United States Patent

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[54] **BAG-MAKING APPARATUS AND METHOD**
8 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **156/311,**
156/516, 156/583
[51] **Int. Cl.** **C09j 5/00**
[50] **Field of Search** 156/282,
311, 516, 200, 306

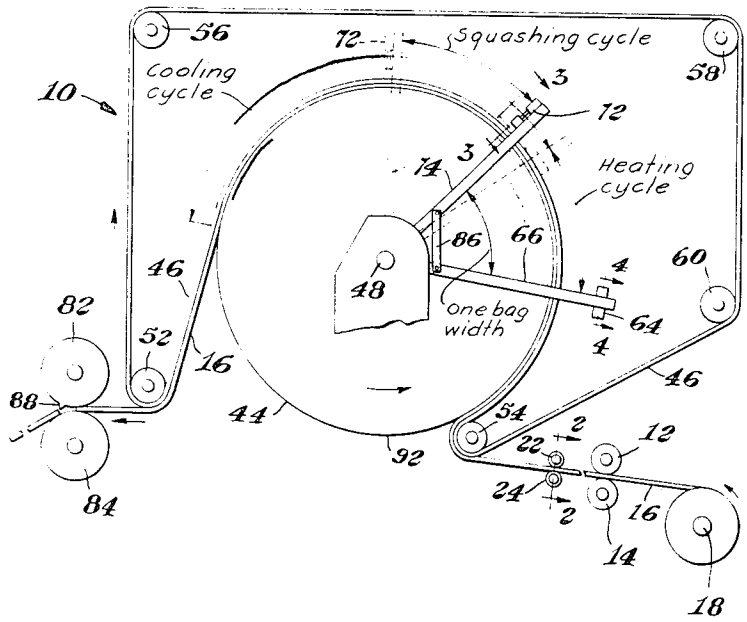
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ABSTRACT: Apparatus and method for forming bags from flattened tubular or longitudinally folded web stock wherein the stock can include opposed beadlike closure members located on the inner surface thereof. The flattened stock is initially sandwiched between two layers of release material, and then directed to between cooperating sealing elements, one of which is heated. The sealing elements laterally seal the stock at regularly spaced intervals to form a plurality of connected compartments or bags. Assisting the sealing elements is a stomperlike member which flattens the closure members in the region of each seal, thereby rendering the seal at the closure substantially liquid and gastight. Thereafter, the release is removed from each side of the sealed stock, and the stock parted into individual bags.



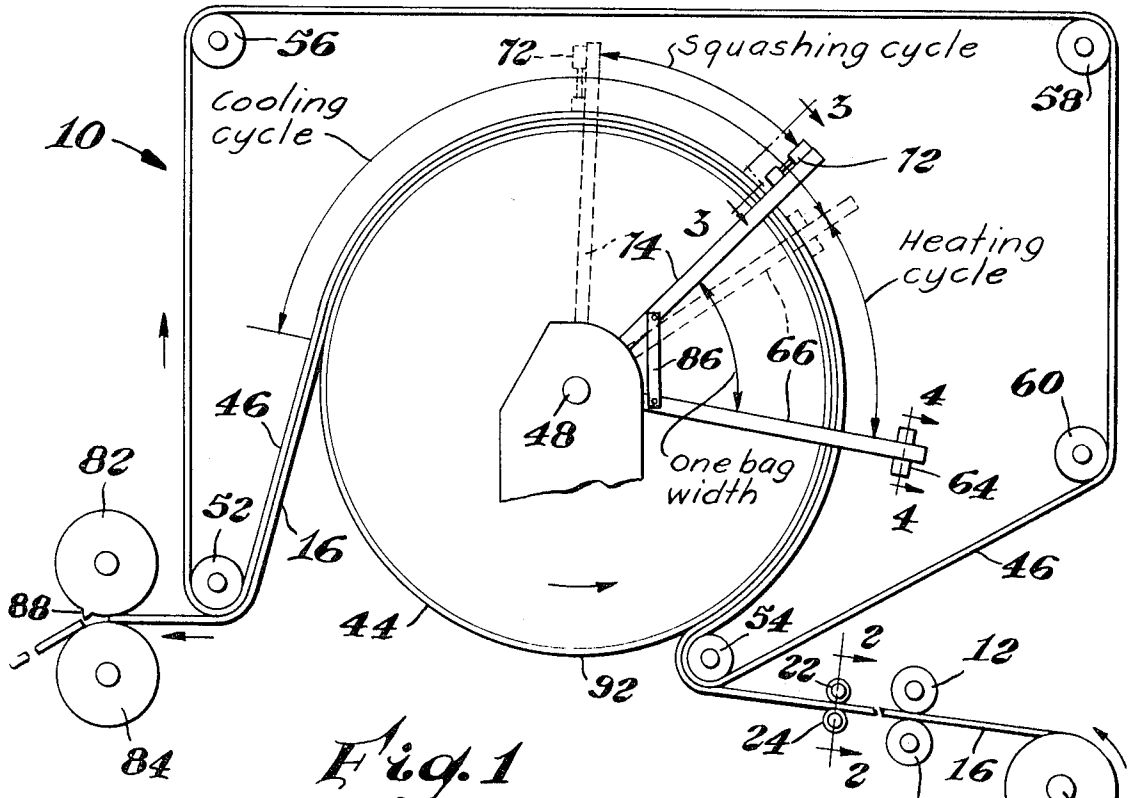


Fig. 1

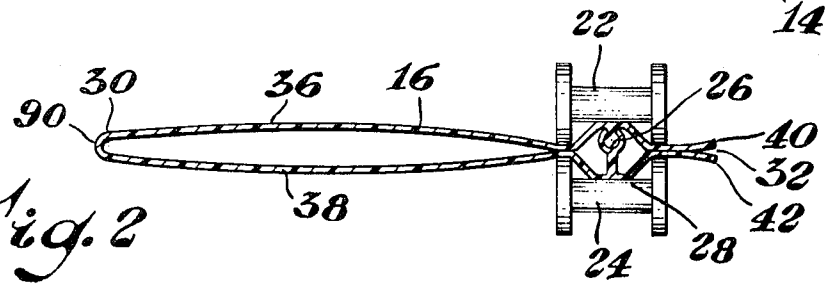


Fig. 2

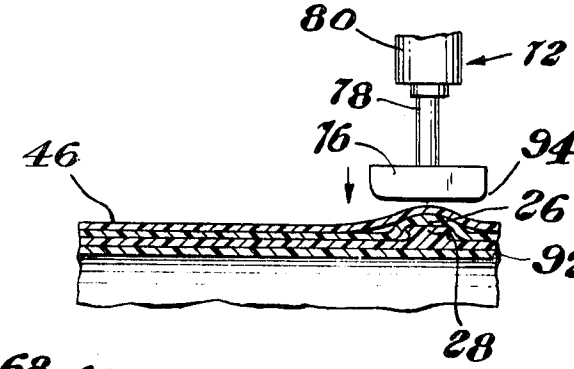


Fig. 3

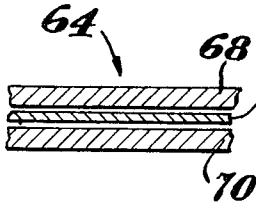


Fig. 4

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BAG-MAKING APPARATUS AND METHOD

Frequently frozen foods are packaged in plastic bags so designed as to allow the food to be prepared by immersing the bag with the food therein in boiling water. The bag material can be, for example, irradiated polyethylene or similarly tough material which will not degrade at the relatively high temperatures involved in such applications. Also, the bag seals should be such that they will resist delamination when immersed in boiling water and in the presence of the animal and vegetable fats emitted from the food product.

In such bags it is particularly desirable to include an easy opening and reclosable feature wherein, for instance, unused portions of food servings can be placed within the bag, the bag closed, and then placed in a refrigerated compartment for storage. The closure members, for example, can be of the frictionally interfitting or interlocking variety which permits the bag to be repeatedly opened and closed whereby the same bag can have a serviceable life of several "boil-in-the-bag" applications. Closures of this variety are often in the form of opposed beadlike locking members, one a female and the other a male, which fit together sufficiently tight to provide a substantially liquid and gastight closure. Examples of such are those closures set forth in U.S. Pat. Nos. 2,666,466; 2,789,609; 3,988,288; and 3,246,672.

To produce heat seals of high quality in such bags and especially those having interlocking closure members, it is frequently necessary to employ longer than normal applications of heat and pressure. Higher sealing temperatures are also frequently desired. The combination of these factors can cause difficulties not usually associated with the more conventional sealing applications. For instance, the high temperatures employed can cause the thermoplastic to adhere to the conventional polytetrafluoroethylene coated sealing elements whereby distortion and tearing of the seal can occur upon removal of the sealing element. This is aggravated by the extremely soft almost viscous state of the seal during such operations wherein at this critical point in time, any relative movement between the layers comprising the seal can result in defects. Complications also can arise at the location of the opposed closure members which form irregular sealing surfaces. Thus, at points where the bag seals cross the closure members, it is especially difficult to obtain a substantially liquid and gastight seal.

Accordingly, it is an object of the present invention to provide an improved method and apparatus for forming bags from synthetic resinous thermoplastic film and sheet materials, wherein, if necessary, higher than normal temperatures and dwell times can be employed to form the bag seals, and wherein relative movement or disturbing of the seal while the same is in its heated and weakened condition is minimized.

It is a further object of the present invention to provide such apparatus and methods wherein substantially liquid and gastight seals can be formed in bags having irregular sealing surfaces as, for example, those including integrally formed closure members.

In accordance with the preferred embodiment of the present invention, the foregoing and other related objects are obtained by sandwiching opposed panels of synthetic resinous thermoplastic film or sheeting between two layers of suitable release material as, for example, glass fiber webs impregnated with polytetrafluoroethylene, applying heat and pressure with a heated sealing bar placed on one side of the sandwich, thereby raising the temperature of the panels sufficiently high to cause heat plastification and sealing or welding together of the same, applying localized pressure to the sandwich in the region the seal crosses the closure members, thereby squashing or flattening the closure members to perfect the seal at the crossing, and thereafter cooling the seal to a temperature below its highly softened state whereby the release material can be removed from each side of the sealed panels without damaging or tearing the seal formed.

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 of reference designate corresponding material and parts throughout the several views thereof in which:

FIG. 1 is a side elevational view showing in schematic form a bag making apparatus constructed according to the principles of the present invention;

FIG. 2 is a cross-sectional view of the apparatus of FIG. 1 taken along reference line 2—2 thereof and particularly showing the flattened stock material from which the bag elements are formed;

FIG. 3 is a fragmentary and enlarged cross-sectional view of the apparatus of FIG. 1 taken along reference line 3—3 thereof, and

FIG. 4 is a fragmentary and enlarged cross-sectional view of the apparatus of FIG. 1 taken along reference line 4—4 thereof.

Referring now more particularly to the drawings, there is shown a bag-making apparatus 10 embodying the principles of the method of the present invention and beneficially designed to operate on a continuous basis. Apparatus 10 includes a pair of drive rollers 12 and 14 which feed to the apparatus at a substantially constant rate of speed, a flattened stock 16 from a supply roll 18. Stock 16 comprises a synthetic resinous thermoplastic material which can be formed, for example, by extrusion of tubular material or the like, and supplied in flat form on roll 18, or can be formed from a flat web of material suitably folded in the longitudinal direction such as to provide satisfactory bag-making stock.

The flat stock is fed from drive rollers 12 and 14 to a pair of guide rollers 22 and 24 of generally H-shaped cross-sectional configuration as best shown in FIG. 2. Specifically, guide rollers 22 and 24 are employed in those instances where the stock 16 includes opposed bead-like closure members 26 and 28 integrally formed therewith, and extending longitudinally on the inner surface of the stock. Essentially the function of guide rollers 22 and 24 is to index the lateral position of the members 26 and 28 in apparatus 10 such that localized operations can be performed on the closure members, as will be explained more fully hereinafter.

In particular, locking members 26 and 28 of stock 16, can be of the frictionally interfitting or interlocking variety, wherein one of the members 28 includes a groove or female portion in which the other member 26, a land or male portion, fits into to form a closure that can be repeatedly opened and closed. Closure members of this general variety, examples of which are set forth in the above enumerated U.S. Patents, can be extruded with thermoplastic tubular material, as, for example, by the method illustrated in Canadian Pat. No. 700,470. To prepare such tubing into suitable bag-making stock, it is customary to initially flatten the tube to form two outside edge portions 30 and 32, as generally depicted in the cross section of the finished stock 16 shown in FIG. 2, and first and second panels 36 and 38 located opposite each other. Specifically, locking member 26 is disposed on the first panel 36, with locking member 28 disposed in aligned and opposed relationship thereto on the second panel 38. Beneficially, one of the two outside edge portions is preslit in the longitudinal direction, shown as edge portion 32, and the two closure members fitted together to complete the preliminary stages in forming stock 16. In particular, the two parted edges or lips 40 and 42 of edge portion 32 provide tablike means which can be separately grasped to unlock members 26 and 28 in the finished bag, thereby opening the same.

From guide rollers 22 and 24, stock 16 travels around a relatively large sealing cylinder or sealing element 44, and more specifically, is sandwiched between cylinder 44 and an endless belt or web layer 46 which travels about the cylinder 44 atop stock 16. Cylinder 44 and belt 46 are driven at a speed synchronized with the speed of rollers 12 and 14, with the cylinder 44 being rotated about its axis 48, and with the endless belt 46 being tensioned and driven about a plurality of rollers designated by the even numbered reference numerals

52 through 60. Specifically, roller 52 assisted by roller 54, wraps the endless belt 46 about a portion of the circumference of sealing cylinder 44, with the remaining rollers 56, 58 and 60 tensioning the belt and providing a closed path around which the same can travel in a continuous fashion. For sealing operations to be performed as described hereinafter, the cylinder 44 and belt 46 are normally of sufficient width to cover the lateral extent of stock 16 as it passes therebetween.

Generally, as the stock 16 travels between cylinder 44 and belt 46, a heat sealing mechanism or element 64 forms lateral seals extending across the width of stock 16 and securing together the first and second panels 36 and 38 at regularly spaced intervals thereon. Thus, stock 16, as it passes about sealing cylinder 44, is compartmented by the lateral seals into bags of uniform width whereby each separate bag is defined between a pair of the lateral seals formed by the sealing mechanism 64.

More specifically, the sealing mechanism 64 is mounted for rotation about the axis of the sealing cylinder 44 by means of a pair of support arms 66 (only one shown) located respectively at each end of the cylinder. More specifically, the sealing mechanism 64 is moveable from a rest position shown in full lines, to a higher position shown in dotted lines, with the circumferential distance covered being less than one bag width. Most simply, the rotational movement of mechanism 64 is obtained by moving the mechanism radially into engagement with cylinder 44 atop belt 46, thereby causing the mechanism to clamp against and ride up the surface of the cylinder. To this end, sealing mechanism 64 includes a heated sealing bar 62 slidingly mounted on arms 66 (by means not shown) to move radially into engagement with cylinder 44 across the lateral extent of stock 16, and a pair of clamping pads 68 and 70 disposed on each side of the heated sealing bar 62, as best shown in FIG. 4, and suitably mounted to move therewith. Thus, while the seal is forming and during the upward travel of mechanism 64, stock 16 is clamped in position by the pads 68 and 70 which firmly press on the endless belt 46 on each side of sealing bar 62, and with the heated bar 62 placed against the belt 46 to apply the heat necessary to effect a lateral seal across stock 16.

Upon reaching the uppermost position in its rotational travel as shown in its rotational travel as shown in dotted lines, the mechanism 64 is released from engagement with the cylinder 44 and is allowed to fall back by gravitational force to its rest position shown in full lines. At this point in time the lateral seals are at least partially formed by means of the heated sealing bar 62, but with the seals formed still remaining in a highly plasticized or highly soft state. Particularly, for bag stock wherein locking members are incorporated, the amount of heat supplied by sealing bar 62 will be considerable, whereby sufficient heat is applied in the region of the locking members to leave them in a highly workable, plasticized state such that they can be later squashed or flattened, as will be explained hereinafter. The remainder of the seal, that is, the portion of the seal not in the region occupied by the closure members 26 and 28 and where the stock 16 is normally of a thinner cross section, will normally be found to be in a highly tacky, liquidlike state wherein even slight strain can cause a distortion and imperfection to form. Even so, withdrawal of the heated sealing bar 62 can be smoothly accomplished since by employing belt 46, direct contact between the heated bar and the seal is not permitted. Further benefit is achieved by the support provided for the stock 16 whereby by sandwiching the same between belt 46 and cylinder 44, strain on the newly formed seal is minimized.

Assisting heated bar 62 in forming the lateral seals is a stomper mechanism 72 located above mechanism 64 and likewise mounted for rotation about cylinder 46 by means of a support arm 74. Support arm 74 pivots at one end about the axis of the cylinder 46, and at the other end mounts the stomper mechanism 72 in a working relationship with the surface of the cylinder. Specifically, stomper mechanism 72 is moveable from a rest position shown in full lines, to a somewhat higher position shown in dotted lines. More specifically, the circumferential spacing between stomper mechanism 72 and sealing mechanism 64 is maintained at one bag width whereby the stomper mechanism 72, as it rotates upwardly about cylinder 44, is aligned over the seal last formed by sealing mechanism 64. This is accomplished by means of a bracket or elongated arm 86 connecting together the two mechanisms in fixed spaced relationship with the bracket 86 fixed at one end to the support arm 74 of stomping mechanism 72, and at the other end to the adjacent one of the support arms 66 mounting sealing mechanism 64.

Specifically, the function of stomper mechanism 72 is to squash or flatten down the portion of the closure members 26 and 28 located in the region of the lateral seals. To this end, stomper mechanism 72 comprises a stomper head or means 76 aligned over the lateral position of closure members 26 and 28 on cylinder 44, as best shown in FIG. 3, and which is connected to a drive rod 78 of a conventional air cylinder 80. Drive rod 78 pushes the stomper head 76 radially downwardly into pressure engagement atop belt 46 and again the backup provided by cylinder 44, whereby localized pressure is applied to the closure members 26 and 28 in the region of the lateral seal last formed by mechanism 64. Thereafter, the stomper head 76 rides the cylinder 44 to the position shown in dotted lines, whereat the stomper mechanism 72 is disengaged and allowed to fall back with sealing mechanism 64, each going to their respective rest positions shown in full lines.

Following the squashing or flattening step, the laterally sealed stock 16 continues its travel about cylinder 44 for a sufficient time to allow the newly formed seals to solidify and strengthen.

Thereafter, belt 46 and stock 16 are directed from cylinder 44 to roller 52, whereat the belt 46 and stock 16 are separated with the belt 46 beginning its journey to cylinder 44, and with stock 16 being forwarded to between a pair of nip rollers 82 and 84, one of which, roller 82, is equipped with a cutting means or blade 88. Specifically, the circumference of roller 84 is substantially that of one bag width whereby by proper indexing and with each turn of the roller 82, stock 16 is laterally parted along and within a respective one of the lateral seals, thereby forming individual bags. Particularly for the type bag stock 16 illustrated, there is obtained a plurality of bags each closed across their two sides by the seals formed by apparatus 10, and across their respective bottoms by a fold, that being fold 90 of edge portion 30, illustrated in FIG. 2. Across the top of each bag there is located the closure members 26 and 28 which can be conveniently opened by separately grasping lips 40 and 42 and pulling the two members apart. The bags can thereafter be closed by pressure fitting the two closure members 26 and 28 back together again, with repeated opening and closing of the bag being possible to provide for repeated use of the same.

Considering now the details of the bag-making apparatus of the present invention, the sealing cylinder 44 shown in FIG. 1 is conventionally covered by a pad or layer of neoprene, silicone rubber, or similarly resilient material providing a resilient backup surface for the heat sealing and squashing operations. This is in turn covered with a layer or pad 92 of release material as, for example, a web of glass fibers coated or impregnated with polytetrafluoroethylene. The belt 46 can also comprise a glass fiber webbing impregnated with polytetrafluoroethylene to minimize sticking between the belt and the heated stock 16. Normally, a suitable thickness for such release material can be generally in the range of less than about 10 mils, thereby allowing for relatively rapid heat transfer to the stock 16 being sealed.

The sealing mechanism 64 can be like that illustrated in U.S. Pat. No. 2,670,783 wherein teachings in some detail concerning the inner workings of one such mechanism are presented. Particularly, these teachings concern obtaining lateral seals at regular and spaced intervals in suitable bag-making stock, whereby the side to side width of each bag is made uniform. With stomping mechanism 72 bracketed to

such a sealing mechanism at a circumferential distance of one bag width, the stomper mechanism is, accordingly, maintained properly indexed over the seal last formed by mechanism 64 during the upward rotational travel of both about cylinder 44.

The stomper head 76 can comprise a block cut, for example, from steel, aluminum, magnesium or like material and with the edges preferably rounded at the lower or stomping end 94 thereof as shown in FIG. 3, to avoid a possible cutting damage to the belt 46 or stock 16 by a sharp edge portion. Most beneficially, the block is substantially of equal width to the seal formed by heated bar 62, with the length dimension of the block surface somewhat greater than the width of the fitted together closure members to allow for their increased dimensions as they flatten out.

The actuating of the air cylinder 80 driving the stomper head 76 can be achieved in part by a conventional solenoid which is in turn activated by an off-on microswitch (not shown). Beneficially the solenoid is spring loaded such that after cutting the power thereto, it returns to a rest position. In such an arrangement it would be common to employ the solenoid to operate a valve controlling a compressed air line connected into the air cylinder. Specifically, the solenoid in the "on" position would open the valve allowing compressed air to enter into and operate air cylinder. Preferably, the valve would be of at least a two-way variety wherein at the "off" position, the spring loaded solenoid would close the valve thereby sealing off the compressed air line, and with the valve in the closed position forming a port through which the compressed air in the air cylinder could escape to the atmosphere. By spring loading the drive rod 78, then, in the "off" position the drive rod would pull partially back into the air cylinder thereby disengaging the stomper head 76 and the sealing cylinder 44.

More specifically, the off-on switching of the microswitch can be indexed (by suitable means not shown) with the motion of sealing mechanism 64 with the microswitch being turned "on" at the beginning of the upward rotational movement thereof, and then "off" as the sealing mechanism 64 reaches its upward position shown in dotted lines. Means for accomplishing these results are conventional with most being such as to manually turn the microswitch to its "off" and "on" positions.

Briefly then, the method of the present invention as embodied in apparatus 10 operates generally in three cycles. Specifically, the first cycle comprises a heating cycle wherein by means of sealing mechanism 64, heat is applied at regularly spaced intervals along lateral strips of stock 16 leaving the stock at these spaced locations, and especially at the region of the closure members, in a relatively highly plasticized workable or flowable state. After completion of the heating cycle, the cooling cycle begins and extends in time from the disengagement of sealing mechanism 64, as shown by its position in dotted lines, to the time at which the stock 16 is stripped from cylinder 44, and together with belt 46 directed to roller 52. Specifically, the time duration of the cooling cycle is sufficient to allow adequate cooling of the lateral seals such that the same will not be distorted and damaged by removal of the release material on each side thereof, that being belt 46 and pad 92 of cylinder 44. During the cooling cycle and generally immediately after application of heat by sealing mechanism 64, the squashing cycle occurs. In any event, the squashing cycle occurs at a point in time when the closure members 26 and 28 are in a heated workable or flowable state whereby the same can be flattened a sufficient amount such as to obtain a substantially liquid and gastight seal in the closure region.

As a specific example of the operation of the above described apparatus and method, stock 16 formed of low density polyethylene (0.921 grams/cc.) and having a panel thickness of 2 mils and a combined closure thickness of 75 mils, is formed into bags by employing a sealing bar pressure and temperature settings of about 15 p.s.i., and about 420° F., respectively, and at a dwell time or heating duration of about 4 seconds, and with the stomper head 76 operated at a pressure of about 120 to about 130 p.s.i. A suitable time duration for the localized pressure applied by the stomper head 76 is from about 3½ to about 4 seconds. Polyethylene bags formed of these thicknesses and closure specifications are suited for packaging sandwiches and the like whereby the seal is such as to maintain and protect the product in a fresh condition for extended periods of time.

As yet another example, suitable bags for "boil-in-the-bag" applications are formed as described above with the stock 16 comprising, for instance, irradiated polyethylene having a panel thickness of about 2.8 and 3 mils and a combined thickness for the fitted together closure members of about 95 mils and with the density of the polyethylene being, for example, 0.921 grams/cc. The irradiation dosage of the polyethylene can be at approximately 8 megarads and is desired to prevent stress cracking of the film in such applications. Suitable seals for such stock can be obtained by heating the bar to a temperature of 625° F. and maintaining the bar in engagement with the belt for a dwell time of about 8 seconds and at a pressure of approximately 15 p.s.i. Preferably a relatively wide seal of approximately one-fourth inch is made which, when divided to form separate bags, measures a ⅛-inch seal at each side of the bags. The closure members can be flattened at the seal region by employing a stomper head pressure of about 120 to 130 p.s.i. and for a time duration of about 7.5 to about 8 seconds. Bags formed at the above settings were tested by filling the same with a mixture of 300 mils of water and 10 mils of cooking oil, and then immersing the closed bags in boiling water for one hour. Upon removal of the bags from the boiling water, the seals at the sides of the bags were examined and found satisfactory and without noticeable delamination.

In both of the above examples, suitable results are obtained with the stomping head engaging and flattening the closure members at a point in time of from about 1 to about 2 seconds following termination of the heating cycle.

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. A method of intermittently sealing together continuous panels of synthetic resinous thermoplastic material wherein the panels are placed in face to face generally contiguous arrangement, said method comprising the steps of:

a. continuously feeding said panels in superposed relationship between continuous opposed supporting layers of material, said layers intimately engaging said panels from opposite sides,

b. moving said layers continuously forward as a unit, whereby said panels are carried forward between said layers, c, while said layers are intimately engaging said panels and continuously moving forward, applying heat externally by engaging a heat-applying element against a relatively narrow strip of one of said layers to raise said panels to a temperature sufficient to cause them to adhere and seal together along said strip, said strip extending in a direction generally transverse to the direction of movement of the layers,

d. disengaging said heat-applying element while maintaining said panels in supported relationship between said moving layers, and thereafter

e. carrying said layers forward as said panels cool in intimate supported relationship therebetween, and to a sufficient degree so that said layers can be removed from said panels without objectionably disturbing the material comprising the sealed strip area, and then

f. removing said layers of material from said sealed together panels.

2. The method of claim 1 wherein at least one of said panels includes a thickened profile located in said sealed strip area, said heat applying step comprising applying sufficient heat to

heat plastify the material comprising the portion of said profile in the region of said strip, and including the additional step of applying pressure externally to one of said layers to locally flatten the heat plasticized portion of said profile, said pressure being sufficient to obtain a substantially airtight adherence between said panels in the area of said strip comprising the profile.

3. The method of claim 2 wherein said heat applying step comprises applying said heat substantially uniformly across the entire area comprising said strip.

4. The method of claim 1 wherein said supporting layers comprise release material.

5. Apparatus for sealing together continuous panels of synthetic resinous material placed in face to face contiguous relationship, said apparatus comprising a first continuous layer of release material, a second continuous layer of release material disposed in superposed relationship with said first layer of material, means to continuously move said first and second layers of material forward as a unit, a first region where said layers are continuously brought together, a second region where said layers are continuously separated from each other, said second region being located downwardly of said first region with respect to the direction and travel of said layers, said layers at said first region being adapted to continuously receive said panels therebetween and carry said panels forward to said second region, first and second sealing elements disposed opposite each other with said layers being disposed between the sealing elements, means to move said sealing elements at a rate uniform with the movement of said layers and at least partially over the distance between said first and second regions, means to reversibly move at least one of said sealing elements generally transversely with respect to the direction of movement of said layers so that said sealing elements can be moved together and apart engaging a strip of said layers therebetween in the closed position, and means to transmit heat through at least one of said sealing elements in the closed position to cause said panels to adhere to each other along said strip.

6. The apparatus of claim 5 including means to disengage said sealing elements at a vicinity remote from said second region said apparatus including a cooling zone located between said second region and the vicinity said sealing elements disengage, whereby said panels can cool while being firmly supported between said first and second layers.

7. The apparatus of claim 6 wherein at least once of said panels includes a thickened profile, said heating means being sufficient to heat plastify the portion of said profile located in the region of said strip, said apparatus including means to locally flatten said profile in the area thereof contiguous with said strip.

8. The apparatus of claim 7 wherein said flattening means operates in said cooling zone, said apparatus including means to move said flattening means at a rate uniform with said layers while a flattening means is applying pressure locally to said profile.

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