

Sept. 15, 1959

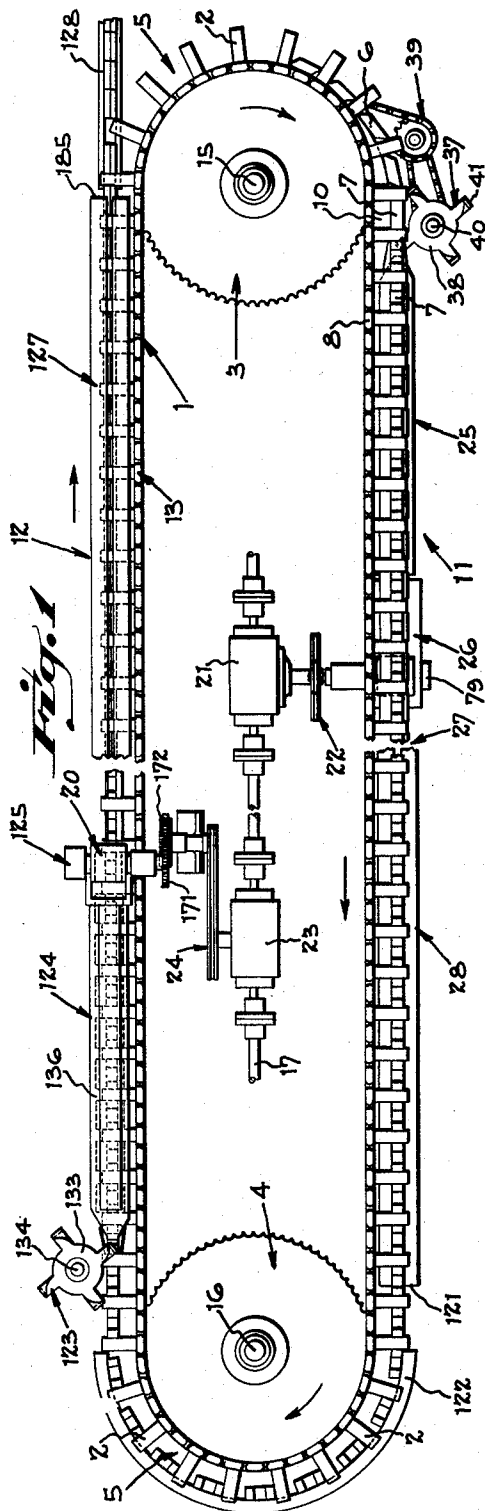
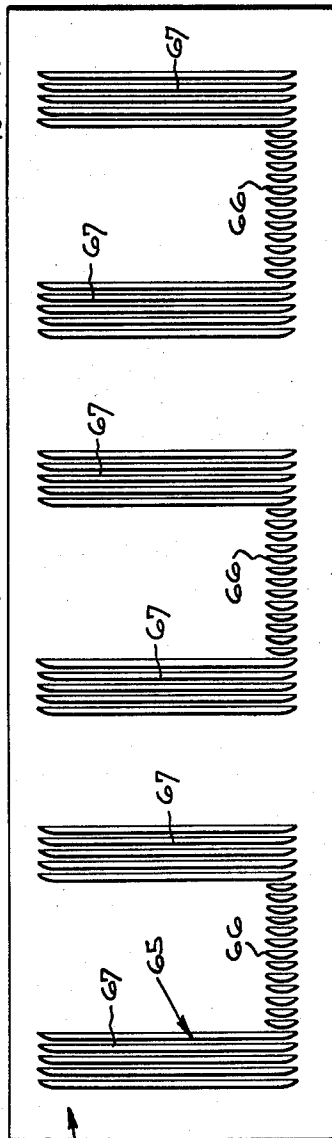
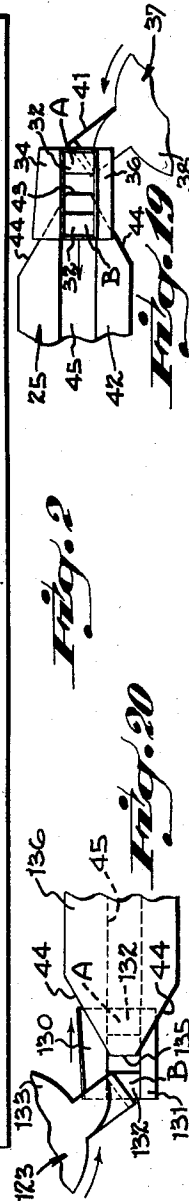
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2,903,833

HIGH SPEED CARTON CLOSING AND SEALING APPARATUS

Filed Nov. 8, 1957

6 Sheets-Sheet 1



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6 Sheets-Sheet 2

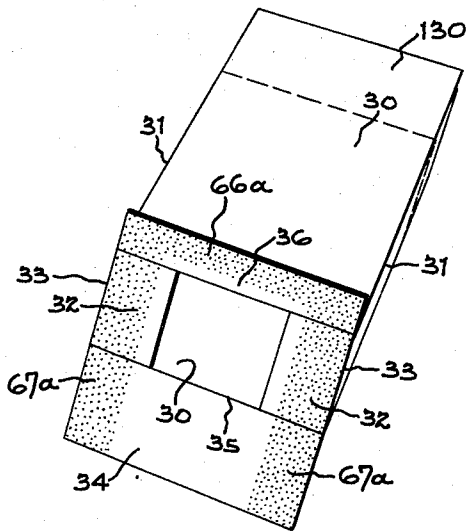


Fig. 3

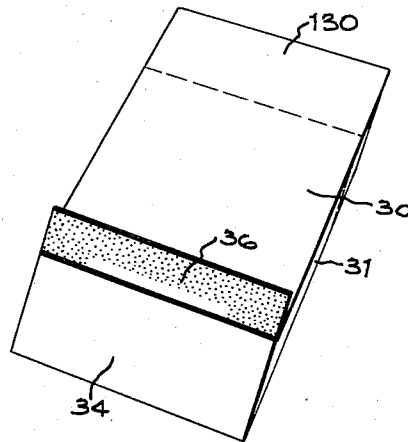


Fig. 4

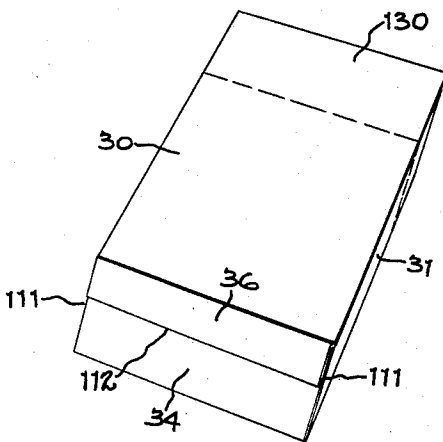


Fig. 5

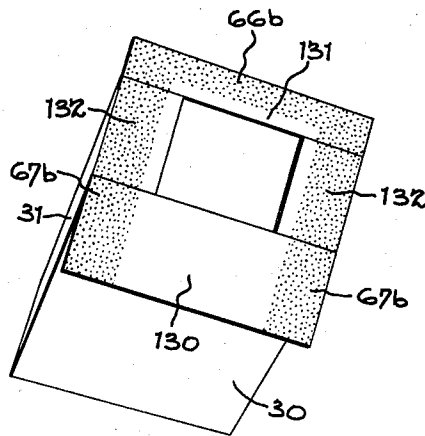


Fig. 6

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6 Sheets-Sheet 3

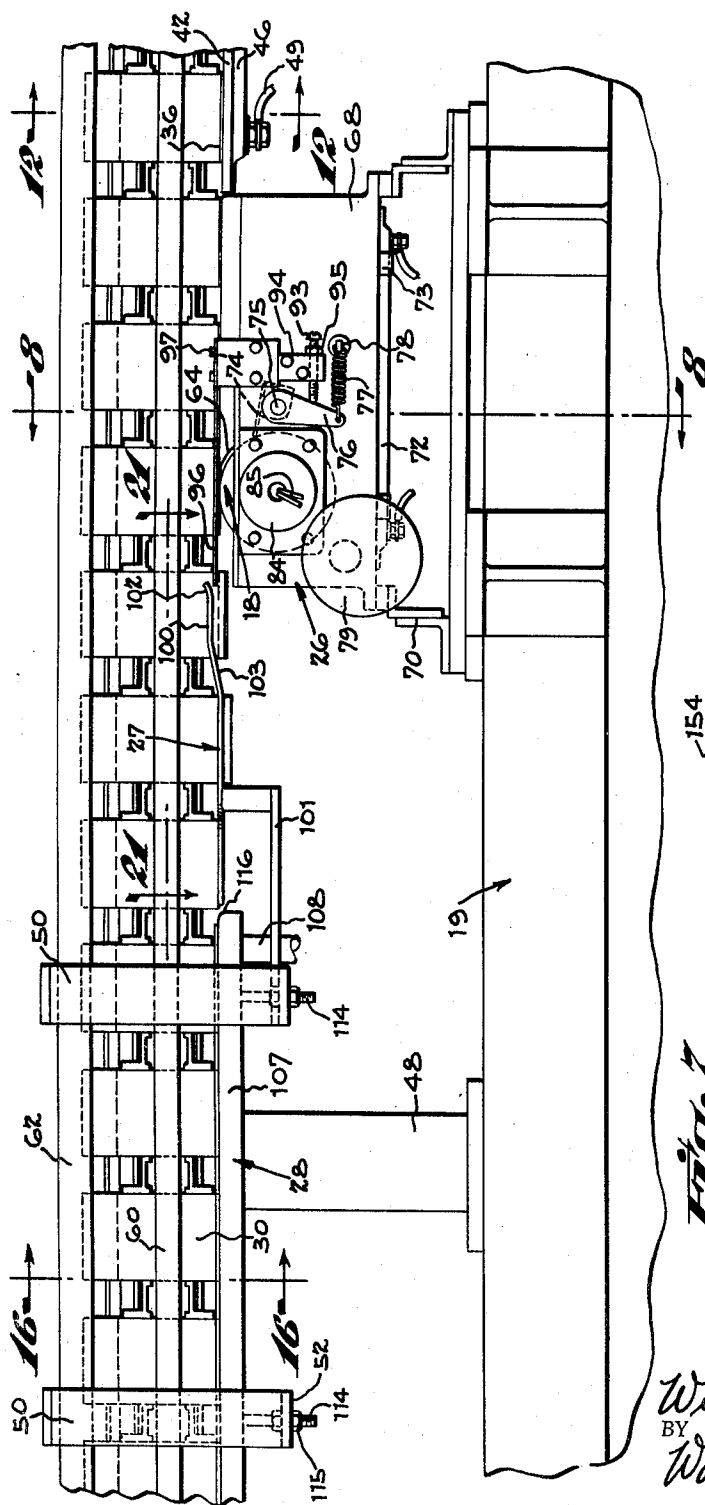


Fig. 1

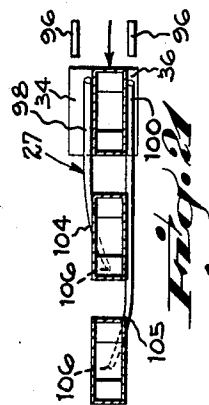


Fig. 18

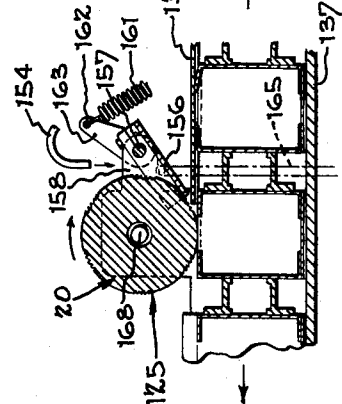


Fig. 19

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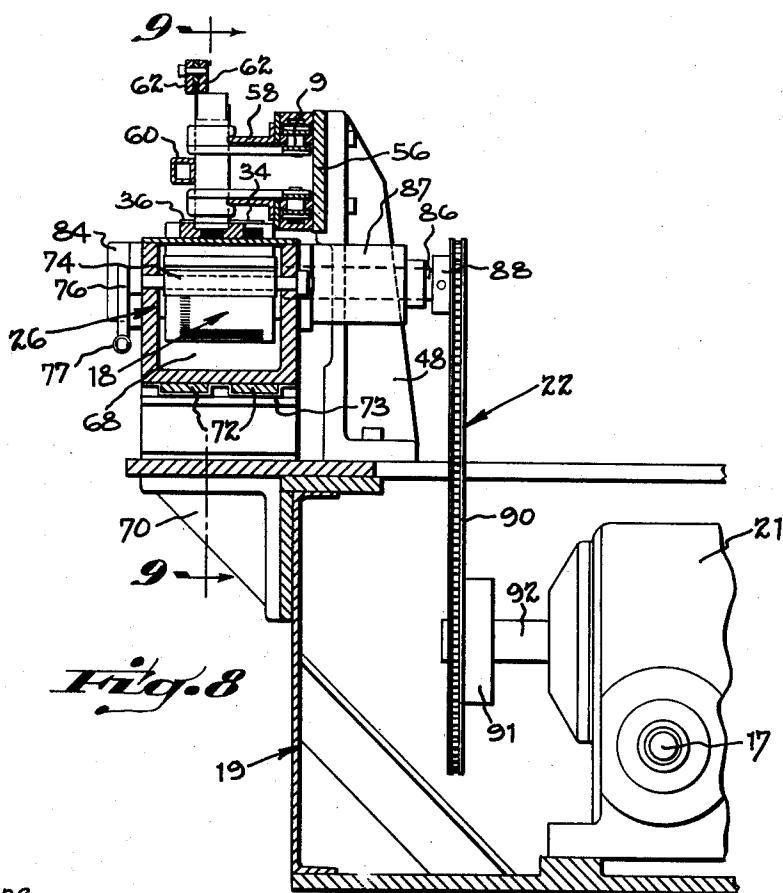
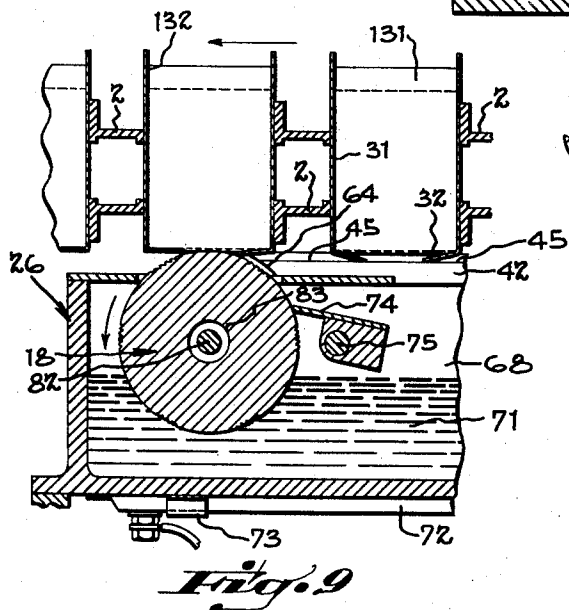
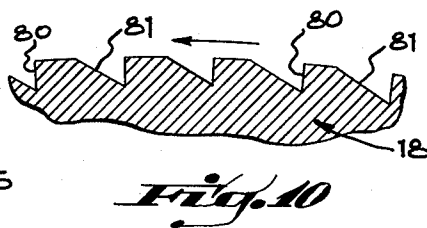
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HIGH SPEED CARTON CLOSING AND SEALING APPARATUS

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6 Sheets-Sheet 4



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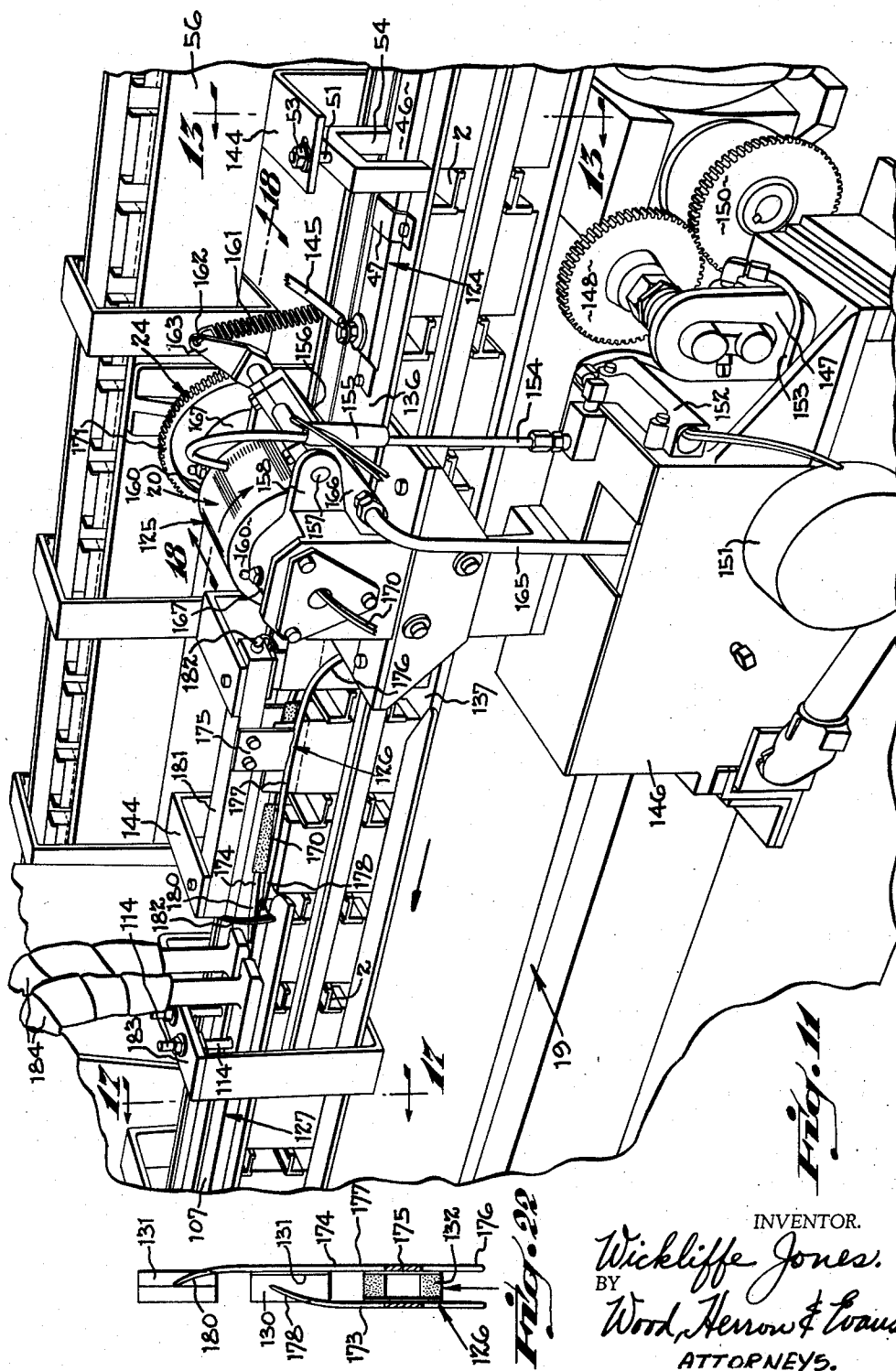
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HIGH SPEED CARTON CLOSING AND SEALING APPARATUS

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6 Sheets-Sheet 5



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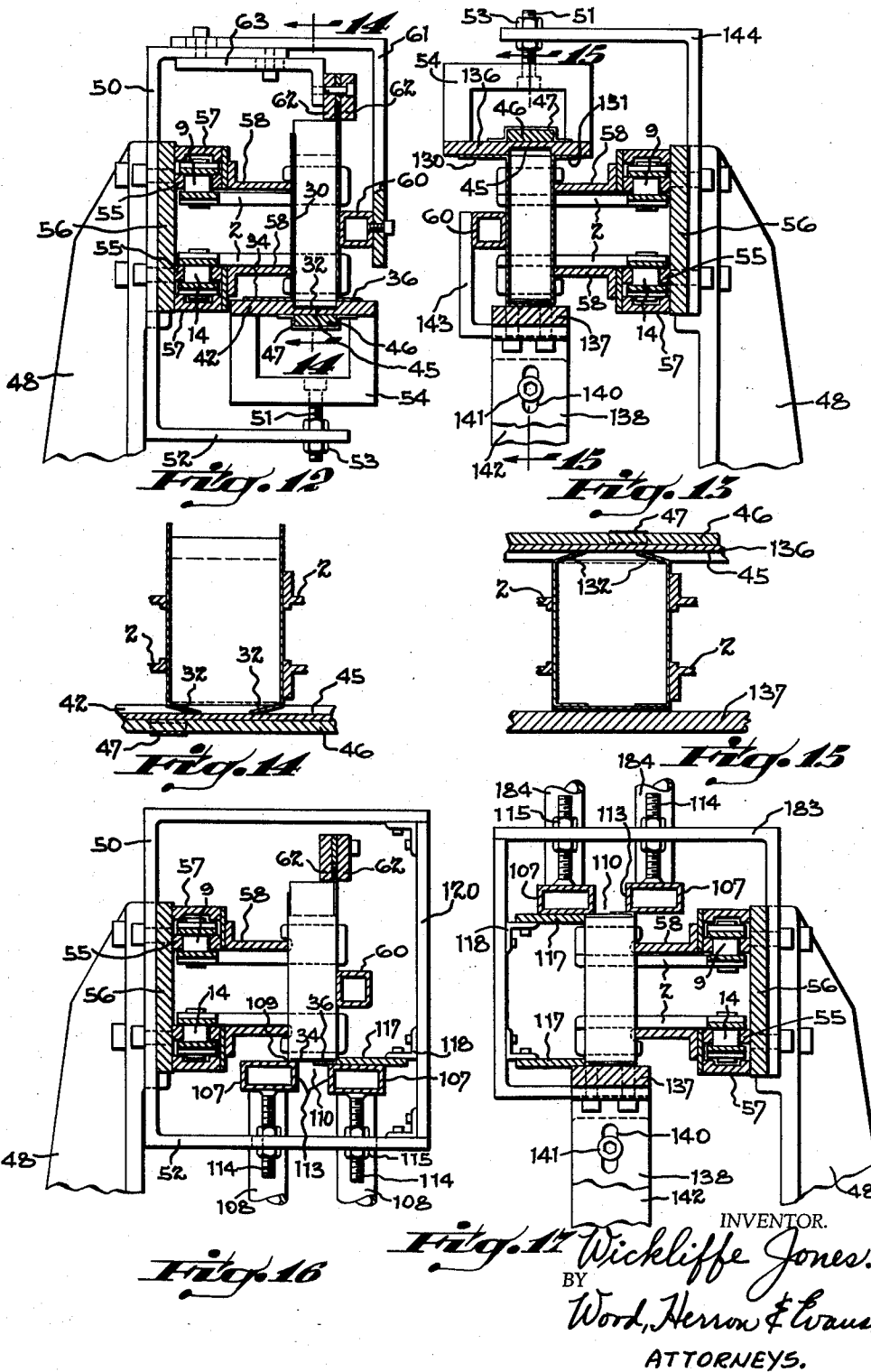
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HIGH SPEED CARTON CLOSING AND SEALING APPARATUS

Filed Nov. 8, 1957

6 Sheets-Sheet 6



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2,903,833

HIGH SPEED CARTON CLOSING AND SEALING APPARATUS

Wickliffe Jones, Cincinnati, Ohio, assignor to R. A. Jones & Co., Inc., Covington, Ky., a corporation of Kentucky

Application November 8, 1957, Serial No. 695,251

17 Claims. (Cl. 53—375)

This invention relates to a high speed cartoning machine for sealing the flaps of cartons, utilizing a hot, fast setting thermoplastic adhesive as the flap sealing agent. The present flap sealing apparatus is intended particularly to act upon the cartons as they are fed at high speed in partially erected condition by the carton feeding apparatus as disclosed in my copending application entitled "High Speed Carton Handling Apparatus," Serial No. 702,946, filed on December 16, 1957.

The cartons, for which the apparatus is particularly intended, are fabricated from a suitable paper stock which is impregnated with paraffin or a similar moisture-resistant material for protecting the contents, usually granulated materials, which are loaded into the cartons. The cartons include closure flaps at respective opposite ends; the cartons are partially erected and are fed by the carton handling apparatus to the present cartoning machine in an upright position with the flaps projecting endwisely from the upper and lower ends of the cartons.

The present carton closing and sealing apparatus includes a continuously advancing conveyor system having spaced lugs which project outwardly and the cartons are fed to the spaces between the lugs in time with the advancement of the lugs. During high speed advancement along the downstream run of the conveyor, the bottom flaps of the cartons are closed and sealed, and at the downstream end, the contents of the cartons are fed into them. The top flaps of the cartons subsequently are closed and sealed as the cartons are advanced by the conveyor along its upstream run. The loaded cartons, with the flaps sealed at opposite ends, are then discharged.

In the present disclosure, the major flaps project from the side walls of the carton and the side flaps project from the end walls. During passage through the sealing apparatus, the side walls and their major flaps reside parallel with the path of advancement and the end walls and their flaps reside transversely to the path of advancement. In order to indicate clearly the relationship of the flaps during advancement through the apparatus, the major flaps are called "side wall flaps" and the side flaps are called "end wall flaps" in the present disclosure.

One of the objectives of the present invention has been to provide means for rapidly pre-heating the flaps of the advancing cartons before application of the hot thermoplastic glue, so as to partially expel the paraffin and improve penetration of the hot liquid glue as it is applied to the flaps. As the cartons are fed into the present apparatus, with the flaps projecting outwardly from opposite ends, the lower end wall flaps are folded inwardly toward one another and the lower side wall flaps are spread outwardly in opposite directions. Thereafter, the cartons advance along a longitudinal flap heating bar which extends along the downstream conveyor run, with the flaps presented to the top surface of the bar. This bar is heated to a temperature sufficiently high to pre-heat the flaps quickly and partially expel the paraffin for application of the heated glue.

Another feature resides in the arrangement of the heat-

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ing bar, whereby the pre-heated flaps spring naturally, by their own resiliency, into tracking engagement with a rotating lower glue applicator roll, as they issue at a continuous rate from the downstream end of the heating bar. For this purpose, the heating bar includes a depressed longitudinal channel or passageway slidably contacting the infolded ends of the end wall flaps, the flaps being only partially closed so as to retain a portion of their resiliency. The outwardly folded side wall flaps advance in facial sliding contact with the raised surface of the bar on opposite sides of the channel; hence, the side flaps also tend to spring downwardly. As the cartons advance from the downstream end of the heating bar in pre-heated condition, the flaps spring naturally into tracking contact with the periphery of the lower glue roll which resides adjacent the end of the heating bar. The lower glue roll is provided with a series of glue printing areas and is driven at constant speed in synchronism with the carton conveyor, such that each printing area advances at a surface speed corresponding to the lineal speed of the flaps and imprints the glue pattern upon the surface of the flaps as they track across across the periphery of the roll.

Another aspect of the invention resides in a glue roll structure which is capable of imprinting the glue patterns in a positive manner while rotating at a relatively high speed in time with the lineal rate of carton advancement. The thermoplastic glue is applied in heated condition to the roll and the roll itself is also heated sufficiently to keep the adhesive in a liquid state as it is applied to the flaps. Excess glue is removed from the periphery of the roll by a scraper device, such that only the residual glue, which is trapped in the printing area, is carried to the flap surfaces. The thermoplastic glue, when heated to the temperature required for liquefying it, is of low viscosity and tends to be displaced from the roll because of its high rate of rotation. However, according to the present invention, the glue patterns of the roll are delineated by incised cavities extending parallel with the axis of roll rotation, each cavity being generally V-shaped in cross section. Each V-shaped cavity, at its trailing side, has a wall which is radial to the axis of rotation, the radial wall being joined by an upwardly inclined wall which forms the leading side of the cavity. It has been found that this configuration prevents the sweep-out of the hot glue and imprints the glue patterns on the flaps in a reliable manner under high speed roll rotation.

A further objective has been to provide a chill section for chilling the flaps quickly after the hot glue pattern is applied, thereby to set the thermoplastic glue and permanently seal the bottom flaps before the cartons are loaded. As the cartons advance from the glue roll, with the end wall flaps (side flaps) folded inwardly to closed position, the side wall flaps (major flaps) are sequentially folded to closed position one upon another into contact with the end wall flaps, such that the glue-coated flap surfaces are brought into facial engagement. Thereafter, the closed bottom flaps advance immediately to the chill section with the folded flaps in sliding contact with a chill surface; the chill section extends longitudinally along the downstream conveyor run to the loading end of the machine.

An important aspect of the invention resides in an arrangement whereby the flap chilling section is kept free of excess adhesive which tends to ooze from the closed flaps after they pass from the flap closing station with the hot liquid glue compressed between the flap interfaces. For this purpose, the flap chilling section comprises parallel chill tubes spaced apart from one another and having flat surfaces which establish a sliding contact with the closed flaps along their edgewise portions adjacent the carton side walls. To provide rapid chilling, liquid re-

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frigerant is circulated through the chill tubes. The excess hot glue, which tends to ooze from the closed flaps normally will adhere to the chill surface if the chill surfaces extend completely across the folded flaps. As a consequence, this excess glue eventually will build up to a point where machine operation is impaired seriously. By providing spaced chill tubes according to the principle of this invention, the longitudinal seam delineated by the folded flaps advances lengthwise along the space between the parallel chill tubes and any excess glue appearing along this line is solidified without contact with the chill surface. Moreover, since the transverse seams span the space between the parallel chill tubes, the major portion of the hot glue, which may ooze out along the transverse seams, is isolated from the chill surfaces and hence does not adhere to them. It has been found that the small percentage of glue which appears along the transverse seams does not adhere to the bearing surfaces, but instead, creeps along the vertical faces of the chill tubes and adheres where it does not interfere in any way with continuous motion of the cartons along the chill surfaces.

As the cartons advance from the downstream end of the chill tubes with the bottom flaps closed and permanently sealed, they pass around an idler sprocket assembly; during this brief period, the granulated material is charged into the cartons through their open upper ends (with the top flaps projecting upwardly), then the cartons advance along the top flap closing and sealing apparatus which extends along the upstream run of the conveyor system. The top flap closing and sealing apparatus follows the principles outlined above, except that its components reside in a plane suitable to act upon the top flaps.

Described briefly, the top flaps of the loaded cartons are intercepted by a preliminary flap folding station which folds the end wall flaps (side flaps) inwardly toward one another and spreads the side wall flaps (major flaps) outwardly in opposite directions. The top flaps then advance along a top flap heating bar which pre-heats and partially expels the paraffin from the flaps as the cartons advance toward an upper glue roll mounted in position to act upon the top flaps. The upper glue roll includes glue printing areas similar to those of the lower roll and is rotated at a surface speed to imprint the glue pattern upon the advancing flaps. Thereafter, the side wall flaps are folded sequentially to closed position and advanced along parallel chill tubes residing above the top flaps. The chill tubes set the glue and cause the cartons to be delivered with their top flaps permanently sealed as they pass from the upstream end of the chill tubes.

The various features and advantages of the invention will be more clearly apparent to those skilled in the art from the following description, taken in conjunction with the drawings.

In the drawings:

Figure 1 is a top plan view of the cartoning machine showing in general the location of the several components which act upon the carton flaps.

Figure 2 is a developed view of the glue roll which applies the hot thermoplastic adhesive to the flaps.

Figure 3 is a perspective view of one of the cartons, showing the adhesive pattern which is applied to the bottom flaps by the lower glue roll.

Figure 4 is a similar perspective view showing the bottom flaps in partially folded position after the carton has advanced beyond the lower glue roll.

Figure 5 is a perspective view showing the bottom flaps completely folded and adhesively sealed.

Figure 6 is a perspective view of the carton showing the glue pattern which is applied to the upper flaps by the upper glue roll after the contents have been introduced into the carton.

Figure 7 is an enlarged fragmentary side elevation showing the downstream section of the machine which acts upon the bottom flaps.

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Figure 8 is a sectional view taken along line 8—8 of Figure 7, illustrating the lower glue roll and associated parts.

Figure 9 is a sectional view taken along line 9—9 of Figure 8, further detailing the lower glue roll structure.

Figure 10 is an enlarged fragmentary view taken from Figure 9, detailing the glue-retaining cavities which are incised in the periphery of the glue roll.

Figure 11 is a fragmentary perspective view of the upstream section of the machine which acts upon the top carton flaps.

Figure 12 is a cross sectional view taken along line 12—12 of Figure 7, detailing the carton conveyor and heating bar which pre-heats the bottom flaps before the adhesive is applied to them along the downstream conveyor run.

Figure 13 is a sectional view taken along line 13—13 of Figure 11, illustrating the heating bar which pre-heats the top flaps as the filled cartons advance along the upstream run toward the upper glue roll.

Figure 14 is a sectional view taken along line 14—14 of Figure 12, detailing the heating bar and relationship of the bottom flaps as the carton is advanced to the lower glue roll.

Figure 15 is a sectional view taken along line 15—15 of Figure 13, detailing the relationship of the heating bar and top flap as the filled cartons approach the upper glue roll.

Figure 16 is a sectional view taken along line 16—16 of Figure 7, showing the chill bars acting upon the bottom flaps to chill and set the adhesive after the flaps have been closed.

Figure 17 is a sectional view taken along line 17—17, of Figure 11, showing the arrangement of chill bars which act upon the upper flaps to chill and set the adhesive after the flaps have been closed.

Figure 18 is a sectional view taken along line 18—18 of Figure 11, further detailing the upper glue roll and associated parts.

Figure 19 is a diagrammatic view taken from Figure 1, illustrating the mechanism which closes the lower end wall flaps.

Figure 20 is a diagrammatic view, also taken from Figure 1, showing the mechanism for closing the upper end wall flaps.

Figure 21 is a diagrammatic sectional view taken along line 21—21 of Figure 7, showing the bars which close the lower side flaps after the adhesive is applied.

Figure 22 is a similar view taken from Figure 11, showing the bars which close the upper side flaps.

Structure and operation generally

Referring to Figure 1, the cartoning machine of this invention comprises a chain conveyor indicated generally at 1 having spaced lugs 2 which project outwardly for advancing the cartons serially through the flap closing and sealing apparatus. The conveyor 1 is advanced by a drive sprocket assembly 3 delineating the receiving or intake end of the machine. The downstream end of the chain conveyor passes about an idler sprocket assembly 4, which delineates the carton loading end of the machine.

The carton feeding apparatus disclosed in the aforesaid copending application resides adjacent the sprocket assembly 3 and advances the cartons individually into the radial throats 5 delineated by the lugs as they pass about the sprocket assembly 3. The cartons are in partially erected condition as they are fed into the throats, as indicated at 6, as the lugs pass around the sprocket assembly 3, they shift progressively to parallel relationship with one another to bring the partially erected cartons to their final rectangular shape, as indicated at 7.

As disclosed in the copending application, the partially erected cartons, as advanced by the carton feeder into the throats, are confined in position by an arcuate guide structure. This structure forms no part of the present

invention and has been omitted. As shown in Figure 1, the cartons 6 are guided into alignment with the downstream run 8 of the conveyor by an internal guide rail 10, located generally at a tangent to the sprocket assembly 3. It will be understood at this point, that the cartons are provided with closure flaps at opposite ends and that these flaps project endwisely from opposite ends of the cartons as they are fed into the throats 5.

According to the present apparatus, the lower carton flaps are closed and sealed by the lower flap sealing apparatus, indicated generally at 11 in Figure 1. This apparatus extends along the downstream run 8 of the conveyor and closes and seals the flaps as the cartons are advanced toward the idler sprocket assembly, as indicated by the arrow. As the cartons are advanced around the idler assembly 4, with their bottom flaps closed and adhesively sealed, the contents are fed into the open upper ends of the cartons by a loading apparatus (not shown) which is located adjacent the idler assembly 4.

The top flap closing and sealing apparatus, which is indicated generally at 12 extends along the upstream run 13 of the conveyor. As the filled cartons advance upstream, as indicated by the arrow, the top flap apparatus closes and seals the top flaps, then the filled and sealed cartons are discharged from the machine. The various parts of the apparatus are mounted upon a machine base indicated generally at 19 in Figure 7.

As disclosed in the copending application, the conveyor 1 comprises an upper chain run 9 and lower chain 14 (Figures 12 and 13) each chain having corresponding lugs 2 spaced one above the other to engage the upper and lower portions of the cartons. The sprocket assembly 3 consists of duplicate sprockets spaced one above the other upon a common drive shaft 15 for advancing the upper and lower chains in unison. The sprocket shaft 15 is driven in synchronism with the carton feeding apparatus, as explained later, such that the cartons are fed to the throats 5 in time with the advancement of the conveyor lugs. The idler sprocket assembly 4 also comprises upper and lower sprockets for the two chains, the sprockets being mounted upon a common idler shaft 16.

As shown in Figure 1, the cartoning machine is driven by a main drive shaft 17 which is in driving connection with the shaft 15 of the drive sprocket assembly 3. Drive shaft 17 also is in driving connection with the carton feeding apparatus, as disclosed in the copending application, which that the partially erected cartons 6 are fed into the radial throats 5 in time with the advancement of the conveyor lugs. The main drive shaft 17 likewise is in driving connection with the lower glue roll 18 (Figure 9) and upper glue roll 20 (Figure 18) the glue rolls being driven at surface speeds corresponding to the speed of advancement of the cartons, in order to print the glue patterns in registry with the advancing carton flaps. For this purpose, main drive shaft 17 (Figure 1) includes a gear box 21 and driving system 22 connected to the lower glue roll 18; a similar gear box 23 and driving system 24 is connected to the upper roll 20.

Lower flap pre-heating section

Described generally with reference to Figure 1, the lower flap closing and sealing apparatus 11 includes a flap heating section, indicated generally at 25, extending from the infeed end to the lower glue station 26, which includes the lower glue roll 18, previously noted. Downstream from the glue station 26 there is located a side flap closing station, indicated at 27 (Figures 7 and 21) for closing the flaps after the adhesive pattern is applied to them at the glue station 26. An elongated flap chilling section 28 extends downstream from the flap closing station 27 to the idler assembly 4.

Referring to Figures 3, 4 and 5, the carton for which the present apparatus is intended, comprises a rectangular body formed of paper stock impregnated with paraf-

fin, and having opposed side walls 30—30 and opposed end walls 31—31. The end walls of the carton body are provided with pairs of side flaps 32—32 formed as an integral part of the end walls 31 and joined thereto along the fold lines 33—33. The side flaps 32—32 are hereinafter called "end wall flaps" since they are joined to the end walls.

One of the side walls 30 includes an inner major flap 34 joined to the side wall along the fold line 35. The inner major flap 34 is dimensioned to form the bottom of the carton when folded to closed position as shown in Figure 5. The opposite side wall includes an outer major flap 36 which partially overlies the major flap 34 when the flaps are closed and sealed (Figure 5). The inner and outer major flaps 34 and 36 are hereinafter called "side flaps" since they are joined to the side walls of the carton.

The upper end of the carton is provided with similar flaps; however, the position of the two side flaps at the upper end are reversed with respect to the lower end, as described later.

As the cartons assume the rectangular shape indicated at 7 in Figure 1, with the flaps projecting endwisely from the walls of the carton, the lower flaps are acted upon by a preliminary flap folding station, indicated generally at 37 in Figures 1 and 19. At this station, the end wall flaps 32—32 are folded inwardly, and at the same time, the side wall flaps 34 and 36 are spread outwardly to the position shown in Figure 3 to receive the glue pattern.

As shown in Figure 1, the preliminary folding station 37 comprises a rotating flap closing wheel 38 mounted upon a vertical shaft 40 and having radially projecting fingers 41. A driving system, indicated generally at 39, connects shaft 40 with the main drive shaft 17 such that the fingers are advanced in synchronism with the conveyor lugs 2. The vertical shaft 40 is journaled in bearings mounted on base 19 and the wheel resides in a horizontal plane which is common to the lower ends of the cartons as they are advanced by conveyor 1.

The outer ends of the fingers 41 are spaced apart somewhat greater than the spacing of lugs 2, and the end portion of the fingers advance at a higher velocity than the lugs. The timing is such that one of the fingers intercepts the trailing end flap 32, as indicated at A in Figure 19, and folds the flap forwardly to closed position as the flap advances toward the leading end of the heating section 25. As the trailing flap A is folded, the leading end flap, indicated at B, is also folded, as described below. The heating section has an upper surface residing in a plane generally common to the lower end of the carton, such that the end flaps are held in partially closed position by the heating section as the cartons are advanced along it.

As indicated in Figure 19, the heating section 25 comprises a flap heating rail or bar 42 having a flat leading end 43 and diverging side edges 44—44. As the carton advances, the leading end flap B first is folded inwardly as it is intercepted by the flat 43, while the trailing flap A is folded inwardly by the advancing fingers 41; flap A is held by the finger in this position until it passes across the flat 43 to be engaged by the top surface of heating bar 42. As the infolded end flaps pass across the flat leading end 43, the side flaps 34 and 36 are intercepted by the diverging edges 44 and are thus spread outwardly by camming action.

The upper surface of heating bar 42 (Figures 12 and 14) is provided with a shallow longitudinal channel 45 having a width to receive the infolded end flaps 32, with the outer ends of the flaps in sliding engagement with the surface of channel 45. After passing across the leading end portion of heating bar 42, the carton advances along the bar with its side flaps 34 and 36, facially engaging the top surface of bar 42 (Figure 12) while the end flaps 32 are bent inwardly, at an angle less than 90 degrees, since they engage the surface of channel 45

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which is depressed below the top surface of heating bar 42. Accordingly, the end flaps 32 retain sufficient resiliency to spring against the periphery of the lower glue roll 18 (Figure 9) to receive the glue pattern. The side flaps 34 and 36 also retain sufficient resiliency to spring into contact with the glue roll.

Heating bar 42 is heated by an electrical heating element 46 (Figures 12 and 14) which is coextensive with the heating bar. Electrical energy is conducted to heating element by cables 49, as shown in Figure 7. The electrical element is clamped in contact with the lower surface of the heating bar by a series of U-shaped clips indicated at 47. The heating element heats bar 42 sufficiently to pre-heat the side and end flaps as they advance in contact with the bar surface toward the lower glue roll 18. Pre-heating the flaps partially expels the paraffin and in this way, creates better glue penetration as the flaps pass across the periphery of the lower glue roll 18.

Described in detail with reference to Figures 7 and 12, heating bar 42 is supported upon the machine base 19 by a series of vertical brackets 48 supporting a longitudinal support rail 56 (Figure 12). In order to adjust the heating bar 42 to the proper elevation, it is supported along rail 56 by a series of channel brackets 50, each having vertical adjustment screws 51 passing through the lower horizontal limbs 52 of the brackets 50; the screws 51 are locked in adjustment by nuts 53. The upper portion of each adjusting screw is joined to a U-shaped support bracket 54 depending downwardly from the heating bar.

As best shown in Figure 12, the upper and lower chain runs 9 and 14 are guided in their respective planes by the opposed chain guides 55 which are supported by the longitudinal support rail 56 carried by the vertical brackets 48. The parallel chain guides 55 are held in spaced relationship by a connecting rail structure indicated at 57. As shown, the lugs 2 of the parallel chain runs project outwardly and contact the upper and lower portions of the cartons so as to maintain the cartons in a perpendicular position with the lower flaps in sliding contact with the bar 42.

The cartons are guided laterally by a pair of longitudinal carton guides 58—58 projecting outwardly from the upper and lower chain guide structures 57, the outer edges of the carton guides 58 being in sliding contact with one side wall 30 of the carton. The opposite side wall 30, at a midpoint along its length, is in sliding contact with an intermediate carton guide 60, such that the carton is held laterally in an upright position by the sliding contact of the guides 58 and 60. The carton guide 60 is supported by a series of L-shaped brackets 61 attached to the respective channel brackets 50. The lateral carton guides 58 and 60 extend for the full length of the lower flap sealing apparatus.

As the cartons are advanced, the top side flaps of the cartons are held in upright position by a pair of spaced rails 62—62 which slidably engage the side flaps along opposite sides (Figure 12). The spaced flap rails 62 are supported from the U-shaped brackets 50 by L-shaped brackets 63. The flap rails 62 also extend for the full length of the lower flap sealing apparatus, as indicated in Figure 7.

Lower glue station

As best shown in Figures 7 and 9, the heating bar 42 terminates as at 64 adjacent the periphery of the lower glue roll 18. It will be seen in this view, that the periphery of the roll passes through a plane common to the top surface of the heating bar 42, such that the advancing end flaps 32 and side flaps 34 and 36 track across the periphery of the roll. As noted earlier, the end flaps 32 retain sufficient resiliency to spring naturally into contact with the periphery of the roll as they track across it. The side flaps 34 and 36 also spring naturally

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into contact with the glue roll as they pass beyond the end 64 of the heating bar (Figure 8).

As shown in the development of the lower glue roll 18 (Figure 2), it carries upon its periphery a series of glue patterns 65 which are formed by parallel grooves cut into the periphery of the rail. Each glue pattern 65 is U-shaped comprising a base section 66 joined to a pair of parallel limbs 67—67. As explained earlier, the glue roll 18 is driven in time with the conveyor 1 (main drive shaft 17, gear box 21 and driving system 22) so as to track upon the flaps at a surface speed corresponding to the lineal advancement of the cartons. The spacing of the glue patterns 65 is related to the spacing of the cartons by the conveyor lugs to cause the glue patterns to register with the carton flaps. Accordingly, as shown in Figure 3, the base section 66 is imprinted as at 66a upon the side wall flap 36, while the limb portions 67 are imprinted upon the end flaps 32 and side wall flap 34, as indicated at 67a. After passing across the glue roll 18, side wall flap 34 is folded inwardly into contact with the end wall flaps 32 (Figure 4) then the side wall flap 36 is folded over in overlapping position upon the free edge portion of the side wall flap 34 as shown in Figure 5. The flaps are closed in this sequence by the flap closing station 27 as described later.

The lower glue station 26, of which roll 18 forms a part comprises a glue reservoir 68 (Figure 9) mounted upon brackets 70 supported by the machine base 19, as indicated in Figure 8. The thermoplastic glue 71 is kept in a liquid state by electrical heating elements 72 attached as at 72 to the bottom of the reservoir. The glue temperature is regulated by a thermostat 79, of conventional design, interconnected with the electrical heating elements. The lower portion of glue roll 18 passes through the hot liquid glue, such that a film of glue adheres to the surface of the roll. The excess glue is scraped from the smooth surface of the roller by a scraper plate 74 mounted upon a pivot shaft 75.

As shown in Figure 7, the outer end of pivot shaft 75 includes a lever 76 having its free end connected to a tension spring 77 anchored as at 78 to reservoir. The tension of the spring biases the free end of the scraper 74 yieldably against the roll, with the scraper plate generally tangent to the periphery of the roll. By virtue of this arrangement, excess glue is scraped from the roll and is drained back to the reservoir. However, since the glue pattern comprises cavities residing below the periphery of the roll, the cavities retain the glue as the pattern passes under the edge of the scraper plate; hence, only the indicated portions of the flaps receive the glue pattern. The pressure of the scraper upon the roll is regulated by an adjustment device as explained later.

It will be noted in Figure 10, that each groove or cavity is generally V-shaped, being delineated by a vertical wall 80 and an upwardly inclined wall 81. The vertical wall 80 resides at the trailing end of the cavity with respect to the direction of roll rotation as indicated by the arrow. It has been found that the glue tends normally to be displaced outwardly from cavities which are semi-circular or rounded in configuration, due to the high rate of rotation of the glue roll in the present apparatus. This problem is accentuated when using hot melt glue of the present type, which is of low viscosity under the temperature found necessary for high speed operation. The V-shaped configuration of the cavity, in which the trailing wall 80 of the cavity is radial in relation to the axis of roll rotation, has been found to overcome this difficulty and to apply the glue patterns rapidly in a reliable manner.

In order to maintain the thermoplastic glue at a liquefying temperature, the glue roll 18 includes an internal heating element 82 (Figure 9). Element 82 resides in a cavity 83 extending axially into the roller; the element is supported by a cap 84 attached to the wall of the reservoir (Figure 7). Electrical energy is supplied to the

heating element by the cables 85 (Figure 7) passing through cap 84 and connected to element 82.

As best shown in Figure 3, the glue roll 18 is carried by a shaft 86 projecting from one end of the roll and journaled in a bearing bracket 87 attached to the side wall of the reservoir opposite the cap 84. Shaft 86 is driven by the driving system 22, comprising a sprocket 88 having a chain 90 passing over a second sprocket 91. Sprocket 91 is mounted upon a shaft 92 projecting from the gear box 21, which is driven from main shaft 17, as noted earlier with respect to Figure 1.

In order to regulate the pressure of scraper plate 74 against the periphery of the glue roll, there is provided an adjustment screw 93 (Figure 7) threaded through a block 94 attached to the wall of the reservoir, the screw having its end in contact with the scraper lever 76. The adjustment screw 93 is locked in set position by a nut 95. It will be noted that the adjustment screw opposes the tension spring 77; hence, the pressure of the scraper plate upon the periphery of the roll may be regulated precisely by manipulating the screw.

As shown in Figures 7 and 21, the glue station 26 includes a pair of longitudinal flap retainer plates 96—96 passing above the glue roll in a position to overlie the side flaps 34 and 36 as they advance across the glue roll. The retainer plates are supported in cantilever fashion by a block 97 attached to the wall of the glue reservoir. These plates hold the flaps down for positive engagement by the lower flap closing station 27 after the glue is applied to the flaps.

Lower flap closing station

As best shown in Figures 7 and 21, the lower flap closing station 27 comprises a pair of bars 98 and 100. These bars are mounted in stationary position by a bracket 101 which is attached to one of the channel brackets 50. The bars 98 and 100 extend parallel with one another and each is provided with a flap-receiving end which is curved upwardly as at 102 above the downstream end of the flap restraining plates 96, such that the flaps pass beneath the bars 98 and 100 without interference. As shown in Figure 21, bar 98 acts upon the side wall flap 34 (inner major flap) while bar 100 acts upon the short side wall flap 36 (outer major flap). As the flap advances along the upstream portions of the bars 98 and 100, they slide along the downwardly inclined portions 103 (Figure 7) of the bars. These inclined portions progressively shift the flaps from the outwardly spread position, downwardly to a vertical position; thereafter, the flaps 34 and 36 are folded sequentially to closed position by the bars into sealing contact with the previously folded end flaps 32, as explained below.

The sequential closing of the main flap and sealing flap is brought about by the curved endwise sweep 104 of bar 98 and a similar curved sweep 105 of bar 100, which is located downstream in the direction of carton advancement (Figure 21). As shown in Figure 7, the straight upstream portion of the back bar resides above the lower end of the cartons and the downwardly inclined portion 103 of each descends to a plane parallel with the lower end of the carton. The curved sweeps 104 and 105 extend from the lower ends of the inclined portions 103 in plane with the lower ends of the cartons.

As the cartons advance, as indicated in Figure 21, the inner major flap 34 progressively is cammed through an arc to its closed position by the sweep 104. As soon as flap 34 is closed, the outer major flap 36 is intercepted by sweep 105 and progressively is cammed to closed position overlying the free edge portion of flap 34 (Figure 5). The spacing between the ends 106—106 of the two sweeps is such that the inner flap 34 is held closed by sweep 104 as sweep 105 begins to close the outer flap 36. By virtue of this arrangement, the flaps are closed rapidly in proper sequence without

any interference with one another. As the cartons pass from the end 106 of sweep 105, the flaps immediately pass upon the upstream end of the flap chilling section 28.

Lower flap chilling section

Referring to Figures 7 and 16, the flap chilling section 28 essentially comprises a pair of chill tubes 107—107 located in a horizontal plane to slidably contact the flaps after the flaps are closed at the flap closing station 27. The chill tubes are rectangular in cross section to present flat side bearing surfaces suitable to hold the flaps firmly in closed position as they are advanced. It is the function of the chill bars to absorb heat from the freshly glued flaps, thereby to quickly set the hot thermoplastic adhesive, such that the flaps are permanently bonded as the cartons reach the idler sprocket assembly 4 for loading. The chill bars are kept at a suitable low temperature by a refrigerating system which continuously circulates liquid refrigerant through the tubes. The conduits which convey the refrigerant to the bars are indicated at 108 in Figure 7; since the system itself forms no part of the invention, it has been omitted from the disclosure.

As shown in Figure 16, the spaced chill tubes 107—107 contact the side flaps 34 and 36 only along their edgewise portions which are joined to the side walls at the carton, with the major portion of the flap area spanning the spaced tubes as at 110. The purpose of this arrangement is to avoid the problem of glue adhering to the chill surface and interfering with proper operation. It has been found in practice, that a certain amount of glue oozes from beneath the flaps after they are closed and advanced to the chill tubes. This excess glue normally appears along the edges of the flaps as indicated at 111 and 112 in Figure 5.

If a chill surface is utilized which extends completely across the closed flaps, then the excess glue appearing along the transverse lines 111 and longitudinal line 112 naturally will be deposited upon the chill surface and eventually will build up to the point where operation is impaired, making it necessary to shut down the machine and to scrape off the adhering glue. In the present structure, only a small fraction of the transverse lines 111 contact the chill surfaces (Figure 16); hence, the major portion of the glue appearing along these lines is set without contacting the chill surfaces. Moreover, it has been discovered that, with the use of spaced chill tubes, the small percentage of glue, which may seep out along the lines 111 which contact the chill surfaces as at 109, will follow the vertical faces 113 of the chill tubes and will offer no interference with machine operation. The glue which may ooze out along the longitudinal line 112 cannot contact the spaced chill tubes; any glue which may appear along this line is set by the chilling action before the carton reaches the sprocket assembly 4.

Described in detail with reference to Figures 7 and 16, the chill tubes 107 are supported by adjustment screws 114 passing through the lower limb 52 of the channel brackets 50, as described with reference to the heating bar 42. The adjustment screw allow the bars to be adjusted in a horizontal plane suitable to hold the flaps in closed position after they issue from the flap closing station 27. The screws are locked in adjusted position by nuts 115—115 in clamping engagement with the limb 52. As shown in Figure 7, the upstream end of the chill tubes are curved as at 116 to prevent interference with the flaps as they pass from the flap closing station 27 to the chill bars.

As described earlier with reference to the heating bar 42 (Figure 12), the carton guides 58 and 60 extend for the full length of the machine and thus maintain the the cartons in perpendicular position as they advance along the chill section to guide the top flap in its vertical position. In order to hold the sealing flap 36 in square relation with the carbon, the right hand chill tube 107 includes a guide rail 117 having an edge in sliding

engagement with the lower edge portion of the carton, adjacent the flap 36. This rail prevents any displacement of the sealing flap under frictional resistance with the chill tube 107. The guide rail 117 is held in position by angle brackets 118 joined to vertical plates 120 which are carried by the channel brackets 50. The chill bars and guide structure, shown in Figure 16, terminate as at 121 (Figure 1) adjacent the idler assembly 4, at which point the cartons advance to the filling apparatus with the bottom flaps permanently sealed.

As indicated in Figure 1, the cartons are advanced from the downstream end 121 of the chilling section to an arcuate guide structure 122 and are thus advanced in an arc with respect to the carton filling apparatus (not shown) as the lugs 2 again assume radial positions delineating the radial throats 5. Since the downstream guide structure does not form a part of the invention, the details have been omitted; however, it will be understood that the structure includes suitable flap guides for holding the top flaps in open position as the contents of the cartons are fed into them. After being filled, the cartons advance in an upstream direction along conveyor run 13 to be acted upon by the top flap closing and sealing apparatus previously indicated at 12.

Upper flap pre-heating apparatus

Referring to Figure 1, the upper flap closing and sealing apparatus 12 comprises a preliminary top flap folder indicated at 123 adjacent the idler assembly 4, an upper flap heating section indicated at 124, and an upper glue station 125, which includes the upper glue roll previously indicated at 20. Upstream from the glue station, there is located a top flap closing station indicated at 126 (Figures 11 and 22) and a top flap chilling section indicated at 127. At the upstream end of the chilling section 127, the sealed cartons are delivered to a discharge conveyor indicated at 128 (Figure 1).

As noted previously with reference to Figures 3-6, the upper end of the carton is provided with flaps similar to the lower flaps; however, the position of the side flaps (major flaps) at the top are reversed relative to the bottom side flaps. Referring to Figure 6, the inner major top flap is indicated at 130 and the outer major flap, which overlies flap 130, is indicated at 131. The end flaps for the top of the carton are similar to those at its lower end, as indicated at 132-132. As the cartons advance upstream along the top flap mechanism, the major side flaps 130 reside on the outward side of the machine corresponding to the position of the lower major flaps 36 along the downstream side (Figures 12-17). The components of the top flap closing and sealing apparatus accordingly are reversed in position from the downstream apparatus, as explained below.

As the filled cartons emerge from the guide structure 122 and advance upstream toward the top flap closing and sealing apparatus, the flaps 130 are disengaged from the top flap guide 62 and project freely from the open top of the carton. In this position, the top flaps are intercepted by the preliminary flap folder indicated previously at 123. The top flap folder comprises a rotating flap closing wheel 133, generally similar to the wheel 38 which acts upon the bottom flaps, as described earlier. The top closing wheel 133 is mounted for rotation upon a shaft 134 suitably journaled in a bearing bracket carried by the base 19 of the machine and in driving connection with main shaft 17 by a lateral driving system (not shown) for rotation of the wheel in time with the advancement of the cartons. Closing wheel 133 is supported at a plane suitable to act upon the top end flaps 132 to fold the flaps inwardly as they advance to the flat leading end 135 of the top heating bar 136. As indicated in Figure 20, the leading end flap 132, as indicated at A, is intercepted by the flat leading end 135, and at the same time, the trailing end flap, as indicated at B, is folded inwardly by wheel 133 before reaching

the leading end 135, as described with reference to the lower end flaps. The top heating bar is provided with diverging side edges 44 as described with reference to Figure 19, which spread the side flaps 130 and 131 outwardly for passage in facial sliding contact with top heating bar 136.

Referring to Figures 13 and 15, the cartons rest upon a support rail 137 which slidably engages the closed lower ends of the cartons as they advance from the idler assembly 4. Rail 137 extends from the arcuate guide structure 122, which supports the cartons as they are advanced relative to the carton filling apparatus, and is co-extensive with the top closing and sealing apparatus. The support rail is mounted for vertical adjustment upon a series of brackets 138 each of which is slotted as at 140 and engaged by a screw 141 for vertical adjustment relative to vertical plate 142 rising from the base 19 of the machine. As shown in Figure 13, the external carton guide 60 is supported by L-shaped brackets 143 attached to the support rail 137 along the upstream run of the machine. The carton guides 58-58 also extend from the chain rail structure 57, which is supported by the longitudinal plate 56, as described earlier.

As shown in Figures 13 and 15, the lower surface of heating bar 136 is provided with a channel 45 having a width to receive the end flaps 132-132, such that the end flaps 132 are bent at less than a right angle (Figure 15) as they advance along the heating bar. In a similar manner, the side flaps 130 and 131 are held in facial engagement with the surface of the bar (Figure 13) as they advance along its length. Heating bar 136 is heated by a heating element 46, as described above, which preheats the flaps and partially expels the paraffin in preparation for application of the hot thermoplastic glue.

As best shown in Figure 13, the top heating bar 136 is supported by a series of L-shaped brackets 144 by means of adjustment screws 51 projecting from U-shaped brackets 54 which project from the heating bar. Electrical energy is conducted to the top heating element 46 by the cables 145 as indicated in Figure 11.

Upper glue station

The upper glue roll 20 (Figure 18), is mounted at the upstream end of the top heating bar 136 in position to apply the gluepattern to the top flaps as they emerge from the heating bar in pre-heated condition. The top glue roller 20 includes a similar glue pattern 65 (Figure 2) delineated by V-shaped slots, previously described with reference to Figure 10. The glue pattern is arranged to impress the connecting portion 66 of the pattern on the major flap 131 as at 66b (Figure 6) and the parallel pattern sections 67 upon the end flaps and major flaps as at 67b in the same manner as shown in Figure 3, such that the flaps are folded to sealing position in the same sequence. Since the upper glue roll operates from above the cartons, the upper glue station 125 is of the circulating type as described below.

Referring to Figure 11, the upper glue station 125 comprises a glue reservoir 146 provided with a glue pump 147 which is driven by the gears 148 and 150. These gears are connected to the driving system 24 which drives the glue roll 20 from the main shaft 17. The glue station 125 is a commercial unit, and for this reason, the details of its construction have been omitted.

In general, the glue reservoir 146 includes a thermostat 151 (Figure 11) mounted upon the reservoir and arranged to regulate the temperature of the thermoplastic glue, being in electrical connection with several heating elements, one of which is indicated at 152. The hot liquid glue is withdrawn from the reservoir 146 by way of an intake conduit 153 leading from the reservoir to the pump 147. From the pump, the liquid glue is advanced by way of the delivery conduit 154 to the glue roll 20. The upper portion of conduit 154 preferably in-

cludes a heating element 155 to maintain the temperature of the glue as it is delivered to the roll.

The delivery conduit 154 communicates with a scraper plate 156 which confines a pool of glue in contact with the periphery of the roller. Scraper plate 156 is pivotally mounted on a pivot shaft 157, which is journaled in ears 158—158 projecting outwardly in sliding contact with the end surfaces 160—160 of roll 20. The side plates of scraper plate 156 are in sealing contact with the ears 158 and the lower edge of the scraper is in sealing engagement with the periphery of the glue roll (Figure 18). The sealing pressure is applied to the swinging end of the scraper plate by a tension spring 161 anchored as at 162 to a lever 163 attached to pivot shaft 157, generally as described with reference to the lower glue roll scraper. The delivery conduit 154 feeds a continuous stream of hot glue to the trough which is delineated by the scraper plate 156 and roll 20. A glue level is maintained in the trough by an overflow tube 165 (Figure 11) which communicates with one side wall 166 of the scraper. The overflow tube 165 drains the excess glue back to reservoir 146, such that a continuous flow of heated glue is circulated to the upper glue roll. As described earlier, the scraper 156 removes the excess glue from roll 20, such that the glue is maintained only in the pattern 65 to be imprinted on the top flaps, as indicated.

The upper glue roll 20 is carried by a shaft similar to roller 18, the shaft being journaled in the bearing structure indicated at 167 in Figure 1. As disclosed in Figure 18, a heating element 168 projects endwisely into an axial cavity formed in the glue roll to maintain it at the proper temperature. Electrical energy is conducted to element 168 by electrical cables 170, as indicated in Figure 11.

The glue roller 20 is rotated in the direction indicated by a gear 171 attached to its shaft and meshing with a gear 172 (Figure 1) which forms a part of the driving system previously indicated at 24. The driving system advances the glue roll at a speed timed with the linear advancement of the cartons to impress the glue pattern 65 upon the flaps (Figure 6) as explained earlier. As the pre-heated upper flaps issue from the end of heating bar 136, they spring naturally into contact with the glue roll surface to receive the glue pattern as explained earlier.

Top flap closing station

As indicated in Figures 11 and 22, the top flap closing station 126 comprises a pair of stationary flap closing bars indicated at 173 and 174 mounted by a bracket structure 175 in position to intercept the top side flaps 130 and 131 as they issue from the upper glue station 125. The bars 173 and 174 each include an upwardly curved section 176 disposed in planes parallel with the side walls of the cartons; the curved sections blend into straight sections 177—177 which reside parallel with the upper ends of the cartons. The straight sections 177 blend into curved sweeps 178 and 180 similar to the sweeps which engage the lower flaps. As shown in Figure 22, sweep 187 is located in advance of the sweep 180 so as to cam the inner major flap 130 to closed position; sweep 180 subsequently sweeps the outer major flap 131 to its closed position in sealing contact with the free edge portion of flap 130.

As indicated in Figure 11, the apparatus preferably includes a heating bar 181, energized by electrical cables 182. This heating bar is supported by the channel brackets 50; the bracket 175 depends from the heating bar and supports the flap closing bars 173 and 174. The heating bar 181 prevents premature cooling of the glue pattern as the flaps are folded by the closing bars for advancement to the chilling section 127.

Top flap chilling section

As indicated in Figure 11, the cartons advance immediately to the top flap chilling section 127 after the flaps are closed at the closing station 126. The top flap chilling

section is identical to the chilling section for the lower flaps, comprising a pair of chill tubes 107—107 adjustably supported by screws 114 (Figure 17). The screws are locked in adjustment by similar nuts 115 clamped to L-shaped brackets 183 overhanging the chill tubes. As described earlier, the chill tubes slidably engage only the edgewise portions of the side flaps, the major portion of the flaps spanning the spaced tubes as at 110. This prevents the excess glue which may ooze from the edges 111 and 112 of the top flaps from reaching the chill surface. Any excess glue which may seep from the transverse lines 111 along the top flaps will follow the vertical faces 113 of the tubes; the glue which may ooze out along the longitudinal line 112 is set by the chilling action as explained earlier with reference to the bottom flaps.

Liquid refrigerant from the refrigerating system is supplied to the top chill tubes by the conduits 184—184 (Figure 11). The temperature of the top tubes, similar to the lower tubes, is sufficiently low to permanently set the adhesive before the cartons reach the upstream end 185 (Figure 1) of the tubes. At this point, the conveyor lugs 2 pass radially about the drive sprocket assembly 3 and advance the sealed cartons to the delivery conveyor 128. This conveyor preferably is of the belt type and is arranged to carry the finished cartons in upright position from the sealing machine for final packaging.

Having described my invention, I claim:

1. In an apparatus for gluing and sealing cartons having an open end, including a pair of side flaps and a pair of end flaps, conveyor means for advancing the cartons with said side flaps residing generally parallel to the path of advancement and with said end flaps extending generally transverse to the path of advancement, an end flap folder engaging the end flap at the trailing end of each carton and folding the same inwardly upon the open end of the carton, a flap heating section having a leading end residing adjacent said end flap folder, said leading end intercepting and folding the other of said end flaps inwardly across the open end of said carton, said heating section having opposed side edges which diverge outwardly from said leading end, said diverging edges intercepting and camming the side flaps outwardly in opposite directions, said conveyor means advancing said carton along said heating section with the surfaces of said side and end flaps presented to the heating section and thereby pre-heating said flaps, a glue station residing adjacent the downstream end of said heating section and having a rotating glue applicator roll, said roll having a periphery advancing in the same direction as said flaps and applying glue to the surfaces of the pre-heated side and end flaps which previously were presented to the heating section, and a flap closing station residing adjacent said glue station, said closing station including means intercepting said side flaps and folding the same in sequence one upon the other over said folded end flaps, whereby the said glue resides between said closed side and end flaps, and a chilling section adjacent said flap closing station, said chilling section having a surface presented to said closed flaps and chilling the same, whereby said glue is hardened and said flaps are sealed in closed position.

2. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps and a pair of end flaps, conveyor means for advancing the carton with said side flaps residing generally parallel with the path of advancement and with said end flaps extending generally transverse to the path of advancement, preliminary flap folding means residing in the path of advancement of the flaps, said flap folding means folding said end flaps inwardly upon the open end of the carton, and folding said side flaps outwardly in opposite directions, a flap heating section having a leading end residing adjacent the preliminary flap folding means, said conveyor means advancing said carton along said flap heating section with the surfaces of said side flaps and end

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flaps presented to the heating section, said heating section having a longitudinal center area which is depressed relative to the surface of the heating section and receiving said infolded end flaps with said flaps sprung partially toward open position and in sliding contact therewith, said outwardly folded side flaps being in sliding contact with the surface of the heating section on opposite sides of said center area, thereby pre-heating the said flaps, a glue station residing adjacent the said heating section and applying glue to the surfaces of the pre-heated flaps which previously were presented to the heating section, and flap closing means residing adjacent said glue station, said flap closing means intercepting said side flaps and folding the same inwardly one upon the other over said folded end flaps, whereby the said glue resides between the surfaces of said closed flaps for sealing the flaps in closed position.

3. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps and a pair of end flaps, conveyor means for advancing the carton with said side flaps residing generally parallel with the path of advancement and with said end flaps, extending generally transverse to the path of carton advancement, preliminary flap folder means residing in the path of advancement of the flaps and folding said end flaps inwardly upon the open end of the carton, a flap heating section having a leading end residing adjacent said preliminary flap folder means in the path of the side flaps and spreading the side flaps outwardly in opposite directions, said conveyor means advancing said carton along said flap heating section with the surfaces of said side flaps and end flaps presented to the heating section, said heating section having a longitudinal center area which is depressed relative to the surface of the heating section and receiving said infolded end flaps with said flaps sprung partially toward open position and in sliding contact therewith, said outwardly folded side flaps being in sliding contact with the surface of the heating section on opposite sides of said center area thereby pre-heating said flaps, a glue station residing adjacent the said heating section and applying glue to the surfaces of the pre-heated side and end flaps which previously were presented to the heating section, and flap closing means residing adjacent said glue station, said flap closing means intercepting said side flaps and folding the same inwardly one upon the other over said folded end flaps, whereby the said glue resides between the surfaces of said closed flaps, and a chill section adjacent said flap closing means, said chill section being presented to said closed flaps and chilling the same, whereby said glue is hardened and said flaps are sealed in closed position.

4. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps and a pair of end flaps, conveyor means for advancing the cartons with said side flaps residing generally parallel with the path of advancement and with said end flaps residing generally transverse to the path of advancement, preliminary flap folding means residing in the path of advancement of the flaps, said folding means engaging the end flap at the trailing end of the carton and folding the same inwardly upon the open end of the carton, a flap heating section having a leading end residing adjacent said preliminary flap folding means in the path of advancement of the side flaps and spreading said side flaps outwardly in opposite directions, said leading end intercepting and folding the other of said end flaps inwardly across the open end of the carton, said heating section having a longitudinal center area depressed relative to the surfaces of the heating section and receiving said infolded end flaps with said flaps sprung partially toward open position and with the outer ends of the flaps in sliding contact with the surface of said depressed center area, said outwardly folded side flaps being in facial sliding contact with the surface of the heating section and bent outwardly substantially at right angles to the carton, whereby the

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side and end flaps are pre-heated during advancement along the heating section, a rotating glue applicator roll residing adjacent the end of said heating section and having a periphery advancing in the same direction as said cartons, whereby said side flaps and end flaps are free to spring into tracking contact with said roll upon advancing from said heating section, said roll applying glue to the surfaces of the pre-heated side flaps and end flaps which previously were in contact with the heating section, flap closing means residing adjacent said glue roll, said flap closing means intercepting said side flaps and folding the same inwardly one upon the other over said folded end flaps, whereby said glue resides between the surfaces of said flaps, and a flap chilling section residing adjacent said flap closing means, said chilling section being presented to said closed flaps and chilling the same, whereby said glue pattern is hardened and said flaps are sealed in closed position.

5. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps and a pair of end flaps, conveyor means for advancing the carton with said side flaps residing generally parallel with the path of advancement and with said end flaps residing generally transverse to the path of advancement, preliminary flap folding means residing in the path of advancement of the flaps, said folding means engaging the end flap at the trailing end of the carton and folding the same inwardly upon the open end of the carton, a flap heating section having a leading end residing adjacent said preliminary flap folding means in the path of advancement of the side flaps and spreading said side flaps outwardly in opposite directions, the leading end of the heating section concurrently intercepting and folding the other of said end flaps inwardly across the open end of the carton, said heating section having a longitudinal center area depressed relative to the surface of the heating section and receiving said infolded end flaps with said flaps sprung partially toward open position, and with the outer ends of the flaps in sliding contact with the surface of said depressed center area, said outwardly folded side flaps being in facial sliding contact with the surface of the heating section and bent outwardly substantially at right angles to the carton, whereby said side and end flaps are pre-heated during advancement along the heating section, a rotating glue applicator roll residing adjacent the end of said heating section and advancing in the same direction as said cartons, whereby said side flaps and end flaps are free to spring into tracking contact with said roll upon advancing from said heating section, said roll applying glue to the surfaces of the pre-heated side flaps and end flaps which previously were in contact with the heating section, and flap closing means residing adjacent said glue roll, said flap closing means intercepting said side flaps and folding the same inwardly one upon the other over said folded end flaps, whereby said glue resides between the surface of said flaps for sealing the flaps in closed position.

6. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps and a pair of end flaps, conveyor means for advancing the cartons with said side flaps residing generally parallel with the path of advancement and with said end flaps residing generally transverse to the path of advancement, preliminary flap folding means residing in the path of advancement of the flaps, said folding means engaging and folding said end flaps inwardly to closed position over the open end of the carton, a longitudinal flap heating section having a leading end residing adjacent said preliminary flap folding means in the path of advancement of the side flaps and spreading said side flaps outwardly in opposite directions, said heating section having side flap bearing surfaces and a parallel end flap bearing surface spaced outwardly therefrom, said end flap bearing surface residing in a plane to receive said folded end flaps with said flaps sprung partially toward open position with

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the outer ends thereof in sliding contact with the end flaps bearing surface, the side flap bearing surface residing in a plane to receive the side flaps in facial sliding contact, with the flaps bent outwardly substantially at right angles to the carton, whereby said side and end flaps are pre-heated during advancement along the heating section, a rotating glue applicator roll residing adjacent the end of said heating section and advancing in the same direction as said cartons, whereby said side flaps and end flaps are free to spring into tracking contact with said roll upon advancing from said heating section, said roll applying glue to the surfaces of the pre-heated side flaps and end flaps which previously were in contact with the heating section, whereby the side flaps subsequently may be folded inwardly one upon the other over said folded end flaps, with the glue residing between the surface of said flaps for sealing the flaps in closed position.

7. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps and a pair of end flaps and a pair of end flaps projecting outwardly from said open end, conveyor means for advancing the cartons with said side flaps residing generally parallel with the path of advancement and with said end flaps residing generally transverse to the path of advancement, an end flap folder engaging the end flap at the trailing end of each carton, and folding the same inwardly upon the open end of the carton, a longitudinal flap heating bar extending generally parallel with the conveyor means, said flap heating bar having a leading end residing adjacent said end flap folder, said leading end intercepting and folding the other of said end flaps inwardly across the open end of the carton, said flap heating bar having opposed side edges which diverge outwardly in opposite directions from said leading end, said diverging edges intercepting and camming the side flaps outwardly in opposite directions, said heating bar having a longitudinal center area which is depressed relative to the surface of the heating bar and receiving said end folded flaps, whereby the heating bar slidably contacts and holds the end flaps partially in closed position and slidably holds said side flaps substantially at right angles to the carton as the conveyor means advances the cartons, said heating bar pre-heating said flaps during advancement along the heating bar, a glue applicator residing adjacent the downstream end of the heating bar and having a surface advancing in the same direction as said cartons, whereby the side flaps and end flaps spring into contact with said surface upon advancing from the downstream end of the heating bar, said applicator applying heated thermoplastic glue in a liquid state to the surfaces of the pre-heated side flaps and end flaps which previously were in contact with the heating bar, whereby said side flaps subsequently may be folded inwardly one upon the other into contact with the folded end flaps with said thermoplastic glue residing between the surfaces of said flaps for sealing the flaps in closed position.

8. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps and a pair of end flaps projecting outwardly from said open end, conveyor means for advancing the carton with said side flaps residing generally parallel with the path of advancement and with said end flaps residing generally transversely to the path of advancement, a rotating end flap folder having means engaging the end flap at the trailing end of each carton and folding the same inwardly upon the open end of the carton, a longitudinal flap heating bar extending generally parallel with the conveyor means, said flap heating bar having a leading end residing adjacent said end flap folder, said leading end intercepting and folding the other of said flaps inwardly across the open end of the carton, said flap heating bar having opposed side edges which diverge outwardly in opposite directions from said leading ends, said diverging edges intercepting and camming the side flaps outwardly in opposite directions, said heating bar having a surface

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slidably contacting said side flaps and end flaps, said heating bar pre-heating said flaps during advancement along the heating bar, a glue applicator residing adjacent the downstream end of the heating bar, whereby said side flaps and end flaps spring into contact with said glue applicator upon advancing from the downstream end of the heating bar, said glue applicator applying glue to the surfaces of the pre-heated side flaps and end flaps which previously were in contact with the heating bar, whereby the side flaps subsequently may be folded inwardly one upon the other into contact with the folded end flaps with said glue residing between the surfaces of said flaps for sealing the same in closed position.

9. In an apparatus for gluing and sealing cartons having an open end and having a pair of side flaps and a pair of end flaps, conveyor means for advancing the cartons with said side flaps residing generally parallel with the path of advancement and with said end flaps extending generally transverse to the path of advancement, means residing in the path of advancement of said flaps folding said end flaps inwardly toward one another and folding said side flaps outwardly in opposite directions during advancement of the cartons by the conveyor means, a glue roll rotating in the direction of the conveyor means and having a periphery which tracks against the surfaces of said outwardly folded side flaps and inwardly folded end flaps, the periphery of the glue roll having a printing area which registers with the advancing flaps, said printing area being generally U-shaped and imprinting a pattern of glue upon the surface of one of said outwardly folded side flaps, leaving the other side flaps blank, said printing area imprinting respective glue patterns upon the surfaces of said inwardly folded end flaps, a flap closing station residing adjacent said glue roll, said flap closing station intercepting said side flaps and folding said blank side flap inwardly over upon the transverse glue pattern of said end flaps, said flap closing station thereafter folding the other side flap, which carries the glue pattern, inwardly into facial contact with said folded blank side flap, whereby the said glue pattern resides between the surfaces of said closed flaps, and a chilling section residing adjacent said flap closing station, said conveyor advancing said carton with said closed flaps presented to the chilling station, whereby said glue pattern is hardened and said flaps are sealed in closed position during advancement by the conveyor means along the chilling section.

10. In an apparatus for gluing and sealing cartons having an open end and having a pair of side flaps and a pair of end flaps projecting outwardly therefrom, conveyor means for advancing the cartons of said side flaps residing generally parallel with the path of advancement and with said end flaps extending generally transverse to the path of advancement, preliminary flap folding means residing in the path of advancement of said flaps and folding said end flaps inwardly toward one another and folding said side flaps outwardly in opposite directions during advancement of the cartons by the conveyor means, a glue applicator acting upon the surfaces of said outwardly folded side flaps and inwardly folded end flaps, the glue applicator having a printing area which registers with the advancing flaps, said printing area imprinting a pattern of glue upon one of said outwardly folded side flaps, leaving the other side flap blank, said printing area imprinting a glue pattern upon the surfaces of said inwardly folded end flaps, a flap closing station residing adjacent said glue applicator, said flap closing station intercepting the side flaps and folding said blank side flap inwardly over upon the glue pattern of said end flaps, said folding station thereafter folding the other side flap, which carries the glue pattern, inwardly into contact with said blank side flap, whereby the said glue patterns reside between the surfaces of said closed flaps for sealing said flaps in closed position.

11. In an apparatus for gluing and sealing cartons hav-

ing an open end, said open end having a pair of side flaps and a pair of end flaps projecting outwardly therefrom, conveyor means for advancing the carton with said side flaps residing generally parallel with the path of advancement and with said end flaps residing generally transverse to the path of advancement, flap folding means residing in the path of advancement of the flaps, said flap folding means folding said end flaps inwardly upon the open end of the carton and spreading said side flaps outwardly, a rotating glue applicator roll, said roll having a surface presented to said inwardly folded end flaps and outwardly folded side flaps, whereby said flaps advance in tracking engagement with the periphery of the glue roll, said periphery having a printing area which applies liquid thermoplastic glue to said flaps in time with the advancement thereof said printing area being delineated by a series of cavities formed in said periphery generally parallel with the axis of rotation of the roll, each of said cavities being generally V-shaped in cross section and having a rear wall residing at the trailing side of the cavity in the direction of roll rotation, said rear wall being generally radial to the axis of roll rotation, means for heating and applying heated thermoplastic glue in a liquid state to the periphery of said roll, and scraper means contacting said periphery and removing the liquid glue from the said periphery and leaving a glue pattern in said printing area, the radial rear wall of said V-shaped cavities confining the liquid glue therein, whereby said glue pattern is imprinted upon said inwardly folded flaps and upon one of said outwardly folded side flaps, leaving the other side flap blank, whereby said blank side flap subsequently may be folded inwardly upon the glue pattern of said end flaps and the other of said side flaps subsequently folded to closed position over upon said blank side flap for sealing said flaps in closed position upon chilling of said thermoplastic glue pattern.

12. In an apparatus for gluing and sealing cartons having an open end, said open end having a plurality of flaps projecting outwardly therefrom, conveyor means for advancing the carton with said flaps positioned to receive a glue pattern, a rotating glue applicator roll, said roll having a surface presented to said flaps, whereby said flaps advance in tracking engagement with the periphery of the glue roll, said periphery having a printing area which applies liquid thermoplastic glue to said flaps in time with the advancement thereof, said printing area being delineated by a series of cavities formed in said periphery generally parallel with the axis of rotation of the roll, each of said cavities being generally V-shaped in cross section and having a rear wall residing at the trailing side of the cavity in the direction of roll rotation, said rear wall being generally radial to the axis of roll rotation, means for heating and applying heated thermoplastic glue in a liquid state to the periphery of said roll, the radial rear wall of said V-shaped cavities confining the liquid glue therein and thereby printing said glue pattern upon said flaps, whereby the flaps subsequently may be folded to closed position with the glue pattern residing between the surfaces thereof for sealing said flaps in closed position upon chilling of said thermoplastic glue pattern.

13. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps joined to the sides of the carton and having a pair of end flaps, conveyor means for advancing the carton with said flaps folded inwardly toward one another and said side flaps spread outwardly in opposite directions, glue applicator means residing along the conveyor means in position to act upon said flaps, said glue applicator means including heater means and adapted to apply heated thermoplastic glue to the surfaces of said flaps, flap closing means along the conveyor, said flap closing means folding said side flaps to closed position in contact with the end flaps and overlapping one another, and a chill section residing along said conveyor adjacent the flap closing station, said chill section comprising a pair

of spaced parallel chill elements extending along the conveyor in a plane slidably contacting said closed side wall flaps along the side portions thereof which are joined to the sides of the carton the spacing of the chill elements being such that the major portion of the said closed flaps extend across the spaced chill elements in a position remote from said chill elements, said chill elements chilling the closed flaps during advancement of the cartons by the conveyor means and hardening the thermoplastic glue residing between said flaps and thereby sealing said closed flaps.

14. In an apparatus for gluing and sealing cartons having an open end, each carton having a pair of side flaps and a pair of end flaps resiliently joined to the open end of the carton, said apparatus including conveyor means for advancing the carton with said end flaps folded inwardly toward one another and said side flaps spread outwardly in opposite directions, the improvement which comprises a flap heating bar, said heating bar extending generally parallel with said conveyor means, said heating bar having a major heating surface residing in a plane spaced from the conveyor means to receive said outwardly spread side flaps in facial engagement, said heating bar having a longitudinal channel way providing a secondary heating surface which is depressed relative to major heating surface, said secondary heating surface having a width to receive said end flaps, whereby said end flaps are held in partially closed position by the secondary heating surface with the outer portions of the end flaps in sliding contact therewith, said carton being advanced along said heating bar by the conveyor means, whereby the side flaps are heated during advancement along the major heating surface, the depressed secondary heating surface pre-heating the outer portions of the end flaps while the portions thereof which join the end of the carton retain sufficient resiliency to spring toward open position upon passing beyond the end of said heating bar for application of glue to the outer surfaces thereof.

15. In an apparatus for gluing and sealing cartons having an open end, each carton having closure flaps joined to the open end of the carton, said apparatus having conveyor means for advancing the carton with said flaps folded to a position for receiving a glue pattern upon the surface thereof, the improvement which comprises a rotating glue applicator roll having a periphery advancing in unison with the conveyor means, said periphery intercepting and tracking upon the surface of said flaps, said periphery having a printing area configured to register with said flaps, said printing area being delineated by a series of generally V-shaped cavities formed in the periphery of the roll, each of said cavities having a rear wall residing at the trailing side of the cavity in the direction of roll rotation, said rear wall being generally radial to the axis of roll rotation, means applying heated thermoplastic glue in a liquid state to the periphery of the roll, the rear wall of each cavity confining said liquid glue in said cavity and means contacting the periphery of the roll and removing the liquid glue from the periphery of the roll, said cavities retaining liquid glue therein, whereby a glue pattern is imprinted upon said flaps by the printing area during advancement thereof in tracking engagement with the surface of the flaps.

16. In an apparatus for gluing and sealing cartons having an open end, said open end having a pair of side flaps and a pair of end flaps joined to the carton, said apparatus including conveyor means for advancing the carton with the side flaps residing generally parallel with the path of advancement thereof, means applying heated thermoplastic glue in a liquid state to the surfaces of the flaps, and means folding the end flaps to closed position and folding the side flaps one upon another over the end flaps with said glue residing between the surfaces of the flaps, the improvement of which comprises a pair of spaced parallel chill elements extending along the con-

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veyor, said chill elements having chill surfaces spaced from the conveyor means in a plane slidably contacting said closed side flaps along the portions thereof which are joined to the carton, said chill elements having angularly related glue-retaining surfaces joining said chill surfaces along the opposed inner edges thereof, said chill surfaces chilling said flaps and setting the thermoplastic glue residing therebetween during advancement of the closed flaps along the chill surfaces, said angularly related glue-retaining surfaces receiving and setting excess glue which may seep from the edges of said closed flaps, whereby the said chill surfaces remain free of said excess glue.

17. In an apparatus for gluing and sealing cartons having an open end, said open end having closure flaps joined to the carton, said apparatus including conveyor means for advancing the carton, means for applying heated thermoplastic glue in a liquid state to the surfaces of the flaps, and means for folding the flaps to closed position with the glue residing between the surfaces of the flaps, the improvement of which comprises a pair of

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spaced parallel chill tubes extending along the conveyor, means connected to said tubes for chilling the same, said chill tubes having chill surfaces spaced from the conveyor means in a plane slidably contacting said closed flaps along opposite edgewise portions thereof which are joined to the sides of the carton with the major portion of said closed flaps spanning said spaced chill surfaces, said chill surfaces chilling said flaps and setting the thermoplastic glue residing therebetween during advancement of the closed flaps along the chill surfaces, said chill tubes setting excess glue which may seep from the edges of said closed flaps which span the spaced chill surfaces whereby the said chill surfaces remain free of the excess glue.

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