Aug. 15, 1967 L. D. BAKER ETAL 3,335,544

CARTON FLAP HEAT SEALING APPARATUS

Filed March 12, 1965 6 Sheets-Sheet 1

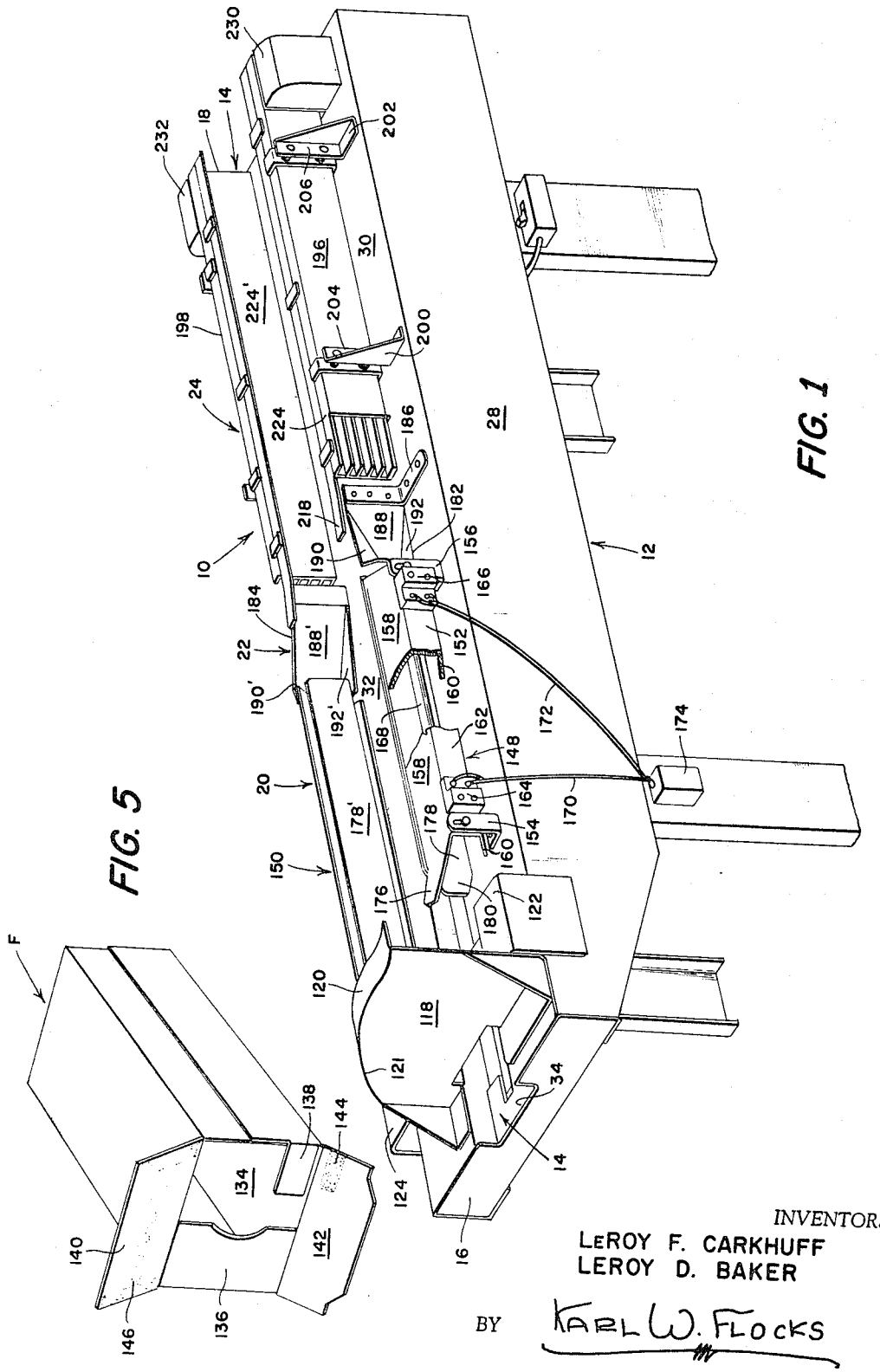


FIG. 1

FIG. 5

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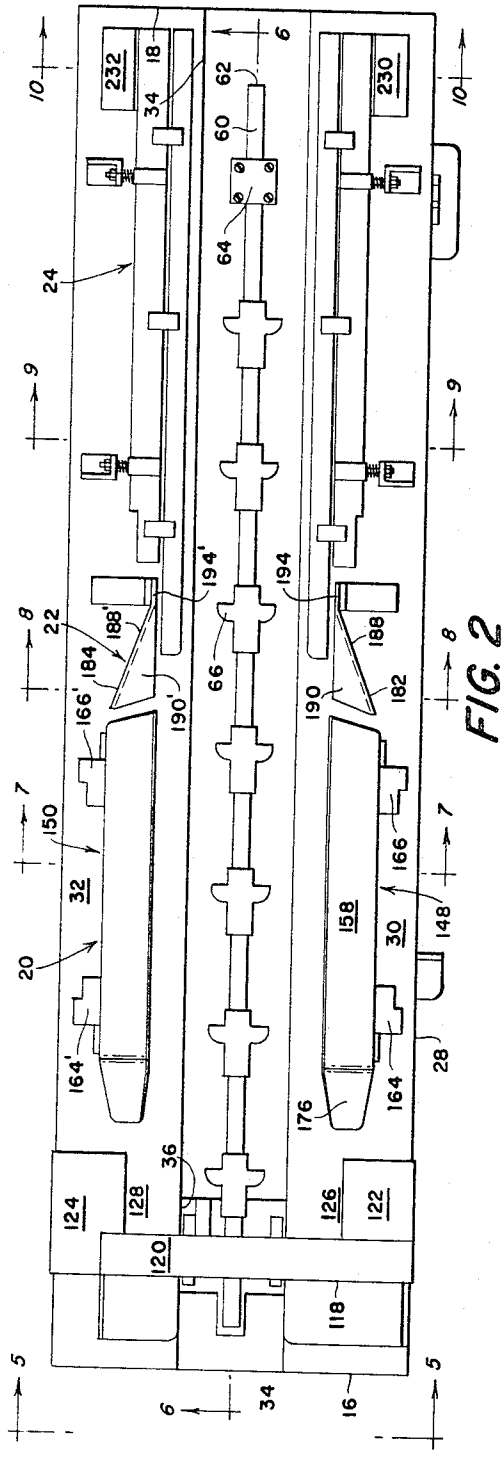


FIG. 2

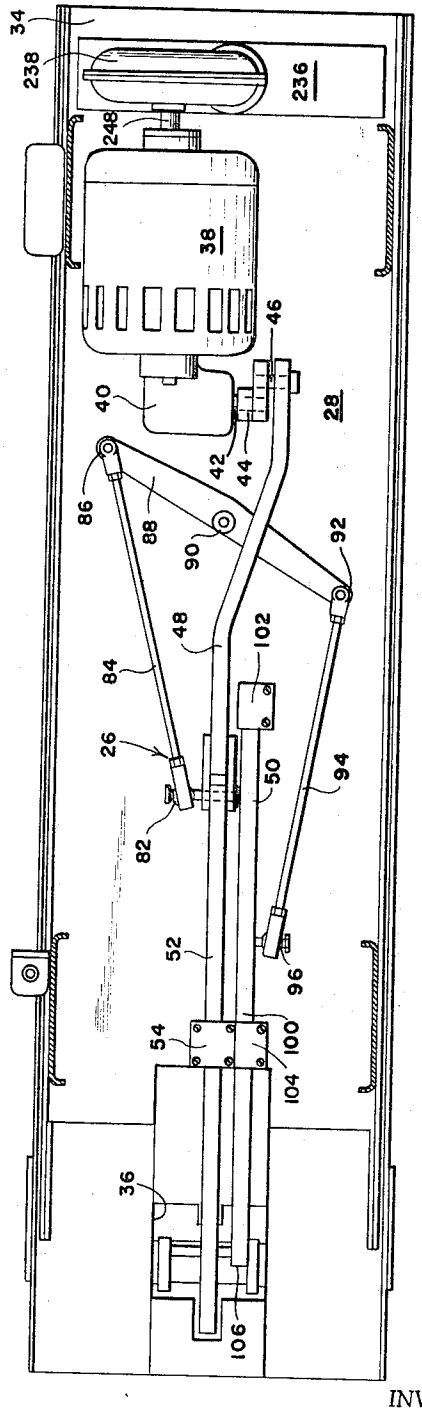


FIG. 4

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CARTON FLAP HEAT SEALING APPARATUS

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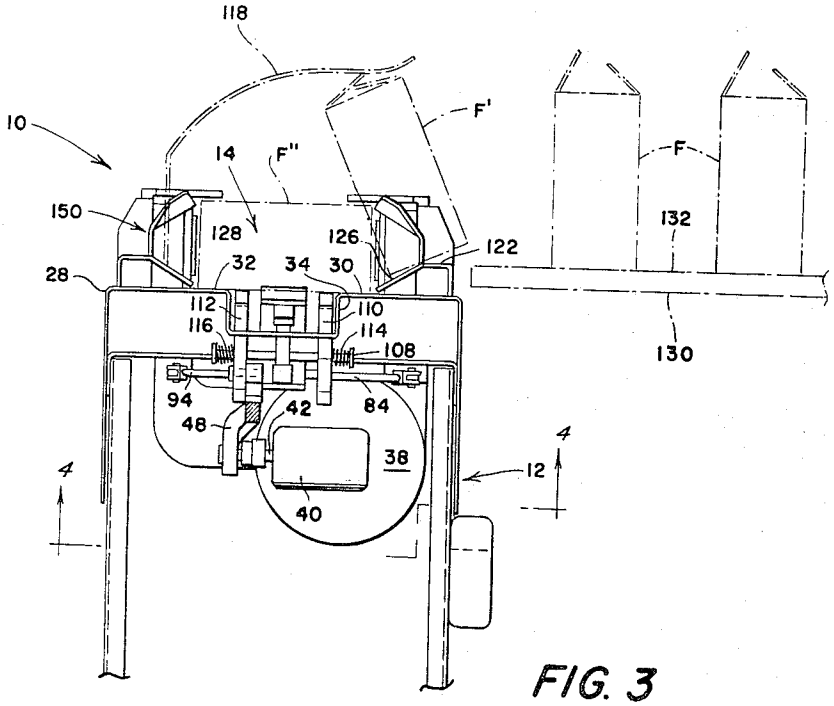


FIG. 3

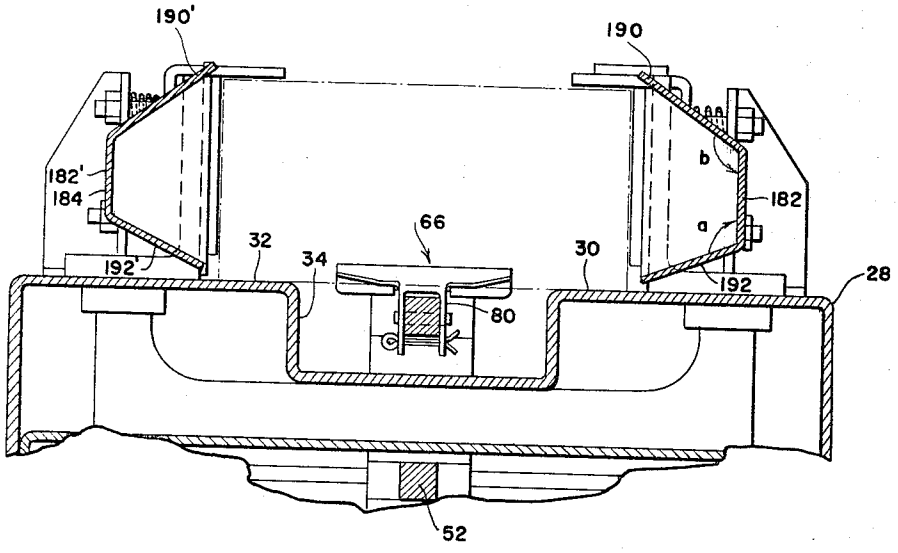


FIG. 8

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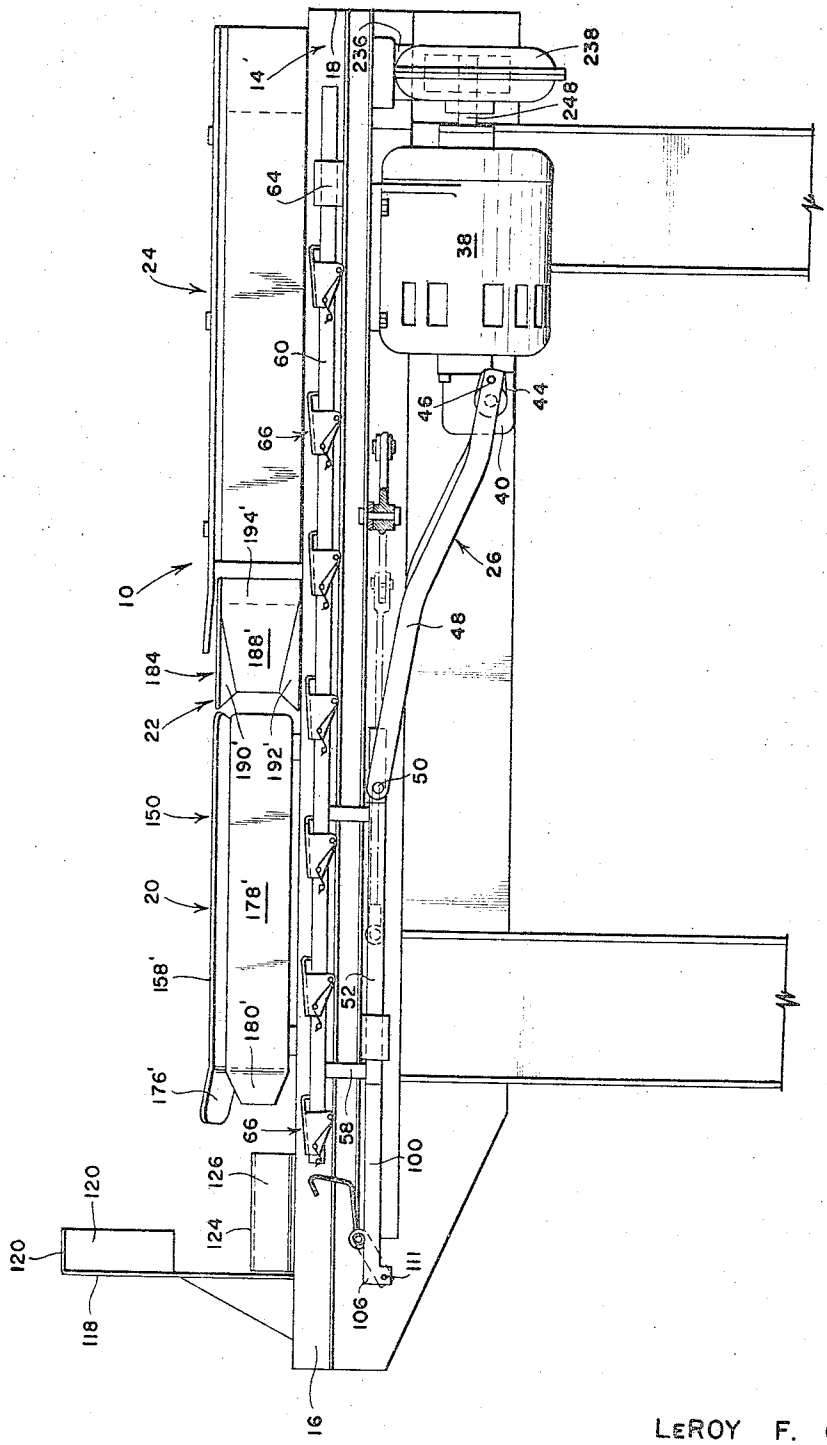


FIG. 6

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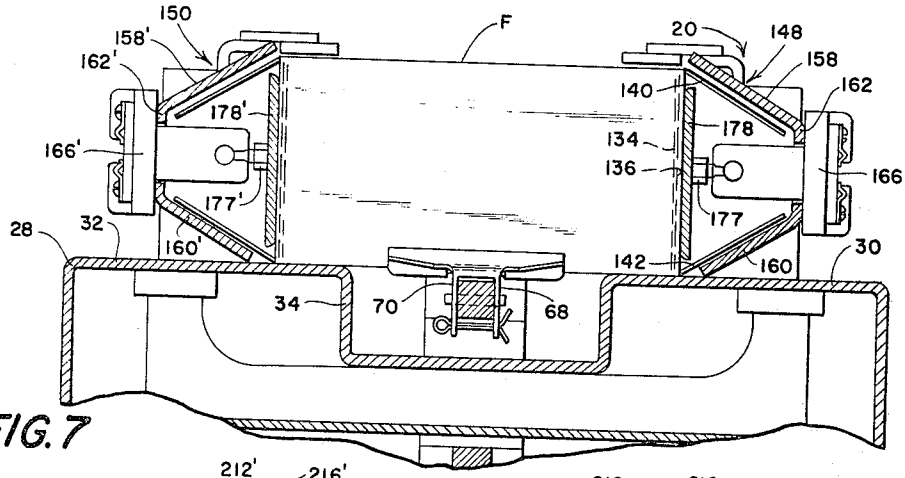


FIG. 7

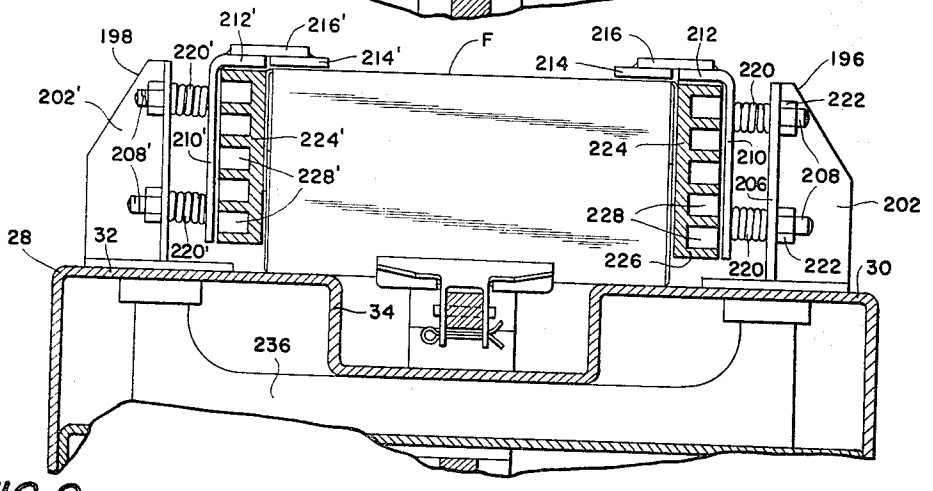


FIG. 9

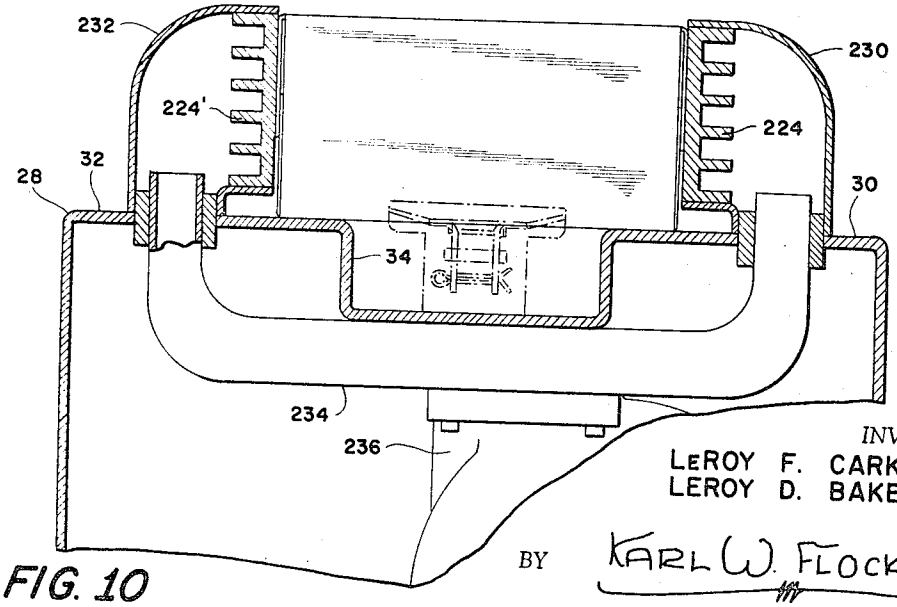


FIG. 10

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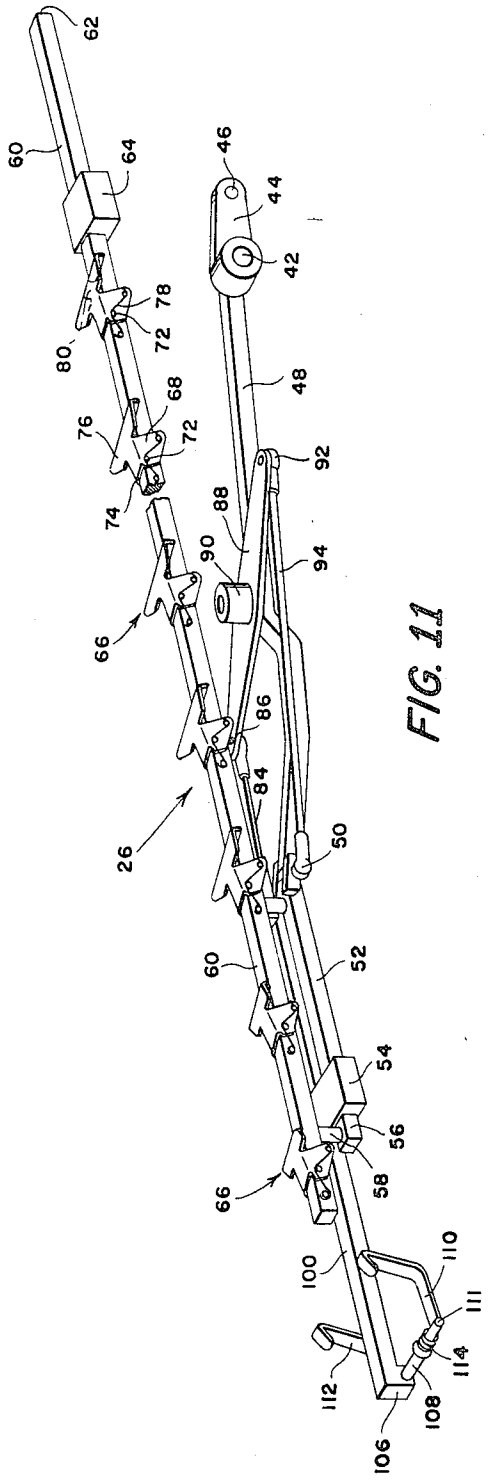


FIG. 11

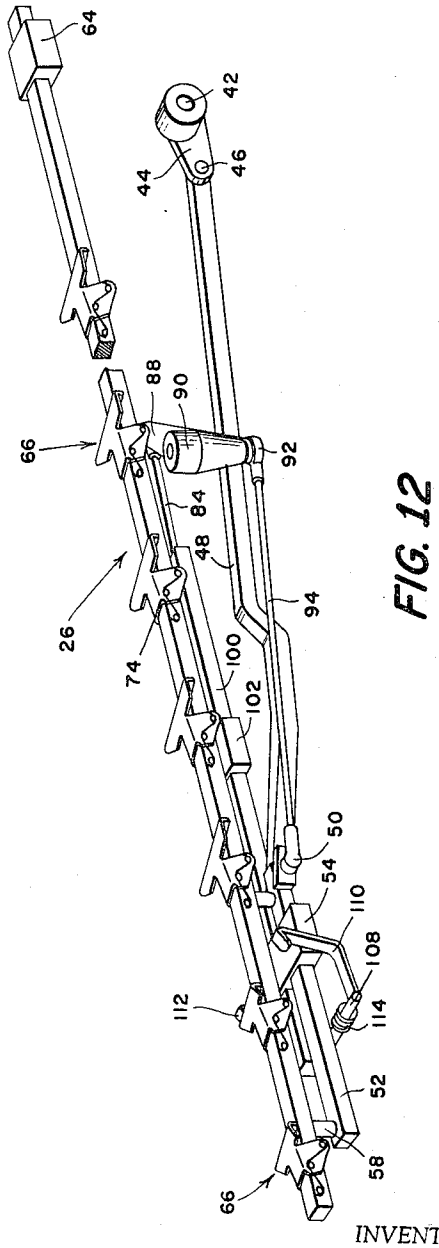


FIG. 12

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United States Patent Office 3,335,544 Patented Aug. 15, 1967

3,335,544

CARTON FLAP HEAT SEALING APPARATUS

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Filed Mar. 12, 1965, Ser. No. 439,174
7 Claims. (Cl. 53—375)

This invention relates generally to apparatus for heat-sealing articles having closure flaps coated at least in part with a thermoplastic material and more particularly to heat sealing apparatus particularly adapted for sealing cartons used for packaging ice cream or similar products.

Ice cream is customarily packaged in cartons employing conventional end-locking means, for example, apparatus of the type used for this purpose is disclosed in U.S. Letters Patent to S. F. Anderson No. 2,612,016. From the standpoint of storage space, utility and convenience, a practical packaging means is parallelepiped, heat-sealed carton with glued or permanent end closure flaps. Such a carton is essentially tamper proof and a typical sealed end carton is disclosed, for example, in FIG. 4 of U.S. Letters Patent No. 2,760,713 and in the application of Edward P. Fanter Ser. No. 301,373 filed Aug. 12, 1963; the latter application having an assignee common to the present application.

Apparatus of the general character utilized for a purpose similar to that of the apparatus of the present invention is disclosed, for example, in the U.S. Letters Patent to Taggart et al. No. 3,114,226.

Heretofore, the use of heat sealed cartons has been limited by the fact that it is difficult to obtain a proper seal between the desired surfaces without detrimental side effects to the carton or the contents. Further, in order to obtain proper adhesion of the thermoplastic adhesive, the adhesive must be completely melted. The heat for melting adhesive presents unique problems when the carton is filled with a fluent, meltable material such as ice cream or the like.

Primary objects of the present invention are to provide an apparatus for continuously heat-sealing and closure flap assemblies of parallelepiped cartons in a rapid, efficient and expeditious manner without detrimentally affecting the contents of the carton; to provide a novel heat sealing apparatus particularly adapted for use with apparatus of the character disclosed in U.S. Letters Patent to S. F. Anderson No. 2,612,016; to provide apparatus in which heat applied to inner surfaces of outer closure flaps of a parallelepiped carton is substantially insulated away from the inner closure flaps thereof and the contents of the carton; to provide outer closure-flap folding means controlling the folding sequence of the outer closure flaps to ensure the proper folding sequence of the flaps having activated thermoplastic adhesive thereon; and to provide novel means for cooling the previously activated adhesive on the outer closure flap of the carton while the closure flaps of the carton are retained in their finally positioned, sealed condition.

The objects mentioned above are accomplished by moving an article through successive steps along a longitudinal path of travel of way-means provided for the carton, and thus a further object of the present invention is to provide novel means for transporting or moving the cartons along a longitudinal path of travel in such way-means.

These together with other and more specific objects of the invention will become apparent from a consideration of the following specification and drawings forming a part thereof, wherein:

FIG. 1 is a perspective view of the carton-flap, heat-sealing apparatus of the invention;

FIG. 2 is a top plan view of FIG. 1;

FIG. 3 is an end elevation taken substantially on the plane of line 3—3 of FIG. 2 with portions removed for the purpose of showing details, and showing by means of phantom lines the manner in which filled cartons are received from an ice cream carton filling apparatus;

FIG. 4 is a bottom plan view taken substantially on the plane of line 4—4 of FIG. 3;

FIG. 5 is an enlarged perspective view of a typical carton having an end closure flap assembly to be heat-sealed by means of the apparatus of the invention;

FIG. 6 is a longitudinal vertical section taken substantially on the plane of line 6—6 of FIG. 2;

FIGS. 7–10 are enlarged vertical sections respectively taken substantially on the planes of lines 7—7, 8—8, 9—9 and 10—10 of FIG. 2;

FIG. 11 is a perspective view of the transport or shuttle assembly of the invention showing one position during the cycle of operation thereof; and

FIG. 12 is a perspective view similar to FIG. 11, showing an alternate position of the parts of the shuttle assembly of the invention.

Referring to the drawings in detail, and first considering FIGS. 1–3, the carton-flap, heat-sealing apparatus is indicated generally at 10 and comprises a support stand indicated generally at 12, having extending longitudinally thereof way-means indicated generally at 14 and defining a longitudinal path of travel through the apparatus.

Longitudinally spaced along the way-means 14, from the upstream end 16 to the downstream end 18 thereof, is a combined carton-flap, heating-and-manipulating means indicated generally at 20 generally defining a first station along the longitudinal path of travel of cartons (which will be sealed as they move through the way means), an outer carton-flap folding means indicated generally at 22 and located downstream with respect to the carton-flap heating-and-manipulating means 20, and located still further downstream with respect to the outer carton-flap folding means 22 is a carton outer closure-flap cooling-and-pressure applying means indicated generally at 24.

Disposed beneath the way-means 14 and having portion extending thereinto is an article-transport means comprising a shuttle bar assembly indicated generally at 26 (see FIGS. 4, 11 and 12, for example).

The support stand 12 comprises a top member 28 including a pair of spaced, longitudinally extending, horizontally-disposed, coplanar plate portions 30 and 32 extending the length of the apparatus. Formed between the plate portions 30 and 32 is a trough section 34 having a cutout portion 36 extending therethrough.

The shuttle bar assembly 26 includes a suitable power source such as an eletcrically-driven motor 38 operatively connected at one end to a transmission 40 having connected to a power output shaft 42 thereof a radially extending link 44 from which projects an eccentrically disposed support shaft 46. A force transmitting link 48 is journaled at one end of the support shaft 46, the other end of which is pivotally connected at 50 to a drive bar 52 reciprocably supported in a suitable bearing 54 depending from the under surface of the top 28 of the support frame for the apparatus.

The drive bar 52 has extending vertically from the terminal end 56 thereof a stud element 58 which has suitably secured to the upper surface thereof a primary shuttle bar 60 extending longitudinally within the trough 34. Fixed in the trough 34 and reciprocably receiving the downstream end 62 of the shuttle bar 60 is a suitable support bearing 64.

Longitudinally spaced along the primary shuttle bar 60 and extending vertically therefrom are pusher lug element assemblies 66 which function to afford step-by-step movement to cartons disposed in the longitudinal path of travel

of the way-means **14**. Each of the pusher-lug elements **66** includes a pair of depending ear portions **68** and **70** straddling opposite sides of the primary shuttle bars **60** and pivotally connected thereto by means of suitable shaft element **72**. The elements **66** include a rear abutment edge portion **74** engageable with the upper surface of the shuttle bar **60** and include a transverse pusher plate portion **76** for engaging the side wall of a carton disposed in the way means. Suitable means such as a torsion spring **78** urges the pusher lug element upwardly about the shaft elements **72** until the abutment edge **74** engages the upper surface of the shuttle bar. Lug elements are normally disposed in the position seen in FIG. 11, for example; however, when the shuttle bar **60** is moved in an upstream direction, i.e. toward end **16** of the apparatus, pusher plate portion **76** has intermediate notches **80** which permit the lug elements **66**, i.e. the pusher plate portion **76** thereof, to move downwardly against the action of the torsion spring **78** to permit the lug elements to pass beneath a carton disposed upstream thereof.

Pivotally connected at **82** (see FIG. 4) is a drag link **84** movable in unison with drive bar **52** and the drag link **84** is pivotally connected at **86** to one end of a pivot arm **88** intermediately journaled at **90** on a support shaft depending from the bottom **28** of the support stand. The pivot arm has pivotally connected at **92** one end of a force transmitting rod **94** which is pivotally connected at **96** to a stub shaft **98** extending laterally from a secondary shuttle bar **100**. The secondary shuttle bar **100** is journaled for reciprocatory movement in suitable bearings **102** and **104** depending from the under surface of a top plate **28** and terminates at end **106** disposed beneath the opening **36** of the top member **28**. The secondary shuttle bar **100** has extending transversely therethrough, adjacent the end **106** thereof, a transverse support shaft **108** having journaled on opposite ends thereof secondary pusher lug elements **110** and **112** which are spring biased upwardly by torsion springs **114** and **116**, respectively.

The pusher lug elements **110** and **112** will be effective to engage a carton disposed at the upstream end of the longitudinal path of travel in the way-means to ensure that a filled carton received from the carton-filling apparatus is moved out of the path of travel of next oncoming carton, and will orient the same for subsequent engagement in a step-by-step manner by the lug element **66**.

It will be clearly apparent from FIGS. 11 and 12 that as the drive bar **48** reciprocates in one direction and carries the drag link **94** therewith, the pivot arm **88** causes reverse movement to the secondary shuttle bar **100**, and this movement is reversed when the drive bar **52** is moved in the opposite direction.

Suitably secured transversely over the trough **34**, adjacent the upstream end **16** of the apparatus, is a vertically extending guide plate **118** (see FIGS. 1 and 2) which preferably includes at the upper periphery thereof an upper peripheral guide flange **120**. Projecting vertically adjacent the inner surface of the plate **118** are horizontally disposed landing plates **122** and **124** which respectively continue as downwardly angled portions **126** and **128**, respectively, which journal inwardly of adjacent side margins of the trough (see FIGS 2 and 3) for example (the guide plate **118** having been removed from FIG. 3).

Still referring to FIG. 3, a fragmentary portion of a suitable conveyor is disposed laterally of the landing plate **122** as indicated at **130**, and will have disposed thereon filled cartons F which were filled on apparatus such as that disclosed in the patent to S. F. Anderson No. 2,612,-016. The conveyor **130** has the upper surface **132** thereof in substantial coplanar alignment with the landing plate **122**, and cartons moved from the conveyor **130** toward the landing plate **122** will eventually engage the angular portion **126** thereof as indicated at F'. As seen in FIG. 1, for example, the peripheral guide flange **120** includes a downwardly angled portion **121** which cams the filled carton F' downwardly into the position F'' wherein the carton will extend transversely of the trough **34** at opposite ends thereof resting on the substantially coplanar plate portions **30** and **32**.

The acrtons F–F'' will have the end closure flaps thereof in an unsealed condition. Considering FIG. 5 the filled carton F includes overlapped inner closure flaps **134** and **136**, and a cover tab **138** extends in overlying relationship with respect to the inner closure flap **134**. Upper and lower outer closure flaps **140** and **142** are disposed in substantially obtuse angular relationship with respect to the plane of the overlying juxtaposed inner closure flaps **134** and **136**. In the final end closure assembly of the sealed cartons, the flap **142** will underlie the inner surface (that disclosed in FIG. 5) of the upper closure flap **140**. The inner surface of the lower closure flap **142** includes a thermal-responsive adhesive portion **144** which will overlie and engage the tab **138** when the carton is sealed. The upper closure flap **140** includes on the inner surface thereof thermal-responsive adhesive **146** which will engage the outer surfaces of the inner closure flaps **134** and **136** and retain a portion of the outer closure flap **142** therebeneath.

The combined carton-flap heat-and-manipulating means **20** comprises, at what might be defined a first station, two assemblies which in a sense can be described to be mirror images of each other; these assemblies are indicated generally at **148** and **150**. In view of the apparent similarities between assemblies **148** and **150**, only assembly **148** will be described in detail, and similar primed reference numerals will be applied to assembly **150**.

The assemblies **148** and **150** include a longitudinally disposed trough member **152** supported on the horizontal plate portions **30** and **32** by means of suitable support brackets **154** and **156**. The trough member **152** includes upper and lower guide plate portions **158** and **160** diverging angularly from a substantially vertical plate portion **162**. The plate portion **160** is disposed in substantially coplanar relationship with the angular plate portion **126** of the landing plate **122** as is the corresponding structure of assembly **150** with respect to angular portion **128** of the landing plate **124**. The substantially angularly disposed, coplanar portions **126** and **160** will receive thereon a lower, outer closure flap **142** of the cartons as they are moved through the longitudinal path of travel through the apparatus. Likewise, the angular portion **158** of assembly **148** will engage the upper, outer closure flap **140** (see FIG. 7) for example.

The plate portion **162** has suitably thereon insulated lamp-holder brackets **164** and **166** which have extending therebetween, in spaced relationship from the inner surfaces of the guide plate portions **158** and **160**, and extending substantially the length thereof, an elongated heating element **168** such as a quartz-heat lamp or the like. The heat-lamp holder brackets **164** and **166** are operatively connected by conducting wires **170** and **172** to a transformer **174** for providing current to the heat lamp. The current supplied by the transformer will be sufficient to activate the heat lamp **168**, and the thermoplastic adhesive portions **144** and **146** on the inner surfaces of the respective lower and upper outer closure flaps of the carton F will be activated or softened as the cartons pass through the longitudinal path of travel of the way means, being transported by the shuttle assembly **26**.

The upper guide plate **158** has at the lead end thereof an upwardly angled sword or blade portion **176** guiding the upper closure flap **140** beneath the guide plate **158**. Inasmuch as guide plate portion **160** is in substantially coplanar relationship with respect to angular portion **126** of the landing platform, during movement of the carton from the position at the landing platform through the trough **162**, lower closure flap **142** will be disposed in the angular position shown in FIG. 7 of the drawings.

The support brackets **164** and **166** have extending inwardly (only one being shown) support element **177** supporting thereon a vertically extending guide plate **178**

extending the length of the heating element or lamp **168** and having the dual function of baffling or insulating heat of the heating element away from the carton as it passes through the longitudinal path of travel of the way means, and having the further function of retaining the overlapped inner closure flaps **134** and **136** and tab **138** in juxtaposed relation for retaining and maintaining the contents of the carton therewithin.

The guide plate **178** includes a slightly outwardly angled leading end blade portion **180** for ensuring that the just mentioned inner closure flaps and tab are maintained therebehind during their passage along the longitudinal path of travel of the way-means.

The thermoplastic adhesive etc., of the inner and outer closure flaps of the carton at the end opposite that shown in FIG. 5, for example, is activated by the structure of assembly **150** which corresponds to the structure of assembly **148**.

The outer carton-flap folding means **22** is disposed at a station downstream of the means **20** and comprises units **182** and **184** which are mirror images of each other, and only the unit **182** will be described in detail, and primed reference numerals will be used to identify corresponding structure of the unit **184**.

The unit **182** includes a support bracket **186** mounted on the upper surface of the horizontal plate portion **30** and includes a vertically disposed and inwardly angled plate portion **188** which extends generally from the plane of the vertical plate portion **162** inwardly toward the longitudinal path of travel of the way-means, i.e., terminating substantially coplanar relationship with the inner surface of the guide plate **178**. The plate portiton **188** includes inwardly angled upper and lower corner portion **190** and **192** (see FIG. 8) for example. It will be noted that the included angle *a* between the angular bent corner **192** and vertical plate **182** is less than the corresponding included angle *b* between the upper bent corner **190** and the vertical plate **182**. The just mentioned angular relationship will cause the lower, outer closure flap **142** of the carton to be folded inwardly before the outer closure **140** is folded thereover, i.e. as the carton is moved along the longitudinal path of the way-means.

The plate portions **182** and the bent corners **190** and **192** merge into a vertically extending planar plate segment **194**, the inner surface of which is substantially coplanar with the inner surface of the guide plate **178**. The inner and outer closure flaps of the cartons F will be disposed in their juxtaposed position for final sealing when they pass the plate segment **194**.

Located downstream of the means **22**, at what can be described as a third station, is the previously mentioned carton outer closure flap, cooling and pressure applying means **24** which comprises units **196** and **198** which are also mirror images of each other, and the portions of unit **198** which correspond to those of unit **196** will be identified with primed reference numerals without specifically describing the structure thereof.

Unit **196** comprises a pair of longitudinally spaced, vertically extending support brackets **200** and **202** which respectively include mounting plate portions **204** and **206**. The mounting plate portions **204** and **206** are suitably apertured and thave extending therethrough stud elements **208** which extend outwardly from a housing element **210** which opens upstream and has extending inwardly from the upper portion **212** thereof a guide plate **214** secured thereon by means of suitable support straps **216**. The leading end of the guide plate **214** is upturned at **218** (see FIG. 1), for example, and will engage the upper surface of the filled carton F as it passes therebeneath along the longitudinal path of travel of the way means. Circumposed about the mounting studs **208** are compression springs **220**, and adjusting or retaining nuts **222** are engaged on the stud elements **208** (see FIG. 9). Disposed within the housing element **210** is a pressure and guide plate **224** which will engage the juxtaposed closure flaps, and the guide plate **224** includes longitudinally extending ribs **226** forming a plurality of longitudinally extending, open-ended passages **228**. The plate **224** is produced from aluminum or a similar good conductor of heat, and as will subsequently be described in detail, air is urged through the passages **228** to conduct heat away from the guide plate **224** which serves to rapidly cool the thermoplastic adhesive that was previously activated on the inner surfaces of the outer closure flaps **140** and **142**.

It will be noted that the guide plates **224, 224'** are spring urged from opposite sides of the longitudinal path of travel of the cartons F, and in order to apply pressure to the opposite ends of the cartons as the thermoplastic adhesive is being cooled, the inner surfaces of the plates **224, 224'** will be so adjusted that the desired pressure is applied to the ends of the cartons.

A pair of opposed housings **230** and **230'** are mounted on the horizontal plate portions **30** and **32** of the support stand, and the guide plates **224** and **224'**, respectively, terminate therein. Communicating with the interior of the housings **230** and **230'** are upper ends of a substantially U-shaped conduit **234** (see FIG. 10), which in turn is connected to the outlet end **236** of a centrifugal fan **238** depending from the under surface of the support stand and having a rotor (not shown) operatively connected to the output shaft **240** of the motor or power means **38** (see FIG. 4).

When the apparatus is operating, air will be forced into the housings **230** and **232**, along the passages **228, 228'** and accordingly as filled cartons are moved along the longitudinal path of travel of the way means, the activated thermoplastic adhesive on the inner surfaces of the outer closure flaps will be rapidly cooled. This rapid cooling of the previously activated thermoplastic adhesive, will aid to obviate melting of ice cream or the like retained in the filled cartons by the juxtaposed closure flaps of the end closure assemblies thereof.

Brief review of the operation of the apparatus

Filled cartons F are moved from the conveyor **130** into the apparatus to reach the position shown at F'' of FIG. 3. The shuttle assembly **26**, i.e. through the expedient of pusher lug elements **110** and **112** initially move the filled cartons disposed on plate portions **30** and **32'** away from the guide plate **118** adjacent the upstream end **16** of the apparatus.

The pusher lug elements **66** function to move the cartons in a step-by-step manner along the longitudinal path of travel defined by the way means **14**. The end closure assembly of the filled cartons initially move through station **1**, i.e. the combined carton flap heating and manipulating means **20**, during which time the inner closure flaps **134, 136** and tab **138** are maintained in substantially coplanar relationship by the guide plates **178** and **178'** of the units **148** and **150** respectively. The thermoplastic adhesive **144** and **146** on the inner surfaces of the respective upper and lower outer closure flaps **140** and **142** is activated by the heating elements **168** which are disposed within the units **148** and **150** and the guide plates **178** and **178'** insulate the contents of the carton and the overlying or overlapped inner closure flaps of the carton away from the heat generated by the elements **168**.

The cartons are then moved to station No. **2**, i.e. past the outer carton flap folding means **22**, at which time the outer closure flaps **142** and **140** are folded overlapped in the proper sequence so that a portion of flap **142** underlies flap **140**.

Next, the cartons are moved through station **24**, at which time the guide and pressure plates **124** serve to retain the closure flaps at the ends of the carton in overlapped relationship and simultaneously cool the previously activated thermoplastic adhesive.

Suitable means (not shown) are provided at the downstream end 18 of the apparatus for conveying the now sealed cartons away from the apparatus.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

We claim:

1. Carton flap sealing apparatus for sealing closure flaps on a carton filled with a material comprising, in combination, way means extending longitudinally and defining a path of travel therealong; article-transport means in said way means including means for conveying a filled carton along the longitudinal path of travel of said way means through a plurality of stations therealong; combined carton flap heating and manipulating means disposed at a first station upstream of the longitudinal path of travel of said way means including means for retaining inner closure flaps of a carton in overlapping sealing relationship and for activating heat activated adhesive on the inner surfaces of outer carton closure flaps; outer carton flap folding means disposed downstream of said carton flap heating and manipulating means and including means for positioning the outer carton closure flaps in overlying relationship; and carton outer closure flap cooling and pressure applying means disposed downstream of said outer carton-flap folding means and underlying means for retaining the carton closure flaps in overlying sealed relationship and cooling the heat-activated adhesive for completing the sealing of the carton.

2. The structure as claimed in claim 1 in which said article transport means comprises a shuttle bar assembly disposed beneath said way means and includes a primary and a secondary shuttle bar disposed in parallel relationship along longitudinal path of travel by said way means, and primary shuttle bar including a plurality of upwardly biased pusher lugs pivotally connected thereto and longitudinally spaced along said primary shuttle bar and extending into the longitudinal path of travel of said way means, said secondary shuttle bar including upwardly biased pusher lugs extending vertically into the longitudinal path of travel of said way means and located at the upstream end of said longitudinal path of travel, power means including force transmitting numbers operatively connected to said primary and secondary shuttle bars and including means for simultaneously reciprocating the respective shuttle bars in opposite directions.

3. The structure as claimed in claim 1 in which said combined carton flap heating and outer flap manipulating means comprises at least one trough member extending longitudinally along the longitudinal path of travel of said way means and at one side thereof and including upper and lower guide plates for orienting the outer closure flaps of a carton moving through said way means, a heat source in said trough and disposed between said upper and lower guide plates for activating the adhesive on inner surfaces of said outer closure flaps, and a guide and insulating plate extending along the longitudinal path of travel of said way means inwardly of said heat source for retaining the inner closure flaps of the carton in overlying sealed relationship and insulating heat away from the contents of said carton.

4. The structure as claimed in claim 1 in which said outer carton flap folding means comprises at least one vertically extending plate extending angularly toward the downstream end of the longitudinal path of travel of said way means, said vertically extending plate including upper and lower, inwardly angled, corner portions disposed upstream of the downstream end of said vertically extending plate, said inwardly angled corners merging into said vertically extending plate toward the downstream end thereof and being disposed at different angles with respect to each other for controlling the inward folding sequence of the outer closure flaps of the carton.

5. The structure as claimed in claim 1 in which said carton outer closure flap cooling and pressure applying means comprises at least one guide plate extending longitudinally of and along the longitudinal path of travel of said way means, for engaging and retaining the inner and outer closure flaps of a carton in overlying relationship while the heat activated adhesive of the outer closure flaps is cooled, an air chamber extending longitudinally of said plate and outwardly and along the length thereof, and a forced air source connected to said air chamber for forcing air therethrough and cooling said guide plate for conducting heat away from said plate and cooling the heat-activated adhesive.

6. The structure as claimed in claim 5 including means biasing said guide plate laterally toward the longitudinal path of travel of said way means for applying pressure to the overlying inner and outer closure flaps while the heat-activated adhesive on the outer closure flaps is being cooled.

7. The structure as claimed in claim 1 in which said outer carton flap heating and manipulating means, outer carton flap and carton outer closure flap cooling and pressure applying means are disposed in the order mentioned along the longitudinal path of travel of said way means in opposed pairs at opposite sides of said way means for closing and sealing opposite ends of the filled carton.

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