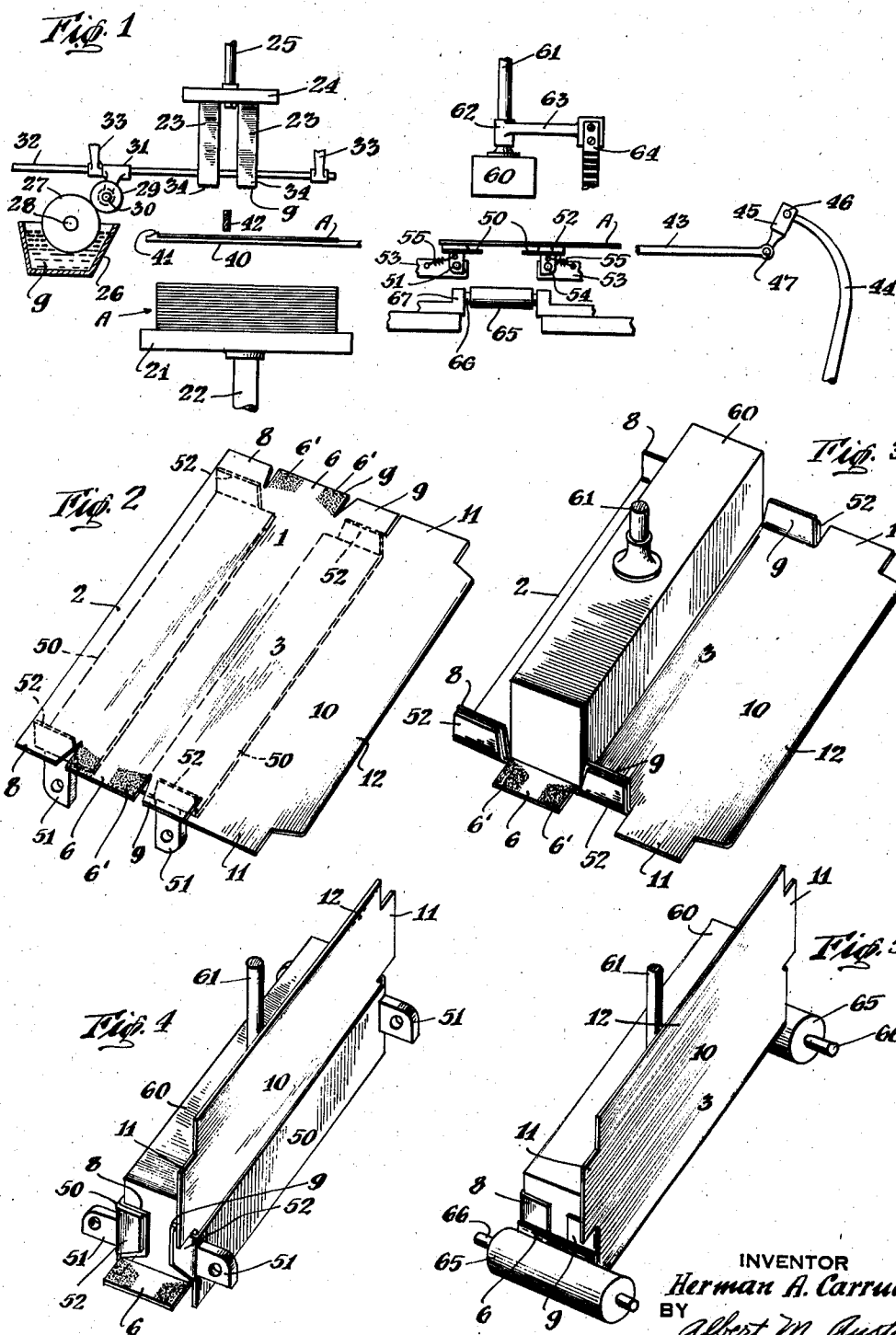


Jan. 20, 1942.

H. A. CARRUTH
METHOD AND APPARATUS FOR CLOSING AND SEALING
PAPERBOARD BOXES AND CARTONS
Filed Oct. 25, 1939

2,270,264

6 Sheets-Sheet 1



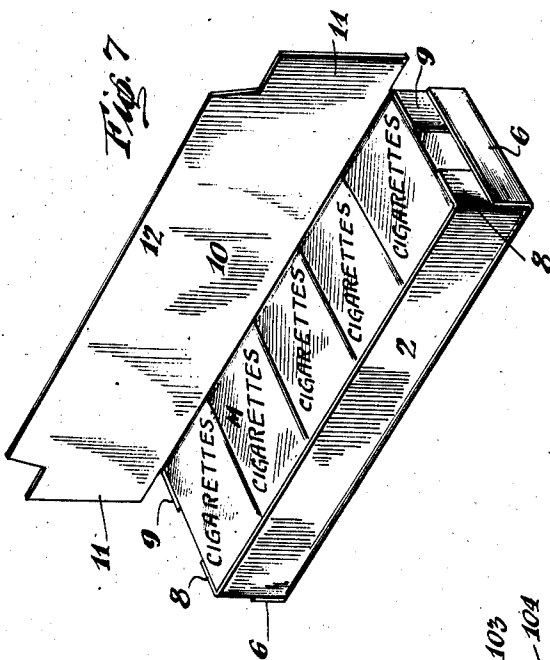
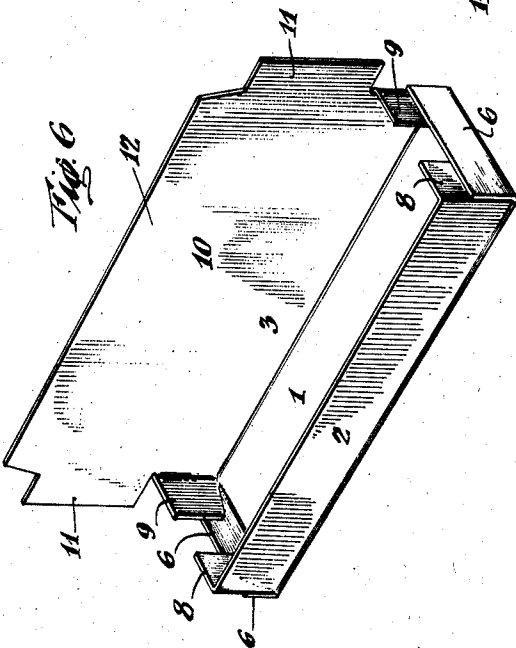
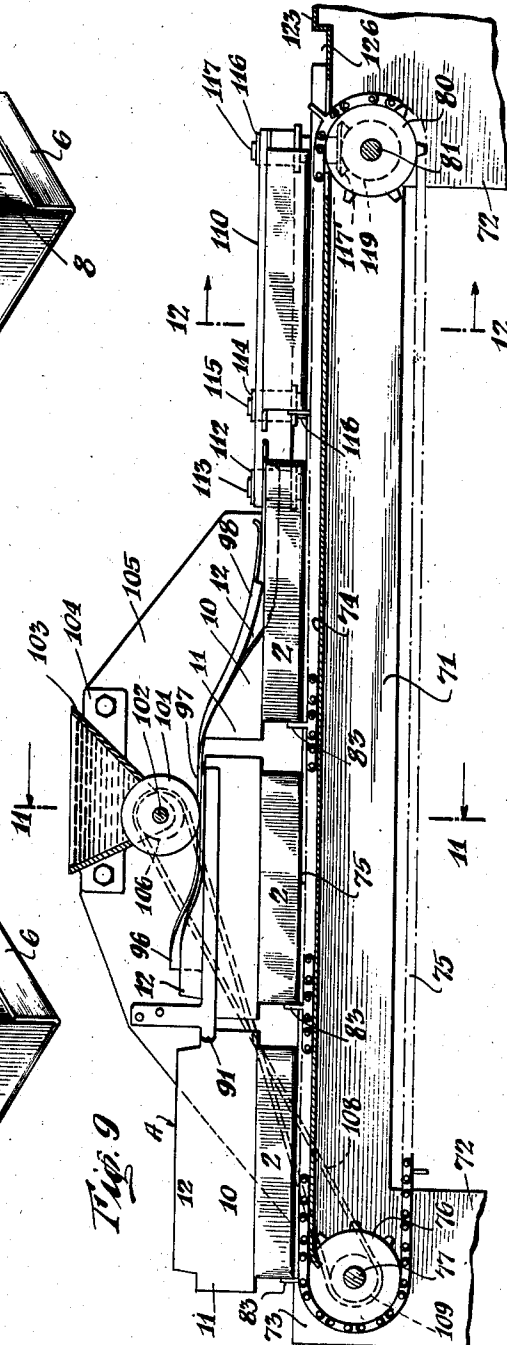
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6 Sheets-Sheet 2



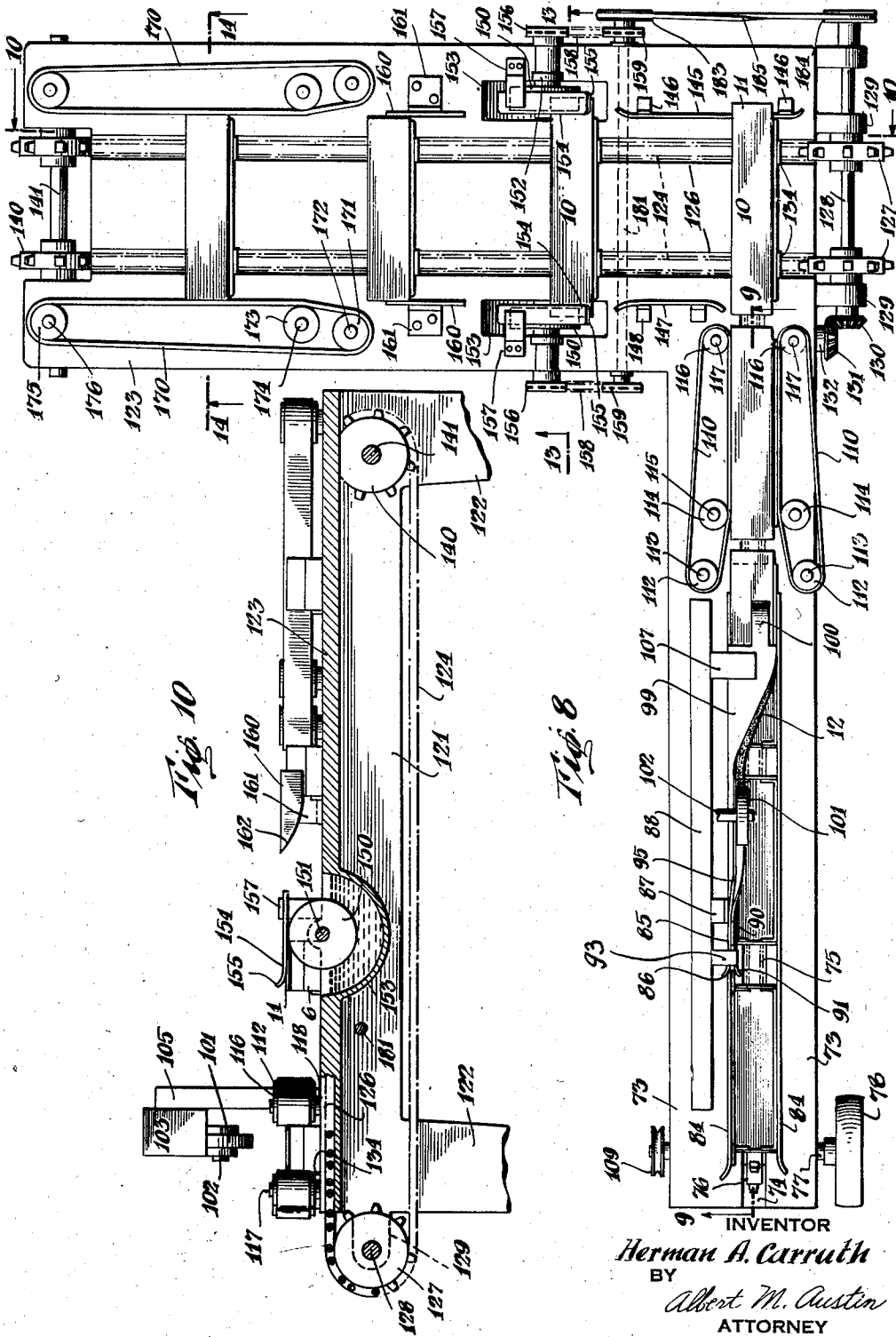
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2. **H. A. CARRUTH**
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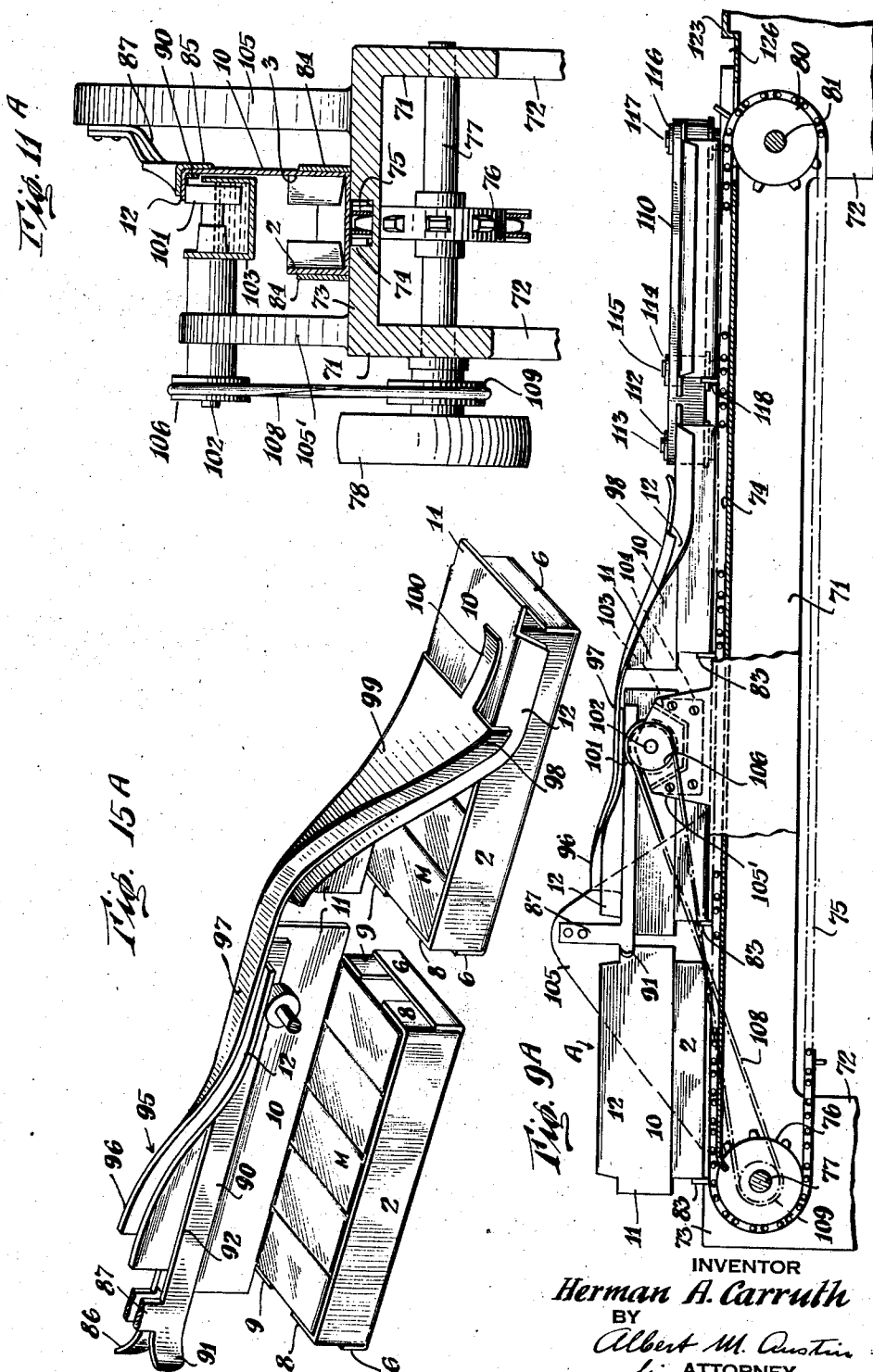


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6 Sheets-Sheet 4

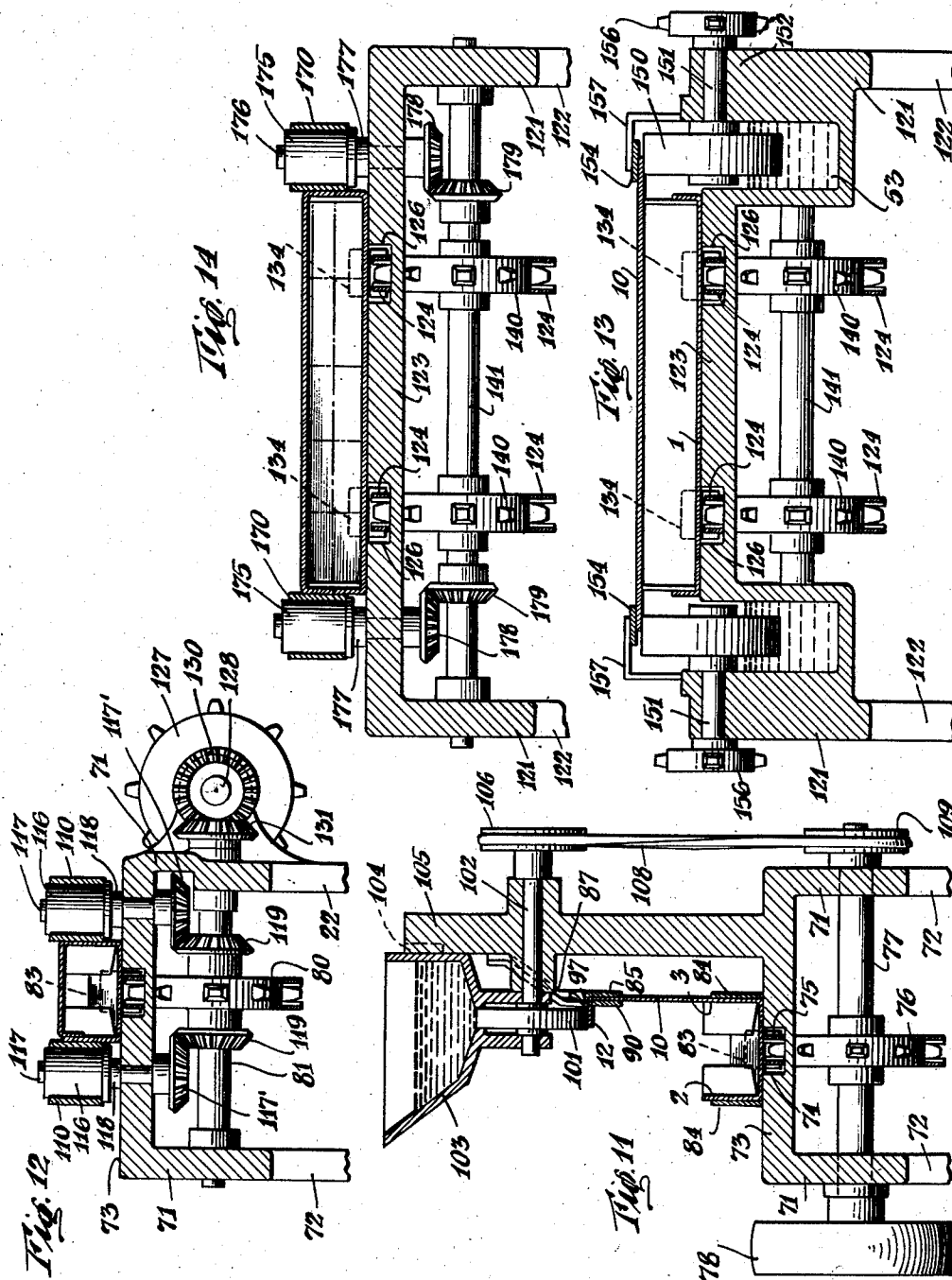


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6 Sheets-Sheet 5



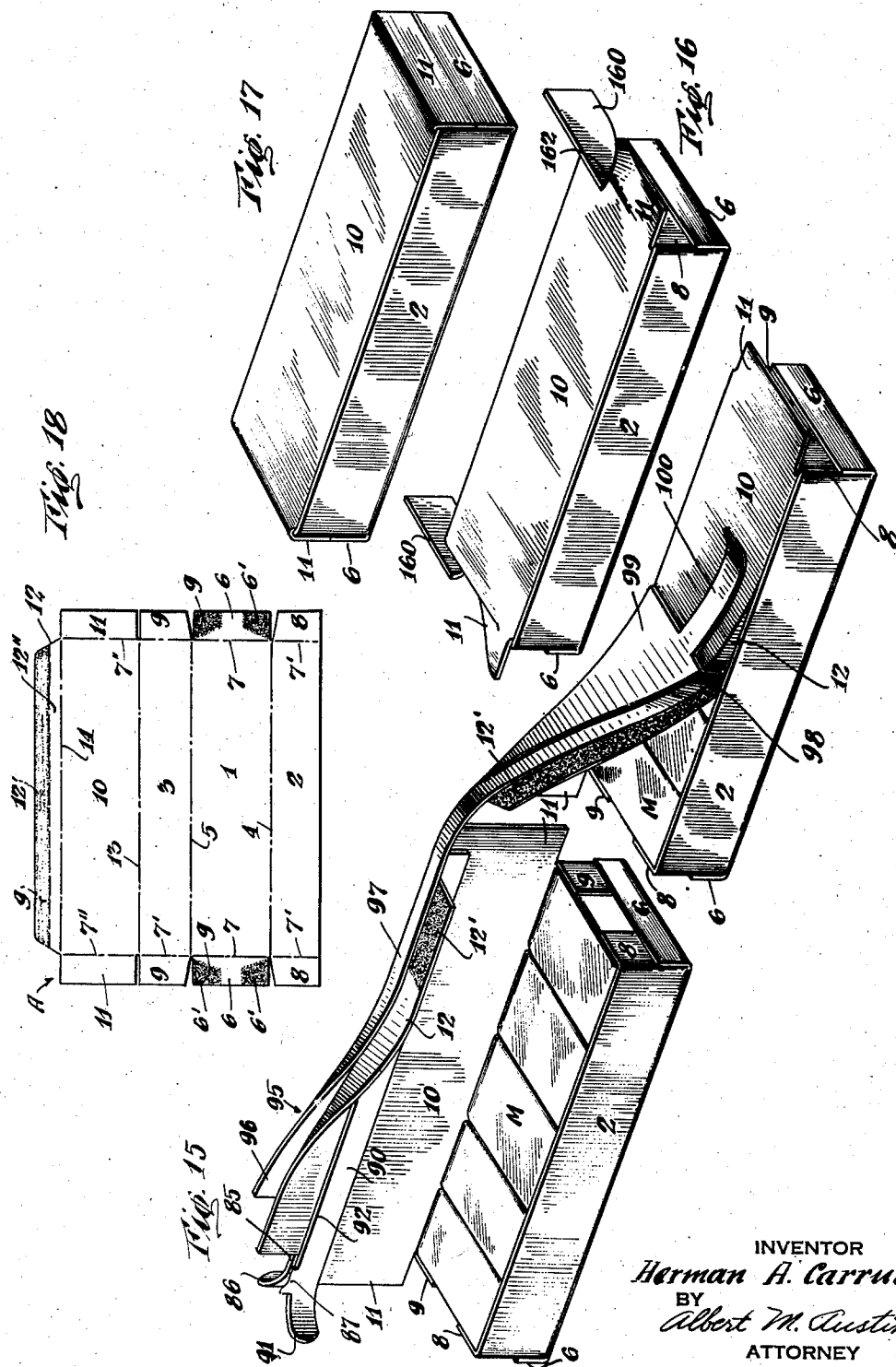
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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,270,264

METHOD AND APPARATUS FOR CLOSING
AND SEALING PAPERBOARD BOXES AND
CARTONSHerman A. Carruth, Northford, Conn., assignor to
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Conn., a corporation of New Jersey

Application October 25, 1939, Serial No. 301,093

16 Claims. (Cl. 93—6)

This invention relates to an improved method and apparatus for closing and sealing paperboard boxes and cartons, and more particularly to a new and novel arrangement of steps and devices whereby paperboard boxes and cartons, after being packed with merchandise, may be automatically closed and sealed at a high production rate substantially without hand labor.

Vast quantities of paperboard boxes and cartons are used in the packaging of numerous and various different kinds of merchandise. Such boxes and cartons are usually thrown away or destroyed after a single use and consequently the cost of the packaging medium constitutes a substantial item in determining the final cost of the merchandise to the consumer. A box or carton formed from a single paperboard blank which is in all substantial respects rectangular in shape, is the most economical since such box and carton blanks can be cut and scored substantially without waste of paperboard material. Difficulty arises, however, in closing and sealing boxes and cartons erected from such rectangular blanks at a satisfactory production rate. Boxes and cartons used in the packaging of cigarette packs, for example, have been formed from blanks having end flaps of different lengths, resulting in substantial waste and loss of material in cutting the blanks. Boxes and cartons have been heretofore made from such irregular-shaped blanks for the reason that no satisfactory method or apparatus has been devised for automatically closing and sealing boxes formed from rectangular-shaped blanks at a production rate commensurate with the saving in material effected.

In accordance with this invention, a method and apparatus has been devised for closing and sealing boxes and cartons formed from rectangular blanks of paperboard material at an unusually high speed of production so that substantial savings are effected not only in paperboard material but also in closing and sealing the packed box or carton. My improved method and apparatus are particularly adapted for operating upon an erected and packed box formed from a single blank of paperboard material having a cover panel which is to be brought into closed position, the cover panel having a front-securing tab and end flaps which must be brought into sealing engagement with the front wall and end walls of the box body. The box blank may be erected into box form by various box-assembling operations now known to the art, which operations comprise raising the front and rear wall panels at right angles to the bottom wall panel, turning the end tabs hinged to the ends of the front and rear wall panels inwardly at right angles thereto, and raising the end wall flaps hinged to the ends of the bottom wall panel into adhesive contact with the inturned end tabs,

which operations produce a box body in which merchandise may be packed.

This invention is more particularly directed to improved method steps and devices whereby such a packed box and carton may be closed and sealed automatically without hand labor and at a high production rate. In carrying out this closing and sealing operation, the sealing tab hinged to the cover panel is first bent at right angles thereto and a relatively narrow strip of adhesive is applied to this cover tab, which operations are performed as the box is continuously advanced on a moving conveyor. As the box continues to advance, the cover panel is brought into closed position, the cover tab tucked into the box adjacent the inside face of the front panel thereof, and the cover tab pressed into firm adhesive engagement with the inside face of the front panel of the box. As the box continues its advance, adhesive is applied to the end flaps projecting from the ends of the cover panel, the cover end flaps are then folded over the end tabs projecting inwardly from the front and rear wall panels, following which the cover end flaps are pressed into firm adhesive engagement with these end tabs, producing a packed box which is neatly closed and sealed. The free edges of the adjacent upturned bottom flaps and the adjacent downturned cover flaps are preferably cut to neatly meet at the midsection of the end walls, thus formed.

The various method steps are so arranged and related that the closing and sealing operation is readily susceptible of being performed automatically and at high production speed upon apparatus which also forms an important part of this invention. High production speeds are attained by reason of the fact that the mechanisms which manipulate the various parts of the blank remain stationary while the box is continuously and positively advanced upon a driven conveyor or conveyors. The only moving parts of my improved closing and sealing apparatus comprise the box-advancing conveyor belts, the box pressure belts, and the glue-applying rollers which, though rotating, remain stationary with respect to the advancing movement of the boxes. The conveyor mechanism is so constructed and arranged that the boxes are successively advanced therealong in substantially uniform spaced relationship. The output speed which may be developed is limited only by the speed at which the box-advancing belts may safely be driven. All moving parts, including the conveyor belts, pressure belts and glue rollers, are driven from a single power source, assuring positive synchronism of these moving parts. The mechanisms and devices for folding and manipulating the cover panel, cover sealing tab and cover end flaps, are so arranged and constructed that these

parts of the box are moved into closing and sealing position by streamlined flow as the boxes are advanced, so that no parts of the box are subjected to sudden or precipitate strains which might lacerate or injure the boxboard.

An object of this invention is to provide an improved method for closing and sealing packed boxes and cartons expeditiously at a high production rate so as to produce sealed boxes and cartons which are strong and sturdy in construction, and neat and attractive in appearance.

Another object of this invention is to provide means for automatically closing and sealing packed boxes and cartons by continuous flow operation, at a high production rate with a minimum of supervision or attention.

Other objects of this invention will become apparent as the disclosure proceeds.

The invention also consists in certain new and original features of construction and combination of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part hereof, in which

Fig. 1 is a diagrammatic elevational view of the apparatus employed in assembling my improved box from a prepared blank;

Fig. 2 is a perspective view of the prepared blank and details of the elements of the box assembly apparatus operative to raise the front and rear wall panels and fold the end wall securing tabs into box-forming position;

Fig. 3 is a perspective view of the box-forming block, the front and rear panel raising elements, and the tab folding elements as they appear at one stage of operation upon the blank;

Fig. 4 is a perspective view of the prepared blank at a further stage of assembly, showing the front and rear wall panels and the end wall securing tabs thereof folded into box-forming position by folding elements of the machine;

Fig. 5 is a perspective view of the prepared blank when folded around the forming block, with the forming block and folded blank moved into position to be operated upon by end rollers which fold the bottom end wall flaps into position;

Fig. 6 is a perspective view of the assembled box as formed by the box assembly machine;

Fig. 7 is a perspective view of the assembled box showing merchandise, such as a plurality of cigarette packs, packaged therein;

Fig. 8 is a top plan view of the box sealing machine which folds the box cover into position, applies adhesive to the tuck-in tab associated with the cover, inserts the tuck-in tab into the box, applies adhesive to the inside face of the cover end flaps, and folds the cover end flaps into sealing position to close the end walls of the box;

Fig. 9 is a longitudinal cross-sectional view through a portion of the cover-folding and sealing apparatus positioned to place the cover sealing flap adjacent the inside face of the front wall panel, this view being taken along line 9—9 of Fig. 8;

Fig. 9A is a longitudinal cross-sectional view through the cover folding and sealing apparatus positioned to apply the cover sealing flap to the outside face of the front wall panel.

Fig. 10 is a longitudinal cross-sectional view through the apparatus for applying adhesive to the cover end flaps, folding the same over the end walls, and sealing the same into position, this view being taken on line 10—10 of Fig. 8;

Fig. 11 is a transverse cross-sectional view of the machine as it appears when looking in the direction of the arrows 11—11 of Fig. 9, this view showing particularly the device employed in applying adhesive to the cover tuck-in tab;

Fig. 11A is a transverse cross-sectional view of the machine wherein the adhesive applying device is positioned to apply adhesive to the inside face of the cover sealing flap whereby it may be secured to the outside face of the front wall panel.

Fig. 12 is a transverse cross-sectional view of the machine as it appears when looking in the direction of the arrows 12—12 of Fig. 9, this view showing particularly the pressure belts employed for pressing the cover tuck-in tab and the adjacent side wall of the box in adhesive contact;

Fig. 13 is a transverse cross-sectional view of the machine as it appears when looking in the direction of the arrows 13—13 of Fig. 8, this view showing particularly the device employed in applying adhesive to the cover end flaps;

Fig. 14 is a transverse cross-sectional view of the machine as it appears when looking in the direction of the arrows 14—14 of Fig. 8, this view showing particularly the pressure belts employed for pressing the cover end flaps into sealing contact with the end wall tabs extending from the front and rear wall panels of the box;

Fig. 15 is an enlarged fragmentary perspective view of the cover-folding and sealing device;

Fig. 15A is an enlarged fragmentary perspective view of the cover folding and sealing device arranged to apply the cover sealing flap to the outside face of the front wall panel;

Fig. 16 is a perspective view of the packed box showing folding elements of the machine in position to fold the end wall flaps into end wall sealing position;

Fig. 17 is a perspective view of the packed and sealed box as it appears when ejected from the apparatus ready for shipment; and

Fig. 18 is a plan view of the blank from which the box may be formed.

Similar reference characters refer to similar parts throughout the several views of the drawings and the specification.

In the assembling, packaging and sealing of boxes according to the method and apparatus comprising this invention, body-forming blanks which may be of the general type illustrated in Fig. 18, are first prepared. The body-forming blanks may be formed from relatively strong paperboard of the necessary strength and stiffness to properly support and retain the merchandise within the box. In order that the method and apparatus for assembling, packaging and sealing boxes comprising this invention may be better understood, the general construction of the blank and the box formed therefrom will be first described.

Blank and box formed therefrom

Referring more particularly to Fig. 18, each blank may be cut from a large sheet or roll of the selected paperboard material, the cutting of the blanks from the sheet or roll into the proper shape and the scoring thereof being advantageously performed by an automatic cutting and scoring machine. As shown in Fig. 18, each

blank comprises a bottom wall panel 1 having a front wall panel 2 hinged to the bottom wall panel along the fold line 4 and a rear wall panel 3 hinged to the bottom wall panel 1 along the fold line 5. Bottom end wall flaps 6 are hinged to each end of the bottom wall panel 1 along a fold line 7. Turn-in end wall tabs 8 are hinged to each end of the front wall panel 2 along a fold line 7', the score line 7' being inwardly offset from the score line 7 approximately the thickness of the paperboard. An end wall tab 9 is hinged to each end of the rear wall panel 3 along the fold line 7', each fold line 7' likewise being inwardly offset from the adjacent fold line 7 approximately the thickness of the paperboard.

A cover flap 10 is hinged to the rear wall panel 3 along a fold line 13, the cover panel 10 having an end wall flap 11 hinged to each end thereof along the fold line 7'', which extends substantially in alignment with fold line 7. A tuck-in tab 12 is hinged to cover panel 10 along a fold line 14, which tuck-in flap serves to seal the packaged box.

Method of assembly

The method employed for assembling the blank shown in Fig. 18 into the box shown in Fig. 6, and the method employed for sealing and closing the packaged box, shown in Fig. 7, will now be described. In general, the operation comprises, first, the assembly of the box formed as shown in Fig. 6 from the blank shown in Fig. 18, following which the merchandise M is packed in the box, as illustrated in Fig. 7. After the merchandise has been packed in the box, the box closing and sealing operation is performed, comprising folding the tuck-in flap at right angles to the cover panel, applying adhesive to the tuck-in flap 12, folding the cover panel over the box, tucking the tuck-in flap within the box and, finally, pressing the tuck-in flap into sealing contact with the front wall panel. The tuck-in flap 12 is inserted into the box during advancing movement thereof, substantially simultaneously with the folding of the cover panel 10 over the merchandise, and the tuck-in flap is then pressed into firm adhesive engagement with the front panel 2 thereof. A strip of adhesive is then applied to the inside face of each of the end cover flaps 11, the end cover flaps folded downwardly over the end flaps 8 and 9, and pressed into sealing engagement therewith.

The box assembly operation may be better understood by referring to Figs. 1 to 5 inclusive. Suitable glue-applying mechanism may be employed for applying a spot of adhesive *g* to each corner area 6' of the bottom end flap 6, which operation may be performed manually or automatically. The front panel 2 and the rear panel 3 are then folded so as to extend substantially at right angles to the bottom wall panel 1. The end flaps 8 and 9 hinged to each end of the front panel 2 and rear panel 3, respectively, are then folded inwardly, as illustrated in Fig. 4, so as to extend substantially perpendicular to the front and rear wall panels. The bottom end flaps 6, to which adhesive *g* has been applied to the inside areas 6' thereof, are then folded at right angles to the bottom wall panel 1 and pressed into adhesive contact with the adjacent end flaps 8 and 9. The box as shown in Fig. 6 is thus produced.

After the merchandise M has been packed within the box, as shown in Fig. 7, the box-sealing operations are performed. By referring more particularly to Fig. 15, the tuck-in flap 12 is

first bent substantially at right angles to the cover panel 10, and while suitably supported in this position a strip of adhesive is applied to a portion 12' of the outside face thereof. The cover panel 10 is then folded to overlie the merchandise and substantially simultaneously the tuck-in flap 12 is inserted into the box adjacent the inside face of the front wall panel 2. Preferably, pressure is exerted on the outside face of the front wall panel 2 so as to press this panel into firm adhesive engagement with the tuck-in flap.

Following this operation, adhesive is applied in strip form to the inside face of the cover end flaps 11, which, if desired, may be performed by strip glue-applying mechanism. The cover end flaps 11 are then folded at right angles to the cover panel 10, as shown in Fig. 16, so as to overlie the end flaps 8 and 9. Pressure is applied to the cover end flaps 11 so as to press the same into firm adhesive contact with the end flaps 8 and 9.

The box as thus formed, packed and sealed cannot be opened without giving visible evidence of tampering. The box as assembled has doubly end walls and thus is strong and sturdy in construction, so that large numbers of packed cartons may be stacked one upon the other without danger of crushing or damage to the merchandise therein.

Box assembly apparatus

There is shown in Figs. 1 to 5 inclusive the apparatus whereby the various steps of assembling the blank into boxes of the form shown in Fig. 6, may be performed. It is understood, however, that the apparatus shown in the drawings is for the purposes of illustration only and that other types of apparatus may be employed to carry out the novel assembly steps of this invention.

A plurality of stacked blanks which may be formed as illustrated in Fig. 18 without adhesive applied thereto, are placed upon a suitable blank-supporting platform 21 supported upon a pedestal 22. The platform 21 may be so mounted as to be raised upwardly in predetermined stages as the blanks are removed from the top thereof.

A spot of adhesive is applied to each corner area 6' of the bottom end flaps 6, by means of glue plungers 23 which have the bottom end 34 thereof shaped to conform to the glue area 6'. The blank, as shown in Fig. 18, has four glue areas 6', so that four glue plungers 23 will be provided suitably spaced to apply adhesive to the blank at the proper points. The glue plungers 23 may be adjustably fixed to a suitable frame member 24 mounted on a reciprocating shaft 25, which is arranged to reciprocate vertically. Upon downward reciprocation of the shaft 25, the lower ends 34 of the plungers 23, each having a layer of adhesive *g* applied thereto, contact the topmost blank supported on the platform 21 and raise the blank in a position to be received by a pair of horizontally reciprocating blank-supporting arms 40 which move under a stationary plate 42. The plate 42 limits the upward movement of the topmost blank so that the lower ends of the plungers 23 tear loose from the blank, causing the blank to drop upon the arms 40 moved under the blank.

Adhesive is supplied to the lower ends 34 of the plungers 23 by means of suitable adhesive-applying mechanism, which may comprise a glue

pot 26 for containing the adhesive, a pair of glue transfer rollers 27 rotatably fixed to a rotating shaft 28, whose peripheral surface is adapted to contact a pair of glue-applying rollers 29 fixed to a rotatably mounted shaft 30. Rotatably mounted shaft 30 may be supported in bearings provided upon suitable spaced brackets 31 each fixed to a reciprocating rod 32 which reciprocates in spaced hanger brackets 33. By reciprocating the paired rods 32 the glue-applying rollers 29 may be moved into contact with the glue transfer rolls 27 which when rotated rotate the glue-applying rolls 29 to apply a film of adhesive to the periphery thereof. Rods 32 are then moved to the right, as shown in Fig. 1, so that each roller 29 rolls into adhesive-applying contact with the lower end 34 of two of the plungers 23 so as to apply a film of adhesive to the lower ends thereof. The glue roller supporting rods 32 are operated in synchronism with the vertically reciprocating movement of plunger shaft 25 so as to apply a film of adhesive to the lower ends 34 thereof before the plungers 23 move downwardly to contact the topmost blank supported upon the platform 21.

The adhesive *g* applied to the ends 34 of the plungers 23 when moved into contact with the blank causes the topmost blank to stick or adhere to the plungers 23 so that the blank can be raised from the stack of blanks, at which time the paired arms 40 move under the blanks. When the paired arms 40 have been moved to the right, as shown in Fig. 1, and the blank released from the plungers by plate 42, a hook portion 41 on each end of the arms 40 engages the adjacent end of the blank and draws the blank to the right under the stationary plate 42, the arms 40 carrying the blank to box assembly mechanism which will be presently described. Reciprocation of the arms 40 may be effected by a pivotally mounted lever 44 which is connected to a link 45 through pivot connection 46 and to rod 43 through pivot connection 47, the rod 43 being connected to the arms 40.

The reciprocating arms 40 move the blank supported thereon into position over a pair of spaced tilting plates 50 which are adapted to fold the front and rear wall panels 2 and 3 of the blank into position substantially at right angles to the bottom wall panel 1, when a box-forming block 60 is pressed downwardly against the bottom wall panel 1 of the box. The box-forming block 60 is shaped to substantially conform to the interior of the box to be formed, the lower surface of the block substantially conforming in area to the bottom wall panel 1 of the box. The block 60 is fixed to a reciprocating rod 61 which slides through a suitable sleeve 62 provided in supporting arm 63 which is fixed to supporting bracket 64.

The front and rear panel folding plates 50 have an area substantially equal to the corresponding front and rear wall panels of the box. A lip element 52 projects at right angles from each end of each plate 50 in position to engage the adjacent end flaps 8 and 9 at the ends of the front and rear wall panels 3. Each plate 50 is provided with a pair of lugs 51 through which a shaft 54 journaled in a supporting bracket 53 extends. A tension spring 55 is secured to lug 51 and to the bracket 53. The mechanisms for folding the front and rear wall panels of the box positioned substantially at right angles to the bottom wall panel 1 are substantially identical.

The reciprocating arms 40 carry the blank from beneath the glue-applying plungers 23 to a position where the blank is supported upon the spaced tab-folding elements 52, as shown in Fig. 2. When the block 60 is moved down to press against the bottom wall panel of the box, the tab-folding elements 52 operate to fold the end tabs 8 and 9 in position substantially at right angles to the front and rear wall panels 2 and 3 respectively. Upon further downward movement of the forming block 60, the front and rear panel folding plates 50 are swung into vertical position against the action of tension springs 55, so as to fold the front and rear wall panels of the box against the sides of the forming block 60, as shown in Fig. 4. This operation also causes the tab-folding elements 52 to fold the end tabs 8 and 9 against the ends of the form block 60, as shown in Fig. 4.

Upon further downward movement of the form block 60, which carries the partially formed box with it, the bottom end flaps 6 having adhesive *g* applied to the areas 6' thereof move into contact with spaced rollers 65 each fixed to a rotatably mounted spindle 66. Each roller 65 serves to wipe the adjacent bottom end flap 6 upwardly and into adhesive contact with the end tabs 8 and 9, pressing the bottom end flap into firm adhesive engagement with the end tabs 8 and 9. The box as thus formed, appearing as shown in Fig. 6, is then ejected from the machine.

It will be appreciated that the various box assembly devices above described are formed as a part of a unitary machine and are operated in synchronism through suitable driving devices to effect rapid assembly of successive boxes. It will be appreciated that various modifications of the box assembly devices may be made by those skilled in the art by following the teachings of the disclosure above made. It will therefore be understood that this invention is not limited to the employment of the particular box-assembly mechanism above described.

After the box has been assembled in the form shown in Fig. 6, the merchandise *M* is packed therein, which, as shown in Fig. 7, may comprise a plurality of cigarette packs. While the box as thus formed provides an economical and highly satisfactory packaging medium for cigarette packs, it will be appreciated that numerous other kinds of merchandise can be packaged therein within the purview of this invention.

Box closing and sealing mechanism

The mechanism for closing and sealing the box is generally illustrated in Figs. 8 to 15 inclusive. The mechanism for folding the tuck-in flap 12 at right angles to the cover panel 10, for applying a strip of adhesive to the outer section 12' of the tuck-in flap 12, and for closing the cover and inserting the tuck-in flap 12 into the box, is more particularly illustrated in the left-hand section of Fig. 8 and in Figs. 9 and 15. The mechanism for applying adhesive to the inside face of the cover end flaps 11 and for folding these flaps into adhesive contact with end tabs 8 and 9, is more particularly illustrated in the right-hand section of Fig. 8 and in Fig. 10.

Referring more particularly to the left-hand section of Fig. 8, and Figs. 9, 11, 12 and 15, the mechanism for forming the specified operations first above enumerated is supported upon spaced frame members 71 supported by suitable legs 72 resting on the floor. A table top 73 is supported

upon the frame members 71, the table top having a depressed groove or channel 74 therein within which the upper flight of a conveyor belt 75 may move. Conveyor belt 75 is supported at the head end of the machine by a suitable sprocket 76 over which the belt or chain is trained, the sprocket 76 being fixed to shaft 77 rotatably mounted in suitable bearings provided in the frame members 71 of the machine. A drive pulley 78 fixed to one end of shaft 77 may be driven by suitable belting connected to a source of power, such as an electric motor. The belt 75 is provided with spaced box pusher lugs 83 fixed thereto, each lug being adapted to engage the rear end wall of the packed box positioned upon the table top 73 and advance it continuously along the table top 73 when the belt is driven by drive pulley 78. The discharge end of the belt 75 is supported upon a suitable sprocket 80 fixed to shaft 81 rotatably mounted in suitable bearings provided in the side frames 71.

When the packed box, shown more particularly in Figs. 9, 11 and 15, is positioned on the table top 73, the cover panel 10 and the tuck-in flap 12 extend vertically substantially in alignment with the rear panel 3. A pair of spaced guide plates 84 extending vertically from the table top 73, are provided for guiding the box therebetween in its advancing movement along the table top 73. During the advance of the box the cover panel 10 moves between two spaced bars 85 and 90 which are each supported by suitable brackets 87 and 93 respectively, fixed to a frame member 88 supported upon the table top 73. The guide members 85 and 90 have outwardly flared ends 86 and 91 respectively, as shown more particularly in Fig. 15, to facilitate entry of the cover panel 10 therebetween. The top edge 92 of inside guide bar 90 is positioned so as to substantially align with the crease line 14 defining tuck-in flap 12 from the cover panel 10.

Means are provided for folding tuck-flap 12 inwardly at right angles to the cover panel 10, which operation must be performed before the cover panel is brought into closed position. This folding means may comprise a twisted strip of metal 95 fixed to or forming an integral part of outside guide bar 85, which strip has a vertically extending portion 96 projecting upwardly from guide bar 85. The vertical portion 96 merges by a smooth curved portion into a horizontally extending portion 97 which is of sufficient width to engage narrow strip section 12' of the tuck-tab 12, the horizontal portion 97 operating to fold tuck-in tab 12 inwardly over the top edge 92 of guide bar 90 so as to extend substantially at right angles to cover panel 10, as shown in Fig. 15. The horizontal portion 97 of the flap-folding strip 95 merges into a downwardly extending flange portion 98 which terminates adjacent the top edge of the front wall panel 2 of the box as the box is advanced along the conveyor. It will be noted by referring to Fig. 15 that the downwardly extending flange portion 98 also swings in a smooth curve from a point adjacent the rear panel 3 of the box to the front panel 2 thereof. The arm 85 enlarges in width at a point where the horizontal flange 97 turns downwardly, so as to provide a plate portion 99 which rolls from a vertical to a horizontal position to overlies the box cover. The cover-folding plate portion 99 may be additionally supported by a bracket 107 fixed to the frame of the machine. The plate portion 99 of

the folding device may terminate in a cover pressing tail 100 which serves to press the cover panel 10 in position to overlies the merchandise in the box.

Referring more particularly to Figs. 8, 9 and 11, means are provided for applying a strip of adhesive to the outside face of the tuck-in flap 12 when folded into horizontal position. An adhesive-applying roller 101 rotatably mounted on shaft 102 is positioned so that the periphery thereof contacts the exterior portion 12'' of the flap when in horizontal position and when engaged by horizontal portion 97 of the flap-folding mechanism 95. The periphery of the glue roller 101 receives adhesive from a suitable glue pot 103 fixed as by brackets 104 to a supporting plate 105 fixed to the table top 73 of the machine. Glue roller 101 removes adhesive from glue pot 103 and the film of adhesive applied to the periphery thereof is transferred in strip form to the outer portion 12' of the tuck-in flap. The glue roller 101 may be positively driven by a pulley 106 fixed to roller shaft 102, driven by belting 108 trained over pulley 109 fixed to one end of shaft 77.

In event it is desirable to apply the front sealing flap 12 to the outside face of the front wall panel 2, it will be appreciated that the glue roller 101 may be positioned beneath the intumed front sealing flap 12, as shown in Figs. 9A, 11A and 15A, so as to apply adhesive to the undersurface thereof. The glue pot 103 would be conveniently arranged to apply adhesive to the periphery of the glue roller 101 when so positioned. A suitable bracket support 105' would then be provided for the glue roller shaft 102 which bracket would be supported by the table top 73 and positioned at the left-hand side of the table as viewed in Fig. 11A. As a further modification, the downwardly extending flange portion 98, as shown more particularly in Fig. 15A, would have its lower end so arranged as to overlap the outside face of the front wall panel 2 so that the front sealing flap 12 would be brought into sealing engagement with the outside face of the front wall panel.

It will now be appreciated that as the packed box is advanced along the table top 73 by conveyor belt 75, the cover panel 10 moves between guide bars 85 and 90 and during its continued advance the horizontal portion 97 of the flap-folding device 95 holds the flap 12 in horizontal position, when glue roller 101 applies adhesive in strip form to the outer portion 12'' of the flap. Downwardly extending and downturned flange portion 98 of the flap-folding device folds the flap 12 downwardly and plate portion 99 and tail 100 folds the cover panel 10 in closed position over the merchandise in the box, during which operation the tuck-in flap 12 is inserted within the box adjacent the inside face of the front panel 2. The tuck-in flap folding device and the cover-folding device are stationary while the box is progressively advanced through the apparatus, high production speeds thereby being obtained.

To insure firm adhesive engagement between the tuck-in flap 12 and the front panel 2, a pair of presser belts 110 are provided positioned adjacent the front and rear wall panels of the box, as shown more particularly in Figs. 8, 9 and 12. Each of the presser belts 110 is trained over spaced rollers 112 and 116. Each roller 112 is rotatably mounted upon a spindle 113 fixed to the table top 73. Each roller 116 is fixed to

spindle 117 which extends through the table top 73 and is supported by a bearing 118 fixed to the table top 73. A beveled gear 117' is fixed to the end of each spindle 117, gear 117' meshing with gear 119 fixed to sprocket shaft 81. A belt tensioning roller 114 rotatably mounted upon spindle 115 fixed to table top 73 retains each belt 110 in pressing engagement against the adjacent side wall panel of the box. The belts 110 are positively driven in synchronism with the box advancing chain 75 by roller 116 positively driven from the sprocket 80. The belts 110 also assist the sprocket chain 75 to advance the successive boxes onto conveyor belts 124, which may be arranged at right angles to the conveyor belt 75, conveyor belts 124 advancing the box into engagement with further box sealing mechanism, which will now be described.

Referring more particularly to the right-hand section of Fig. 8 and Figs. 10, 13 and 14, parallel extending spaced frame members 121 are provided supported upon legs 122, the frame members 121 extending generally at right angles to the frame members 71. A table top 123 is supported upon the frame members 121 and is provided with a pair of spaced parallel extending grooves 126 each adapted to receive and retain the upper flight of a conveyor belt 124. Each of the conveyor belts 124 is trained over a sprocket 127 at the head end of the apparatus and a sprocket 140 at the discharging end of the apparatus. The paired sprockets 127 are fixed to the shaft 128 journaled in suitable brackets 129 fixed to the frame members 121. One end of shaft 128 is provided with a beveled gear 130 which meshes with beveled gear 131 fixed to driven shaft 81.

The belts 110 engage the side wall panels of the box, advance the box onto the table top 123, preferably positioned at the same elevation as or at an elevation slightly below table top 73. A stop plate 145, supported by brackets 146 fixed to the table top 123, limits and defines the advancing end of the box so that it is properly positioned upon table top 123. Each of the advancing chains 124 are provided with paired box-engaging lugs 134 which engage the front wall panel of the box so that it is properly positioned upon table top 123. A guide plate 147 supported by brackets 148 fixed to table top 123 further serves to position and guide the adjacent end of the box so that the box is spaced between the guide plates 145 and 147 and is thus evenly advanced by the conveyor belts 124.

As the box is advanced by the conveyor belts 124, the laterally projecting cover end flaps 11 thereof each move under a backing plate 154 fixed to bracket support 157, which bracket is fixed to the table top 123 exterior to the advancing belts 124. Each of the backing plates 154 may have an upturned entry end 155 to facilitate movement of the cover flaps 11 thereunder. Immediately below each of the backing plates 154 is a glue roller 150 fixed to shaft 151 rotatably supported by a suitable bracket 152 supported by the table top 123. Each of the glue rollers 150 has the lower portion thereof extending into a glue well 153 formed in the table top 123.

As the cover flaps 11 move under the overlying backing plates 154, they also move into contact with the peripheral surface of the glue-applying rollers 150, which peripheral surface receives a film of adhesive from the glue contained in the glue well 153. As the cover flaps 11 are positively advanced by lugs 134 engaging the box

under the backing plates 154, the undersurface of the cover flaps moves into contact with the peripheral surface of the glue rollers 150 so as to receive a strip of adhesive on the undersurface thereof. Each glue roller 150 may be positively driven by means of a sprocket 156 fixed to the glue roller shaft 151. A drive chain 158 is trained over each sprocket 156 and a sprocket 159 fixed to a common shaft 181 journaled in the side frames 121 and driven by a pulley wheel 183 which receives a belt 185 trained over pulley wheel 184 fixed to driven shaft 128.

Upon further advance movement of the box through the apparatus, the cover flaps 11 move into contact with a pair of spaced flap-folding knives 160, shown in Figs. 8, 10 and 16; a folding knife 160 being provided for each of the cover end flaps 11. Each folding knife 160 is fixed to a suitable bracket 161 supported by the table top 123. The lower edge of each knife 160 has a curved entry edge 162 which rides over the adjacent cover flap 11 and as the box is advanced folds the cover flap into adhesive contact with the adjacent end tabs 8 and 9 of the box.

To make sure that firm adhesive engagement between the cover end flaps 11 and the end tabs 8 and 9 is effected, the box is preferably moved between spaced pressure belts 170, as shown in Figs. 8, 10 and 14. Each pressure belt is rotatably supported upon spaced rollers 171 and 175. Roller 171 is rotatably supported upon a spindle 172 fixed to the table top 123, while roller 175 is fixed to a spindle 176 which extends through table top 123 and is supported by a bearing 177 fixed to the table top. Each of the spindles 176 carries a beveled gear 178 at the lower end thereof which meshes with a beveled gear 179 fixed to the driven shaft 141 which supports the belt sprockets 140. Thus the belts 170 are positively driven by the driven shaft 141 in synchronism with the advancing movement of the box-advancing belts 124.

A tension roller 173 may be associated with each of the belts 170 to maintain the inner run of the belt in pressing contact with the adjacent end of the box. Each roller 173 is rotatably supported upon spindle 174 fixed to the table top 123. The tension rollers 173 serve to tension each of the belts 170 and retain the inner run thereof in pressing engagement against the downturned cover flaps 11. Positive and secure adhesive engagement between the cover flaps 11 and the end tabs 8 and 9 of the box is thus attained. Each box is ejected from the discharge end of the table 123 fully packed and sealed in the condition shown in Fig. 17. The packed boxes, of which Fig. 17 is an exemplification, are then arranged in suitable shipping cartons ready for shipment to the merchandiser.

By employing the method and apparatus above described, boxes or cartons for the reception of merchandise can be formed from substantially rectangular blanks of paperboard material, as shown in Fig. 18, substantially without cutting waste. In the first operation the boxes are assembled in the form shown in Fig. 6, which assembly operation may be rapidly performed by the assembly apparatus illustrated in Figs. 1 to 5 inclusive at a high production rate. Since the merchandise M, such as cigarette packs, generally requires inspection before packaging, it is generally desirable that separate articles of merchandise be packed in the erected box by hand as each article is inspected, although an automatic packaging machine, which forms no part

of this invention, may be employed. The third operation comprises a series of method steps for bending the sealing tab 12 at right angle to the cover panel 10, applying the sealing adhesive 12' in strip form to the cover sealing tab, tucking the cover sealing tab 12 into the interior of the box as the cover panel is folded down in closed position, pressing the cover sealing tab in firm adhesive contact with the inside face of the front wall panel 2, applying adhesive to the cover flaps 11 extending from the ends of the cover panel, folding these cover end flaps 11 into sealing engagement with the end tabs 8 and 9, firmly pressing the cover end flaps 11 in firm adhesive engagement with the end tabs 8 and 9, and finally ejecting the fully packed box.

The box closing and sealing operation can be performed in rapid succession at a high production rate by means of the apparatus disclosed in Figs. 8 to 14 inclusive and above described. Since the folding, tucking and adhesive applying mechanism operating upon the packed box are relatively stationary with respect to the advancing movement of the spaced boxes, high production can be maintained with less danger that the operating parts will get out of order than where moving operating mechanisms are employed. The box sealing machine is driven from a single belt pulley 78 at the head end of the machine, thus assuring positive synchronism of the box-advancing belts, box pressure belts, and glue rollers. Except for the box-advancing belts, box pressure belts, and glue rollers, all operating parts and mechanisms remain stationary, so that there is no danger that the box folding and tucking mechanisms will become disarranged or out of synchronism.

Boxes which are neat in appearance and positively and uniformly sealed automatically and without hand operation, may be produced by following the teachings of my improved method and apparatus above described. While the sealed boxes thus produced have been illustrated in connection with the packaging of cigarette packs, it is understood that numerous and varied kinds of merchandise may be packaged and sealed in cartons of various shapes and forms by following the teachings of this invention.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. The method of closing and sealing merchandising cartons each of which comprises a body portion having a bottom, side and end wall panels and a cover portion having a cover panel and a front sealing flap and end sealing flaps hinged to the cover panel, which method comprises, bending the front sealing flap substantially at right angles to the cover panel, applying a strip of adhesive along substantially the full length of the front sealing flap, folding the cover panel into a plane substantially parallel to the bottom wall panel, pressing the front sealing flap into sealing engagement with the front wall panel, applying adhesive to the underside of each of the end wall flaps, and pressing each of the end wall flaps into sealing engagement with the adjacent end wall panel.

2. The method of closing and sealing merchandising cartons each of which comprises a body portion having bottom, side and end wall

panels, and a cover portion having a cover panel, a front sealing flap and end sealing flaps hinged to the cover panel, which method comprises, applying a relatively narrow strip of adhesive to the front sealing flap, folding the cover panel in a plane substantially parallel to the bottom wall panel so as to overlie the merchandise contained in the body portion, pressing the front sealing flap into sealing engagement with the front wall panel, applying adhesive to the underside of each of the end wall flaps, and pressing each of the end wall flaps into sealing engagement with the adjacent end wall panel.

3. The method of closing and sealing merchandising cartons each of which comprises a body portion having a bottom wall panel, front and rear wall panels, and end wall panels, and a cover portion having a cover panel hinged to the rear wall panel, a front sealing flap and end sealing flaps hinged to the cover panel, which method comprises the steps of raising the cover panel into a substantially vertical position, advancing the carton along a predetermined path and during said advance applying a strip of adhesive along substantially the full length of the front sealing flap, folding the cover panel in a plane substantially parallel with the bottom wall panel, pressing the front sealing flap into sealing engagement with the front wall panel, applying adhesive to the underside of each of the end wall flaps, and pressing each of the end wall flaps into sealing engagement with the adjacent end wall panel.

4. The method of packaging, closing and sealing merchandising cartons each of which comprises a body portion defined by a bottom wall panel, front and rear wall panels, and end wall panels, and a cover portion defined by a cover panel hinged to the rear wall panel, a front sealing flap and end sealing flaps hinged to the cover panel, which method comprises the steps of inserting merchandise into the assembled body portion, advancing the packed carton along a predetermined path and during said advance bending the front sealing flap substantially at right angles to the cover panel, applying a relatively narrow strip of adhesive along substantially the full length of the front sealing flap, folding the cover panel in a plane substantially parallel to the bottom wall panel so as to overlie the merchandise contained in the body portion, pressing the front sealing flap into sealing engagement with the front wall panel, applying adhesive to the underside of each of the end wall flaps, and pressing each of the end wall flaps into sealing engagement with the adjacent end wall panel.

5. The method of packaging, closing and sealing merchandising cartons each of which comprises a body portion defined by a bottom wall panel, front and rear wall panels, an intumed end tab hinged to each end of each front and rear wall panel, a bottom end flap hinged to each end of the bottom wall panel adhesively secured to the adjacent intumed end tabs, and a cover portion defined by a cover panel hinged to the rear wall panel, a front sealing flap and complementary end sealing flaps hinged to the cover panel, which method comprises, inserting merchandise into the assembled body portion, thereafter advancing the carton along a predetermined path, applying a relatively narrow strip of adhesive along substantially the full length of the front sealing flap during advance movement of the carton, progressively folding

the cover panel into a plane substantially parallel to the bottom wall panel so as to overlie the merchandise contained in the body portion during advance movement of the carton, pressing the front sealing flap into sealing engagement with said front wall panel during advance movement of the carton, applying adhesive to the underside of each of the end wall flaps during advance movement of the carton, and pressing each of the end wall flaps into sealing engagement with the adjacent inturned tabs during advance movement of the carton.

6. The method of packaging, closing and sealing merchandising cartons each of which comprises a body portion defined by a bottom wall panel, front and rear wall panels, an inturned end tab hinged to each end of each front and rear wall panel, and a bottom wall flap hinged to each end of the bottom wall panel adhesively secured to the adjacent inturned end tabs, and a cover portion having a cover panel hinged to the rear wall panel, a front sealing flap hinged to the front edge of the cover panel and a complementary end sealing flap hinged to each end of the cover panel, which method comprises, inserting merchandise into the assembled body portion, erecting the cover panel into a position substantially co-planar with said rear wall panel, progressively bending said front sealing flap into a position substantially at right angles to the cover panel, applying a relatively narrow strip of adhesive to the front sealing flap, progressively folding the cover panel into a plane substantially parallel to the bottom wall panel and substantially simultaneously tucking the front sealing flap into the body portion, pressing the front sealing flap into sealing engagement with the front wall panel, applying adhesive to the underside of each end wall flap, and pressing each of the end wall flaps into sealing engagement with the adjacent end wall tabs.

7. A machine for closing and sealing packed cartons each of which comprises a body portion defined by bottom, side and end wall panels, and a cover portion hinged to one of said side wall panels comprising a cover panel to which is hinged a front sealing flap and end sealing flaps, said machine comprising means for advancing the carton along a predetermined path, means for bending the front sealing flap into a position substantially at right angles to the cover panel during advance movement of the carton, means for applying a strip of adhesive along substantially the full length of the front sealing flap during advance movement of the carton, means for progressively folding the cover panel into a plane substantially parallel to the bottom wall panel during advance movement of the carton, means for applying adhesive to the underside of each of the end wall flaps during advance movement of the carton, means for folding said end wall flaps downwardly, and means for pressing each of said end wall flaps into sealing engagement with the adjacent end wall panel.

8. A machine for closing and sealing packed cartons of the type wherein each carton comprises a merchandise-containing body portion having a bottom wall panel and front and rear wall panels, a cover panel hinged to the rear wall panel of the body portion and a front sealing flap hinged to the cover panel, said machine comprising means for progressively advancing the carton along a predetermined path, a pair of spaced guide elements operative to support said cover panel therebetween, normally stationary

means for progressively bending the front sealing flap into a position substantially at right angles to the cover panel during advance movement of the carton, means for progressively applying a relatively narrow strip of adhesive along substantially the full length of the front sealing flap during advance movement of the carton, normally stationary means for progressively folding the cover panel into a plane substantially parallel to the bottom wall panel during advance movement of the carton, and means for progressively pressing the front sealing flap into sealing engagement with an adjacent front wall panel of the body portion during advance movement of the carton.

9. A machine for closing and sealing packed cartons of the type wherein each carton comprises a merchandise-containing portion defined by a bottom wall panel, front and rear wall panels, and end wall panels, and a cover portion defined by a cover panel hinged to the rear wall panel of the body portion and a front sealing flap hinged to the cover panel, said machine comprising means for progressively advancing each carton along a predetermined path, a pair of spaced substantially stationary guide elements adapted to receive the cover panel therebetween and operative to maintain said cover panel in substantially erect position during a portion of said advance movement, substantially stationary means for progressively bending said front sealing flap into a position substantially at right angles to the cover panel while supported in erect position, means for progressively applying a strip of adhesive to said front sealing flap during advance movement of the carton, substantially stationary means for progressively folding the cover panel into a plane substantially parallel to the bottom wall panel during advance movement of the carton, and substantially stationary means for tucking the front sealing flap into the carton adjacent the inside face of the front wall panel during advance movement of the carton.

10. A machine for closing and sealing packed cartons of the type wherein each carton comprises a merchandise-containing portion defined by a bottom wall panel, front and rear wall panels and end wall panels, and a cover portion defined by a cover panel hinged to the rear wall panel of the body portion and a front sealing flap hinged to the cover panel, said machine comprising a conveyor belt for progressively advancing said cartons along a predetermined path in predetermined spaced relationship, means normally stationary with respect to said conveyor belts for progressively applying a strip of adhesive to each of said front sealing flaps, means for supporting said front sealing flaps during engagement with said adhesive-applying means, a normally stationary guide plate having a portion for progressively folding the cover panels into a plane substantially parallel to their corresponding bottom panels during advancing movement of the cartons, and a portion for progressively tucking said front sealing flaps into their associated cartons during advance movement of the cartons, and means for progressively pressing said front sealing flaps into adhesive sealing engagement with their corresponding front walls of the cartons during advance movement.

11. A machine for closing and sealing packed cartons of the type wherein each carton comprises a merchandise-containing portion defined by a bottom wall panel, front and rear wall

panels hinged to said bottom wall panel, an in-turned tab hinged to each end of each of said front and rear wall panels, and a bottom end flap hinged to each end of said bottom wall panel and adhesively secured to the adjacent in-turned end tabs, and a cover portion defined by a cover panel hinged to the rear wall panel of the body portion, a front sealing flap and end sealing flaps hinged to the respective front side edge and end edges of the cover panel, said machine including means for progressively advancing each carton along a predetermined path, means for progressively applying a strip of adhesive to the front sealing flap during advance movement of the carton, means for progressively folding the cover panel into a plane substantially parallel to the bottom wall panel during advance movement of the carton, means for progressively pressing the front sealing flap into adhesive engagement with the front wall panel during advance movement of the carton, means adjacent each end of the carton for applying a strip of adhesive to the underside of each of the cover end flaps during advance movement of the carton, and means for progressively pressing each of said cover end flaps into adhesive engagement with the adjacent in-turned end tabs during advance movement of the carton.

12. A machine for closing and sealing packed cartons of the type wherein each carton comprises a merchandise-containing body portion defined by a bottom wall panel, front and rear wall panels and end wall panels, and a cover portion defined by a cover panel and a front sealing flap hinged to said cover panel, said machine including means for progressively advancing each carton along a predetermined path, a pair of normally stationary spaced guide means adapted to receive and support therebetween said cover panel during a portion of the advance movement of the carton, a normally stationary curved deflecting means operative to bend the front wall sealing flap into a position substantially at right angles to the cover panel during advance movement of the carton, and a relatively stationary guide plate operative to progressively fold the cover panel into a position substantially parallel to the bottom wall panel during advance movement of the carton.

13. A machine for closing and sealing packed cartons of the type wherein each carton comprises a merchandise-containing body portion defined by a bottom wall panel, front and rear wall panels and end wall panels, and a cover portion defined by a cover panel and a front sealing flap hinged to said cover panel, said machine including means for progressively advancing each carton along a predetermined path, a normally stationary curved deflecting means operative to bend the front sealing flap into a position substantially at right angles to the cover panel during advance movement of said carton, an applicator positioned to contact the sealing flap for progressively applying a relatively narrow strip of adhesive thereto during advance movement of the carton, and a normally stationary curved deflecting plate having a portion operative to progressively fold the cover panel into a position substantially parallel to the bottom wall panel during advance movement of the carton and a curved portion operative to bend said front sealing flap in overlapping sealing position with respect to said front wall panel.

14. A machine for closing and sealing packed

cartons of the type wherein each carton comprises a merchandise-containing body portion defined by a bottom wall panel, front and rear wall panels and end wall panels, and a cover portion defined by a cover panel and a front sealing flap hinged to said cover panel, said machine including means for progressively advancing each carton along a predetermined path, an applicator positioned to contact the sealing flap for progressively applying a strip of adhesive thereto during advance movement of the carton, a normally stationary curved deflecting plate having a portion operative to progressively fold the cover panel into a position substantially parallel to the bottom wall panel during advance movement of the carton, and a curved tuck-in portion associated with said curved deflecting plate operative to insert the front sealing flap into the carton during advance movement of the carton.

15. A machine for closing and sealing packed cartons of the type wherein each carton comprises a merchandise-containing body portion defined by a bottom wall panel, front and rear wall panels and end wall panels, and a cover portion defined by a cover panel and a front sealing flap hinged to said cover panel, said machine including means for progressively advancing each carton along a predetermined path, normally stationary spaced guide means adapted to receive the cover panel therebetween during advance movement of the carton, a normally stationary curved deflecting means operative to bend the front wall sealing flap into a position substantially at right angles to the cover panel during advance movement of the carton, an applicator positioned to contact the sealing flap for progressively applying a strip of adhesive thereto during advancing movement of the carton, a normally stationary curved deflecting plate having a portion operative to progressively fold the cover panel into a position substantially parallel to the bottom wall panel during advance movement of the carton and a curved portion adapted to progressively fold the front sealing flap into a position adjacent said front wall panel during advance movement of the carton, and means for progressively pressing the front sealing flap into adhesive engagement with the front wall panel during advance movement of the carton.

16. A machine for closing and sealing packed cartons of the type wherein each carton comprises a merchandise-containing body portion defined by a bottom wall panel, front and rear wall panels and end wall panels, and a cover portion defined by a cover panel and an end wall flap hinged to each end of said cover panel, said machine including means for progressively advancing said carton along a predetermined path, means for progressively folding the cover panel into a position substantially parallel to the bottom wall panel during advance movement of the carton, applicator means positioned adjacent each end of the carton for applying a strip of adhesive to the underside of each end wall flap during advance movement of the carton, means positioned adjacent each end of the carton for folding the adjacent end wall flap downwardly during advance movement of the carton, and means positioned at each end of the carton for pressing each downwardly folded end wall flap into adhesive engagement with the adjacent end wall panel during advance movement of the carton.

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