14 and thus are widest at die cut termini 24, 25 and narrower at the flattened edge 23. Accordingly, as more particularly shown in FIG. 2, each side flap 12, 14 when unfolded along flattened edge 11 approximates a square shape diagonally bisected by flattened edge 11. As shown in FIG. 3 the end flaps 16 and 18 are infolded and the opposed side flaps 12, 14 are then inwardly folded over edges 20 and 21 respectively (FIG. 2) in overlapping relationship to each other and with respect to flattened end flaps 16, 18. The necessary equipment suitable for carrying out this folding operation is fully described in U.S. 3,220,601 referred to hereinabove, as well as the heat sealing application. In the alternative impulse sealing of the folded flaps can be used to form the final seal. Referring to FIGS. 4 and 5 the heat sealing together of the end flaps and side flaps to form a silt proof yet ventable bottom closure is accomplished by fusing together all overlapping film plies. Hence, the resulting bottom closure assumes a substantially flat rectangular shape upon the bag being filled with a pourable commodity.

Hence, a silt-proof industrial bag which is ventable is obtained by overlapping the opposed side flaps 12, 14 and infolded the end flaps 16, 18. In addition thereto, the side flaps 12, 14 and the end flaps 16, 18 are heat sealed directly to each other in their common areas of overlap (FIG. 3) as shown in FIGS. 3 and 5, and a portion of the edges 16', 18' of the end flaps 16, 18 and a portion of the edges 12', 14' of the side flaps 12, 14 adjacent the corners of the bag are infolded over the end flaps producing a triangular tuck 30 with inward edges at the corner of the bag and heat sealed 28 to the end and side flap. The heat seal 28 is made extending almost to the bezet of the tuck 30. Alternatively, if the die cut of FIG. 6 is employed, the bag end when folded assumes the configuration of FIG. 8 with tucks 30a in all four corners as shown. These tucks, likewise, are formed when a portion of the edges of the side and end flaps adjacent the corners of the bag are infolded over the end flaps and heat sealed to the end and side flap. A heat seal pattern as shown in FIG. 9 is suitable for such a bag configuration although not limited thereto.

The above design in combination with the heat seal forms a labyrinth type passageway which allows air to escape, but retains bag ingredients or particles. A second cut and fold is the improved strength of the seal at the point where the side flap seals stop on the end tab 32. In the preferred form of the invention the straight angle cut and the closure seal are both made on a 45° angle with the flat edge of the bag. The location of the seal is such as to bisect the angle of the tuck 30.

The top closure for the bag can be made in various ways including heat sealing together the opposing walls, stapling or clamping with metal fasteners, sewing, tying, with twine, or knotting the gathered end. Preferably however, the bag is a rectangular top closure similar to the bottom closure, the closure being provided with a filling valve for the bag, the bag having a pourable commodity, the valve being closeable by pressure being exerted thereon by the filling bag's contents causing the valve walls to collapse against each other.

The bag of the invention was subjected to various drop test and structural tests as set forth in U.S. 3,220,601 and were found to have a lower incidence of breakage than end fold nipped seal bags and bags made of thermoplastic film heat sealed together by pinched type seals or face to face seals. Furthermore, the bag was found to be airtight as well as ventable. The superior resistance to breakage of the thermoplastic film bags of this invention, particularly in the area of the bottom and top closures is a direct result of the closures having been formed by sealing together in overlapping relationship the several flaps constituting the closure whereby the stresses transmitted to the bag walls by its contents are resisted in shear. Further contributing to the bag's resistance to breakage is the double and triple film ply construction of the bag's several corners which are formed by the sealed overlap of the side flaps and each end flap.

Although this invention has been described in a particular detail with respect to bags made from plastic film of a single wall thickness, the principles of this invention are applicable to the manufacture of bags from laminated thermoplastic films including such composite films as laminates of polyethylene film and polypropylene film, a polyethylene film and vinylide chloride polymer or copolymer, of plasticized vinyl chloride polymer or copolymer film and polyethylene film; of polyethylene film and regenerated cellulose film coated with a heat sealable coating; of a heat sealable thermoplastic film such as polyethylene film or plasticized vinyl chloride polymer or copolymer film in a metal foil such as aluminum foil; of thermoplastic films such as polyethylene and a fibrous web such as paper woven or un woven fabrics of organic or inorganic fibers such as cotton fibers, rayon fibers, nylon fibers, linear polyester fibers, polyacrylonitrile fibers, asbestos fibers and glass fibers.

In the use of such laminated films, it is preferred, that both outer laminate surfaces be a heat sealable thermoplastic material in order to obtain strong shear-resistant seals in the bag's bottom and top closures. By suitable choice of the various materials in a film laminate it is possible to provide desired vapor transmission rate through the bag walls, resistance to attack by corrosive packaged commodity, heat resistance, abrasion and scuff resistance, opacity to light, particularly in the instance of metal foil, and improved flexural, impact and tensile strengths as, for example, in the instance of laminates having a reinforcing fabric ply.

Bags can also be made according to this invention from a plurality of concentrically assembled individual tubular films of substantially the same flat width, such films being of the same or different polymers. Bags made of such multi-ply films generally offer such advantages as improved energy absorbing characteristics, and puncture and abrasion resistance over bags made of single ply films of the same thickness as the multi-ply film thicknesses. It will be readily apparent to those skilled in the art that various changes and modifications can be made in the above description of the invention without departing from the nature or spirit thereof. Thus, for example, it is feasible, if desired, to substitute for the seamless tubular film from which the bag blank was die cut, tubing made by longitudinally edge sealing a flat sheet of thermoplastic film. Moreover, instead of heat sealing the overlapped plies to form seals resistant to shear to applied stress it is within the contemplation of the invention to use other methods of sealing as, for example, adhesives, or solvent seals which are usually more expensive in time and material cost than the aforesaid described heat seals.
What is claimed is:

1. In a thermoplastic film bag having a heat-sealed rectangular-shaped bottom closure formed by a pair of overlapping opposed side flaps and a pair of infolded end flaps, said side flaps and said end flaps being heat sealed directly to each other in their common areas of overlap, the improvement which comprises a sift-proof, industrial bag wherein a portion of the edges of the side and end flaps adjacent the corners of the bag are infolded over the end flaps and heat sealed to the end and side flap to form at least one sift-proof air vent pocket.

2. A sift-proof bag according to claim 1 wherein the film is polyethylene film.

3. A sift-proof bag according to claim 1 wherein at least one pair of side edges of said side flaps and said end flaps are tapered.

4. A sift-proof bag according to claim 1 wherein said side flaps each have an inwardly tapering terminal edge and side edges running perpendicular to the bag length, and said end flaps each have interior edges of a configuration complementary to said side flap edges.

5. The sift-proof bag of claim 1 wherein the side and end flaps adjacent the valve end of the bag are infolded and heat sealed together to form at least one sift-proof air vent pocket at the valve end of the bag.

6. The sift-proof bag of claim 5 wherein both side flaps are partially tapered at the valve end of the bag.

7. The sift-proof bag of claim 5 wherein both side flaps are cut diagonally with respect to their respective hinge lines along the initial portion of their opposed side edges where said edges extend from the bag at the valve end thereof, each such side edge then being cut perpendicular to the hinge line of each flap.

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