May 7, 1968 R. H. AYRES ETAL 3,381,448

BAG CLOSING AND SEALING MACHINE FOR STEPPED END BAGS

Filed Aug. 20, 1965 3 Sheets-Sheet 1

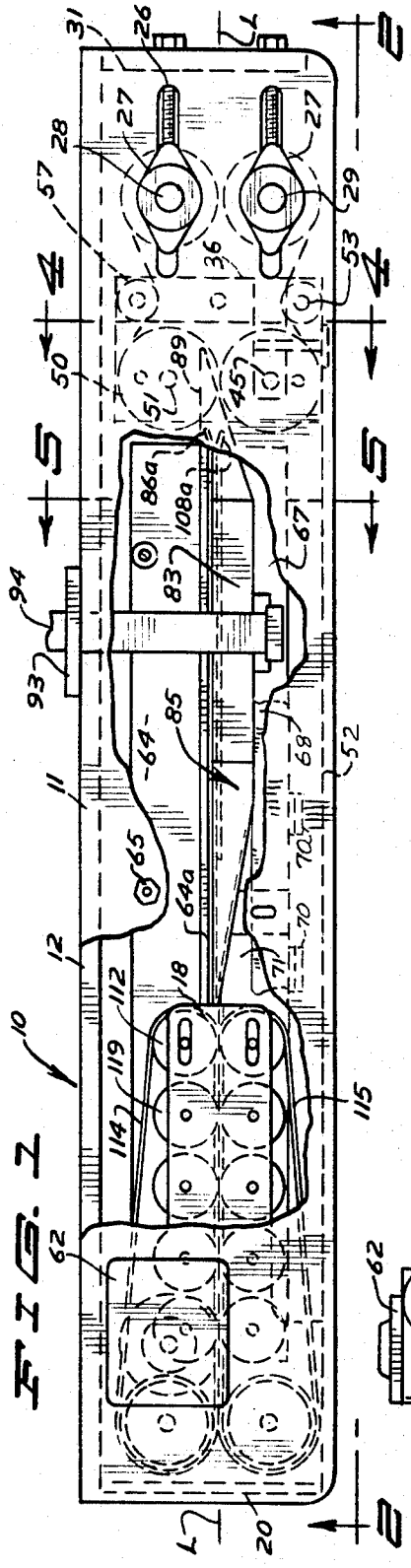


FIG. 1

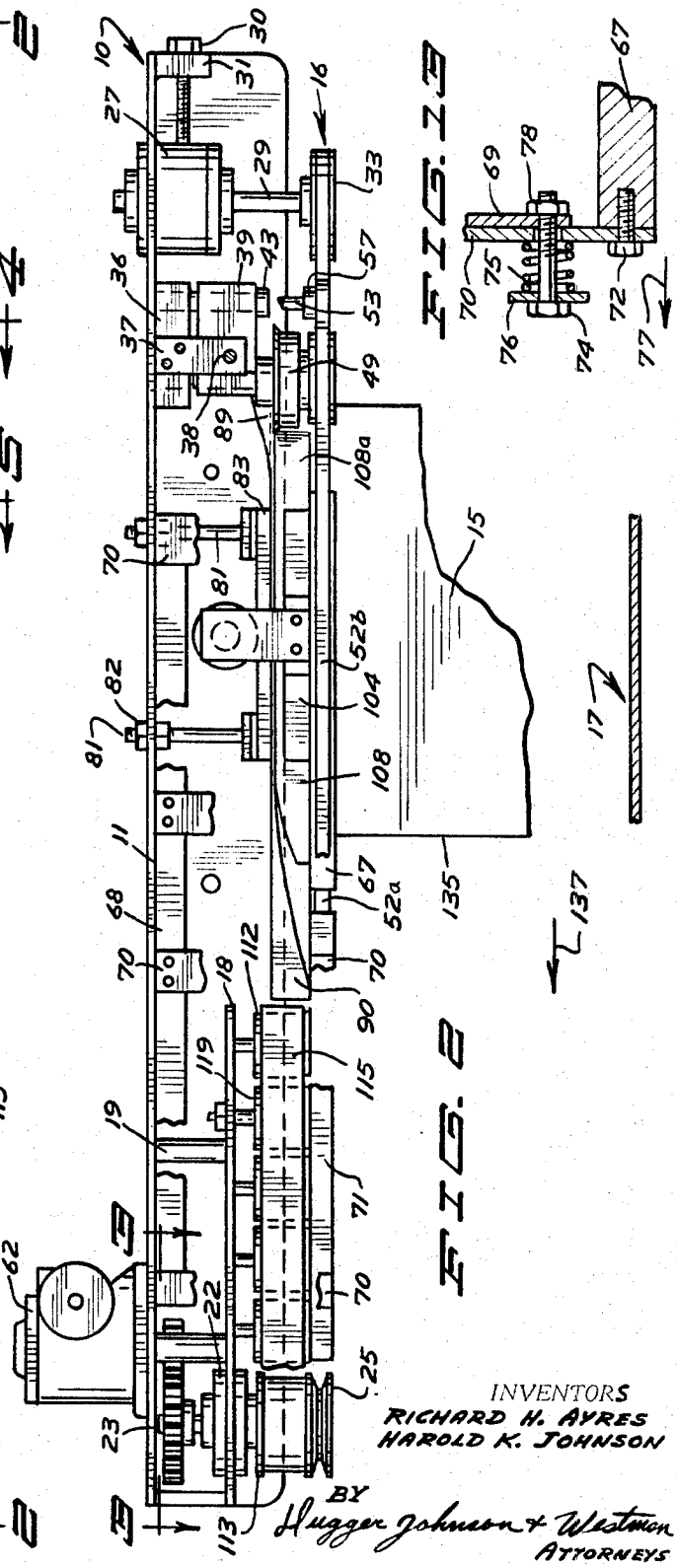


FIG. 2

FIG. 3

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FIG. 3

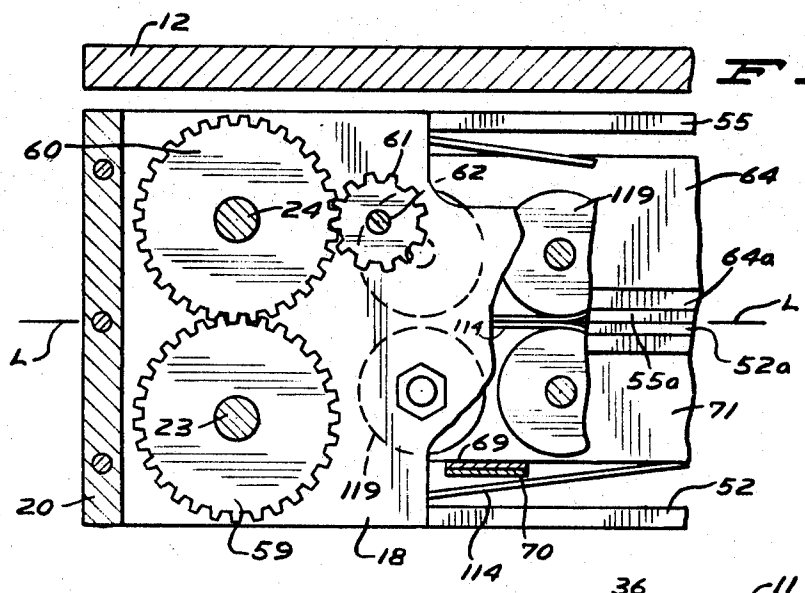


FIG. 4

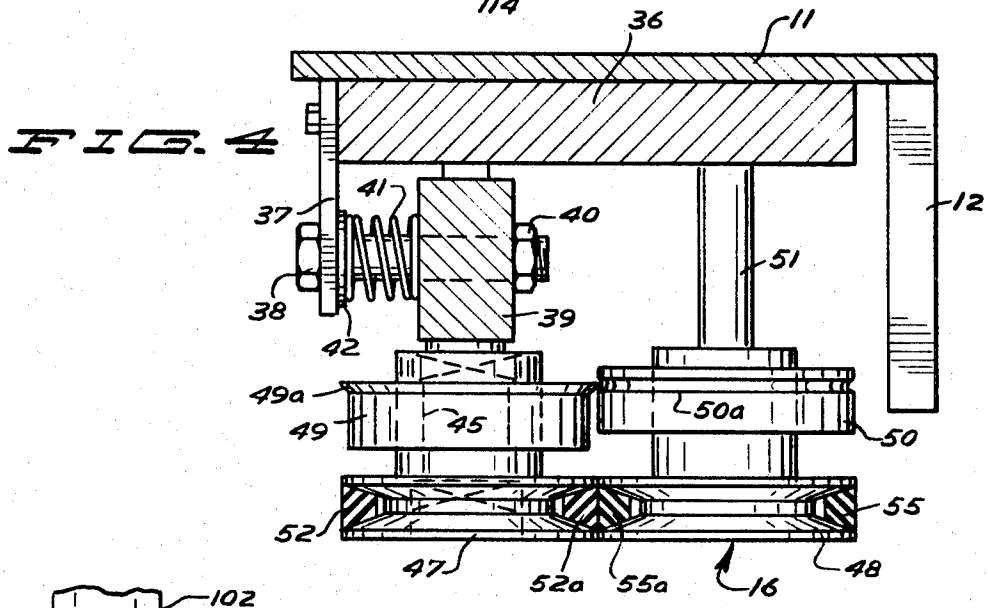
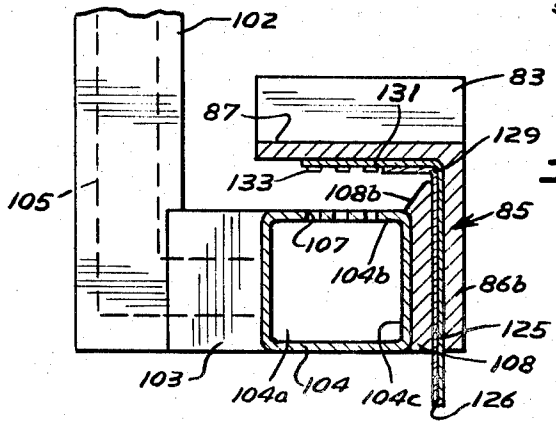


FIG. 5



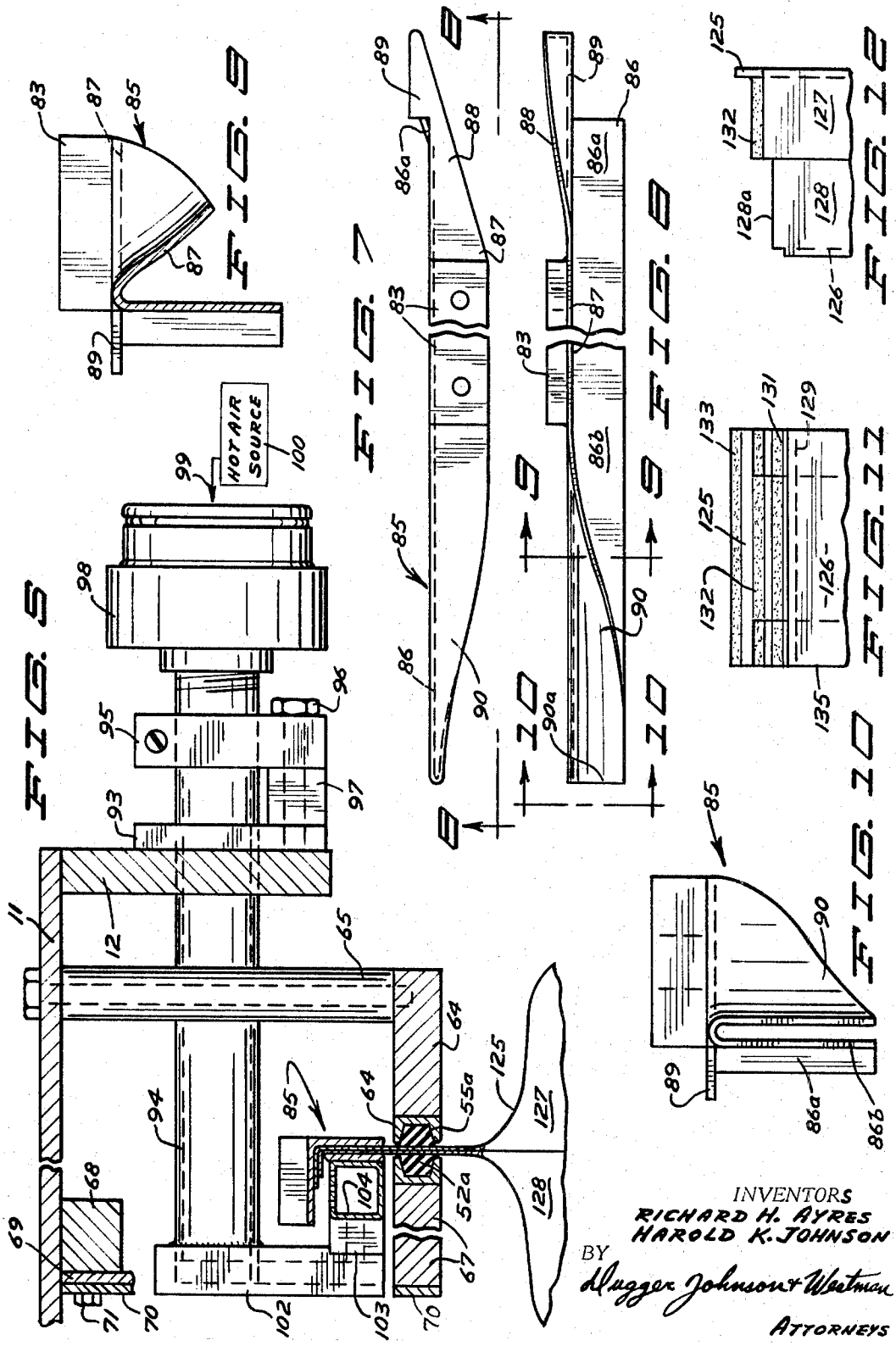
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BAG CLOSING AND SEALING MACHINE FOR STEPPED END BAGS

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ABSTRACT OF THE DISCLOSURE

Bag closing and sealing apparatus having conveyor belt inner runs that convey the stepped end portion of a bag successively through creasing rolls, a folder blade to successively fold said bar portion from a vertical to a horizontal condition and thence downwardly to abut against the adjacent portion of the bag and compression rolls. The folder blade central portion extends transverse over a nozzle that discharges hot air to activate the adhesive on the horizontally extending bag portion. A shoe is mounted on the nozzle to cooperate with the folder blade in folding said bag portion. Spring steel plates are resiliently urged to position the belt guide plates mounted thereon to retain the inner runs adjacent one another.

This invention relates to new and novel apparatus for folding and sealing the stepped end portion of a stepped end bag to form a sealed bag top closure. More particularly this invention relates to new and novel apparatus for activating the "hot melt" adhesive on the bag top portion of a stepped end bag, folding over the bag top portion having the activated adhesive, and compressing the resulting bag closure to form a tight seal.

Powdered and granular material in 25 to 100 lb. lots are presently being packaged and sold in multi-wall bags called "stepped end" bags. This type of bag is also sold under the trademark "Pinch Bottom" bag, this trademark being owned by St. Regis Paper Company. Such bags on their open inner wall have a "step" on which there is preapplied a "hot melt" adhesive. The apparatus of this invention is provided for forming a sealed bag top closure on the aforementioned type bags.

One of the objects of this invention is to provide new and novel apparatus for partially folding the stepped end portion of a bag and activating the hot melt adhesive on the stepped end. Another object of the invention is to provide new and novel apparatus utilizing hot air for activating the hot melt adhesive on the partially folded end portion of a stepped end bag. A further object of this invention is to provide new and novel apparatus for partially folding the stepped end portion of a bag as it is being conveyed, next activate the hot melt adhesive on said partially folded end portion, and thence completing the fold and compressing the completed fold to obtain a tightly sealed bag top closure.

Other and further objects are those inherent in the invention herein illustrated, described and claimed, and will become apparent as the description proceeds.

To the accomplishment of the aforegoing and related ends, this invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description setting forth in detail, certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

The invention is illustrated in the drawings in which the same numerals refer to corresponding parts and in which:

FIGURE 1 is a plan view of the apparatus of this invention, portions of the top plate being broken away to more clearly illustrate structure therebeneath;

FIGURE 2 is a side view generally taken along the line and in the direction of the arrows 2—2 of FIGURE 1, portions of the conveyor belt and the conveyor belt guide structure being broken away;

FIGURE 3 is an enlarged, horizontal fragmentary cross-sectional view generally taken along the line and in the direction of arrows 3—3 of FIGURE 2 to illustrate part of the drive structure, portions of FIGURE 3 being broken away to more clearly illustrate structure at a lower elevation;

FIGURE 4 is a further enlarged, transverse cross sectional view, said view being generally taken along the line and in the direction of arrows 4—4 of FIGURE 1 to show the creasing rollers and the mounting thereof;

FIGURE 5 is an enlarged transverse cross sectional view generally taken along the line and in the direction of the arrows 5—5 of FIGURE 1 to show the structure for partially folding the stepped end portion of the bag and applying hot air to melt the adhesive on the stepped end portion;

FIGURE 6 is a still further enlarged, fragmentary cross sectional view of part of the structure illustrated in FIGURE 5 to more clearly show the hot air nozzle applying hot air to a stepped end portion of a bag that is held in a partially folded condition by the folder blade, said view being taken through the bag longitudinally between the folded gusset panels at one end and the gusset panels at the other end;

FIGURE 7 is a plan view of the folder blade, a central portion of the folder blade being broken away;

FIGURE 8 is a side elevational view generally taken along the line and in the direction of the arrows 8—8 of FIGURE 7 to further illustrate the construction of the folder blade;

FIGURE 9 is a transverse cross sectional view generally taken along the line and in the direction of the arrows 9—9 of FIGURE 8;

FIGURE 10 is a transverse, rear end view of the folder blade, said view being generally taken along the line and in the direction of the arrows 10—10 of FIGURE 8;

FIGURE 11 is a fragmentary plan view of the upper end portion of a gusseted stepped end bag in flat folded condition to show the pattern of hot melt adhesive on the bag top portion of said bags;

FIGURE 12 is a fragmentary end view of the bag of FIGURE 11 other than the bag has been opened; and

FIGURE 13 is a fragmentary transverse cross sectional view showing the resilient mounting of one of the belt guides.

Referring now in particular to FIGURES 1, 2 and 4, the apparatus of this invention, generally designated 10, includes a frame having a horizontal, elongated top mounting plate 11 and a vertical, longitudinally elongated mounting plate 12 that has its upper edge dependingly secured to one longitudinal edge of the mounting plate 11. Plate 12 is bolted or otherwise appropriately secured to a stand (not shown) whereby plates 11 and 12 are located a substantial distance above the floor. The stand mounts plates 11 and 12 in overhanging relationship to a conveyor assembly, generally designated 17, that extends the longitudinal length of the machine 10 to support the bottom of a filled bag 15 as it is conveyed through the apparatus of this invention.

Directly below the rearward end portion of plate 11, there is provided a horizontal compression roller mounting plate 18, plate 18 being somewhat T-shaped in plan view. A plurality of spacer members 19 are dependingly secured to plate 11 and dependingly mount compression roller mounting plate 18 in horizontal spaced relationship to plate 11. A spacer plate 20 has opposite ends respectively secured to plate 18 and the rear transverse edge of plate 11.

The apparatus of this invention also includes a conveyor assembly, generally designated **16**, for supportingly holding the bag top side walls closely adjacent one another at a proper elevation relative to conveyor **17** while the bag top is moved through the apparatus **10**. For purposes of facilitating the further description of the apparatus **10**, the vertical plane of conveyance of the bag top of the bag **15** through the apparatus **10** by conveyor assembly **16** will be referred to as the central longitudinal axis L—L of the machine, a location in a horizontal direction at right angles to said plane as transversely outwardly (right or left), the end of the machine where the bag enters as the forward end, and the end where the bag exits from the machine as the rear or back end. Thus as the bag top moves through the apparatus **10**, it is considered as being moved in a rearwardly direction.

The conveyor assembly **16** includes a pair of mounts **22** that are attached to a rear portion of plate **18** in transverse spaced relationship, each mount respectively journalling a shaft **23**, **24** for rotation about a vertical axis with each shaft extending above and below plate **18**. A pulley sheave **25** is keyed to the lower end of each of the shafts **23**, **24**. The forward end portion of the plate **11** has a pair of longitudinally elongated transverse slots **26**, a shaft **28** being extended through the right hand slot and journaled for rotation by a mount **27**. A shaft **29** is likewise extended through the left hand slot and is journaled for rotation by a mount **27**. Each of the mounts **27** mount the respective shaft **28**, **29** on plate **12** for adjustable longitudinal movement, there being provided a bolt **30** threaded into each mount and rotatably extended through a bar **31** that is dependingly attached to the plate **12**. Each of the shafts **28**, **29** has a pulley sheave **33** keyed thereto.

Rearwardly of shafts **28**, **29**, a mounting block **36** is bolted to the under side of plate **11**. A vertical bar **37** has its upper end attached to the block **36** and has an apertured lower end through which the smooth central portion of a bolt **38** is extended. Bolt **38** slidably extends through a central portion of a pulley mount **39** and has a nut **40** threaded thereon. A washer **42** is provided on bolt **38** to abut against bar **37**, a coil spring **41** being provided on bolt **38** to have one end abut against the washer and the opposite end to abut against the adjacent vertical surface of mount **39** in order to resiliently retain mount **39** in abutting relationship with nut **40**.

A shoulder screw **43** has its threaded end portion threaded into block **36** to depend therefrom. The smooth intermediate portion of the shoulder screw extends through an aperture in the forward end of mount **39** and has a head abutting against the lower surface of said mount in order to permit mount **39** pivoting about a vertical axis, but at the same time prevent the mount moving in a vertical direction. Thus, screw **43** prevents vertical movement of mount **39** relative to plate **11**, while due to sufficient play provided by the aperture in bar **37** through which bolt **38** is extended, mount **39** can pivot a limited amount about the vertical axis of screw **43** toward plate **37**.

A vertical stud shaft **45** has its upper end secured in block **39** rearwardly of bolt **38**, the stud shaft extending adjacent to, but out of engagement with block **36**. A left hand creasing roller drive pulley **47** is rotatably mounted on the lower end of shaft **45**, while a right hand creasing roller drive pulley **48** is rotatably mounted on the lower end of a vertical shaft **51**. The upper end of shaft **51** is secured in block **36**. Each of the pulleys **47**, **48** has an upwardly extending annular flange to which there is respectively keyed a left creasing roller **49** and a right creasing roller **50**. As may be noted from FIGURE 4, roller **50** has an annular groove **50***a*, while roller **49** has an upper annular creasing flange **49***a* that normally extends into groove **50***a*.

A belt **52** having a generally straight length inner run **52***a* is extended around the pulley sheave **33** on shaft **29** and thence has its inner run extend rearwardly in abutting engagement with pulley sheave **47** and thence rearwardly

to the pulley sheave **25** on shaft **23**. Belt **52** then extends around sheave **25** and has an outer run **52***b* that extends forwardly into abutting engagement with pulley **47** and thence back to the pulley sheave on shaft **29**. A shaft **53** is dependingly secured to block **36** and rotatably mounts an idler pulley **57** in position to bear against the outer run of belt **52** intermediate pulley **47** and the left front pulley sheave **33** such that the outer run of the belt bears against a substantial angular portion of pulley **47** to drive pulley **47**.

A second belt **55** having a generally straight length inner run **55***a* is extended around the right front pulley sheave on shaft **28** and has its inner run extending rearwardly to pass in abutting engagement with pulley **48**. Belt **55** then extends rearwardly to pass around the pulley sheave **25** on shaft **24**, thence forwardly to pass in abutting engagement with pulley **48** and next back to the pulley sheave on shaft **28**. A second shaft **53** mounts an idler pulley **57** in position to bear against the outer run of belt **55** intermediate the right sheave **33** and pulley **48** such that the outer run of belt **55** bears against a substantial angular portion of pulley **48** to drive pulley **48**. Shafts **53** are dependingly mounted by block **36**.

In order to drive the belts such that the inner runs **52***a*, **55***a* move in the same direction at the same rate, a gear **59** is keyed to the upper end of shaft **23** in driven relationship to a gear **60** keyed to the upper end of shaft **24** (see FIGURE 3). Since gear **59** is driven by gear **60**, gear **59** rotates about the axis of shaft **23** in a direction opposite the direction of rotation of gear **60** about the axis of shaft **24**. In order to drive the gear **60**, a gear **61** is keyed to the lower end of the motor shaft **62***a*, gear **61** being in driving relationship to gear **60**. A motor **62** is mounted on the rearward portion of plate **11** and has its motor shaft **62***a* extended downwardly through an appropriate aperture in plate **11**.

In order to hold the length of the belt inner run **55***a* that extends between pulley **45** and the pulley sheave on shaft **24** adjacent run **52***a*, there is provided an elongated belt guide **64** that has a portion **64***a* with a groove along one vertical edge into which inner run **55***a* extends (see FIGURE 5). A plurality of longitudinally spaced, vertically elongated mounting members **65** support the belt guide **64** from plate **11** and at the same time retain the guide at a substantially lower elevation than plates **11** and **18**. A second belt guide **67** having a groove into which a length of inner run **52***a* extends is provided for resiliently retaining the portion of run **52***a* that is transversely adjacent the forward end portion of guide **64** closely adjacent the corresponding portion of run **55***a*. A second belt guide **71** of the same construction as guide **67** is provided longitudinally rearwardly of guide **67** and transversely opposite the rear portion of guide **64**.

In order to mount guides **67**, **71**, a longitudinally elongated bar **68** is dependingly secured to plate **11** adjacent its right longitudinal edge. A plurality of longitudinally spaced, vertically extending bars **69** and a corresponding number of spring steel plates **70** are provided. Bolts **71** are extended through the upper end portions of bars **69** and plates **70**; and threaded into bar **68** such that there is a bar **69** intermediate each plate **70** and the adjacent portion of bar **68**. The lower ends of plates **70** are bolted at **72** to the adjacent portions of guides **67**, **71** respectively. As may be noted from FIGURE 13, the bars **69** are of a length that their lower end portions are located a slight distance above guide **67**. A bolt **74** is extended through apertures in the lower end portions of each set of bars **69** and plates **70**, and has a nut threaded thereon to abut against bar **69**. A coil spring **75** is provided on bolt **74** to have one end abut against plate **70** and an opposite end to abut against a washer **76** on bolt **74**, the washer abutting against the head end of the bolt. As a result of providing spring **75** and sufficient play in the aperture of plate **70** through which bolt **74** is extended; the lower end portion of plate **70** is resiliently retained in engage-

ment with bar 69, but at the same time can move a limited amount in the direction of the arrow 77 away from the lower end portion of bar 69. As a result, when the top portion of the bag is being conveyed by the inner run of belts 52*a*, 55*a* transversely between guides 64 and 67 or 71, the respective guides 67, 71 can move a limited amount in the direction of the arrow 77 against the action of spring 75.

A pair of longitudinally spaced bolts 81 have their upper end portions extended through appropriate apertures vertically above the belt inner runs and rearwardly of the creasing rollers, there being provided upper and lower adjustments nuts 82 on the bolts for retaining said bolts in a vertically adjusted position relative plate 11. The lower ends of bolts 81 mount a longitudinally elongated blade mount 83 which in turn dependingly mounts the folder blade, generally designated 85. The folder blade is integrally formed and has a vertical, longitudinally extending backing plate 86 that is located above inner run 55*a*.

Blade 85 also includes a longitudinally central, planar horizontal portion 87 having a right edge joined to a backing plate 86, and a front edge integrally joined to a front portion 88 which initiates the folding of a bag top being conveyed adjacent thereto by belts 52, 55. As may be noted from FIGURE 8, the left edge of portion 88 is gently curved upwardly to extend longitudinally forwardly of planar portion 87 while the right edge extends horizontally forwardly and in part is joined to the planar portion 86*b* of the backing plate and in part extends forwardly thereof. In a transverse vertical plane, portion 88 at the forward edge curves upwardly and transversely to the left, the amount of curvature being progressively less the more closely adjacent planar portion 87 that the transverse cross section is taken.

The folder blade also has a horizontal flange 89 that extends transversely to the left of backing plate portion 86*b*, and is in part joined to the curved portion 86*a* of the backing plate and also to the adjacent edge of portion 88. In this connection, it is to be noted that in horizontal cross section, portion 86*a* in a rearward direction curves transversely inwardly toward the plane of portion 86*b* whereby portions 86*a* and flange 89 bend the leading edge of a bag to the left side of portion 86*b* in the event that the upper edge portion of the bag top is inclined slightly toward the right. Further, as may be in part noted from FIGURES 1 and 2, flange 89 in part closely overlays the top surface of creasing roll 50 while the forward edge of portion 86 is closely adjacent a vertical surface portion of said creasing roll.

The folder blade also includes a rear portion 90 that has a front edge integrally joined to central portion 87 and a longitudinal edge integrally joined to the upper edge of backing plate portion 86*b*. Portion 90 is smoothly curved such as shown in FIGURES 8 and 10 to, in a longitudinal rearward direction from central portion 87, curve downwardly such that at the rearward end of the folder blade there is provided a U-shaped web portion and a leg portion extending generally parallel to the transverse adjacent portion of the backing plate and transversely spaced therefrom by a distance substantially the same as the thickness of the folded bag top closure formed by apparatus 10.

Referring in particular to FIGURES 1, 2, 5 and 6, the hot air assembly includes a heater mount 93 attached to mounting plate 12 and a transversely elongated tube 94 that extends through appropriate apertures in plate 12 and mount 93, and transversely outwardly on either side thereof. A heater clamp 95 is clamped on tube 94, bolt 96 being extended through clamp 95 and a spacer 97 intermediate clamp 95 and mount 93 to be threaded into mount 93. Adapter 98 is connected to one end of tube 94 and to line 99 to conduct hot air under pressure from a conventional hot air source 100 to the tube 94. The opposite end of tube 94 extends transversely across the folder blade in a vertical spaced relationship thereto, and mounts a downwardly extending tubular member 102. The lower end of tubular member 102 mounts a transverse tubular member 103 which in turn mounts the hot air nozzle member that includes a hot air nozzle 104. Members 102, 103 have a fluid passageway 105 for conducting fluid from the aforementioned opposite end of tubular member 94 to the plenum chamber 104*a* of nozzle 104.

The nozzle 104 is rectangular in transverse cross section and is elongated in the direction of movement of the bag through apparatus 10. The nozzle is mounted to underly nearly the entire longitudinal length of the central portion 87 of the folder blade. Further, the nozzle has a vertical side wall 104*c* and a planar top wall 104*b* that has a plurality of discharge apertures 107 that open to the plenum chamber 104*a* to permit discharge of air under pressure upwardly toward the central portion 87 of the folder blade. In this connection, there are provided longitudinally spaced apertures 107 along substantially the entire length of the top wall 104*b*.

The nozzle member also includes a longitudinally elongated shoe 108 attached to vertical sidewall 104*c*, shoe 108 having a vertical surface extending parallel to backing plate portion 86*b* from the front end thereof to a location underlying the rear portion 90 such as shown in FIGURE 2. Further, the shoe has a front end portion 108*a* that is curved to diverge outwardly from portion 86*a* to in conjunction therewith form a throat for directing the leading edge 135 of a bag into the space between the adjacent planar surfaces of the shoe and the backing plate. Further, the shoe has an incline surface 108*b* that is inclined upwardly from adjacent the juncture of nozzle walls 104*b*, 104*c* toward the juncture of central portion 87 and backing plate portion 86*b*.

Just rearwardly of the folder blade there is provided a compression roller assembly that includes a right hand compression roll 112 and a left hand compression roll 112, said rolls being mounted in transverse spaced relationship to rotatably depend from plate 18. On each of the shafts 23, 24 there is keyed a driven compression roll 113. A belt 114 is extended around the left hand compression roll 112 and the left roll 113 to have an inner run vertically above the inner run 52*a*. Likewise the right hand rolls 112, 113 mount a belt 115 to have its inner run vertically above belt inner run 55*a*. As may be noted from FIGURE 2, the lower horizontal edges of belts 114, 115 are approximately the same elevation as the lower edge of the backing plate 86 and only a slightly distance vertically above the upper edges of belts 52, 55. Two transverse rows of idler compression rollers 119 are dependingly mounted on plate 18 in position to resiliently retain the adjacent surfaces of the inner runs of belts 114, 115 closely adjacent one another (each of the rollers 119 having at least an annular surface portion made of resilient material). As may be noted from FIGURE 2, belts 114, 115 vertically extend from about the same elevation as the lower edge of plate 86 to a substantially higher elevation than portion 87.

Before proceeding with the description of the operation of the apparatus of this invention, the upper end portion of the stepped end bag 15 will be briefly described with reference to FIGURES 11 and 12. Bag 15 includes a first side wall 125, a second side wall 126 and a pair of gussets each having a gusset panel 127 and a gusset panel 128. Each gusset panel 128 has one edge joined to the contiguous edge of the side wall 126 and an opposite edge joined to the contiguous edge of the gusset panel 127. Each gusset panel 127 has one edge joined to the contiguous edge of the side wall 125. Each set of gusset panels 127, 128 forms an end wall of the bag.

Assuming that the bag 115 has been filled with product and the upper end portion of the bag has been folded such that the outer surface of the upper end portion of each gusset panel 127 abuts against the adjacent portion of gusset panel 128 and extends vertically above the

product, the peripheral horizontal edge of side wall **126** is located at a substantially lower elevation than the corresponding edge of side wall **125**. Each of the panels **128** has a horizontal edge **128***a* located at a higher elevation than the bag top edge of wall **126**, but at a lower elevation than the corresponding bag top end of panel **127**. Further, the bag top edge of panel **127** is at a lower elevation than the bag top edge of wall **125**. The bag is initially formed with a plurality of hot melt adhesive strips, for example three strips, **131**, **132** and **133**. As may be noted from FIGURE 11, the strip **131** extends across the inner surface of panels **128** and the portion of side wall **125** intermediate said panels in a folded condition, strip **131** being above the top edge of the side wall **126**. A second strip of adhesive **132** is provided to extend across the outer surfaces of panels **127** that extends above panels **128** and the surface portion of side wall **125** that is intermediate panels **127** in a bag top folded condition. A third strip of adhesive **133** is provided across the top edge portion of side wall **125** at an elevation above the top edges of panels **127**.

Using the apparatus of this invention, a stepped end bag **15** is filled with product and the top portion of bag is folded so that the upper portions of the bag gussets and the side walls extend in a vertical condition upwardly above the product but with the side wall **126** closely adjacent side wall **125**. With the thus filled bag on the conveyor **17**, the bag is conveyed such that the leading edge **135** is moved into the entry nip of belts **52**, **55** whereby the belts conveyingly engage the side walls **125**, **126** at a substantial distance below the top edge of wall **126** but above the level of product in the bag. At this time inner run **55***a* abuts against the upper portion of side wall **125** while inner run **52***a* abuts against the upper portion side wall **126** whereby the inner runs of the belts **52**, **55** supportingly hold side walls **125**, **126** in abutting relationship to each other or to the adjacent gusset panel, and the upper portions of the respective set of panels **127**, **128** in surface abutting relationship. The bag is thus conveyed in the direction of the arrow **137** to have the leading edge portion enter the entry nip between creasing rolls **49**, **50**, which as the bag top portions move between rolls **49**, **50**, creases the bag top along a crease line (also referred to as a fold line) **129**. As may be noted from FIGURE 11, the crease line is at a lower elevation than the top edge of side wall **126**. Due to the shape of the creasing roll flange **49***a* and a groove **50***a*, the portion of the bag top above crease line **129** is bent to incline upwardly and transversely toward the left. As the creased portion of the bag top leaves the exit nip of the creasing rollers, it is longitudinally moved to a position to abut against forward portion **88** which in part overlays creasing roller **48** and is inclined from above creasing roller **48** to extend upwardly and transversely to the left above belt inner runs **52***a*, **55***a* to progressively fold the creased portion toward a general horizontal condition as the bag is further advanced in the direction of the arrow **137**. Slight additional movement of the leading edge portion of the bag beyond the creasing roller exit nip moves the leading edge portion into the throat formed by folder blade portion **86***a* and shoe portion **108***a*. The shoe has a horizontal top edge at substantially the same elevation as that of the crease line **129** formed by the creasing rollers; and accordingly, the folding shoe folds the bag top portion about a general axis formed by the shoe top edge. That is as the bag top passes beneath central portion **87**, substantially the portion of the bag top shown above crease line **129** in FIGURE 11 is folded to a generally horizontal condition as shown in FIGURE 6.

Still further movement of the bag brings the bag folded edge portion into underlying relationship with the central portion **87** and into overhanging relationship to the nozzle **104**. As the folded portion of the bag top is moved over nozzle **104**, hot air is discharged through apertures **107** to impinge upon the folded portion and the adhesive to activate the adhesive, and to retain the horizontally folded portion adjacent central portion **87**. The adhesive is sufficiently activated at the time the bag longitudinally advances rearwardly of the nozzle, and as leading edge portion of the bag is advanced to the rearward end portion of shoe **108**, rear plate portion **90** begins to further fold the bag top about crease line **129** such that as the bag top leaves the rear end of the folder blade, the adhesive strips **131**, **132** and **133** have been pressed into engagement with the side wall **126** at a location below crease line **129**. Shortly after the leading edge portion of the bag leaves the trailing edge **90***a* of the folder blade, the leading edge portion enters the entry nip between belts **114**, **115** to pass between the compression rolls. The compression rolls hold inner runs of belts **114**, **115** in sufficiently tight relationship that the dependingly folded portion of the bag top having the adhesive strips thereon is firmly pressed against side wall **126** at a location below crease line **129** to form a tightly sealed bag top closure. By the time the bag top leaves the exit nip between belts **114**, **115** the adhesive has set sufficiently to retain the bag top in a folded, sealed condition.

To be mentioned is that during the time the machine is operating, hot air is continuously applied through tube **95** and discharged through nozzle apertures **107** to impinge against the adjacent surface of blade portion **87** such that portion **87** is heated between each bag passing therebeneath. The heat retained by plate **87** assists in activating the "hot melt" adhesive of the oncoming bag. Also to be mentioned is that the particular pattern of hot air discharged from nozzle **104** coincides with the pattern of "hot melt" adhesive on the bag top.

Although the apparatus **10** has been described with reference to forming a folded, sealed bag top closure on a gusseted type bag, it can be used to form such a closure on a non gusseted bag having a first side wall **126** and a second side wall with contiguous bottom and side edges joined to one another and the top edge of the first side wall below the top edge of the second side wall. With an upright non gusseted bag, the adhesive strips would extend across the portion of the second side wall that extends above the first side wall.

Also, the apparatus **10** likewise can be used to form a bottom closure on an empty gusseted or non gusseted bag in a manner similar to that previously described, i.e. with the open bottom stepped end being above the inner runs **52***a*, **55***a*. If a closure is to be formed on an empty stepped end bag, a conveyor assembly need not be used since belts **52**, **55** supportingly convey an empty bag through apparatus **10**.

Many widely apparently different embodiments of the invention may be made without departing from the spirit and scope thereof, and it is to be understood that we do not limit ourselves to the specific embodiments herein.

What we claim is:

1. In a bag top sealing machine for a stepped end bag having hot melt adhesive on its upper end portion, a longitudinally extending frame, means mounted on the frame for supportingly holding the bag upper end portion in an upright flat folded condition below said adhesive and conveying said upper end portion in a longitudinally rearward direction, longitudinally extending hot air nozzle means mounted on the frame adjacent the conveyor means for discharging hot air under pressure in an upward direction, said nozzle means including a nozzle member having an upwardly opening discharge opening, means mounted on the frame for successively folding said stepped end portion to extend transversely over said nozzle means to have hot air discharged against said adhesive to activate the adhesive as the bag is conveyed and then further fold said bag end portion to bring the activated adhesive into abutting engagement with an adjacent portion of the bag below the stepped end portion to form a sealed bag closure, said folding

means including a folder blade portion extending over said nozzle member and forwardly thereof and a longitudinally elongated backing plate joined to the folder blade portion, said nozzle means including a longitudinally elongated shoe underlying said folder blade portion and extending adjacent said backing plate, said shoe having a backing surface adjacent and shaped from the backing plate and a top folding edge, and means for driving the conveyor means to convey the bag in a longitudinally rearward direction.

2. In apparatus for forming a bag closure on a bag having opposite side wall portions in a flattened condition, one side wall portion having a free horizontal edge substantially spaced from the corresponding free edge of the other side wall portion, one of the side wall portions having a strip of hot melt adhesive intermediate said free edges, a longitudinally extending frame, conveyor means mounted on the frame for conveying the side wall portions in a rearward direction and supportingly retaining said side wall portions in a flattened condition at positions adjacent and spaced from said edges, a hot air nozzle member mounted on the frame adjacent the conveyor means for discharging hot air under pressure, said nozzle member having a discharge opening for discharging hot air in a direction outwardly of said conveyor means, folder blade means mounted on the frame for successively folding said side wall portions to in part extend transversely across said nozzle member to have hot air discharged against said adhesive strip to activate the adhesive as the bag is conveyed and then further fold said side wall portions to bring the activated adhesive into abutting engagement with the side wall portion other than the one which has the adhesive strip thereon, shoe means on the frame extending transversely intermediate the nozzle member and the folder blade means and spaced from the folder blade means for cooperating with the folder blade means to fold the side wall portions to in part extend over the discharge opening, said shoe means having a backing surface adjacent the folder blade means for abutting against the side wall portions opposite the folder blade means and a folding edge intermediate the folder blade means and the conveyor means.

3. In a bag top sealing machine for a stepped end bag having hot melt adhesive on its upper end portion, a longitudinally extending frame, means mounted on the frame for supportingly holding the bag upper end portion in an upright flat folded condition below said adhesive and conveying said upper end portion in a longitudinally rearward direction, longitudinally extending hot air nozzle means mounted on the frame adjacent the conveyor means for discharging hot air under pressure in an upward direction, means mounted on the frame for successively folding said stepped end portion to extend transversely over said nozzle means to have hot air discharged against said adhesive to activate the adhesive as the bag is conveyed and then further fold said bag end portion to bring the activated adhesive into abutting engagement with an adjacent portion of the bag below the stepped end portion to form a sealed bag closure, means for driving the conveyor means to convey the bag in a longitudinally rearward direction, said conveyor means including a pair of conveyor belts each including an inner run having a central portion and means for mounting said belts on the frame in drivable relation to the conveyor drive means with the inner runs closely adjacent one another and extending beneath the folding and nozzle means, said frame including a top horizontal plate extending in overhanging relationship to the inner runs and the folding means, and belt guide means mounted on the frame for resiliently holding the central inner run portions closely adjacent one another, said belt guide means including a plurality of longitudinally spaced bars and spring steel plates dependingly secured to said top plate with a bar intermediate each plate and a belt inner run, a belt guide plate mounted on the lower end of each of said spring steel plates to abut against one of the inner runs to hold it adjacent the other inner run, and means mounted by each bar for resiliently urging each spring steel plate to a position to hold the guide plate in position to retain said one inner run closely adjacent the other inner run.

4. In a bag top sealing machine for a stepped end bag having hot melt adhesive on its upper end portion, a longitudinally extending frame, means mounted on the frame for supportingly holding the bag upper end portion in an upright flat folded condition below said adhesive and conveying said upper end portion in a longitudinally rearward direction, lonigtudinally extending hot air nozzle means mounted on the frame adjacent the conveyor means for discharging hot air under pressure in an upward direction, means mounted on the frame for successively folding said stepped end portion to extend transversely over said nozzle means to have hot air discharged against said adhesive to activate the adhesive as the bag is conveyed and then further fold said bag end portion to bring the activated adhesive into abutting engagement with an adjacent portion of the bag below the stepped end portion to form a sealed bag closure, said folding means comprising a folder blade having a longitudinally elongated backing plate, a first longitudinal forward portion joined to the backing plate and curved to fold said stepped end portion from a generally vertical condition to a generally horizontally extending condition as the bag is conveyed, a second lonigtudinally central, generally horizontal portion joined to said backing plate and extending over said nozzle means, and a third portion joined to said backing plate and to said central portion, said third portion being of a shape to progressively curve in a longitudinally rearward direction from a general horizontal condition to a condition extending generally parallel to said backing plate and spaced therefrom approximately the thickness of the bag closure to fold the activated adhesive portion into contact with said adjacent bag portion, said nozzle means including a lonigtudinally elongated nozzle member having a plenum chamber and an upwardly directed discharge opening, and a longitudinally elongated shoe mounted on the nozzle member adjacent the backing plate, to underlay said second portion and at least a substantial part of the rearward part of said first portion, said shoe having a generally vertical surface adjacent the backing plate and a horizontal top folding edge, and means for driving the conveyor means to convey the bag in a longitudinally rearward direction.

5. The apparatus of claim 4 further characterized in that there is provided creasing roller means on the frame generally forwardly of the folder blade to crease the bag as it is conveyed at about the same elevation as said horizontal edge and to initiate the folding of the stepped end portion in the same direction as it is folded by the folder blade.

6. In a bag top sealing machine for a stepped end bag having hot melt adhesive on its upper end portion, a longitudinally extending frame, means mounted on the frame for supportingly holding the bag upper end portion in an upright flat folded condition below said adhesive and conveying said upper end portion in a longitudinally rearward direction, longitudinally extending hot air nozzle means mounted on the frame adjacent the conveyor means for discharging hot air under pressure in an upward direction, means mounted on the frame for successively folding said stepped end portion to extend transversely over said nozzle means to have hot air discharged against said adhesive to activate the adhesive as the bag is conveyed and then further fold said bag end portion to bring the activated adhesive into abutting engagement with an adjacent portion of the bag below the stepped end portion to form a sealed bag closure, and means for driving the conveyor means to convey the bag in a longitudinally rearward direction, said conveyor means including a pair of conveyor belts each having an inner run,

each inner run having a central portion, means for mounting said belts on the frame in drivable relation to the conveyor drive means with the inner runs closely adjacent one another and extending beneath the folding and nozzle means, belt guide means mounted on the frame for resiliently holding the central inner run portions closely adjacent one another, said belt mounting means including idler pulley means mounted on the frame forwardly of said folding means, and means mounted by the idler pulley means and drivably connected thereto for creasing the stepped portion along a crease line at about the same elevation as the line of folding by the folding means, said frame includes a top horizontal plate extending in overhanging relationship to the inner runs and the folding means, and that the belt guide means includes a plurality of longitudinally spaced bars and spring steel plates dependingly secured to said top plate with a bar intermediate each plate and a belt inner run, a belt guide plate mounted on the lower end of each of spring steel plates to abut against one of the inner runs to hold it adjacent the other inner run, and means mounted by each bar for resiliently urging each spring steel plate to a position to hold the guide plate in position to retain said one inner run closely adjacent the other inner run.

7. Apparatus for forming a bag closure on a bag having opposite side wall portions in a vertical condition, one side wall portion having a free horizontal edge substantially below a corresponding free edge of the other side wall portion and a horizontal strip of hot melt adhesive on the other side wall portion inner surface at an elevation intermediate said free edges, said apparatus comprising a longitudinally extending frame, two conveyor belts each having inner runs, means for mounting the conveyor belts on the frame and retaining the inner runs adjacent one another to hold said side wall portion adjacent one another and supportingly convey said bag in a longitudinally rearward direction, the last mentioned means including means for driving said conveyor belts to move the conveyor belt inner runs in the same direction, the above mentioned inner runs in supportingly conveying a bag engaging said side walls at an elevation substantially below the one side wall horizontal edge, means mounted on the frame in driven relationship to said conveyor belts for creasing the side wall portions along a crease line at an elevation between said conveyor belts and the one side wall horizontal edge as the bag is supportingly conveyed, nozzle means mounted on the frame longitudinally rearwardly of the creasing means for discharging hot air under pressure in a generally upward direction, said nozzle means including a horizontally elongated hot air discharge member closely adjacent and above one of said inner runs, a longitudinally elongated folded blade having a central portion mounted on the frame to have said central portion transversely extend over said discharge member, said folder blade having means extending forward of said central portion and adjacent to said creasing means for folding said side walls about said crease line in a direction that the adhesive strip is transversely moved to a position to have hot air directly contact it as the bag is supportingly conveyed, and means extending rearwardly of said central portion for further folding said side wall portions about the crease line to a position that the adhesive strip abuts against said one side wall as the bag is supportingly conveyed, and means mounted on the frame longitudinally rearwardly of the last mentioned means for holding the further folded side wall portions in compression as the bag is supportingly conveyed by said inner runs, said nozzle means including a shoe mounted on the nozzle member to abut against said one side wall between the crease line and the conveyor belts for holding said one side wall portion closely adjacent the corresponding part of the other side wall portion as the bag is conveyed beneath said central portion, and said compression means including a pair of compression belts having longitudinally extending inner runs and means mounted on the frame for mounting the compression belts to have their inner runs above and closely adjacent the conveyor belt inner runs, the compression belt mounting means including means drivenly connected to the conveyor belt drive means for driving said compression belt inner runs in the same direction.

References Cited

UNITED STATES PATENTS

1,909,319	5/1933	Taylor	53—371
2,576,472	11/1951	Messmer et al.	53—371
3,248,843	5/1966	Winters et al.	53—373

FOREIGN PATENTS

1,301,269	7/1962	France.
1,136,262	9/1962	Germany.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,381,448 May 7, 1968

Richard H. Ayres et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 9, line 7, "shaped" should read -- spaced --. Column 10, lines 13, 29, and 39, "donigtudinally", each occurrence; should read -- longitudinally --. Column 12, line 5, "folded" should read -- folder --.

Signed and sealed this 13th day of January 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR
Commissioner of Patents