

[54] **METHOD AND APPARATUS FOR ADHESIVE SEALING OF PLASTIC BAGS**

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[58] Field of Search.....53/39, 46, 47, 373, 375, 371, 53/372, 378, 379; 156/517, 526, 529, 463, 465, 476, 258, 266, 267, 270, 271, 202, 203, 218

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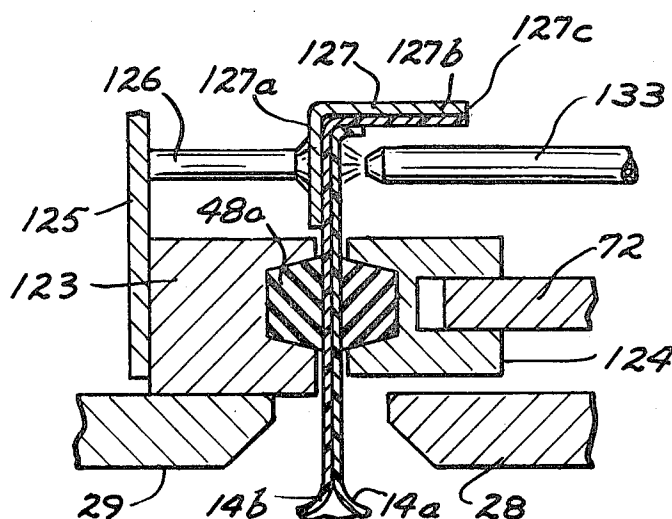
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[57] **ABSTRACT**

A machine for forming a bag closure that includes endless conveyor belts for supportingly conveying at least one bag end portion continuously rearwardly past the member set forth hereinafter, a first trimmer assembly for trimming off part of the one bag end portion that is remote from the belts, a slitter assembly for slitting part of the leading and trailing edges of the non-trimmed off one end portion to provide first and second side wall flaps and first and second side wall portions joined to the respective flap, and spreading the side wall flaps, a side flap trimmer assembly to trim off a part of the first side flap, a guide and ramp rearwardly of the first trimmer assembly to retain the second flap spaced from the side flap trimmer assembly and move the first flap to a condition to be trimmed, a second ramp and a folder assembly for relatively folding a trimmed first flap terminal part and the second flap to have the first flap underlapping part of the second flap, an applicator for applying adhesive to the folded flaps, a folder blade for folding the first flap terminal part and second flap with adhesive thereon against the first side wall portion to form a sealed closure and compression rollers for compressing the sealed closure.

20 Claims, 12 Drawing Figures



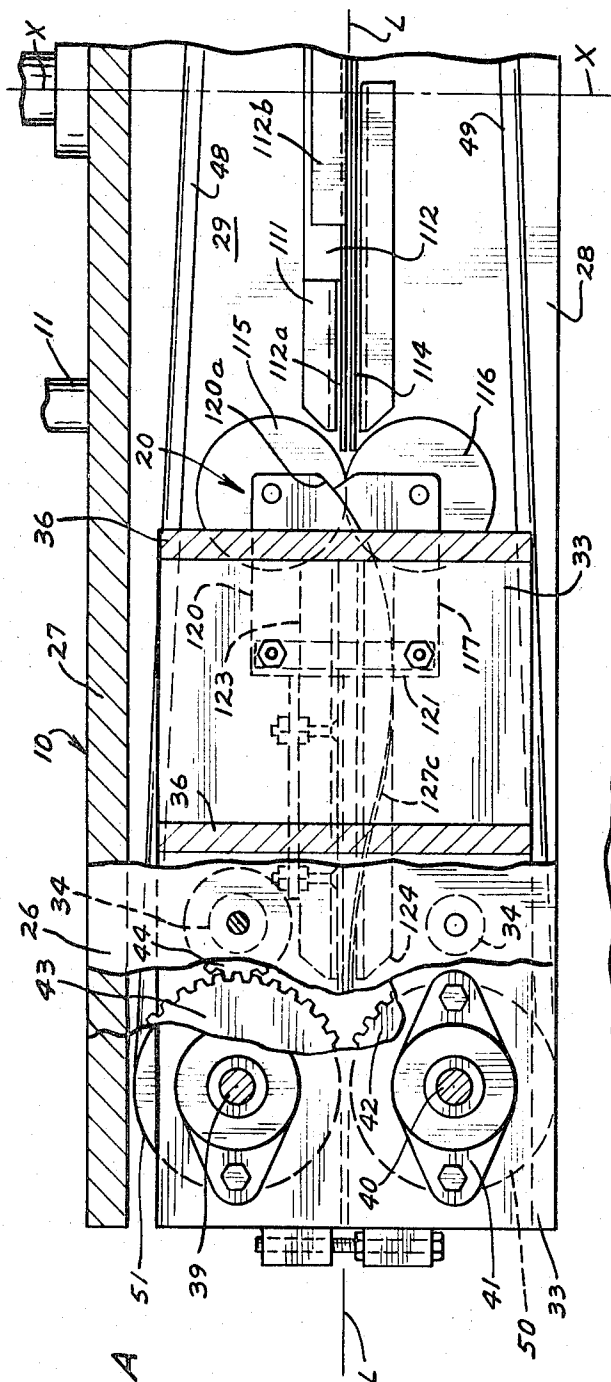


FIG. 2A

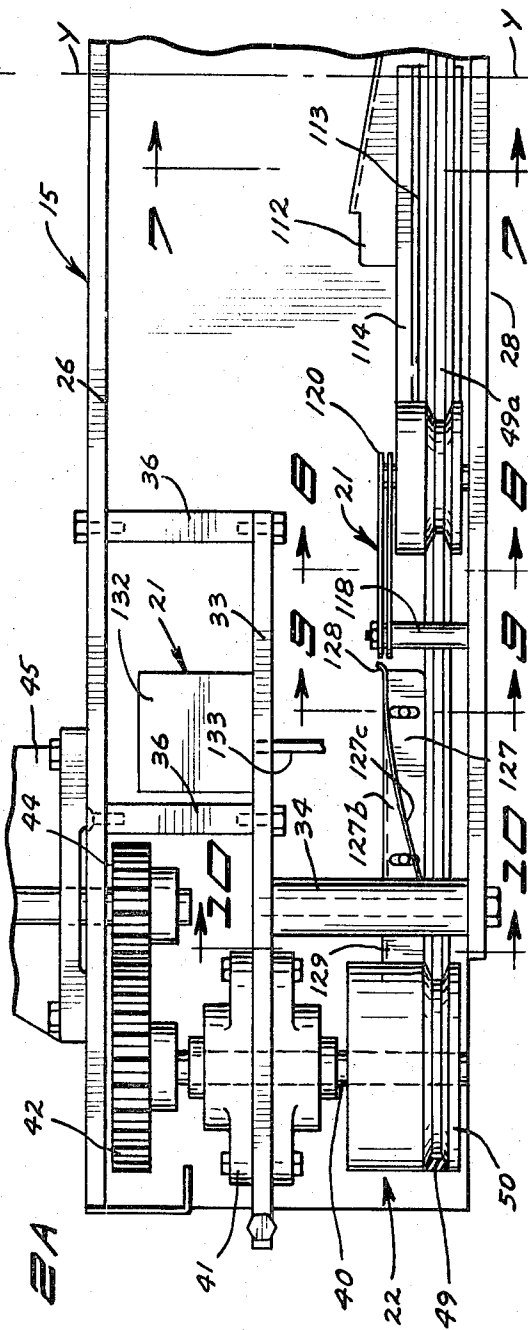


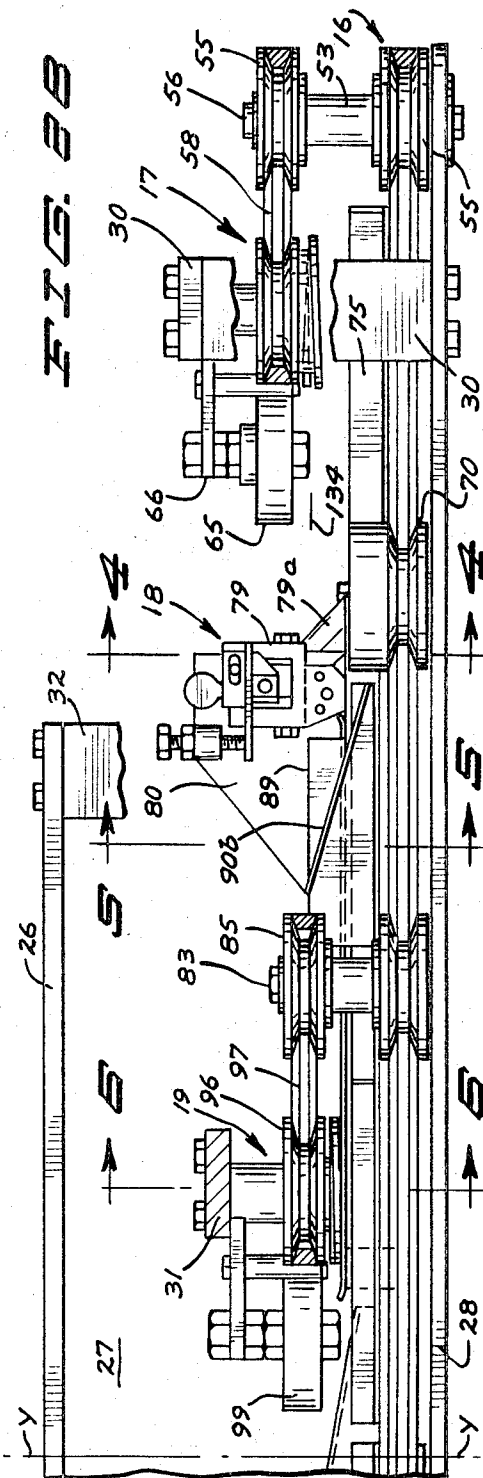
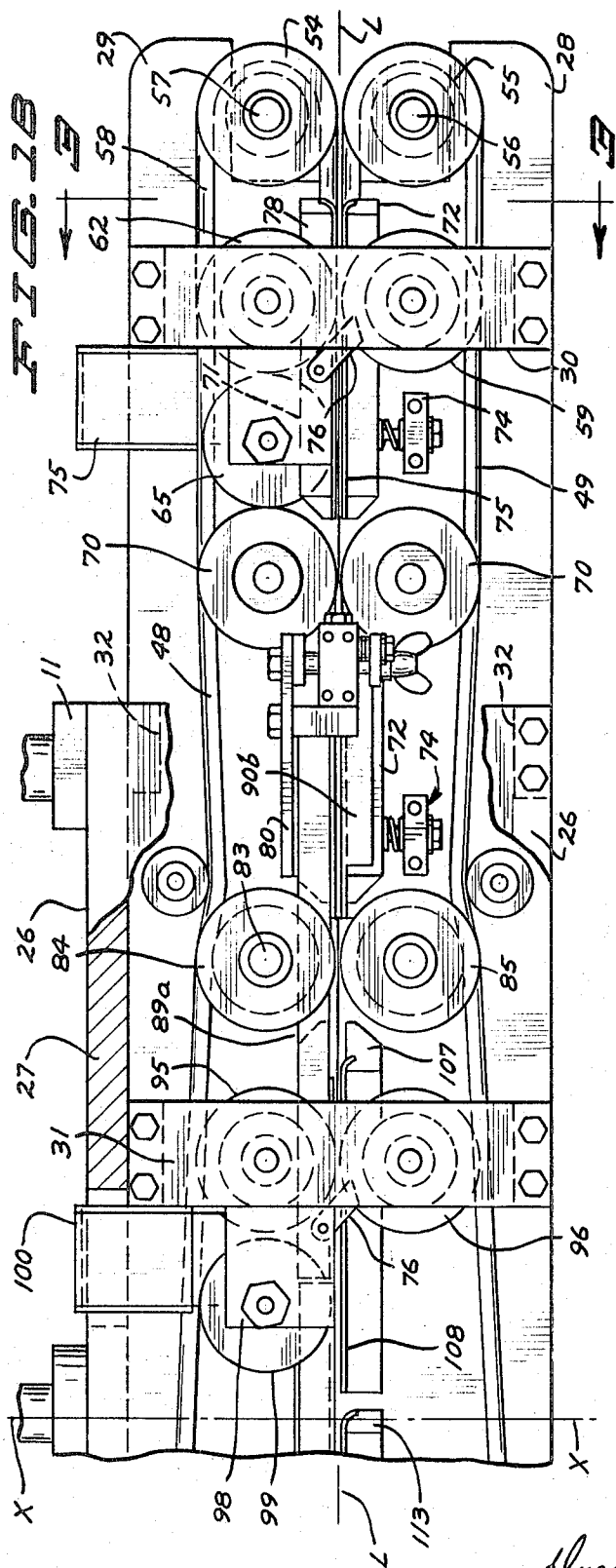
FIG. 2B

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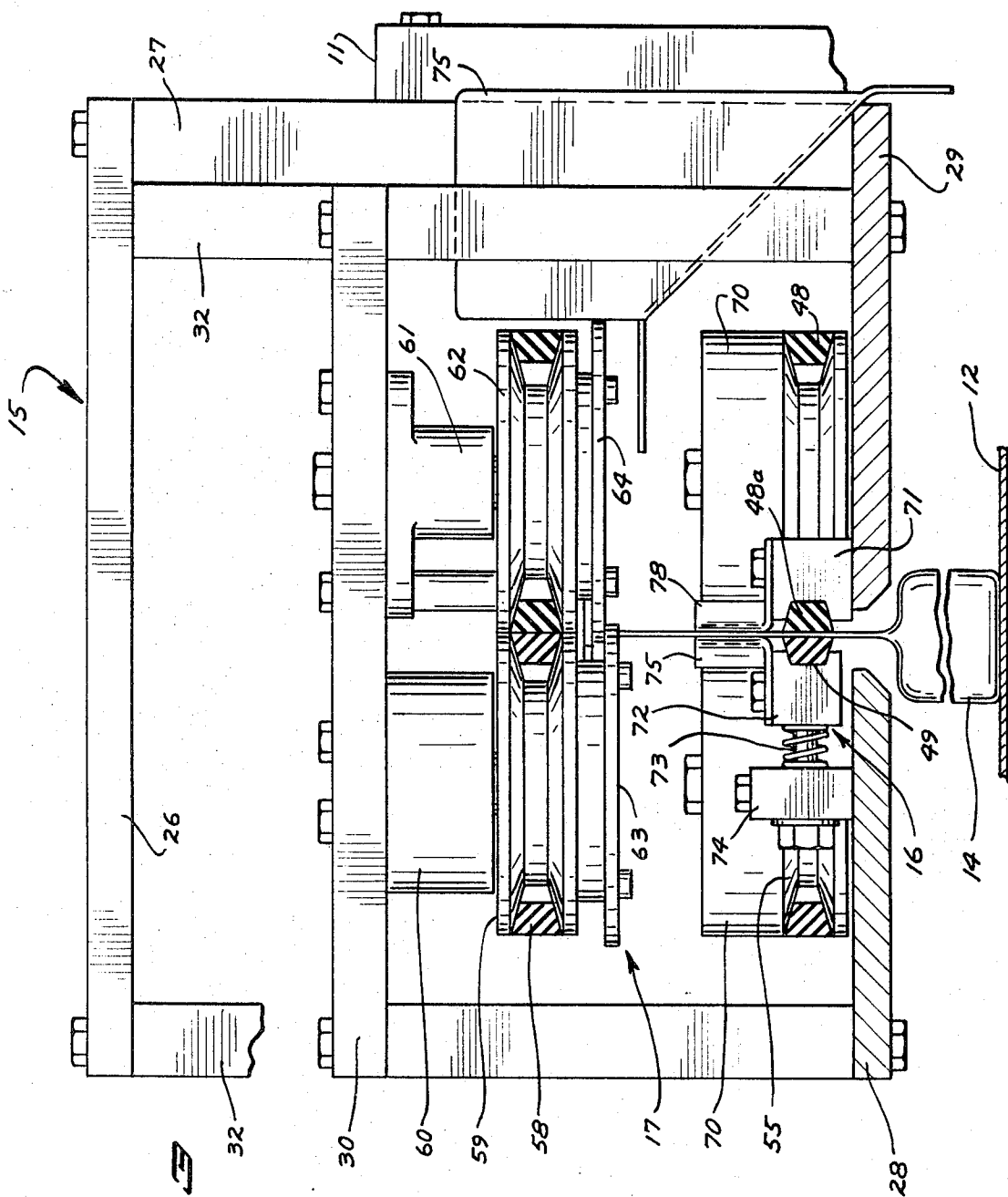
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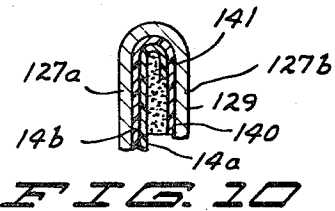
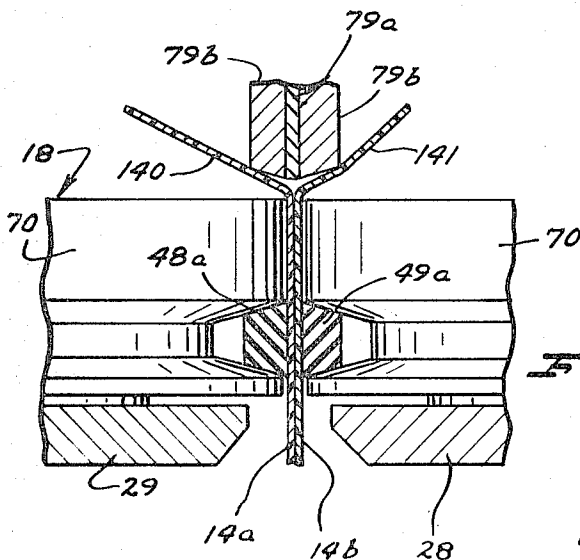
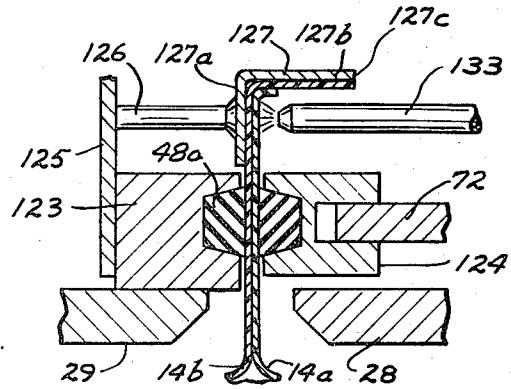
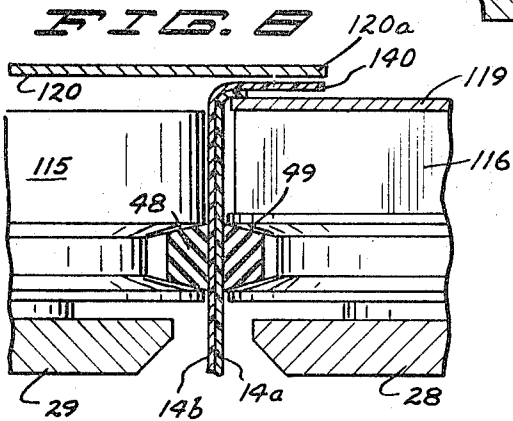
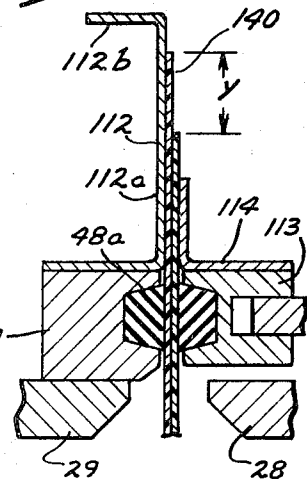
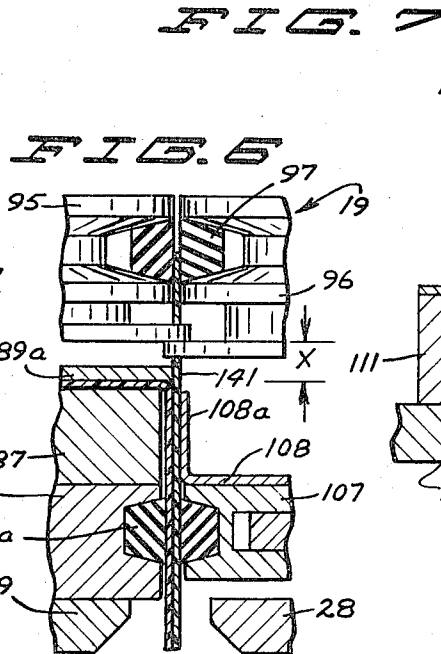
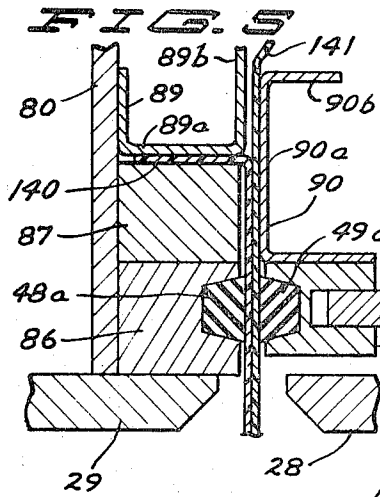
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METHOD AND APPARATUS FOR ADHESIVE SEALING OF PLASTIC BAGS

BACKGROUND OF THE INVENTION

A bag top closure forming machine to form an adhesively sealed closure.

In the prior art it is old to form a heat sealed bag closure as the bag is being conveyed, to trim off part of the bag and slit part of the bag leading and trailing edges prior to forming the heat seal closure, see for example U.S. Pat. No. 3,286,433 and No. 3,333,496. Also it is old to fold the stepped end portion of a stepped end multi-wall bag that has hot melt adhesive on the stepped end portion of the bag, including heating the adhesive to form a bag closure, for example see U.S. Pat. No. 3,381,448. However such closures do not have the strength that is desired in many cases. For example in prior art heat sealing of polyethylene, due to contamination and other factors, quite often only a superficial bond is obtained, and most seals, if loaded, will tend to peel open after a period of time. Heat sealing of polyethylene even after cleaning the surfaces that are to be sealed together, is not always successful. In order to overcome problems such as the above as well as others, this invention has been made.

SUMMARY OF THE INVENTION

A bag closure forming machine for forming a sealed closure that includes a conveyor for supportingly conveying one end portion of a bag in a rearward direction, a slitter assembly to slit the leading and trailing edges of the bag one end portion to provide a first side wall flap joined to a first side wall portion and a second side wall flap joined to a second side wall portion and spreading said flaps, a trimmer assembly to trim off part of the first flap remote from the first side wall portion, a folder assembly for folding the second flap into overlapping relationship to a terminal part of the first flap to extend therebeyond, an adhesive applicator to apply adhesive to at least the second flap, and a folder blade to fold the second flap against the first side wall with the adhesive therebetween. By practicing this invention a stronger seal is provided than a heat seal on plastic bags since the seal is in shear. Moreover the adhesive seal will grip better on a contaminated surface as the adhesive literally submerges the contamination.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A and 1B when fitted together along line X—X form a plan view of the apparatus of this invention, portions of the frame being broken away, and some of the belt guides mounts and parts of the belts not being illustrated;

FIGS. 2A and 2B when fitted together along the line Y—Y form a vertical side view of the apparatus of this invention, the outer runs of the adjacent belts, the belt guide mounts and portions of the frame not being illustrated;

FIG. 3 is an enlarged transverse cross-sectional view taken along the line and in the direction of the arrows 3—3 of FIG. 1B to in particular more fully illustrate the construction of the bag top trimmer assembly;

FIG. 4 is an enlarged, fragmentary transverse cross-sectional view generally taken along the line and in the direction of the arrows 4—4 of FIG. 2B to illustrate

part of the slitter knife assembly and adjacent structure;

FIG. 5 is an enlarged, fragmentary transverse cross-sectional view generally taken along the line and in the direction of the arrows 5—5 of FIG. 2B to illustrate the mechanism for retaining one bag side wall flap in a generally horizontal condition and folding the other flap to a vertical condition;

FIG. 6 is an enlarged, fragmentary, transverse cross-sectional view generally taken along the line and in the direction of the arrows 6—6 of FIG. 2B to more fully illustrate the side flap trimmer assembly;

FIG. 7 is a fragmentary, enlarged transverse cross-sectional view generally taken along the line and in the direction of the arrows 7—7 of FIG. 2A to illustrate the mechanism for moving the horizontal side wall flap to a generally vertical condition;

FIG. 8 is an enlarged, fragmentary, transverse cross-sectional view generally taken along the line and in the direction of the arrows 8—8 of FIG. 2A to more fully illustrate the structure for folding the trim side wall flap and the nontrimmed side wall flap to a generally horizontal condition;

FIG. 9 is an enlarged, fragmentary, transverse cross-sectional view generally taken along the line and in the direction of the arrows 9—9 of FIG. 2A to illustrate the bag top folder blade and the adhesive applying nozzle; and

FIG. 10 is an enlarged, fragmentary, transverse cross-sectional view generally taken along the line and in the direction of the arrows 10—10 of FIG. 2A showing a part of the folder blade and the bag top seal formed with this invention.

Referring now in particular to FIGS. 1A, 1B, 2A, 2B, and 3, there is illustrated the machine of this invention, generally designated 10, supported in an elevated condition by a stand 11 in overhanging relationship to a conveyor 12 that extends the longitudinal length of the machine 10 to support the bottom of a filled bag 14 as the bag is conveyed through apparatus 10. The apparatus 10 includes a longitudinally extending frame, generally designated 15; a bag top conveyor assembly, generally designated 16 for supporting the bag top side walls closely adjacent one another at the proper elevation above the conveyor 12 as the bag top is moved through the machine; a bag top trimming assembly 17 on the forward part of the frame to trim off the excess bag top before a bag top seal is formed; a bag top opening and slitting assembly generally designated 18, to slit the upper parts of the bag top leading and trailing edge portions and spreading the side wall flaps formed; a side wall flap trimmer assembly generally designated 19; a folding assembly, generally designated 20, for folding the trimmed side wall flap and the other side wall flap preparatory to applying adhesive; an adhesive applying assembly, generally designated 21; and a compression roller assembly, generally designated 22.

The frame 15 includes a longitudinally elongated horizontal top plate 26 which has one edge secured to a longitudinally elongated vertical support plate 27 which in turn is mounted by the stand 11. The lower edge of plate 27 is attached to one edge portion of the longitudinally elongated mounting plate 29. A second mounting plate 28 is mounted in a parallel relationship to plate 29 as described hereinafter.

At the rear end portion of the machine there is an intermediate plate 33 mounted in overhanging relationship to plates 28, 29 by a pair of transverse vertical plates 36; the rear end portions of plates 28 and 29 being retained in vertical spaced relationship to plate 33 through bolts and spacer members 34. Intermediate bracket 31 and a front bracket 30 each have one leg attached to the outer edge portions of plate 29 and an opposite leg attached to the outer edge portion of the plate 28; while a bar 32 extends between and is secured to plates 26, 29 at the outer edge portions thereof and a second bar 32 is secured to the outer edge portions of the plate 26 and 28. By the above mentioned brackets 30, 31, and bars 32, plates 28, 29 are mounted in the same plane in transverse spaced relationship and have parallel inner edges spaced on either side of longitudinal axis L—L to form a throat that extends the length of said plates.

The bag top conveyor assembly includes mounts 41 that mount a pair of vertically extending shafts 39, 40 in transverse relationship to extend through plate 33, the mounts being secured to plate 33 at the rear end portion thereof. Keyed to the upper end of shaft 39 is a sprocket 43 that is driven by a sprocket 44 keyed to the lower end of the reducer output shaft of the motor reducer 45, the output shaft being extended through plate 26 and the motor-reducer being mounted on said plate. Sprocket 43 is in driving relationship to a sprocket 42 that is keyed to the upper end of shaft 40. On the lower ends of shafts 39, 40 there is respectively keyed a combination compression roller-drive pulley sheave 51 and 50, the sheave portions of members 50 and 51 being located at a slightly higher elevation than plates 28, 29. A belt 49 is extended around sheave 50 and a lower idler sheave 55 keyed to a spacer 53 that is mounted for rotation on a shaft on the forward end portion of plate 28. Likewise, a belt 48 is extended around sheave 51 and a lower sheave 54 keyed to a spacer 53 that in turn is mounted for rotation by a shaft 57 on the forward end portion of plate 29, belts 49, 48 being respectively driven by sheaves 50 and 51. The sheaves 50, 51, and lower sheaves 54 and 55 mount the belts such that the inner runs 48a, 49a of the belts 48, 49 are retained in abutting relationship when no bag top is therebetween. The inner runs 48a, 49a are in overhanging relationship to the gap between plates 28, 29.

An upper pulley sheave 55 is keyed to the spacer on shaft 56 at a substantially higher elevation than the lower sheave. Likewise, the spacer on vertical shaft 57 has an upper pulley sheave 54 keyed thereto at a substantially higher elevation than lower sheave 54. A belt 58 is driven by the upper sheave 55, the belt in turn driving a sheave 59 that is rotatably mounted by mount 60 which in turn is dependently secured to the web portion of the bracket 30 (see FIG. 3). A mount 61 mounted on the web of bracket 30 rotatably, dependently mounts a sheave 62 transversely adjacent sheave 59, sheave 62 being driven by a belt 58 extended therearound and around the upper sheave 54. The inner runs of belts 58 are located directly vertically above the inner runs of belts 48, 49. Cooperating rotary knife members 63, 64 are respectively dependently mounted on sheaves 59, 62 to rotate therewith, said knife members cooperating to trim off the portion of a bag that extends above the elevation of the trimming edges thereof.

On each of the plates 28, 29, rearwardly of sheaves 59, 62, there is rotatably mounted sheave-rotary guide members 70, 70 of the slitter assembly 18. Each of members 70 has a sheave portion in driven engagement with the inner runs 48a, 49a respectively and an upper cylindrical portion to abut against the adjacent side wall of a bag conveyed therepast by the belts 48 and 49. Mounted on plate 29 in a fixed position to extend longitudinally between guide 70 and lower sheave 54 is a belt guide 71 (FIG. 3) to abut against inner run portion 48a for retaining it adjacent inner run 49a. A longitudinally elongated belt guide 72, at each end portion, is mounted on one end portion of a horizontal shaft 73 by a vertical pivot member, shaft 73 being slidably extended through block 74 on plate 28 for transverse movement. A spring is provided on each shaft 73 for resiliently urging the guide 72 transversely toward the guide 71, a nut being provided on the opposite end of the shaft for limiting the movement of guide 72 in a direction toward guide 71. Mounted on guides 71, 72 are bag top guides 78, 75 respectively that have longitudinal vertical legs that are transversely spaced and vertically above the adjacent parts of inner runs 48a, 49a. The forward portions of the guides are curved to diverge forwardly to provide an entry throat.

A plate 66 is mounted by the web portion of bracket 30 to extend rearwardly thereof, a rotary guide 65 being rotatably mounted in depending relation to the plate for cooperating with sheave 62 and the portion of the belt extended therearound for directing the trimmed off portion of bag top into the chute 75. Chute 75 is secured to adjacent leg of bracket 30 for directing the trimmed off part of the bag top off the machine frame. A deflector 76 is dependably mounted from plate 66 and includes a diagonally extending portion for directing trimmed off portion of bag top leaving the exit nip of sheaves 62, 59 into the entry nip between sheave 62, 65.

The bag top slitting assembly 18 includes the bag top slitting device 79 mounted on a vertical plate 80 which in turn is mounted on plate 29, the slitting device including a knife 79a having a cutting edge inclined upwardly and rearwardly. The forward point of the cutting edge is located at a slightly higher elevation than the guide members 70 just above the exit nip of said guide members. The portions 79b that mount the knife 79a extend on either side of the knife, and rearwardly of the knife to spread the bag side wall flaps as will be more fully indicated hereinafter. Since the bag top slitting device is of the construction described in detail in U.S. Pat. No. 3,333,496 to Fox, its construction will not be set forth in greater detail herein.

Rearwardly of the assembly 18 on each of the plates 28, 29 there is mounted an upright shaft 83 of the side flap trimmer assembly 19. On the shaft 83 that is on plate 28, there is rotatably mounted an upper and lower sheave 85, that are spaced and retained in the same angular relationship by an annular spacer, the lower sheave being in driven relation to inner run 49a; while on the other shaft 83 there is likewise mounted an upper and lower sheave 84 with the lower sheave in driven relationship with inner run 48a. A fixed belt guide 86 is mounted on plate 29 to extend longitudinally between rotary guide 70 and lower sheave 84 while a transversely movable guide 77 is mounted to extend between rotary guide 70 and lower sheave 85.

Guides 86, 77, other than for length, are of the same construction as guides 71 and 72, respectively, and perform the same function. Mounted on guide 86 is a longitudinally elongated block 87 which has a top surface at substantially the same elevation as the top surfaces of the rotary guides 70 and a side surface substantially coextensive with the inner side surface of the vertical inner surface portions of guide 86. A hold down bracket 89 has a vertically extending leg secured to the mounting plate 80, a longitudinally elongated, horizontal web portion 89a spaced above the top surface of block 80 sufficiently to have a side wall flap in a horizontal condition passed therebeneath, and a second leg 89b extending upwardly from the web portion that is vertically above inner run 48a. The forward end of the web portion 89a terminates closely adjacent and rearwardly of the slitter assembly and has a slightly upwardly curved forward edge portion. The legs of bracket 89 terminate forwardly of sheave 84, however the web portions extend beneath sheave 84 and a substantial distance rearward thereof.

On belt guide 77 there is mounted a ramp bracket 90 that has a vertical leg 90a parallel to leg 89b, spaced a slight distance therefrom, and in overhanging relationship to inner run 49a. Bracket 90 has an upper longitudinally elongated, transverse leg 90b that is inclined upwardly and rearwardly, leg 90b being integrally joined to one edge of the ramp leg 90a. The ramp leg 90b at its forward end extends beneath the vertically adjacent forward part of portion 79b and terminates close to rotary guide 70 at a substantially lower elevation than the top surface of guide 70. The opposite end of the ramp leg 90b is at an elevation intermediate the top and bottom surfaces of the upper sheave 85 and a short distance forwardly thereof.

Referring to FIG. 6, the side wall flap trimmer assembly 19 also includes a first combination sheave and knife member 95 and a second combination sheave and knife member 96, members 95 and 96 being dependently, rotatably mounted from the web portion of bracket 31 with member 96 in overhanging relationship to plate 28. A belt 97 is extended around upper sheave 85 and the sheave portion of member 96 to drivingly rotate member 96 while a second belt 97 is extended around sheave 84 and the sheave portion of member 95 to drivingly rotate member 95. The knife portions of members 95, 96 cooperate for trimming off the part of the side wall flap from the side wall as will be described hereinafter. The horizontal leg 89a of the hold down bracket extends beneath member 95 and terminates beneath a roller 99. A plate 98 dependently mounts the roller 99 rearwardly adjacent member 95, roller 99 acting in cooperation with sheave 95 and the adjacent portion of belt 97 for directing the trim off portion of the side flap to the chute 100 that is mounted by and extends through an aperture in wall 27. A deflector 76 is dependently mounted by plate 98 which aids in directing the trim side wall flap portion into the entry nip of roller 99 and the sheave portion of member 95. To be mentioned is that member 96 is of the same construction as members 59, 60 while member 95 is of the same construction as members 62, 64.

Mounted on plate 29 to extend rearwardly of the lower sheave 84 is a belt guide 106 of the same construction as belt guide 86, a rearward portion of block

87 being mounted on guide 106 (see FIG. 6). Transversely opposite guide 106 is a transversely movable belt guide 107 that is of the same construction as guide 77. Mounted on guide 107 is a longitudinally elongated bracket 108 having a vertical leg 108a parallel to block 87 other than for the forward end portion which is curved transversely outwardly to facilitate the entry of the side wall flaps between bracket 108 and block 87. Bracket 108 terminates horizontally rearwardly of rotary guide 99, the top longitudinal edge of leg 108a being at about the same elevation as the top surface of block 87.

On plate 29 there is mounted a fixed belt bracket 111 that other than for length is of the same construction as fixed belt guide 106. On guide 111 there is mounted a ramp bracket 112 that has a longitudinally elongated vertical leg 112a in overhanging relationship to belt run 48a and a ramp leg 112b that extends transversely, elongated in a longitudinal direction, has a forward terminal end portion that extends beneath roller 99 to a lower elevation than knife members 95, 96, and to a lower elevation than the top surface of block 87, and a rear terminal end portion that extends to a higher elevation than the trimming edges of knife members 63, 64. On a transversely movable belt guide 113 which other than for length is of the same construction as guide 107, there is mounted a flap guide bracket 114 that has a longitudinally elongated vertical leg parallel to and spaced from the vertical leg of bracket 112. The rearward end portions of the vertical legs of bracket 112 and guide bracket 114 terminate closely adjacent the entry nip of combination rotary sheave-guide members 115, 116. The sheave guide member 115 is mounted on plate 29 while sheave guide member 116 is mounted on plate 28, the guide portions being of cylindrical shape and above the sheave portions of the respective member. The sheave portions of members 115, 116 respectively engage the inner runs of belts 48, 49 to be driven thereby.

Two spacer and bolt members 118 are mounted on plates 28, 29 respectively to extend thereabove for in turn mounting horizontal folder plates 119, 120. One member 118 is mounted rearwardly of each of the sheave members 115, 116. Plate 119, except at the forward end portion thereof, has a straight longitudinally extending inner edge in overlaying relationship to the abutting surfaces of inner runs 48a, 49b, the forward end portion of the inner edge of plate 119 being curved forwardly and transversely outwardly to facilitate the entry of the bag top to the folding plates. Plate 119 is at a slightly higher elevation than sheave and guide member 116, extends forwardly to the entry nip between members 115, 116 and has a top surface at the same elevation as the point of the knife 79a (same elevation as the lowest elevation of the slits formed in the leading and trailing edges of the bag top by the knife). Plate 120 has an inner edge that extends across the exit nip between rotary guide members 115, 116, and is curved rearwardly in the direction toward the outer edge of plate 28 to, at the rear end portion of plate 120, extend a transverse distance from vertically above the inner edge of plate 119 toward the outer edge of plate 28 that is greater than the height dimension of the side wall flaps being folded by plates 119, 120. Plate 120 is mounted at a slightly higher

elevation than plate 119 (by a dimension slightly greater than the thickness of the flaps) and in part overlaps plate 119 as is indicated in FIG. 1A. A bar member 121 is mounted by members 118 in abutting relationship with plate 120 and has a depending portion abutting against plate 119 to aid in retaining the plates in fixed positions.

Mounted on plates 29, 28 respectively are fixed guide 123 and a transversely movable guide 124, guides 123, 124, other than for length being of the same construction as guide 86, 77 (see FIG. 9). Guides 123, 124 extend longitudinally rearwardly of the exit nip of rotary guide members 115, 116 and terminate slightly forwardly of the entry nip of members 50, 51. A vertical plate 125 is mounted on the rear surface portion of guide 123. Plate 125 mounts a pair of transverse members 126 which in turn are attached to the vertical leg 127a of the longitudinally elongated folder blade 127 to support the vertical leg vertically above the inner portion of the adjacent part of the inner run 48a. The folder blade has a folder leg 127b which is joined to the upper edge of the vertical leg to extend substantially entire length thereof. The folder leg has a forward end portion that has an upwardly curved part 128 which extends to a slightly higher elevation than plate 120 and located closely adjacent to rearward transverse edge thereof. Rearwardly of part 128, leg 127b extends horizontally and then is bent to have the outer terminal edge 127c thereof extend progressively downwardly in a rearward direction transversely more closely adjacent the vertical leg 127a as indicated in FIGS. 1A and 2A. The rearward portion 129 of leg 127b, other than for top part which is curved through an arc, extends generally parallel to leg 127a and is transversely spaced therefrom by a distance equal to the folded-sealed part of the bag top as more particularly illustrated in FIG. 10. The rearward end of the folder blade terminates just slightly forwardly of the entry nip of the upper compressing roller portions of the sheave-compressing members 50, 51 and at a lower elevation than the top surfaces of members 50, 51.

The adhesive assembly 21 includes a tank 132 mounted on plate 33. An adhesive conduit 133 extends downwardly through plate 33 and thereafter inwardly to position its discharge nozzle at a location closely adjacent where the folder leg 127b begins to turn downwardly and inwardly toward the vertical leg 127a.

When practicing this invention, a bag without side gussets has at least the top portion thereof in a flat folded condition with the terminal edges defining the bag mouth being above the remainder of the bag as the bag is conveyed into the entry nip of sheaves 54, 55 such that the top terminal edges of the bag extend to a higher elevation than the lowermost parts of inner runs of belts 58. As the bag moves rearwardly, belts 48, 49 and belts 58 maintain the part of the bag top vertically between said belts in a vertical condition. As the bag top passes through the entry nip of knife members 63, 64, the part of the bag top (part of both side walls) extending to a higher elevation than the trimming edges of the knife members 63, 64 is severed from the remainder of the bag. The severed part is directed by deflector 76 into the entry nip of members 62, 65 to be discharged through chute 75.

The bag top guides 78, 75 on belt guides 71, 72, together with the limited stiffness of the bag 14, retain the part of the trimmed bag extending to a higher elevation than the guides 78, 75 in an upright position as the bag moves rearwardly of the knife members, the elevation of the trimmed terminal edges of the bag top intermediate the slitter assembly 18 and the rotary knife members 63, 64 being indicated by the elevation line 134 in FIG. 2B. As the leading edge of the trimmed bag top moves into engagement with the slitter knife 79a, the part of the leading edge extending from the elevation of the point of the knife and upwardly is slitted and the resulting side wall flaps 140, 141 from the height of the lower most part of the slit and upwardly thereof are bent outwardly by the knife and then the portions 79b mounting the plate such as described in U.S. Pat. No. 3,333,496. Further knife 79a slits the trailing edge in a corresponding manner as it moves by the knife. The resulting flaps 140, 141 are integrally joined along lower edges to side wall portions 14b, 14a respectively. The spread side wall flap 140 in moving rearwardly of portion 79b moves between block 87 and web 89a of the hold down bracket 89 to maintain said flap in a horizontal condition as it moves rearwardly of the forward curved end of web portion 89a. However, the opposite side wall flap 141, as it moves rearwardly, abuts against the top surface of the ramp portion 90b whereby flap 141 moves progressively in a vertical direction as the bag is conveyed rearwardly.

Prior to the side wall flap 141 being moved into the entry nip of the upper sheaves 84, 85, the part adjacent said sheaves is positioned in a vertical direction to have the upper terminal edge of this part at the same elevation as line 134. Upon flap 141 moving into the entry nip of the upper sheaves 84, 85, it is gripped by the inner runs of belts 97 to maintain the terminal edge of the part of the flap gripped by the belts 97 at a substantial constant spacing from the part of the bag gripped by belts 48, 49. The side wall flap 141 moves into the entry nip between sheave portions of members 95, 96 and the part thereof extending above the trimming edges of said members is trimmed from the remainder of the side wall flap. The trimmed off part of the side wall flap 141 is directed by the adjacent deflector 76 into the entry nip between members 95, 99 to be discharged through chute 100. As may be noted, at the time that side wall flap 141 is being trimmed, the transverse adjacent part of side wall flap 140 is still being maintained in a generally horizontal direction at a lower elevation than members 95, 96 and accordingly flap 140 is not trimmed. As a result, the horizontal dimension of flap 140 is substantially larger, for example about ½ inch than the corresponding dimension of the remainder of the untrimmed part of flap 141 (dimension X - FIG. 6).

As flap 141 moves rearwardly of the exit nip of knife members 95, 96, it is retained in its vertical direction by the bracket 108 and then bracket 114 while side wall flap 140 moves into engagement with the ramp leg of ramp bracket 112 to be progressively moved to a vertical direction as the bag is moved further rearwardly. Accordingly, prior to the side wall flaps moving rearwardly of the vertical leg 112a of ramp 112, both side wall flaps extend vertically upwardly as indicated in FIG. 7 where the difference in elevations of the top

lateral edges of the flaps is indicated by the dimension Y. At this location, the upper terminal edge of flap 140 is at the elevation indicated by elevation line 134 of FIG. 2B while the elevation of the upper terminal edge of the trimmed side wall flap 141 is at a slightly higher elevation than folder plate 119.

As the now vertical side wall flaps move rearwardly, the leading edge portions of said side wall flaps enter the throat of the folder plates 119, 120, and as the side wall flaps move along the inner longitudinal edge of plate 119, due to plate 120 (in a rearward direction) extending progressively further in overlaying relationship to plate 119, the flaps are folded to a generally horizontal condition in overlaying relationship to the position indicated in FIG. 8. As may be noted in FIG. 8, the trimmed side wall flap 141 underlays the flap 140. As the leading edge portions of the now horizontally side wall flaps leave folder plates 119, 120, they move under the generally horizontal part of the folder leg 127b and, through appropriate controls (not shown), actuate the adhesive assembly so that adhesive is sprayed from nozzle of conduit 133 to be applied to the outer surface of the vertically extending part of side wall 14a from the junction of flap 141 with side wall portion 14a to a slightly lower elevation than members 126. The vertical height of the strip of adhesive applied is substantially greater than the transverse horizontal dimension of flap 141 as viewed in FIG. 9 and the strip of adhesive extends from the leading edge to the trailing edge of the bag.

As the bag top is conveyed further rearwardly, due to the curvature of leg 127b, the side wall flaps are folded progressively more closely adjacent to the vertical surface of 14a that has adhesive applied thereto. As the bag top moves through part 129 of the folder blade, the flaps are compressed against the side wall 14a that flap 141 is joined to form a bag top seal. Note that flap 141 is adhered to the transversely adjacent part of side wall portion 14a while the part of flap 140 that extends to a lower elevation than flap 141 is also adhered to the transversely adjacent part of side wall 14a. Now the folded, sealed bag top is passed through the compression roller parts of members 51, 50 whereby a firm bag top seal is formed.

It is to be understood that even though the invention has been described with reference to the adhesive being sprayed on the vertical part of side wall 14a as viewed in FIG. 9, the conduit 133 may have its nozzle end turned upwardly to discharge adhesive onto substantially the entire horizontal surface of flap 141 and the lower horizontal surface of flap 140 that is not in overlapping relationship to flap 141 as viewed in FIG. 9. The transverse width of the strip of adhesive applied to flap 140 would be substantially greater than the transverse width of flap 141.

Further it is to be understood that even though the invention has been described with reference to forming a bag top closure, it also can be used to form a bottom closure on an empty bag or tubular piece of material. If the closure is to be formed on an empty tubular piece of material, the conveyor 12 need not be used since the belts 48, 49 will supportingly convey the empty bag through the machine.

What is claimed is:

1. For forming first and second bag flaps that are integrally joined to first and second side wall portions respectively, trimming off part of the first flap and adhesively adhering the second flap to the first side wall portion to form an adhesive bag closure on a tubular bag, said bag having a first side wall and a second side wall, said side walls being joined at a leading edge and a trailing edge and having first lateral terminal edges extending between the leading edge and trailing edge, a closure forming machine comprising a frame, first means on the frame for supportingly holding the bag with its side walls in abutting relationship at an elevation below and spaced from said lateral edges and conveying said bag in a rearward direction through the machine, second means mounted on the frame and extending above the conveyor means for slitting the leading and trailing edges and spreading the parts of the side walls above the first means to form first and second side wall flaps that are respectively joined to first and second side wall portions extending below the slitting means as the bag is conveyed rearwardly by the conveyor means, third means on the frame rearwardly of the second means and adjacent the conveyor means for trimming off the part of the first flap that extends more than a predetermined distance away from the first wall portion as the bag is conveyed rearwardly by the conveyor means to form a trimmed first flap having a second terminal lateral edge that is substantially closer to the first side wall portion than the second side wall flap lateral edge is to the second side wall portion, fourth means on the frame rearwardly of the third means and extending above the conveyor means for moving the trimmed first side wall flap and the second flap relative one another into abutting relationship to position the second lateral edge closely adjacent the second flap and substantially spaced from the second flap lateral edge as the bag is conveyed rearwardly by the conveyor means, fifth means for applying an adhesive strip to the surface of the bag adjacent the juncture of the first side wall portion and the first flap and on the same side of the bag as the first flap and that at least in part is located more remote from said juncture than the second lateral edge, said fifth means being mounted on the frame rearwardly of the third means and sixth means for folding the second flap into abutting relationship with the first side wall portion with the adhesive strip between the second flap and first side wall portion to adhere the second flap to the first side wall portion, said sixth means being mounted on the frame rearwardly of the fourth means and extending above the conveyor means.

2. The apparatus of claim 1 further characterized in that the second means includes knife means having a severing edge, that there is provided means on the frame intermediate the third means and the fifth means for folding the trimmed first flap and the second flap into a generally horizontal condition with the second flap in overlying relationship to the trimmed first flap, that the first means includes a pair of conveyor belts having longitudinally extending inner runs that extend beneath the trimmed first flap and the last mentioned second flap folding means, and that the trimmed first flap and the last mentioned second flap folding means includes a folder plate having a longitudinally extending folder edge above the inner runs and at a lower

elevation than the severing edge, and means cooperating with the folder plate for folding the flaps about said folding edge as the bag is conveyed therepast.

3. The apparatus of claim 1 further characterized in that the second means includes means for moving the second side wall flap toward a horizontally extending direction as the side walls move therepast, and that the third means includes seventh means extending adjacent to and a substantial distance rearwardly thereof for retaining the adjacent part of the second flap in a generally horizontally extending direction as it moves therepast, ramp eighth means on the frame rearwardly of the second means for moving the first flap to a vertically extending direction as it moves therepast, and knife means on the frame adjacent to and rearwardly of the ramp means for trimming off the part of the first flap that extends more than a predetermined distance away from the first means as the first flap moves therepast and the transversely adjacent part of the second flap is retained in a generally horizontally extending direction by the seventh means, the seventh means in part extending rearwardly of the forwardmost part of the knife means.

4. The apparatus of claim 3 further characterized in that the fourth means includes ramp ninth means on the frame extending adjacent to and rearwardly of the seventh means for moving the second flap to extend vertically as the second flap moves therepast, the ninth means being located rearwardly of the knife means.

5. The apparatus of claim 3 further characterized in that the fourth means includes tenth means extending over the first means for folding the second flap as it moves therepast to a generally horizontally extending direction extending generally transversely from that which it extends when moving past the seventh means.

6. The apparatus of claim 5 further characterized in that the knife means has a severing edge, that there is provided means for moving the second flap to extend generally vertically and retaining the flaps to extend generally vertically as the flaps move therepast and to the seventh means, and that the seventh means has a longitudinally extending folding edge at a lower elevation than the severing edge whereby the trimmed first flap is folded to extend generally horizontally underlying the second flap.

7. The apparatus of claim 6 further characterized in that the fifth means has means for spraying adhesive on the first side wall portion when the trimmed first flap extends generally horizontally and that the fourth means includes means for folding the first and second flaps thereon into engagement with the adhesive on the first side wall portion, and that the conveyor means includes a pair of conveyor belts having inner runs extending beneath the second, fourth and sixth means.

8. The apparatus of claim 6 further characterized in that the first means includes a pair of conveyor belts having transversely adjacent, longitudinally extending inner runs, that the tenth means includes a first folding plate having the above mentioned folding edge extending above the inner runs and a second folding plate above the first plate that has a rearward portion in overhanging relationship to the first plate, said second plate having a folding edge extending across the inner runs.

9. For forming first and second bag flaps that are integrally joined to first and second bag side wall portions respectively and adhesively adhering the second flap to the first side wall portion to form an adhesive type closure seam on bag material having a leading edge, a trailing edge and first and second side walls having marginal edges and being joined at the leading and trailing edges, a bag closure machine comprising a frame, first means on the frame for supportingly holding said side walls in abutting relationship at an elevation below and spaced from said marginal edges and conveying said side walls in a rearward direction, second means mounted on the frame and extending above the conveyor means for trimming off a portion of said side walls that extend more than a predetermined amount away from the conveyor means as the side walls are being conveyed rearwardly, third means mounted on the frame rearwardly of the second means and extending above the conveyor means for slitting the leading and trailing edges and for separating the side wall parts above the first means to provide first and second side wall flaps, and first and second side wall portions extending below the slitting means, fourth means for moving the first side wall flap rearwardly of the third means in a vertically extending direction and holding the second side wall flap in a spread condition at a substantially lower elevation than maximum elevation of the first flap as the side walls are conveyed rearwardly, fifth means for trimming off the portion of the first flap that extends more than a second predetermined distance away from the conveyor means as the side walls move rearwardly of the third means and the second flap is at said lower elevation, said fifth means being mounted on the frame rearwardly of the third means, sixth means for moving the side wall flaps relative one another to force the trimmed first flap into substantial abutting relationship with a corresponding part of the second flap, said sixth means being mounted on the frame rearwardly of the fifth means, means for applying adhesive to at least one of the parts of the second flap that is out of abutting relationship with the first flap, and the first side wall portion, and means mounted on the frame rearwardly of the sixth means and above the conveyor means for folding the first trimmed flap and the second flap into abutting relationship to the first side wall portion with the applied adhesive therebetween to provide a sealed bag closure.

10. In a method for forming an adhesive bag closure on a tubular bag having a first side wall and a second side wall, said side walls being joined at a leading edge and a trailing edge and having first lateral terminal edges, the steps of supportingly conveying in a rearward direction, a tubular bag at its side walls while holding together horizontal parts of said side walls below said marginal edges, slitting the upper parts of the leading and trailing edges and spreading the slit side wall parts as the bag is being conveyed rearwardly to provide first and second side wall flaps having said lateral edges and first and second side wall portions extending below the slit parts of the leading and trailing edges, after the slitting step, trimming off the part of the first flap that extends more than a predetermined distance away from the first side wall portion to provide a trimmed flap that extends away from the first side wall portion a substantially smaller distance than the

second flap extends away from the second side walls as the bag is being conveyed, after the trimming step, applying adhesive to a surface portion of the bag that is on the same side as the first flap and adjacent the juncture of the first flap and first side wall portion while the bag is being conveyed and thence folding the second flap to adhesively adhere it to the first side wall portion to form a bag closure as the bag is being conveyed.

11. The method of claim 10 further characterized in that the adhesive applying step includes applying adhesive to the first side wall portion in a strip that is of a greater vertical dimension than the distance the trimmed flap extends away from the first side wall portion, and that the folding step includes folding the trimmed first flap into abutting relationship with the first side wall portion to adhesively adhere the trimmed first flap to the first side wall portion.

12. The method of claim 10 further characterized in that, as the bag is being conveyed, the steps of moving the first flap to extend generally vertically after the slitting step and prior to the trimming step, retaining the second flap to extend generally horizontally as the first flap is being trimmed, and moving the second flap to extend generally vertically after the trimming step and prior to the folding step.

13. For forming first and second bag flaps, trimming off part of the first flap and adhesively adhering the second bag flap to a bag side wall to form a bag closure on a tubular bag, said bag having a first side wall and a second side wall, said side walls being joined at a leading edge and a trailing edge and having first lateral terminal edges extending between the leading and trailing edges, a closure forming machine comprising a longitudinally elongated frame, conveyor means mounted on the frame for supportingly holding bag side walls in abutting relationship at an elevation below and spaced from the lateral edges thereof and conveying the bag longitudinally rearwardly along a given path of travel through the machine, a bag leading and trailing edge slitter and spreader member mounted on the frame, said slitter member having a cutting edge in said path of travel that is above and spaced from the conveyor means, a bag side wall first flap trimmer assembly mounted on the frame rearwardly of the slitter member and having a cutting edge above and spaced from the conveyor means a given distance, a first flap support member mounted on the frame rearwardly of the trimmer assembly and having a first flap support surface above and extending along the conveyor means laterally on one side of the path of travel, a second flap support member mounted on the frame rearwardly of the trimmer assembly and having a second flap support portion above and extending along the conveyor means laterally on the opposite side of the path of travel from the first support member, said second flap support portion having a second flap support surface that has a front portion at a lower elevation than the trimmer assembly cutting edge and is inclined upwardly in a rearward direction, bag side wall adhesive applying means mounted on the frame rearwardly of the trimmer assembly for applying adhesive at a location spaced from the conveyor means a greater distance than the minimum distance the trimmer assembly cutting edge is spaced from the conveyor means, and second flap folding mechanism mounted on the frame and extending

above the conveyor means and rearwardly of the adhesive applying means.

14. The apparatus of claim 13 further characterized in that the flap folding mechanism includes means for folding the second flap toward the first side wall to adhesively adhere the second flap to the first side wall and that there is provided a second flap hold down member mounted on the frame, said hold down member having a second flap hold down portion extending rearwardly from adjacent the slitter member to rearwardly of the trimmer assembly cutting edge at an elevation lower than the trimmer assembly cutting edge and a first flap ramp member having a rearwardly and upwardly inclined ramp surface extending from adjacent the slitter member at an elevation lower than the slitter member cutting edge to adjacent the trimmer assembly at an elevation about the same as the trimmer assembly cutting edge, and that the adhesive applying means comprises means for applying adhesive to the first side wall.

15. For forming side wall first and second flaps, trimming off part of the first flap and adhesively adhering the second flap to the side wall having the first flap to form a bag closure on a tubular bag that includes first and second side walls joined together at a leading edge and a trailing edge and has lateral edges extending between the joined leading and trailing edges, a closure forming machine comprising a longitudinally elongated frame, a pair of driven conveyor belts having transversely adjacent, longitudinally extending inner runs for supportingly conveying the bag rearwardly through the machine, said conveyor belts being mounted on the frame, a tubular member leading and trailing edge slitter and side wall spreader assembly mounted on the frame, said slitter and spreader assembly having an upwardly extending cutting edge located above the inner runs and spaced therefrom, a side wall first flap trimmer assembly mounted on the frame rearwardly of the slitter and spreader assembly and having knife portions above the inner runs at an elevation higher than the elevation of the lowermost part of the slitter assembly cutting edge, a longitudinally elongated side wall flap folder assembly mounted on the frame rearwardly of the trimmer assembly and extending above the inner runs, said folder assembly having a front end portion and a rear end portion, and an adhesive applying assembly mounted on the frame rearwardly of the trimmer assembly for applying adhesive above the inner runs intermediate said front and rear end portions.

16. The apparatus of claim 15 further characterized in that a longitudinally elongated second flap hold down bracket is mounted on the frame and has a front end closely adjacent and rearwardly of the slitter assembly and a rear end rearwardly of the trimmer assembly knife portions, said hold down bracket having a longitudinally elongated hold down portion at a lower elevation than the trimmer assembly knife portions that extends therebeneath said trimmer assembly knife portions.

17. The apparatus of claim 16 further characterized in that said frame comprises first and second mounting plates that have adjacent, transversely spaced, longitudinal edges, one belt being mounted on the first plate and the other belt on the second plate, the belt inner

runs being adjacent the respective longitudinal edge of the plate on which the belt is mounted, that said hold down bracket is mounted on the first plate, there is provided a first flap ramp bracket that is mounted on the second plate and has a leg inclined upwardly and rearwardly, longitudinally between the slitter assembly and the trimmer assembly, said ramp leg having a front end portion at a lower elevation than the slitter assembly cutting edge and a rear portion at a higher elevation than the hold down bracket portion, said hold down bracket being slightly transversely spaced from the ramp bracket, that there is provided a trimmer assembly mounted on the frame forwardly of the slitter assembly, the last mentioned trimmer assembly having a cutting edge above the conveyor means at a higher elevation than the lowermost part of the slitter assembly cutting edge.

18. The apparatus of claim 17 further characterized in that said folder assembly includes a longitudinally elongated folder blade having a vertical leg vertically above the inner run that is adjacent the first mounting plate and a second leg having one edge joined to the vertical leg, said second leg in a longitudinally rearward direction having a horizontal portion extending transversely across the inner runs, and a terminal edge rearwardly of the second leg horizontal portion that extends progressively downwardly in a rearward direction transversely more closely adjacent the vertical leg, and that the adhesive applying assembly includes a discharge nozzle closely adjacent the leg horizontal portion for spraying adhesive toward the vertical leg.

19. For forming side wall flaps, trimming off one flap and adhesively adhering the other flap to the side wall having the flap that was trimmed to form a closure on a tubular member that includes first and second side walls joined together at a leading edge and a trailing edge and having lateral terminal edges extending between the joined leading and trailing edges, a closure forming machine comprising a longitudinally elongated frame, conveyor means mounted on the frame for supportingly holding said tubular member side walls in

abutting relationship at an elevation below and spaced from said lateral edges and conveying the tubular member longitudinally rearwardly through the machine, tubular member leading and trailing edge slitting and flap forming means mounted on the frame for slitting the leading and trailing edges of the tubular member and spreading the tubular member slitted side wall portions, said slitting and forming means having a cutting edge above and spaced a preselected distance from the conveyor means, first flap trimming means mounted on the frame rearwardly of the flap forming means for trimming off part of one side wall flap, flap supporting means mounted on the frame rearwardly of the flap trimming means and above the conveyor means for moving the side wall flaps into abutting relationship, adhesive applying means mounted on the frame rearwardly of the trimming means for applying adhesive to the tubular member above the conveyor means, and flap folding means mounted on the frame and extending rearwardly of the adhesive applying means and above the conveyor means for adhesively adhering at least one of the flaps to a tubular member side wall to form a sealed tubular member closure.

20. The apparatus of claim 19 further characterized in that the flap folding means includes means on the frame above the conveyor means and intermediate the trimmer means and the adhesive applying means for folding the flaps into a generally horizontal position with one overlying the other, the last mentioned folding means including a folder plate having a longitudinally extending folded edge above the conveyor means at about the same elevation as the lowermost part of the cutting edge, and a folder member cooperating with the folder plate for folding the flaps about said folding edge, and means extending rearwardly of the adhesive applying means for folding at least one of the flaps from the horizontal position to adhesively adhere it to the tubular member to form an adhesively sealed closure, said adhesive applying means comprising means for applying adhesive at an elevation below said folding edge.

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