Dec. 16, 1969 L. BACK ET AL 3,483,803

AUTOMATIC FLAP FOLDING MEANS FOR PACKAGING APPARATUS

Filed Oct. 23, 1967 2 Sheets-Sheet 1

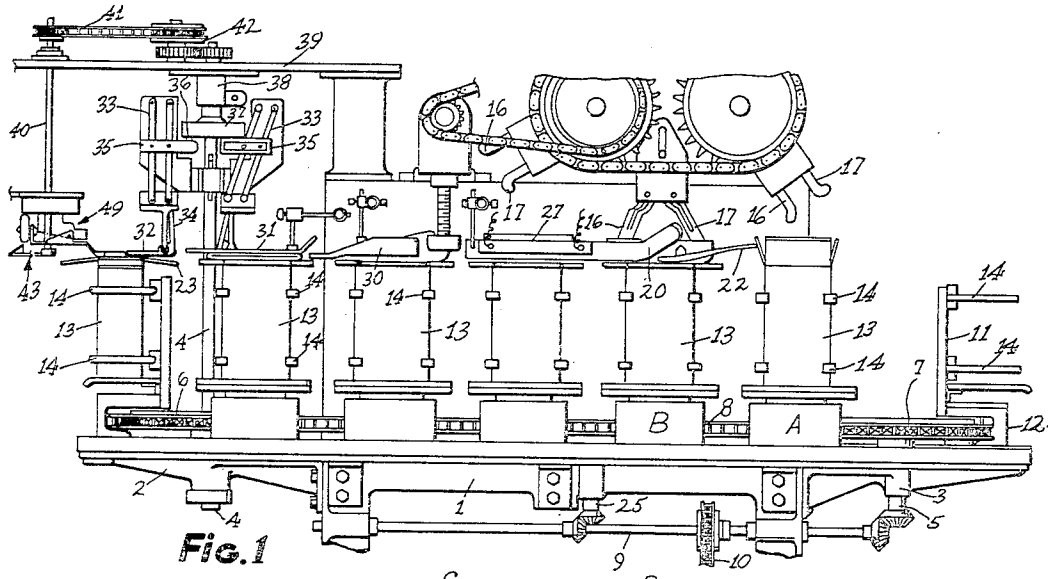

Fig. 1

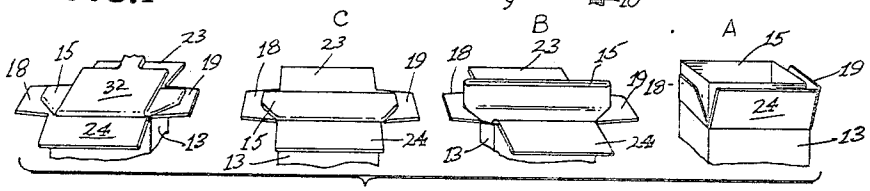

Fig. 2

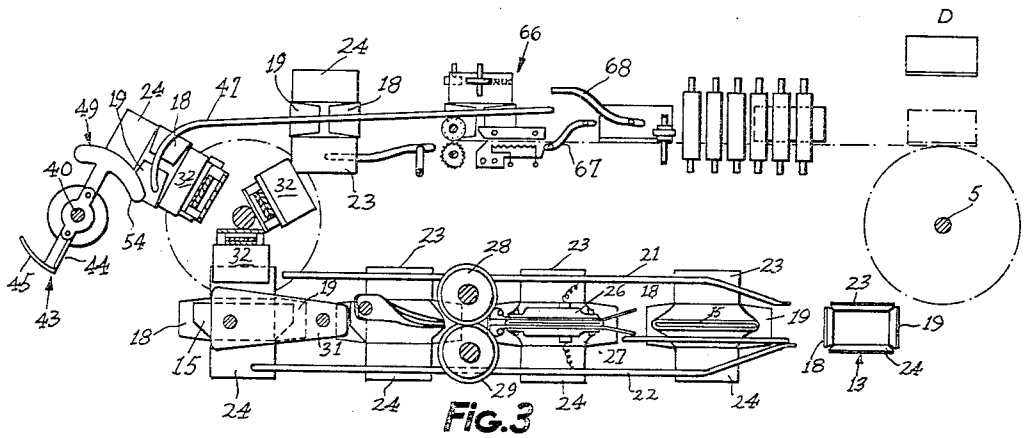

Fig. 3

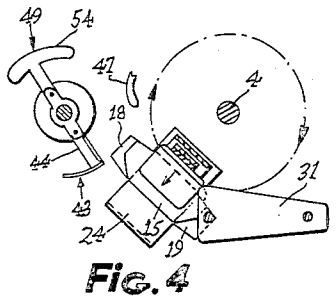

Fig. 4

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AUTOMATIC FLAP FOLDING MEANS FOR PACKAGING APPARATUS

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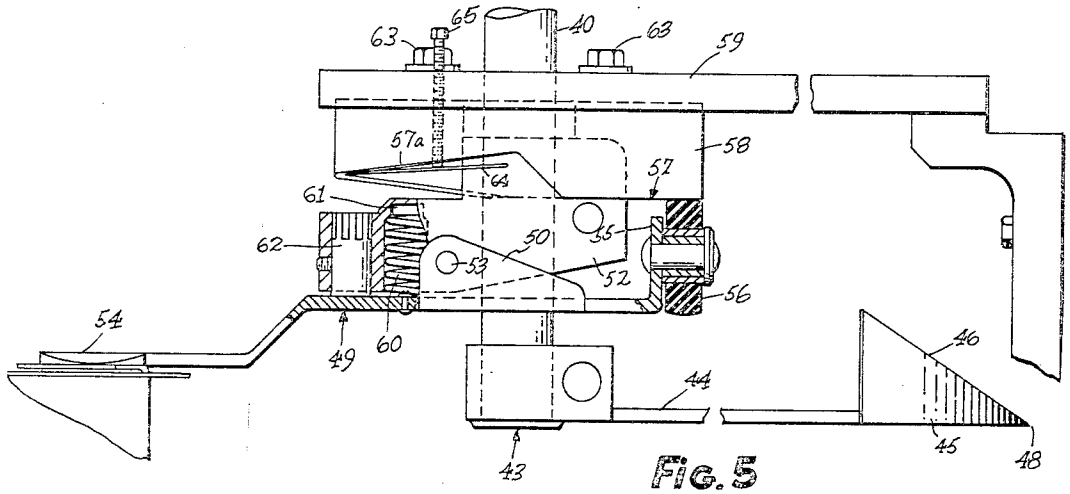

Fig. 5

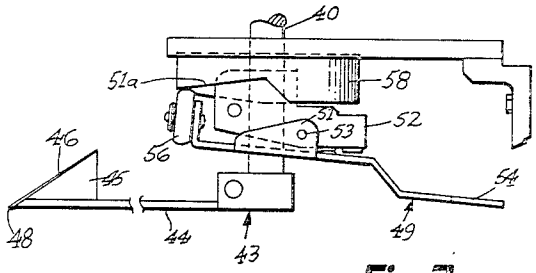

Fig. 6

Fig. 7

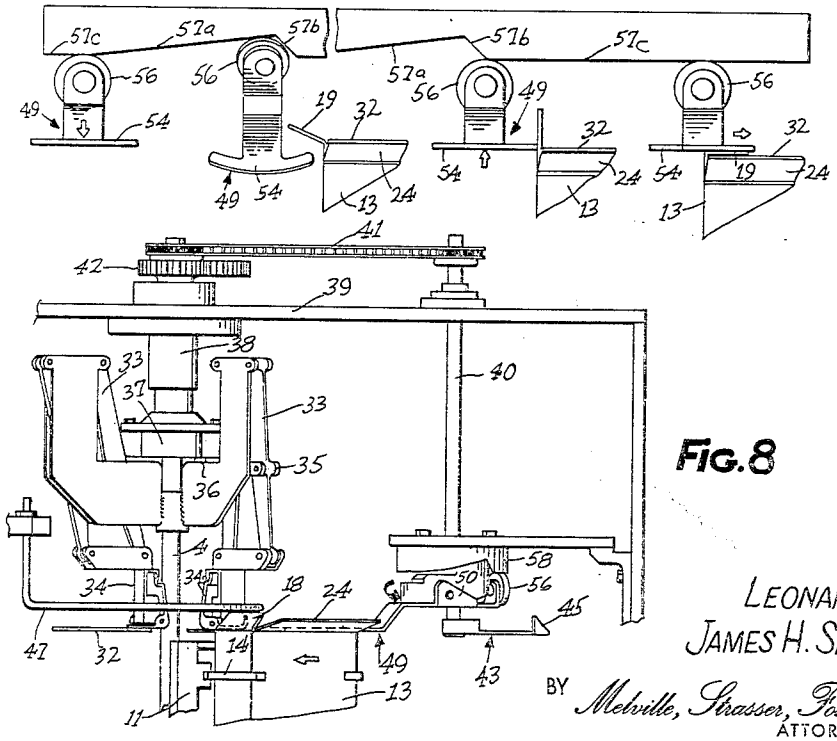

Fig. 8

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AUTOMATIC FLAP FOLDING MEANS FOR PACKAGING APPARATUS

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U.S. Cl. 93—44 12 Claims

ABSTRACT OF THE DISCLOSURE

A flap folding means for use in conjunction with apparatus for closing and sealing the ends of paperboard cartons wherein the cartons are advanced in a path of travel and the end closure flaps sequentially infolded and adhered together, the folding means comprising an oppositely directed pair of folding instrumentalities rotatably mounted on a shaft driven in timed relation to the movement of the cartons being folded, one of the folding instrumentalities acting to contact and elevate a closure flap articulated to the end of the leading carton body wall and position it for contact by a sweep acting to infold the said closure flap, the other of the instrumentalities acting to contact and infold the end closure flap articulated to the trailing carton body wall, the latter folding instrumentality being pivotally mounted for movement in an irregular path as it rotates, there being adjustable cam mechanism operative to effect pivotal movement of the folding instrumentality in a vertical direction as the instrumentality approaches the trailing body wall of the carton body, the pivoting movement serving to elevate the folding instrumentality while in contact with the end closure flap to lift the flap upwardly and at the same time permit the folding instrumentality to clear the upper edge of the trailing carton body wall as the folding instrumentality rotates over the top of the carton body.

BACKGROUND OF THE INVENTION

This invention relates to an improvement in the closure flap folding means employed with the packaging apparatus disclosed in Bergstein et al. United States Patent 2,979,955, dated Apr. 18, 1961 and entitled "Apparatus for Closing and Sealing Lined Containers." This patent discloses a packaging machine wherein lined carton structures to be closed and sealed are placed in carriages which advance the cartons through a series of operating stations at which the extending liner mouths and end flaps are folded and sealed. The infolding of the carton end closure flaps takes place as the cartons are moved in a semi-circular path of travel, the initially outfolded closure flaps being acted upon by a series of folding instrumentalities including a folding plate adapted to be moved to a position overlying the opened upper end of an advancing carton, whereupon a contoured folding arm lying adjacent the path of travel of the carton acts to sequentially engage the leading and trailing end closure flaps and fold them upwardly to positions in which they may be contacted by additional folding instrumentalities which enforce the infolding of the closure flaps over the folding plate, whereupon the plate is withdrawn and the carton advanced with the infolded flaps held in folded position by sweeps.

While apparatus of the character described has been in widespread use, the contoured folding arms just described have presented certain problems, particularly when the apparatus is being operated at high speed. Since the folding arm is positioned adjacent the path of travel of the cartons as they are moved in an arcuate path, the folding arm of necessity must engage marginal edge portions of the leading and trailing closure flaps. Such

engagement requires precise alignment of the folding arm and the maintainenance of such alignment at all times. Even though the folding arm may be accurately aligned with respect to a given carton, the cartons themselves will vary in the dimensions of their flaps and the position of the flaps will vary depending upon a slight twisting of the carton body walls or the position in which the carton is engaged by the carriage which advances it through the machine. These variations are magnified when the machine is operating at high speeds. The result of these variations in position is that occasionally the contoured folding arm will fail to engage one or the other of the closure flaps, resulting in such flap remaining unfolded. Where this occurs, the improperly folded cartons must be scrapped. Since the cartons have been filled with their contents prior to the folding and sealing operations, the scrapped cartons and their contents must either be thrown away or else the imperfect cartons manually opened and the contents salvaged for reuse.

As opposed to the foregoing, the instant invention provides improved flap folding means which eliminate the difficulties inherent in the aforementioned contoured folding arm by providing rotary sweeps which successively engage and elevate the leading and trailing closure flaps to initiate the infolding of such flaps. While in accordance with the aforementioned patent, a rotary sweep was employed to contact and enforce the infolding of the trailing closure flap after it was initially elevated by the contoured folding arm, such sweep, which was positioned to clear the upper most ends of the carton body walls, was dependent upon the contoured folding arm to initially elevate the end closure flap to a position where it could be contacted by the sweep.

In accordance with the instant invention, rotary sweeps are provided which effectively and positively engage the leading and trailing closure flaps irrespective of the minor variations in the dimensions or relative positions of the flaps and hence insure trouble free infolding of the flaps even when the apparatus is operating at high speeds.

RESUME OF THE INVENTION

The folding instrumentalities for the leading and trailing closure flaps comprise a pair of rotary sweeps mounted on a common shaft driven in timed relation to the movement of the cartons being folded and sealed. The leading sweep comprises an arm mounting a curved dart which is of generally right triangular configuration, having an upwardly and rearwardly inclined surface adapted, as the arm rotates, to pass beneath the outfolded leading flap and, as the arm advances, to cause the undersurface of the outfolded closure flap to ride upwardly along the inclined surface of the dart, thereby elevating the closure flap for contact by a stationary sweep lying above the path of travel of the advancing carton, the sweep serving to enforce the infolding of the leading closure flap over a folding plate which, as disclosed in the aforementioned patent, is swung into position overlying the open end of the carton as it is advanced for contact by the folding instrumentalities.

The trailing sweep, which is also mounted for rotation on the common shaft, is positioned to approach the advancing carton from the rear, i.e., toward the trailing wall of the advancing carton, and as the sweep approaches the trailing wall, its vertical position will be sufficiently below the upper edge of the trailing wall to insure that it will pass beneath the outfolded trailing closure flap even though the closure flap is in a somewhat downwardly inclined position. The trailing sweep is also mounted for pivoting movement in a vertical direction and is provided with a cam follower adapted to ride over an adjustable cam surrounding the drive shaft on which the sweep is mounted, the cam surface having a rise positioned to rock

the arm of the sweep upwardly as it passes beneath the trailing closure flap but before it comes into contact with the trailing body wall, the upward movement serving to lift the trailing flap upwardly and at the same time cause the rotating sweep to clear the uppermost edges of the carton body walls so that, as the sweep continues its rotation, it will infold the trailing closure flap over the folding plate and maintain the trailing closure flap in the infolded position until it comes under the influence of the stationary sweep which enforced the infolding of the leading closure flap and, in its prolongation, serves as a hold-down for both infolded closure flaps.

The trailing sweep, which is pivotally mounted, is spring biased into positive contact with the annular cam; the annular cam is rotatably adjustable to effect the required vertical movement of the sweep in synchronism with the movement of the advancing cartons, and in addition, the inclined cam surfaces are adjustable to control the vertical movement of the rotating sweep.

THE DRAWINGS

FIGURE 1 is a side elevation of container closing and sealing apparatus embodying the present invention.

FIGURE 2 is a schematic fragmentary perspective view illustrating successive stages in the operation of the apparatus illustrated in FIGURE 1.

FIGURE 3 is a fragmentary plan view of the apparatus illustrated in FIGURE 1.

FIGURE 4 is a fragmentary plan view illustrating the manner in which the leading rotary sweep engages the leading end closure flap.

FIGURE 5 is an enlarged side elevational view with parts broken away illustrating the rotary sweeps.

FIGURE 6 is a side elevational view similar to FIGURE 5 but showing the sweeps in an alternate position of use.

FIGURE 7 is a schematic elevational view illustrating successive stages in the movement of the trailing rotary sweep.

FIGURE 8 is a fragmentary elevation of the folding plate mechanism and the coacting rotary sweeps.

THE PREFERRED EMBODIMENT

For an understanding of the type of apparatus with which the instant invention may be employed, reference is first made to FIGURE 1 of the drawings which illustrates closing and sealing apparatus of the type disclosed in the aforementioned Bergstein et al. patent. The apparatus comprises a table-like frame **1** mounting bearings **2** and **3** adjacent its opposite ends for vertically disposed shafts **4** and **5** which mount horizontally disposed sprockets **6** and **7** about which a conveyor chain **8** operates in a horizontally disposed flight. Driving power is supplied by the sprocket **7** which is driven through suitable gearing from drive shaft **9** operatively connected by means of a driving sprocket **10** to any suitable source of power, such as an electric motor which is not shown. The conveyor chain **8** carries a series of interspaced carriages **11** which are guided in proper alignment about the path of travel of the conveyor chain by channel guide members generally indicated at **12**.

The carriages **11** are each adapted to receive and convey a carton **13** which will be presented to the carriage at one end of the apparatus, as at the station A indicated in FIGURE 1. The cartons, which in the embodiment illustrated have inner liners, will be presented to the carriages in upright position with their top closure flaps and liners projecting upwardly in the manner illustrated at A in FIGURE 2. The carriages are each provided with coacting pairs of locking arms **14** adapted, upon presentation of the carton to the carriage, to engage the carton body walls and secure it to the carriage.

As each carton **13** is advanced by its carriage, the upstanding liner portion **15** will be contacted by a spreading device comprising a pair of fingers **16** and **17** which enter the mouth of the liner and bring it to the flattened and elongated position seen at B in FIGURES 1 and 2. In addition to elongating or spreading the liner mouth, the fingers serve to outfold the leading and trailing end closure flaps **18** and **19** which are engaged and maintained in their outfolded positions by means of a hold-down bar **20**. Simultaneously with the action of the fingers **16** and **17**, a pair of sweeps **21** and **22**, as best seen in FIGURE 3, engage and outfold the remaining end closure flaps **23** and **24**. The spreading fingers are driven in timed relation to the movement of the carriages **11**, as by means of drive shaft **25** seen in FIGURE 1, which is driven from the drive shaft **9**.

As the fingers **16** and **17** are withdrawn from the elongated and flattened mouth of the liner, the liner passes between a pair of closely spaced apart heating elements **26** and **27**, seen in FIGURE 3, which serve to activate a heat sealable coating on the inner surface of the liner, whereupon a coacting pair of pressure wheels **28** and **29**, best seen in FIGURE 3, seal together the juxtaposed and flattened walls of the liner. Thereafter, the sealed end of the liner is contacted by a sweep **30** which folds over the projecting end of the liner, the carton thus assuming the condition illustrated at C in FIGURE 2, whereupon the upper end of the carton is contacted by a tapered hold-down plate **31** which acts to maintain the upper end of the liner in the folded condition and at the same time holds all of the end closure flaps in outfolded horizontally disposed condition. The sweep **21**, which maintains the closure flaps **23** in the outfolded condition during the flattening and sealing of the liners, terminates as the containers approach a position tangential with respect to the sprocket **6**, and it is at this point that the closure flaps come under the influence of hold-down plate **31**. The closure flaps **23** are thus free for contact by folding plates **32** which are juxtaposed to the upper end of the cartons as they move in a curved path about the sprocket **6**, the plates **32** serving as mandrels over which the leading and trailing end closure flaps are folded.

Movement of the folding plates **32** from a retracted to an extended carton engaging position is effected by the pantograph linkages **33** (FIGURES 1 and 8) terminating at their lower ends in arms **34** to which the plates **32** are pivotally mounted. Since the manner in which the folding plates are mounted to the pantograph linkages is fully disclosed in the aforementioned Bergstein et al. United States Patent 2,979,995, the construction will not be described in detail herein other than to point out that the pantograph linkages are actuated by means of actuating arms **35** provided with cam followers **36** which engage the race of a cam **37** surrounding the shaft **4** and fixedly secured to a mounting bracket **38** secured to an extension **39** forming a part of the machine frame. As will be evident from FIGURES 3 and 4, the cam **37** will be oriented so that each of the folding plates **32** will begin its outward movement as the carton with which it is to be associated passes beyond the hold-down plate **31**. The dimensions of the folding plates **32** are such that their opposite end edges will be aligned with the fold lines of the closure flaps **18** and **19** and hence provide edges about which the extending end portions of the flattened liner may be neatly folded as the closure flaps are infolded by the rotary folding means now to be described.

As seen in FIGURES 1 and 8, both of the rotary folding means are mounted on a common shaft **40** which is driven in timed relation to shaft **4** by means of chain **41** and timing gears **42**, the shaft **40** and the rotary sweeps mounted thereon thus being driven in timed relation to the movement of the carriages **11** which advance the cartons.

The initial folding of leading closure flap **18** is effected by means of rotary sweep **43** secured to the lowermost end of the shaft, the sweep having an arm **44** mounting a curved dart **45** which is of generally right triangular

configuration, the dart having an upwardly and rearwardly inclined surface **46** adapted, as the arm rotates, to pass beneath the flap **18** and, as the sweep advances, to cause the under surface of the closure flap to ride upwardly along the inclined surface **46** of the dart, thereby elevating the closure flap for contact by the stationary sweep **47** (FIGURE 3) which enforces the infolding of the leading closure flap over the folding plate **32**. The vertical position of the dart is such that its leading edge **48** will pass freely beneath the outfolded closure flap **18**, and its speed of rotation will be such that it will pass in front of the leading body wall of the carton. At the same time, the inclined surface **46**, which projects upwardly above the plate of the upper ends of the carton body walls, will elevate the closure flap **18** to an upwardly directed position in which it will be contacted and infolded by the leading edge of stationary sweep **47**.

The trailing closure flap **19** is folded by means of the rotary sweep **49** having ears **50** and **51** intermediate its ends by means of which the sweep is pivotally mounted for vertical movement to a holder **52** by means of pivot pin **53**. The holder **52** is fixedly secured to shaft **40** for rotation therewith.

At its outermost end the sweep **49** mounts a folding finger **54**, and at its opposite end the upturned flange **55** mounts a cam follower **56** which contacts the cam surface **57** of an annular cam **58** fixedly secured to bracket **59** secured to the machine frame. A spring **60** received in a pocket **61** in holder **52** acts against sweep **49** and serves to urge cam follower **56** into engagement with cam surface **57**. The holder **52** also mounts an adjustment screw **62** positioned to bear against sweep **49** and hence serve as a stop for pivotal movement of the sweep in a clockwise direction, as viewed in FIGURE 5.

The annular cam surface **57** has an inclined segment **57***a* terminating in an abrupt rise **57***b* which is followed by a horizontal segment **57***c* which joins the inclined segment **57***a* at its leading end. With this arrangement, as the cam follower **56** follows along the inclined segment **57***a*, the sweep **49** will pivot in a counterclockwise direction, as viewed in FIGURE 5, under the influence of spring **60**, thereby causing the folding finger **54** to move downwardly as the sweep rotates. As schematically illustrated in FIGURE 7, the folding finger **54** will be moved downwardly as the sweep approaches the rear surface of an advancing carton, the downward movement of the folding finger serving to assure that it will underlie the trailing closure flap **19**. The orientation of the cam surface is such that the cam roller **56** will contact the abrupt rise **57***b* just as the finger **54** approaches the trailing wall of the carton, whereupon the arm **49** will be rocked upwardly by a distance sufficient for the finger **54** to clear the upper edges of the carton body walls. Such upward movement lifts the trailing flap **19** upwardly, whereupon the folding finger will enforce the infolding of flap **19** over plate **32** as the sweep continues its rotation in the elevated position, such position being established by the cam segment **57***c*.

As should now be apparent, the cam guided pivotal movement of the trailing sweep permits it to pass beneath the trailing closure flap **19**, whereupon the sweep is elevated so as to not only lift the trailing closure flap but also clear the upper edges of the carton body walls, thereby causing the sweep to enforce the infolding of the trailing closure flap over the folding plate **32**. The now infolded flap **19** will, as the carton advances in its path of travel, pass beneath the stationary sweep **47** which serves to retain the trailing closure flap in the infolded position as it passes beyond the control of rotary sweep **49**.

The cam **59** may be rotatably adjusted relative to the cam follower by means of adjustment screws **63** acting in slots in the cam, as will be readily understood. It is also possible to adjust the inclination of cam segment **57***a* by providing it with a rail **64** of spring steel fixed at one end to the cam track which may be deflected by means of an adjustment screw **65** to vary the inclination of the cam segment **57***a* and hence the extent to which the folding finger will be pivoted downwardly as the sweep approaches the trailing body wall of the carton.

As will be apparent from FIGURE 3, upon completion of the infolding of flaps **18** and **19**, the folding plates **32** will be retracted and the cartons will advance along the second straightline section of the machine for conventional folding and gluing of the closure flaps **23** and **24** as by means of glue applying apparatus indicated generally at **66** and sweep means **67** and **68**, whereupon the closed and sealed cartons will be discharged from the apparatus at station D.

The instant invention thus resides in improved rotary sweep means which will insure positive engagement of the leading and trailing flaps and cause them to be infolded together with the overlying end portions of the liner. Once the rotary sweeps have been properly adjusted, positive contact with the closure flaps is assured even though there may be variations in the dimensions of the closure flaps or in the alignment of the cartons relative to the carriages which convey them. While the invention has been described in conjunction with apparatus for closing and sealing lined carton structures, it will be readily apparent that the apparatus may be utilized to close the flaps of an unlined carton. Similarly, the conveying apparatus by means of which the cartons are presented to the rotary sweep means does not constitute a limitation on the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In carton folding and sealing apparatus wherein carton structures comprising enclosing body walls and end closure flaps are advanced in a path of travel with the leading and trailing end closure flaps folded outwardly, a first rotary sweep means positioned to pass beneath and contact the under surface of the leading end closure flaps, means on said first sweep means to lift the leading closure flaps upwardly upon contact by said first sweep means, lying beyond said first sweep means positioned to engage and infold the lifted leading closure flaps, a second rotary sweep means positioned to pass beneath the trailing closure flaps as the cartons advance, means for displacing said second sweep means upwardly as said second sweep means passes beneath said trailing closure flaps by a distance sufficient to permit the said second sweep means to clear the upper ends of the carton body walls, whereby said trailing closure flaps will be lifted upwardly and continued rotary movement of said second sweep means will infold the trailing closure flaps over the ends of said cartons.

2. The apparatus claimed in claim **1** wherein said first rotary sweep means comprises an arm mounted for rotary movement in an essentially horizontal path of travel, wherein the means for lifting the leading closure flaps upwardly comprises a dart on the free end of said arm, said dart having an upwardly and rearwardly inclined surface the leading edge of which is positioned to lie beneath the upper ends of the carton body walls and the trailing edge of which lies above the upper ends of the carton body walls.

3. The apparatus claimed in claim **1** wherein said second rotary sweep means comprises a sweep arm mounted for rotary movement in a substantially horizontal plane, said sweep arm being additionally pivotally mounted intermediate its ends for limited vertical movement, wherein one end of said arm mounts a closure flap contacting finger, and wherein the means for displacing said sweep arm upwardly comprises cam means operatively connected to the opposite end of said sweep arm.

4. The apparatus claimed in claim **1** wherein said first and second rotary sweep means are mounted on a

common driven shaft for rotary movement in generally horizontally disposed planes, and wherein said common shaft is driven in timed relation to the movement of the cartons in their path of travel.

5. For use in carton folding and sealing apparatus wherein carton structures comprising enclosing body walls and end closure flaps are advanced in a path of travel with the leading and trailing end closure flaps folded outwardly, a rotary sweep means positioned to contact and engage the leading closure flaps of the advancing cartons, said sweep means comprising an elongated arm rotatably mounted at one end for movement in a horizontal path of travel, a vertically disposed dart mounted on the opposite end of said arm and facing in the direction of rotation of said sweep means, said dart having an upwardly and rearwardly inclined surface the leading edge of which is positioned to lie beneath the upper ends of the carton body walls and the trailing edge of which lies above the upper ends of the carton body walls.

6. The apparatus claimed in claim 5 wherein said dart is of generally triangular configuration, and is curved in a vertical plane in the direction of said arm.

7. In carton folding and sealing apparatus wherein carton structures comprising enclosing body walls and end closure flaps are advanced in a path of travel with their leading and trailing end closure flaps folded outwardly, a rotary sweep means for lifting and infolding the trailing closure flaps of the advancing cartons, said sweep means comprising a sweep arm mounted for rotational movement in a generally horizontal path and pivotally mounted intermediate its ends for limited vertical movement, a closure flap contacting finger on one end of said arm, and cam means operatively connected to the opposite end of said sweep arm for pivoting it vertically as it rotates.

8. The apparatus claimed in claim 7 wherein said cam means comprises a cam follower mounted on said sweep arm and an annular cam track positioned to be contacted by said cam follower as said sweep arm rotates, and wherein a spring means biases said cam follower into contact with said cam track.

9. The apparatus claimed in claim 8 wherein said cam track has a plurality of segments, wherein at least one of said segments is covered by a rail along which said cam follower travels, and means for displacing said rail toward and away from said cam follower to alter its path of travel.

10. In carton folding apparatus, a flap folding means comprising a rotary sweep having an arm rotatable in a generally horizontal path of travel, and means operative during each revolution of said sweep to lift said sweep arm from a first level of rotation to a second level of rotation spaced vertically from said first level.

11. The apparatus claimed in claim 10 wherein said flap folding means includes a second rotary sweep also movable in a generally horizontal path of travel, said two sweeps being mounted in vertically spaced apart relation on a common axis of rotation.

12. The apparatus claimed in claim 11 wherein said sweeps are angularly related to each other so as to be sequentially presented to a carton advancing in a path of travel which intersects the paths of travel of said sweeps.

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BERNARD STICKNEY, Primary Examiner

U.S. Cl. X.R.

53—374; 93—52