Feb. 12, 1963 T. W. RUSSELL 3,077,064

CARTON SEALING MACHINE

Filed Dec. 16, 1959

3 Sheets-Sheet 1

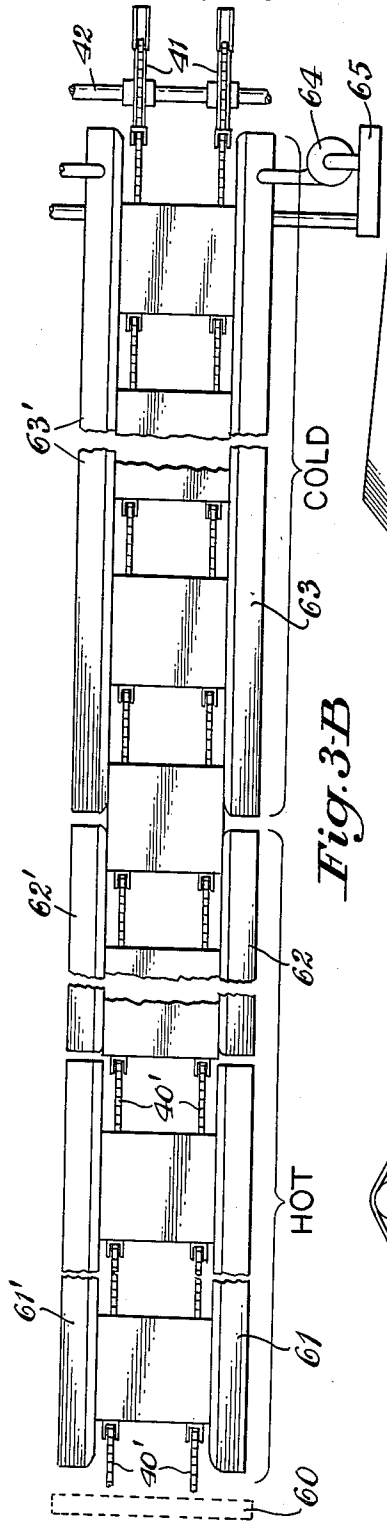

Fig. 3-B

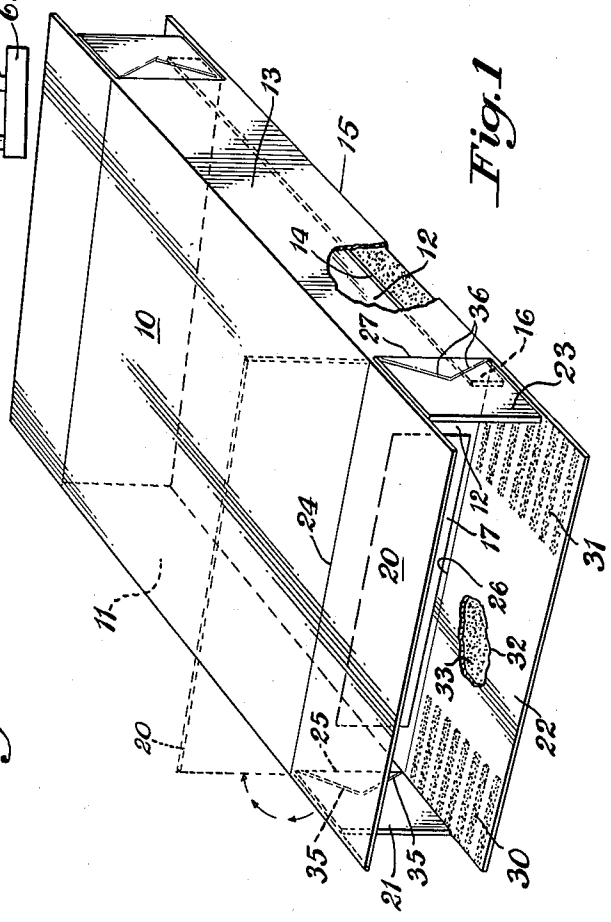

Fig. 1

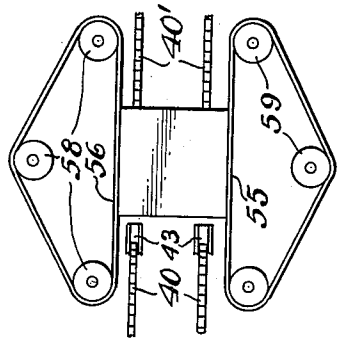

Fig. 4

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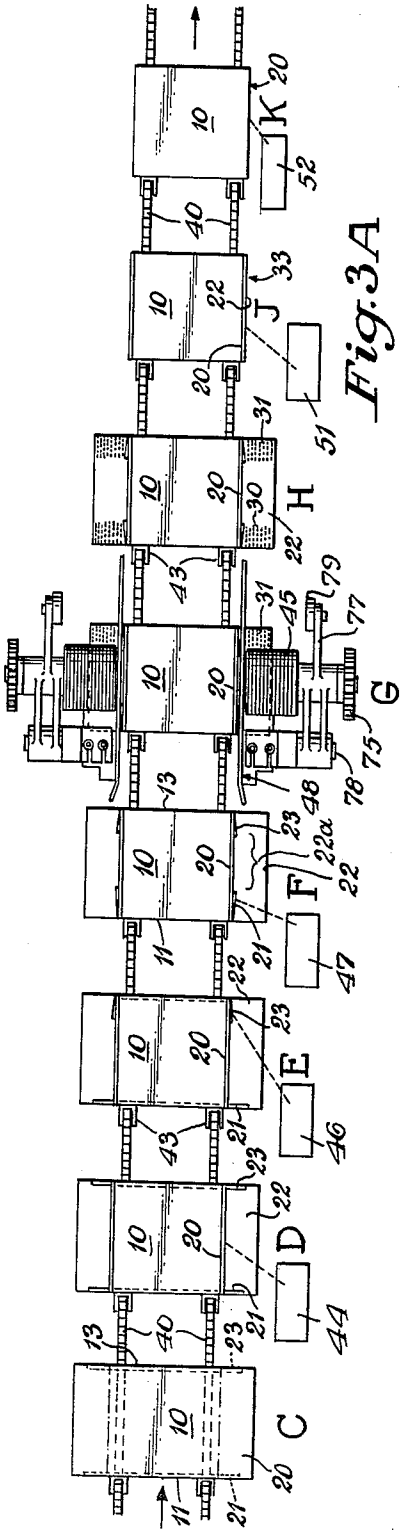

Fig. 3A

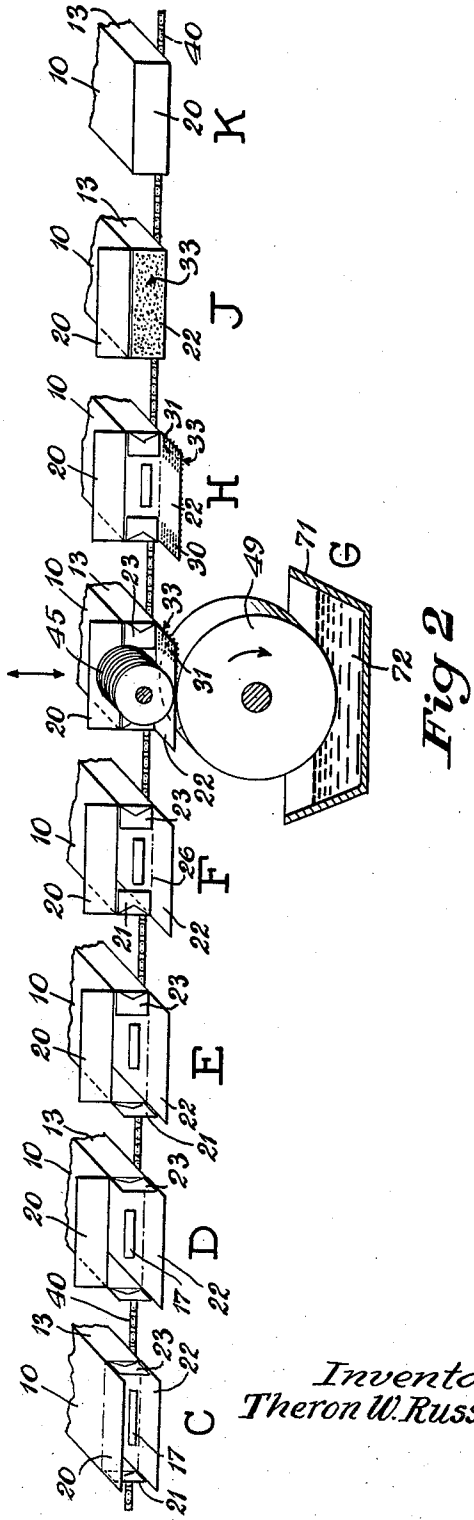

Fig 2

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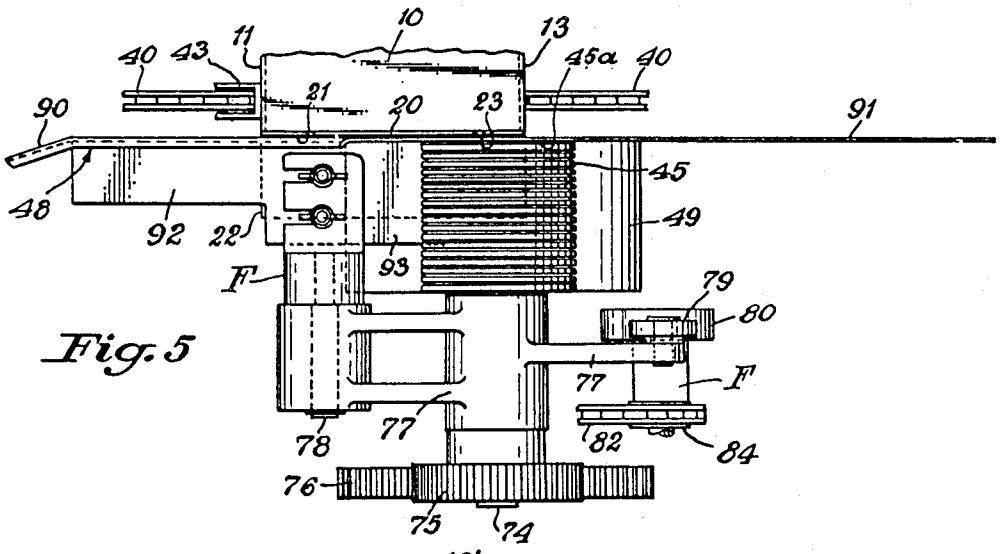

Fig. 5

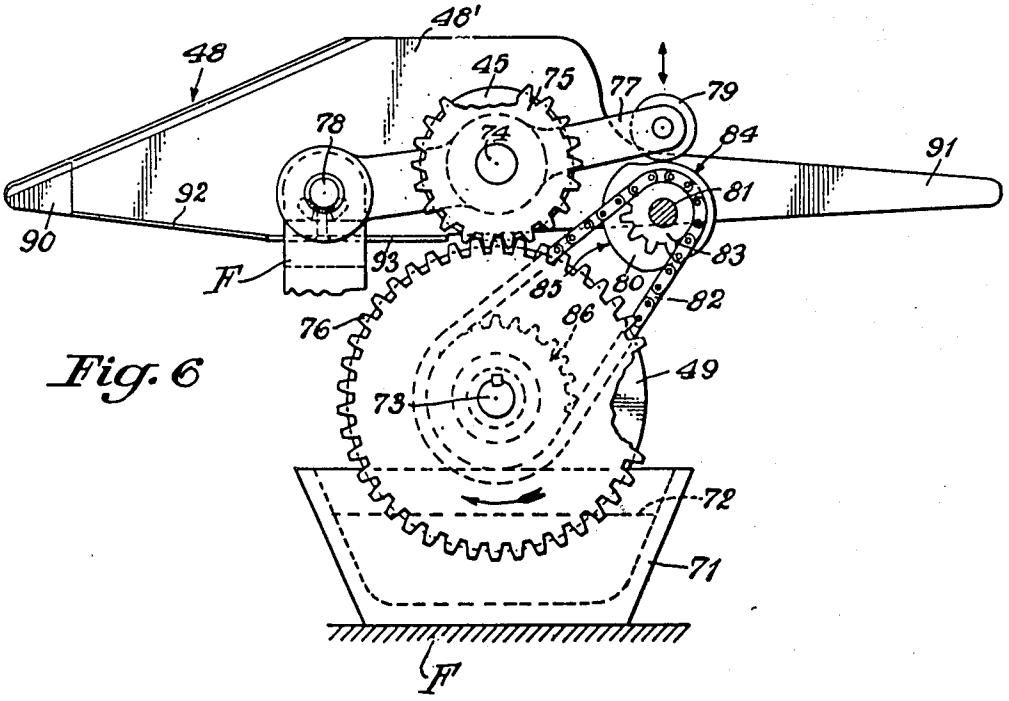

Fig. 6

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3,077,064

CARTON SEALING MACHINE

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16 Claims. (Cl. 53—375)

The present invention relates to machines for closing and sealing cartons, and particularly, to one for tightly sealing cartons for deep-freeze storage.

Reference is made to my copending application Serial No. 860,024 filed December 16, 1959, describing a process for sealing such cartons. As therein described, the carton stock has a coat of fusible waxy material, to function as a moisture-barrier. Heretofore, certain problems have been encountered in sealing wax-coated flaps of cartons. According to the process therein described, an adhesive liquid is applied to a flap to be sealed to another flap, and applied over the solid wax coat. The adhesive is such that it is activated by application of heat at a temperature above that at which the wax coat melts. The carton stock is such that when the wax coat is melted by such heat the wax is absorbed in the body of the carton stock, thus exposing the surface fibers of contacting flaps to the interfacial liquid adhesive that previously resided between the wax coats of the said two flaps. Then the continued effect of the heat is to activate and set the adhesive and provide a fiber-to-fiber bond.

Since such wax-coated cartons are used for display, the appearance is important. The said application of heat to melt the wax and seal results in a heated sealed face of the carton. The stored supply of heat in such face is in part conducted into the side walls of the carton unless otherwise removed. According to the present invention, a machine is provided for applying liquid adhesive to flaps to be sealed, for closing flaps to sealing position, for heating the face with said flaps to be sealed and thereby effecting said fiber-to-fiber bond, and for cooling the resulting hot-sealed carton end.

Machines suitable for closing sleeve type rectangular cartons with four flaps at the end-openings are well-known. They have well-known means for folding flaps and for applying adhesive. The machine of the present invention comprises such a conventional machine with particular modifications, among them means for applying liquid adhesive, heating means and cooling means.

In the drawings:

FIG. 1 represents in perspective a sleeve-type carton to be sealed.

FIG. 2 represents a sequence of operations to effect a closed carton end with applied activatable adhesive.

FIG. 3A represents more or less diagrammatically machine structure for effecting the operations illustrated in FIG. 2, FIG. 2 and FIG. 3A being vertically alined in corresponding sequences.

FIG. 3B represents an extension of the machine portion shown in FIG. 3A, showing more or less diagrammatically the functioning parts.

FIG. 4 represents an optional transfer device which may be used between the conveyers of FIG. 3A and FIG. 3B.

FIG. 5 is a plan view of the gluing station, showing the top glue-roll and a flap-holding means.

FIG. 6 is a side elevation of the structure, shown in FIG. 5.

In reference to a particular use of the machine wherein an aqueous dispersion of resinous adhesive solids is employed, and wherein the sealed cartons have moisture-barrier walls, folds and sealed ends, a special type of carton is described to illustrate certain features of the machine.

In FIG. 1, a carton is shown with identical flaps at both ends, only one end being herein described.

Numerals 10, 11, 12 and 13 represent the four side walls of a rectangular carton, of which side wall 13 contains an overlapping glued seam at which one edge 14 of the flat blank is indicated at the interior of the carton. The junction line 15 between the faces 12 and 13 defines with said edge 14 a narrow strip of the blank which extends as a tab 16 beyond the opening of the carton defined by said four side walls.

Numeral 17 (FIG. 1) is a graphical representation of contents to be sealed within the carton. The side walls 10, 11, 12 and 13 are extended as flaps 20, 21, 22 and 23, respectively, with hinging lines respectively designated 24, 25, 26 and 27 defining the opening of the carton to be closed by folding the flaps. Flaps 21 and 23 are inner flaps. Flaps 22 and 20 are respectively intermediate and outer flaps.

When the flat carton blank is set up to rectangular form, the flaps are in the position indicated, except that the flap 20 may be folded up as shown, or be coplanar with its side wall 10, depending upon whether or not clearance is needed for means used for applying adhesive to flaps 22. The preferred manner of applying adhesive is to apply it in metered streaks 30 and 31 to the inner face of flap 22 and overall at the outer face of flap 22, this being indicated by an opening 32 in flap 22 merely to illustrate adhesive 33 on the outer side of flap 22. The extent of the streaks 30 and 31 inwardly from the ends of flap 22 is substantially the same as the extent of flaps 21 and 23 away from the opening.

On the outer faces of said inner flaps 21 and 23, there are score-lines designated 35 and 36 extending from end to end of the respective folding lines 25 and 27. These score-lines rigidify the said inner flaps for an extent away from their folding lines and provide between each score-line and the folding line an area remaining planar as the flap is moved inwardly to sealing position. In the case of the inner flap 23, said tab 16 is adhesively united to it and provides additional resistance to exert slight pressure against intermediate flap 22 when the latter is folded onto the inner flaps.

Although not indicated in FIG. 1, the carton has a coat of moisture-barrier material, which may be a hydrocarbon composition of 97.5 parts paraffin melting at 135° to 139° F. and 2.5 parts of polyethylene (M.P. 189° F., molecular weight 13,000) applied at 200° F. to 210° F., by the cold-water waxing procedure. Also not indicated are the facts, that the carton stock is capable of absorbing the wax coat when fused thereon as later described, and that the fibers of the flaps at the areas to be united are exposed to the wax, being without cover such as printing ink or clay coat for printing.

In FIG. 2 and FIG. 3A the corresponding parts are designated as lettered stations with travel of the carton in the machine from left to right.

In FIG. 3A and FIG. 3B numeral 40 represents conveyer means having two chain members moved by sprockets 41 (FIG. 1B) on shaft 42. Spaced along the conveyer are uprights 43 at equally spaced intervals to engage and move a squared-up carton such as shown in FIG. 3A at station C. As the carton leaves station C, and when it is desired to move flap 20 out of the path it would follow if it remained in its position of station C, the flap 20 encounters means 44 which turns it up to its position in station D. One reason for so moving flap 20 is to clear means for applying adhesive to the inner face of flap 22, such as cylindrical roll 45, later described. When the thickness of the carton on the conveyer is less than the height of said roll 45, it is turned up. When flap 20 in its position at station C will pass above the means 45, it is not turned up.

As shown, the roll 45 is positioned to apply adhesive to flap 22 close to its hinging line 26, and to do this flaps 21 and 23 should be parallel to the direction of travel, and preferably in their sealing position in order to simplify mechanical movements and to limit the extent of folding them. For this reason, flaps 21 and 23 are first moved to their sealing positions.

Means to close flaps 21 and 23 are varied and well-known and may operate in sequence to close flap 21 then flap 22, or the reverse sequence, or to operate simultaneously. The first sequence is illustrated.

As the carton leaves station D it encounters plow means 46 to close flap 23 as shown in station E. Then as it leaves station E the carton encounters tucker means 47 which closes flap 21, as shown in station F.

The carton is ready to enter glue-station G where adhesive is applied for sealing all the flaps.

The inner face of flap 22 is to be sealed to inner flaps 21 and 23, and the inner face of flap 20 is to be sealed to the outer face of flap 22. The adhesive may be applied to but one face of the two faces to be bonded, and for simplification, it is preferred to apply adhesive only to flap 22 and only at areas thereof to be bonded. In the carton shown at station F there is a space between the closed flaps 21 and 23, so that the corresponding area 22^a on the interior face of flap 22 is preferably free of adhesive.

To accomplish this adhesive applicator roll 45 is constructed to contact flap 22 at areas to overlie flap 21 and 23 and to be moved out of contact with flap 22 when the area 22^a passes the line of application. Also, to clear the path for the carton in passing roll 45, means is provided for holding all the flaps in the position of station F, said means being generally designated 48, later described.

Means for applying adhesive to at least one of the faces forming the interface between flaps 20 and 22 for uniting flaps 20 and 22 is preferably cooperative with roll 45, such as a second roll 49 substantially tangent to roll 45 when no flap 22 passes between them in station G. The second roll 49 applies the adhesive 33 referred to in FIG. 1.

Station H shows the condition of the carton after the adhesive is applied, the flap 22 having glue-areas 30 and 31 applied in streaks for the inner flaps 21 and 23. As the carton enters station J the flap 22 encounters plow means 51 which turns flap 22 to closed position over closed flaps 21 and 23, thus exposing adhesive 33 to view in FIG. 2.

As the carton leaves station J to enter station K flap 20, presently described as folded 180° from its closed position, encounters plow means 52 which folds it into closed position over adhesive 33.

FIG. 3B represents an extension of the machine shown in FIG. 3A, and it may be such a continuation thereof that the conveyer chains 40 of FIG. 3A are the conveyer chains in FIG. 3B. The structure indicated in FIG. 3B may be a separate unit having conveyer chains 40'. In such case a transfer mechanism may be interposed, such as shown in FIG. 4. The transfer mechanism has vertical belts of rubberized fabric 55 and 56, which press upon the closed carton ends and move the carton from conveyer 40 to conveyer 40' when the two are independent. The belts are driven by at least one of the two sets of three pulleys 58 and 59 over which they run.

In FIG. 3B the numeral 60 diagrammatically designates such a transfer mechanism, if used, the dotted lines indicating that it is optional. In FIG. 3B, the closed carton ends slide along heated means in the form of one or more heated platens of which two are designated 61 and 62, on one side and 61' and 62' on the other. When more than one is present the temperatures may decrease in the direction of travel, the first, or the only one, having a temperature of 375° F., when a certain aqueous resin dispersion is the adhesive liquid. When four platens are present the temperatures may be 375° F., 325° F., 275° F., and 225° F., for example. The length of the heated means is predetermined by the speed of travel, the thickness of carton stock and the response time of the adhesive used, and it is such that the adhesive becomes set, excess of length being avoided so as not to prolong heating of the sealed end.

Then, the sealed cartons with their heated ends slide past cooling means in the form of a cooled platen 63 on one side and 63' on the other, which may be cooled by a fluid, preferably a gas, circulated by means such as a pump 64 and cooled by means indicated by numeral 65. The platen 63 may have a temperature of 30° F. and its length is such that it draws heat from the just-sealed heated carton end, thereby minimizing conduction of heat from said end into the side walls of the carton, where it may change the appearance of the wax coat.

The gluing station is shown in detail in FIGS. 5 and 6, the glue-rolls 45 and 49 and the flap-holding means 48 being indicated in FIG. 3A.

Glue roll 45 normally contacts a second and larger glue roll 49, which dips in a supply tank 71 containing liquid adhesive 72, at a suitable level, and which is positioned to apply adhesive to the outer face of flap 22 as it passes the gluing station. Glue roll 49 is secured to a powered shaft 73 mounted in the framework F of the machine and is driven by means not shown. Glue roll 45 is carried by shaft 74 which carries a gear 75 meshing with gear 76 fixed on shaft 73. The upper shaft 74 is mounted on a vertically swinging arm 77, pivoted to the framework F at 78. Arm 77 has a camriding roller 79 running on powered cam 80 on shaft 81 mounted in the framework F. Cam shaft 81 is driven from shaft 73 by the chain 82 and gears 83 and 86. Cam 80 has two concentric faces of different radii 84 and 85 acting on roller 79 to raise and lower arm 77, yet to retain meshing relation of gears 75 and 76. The cam face 84 allows glue roll 45 to run substantially in tangential contact with glue roll 49 to receive its supply of adhesive by transfer. Cam face 85 raises arm 77 to lift glue roll 45 from effective application-position as the portion 22^a of flap 22 passes the region of tangency. Since the cam makes one rotation per passage of carton, it is understood that it is timed with the travel of the conveyer 40, and since it is driven from shaft 73, the two glue rolls are also timed with said conveyer.

The flap 22 passes between the two glue rolls when cam rider 79 is on cam face 84. Glue roll 45 is provided with spaced grooves therein which become filled with adhesive for transfer to the flap to form the metered streaks 31 and 33 shown at station H. When glue roll 45 is lifted as described, means is provided to assure contact of flap 20 with glue roll 49, and such means is a part of a unitary fixture designated 48 in FIG. 3A having other functions. Glue roll 45 has a face 45^a adjacent a thin vertical plate 48' (FIGS. 5 and 6) which holds closed flaps 21 and 23 and out-folded flap 20 behind it and thus away from roll 45. The fixture 48 has a finger 90 at an angle (FIG. 5) to meet the on-coming closed flaps 23 and 21 and to move or to hold them in closed position along the length of plate 48' and its finger-like extension 91 terminating just ahead of station H.

Inwardly from finger 90 the fixture 48 has a downwardly inclined plate 92 leading to an extension plate 93 for guiding flap 22 to its position to enter the nip of rolls 45 and 49, and to hold flap 22 down onto roll 49 when roll 45 is lifted.

When the machine is operated, particularly for moisture-barrier cartons for deep-freeze storage, it is essential that the sealing of the flaps be such as to supplement the barrier properties of the waxed carton faces. This calls for a tight and lasting seal between the inner flaps 21—23 and the flap 22, and a seal tight to the folding lines 25 and 27 of the inner flaps. The scored lines 35 and 36 from end-to-end of the said folding lines function as channels to flow adhesive from the supply in streaks 30 and

31 directly to the ends of the folding lines. The area between the folding lines and said scored lines is rigidified to remain planar as pressure is applied to the flaps to fold them inwardly. The resulting planar regions receive liquid adhesive by the squeezing of the two flaps together with the streaks of adhesive as a supply for spreading. Thus, the carton is properly sealed.

It is to be understood that the machine may be modified in numerous ways within the scope of the invention as set forth in the appended claims.

I claim:

1. A carton-folding and carton-gluing machine suitable for sleeve-type cartons of the rectangular open-end type for containing frozen foods, comprising conveyer means for moving in one direction a succession of fiberboard cartons having a fusible moisture-barrier coat at least on the exterior faces thereof, which cartons are set up to rectangular form with at least one open end, which said carton and a first side wall thereof rest on said conveyor means and said wall extends as a coplanar first flap, and when each remaining side wall of the carton has a coplanar flap extension positioned 90° from its sealed position over the opening of said end, first and second means to move the inner flaps extending from the two side walls adjacent said first side wall substantially into their sealing position over said opening, third means positioned out of the path of the fourth and remaining flap to apply liquid adhesive material to the inner face of the first flap from the immediate vicinity of the ends of said flap inwardly for uniting the inner face of said first flap to the outer faces of said inner flaps, fourth means to apply said adhesive material to at least one of the faces forming the interface between said first flap and the remaining fourth flap when said fourth flap is later folded onto the outer face of said first flap in a folded position of the first flap over said inner flaps, fifth means to fold the adhesive-bearing first flap over and onto the outer faces of the unfolded inner flaps for later uniting them to the first flap by said adhesive carried on said inner face of said first flap, sixth means for folding said remaining fourth flap onto the resulting in-folded first flap, heated platen-means positioned to hold said flaps in contact in sealing position each at 90° to the plane of the rectangular opening of the carton as said conveyer means moves the resulting closed carton-end slidingly along said platen-means, said platen-means having an extent along the line of conveyance and a temperature both sufficient in combination to melt the barrier coat at the adhesive-bearing interfaces and expose the fibers of the flaps, and said adhesive being responsive to said temperature to bind the exposed fibers of one flap to the exposed fibers of an adjacent flap, and cold platen-means positioned to hold said heated and sealed flaps in said sealing position as said conveyer means moves said carton-end slidingly along said cold platen-means, said cold platen-means being substantially an extension of said heated platen-means and having a length along the line of conveyance and a temperature both sufficient in combination to withdraw heat from the resulting sealed carton-end and thereby minimize conduction of heat from the sealed end into the body of the carton.

2. A machine according to claim 1 in which said third means meters the adhesive material applied thereby.

3. A machine according to claim 1 in which said third means meters the adhesive material applied thereby and applies the adhesive material in parallel streaks extending in the direction of travel of the cartons.

4. A machine according to claim 1 in which said fourth means applies adhesive material to the outer face of said first flap.

5. A machine according to claim 1 in which said inner flaps in folded sealing position are separated by open space, and in which said third means for applying adhesive material is movable into and out of position for applying said adhesive material to said first flap, and means to move said third means out of adhesive-applying position as the area corresponding to said open space passes said third means.

6. A machine according to claim 1 in which said fourth means applies adhesive material to the outer face of said first flap, and in which said third means applies adhesive material simultaneously with said fourth means.

7. A machine according to claim 1 in which when the liquid adhesive is aqueous the heated platen-means has a temperature appreciably in excess of the boiling point of water, whereby to dehydrate, activate and set the adhesive solid content of said aqueous adhesive material.

8. A machine according to claim 1 in which said heated platen-means comprises sections extending in the direction of travel of the carton, and in which the sections in said direction have progressively lower temperatures appreciably in excess of the boiling point of water.

9. A machine according to claim 1 in which said cold platen-means has a temperature below the temperature of the environment of said machine.

10. A machine according to claim 1 in which said cold platen-means is cooled by gas, means to feed cooled gas to said platen-means, and means to cool said gas to a temperature below that of the environment of said machine.

11. A carton-folding and carton-gluing machine suitable for sleeve-type cartons of the rectangular open-end type comprising conveyer means for moving in one direction a succession of fiberboard cartons, which cartons are set up to rectangular form with at least one open end, when said carton and a first wall thereof rest on said conveyor means and said wall extends as a coplanar first flap, and when each remaining side wall of the carton has a coplanar flap extension positioned 90° from its sealed position over the opening of said end, first and second means to move the inner flaps extending from the two side walls adjacent said first side wall substantially into their sealing position over said opening, third means positioned out of the path of the fourth and remaining flap to apply heat-activatable liquid adhesive material to the inner face of the first flap from the immediate vicinity of the ends of said flap inwardly for uniting the inner face of said first flap to the outer faces of said inner flaps, fourth means to apply said adhesive material to at least one of the faces forming the interface between said first flap and the remaining fourth flap when said fourth flap is later folded onto the outer face of said first flap in a folded position of the first flap over said inner flaps, fifth means to fold the adhesive-bearing first flap over and onto the outer faces of the infolded inner flaps for later uniting them to the first flap by said adhesive carried on said inner face of said first flap, sixth means for folding said remaining fourth flap onto the resulting in-folded first flap, heated platen-means positioned to hold said flaps in contact in sealing position each at 90° to the plane of the rectangular opening of the carton as said conveyer means moves the resulting closed carton-end slidingly along said platen-means, said platen-means having an extent along the line of conveyance and a temperature both sufficient in combination to activate and set the adhesive between the flaps.

12. The apparatus of claim 11 in which cold platen-means is positioned slidingly to contact the heated sealed carton end for withdrawing heat therefrom.

13. A machine according to claim 11 in which said third means for applying adhesive to the inner face of the first flap lies in the path of the fourth flap when the latter is coplanar with its corresponding side wall, and in which additional plow means is positioned ahead of said third means to turn said fourth flap to a position 180° from its carton-closing position.

14. A machine according to claim 11 in which said fourth means for applying adhesive is positioned to apply adhesive to the outer face of said first flap.

15. A machine according to claim 11 in which said third and fourth means for applying adhesive are cylin-

drical rolls positioned normally in substantial tangential contact for the passage of the first flap between them, means for supplying adhesive continuously to said fourth means, said substantial contact serving to transfer adhesive from the roll of said fourth means to the roll of said third means during the time when no first flap passes between the rolls.

16. A machine according to claim 11 in which said third and fourth means for applying adhesive are cylindrical rolls positioned normally in substantial tangential contact for the passage of the first flap between them, means for supplying adhesive continuously to said fourth means, said substantial contact serving to transfer adhesive from the roll of said fourth means to the roll of said third means during the time when no first flap passes between the rolls, said roll of said fourth means being rotatable on a fixed axis, the roll of said third means being rotatable on an axis movable toward and away from said fixed axis whereby to move its said roll into its said first position of substantial contact for applying adhesive to said first flap and to a second position to avoid so applying adhesive, and means timed with the passage of first flaps between said rolls for moving said axis to avoid application of adhesive to a portion of said first flap.

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