United States Patent [19]

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[54] **METHOD AND APPARATUS FOR AUTOMATICALLY VENTING PLASTIC BAGS**

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[21] Appl. No.: **99,780**

[52] **U.S. Cl.** .....**53/37,** 53/39, 53/46, 53/373, 93/35 R

[51] **Int. Cl.** **B65b 7/08**

[58] **Field of Search** .93/DIG. 1, 8 VB, 8 WA, 35 PC, 93/35 DS, 59 MT; 53/37

[56] **References Cited**

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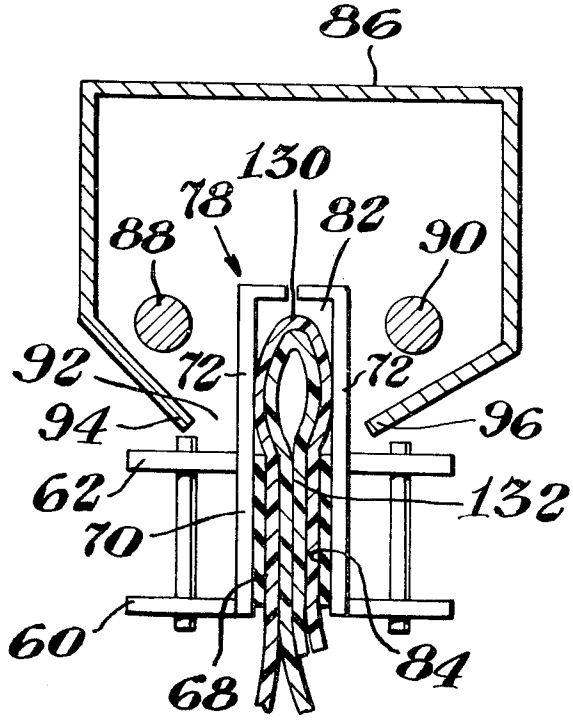
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[57] **ABSTRACT**

Method and apparatus for automatically closing plastic film bags while simultaneously venting the bag in a manner so that the bag is essentially "leak proof," but yet is able to breathe to avoid expansion of "pillowing" when stored at high temperature. The invention contemplates folding over the top portion of the bag, applying heating along the fold line sufficient to heat plastify the film and while cooperatively shielding short increments of the film; and thereafter squeezing and cooling the film to pressure set the seal. Each shielded increment forms an air vent to the above-noted quality.

2 Claims, 7 Drawing Figures



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SHEET 1 OF 2

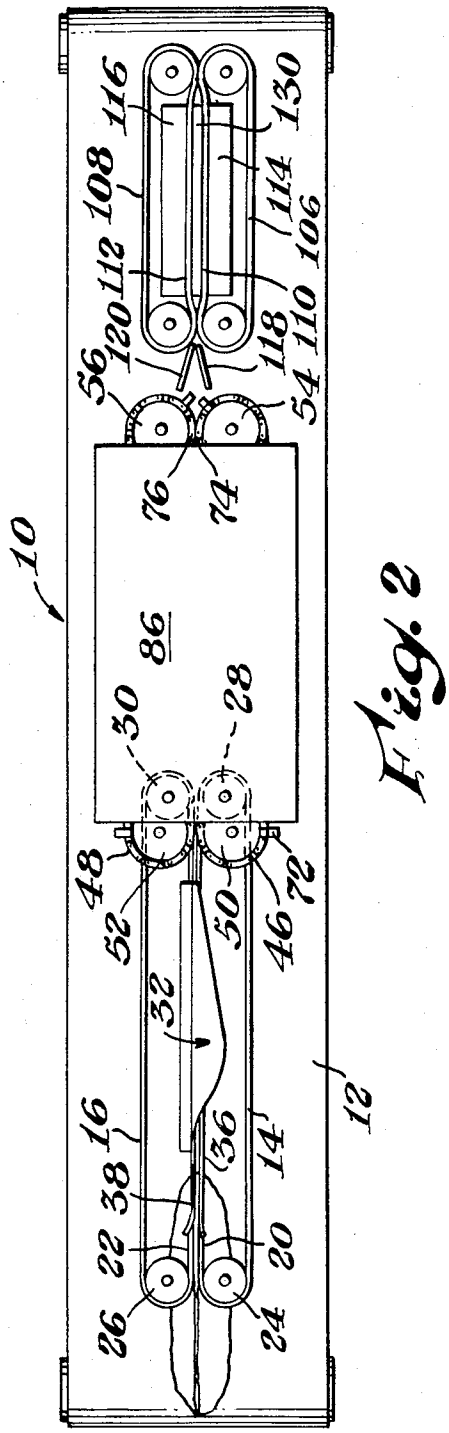


Fig. 2

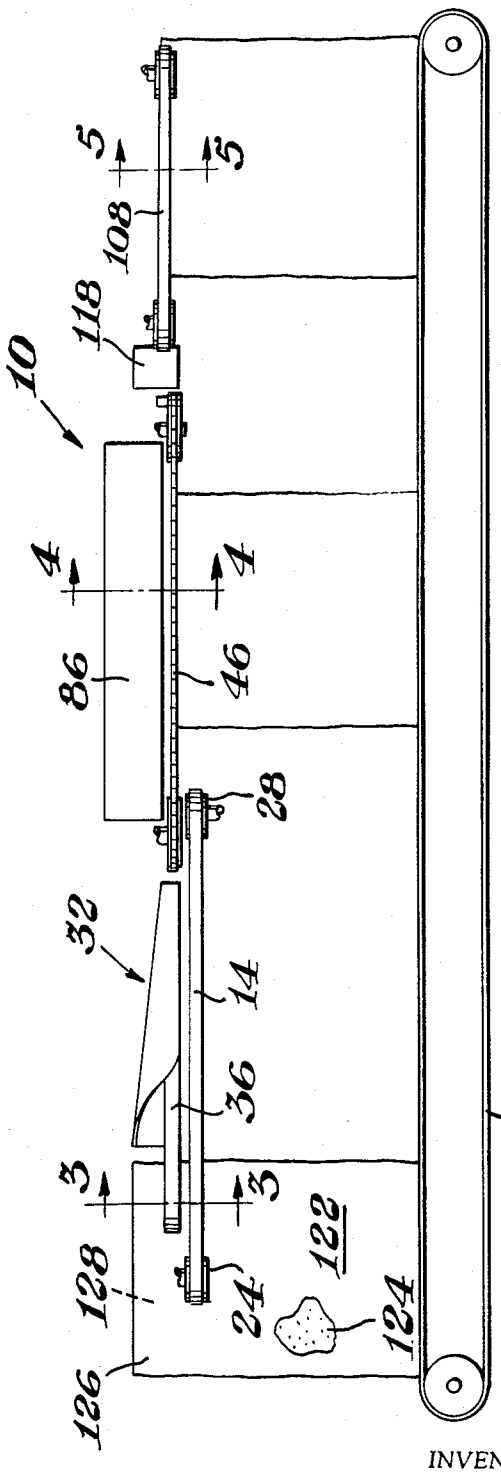


Fig. 1

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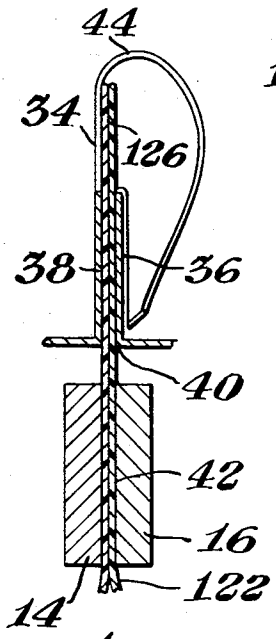


Fig. 3

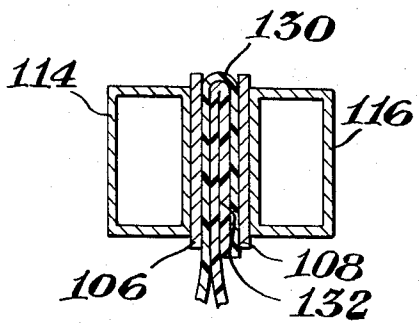


Fig. 5

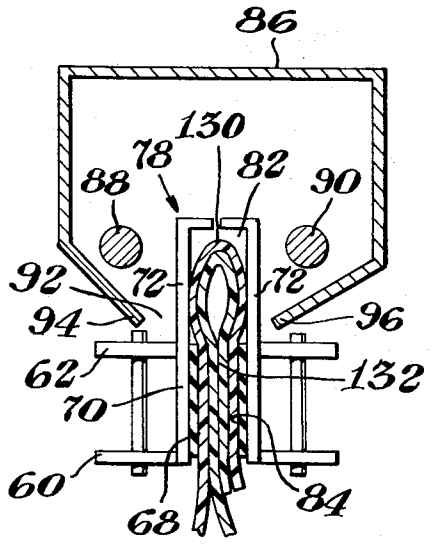


Fig. 4

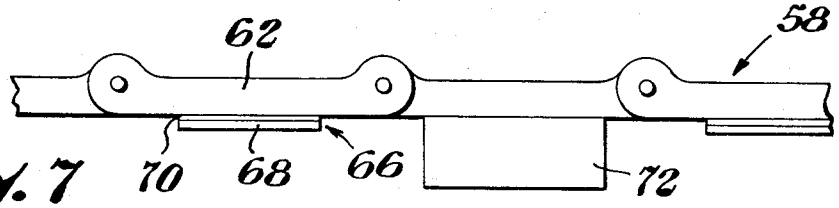


Fig. 7

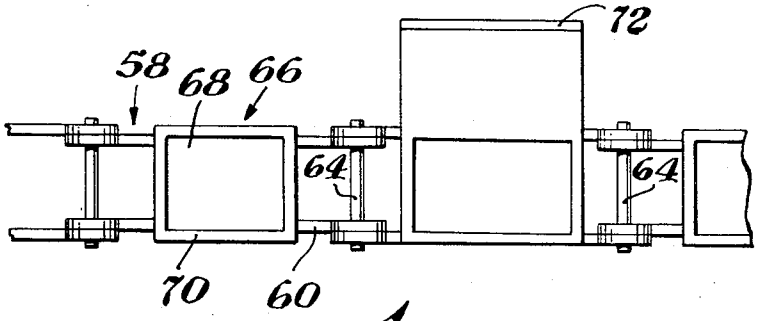


Fig. 6

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METHOD AND APPARATUS FOR AUTOMATICALLY VENTING PLASTIC BAGS

BACKGROUND OF THE INVENTION

A continuing problem in employing plastic bags in certain areas of packaging is the inability of the plastic to breathe. Air trapped within plastic bags, for example, tends to expand such that a pillowing or ballooning effect can occur. In severe cases pillowing can actually cause the bags in a stack to float one on top of the other. This, in turn, effects palletizing operations as the stack is more likely to topple when handled as a unit. Moreover, air pressures developed in the lower bags can reach levels sufficient to cause a bursting or rupturing of the bag material with resultant spilling of the product contained therewithin.

The aforenoted drawback of plastic bags, that is, the inability of the plastic to breathe, is most usually felt in industrial applications using heavy-duty bags for the packaging of unit lots in the range of about 10 to about 100 lbs. Warehouse and freight cars storage temperatures, for example, of as high as 140° F are not unusual, nor is it unusual to require that such bags be stacked to considerable heights to maximize the available storage space.

The obvious solution to this problem, of course, is to somehow vent the bag so that the expanded and heated air can escape without damage to the bag. The difficulty, however, is to form a vent of economical construction that permits leakage of air, but yet is sufficiently tight to retain the product even though the same may be finely divided, such as talc, sugar, salt, fertilizer or the like.

A particularly advantageous vent construction that effectively accomplishes this end is illustrated in U.S. Pat. No. 3,439,869. Basically that patent discloses that an unusually effective vent can be achieved by folding over the top end of the bag and sealing along the fold line. The patent explicitly discloses the use of non compatible material located in the vicinity of the fold, and which prevents a perfect hermetic seal from forming, thus resulting in a vent. Normally the vent width will be approximately ⅜ to ¾ of an inch. If less than ¾ inch, air passes through the vent only with difficulty, but if much greater than ¾ of an inch finely divided products can sometimes escape.

The vent, however, requires special fabricating steps to be pre-applied to the bag material in order to obtain the desired venting action, and, therefore, adds to the eventual price of the bag. Additionally, the solution or substance of a non-compatible nature that is applied to the bag must be applied only in strategic areas and, therefore, its application is oftentimes less than fully convenient for customary commercial embodiments.

Accordingly it is among the objects of the present invention to provide the following:

Method and apparatus for automatically venting plastic bags wherein substantially no additional cost is required to include the vent in the finished bag structure.

Such method and apparatus wherein the resultant vent is sufficiently tight to retain even finely divided products, yet readily exhausts excess air pressure from within the bag, and which can be conveniently incorporated into the bag structure either before or after the bag is filled; and

Such method and apparatus which functions as an integral part of the closure step following bag filling, and which may be included in present day packaging lines with only minor modifications being required of existing bag closing equipment.

BRIEF SUMMARY OF THE INVENTION

Briefly, then, the present invention resides in a discovery related to bag closure methods and apparatus wherein a vent of high quality can be automatically incorporated into the bag during closure thereof, and without requirement of complicated closure steps; or equipment that would detract from the convenience and economics in providing such a vent structure. Basically the vent contemplated herein is formed by folding over the top end of the bag, that is, the end where the mouth or fill opening of the bag is located. The plastic along the fold line is then continuously heat plastified such as by increments which are shielded automatically from the heat. The heat plastified layers are then quickly cooled and squeezed together to pressure set the seal. At each of the shielded increments, however, the seal is non-continuous and therefore permits the bag to breathe. Such steps are accomplished automatically by feeding the bag between opposed gripping belts past a folding tunnel which automatically folds over the top portion of the bag. A second set of gripping belts then receives the folded-over portion of the bag, and located above the second set of belts are radiant heaters which apply heat continuously along the fold line as the bag is moving forward. The second set of belts include shields at spaced intervals which cooperate to shield automatically discreet portions of the film, thereby automatically effecting the desired vent structure.

DESCRIPTION OF THE DRAWINGS

Yet additional objects and advantages of the present invention and its numerous and cognate benefits, are even more apparent and manifest in and by the ensuing description and specification taken in conjunction with the accompanying drawing, in which wheresoever possible, like characters or reference designate corresponding material and parts throughout the several views thereof in which:

FIG. **1** is a side elevational view schematically illustrating apparatus for accomplishing the objectives of the present invention;

FIG. **2** is a top view of the apparatus of FIG. **1**;

FIGS. **3**, **4**, and **5** are enlarged cross-sectional views taken along reference lines **3—3**, **4—4**, and **5—5**, respectively, of FIG. **1**;

FIG. **6** is an enlarged partial side view of certain chain structure used in the apparatus of FIG. **1**, but as viewed separately therefrom; and

FIG. **7** is a view like FIG. **6** only showing the chain structure thereof as viewed from the top.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now more particularly to the drawings, there is shown in FIGS. **1** and **2**, closure sealing apparatus **10** of the general type contemplated for use herein, and comprising a movable bottom support or

conveyor 12. Positioned horizontally above conveyor 12 is a first set of opposed gripping belts 14 and 16. Belts 14 and 16 can comprise, for example, conventional V-belts composed of rubber, synthetic rubber, fabric, or like combinations of the same, and are movably engaged throughout the length of the inner runs 20 and 22 thereof. The belts are operated at each end around pulleys 24 and 26, and 28 and 30, respectively.

Located centrally above belts 14 and 16 is a bag folding station 32 comprising a pair of spaced apart guide plates 36 and 38 formed such as of sheet metal of the like. Plates 36 and 38 define therebetween a continuous gap 40 which is aligned vertically with the interface 42 defined between inner runs 20 and 22 (see FIG. 3) A folding tunnel 34 is formed by extending plate 38 upwardly beyond plate 36 starting at approximately the central part of station 32. Tunnel 34 begins as a slight clockwise directed curl 44. Curl 44 becomes gradually more pronounced and is tapered such that at the mid-region of folding tunnel 34 and backwardly therefrom, the curl extends in radially spaced relationship progressively further about plate 36, and with the amount of such radially spacing progressively diminishing toward the end of the folding tunnel (see FIG. 3).

A second set of gripping belts 46 and 48 is operated horizontally behind folding station 32 and at a level generally immediately above belts 14 and 16. As may be noted, the forwardmost end of belts 46 and 48 can be overlapped with belts 14 and 16 to facilitate the transfer of filled bags therebetween, as will be explained in more detail hereinafter.

Belts 46 and 48 can be comprised of fabric or rubber, like belts 14 and 16, but preferably embody a connected link construction as illustrated in FIGS. 6 and 7; and therefore are operated at each end around suitable sprocket means 50 and 52, and 54 and 56, respectively.

Referring now more specifically to FIGS. 6 and 7, an exemplary chain construction for belts 46 and 48 can include a joined series of metal links 58, each comprising spaced apart parallel plates 60 and 62 rotatably interconnected such as by suitable pin means 64. A pad 66 is affixed vertically between plates 60 and 62 of each link 58, and collectively the pads comprise the actual gripping face of each belt. Pads 66 can comprise, for example, a composite structure including a facing 68 of a rubber or synthetic rubber laminated to a rigid backing 70 such as of metal or the like.

Additionally, certain paced apart links 58 in each belt 46 and 48 include an inverted L-shaped extension 72 affixed to plate 62 thereof adjacent the upper edge of pad 66. Extensions 72 are selectively positioned so that pairs of the same, comprising an extension 72 from each belt "mesh" in moving contiguous relationship with each other as the belts travel along the extent of their inner runs 74 and 76 (See FIG. 4). Pairs of extensions 72 thus cooperate to form shields 78 of discreet length which automatically move at a speed uniform with belts 46 and 48; shields 78 being of a generally inverted U-shaped configuration. The hollow central region 82 of each shield 78 communicates directly with the interface 84 defined between belts 46 and 48.

A hollow housing 86 containing elongated resistant heating means or rods 88 and 90 is located centrally above belts 46 and 48 at a region spaced downwardly from folding station 32. The lower-most extent of housing 86 defines a continuous opening or gap 92 of sufficient size to receive shields 78, and which is located centrally between resistant heating rods 88 and 90. Opening 92 is aligned vertically over and communicates with interface 84, except at regions where the interface is blocked by shields 78. Contiguous with the opposite edges 94 and 96 defining opening 92 can be positioned suitable water jackets (NOT shown). The water jackets can be maintained at a relatively cool temperature by circulating water therethrough protectively interrupt heat transfer from resistant heating rods 88 and 90 to belts 46 and 48, and therefore avoid heat damage to the belts.

A third set of horizontal belts 106 and 108 operate at spaced distance behind belts 46 and 48 approximately longitudinally in line with opening 92. The inner runs 110 and 112 of belts 106 and 108 continuously slide between a second set of water jackets 114 and 116. Belts 106 and 108 comprise, for example, heat conductive material such as thin metal sheeting or the like. Therefore, cooled water or like cooling medium circulating in jackets 114 and 116 is able to quickly conduct heat away from the belts to maintain the interface region thereof relatively cool. Disposed in the space intermediate the adjacent ends of belts 46 and 48, and 106 and 108, are spaced apart stationary vertical guide sections 118 and 120. Sections 118 and 120 gradually converge toward each other as they approach the latter set of belts 106 and 108.

OPERATION

To operate apparatus 10, a bag 122 such as of polyethylene, polypropylene of like packaging film is filled with product 124 and placed on conveyor 12, and the top end 126 of the bag manually or automatically fed between the first pair of gripping belts 14 and 16. Belts 14 and 16 assisted by bottom conveyor 12 automatically forward the bag to folding tunnel 34 where the top end 126 thereof is gradually folded over plate 38 by sliding contact with curled plate 36. Bag 122 thus emerges from tunnel 34 with the film at its top end 126 snugly folded or doubled over, thereby closing the fill opening 128 of bag 122.

The leading edge of bag 122 is then movingly gripped between cooperating pads 66 of the second set of belts 46 and 48 along a strip below the fold line 130, but contiguous with four ply of material comprising the folded over portion 132 of the bag; and the part of the bag above belts 46 and 48 received into housing 86 through 92. At this point discreet length of film along fold line 130 are protectively encased in hollow central region 82 of shields 78. Heat is applied continuously to the moving bag along fold line 130 by radiant heat from resistance heating rods 88 and 90, but does not penetrate as severely into the areas of film protected by moving shields 78. As may be noted, even though the shields are moving, each shield 78 continuously protects a specific area of film as they automatically move at the same speed as bags 122.

Upon emerging from housing 86, the top end 126 of bag 122 is guided between sections 118 and 120 for entrance between belts 106 and 108 where the heat plastified film layers along fold line 130 are cooled and squeezed together simultaneously. The layers of film

along the fold line are thus welded together across the width of bag **122**, thereby securing product **124** therewithin. Each shielded region, however, forms a vent providing a weakened area in the weld rupturable by internal pressures; or an interrupted area in the weld sufficiently tight to retain even finely divided products, but which vents the bag for passage of excess air pressure to the surrounding atmosphere, as explained in the aforenoted U.S. Pat. No. 3,439,869.

Referring now to some of the specifics of the present invention, sufficient heat can be applied to transform the film into a substantially molten, highly heat plastified condition along fold line **130**. Shields **78**, however, formed of metal or a like heat conductive material, not only serve as a shield but also readily conducts heat away from the shielded area to provide a maximum cooling effect, and without requiring sophisticated or expensive cooling means. Thus, even though the four layers welded together might comprise heavy duty film, such as 2 to 10 mil thick film, sufficient heat can be applied to form a secure weld, and yet a quality vent can be provided conveniently and in a manner acceptable for commercial usage. Moreover, the invention as illustrated can accommodate a chain of continuous bag elements either filled or unfilled. Further, it is readily apparent that the method of the present invention can be practiced during the fabrication of bags such as from continuous lengths of plastic web material.

While certain representative embodiments and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a method of venting heat sealable plastic bag material while simultaneously closing the same, the material being generally of a type having opposed walls defining therebetween an opening, said method comprising the steps of:

a. folding said walls over said opening while moving said material forward, defining a fold line extending generally in the direction of movement of said material;

b. moving said material past radiant heating means to radiantly heat plastify the material along a select region thereof extending along said fold line.

c. providing a plurality of heat shielding means moving simultaneously with said material shielding at least partially from said radiantly applied heat, a plurality of discrete increments of material along said fold line as said material is moving past said radiant heating means, said shielding providing a plurality of weakened seals along said discrete increments of material, said weakened seals being sufficient to form vent means in said seal upon the formation of internal pressures, pressing said heated layers together to form a continuous seal along said fold line thereby sealing closed said opening.

2. The method of claim **1** wherein said material comprises a preformed bag, said method including the step before step (a) of filling said bag with product through said opening.

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