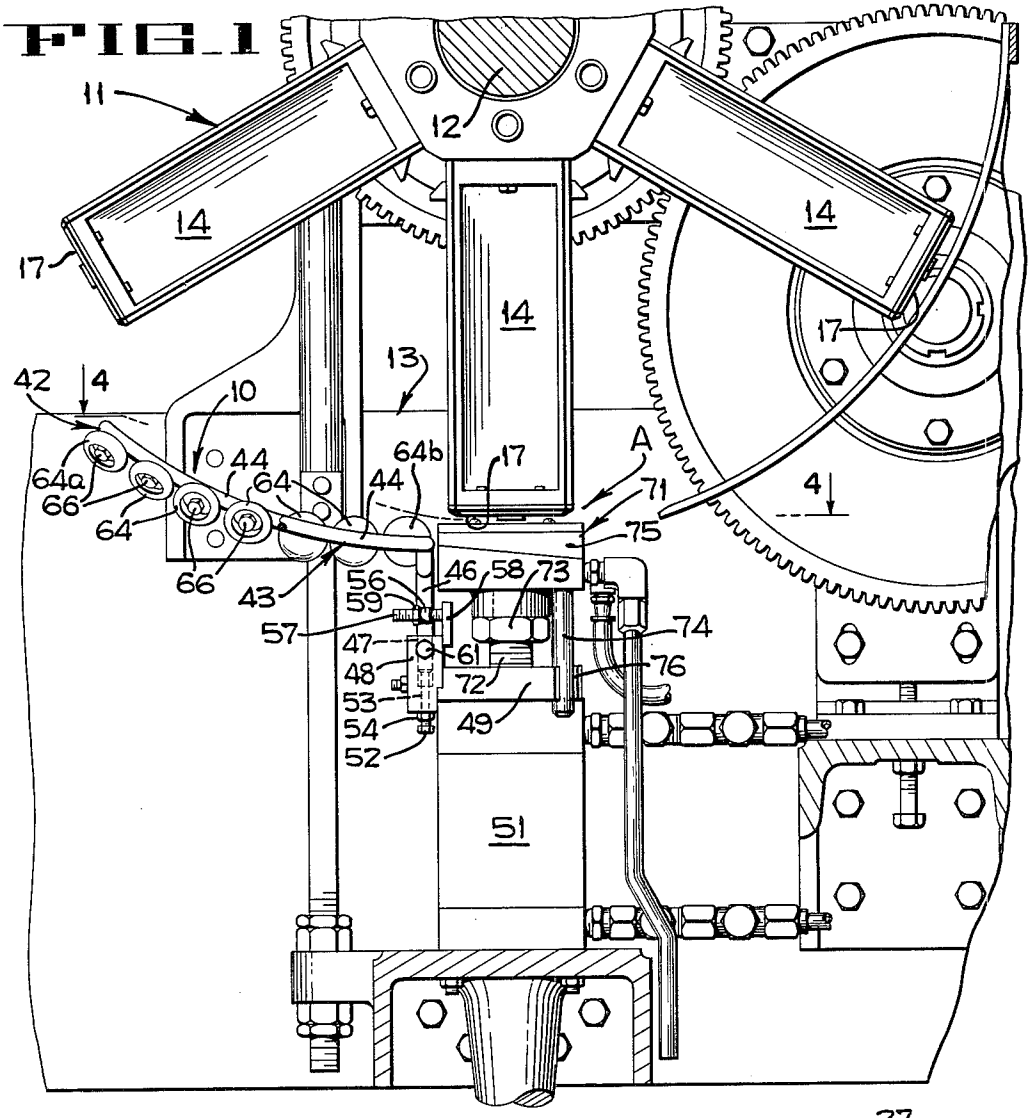
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FLAP FOLDING APPARATUS

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FIG_1



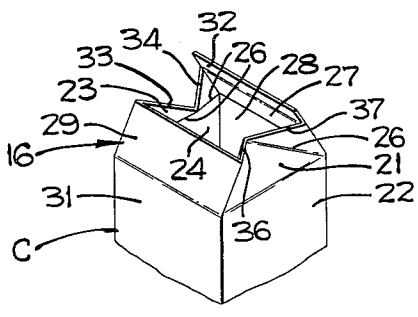


FIG_2

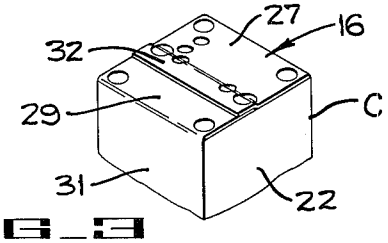


FIG_3

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FLAP FOLDING APPARATUS

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FIG_4

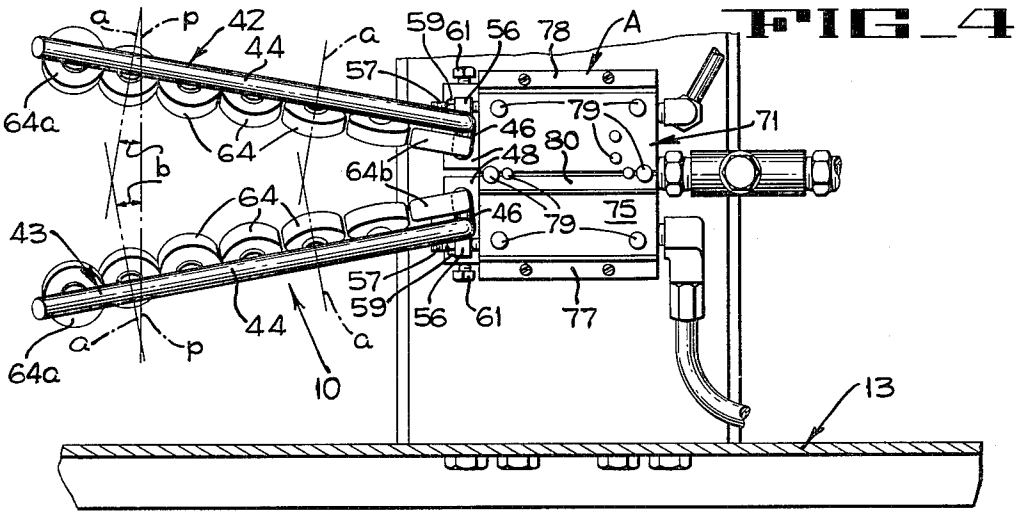


FIG_6

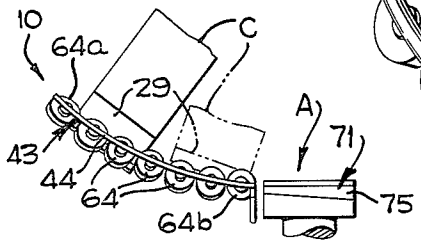


FIG_7

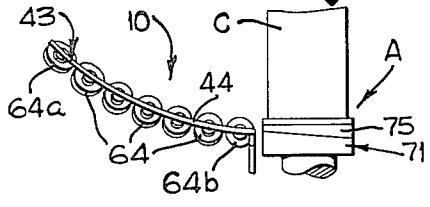


FIG_8

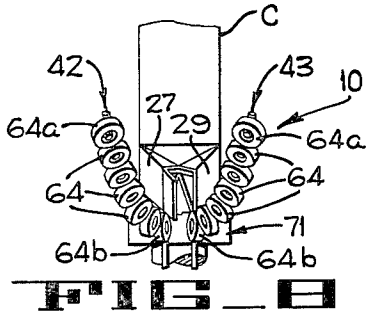
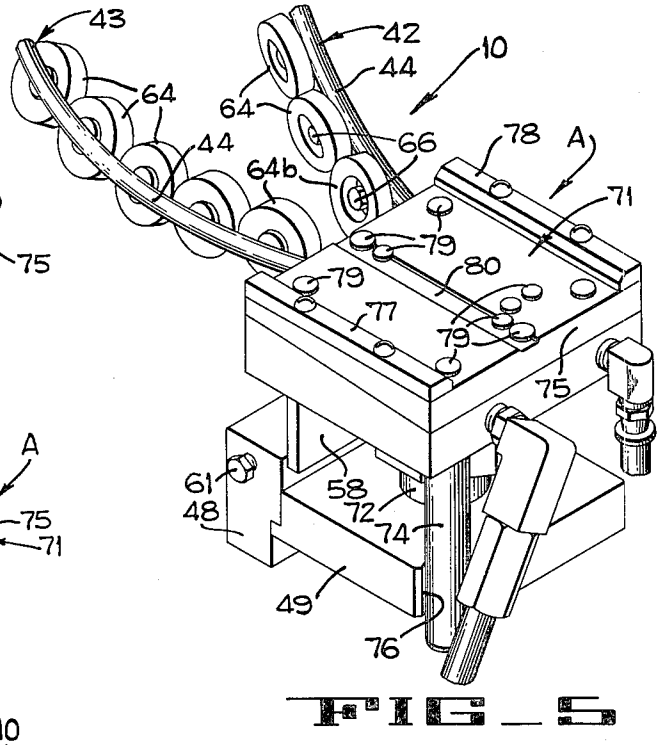


FIG_5



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3,225,666

FLAP FOLDING APPARATUS

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Filed June 26, 1963, Ser. No. 290,795
5 Claims. (Cl. 93—44.1)

The present invention pertains to packaging equipment and more particularly relates to an apparatus for folding the flaps of a carton into sealing position, before the cartons have been filled.

In carton forming and filling machines of the type disclosed in the application for patent of Heffelfinger et al., Serial No. 216,248 filed August 10, 1962, and assigned to the assignee of the present invention, cartons are formed from a laminate for use in packaging milk or similar product. The cartons include a cardboard inner base layer laminated with a polyethylene coating on both the outside and the inside of the base layer. During operation of the above mentioned carton forming and filling machine, folded carton blanks are first erected into an open ended rectangular tube. Each tube is inserted upon one of a plurality of evenly spaced mandrels of a turret, with the flaps which define the bottom closure being outermost on the mandrel. The turret is indexed about a horizontal axis to first index the bottom closures of each carton into position to be engaged by a bottom forming apparatus, which causes the bottom flaps to bend at their score lines, thereby aiding the subsequent folding operation. The cartons are next indexed to a heating station wherein hot air is directed at those surfaces of the bottom closure which are subsequently sealed together. The cartons are next moved over plows, which fold the flaps into sealing position and shortly thereafter presents the flaps to a sealing apparatus which squeezes the flaps against the outer end of the associated mandrel and holds this pressure upon the flaps until the flaps are bonded together to provide a fluid-tight bottom closure for the carton. The carton is thereafter sterilized, filled with milk or other liquid, the top closure parts of the cartons are subsequently sealed together, and the filled and sealed carton is then discharged from the carton forming and filling machine.

In order to consistently provide cartons with leak proof bottom closures, it has been found that the flap folding plows must fold the bottom flaps in such a manner that the outer edges of certain flaps will abut each other. It has also been determined that excessive frictional resistance between the plows and the flaps at times prevents the above mentioned edges from assuming their abutting positions and also scratches the outer polyethylene coating of the bottom closures of the carton.

It is an object of the present invention to provide an improved apparatus for folding the flaps of a carton into sealing position.

Another object is to provide flap folding apparatus having rotary flap engaging surfaces.

Another object is to provide a flap folding apparatus having roller plows arranged in a helical pattern for accurately folding the flaps of a carton into sealing position without scratching the surface thereof.

Another object is to provide roller plows having rollers positioned therealong in helical patterns so as to engage and gradually move the flaps into sealing position, while exerting transverse forces on the flaps which tend to move them towards each other.

These and other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings, in which:

FIGURE 1 is a vertical elevation of a portion of a carton forming and filling machine showing the flap folding apparatus of the present invention associated therewith, certain parts of the flap folding apparatus being broken away.

FIGURE 2 is a perspective of the bottom closure of a carton, showing the several flaps thereof in positions they assume after certain breaking and forming operations have been performed.

FIGURE 3 is a perspective of a completely formed and sealed bottom closure of a carton.

FIGURE 4 is an enlarged horizontal section taken along lines 4—4 of FIGURE 1 showing the flap folding apparatus associated with a bottom sealing apparatus.

FIGURE 5 is a perspective of the flap folding apparatus shown associated with a portion of the bottom sealing apparatus.

FIGURES 6, 7 and 8 are operational views illustrating the manner in which the flap folding apparatus folds the flaps of a carton into sealing position and presents the carton to the bottom sealing apparatus, the spacing of the two groups of rollers being exaggerated in FIGURE 8.

The flap folding apparatus 10 (FIG. 1) of the present invention is suitable for use with a carton forming and filling machine of the type disclosed in the previously referred to Heffelfinger et al. application. This machine includes a turret 11, which is keyed to a horizontal shaft 12 that is journalled in the frame 13 of the machine. The turret 11 includes a plurality of evenly spaced mandrels 14 which project radially outward from the shaft 12. Each mandrel is of generally rectangular form, and receives a carton blank which is shaped in the form of a rectangular tube. Both ends of each blank are open, and the end which forms the bottom closure 16 (FIGS. 2 and 3) of the carton C projects outwardly from the free end or head 17 of the associated mandrel 14. The turret 11 is intermittently indexed in a counterclockwise direction (FIG. 1), into operating stations where the flaps of the bottom closures are first bent about preformed score lines, and thereafter are heated so that the surface materials which are subsequently sealed together, are raised to the bonding temperature.

After the flap surfaces which are to be sealed together have been heated to the bonding temperature, the flaps are moved over the front flap folding apparatus 10 of the present invention, and are accurately folded into sealing position. Continued movement of the turret 11 advances the flaps past the folding apparatus and into a sealing station A, at which pressure is applied to the flaps to seal them together in fluid tight relation. The cartons with their bottom closures sealed, are thereafter discharged from the associated mandrels 14.

Although specific details of the carton forms no part of the present invention, a description of a bottom carton closure 16 (FIGS. 2 and 3) of the type that is closed by the apparatus of the present invention, is presented as an aid in the understanding of the function of the flap folding apparatus.

The bottom closure 16 of each carton C comprises a front flap 21, projecting from a wall 22 of the carton, and a rear flap 23 projecting from the opposite wall 24. Each flap is provided with V-shaped score lines 26, to facilitate the inward bending of the flaps. The bottom closure also includes a flap 27 that projects from a wall 28, and is slightly longer than an opposed flap 29 which projects from the opposite wall 31. The outer end of the long flap 27 provides a lip 32, which is adapted to overlap and be subsequently sealed to the shorter flap 29. The lines of bend between the flaps and their adjacent walls are prescored to facilitate bending of the flaps relative to the walls, the edges of adjacent flaps are connected, and the lines of bend which connect the edges of

the flaps together are likewise prescored to facilitate bending about these edges.

As mentioned previously, the several flaps of the bottom closure **16** are preformed, heated, and assume the position shown in FIGURE 2 prior to movement into the flap folding apparatus **10** of the present invention. The flap folding apparatus **10** folds the bottom closure **16** into sealing position, wherein the free edges **33** and **34** of the flap **23**, and free edges **36** and **37** of the flap **21**, are brought in abutting engagement.

The flap folding apparatus **10** comprises a pair of plow bars **42** and **43** (FIGS. 4 and 5), which include arcuate roller supporting arms **44** that lie in vertical planes that converge toward a sealing station A. The plow bars **42** and **43** also include upright mounting legs **46**, having lower ends which are received in vertical counterbores **47** (FIG. 1) drilled in the mounting blocks **48**. The mounting blocks **48** are bolted to a bracket **49** that is rigidly secured to the stationary body of a hydraulic power unit **51** which, in turn, is bolted to the frame **13** of the machine.

In order to adjust the plow bars **42** and **43** vertically, capscrews **52** (only one being shown in FIG. 1) are screwed into threaded holes **53** which are aligned and communicate with the associated counterbores **47**. The upper ends of the capscrews **52** are screwed against the lower ends of the associated upright legs **46** and thereby provide means for accurately determining the height of the plow bars **42** and **43**. The capscrews **52** are held in adjusted position by locknuts **54**.

In order to accurately adjust the angle of convergence of the plow bars **42** and **43** relative to the path of movement of the cartons, arms **56** are welded to and project outwardly from each upright mounting leg **46**. A threaded socket head adjustment bolt **57** is screwed through a threaded opening in its associated arm **56**, and engages a stop bar **58** welded to the associated mounting block **48**. After the desired degree of convergence is obtained for each plow bar **42** and **43**, each bolt **57** is locked in position by a locknut **59**. Each mounting leg **46** is also locked in place by a setscrew **61**, which is screwed into the associated mounting block **48** and abuts the mounting leg **46** of the associated plow bar **42** or **43**.

As shown in FIGURES 4 and 5, each arcuate roller supporting arm **44** of the plow bars **42** and **43** supports a plurality of rollers **64**, which are journalled on shouldered capscrews **66** screwed into threaded holes in the associated roller supporting arms **44**. The axes of the group of capscrews **66** and rollers **64** on each arm **44** are at progressively different angles, so as to support each group of rollers in a generally semi-helical pattern. It will be noted that the rollers on the plow bar **42** are helically turned in a clockwise direction, when viewed from the inlet end thereof, while the rollers on the plow bar **43** are turned in a counterclockwise direction. The axes of rotation of the cooperating pairs of rollers **64***a* at the inlet end of the plow bars **42** and **43** are directed downwardly and forwardly so as to position the planes of the rollers **64***a* substantially normal to the planes of the associated flaps **27** and **29** when the flaps are moved into engagement therewith by the intermittently driven turret **11**. The angle of convergence of the axis "*a*" of each shouldered capscrew **66** on each plow bar relative to a horizontal plane progressively decreases from the roller **64***a* at the inlet end of the flap folding apparatus, to a roller **64***b* at the discharge end of the apparatus, the axis of which is in a horizontal plane. Thus, the rollers on each of the plow bars are arranged in a substantially helical pattern with the result that the associated flaps **27** and **29** are gradually and gently raised to a substantial horizontal position without an undue frictional resistance being applied thereto.

As seen in FIG. 4, the roller axes "*a*" of all rollers **64** are inclined to a transverse vertical plane "*p*" by equal angles "*b*." The axes "*a*" intersect forwardly of the plane "*p*." As the flaps **27** and **29** of the bottom closure **16** are moved into engagement with the rollers **64**, the rollers gradually fold the heated bottom closure flaps from the position shown in FIGURE 2 to a substantially horizontal position. The freely journalled rollers **64** impart very little resistance to the forward movement of the flaps **27** and **29**; yet, because of the above mentioned angles of inclination, these rollers apply sufficient transverse force to the flaps to cause the flap edge **33** of flap **23** (FIG. 2) to abut the edge **34** of the flap, and to cause the edge **36** of flap **21** to abut the edge **37** of the flap. Since sliding contact between the flaps and the rollers **64** is reduced to a minimum, scratches are not formed on the polyethylene surfaces of the flaps **27** and **29**, which scratches might cause leakage at the seal.

After the carton moves over the last pair **64***b* of rollers **64**, it becomes indexed at station A in position to be engaged by a bottom sealing head **71** (FIGS. 1, 4 and 5). The bottom sealing head **71** is screwed onto the piston rod **72** of the hydraulic power unit **51** and is locked in position by a lock nut **73**. The bottom sealing head **71** is held from rotation about the axis of the piston rod **72** by a pin **74** screwed in the head **71** and slidably received in a slot **76** in the bracket **49**.

The sealing head **71** includes a top plate **75** that mounts side guides **77** and **78** which are chamfered and aid in maintaining the edges **33**, **34** and **36**, **37** of the bottom closure in abutting contact when the head **71** is moved upwardly by the hydraulic power unit **51**. The hydraulic power unit **51** squeezes the heated flaps between the sealing head **71** and the head **17** of the associated mandrel **14** with sufficient force and for a sufficient interval to bond the several flaps of the bottom closure together in fluid-tight relation.

A plurality of buttons **79** are provided on the upper surface of the top plate **75** of sealing head **71**, to localize the sealing pressure to those areas of the bottom closure where leaks are apt to occur. Plate **75** is grooved at **80** to recline lip **32** on side flap **27** (FIG. 3), which lip overlies the opposite side flap **29**. If a detailed description of the function performed by the buttons **79** and the groove **80**, as well as the means for operating the hydraulic power unit **51** in timed relation with the intermittent movement of the turret **11** is desired, reference is presented in the aforementioned Heffelfinger et al. application, the details of which form no part of the present invention.

Although the operation of the flap folding apparatus of the present invention has been included in the description of the components thereof, a brief summary of the operation will follow.

A carton C is positioned on each mandrel **14** (FIG. 1) with the flaps that define its bottom closure **16** projecting outwardly of the head **17** on the outer end of the mandrel. The surfaces of the flaps which are subsequently bonded together are heated to the bonding temperature by means not shown, and shortly thereafter, the intermittently driven turret **11** moves the flaps **27** and **29** (FIGS. 6, 7 and 8) over the two groups of helically positioned rollers **64** which are supported on the plow bars **42** and **43**. Since the plow bars include roller supporting arms **44** which are arcuate and which are mounted so as to converge toward the sealing station A, and since the group of rollers **64** on each arm **44** is arranged in a generally helical pattern the rollers **64** apply very little resistance to the forward motion of the carton while gently folding the flaps upwardly until the edges **33** and **36** abut the edges **34** and **37**, respectively. Continued movement of the turret **11** advances the folded bottom closure **16** into the sealing station A so that the folded flaps of the bottom closure are disposed between the bottom sealing head **71** and the head **17** of the associated mandrel **14**. After movement of the turret **11** stops, the hydraulic power unit **51** moves the bottom sealing head **71** upwardly aganist the folded flaps so as to squeeze the flaps together

and hold them together for a sufficient period to permit the heated polyethylene surfaces of the bottom closure to bond together and provide a fluid tight seal. After the surfaces of the bottom closure have been sealed together, the hydraulic power unit **51** moves the sealing head **71** to its retracted position away from the mandrel **14**, and the turret **11** moves the carton with the sealed bottom closure away from the sealing station A for subseqeunt discharge from the turret **11**.

From the foregoing description it is apparent that the flap folding apparatus **10** of the present invention presents helically arranged rolling surfaces to the carton flaps so as to fold these flaps into sealing position without undue frictional resistance, so that the flaps are consistently brought into the desired final position. The helically mounted rollers are also arranged to engage the flaps in such a manner as to exert transverse forces on the flaps, which forces the edges of the flaps **21** and **23** into abutting engagement.

While one embodiment of the present invention has been shown and described, it will be understood that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

Having thus described the present invention, what is claimed as new and desired to be protected by Letters Patent is:

1. A flap folding apparatus comprising a plurality of rollers each having an axis of rotation, first means supporting a first group of said rollers in a generally helical pattern, second means for supporting a second group of said rollers adjacent said first group of rollers in a second generally helical pattern with the helical pattern running in a direction opposite from that of said first helical pattern, the axis of rotation of an end roller in each group being directed downwardly and toward the associated end roller in the other group, the axes of rotation of the rollers on the opposite ends of each group being horizontal, and means for supporting and moving a carton having flaps to be folded past said rollers so that one flap engages one group of rollers and another flap engages the other group of rollers and are folded from extended positions to positions in substantially planar alignment.

2. A flap folding apparatus comprising a plurality of rollers each having an axis of rotation, first arcuate means for supporting first group of said rollers in a generally helical pattern, second arcuate means for supporting a second group of said rollers adjacent said first group of rollers in a second generally helical pattern with the helix running in a direction opposite that of said first helix, the axis of rotation of an end roller in each group being directed downwardly and toward said associated end roller in the other group, the axes of rotation of the end rollers on the opposite end of each group being horizontal, and means for supporting and swinging a carton having flaps to be folded along an arcuate path past said rollers so that one flap engages one group of rollers and another flap engages the other group of rollers and are folded from extended positions to positions in substantially planar alignment.

3. A flap folding apparatus comprising a plurality of rollers each having an axis of rotation, first elongated means for supporting a first group of said rollers in a generally helical pattern, second elongated means for supporting a second group of said rollers adjacent said first group in a second generally helical pattern with the helix being wound in a direction opposite that of said first helix, the axis of rotation of an end roller in each group being directed downwardly and toward the associated end roller in the other group, the axes of rotation of the end rollers on the opposite ends of each group being horizontal, means mounting said first and said second elongated support means in positions causing said elongated support means to converge toward said opposite ends of said groups of rollers, and means for supporting and moving a carton having flaps to be folded past said rollers so that one flap engages one group of rollers and another flap engages the other group of rollers and are folded from extended positions to positions in substantially planar alignment.

4. A flap folding apparatus comprising a plurality of rollers each having an axis of rotation, first elongated arcuate means supporting the first group of said rollers in a generally helical pattern, second elongated arcuate means for supporting a second group of said rollers adjacent said first group of rollers in a second generally helical pattern with the helix being wound in a direction opposite to that of said first helix, the axis of rotation of an inlet end roller in each group being directed downwardly and toward the inlet end roller in the other group, the axes of rotation of the rollers on the outlet ends of each group being horizontal, means mounting said first and said second elongated support means in positions which converge toward said outlet end of said groups of rollers, and means for supporting and swinging a carton having flaps to be folded along an arcuate path past said rollers so that one flap engages one group of rollers and another flap engages the other group of rollers and are folded from extended positions to positions in substantially planar alignment.

5. A flap folding apparatus comprising a pair of stationary mounting blocks each having a vertical counterbore therein and each having a threaded bore aligned with and communicating with said counterbore, and adjustment screw in each threaded bore, means for locking each adjustment screw in adjusted position, a pair of plow bars each having an arcuate roller supporting arm and a vertical mounting leg with each leg being fitted in an associated one of said counterbores and resting against the associated adjustment screw, a stop bar rigidly secured to each of said mounting blocks, an arm projecting transversely outward from said mounting leg of each plow bar and each arm having a threaded hole therein, an adjustment bolt screwed into each threaded hole for abutment with said associated stop bar whereby said arcuate roller supporting leg of said plow bars are accurately adjusted and held at a predetermined angle of convergence, means for locking said adjustment bolts in adjusted position, a plurality of rollers, means rotatably mounted said rollers on said arcuate roller supporting arms with the end rollers on each mounting leg adjacent the mounting blocks having their axes disposed in a horizontal plane, said other rollers having axes which define angles relative to a horizontal plane which progressively increase as the distance between the rollers and said blocks increase, and means for supporting and swinging a carton having flaps to be folded along an arcuate path past said rollers so that one flap engages the rollers on one of said arcuate roller supporting arms, and so that another flap engages the rollers on the other of said arcuate roller supporting arms and cooperate to fold the flaps from extended to generally horizontal positions.

No references cited.

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