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Goodrich et al.

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[54] **ROTATING CARTON FLAP MANIPULATOR**

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[52] **U.S. Cl.** **53/374,** 53/186, 53/382

[51] **Int. Cl.** **B65b 7/20**

[58] **Field of Search**.....53/47, 186, 374, 375, 381, 53/382

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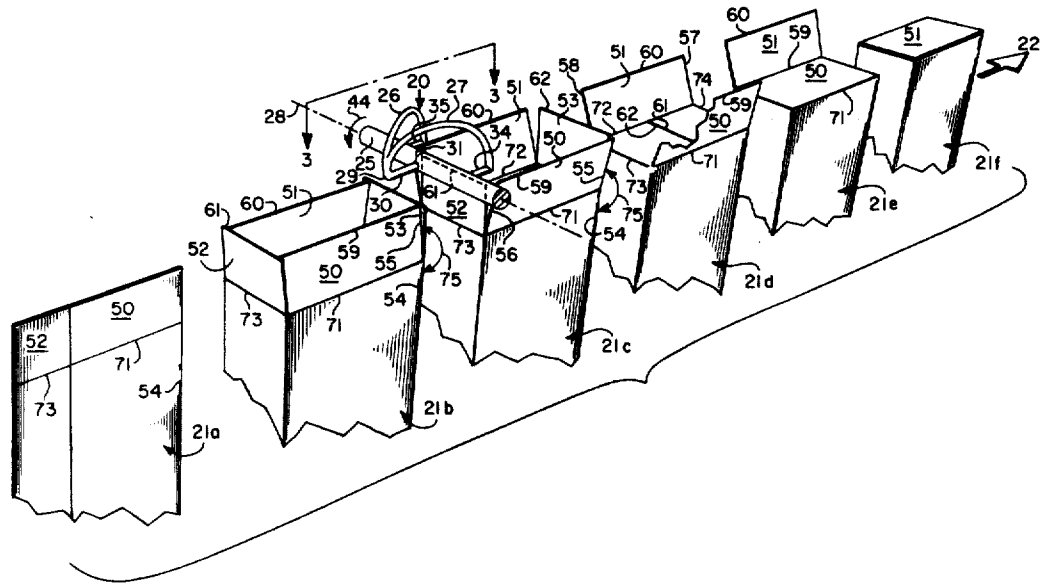
[57] **ABSTRACT**

A spirally configured carton flap manipulator is disclosed that is rotated in timed relation to columnarly advancing cartons having end closure forming flaps projecting substantially coplanarly with their respective carton sides. The rotating flap manipulator has its axis of rotation oriented generally transverse the direction of travel of the moving cartons and disposed outwardly from the projecting flaps. Its spiral camming element is adapted to impose a camming force on a flap having its proximal edge aligned parallel to the direction of carton movement without obstructing other carton flaps, whereby the aligned flap is rotated outwardly about its proximal edge.

4 Claims, 10 Drawing Figures



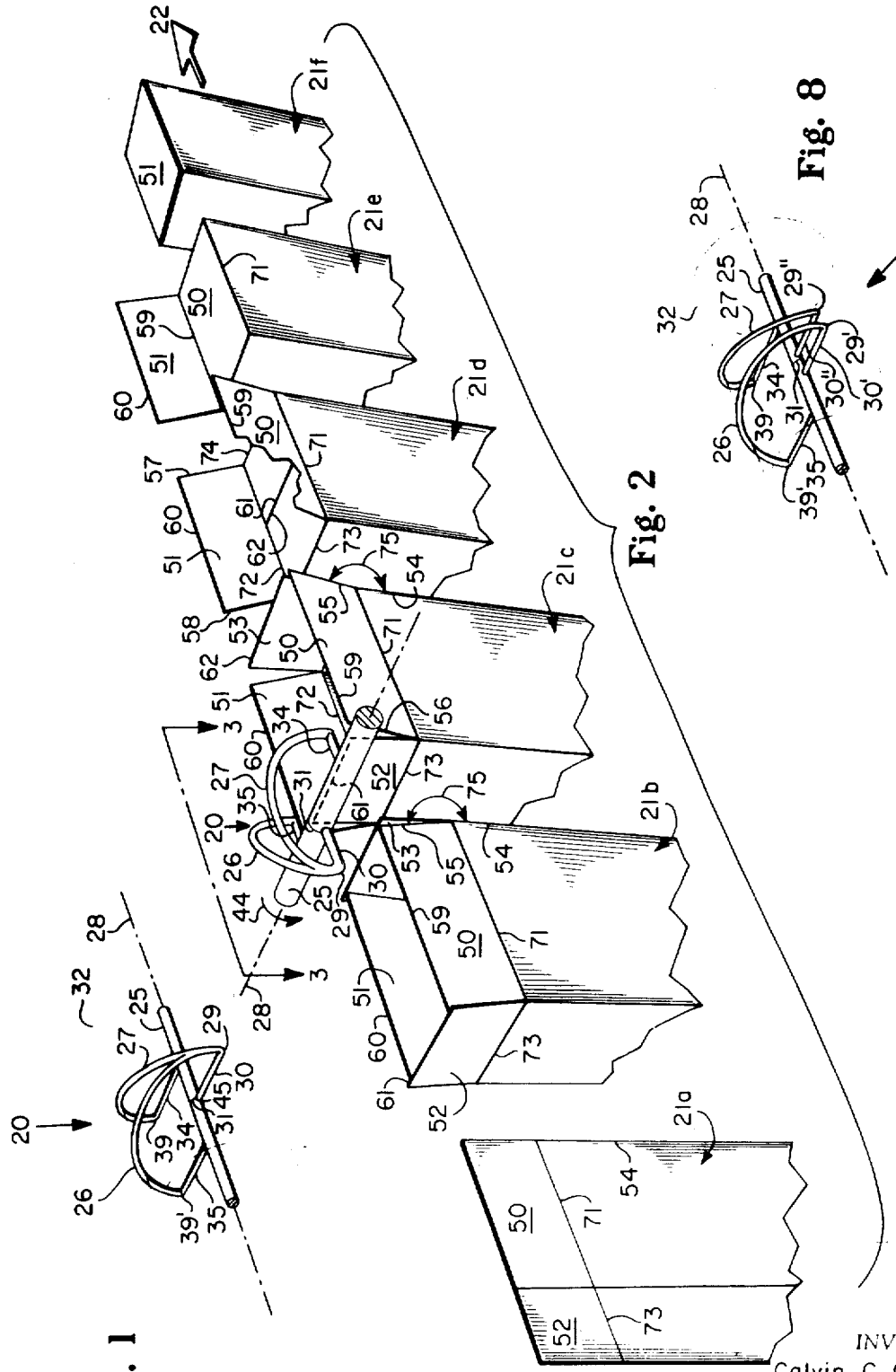


Fig. 1

Fig. 2

Fig. 8

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Fig. 4

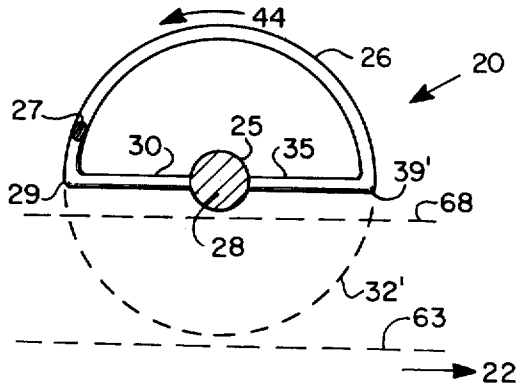

Fig. 3

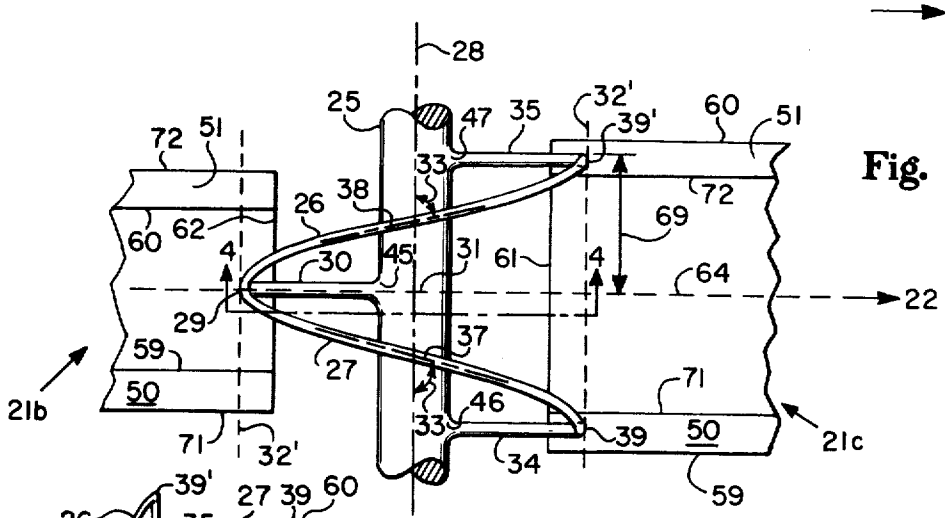

Fig. 5

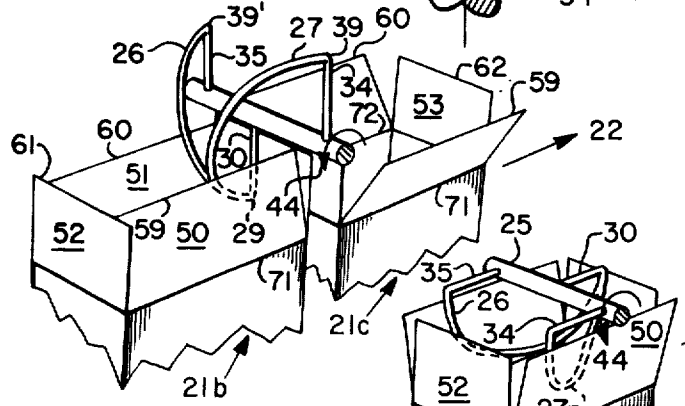

Fig. 6

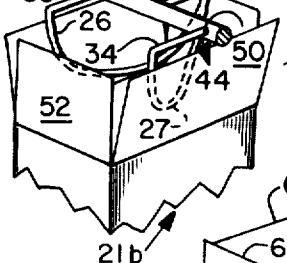

Fig. 7

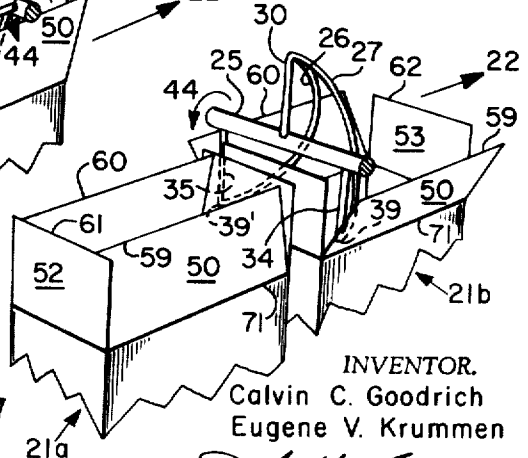

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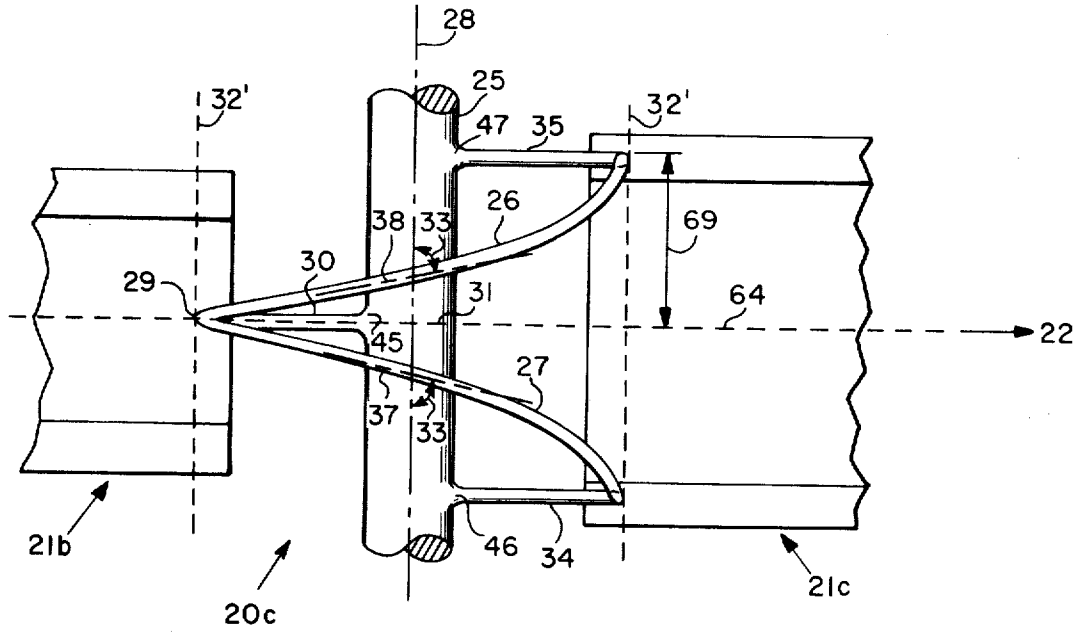
Fig 10



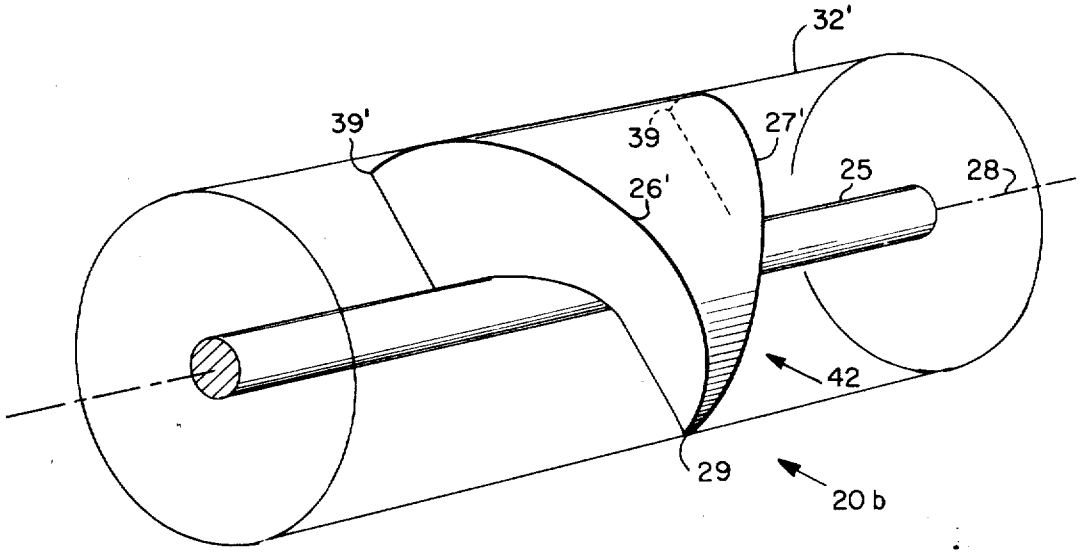


Fig. 9

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ROTATING CARTON FLAP MANIPULATOR

FIELD OF THE INVENTION

This invention relates to carton flap manipulators used in cartoning and packaging machines (hereinafter referred to as cartoners) hat conventionally have flat-folded cartons supplied thereto. It is common for cartoners to feed and forward unsealed cartons in a uniformly spaced columnar relation. While being so conveyed, each carton is expanded to form a rectangular tubular body, filled with product, and its flap-formed end closures formed and sealed. The instant invention relates to a device for insuring that the carton end closure flaps can be folded inwardly in a designated sequence without obstruction.

BACKGROUND OF THE INVENTION

Cardboard cartons having flap-formed end closures commonly have the smaller flaps designated as minor flaps while the larger flaps are designated as major flaps. In most seal end cartons, the flaps cooperate to form closures comprising three layers: the innermost layer comprising the pair of minor flaps folded inwardly until they are substantially coplanar; the middle layer being a major flap, hereby designated the first folded major flap; and the outermost layer being the other major flap hereinafter designated the outer major flap. A variety of other flap-formed end closure arrangements are also well known to those having ordinary skill in the art. Regardless of the specific arrangement of the flaps, however, when production machinery processes them, each must necessarily have their end closures formed by inwardly folding the closure forming flaps in a fixed sequence. The sequence, of course, will vary from arrangement to arrangement.

Such cartons are commonly derived from carton blanks formed by cutting and scoring flat sheets of cardboard wherein the carton's sides, end-closure forming flaps, and side-closing glue flaps are integrally formed. The blanks are then folded and glued along a side seam forming a flat-folded carton which can be expanded into a rectangular tubular shape having end closure forming flaps projecting from the ends of the sides.

Cardboard used in such cartons is normally stiff enough so that the flaps will project from their proximal edges generally coplanarly with their respective sides after a carton is expanded from being flat to a rectangular tubular shape. However, some displacement from being precisely coplanar with their respective sides is common and rather random. That is, the flaps may lean inwardly towards their closed positions, or they may lean outwardly from the planes of their respective sides. It is obvious that an inwardly leaning major flap intended to overlie the minor flaps would obstruct folding the minor flaps inwardly to their closed positions. The instant invention is addressed to preclude such inter-flap interferences in such a manner that continuous, high production rates are obtainable.

This invention is particularly well suited for use with cartons that have minor flaps extending as far or further from their proximal edges than the carton's major flaps and which are conveyed through a cartoner with the proximal edges of the major flaps aligned with the direction of carton movement. In such cases, inwardly leaning major flaps would be in the tubular

space defined by the minor flaps as the carton moves and would thus be hidden from conventional pick off bars or rods which are well known to those having ordinary skill in the art. Thus such conventional pick off bars or rods are not suitable for manipulating major flaps in such circumstances.

Flap folding requirements in cartoning apparatus have spawned a broad variety of flap manipulation equipment including stationary, reciprocating and rotating elements. For instance, Shuttleworth's U.S. Pat. No. 3,448,560, issued June 10, 1969, discloses transversely oriented, articulated kicker arm assemblies 31, 32 that are operated in timed relation with substantially intermittent carton movement. However, such stroking precursor devices are not inherently conductive to smooth, high speed operation requiring the manipulation of flaps having their proximal edges aligned with the direction of carton movement.

OBJECTS OF THE INVENTION

It is an object of this invention to insure that carton flaps can be folded in the proper sequence to form the end closure of a carton.

It is another object of this invention to provide a rotating means to spread later-folded flaps in order to permit earlier-folded flaps to be folded inwardly without being obstructed by interposed later-folded flaps.

It is further object of this invention to provide continuously rotating flap spreader that operates synchronously with a columnar procession of uniformly spaced cartons advancing at substantially contant velocity.

It is a still further object of this invention to provide rotating flap spreader that will operate in timed relation with a continuously advancing columnar procession of uniformly spaced cartons to spread flaps having their proximal edges aligned with the direction of carton advancement without obstructing the advancing cartons or other carton flaps.

SUMMARY OF THE INVENTION

This invention relates to an improved apparatus for manipulating carton flaps. The apparatus comprises spiral camming element secured to a rotatable shaft that is transversely disposed relative to the direction of movement of uniformly spaced columnarly advancing cartons and is spaced outwardly of the flaps. The angular velocity of the shaft is in timed relation to the speed of advancing cartons and the angular position of the camming element is indexed with carton position relative thereto. The apparatus is adapted to have the spiral camming element enter the space intermediate the flaps of a carton and to impose a transversely directed camming force on an aligned flap having its proximal edge parallel to the direction of carton movement whereby the aligned flap is rotated about its proximal edge by the spiral camming element.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctively claiming the subject matter which is regarded as the present invention, it is believed that the invention will be better un-

derstood by the following description taken in conjunction with FIGS. 1–10.

FIG. 1 is a perspective view of a flap spreader having two oppositely pitched sectorial spiral camming elements.

FIG. 2 is fragmentary perspective view of the flap spreader of FIG. 1 in conjunction with an advancing column of uniformly spaced cartons.

FIG. 3 is an enlarged plan view of the flap spreader taken on line 3—3 of FIG. 2.

FIG. 4 is an end elevational view of the flap spreader taken on line 4—4 of FIG. 3.

FIGS. 5, 6, and 7 are fragmentary perspective views similar to FIG. 2, but time displaced therefrom to depict the timed and indexed relationship between the rotating flap spreader and advancing cartons.

FIGS. 8, 9 and 10 are fragmentary perspective views of alternative flap spreader configurations.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and in particular to FIG. 2, the relationship between flap spreader **20** and uniformly spaced cartons 21a through 21f that are columnarly advancing in direction **22** is shown. The several cartons are intended to depict the stages involved in expanding a carton from being flat-folded *21a* to being a rectangular tubular shape *21b*, and then having its flaps manipulated until the closure is formed by folding the flaps in planned sequence. Carton *21b* is shown to have inwardly leaning major flaps **50, 51** while carton *21c* is shown to have the corresponding flaps leaning outwardly or spread apart which spreading would be caused by the operation of flap spreader **20**.

It will be understood by persons having ordinary skill in the art that the columnar relationship may be established in modern cartoning apparatus and the like which apparatus is not shown in the drawings. Such apparatus, however, is typified by a D&W model 801 cartoning apparatus manufactured by the Delamere & Williams Co., Ltd, of Toronto, Ca.

Cartoners of this type can commonly be adapted to run a broad range of carton sizes. For instance, the D&W 801 used with the preferred embodiment of the present invention, as hereinafter described and dimensioned, has a flight of carton carrier blocks with an effective pitch of 30 inches. That is, corresponding points of adjacent cartons would be 30 inches apart although the "801" is basically a 15 inch pitch machine. Different sizes of cartons can be accomodated by such pitch variations or other machine adjustments.

Cartons *21a* through *21f* of FIG. 2 are substantially identical but can, in fact, have dimensional variations consistent with good manufacturing practices. With the "801"set up for a 30-inch pitch and flap spreader **20** configured and positioned as hereinafter delineated, it is suitable for processing cartons having aligned proximal edges **71, 72** nominally 10-5/16 inches long, all intermediate flap edges such as intermediate edge **55** nominally 5-½ inches long, and transverse proximal edges **73, 74** nominally 5-½ inches long. Hereinafter, cartons having these dimensions will be referred to as "size three." Also, like members of each carton are herein identified by identical numerical designators. For instance, number **50** identifies the flap on each carton located on the righthand side of the carton when looking in direction **22** that the cartons are traveling.

Although depicted in FIG. 2 as having the column of cartons oriented with all proximal edges essentially horizontal, and the proximal edges of major flaps aligned with the direction **22** that the cartons are traveling, such is not critical to the instant invention. The elements of the carton are therefore hereinafter identified with regard to their relationship to their direction **22** of travel and the relative disposition of flap spreader **20** thereto. That is, aligned proximal edges **71, 72** of aligned flaps **50, 51** respectively are so designated because they are aligned with the direction of carton movement. The fact that aligned flaps **50, 51** are shown, in FIG. 2, to be major flaps is incidental rather than controlling. In the same vein, transverse proximal edges **73, 74** of transverse flaps **52, 53** respectively are disposed at approximately right angles to direction **22** and are only incidentally depicted as minor flaps.

In order to provide convenient references for the balance of the description of the preferred embodiment, the other carton elements that are germane to the instant invention are identified as follows: flaps **50** through **53** have distal edges **59** through **62** respectively; intermediate edges **55** and **56** of flap **50** extend between its distal edge **59** and its proximal edge **71**; and, intermediate edges **57** and **58** extend between distal edge **60** and proximal edge **72** of flap **51**. Flap angle **75** is the angle between intermediate edge **55** and carton edge **54** measured in a plane perpendicular to proximal edge **71**. The other similarly disposed intersecting pairs of intermediate edges and carton edges have corresponding flap angles.

Two planes of reference are established with respect to the advancing column of cartons to further facilitate explaining the instant invention. Proximal plane **63** is the plane defined by proximal edges **71** through **74** and is shown in FIG. 4. Middle plane **64** is the plane which perpendicularly bisects transverse proximal edges **73, 74** as cartons pass under the spreader and is shown in FIG. 3.

Although flap angle **75** will normally be approximately 180° until acted upon by external forces, it may vary several degrees plus or minus therefrom. However, in the preferred embodiment, the cartons must be stiff enough to insure that intermediate edges **55, 56, 57, 58** will not be cut by middle plane **64** until external forces are applied to their respective flaps. Therefore, distal edge **59** of flap **50** will always lie to the right of middle plane **64** and distal edge **60** of flap **51** will lie to the left of middle plane **64** until the flaps are acted upon by external forces.

Referring now to FIGS. 1, 3, and 4, flap spreader **20** of FIG. 2 is shown in perspective, plan, and end elevational views respectively in order to make the details thereof clearly ascertainable. It comprises shaft **25** having axis of rotation **28**, righthand pitch sectorial spiral camming element **26**, left-hand pitch sectorial spiral camming element **27**, and radial supports **30, 34**, and **35**.

Shaft **25** has provisions, not shown in the figures, For being rotatably secured to the structure of a cartoning machine or the like and for being rotated in timed relation to columnarly advancing, uniformly spaced car-

tons which are carried by the cartoner's flight of carton carrier blocks and thereby restrained from vertical displacement. Although the configuration of shaft **25** is not considered the essence of the invention, its diameter is limited by the location in which it is to be mounted to insure that the shaft will not obstruct passing cartons nor their flaps. For purposes to be hereinafter delineated, shaft **25** has a plane through it perpendicular to axis **28** which is hereby designated central shaft plane **31**.

Camming elements **26, 27** of the preferred embodiment have uniform pitch and radii although such constancy is not critical to the instant invention. Such helical elements may be formed, for instance, by wrapping right circular cylindrical rods about a right circular cylinder of formation **32**, FIG. **1**, while maintaining a constant pitch angle **33**, FIG. **3**, between the tangents **37, 38** to the axis of the rod and a plane including axis **28** of shaft **25** and the points of tangency of tangents **37, 38**. Each camming element of flap spreader **20** only circumscribes or wraps around approximately half of the circumference of cylinder of formation **32** upon which it is formed, for purposes to be hereinafter related. Camming elements, such as those depicted in the figures, which circumscribe less than the full circumference of the cylinder of formation are hereby designated sectorial spiral camming elements.

Radial supports **30, 34** and **35** of this preferred embodiment are rods of stainless steel or other suitable support material. They extend radially outwardly between shaft **25** and camming elements **26, 27** although configurations of the instant invention could be devised with supports positioned and configured somewhat differently.

Flap spreader **20** of the preferred embodiment is assembled by securing radial supports **30, 34** and **35** to shaft **25** so that they extend radially outwardly from shaft **25** from areas **45, 46**, and **47** respectivly as shown in FIG. **3**. Area **45** is bisected by central shaft plane **31** of shaft **25**. Areas **46, 47** are circumferentially spaced approximately 180° and equally but oppositely spaced axially from area **45**. Areas **46** and **47** are spaced from central shaft plane **31** so that camming element **26** can be mounted intermediate the radially outermost ends of radial supports **30** and **35**, and camming element **27** can be secured intermediate the radially outermost ends of radial supports **30** and **34** so that the camming elements lie on the surface of an imaginary cylinder of formation identical to cylinder of formation **32**.

The joints formed by securing camming elements **26, 27** to radial supports **30, 34, 35** are smoothed and contoured in a manner whereby no sharp or rough edges will contact carton elements during operation. The common joint formed by joining camming elements **26** and **27** to the radially outermost end of radial support **30** is designated nose **29** and the areas of attachment between the camming elements and the radially outermost ends of radial supports **34** and **35** are designated tails **39, 39'** respectively.

The span **69**, FIG. **3**, of each camming element is defined as the distance, measured parallel to axis **28**, between central shaft plane **31** and the portion of tail **39** spaced the greatest distance therefrom.

The wrap of flap spreader **20** is defined as the angle enclosed by camming elements **26, 27** between a first plane defined by the axis of radial support **30** and axis **28** of shaft **25**, and a second plane defined by the axes of radial supports **34, 35** and axis **28** of shaft **25**, which angle is measured in a plane perpendicular to axis **28**. In the preferred embodiment, the wrap is approximately 180°. Thus, camming elements **26** and **27** are half-helix shapes having opposite pitches emanating from nose **29** and diverging therefrom in a manner that when flap spreader **20** rotates about axis **28**, camming elements **26** and **27** generate cylinder of gyration **32'**, FIG. **4**.

Flap spreader **20** is mounted so that its shaft **25** is transverse the ends of the advancing cartons and its central shaft plane **31** is disposed in middle plane **64**. As can be seen in FIG. **4**, axis **28** is spaced outwardly of the flaps and of plane **63** whereby cylinder of gyration **32'** cannot reach proximal plane **63**. It will be obvious to those having ordinary skill in the art that cylinder of gyration **32'** does not extend to proximal plane **63** in order to preclude spreading the sides of the cartons apart as the flap spreader rotates. However, it is obvious in FIG. **4** that cylinder of gyration **32'** does extend below maximum height distal edge path **68** representing the closest position that any flap's distal edge can approach shaft **25**.

Flap spreader **20** of the preferred embodiment is rotated by a chain (not shown in the figures) driven in fixed relationship with the cartoners flight of carton carrier blocks whereby flap spreader **20** rotates exactly two revolutions for each carton that passes thereunder. And, it is desirably angularly positioned therewith so that whenever flap spreader **20** is disposed relative to a carton as depicted in FIG. **6**, the midpoints of camming elements **26, 27** and axis **28** of shaft **25** are contained within the imaginary plane which perpendicularly bisects aligned proximal edges **71, 72**. Obviously though, such angular positioning or indexing is not equally critical for all configurations. For some configurations it is even possible to turn the flap spreader end for end and rotate it in the opposite direction from direction **44**.

The two revolution per carton relationship, hereby designated as skip feeding, when the D&W 801 cartoner is set up for 30-inch pitch is established for convenience in order for there to be a 1 revolution per carton relationship when the cartoner is changed over to a 15-inch pitch configuration.

For use with size three cartons in the D&W 801 cartoner, as hereinbefore described, flap spreader **20** having a one inch diameter shaft **25**, camming elements **26, 27** and radial supports **30, 34** and **35** made of one-fourth inch diameter stainless steel rod, 3-½ inch spans **69**, 180° wrap, and a 7-¼ inch diameter cylinder of gyration **32'** is suitable when axis **28** of shaft **25** is mounted 6-⅜ inches above proximal plane **63**, and substantially parallel thereto, FIG. **4**.

THese dimensions have been selected so that no flaps can hit shaft **25**, and so that camming elements **26, 27** will be able to contact flaps **50, 51** and have suitable leverage to rotate flaps **50, 51** about proximal edges **72, 72** respectively as flap spreader **20** rotates to insure flap angles **75, 75** (FIG. **2**) after flap spreader **20** has rotated in the range of from about 135° to about 180°. Thus, as indicated by maximum height distal path, FIG. **4**, a minimum clearance of three-eighths

inch is assured in this embodiment of the instant invention between shaft **25** and distal edges **59–62** of passing cartons whereby shaft **25** per se is precluded from obstructing passing flaps.

The operation of the preferred embodiment is best understood by referring to FIGS. **2, 5, 6,** and **7**. FIGS. **5, 6** and **7** depict the operation of spreader **20** time displaced from FIG. **2** by approximately one quarter, one-half, and three-fourths of a revolution respectively. The timed and indexed relationship is such that transverse flap **53** will be unobstructed as it passes under radial support **30** moving downwardly as flap spreader **20** is rotated in direction **44**. In this manner nose **29** enters the space intermediate flaps **50, 51** just as transverse flap **53** passes under it. By continuing to rotate flap spreader **20** as the carton advances in direction **22**, camming elements **26, 27** are brought into contacting relationship with flaps **50, 51** and impart transverse opening forces thereon whereby flaps **50, 51** are caused to rotate about proximal edges **71, 72** respectively until flap angles **75, 75** are within the range from about 135° to about 180°. Finally, tails **39, 39'** emerge from the space intermediate flaps **50, 51** just in time to avoid obstructing the passage of transverse flap **52**. Having been spread by flap spreader **20**, control of flaps **50, 51** can be transferred to conventional devices well known to those having ordinary skill in the art such as rods **201, 202,** and **203** shown in Shuttleworth's hereinbefore cited U.S. Pat. No. 3,448,560.

Thus, continuously rotating flap spreader **20** is made to spread aligned flaps **50, 51** without hitting or otherwise obstructing transverse flaps **52, 53**. With flaps **50, 51** thus positively spread apart, it is positively assured that transverse flaps **52, 53** can be folded inwardly until they are coplanar as depicted on carton **21*d*** in FIG. **2** or otherwise manipulated as desired without having their movement obstructed by aligned flaps **50, 51**.

During skip feeding of the D&W **801**, flap spreader **20** will make on revolution while camming elements **26, 27** are between flaps **50, 51**; and another revolution which is superfluous to the instant invention while camming elements **26, 27** are between adjacent cartons. However, if identical cartons were spaced with 15 inches between corresponding portions of adjacent cartons (machine pitch of **15** inches) rather than 30 inches the flap spreader would make one revolution for each carton that passes it. This 1 revolution per carton relationship would normally be used with smaller cartons.

Without further eleaboration, it will be obvious to persons having ordinary skill in the art that means to vary the distance between axis **28** and proximal plane **63**, and means to adjust or vary the spreader's span, pitch, wrap, or diameter are but a few ways of increasing the adaptability of the spreader to a variety of carton sizes and machines. That is, the dimensions of flap spreader **20** and its disposition relative to passing cartons is dependent upon the dimensions of the cartons and the timing and speed relationships of the flap spreader and cartons. For example, a single revolution clutch drive for the spreader which is suitably synchronized with advancing cartons and having greater angular velocity of shaft **25**, when driven, would permit greater wraps and larger pitch angles than a constantly rotating flap spreader. And, of course, a spiral spreader having a wrap of 360° could be used if the cartoner was adapted to vary the distance between proximal plane **63** and axis **28**, FIG. **4**, while the space intermediate flaps **50, 51** was suitably subjacent thereto. In general, however, it is believed that wraps of about 180° but in the range of from 135° to about 225° will be preferred.

Further, it will be obvious that a number of alternative flap spreader geometries can be devised without departing from the teaching and spirit of this disclosure.

One such alternative flap spreader configuration is depicted in FIG. **8**. Whereas flap spreader **20** of the preferred embodiment comprised a common nose **29** for spiral camming elements **26, 27**, alternative flap spreader **20*a*** has independent noses **29''** formed on camming elements **26, 27** respectively. Noses **29', 29''** are supported by radial supports **30', 30''** respectively, which supports are symmetrically disposed relative to central shaft plane **31** of shaft **25**. To function as a flap spreader, it is necessary of course that the spacing of noses **29', 29''** from central shaft plane **31** of shaft **25** be limited whereby said noses will revolve in planes disposed between middle plane **64** and the distal edges of associated aligned flaps whereby camming elements **26, 27** can, in fact, impart outwardly directed opening transverse forces on them.

Another alternative flap spreader configuration, somewhat resembling an eagle's beak, is depicted in FIG. **9**. Whereas flap spreaders **20, 20*a*** have camming elements **26, 27** spaced from shaft **25** by radial supports, alternative flap spreader **20*b*** has camming edges **26', 27'** integrated into solid camming member **42** that is secured to shaft **25** or formed integrally therewith. Flap spreader **20*b*** is configured and adapted to perform the same functions as the other embodiments of the instant invention and is subject to broad variations of span, pitch angles, diameter, wrap, and other parameters as hereinbefore delineated to make it compatible with a broad variety of carton sizes, flap configurations, and carton spacing in cartoners.

Yet another alternative flap spreader configuration is depicted in FIG. **10**. Flap spreader **20c** is very similar to flap spreader **20** but does not have constant pitch angles **33, 33** as does flap spreader **20**. Thus, camming elements **26, 27** of flap spreader **20c** are not helices.

In order to understand a possible use of a flap spreader configured such as **20*c*** that does not have constant pitch angles, consider the following. As will be obvious to those having ordinary skill in the art, a camming element of spiral flap spreader of the helical type herein disclosed will initially contact the distal edge of an inwardly leaning associated flap. As the flap is rotated about its proximal edge by the camming element, the point of contact moves from the distal edge to the inwardly facing surface of the flap and advances towards the proximal edge. Thus, the distance between the point of contact and the proximal edge changes during the flap opening operation. Thus, with helical camming elements, the rate of rotation of the flap about its proximal edge would increase as it is opened. For certain applications it may be desirable to configure the flap spreader so that the rotational velocity of the flap is constant or otherwise non-linear. Variation of pitch angles **33, 33** is a means of establishing desired relationships between the rate of flap rotation and its position as it is opened.

It is further anticipated that persons having ordinary skill in the art will be able to apply the teaching of the instant invention to devise a multitude of flap manipulator configurations adapted to be rotated in timed relationship with columnarly advancing cartons and which are configured to manipulate aligned flaps by imparting transverse forces thereto without obstructing transverse flaps. Therefore, the descriptions of the preferred embodiment and the alternative configurations are not intended to limit the scope of the instant invention.

What is claimed is:

1. A flap spreader for wholly removing all aligned flaps from the space intermediate transverse flaps of a carton as uniformly spaced cartons are columnarly advanced in a cartoning apparatus, said cartons being of the type having a rectangular tubular body having flap-formed end closures, each said end closure comprising a set of four integral flaps hinged to the sides of said body along proximal edges of the flaps, said flaps comprising said aligned flaps having their proximal edges aligned with the direction of carton advancement, said flaps further comprising two oppositely disposed said transverse flaps having their proximal edges perpendicular to the direction of carton advancement, said cartons being formed from cardboard having sufficient rigidity that the distal edges of said aligned flaps are always disposed on the same side of the middle plane of said caton as their respective said proximal edges while advancing through said cartoning apparatus unless acted upon by external forces, said spreader comprising:

a. a shaft rotatably secured to the structure of said apparatus, said shaft being spaced outwardly of the outermost reach of said flaps with its axis extending generally parallel said proximal edges of said transverse flaps so that said shaft is transverse the ends of said advancing cartons;

b. a right hand pitch sectorial spiral camming element;

c. a left hand pitch sectorial spiral camming element;

d. said sectorial spiral camming elements having wraps of about 180 degrees being configured so that when secured to said shaft they extend symmetrically in opposite directions from a central shaft plane;

e. means for rotating said shaft in timed relation to said advancing cartons at a constant angular velocity relative to carton movement so that said flap spreader rotates an integral number of full revolutions for each carton that passes it; and

f. said sectorial spiral camming elements and said shaft being configured, disposed and indexed with respect to said advancing cartons that said sectorial spiral camming elements will enter the space intermediate inwardly leaning said aligned flaps without obstructing the passage of said transverse flaps and impose outwardly acting forces on said aligned flaps so that said aligned flaps are rotated about their proximal edges until they are wholly removed from the space intermediate said transverse flaps as said cartons advance.

2. The flap spreader of claim 1 wherein said shaft is rotated exactly one revolution for each carton that passes it.

3. The flap spreader of claim 2 wherein said sectorial spiral camming elements have a common origin, said common origin being bisected by said central shaft plane.

4. The flap spreader of claim 3 wherein said sectorial spiral camming elements have constant pitch angles and radii.

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