Dec. 17, 1968 W. E. STANDLEY ET AL 3,416,285

CASE FLAP FOLDING MECHANISM AND METHOD

Filed Aug. 9, 1965 3 Sheets-Sheet 1

Fig. 1

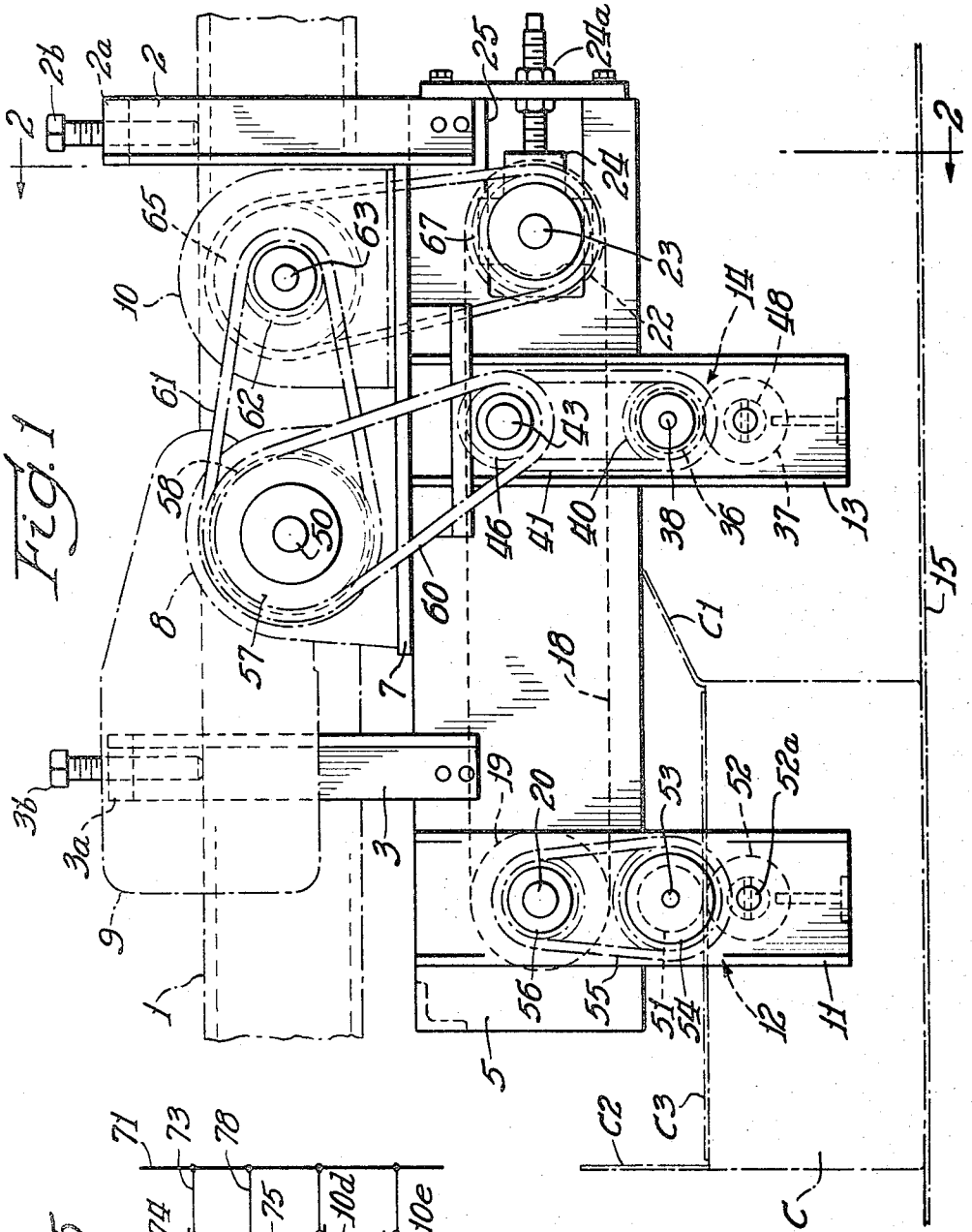
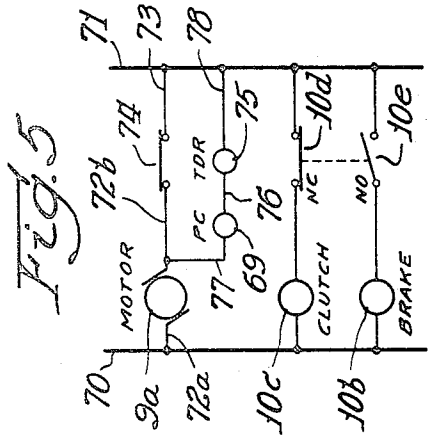


Fig. 5



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CASE FLAP FOLDING MECHANISM AND METHOD

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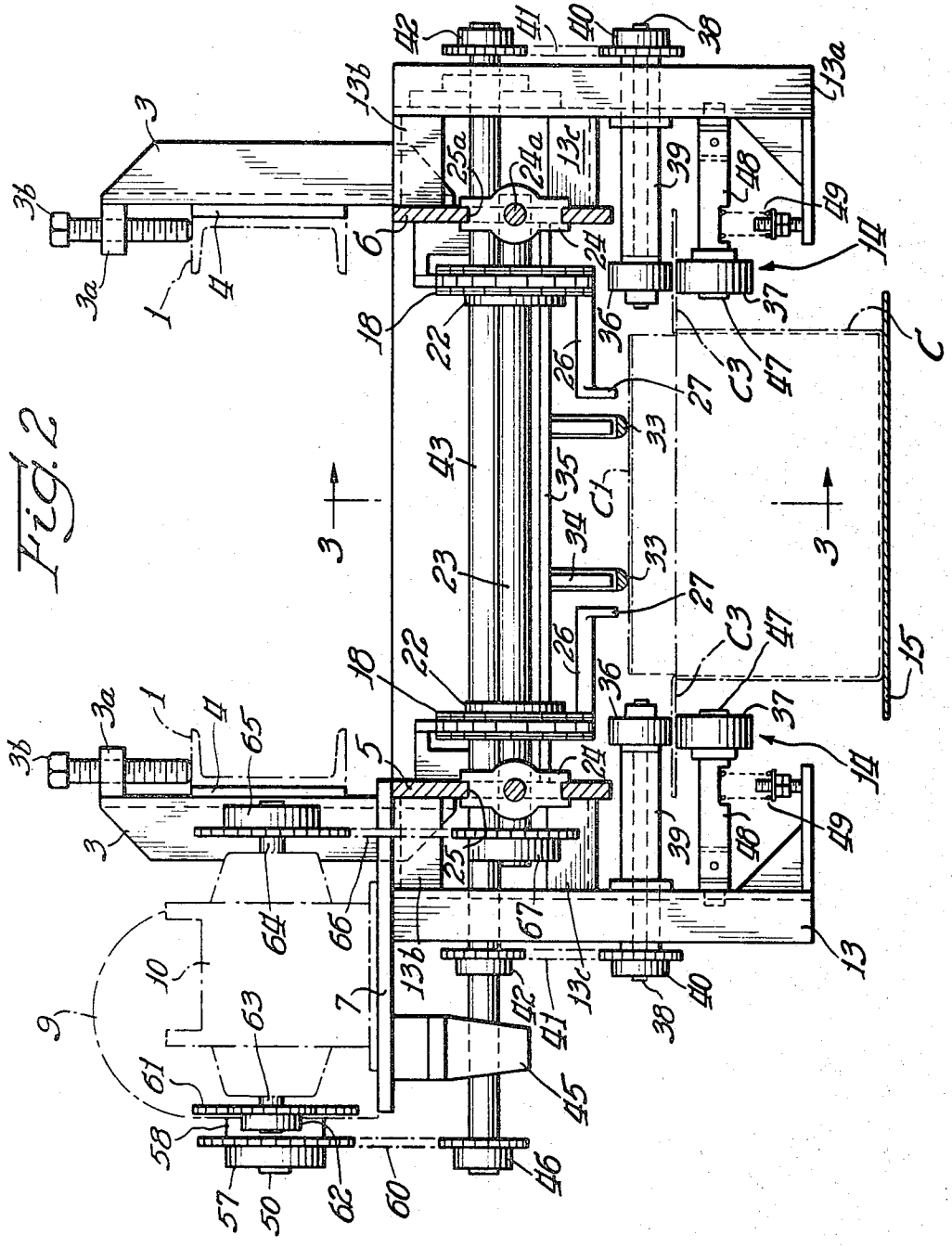

FIG. 2

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CASE FLAP FOLDING MECHANISM AND METHOD

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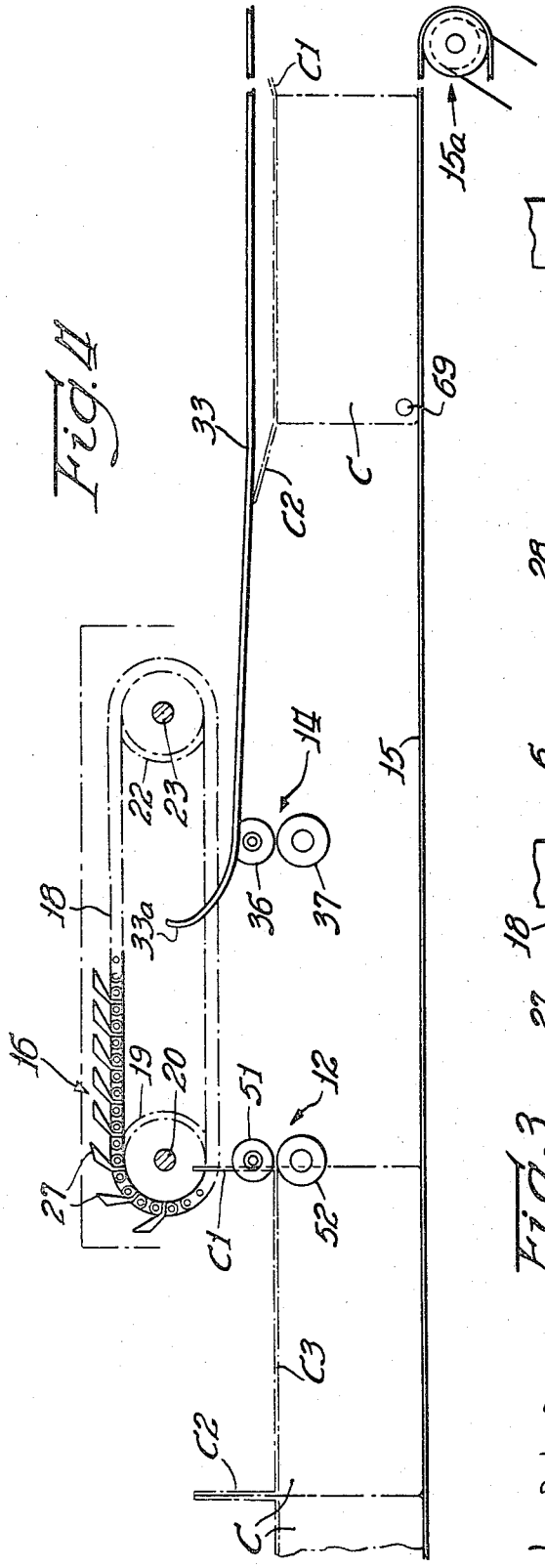

Fig. 4

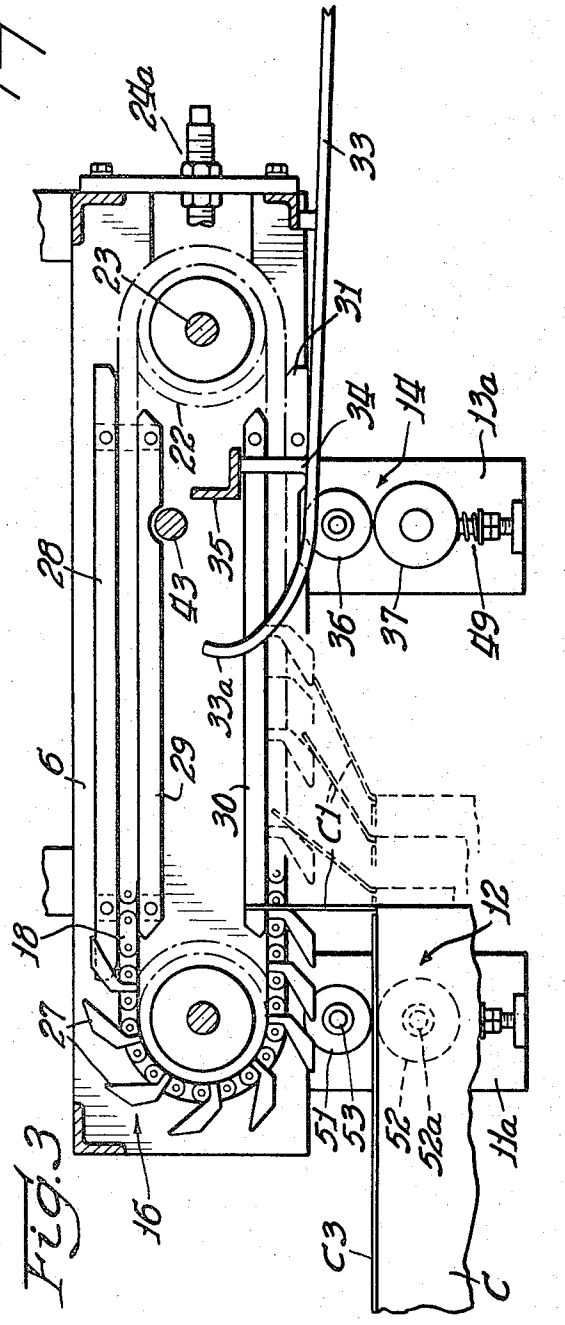

Fig. 3

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CASE FLAP FOLDING MECHANISM AND METHOD

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Filed Aug. 9, 1965, Ser. No. 478,316
12 Claims. (Cl. 53—3)

ABSTRACT OF THE DISCLOSURE

Empty paperboard cases are advanced in a constantly moving row, abutted end-to-end, with their end wall flaps in raised position. Successive leading cases in the advancing row are engaged by a propelling means to accelerate the forward motion of the leading case and separate it a distance from the next case. While the case is so propelled at an increased speed, the leading end wall flap is engaged by a folding member to fold the flap forwardly and downwardly and direct it beneath a flap hold-down means. The case continues to be propelled at an increased speed until the trailing end wall flap is folded rearwardly and downwardly by the hold-down means.

In accordance with a present method of packing beverages, the beverage receptacles, such as cans or bottles, herein for convenience being referred to as cans, a supply of flat, collapsed paperboard containers or cases is delivered to the beverage packing plant and the cans are delivered in large bulk packages. The cases, which may be in the form of regular slotted containers, are of flat, tubular form and have foldable top and bottom closure flaps on the edges of each of their side and end walls. The cases are brought to expanded condition and their bottom flaps may then be sealed to form a bottom closure. The remaining flaps on the upper edges of the side and end walls are left in upwardly projecting position and the cases, as so set up, are placed on a suitable storage or feeding conveyor in end-to-end abutted relation. A convenient conveyor for this purpose is a constantly traveling belt conveyor, or a conveyor comprising so-called live or constantly driven rolls, on which the end-to-end abutted cases are advanced to a control point from which they are removed as needed. The leading end of the line of empty cases may be held at the control point with the conveyor constantly in operation and slipping harmlessly beneath the cases. The line of empty cases on the feeding or storage conveyor may be of considerable length and the number of cases on the conveyor is intended to be adequate to supply the usual case loading machines without interruption.

As the top closure flaps are left in upwardly projecting position, it is an important object of this invention to provide a mechanism for swinging the closure flaps, particularly the leading and trailing flaps, in the present instance illustrated as the end wall flaps, to downwardly and outwardly extended positions and hold them in such positions to enable the case loading mechanism readily to fill them with cans.

In the present disclosure the side wall closure flaps are originally shown in outwardly extended position. These flaps may be folded outwardly by any suitable means, such as side wall flap folding plow rods. They could also be folded outward by hand or other means. The side wall flaps may be maintained in such outwardly

folded position by means such as hold-down bars or rods until the cases reach the control mechanism.

A further object of the invention is to provide a flap folding unit to fold the upstanding, leading and trailing flaps forwardly and rearwardly, respectively, to substantially horizontal positions while the cases are in motion, preparing them to be advanced to the case loading station.

Another object of the invention is to provide for maximum case storage capacity on the storage conveyor by allowing the leading and trailing flaps to remain in their upwardly extended positions until the cases are ready to be treated and promptly moved to the loading station. If the cases on the storage section have their leading and trailing closure flaps in swung-down position while on this section, such flaps will either contact each other or one of the flaps will contact the vertical wall of the adjacent case creating an undesirable space between adjacent cases on the storage section and restricting its capacity.

Allowing the leading and trailing flaps to be folded down while the cases are in abutted relation on the storage conveyor also may tend to distort the vertical walls of the case due to the pressure of the cases against each other on such storage conveyor.

An additional object of the invention is to provide improved and effective advancing or propelling means for the leading case in the supply line on the storage section of the conveyor, whereby such case will be advanced at an accelerated rate and thus spaced ahead of the next succeeding case to assure the proper downfolding of the leading flap of the released case without contacting the trailing flaps of the released case.

A still further object of the invention is to provide additional improved and effective mechanism, whereby the leading, upturned closure flap on the released leading case will be folded downwardly and forwardly at a speed consistent with the accelerated speed of the released case so that such leading flap may quickly be brought to a position sufficiently close to a right angular relation to its attached vertical wall, whereby such forwardly extended flap may thereafter be maintained in such position by suitable means such, for example, as stationary hold-down bars or rods. Thus the forwardly folded, leading closure flap will be restrained from thereafter moving toward closed position.

A still further object of the invention is to provide a case advancing and flap fold-down member that can be constructed as a separate attachable unit to be readily assembled over the usual empty case storage conveyor section of conventional case loading machines.

A still further object of the invention is to provide an improved flap folding mechanism combined with automatic control means, whereby jamming of empty cases on the delivery conveyor section leading to the case loading machine will cause immediate stoppage of the delivery of untreated cases to the flap folding member, and will also effect immediate resumption of delivery of such untreated cases to the flap folding member as soon as the jamming has been overcome and treated cases are again able to flow normally on the delivery conveyor section to the case loading machine.

Additional and more specific objects and advantages of the mechanism of the present invention will become apparent as the description proceeds.

In the drawings:

FIGURE 1 is a side elevational view showing the im-

proved mechanism secured in place over the empty-case storage conveyor of a conventional case loading machine, certain parts being omitted for clarity;

FIGURE 2 is a vertical, transverse sectional view, taken along line 2—2 of FIGURE 1, looking in the direction of the arrows;

FIGURE 3 is a fragmentary vertical sectional view, taken along line 3—3 of FIGURE 2, showing a case being propelled through the flap folding mechanism and the leading case flap on a case being folded downwardly and forwardly to be engaged and held so folded by flap hold-down means;

FIGURE 4 is a fragmentary schematic side view showing the mechanism as it appears in stopped condition and with the flap folding fingers on the flap engaging member ready to be started to fold the leading flap of a case temporarily held on the case storage section of the conveyor; and

FIGURE 5 is a simplified view schematically illustrating the wiring diagram for controlling the stopping and starting of the feeding and folding mechanism.

Briefly considered, a supply of empty paperboard cases is maintained on the storage section of a conveyor. The cases illustrated are of uniform size, rectangular in shape, and have four hinged closure flaps. The cases shown are elongated and are placed on the conveyor, abutted end-to-end with the end flaps extended upwardly. The side flaps are folded outwardly to horizontal position.

Two sets of nip roll units propel the cases by engagement with the outstanding side wall flaps. The first set of nip rolls having a speed to advance the case faster than the normal conveyor speed, thus separating the leading case on the storage section from its succeeding case. Flap engaging fingers on a flap folding member move against the case leading flap with a brushing action and fold the leading flap forwardly and downwardly so it can be brought beneath flap hold-down plow means. The case is then further advanced by a second set of nip roll units engaging the laterally outstanding flaps. As the case is advanced by the second set of nip roll units the trailing case flap is folded rearwardly by the plow means. When the case passes the second set of nip roll units it is then further advanced on the case delivery section of the conveyor to deliver the empty cases, with all flaps outwardly extended, to a conventional case loading machine.

Referring more particularly to the drawings, the mechanism, as herein illustrated, is designed to be attached to longitudinal beams of a conventional case loading machine of the general type illustrated in the patent to Nigrelli et al., No. 3,053,025, such beams being indicated at **1, 1** and being in parallel relation and spaced apart to form supporting means for conveyor mechanism which delivers articles, such as cans or bottles, to be loaded into the empty cases. The unitary flap folding mechanism, as shown, is suspended from the beams **1, 1** by four vertical frame members **2, 2** and **3, 3**, arranged in a rectangular pattern adjacent the front and rear portions of the mechanism. Brackets indicated at **3***a* and **2***a* extend inwardly over the beams **1, 1** and have threaded, vertical apertures to receive adjusting set screws, indicated at **2***b* and **3***b*, the lower ends of which bear upon the tops of beams **1, 1**. Suitable shim plates **4, 4** may be used between the respective vertical members **2** and **3** and the outer faces of beams **1, 1** for the purpose of securing the unitary flap folding mechanism solidily onto the beams.

The lower end portions of vertical frame members **2** and **3** are secured to side frame members **5** and **6**. Side frame member **5** has secured thereto a horizontal bracket support **7** on which are suitably secured a reduction gear casing **8**, a motor casing **9** and a casing **10** containing electrically operated clutch and brake mechanism of conventional construction.

Depending frame members **11** and **11***a* are carried by side frame members **5** and **6** and support the first case propelling units, each indicated as a whole at **12, 12**. Similar depending frame members **13, 13***a* are carried by the side frame members **5** and **6** and support a second set of case propelling units, each indicated as a whole at **14, 14**. The propelling units **12, 12** and **14, 14**, while controlled by independent devices, as will later be explained, during normal operation these units act in tandem substantially as a common conveying means. The depending frame members **11, 11***a* and **13, 13***a* secured to upper and lower, laterally extending frame sections which space the depending frame members from the side frame members. The laterally extending frame members for depending embers **13, 13***a* are shown at **13***b*, **13***b* and **13***c*, **13***c*. The equivalent parts for depending frame members **11** and **11***a* are not shown, but are similarly arranged.

A conveyor, herein shown as a traveling belt **15**, is disposed in parallel relation to the side frame members **5** and **6** and is arranged to deliver cases C, C to the flap engaging member. The general area of the conveyor below the flap engaging member may for convenience be termed a folding area where the cases are treated.

The flap engaging member is arranged above the first and second sets of propelling units and is indicated as a whole at **16**. This member may have various specific forms but, in the present instance, is illustrated as having a pair of spaced endless sprocket chain members **18, 18** passing around separate rear sprockets **19, 19**, secured on shaft **20**. The end of shaft **20** may pass through or be journalled in side frame members **5** and **6** and also journalled in the depending frame members **11** and **11***a*, see FIGURES 1 and 3.

The chains **18, 18** also pass around forward or downstream, driven sprockets **22, 22** fixed on a shaft **23**, journalled in adjustable journal elements **24, 24**, held in cutaway guide channels in the side frames, as indicated at **25** and **25***a*, see FIGURES 1 and 2. The journal elements **24, 24** are held in adjusted position by conventional adjusting screw mechanism, indicated at **24***a*, to tighten or loosen the chain **18, 18**, see FIGURE 1.

The endless chains **18, 18** of the flap engaging member each carry a limited number of inwardly projecting supporting rods **26, 26**, see FIGURE 2, having at their ends radially or outwardly projecting fingers **27, 27** of such length as to enable them to engage the upwardly extended flaps, indicated at C1, on the cases C. As herein shown, there are eight projecting fingers **27, 27** on each chain **18**, relatively closely spaced and serving to engage a leading, upwardly extended case flap C1 to fold it downwardly and forwardly as the chains **18** advance around their sprockets. The chains **18** may have suitable upper chain guide bars **28** and **29** and lower chain guide bars **30** and **31** secured on brackets extending inwardly from the side frame members **5** and **6**, see FIGURE 3.

The flap engaging fingers **27** are adapted to be advanced by the chains **18** at an accelerated speed, as the case advances, for the purpose of directing the leading edge of leading flap C1 beneath a flap hold-down plow means, herein shown as comprising a pair of spaced bars or rails **33, 33** supported on depending frame pieces, one of which is shown at **34** in FIGURE 3, these being in turn supported on a transverse angle bar **35**, having its ends supported on the side frame members **5** and **6**. It is to be noted that the angle bar **35** is arranged between the upper and lower runs of the chains **18**. The downwstream ends of the hold-down plow rails may be suitably curved upwardly at the downstream ends of the rails, as shown at **33***a* in FIGURE 3. The downstream end portions of the flap hold-down plow rails may be supported in any suitable manner, not shown, and the locations of the downstream portions are such as to hold the leading and trailing flaps C1 and C2 of the cases in closely approximately horizontal positions.

The propelling units for advancing the cases independently of the conveyor **15** will now be described. The two sets of propelling units **12** and **14** are similar but are separately driven as will be later explained in detail. One

each of the sets of propelling units **12** and **14** and their driving means are shown in side elevation in FIGURE 1, but only the downstream sets of propelling units **14, 14** are shown in front elevation, see FIGURE 2. Referring particularly to FIGURE 2, it may be seen that the laterally extending case flaps, as indicated at C3, C3, are each engaged between an upper driven roll **36** and a lower idler roll **37**. The upper rolls **36, 36** are each fixed on the end of an inwardly projecting short shaft **38**, each of which is journalled within a casing **39** which serves as a roll supporting element. The casing **39** is fixed on the respective downwardly extending frame sections **13** and **13***a* to project inwardly, whereby the rolls **36** may each engage the upper surfaces of the horizontally extending lateral flaps C3. The outer end portions of the shafts **38** project from the outer sides of the frame members **13** and **13***a* and each has fixed thereon a sprocket **40**. A sprocket chain **41** passes around each sprocket **40** and extends upwardly around a second sprocket **42**, fixed on a transverse shaft **43** extending between the upper and lower runs of sprocket chains **18**. The shaft **43** passes through apertures in the side frame members **5** and **6** and is journalled in the depending frame members **13** and **13***a*. Also shaft **43**, at its end adjacent frame member **13**, extends outwardly farther than at its end adjacent frame member **13***a*. Adjacent the frame member **13** the shaft **43** extends through a second journal in a bracket **45** secured to the underside of the lateral bracket support **7** and has fixed to its end a sprocket **46**, the purpose of which will presently be made clear.

The lower, idler roll **37** of each propelling member **14** is rotatable on a spindle **47** projecting from the inner end of an inwardly extending arm **48**. The end of each arm **48** opposite the roll **37** is guided to slide vertically on the respective depending frame members **13, 13***a* and beneath the arms are adjustable spring means **49, 49** serving to urge the respective rolls **37** upward toward the rolls **36** with the desired degree of pressure to grip the laterally extended flaps.

As shown in FIGURE 2, the casings **39, 39** and the arms **48, 48** may be referred to as roll supporting elements which carry at their ends the two sets of nip rolls **36, 37** and **36, 37**. These supporting elements terminate short of the case path, as shown, to provide space for the travel of a case therebetween.

Each of the upstream propelling units **12, 12** comprises an upper driven roll **51** and a lower idler roll **52**. The driven rolls **51, 51** are each supported spaced from the depending frame members **11** and **11***a* by structure identical to that for driven rolls **36**. These driven rolls **51** are mounted on shaft **53, 53** upon each of which is secured a sprocket wheel **54** driven by sprocket chains **55, 55** passing around other sprocket wheels **56, 56** secured on the opposite ends of shaft **20** upon which the downstream flap engaging member sprockets **19, 19** are fixed, see FIGURE 1.

The idler rolls **52** are each rotatable on a spindle **52***a* and are each urged upwardly toward the respective driven rolls **51**. Their mounting and adjustment is preferably identical with the mounting and adjustment for the idler rolls **37**.

The downstream propelling units **14**, in the present instance, are designed to run continuously while the machine is in operation. The flap engaging member and the upstream propelling units **12, 12** are designed to be operated together and the driving arrangement is such that the flap engaging member and the upstream propelling units **12, 12** can be started and stopped at the same time. For this purpose a shaft **50**, extending from the reduction gear casing **8**, has two sprocket wheels **57** and **58** fixed thereon, see FIGURES 1 and 2. The sprocket **57** on the shaft **50** has a chain **60** passing thereover which also passes around the sprocket **46** on the end of shaft **43**. A sprocket chain **61**, passing around sprocket **58** also passes around a sprocket **62** fixed on shaft **63** operatively connected with conventional electrically actuated clutch and brake mechanism within the clutch and brake casing **10**. Extending from the opposite side of the clutch and brake casing is a shaft **64**, see FIGURE 1, having fixed thereon a sprocket wheel **65**. Over this sprocket wheel **65** is arranged a sprocket chain **66** passing over a sprocket wheel **67** fixed on the end of shaft **23** on which the sprocket wheel **22** for chains **18** of the flap engaging member are also fixed.

In normal operation, when the motor has been started, the clutch will be normally engaged and the brake will be in released position. The flap engaging member and both of the case propelling units will remain in constant operation until the clutch is released and the brake is applied. After the brake is applied the motor will continue running, to rotate shafts **50** and **63**, but shaft **64**, see FIGURE 2, will be held from operation by the application of the brake. This will hold both shafts **23** and **20** from rotation to hold the first propelling units **12, 12** and flap engaging member stationary, see FIGURE 1.

The belt conveyor **15** is operated at a constant speed by driving means indicated at **15***a*.

Assuming the motor to be in stopped condition and the conveyor **15** to be operating to advance cases, a supply of case will be placed upon the conveyor upstream from the nip roll case propelling units **12, 12**. Normally all leading and trailing case flaps will be in raised position so that the cases can be arranged in closely abutted relation. The lateral or side flaps will normally be folded down to horizontal position, as best shown in FIGURE 2. If desired, this may be done by side flap plow means, not shown, which will hold the flaps in the desired position so that the leading edges of the lateral flaps on the leading case will move into the nips of the upstream nip roll propelling units. Folding of the side flaps to the desired position could of course be done manually.

After a supply of cases has been placed on the conveyor belt in end-to-end abutted relation, as above described, the machine may be started to propel the cases through the control area beneath the flap engaging member. For proper folding of the leading flaps the upstream nip roll propelling units **12, 12** will be operated to advance the case at a speed in excess of the speed of the belt conveyor. As soon as the first two sets of nip rolls engage and grip the lateral flaps of the leading case, such leading case will be advanced ahead of the next succeeding case to create a space while the supply of cases behind the leading case, being then free to move, will begin to advance upon the continuously moving conveyor. It is to be understood that, once the machine has been started, the cases on the supply section of the conveyor will be constantly advanced during continued normal operation. The flap folding fingers on the flap engaging member will be so adjusted relative to the upstream nip roll propelling units that as soon as the leading case begins to be advanced by such nip rolls propelling units the sprocket chains **18, 18** carrying the flap engaging fingers will be actuated to advance at a speed in excess of the lineal speed of the upstream case propelling units. Thus the flap folding fingers will operate to fold the leading flap forwardly and downwardly with a successive brushing action while the case is being propelled by the nip roll propelling units.

As the leading flap is successively engaged by the flap engaging fingers and the case continues to be advanced by the upstream case propelling units, this leading flap will reach the flap hold-down plow rails before the final pair of flap engaging fingers pass the end of such leading flap. Thus, the leading flap will be engaged and held forwardly folded and engaged beneath the plow rails at or before passage of the last pair of the sets of flap engaging fingers passes the free end of the leading flap. The principal consideration is that the last of the flap engaging fingers will pass the leading flap before the trailing flap of the case reaches the point where it might be engaged by such flap

engaging fingers. The upstanding trailing flap of the case is then free to be folded rearwardly by the upwardly curved end of the plow rails and will then be held downwardly folded by such rails.

The length of the endless flap folding member **16** is so designed and its speed is so adjusted with respect to the lineal speed of the nip roll propelling units that as soon as the next succeeding case arrives at the upstream nip roll propelling units **12, 12** and begins to be advanced thereby, the flap folding fingers, having arrived into proper relation, will begin their brushing action upon the upstanding leading flap of such succeeding case.

The downstream case propelling units **14, 14** are located somewhat less than a case length from the upstream units. Thus, the nip rolls of the downstream units **14, 14** will grip the opposite, laterally extending flaps and continue the advance of the case at a speed not less than the lineal speed of the case when advanced by the upstream units. The advancing case is thus kept clear of the succeeding case.

As soon as the leading case whose leading and trailing flaps have been folded and have advanced beyond the downstream propelling units **14, 14**, the case will then be propelled by the conveyor **15** along and below the flap hold-down rails with the leading flap extended forwardly and the trailing flap extended rearwardly. Additional holding means for retaining the lateral flaps outwardly extended will, of course, be provided but are not shown in the drawings.

Safety means are preferably provided for preventing treated cases from jamming and backing into the folding section of the mechanism below the flap engaging member.

In the vent the case loading machine that normally receives the cases should not be functioning properly and cannot use the cases delivered to such machine, it is necessary to stop the flap engaging member and hold back the supply of abutted cases on the storage section of conveyor **15** until the case loading machine is again placed in condition normally to receive cases. For this purpose, means are provided for automatically stopping the actuation of the upstream propelling units and stopping the movement of the sprocket chains **18** of the flap engaging member. Such means also serves to reactivate the upstream case propelling units and restart the flap engaging member when conditions are such that treated cases may flow freely from the flap engaging member to the case loading machine.

As shown in FIGURE 4, a suitable switch, herein indicated as a photoelectric switch element **69**, is located at a distance from the downstream propelling units **14, 14** somewhat greater than one case length.

The relationship between the lineal speed of the conveyor **15** and the lineal speed of the two case propelling units particularly the downstream propelling units is such that the trailing end of the advancing case that has been treated by the folding of its leading flap forwardly will normally pass beyond the photoelectric switch to allow its beam to be reestablished after a predetermined short interval before the leading end of the next succeeding case on the conveyor storage section reaches the upstream nip roll propelling units **12, 12**. If the treated case on the delivery section of the conveyor is delayed, due to being obstructed, and fails to advance to allow reestablishment of the light beam before the expiration of this predetermined interval, a time delay mechanism, associated with the photoelectric switch, times out and operates a pair of single acting switches to cause application of the electrically operated brake and disengagement the electrically operated clutch to stop the upstream propelling units **12, 12** and at the same time stop the flap engaging member **16**. The timing out of the switch will occur shortly before the leading case on the conveyor storage section reaches the propelling units **12, 12**. However, the cases on the storage section continue to advance on the conveyor **15** until the leading edges of the laterally extending flaps on the leading case are stopped at the nip entrances of the nip roll propelling units then held in nonrotating condition.

The end of the timing out interval and the relative lineal speed of the nip roll propelling means, the lineal speed of the conveyor **15** and the length and speed of the flap engaging member are such that, when the switch times out to actuate the clutch-brake mechanism, the two companion leading folding fingers on the sprocket chains **18, 18** of the flap engaging member will be stopped approximately midway around their sprockets **19, 19**, where they will be in the clear of the upper edge of the leading flap of the case approaching the nip roll propelling units so that such flap will pass the fingers without contacting them, see FIGURE 4. Thus the flap folding fingers will always be controlled so as to come into engagement behind the leading flap of the case advanced by nip roll units **12, 12**.

Referring to FIGURE 5, showing a simplified, schematic wiring diagram, the main current supply conductors are indicated at **70** and **71**. The motor **9***a* is connected to the main supply conductors through conductors **72***a*, **72***b*, **73** and switch **74**. The photocell **69** and time relay **75** are connected by a conductor **76**. The photocell **69** is connected to conductor **73***b* by conductor **77** and the time delay relay is connected to the main conductor **71** through conductor **78**. Thus, when the motor switch is closed to operate the motor, the light beam of the photoelectric unit will be directed onto the receiver of such unit.

The electric clutch **10***c* will be connected by conductors to the main conductors **70** and **71** through a normally closed switch **10***d* and the electric brake **10***b* will be connected by conductors to the main conductors **70** and **71** through a normally open switch **10***e*. The two switches **10***d* and **10***c* are connected for simultaneous action. That is, when one is closed the other is opened.

Timing out of the time delay relay **75** causes movement of both switches **10***d* and **10***e*, thereby opening **10***d* and closing **10***c*, to release the clutch and apply the brake. The switches remain in this condition as long as the photoelectric unit light beam remains interrupted. Reestablishment of the light beam resets the time delay relay **75** which then acts to reverse the clutch and brake switches and causes restarting of the nip roll propelling units **12, 12** and the flap engaging member **16**.

From the foregoing it is to be understood that the present invention provides an effective flap folding mechanism to cooperate with conveying means for advancing cases which are formed with upstanding hinged leading and trailing flaps, the unit being designed to be located over a flap folding area through which the cases are propelled at an accelerated speed by a first case propelling means to separate the case to be treated from a closely following case, such mechanism also including a flap engaging member movable in a fixed cycle at a lineal speed greater than the accelerated speed at which the case is advanced by the first case propelling means, the flap engaging member including a section acting for only a limited time to engage the upper rear surface portion of a leading case flap with a brushing action to fold the flap forwardly and downwardly and cause it to be inserted beneath flap hold-down means. The length of the folding means being sufficiently limited and so controlled that it will fold forwardly only the leading flap of the case and will not engage its trailing flap, allowing such trailing flap to be folded by the flap hold-down means which holds the leading flap folded forwardly. The mechanism further includes a second case propelling means, also actuated at an accelerated speed for continuing the movement of the case from the folding area after the leading flap has been folded forwardly and engaged beneath the flap hold-down means. The second case propelling means is arranged to advance the treated case to a conveyor section which will carry the treated case to a case loading machine.

The mechanism is designed to operate continuously under normal conditions while empty cases are being constantly delivered to the supply and storage section of the conveyor **15** after the cases have been unloaded of empty cans. The photoelectric switch means is initially actuated by each treated case as it interrupts the light beam and the time delay relay starts its timing out period, but passage of each treated case through the light beam and the reestablishment of the beam within the normal predetermined time will always reset the time delay relay and start a new timing out period. There is thus no requirement for the flap engaging member **16** or the first nip roll propelling units **12, 12** to be stopped as long as the treated cases are carried forward and not obstructed or unduly slowed up while passing through the light beam.

For simplicity of description certain elements of the mechanism have been referred to as horizontal and certain elements are defined as being located either above or below other elements. It is to be understood, however, that references to vertical or horizontal positioning and relationship of various parts are for convenience of description only and are not to be construed as limited to any particular positioning with respect to the vertical.

While the present description sets forth a preferred form of the invention, numerous changes may be made in the construction disclosed without departing from the spirit of the invention, and it is therefore desired that the present invention as disclosed be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

We claim:

1. A method of folding the leading flaps of elongated, rectangular cases, such as cases formed from resilient paperboard, having upstanding, hinged closure flaps on their end walls, such method comprising placing a supply of such cases in end-to-end abutted relation on an elongated conveyor support means along which the cases may be conveyed with their leading and trailing closure flaps extending upwardly, constantly advancing the row of abutted cases on such conveyor support means, successively advancing the leading case of the moving row on the conveyor support means without stopping and with a gripping action at an accelerated speed greater than the speed of movement of the cases on the conveyor support means to space each successive leading case from its succeeding abutted case and maintaining such leading case spaced ahead of the advancing succeeding case while the leading case is moved to and past a flap folding area, contacting with a brushing element a free edge portion of the leading, upstanding, hinged flap of such case with a forward brushing action and moving such brushing element forwardly at a greater speed than the accelerated speed at which the case is then advancing to swing the leading flap forwardly and downwardly during such advance of the case, providing an elongated hold-down means under which the downfolded flap is directed by the brushing element and slidably held while advancing, and thereafter advancing the treated case, with its leading flap held forwardly and downwardly folded, to a desired destination.

2. Mechanism for folding case flaps comprising a conveying means having a case storage section and a delivery section, the cases to be treated being of elongated, rectangular shape, of generally uniform size, and of the type formed from resilient paperboard, the end walls of the cases having hinged cover flaps and the cases being arranged on the storage section in an end-to-end abutted row with their leading end wall flaps extended upward, the cases also having hinged side wall flaps extended laterally outward, an end wall flap folding station between the conveyor storage and delivery sections, means for constantly operating the conveyor storage section to advance the row of cases with a continuous movement toward the flap folding station, flap folding means at the folding station, flap hold-down means, located beyond the flap folding station, beneath which a downfolded flap may be slidingly received, said flap folding means comprising a forwardly movable folding element arranged to engage the upwardly extended, leading end wall flap of an advancing case and fold it forwardly and downwardly to direct it beneath the flap hold-down means, case propelling means for engaging successive leading cases of the row moving on the storage section and advancing each such case along the storage section to the flap folding station, said case propelling means comprising two laterally opposite sets of upper and lower nip rolls, the rolls of each set being arranged to engage opposite surfaces of the respective laterally extended, side wall flaps, means for driving one of the nip rolls of each set to advance a leading case at an accelerated speed, and means for moving the flap folding element forwardly at a speed in excess of the speed of the case propelling means.

3. Mechanism for folding case flaps, comprising an elongated conveyor having a case storage section and a delivery section, the cases to be treated being of elongated, rectangular shape, of generally uniform size, and of the type formed from resilient paperboard, the end walls of the cases carrying hinged cover flaps thereon and the cases being placed on the conveyor storage section in end-to-end, abutted relation with their end wall flaps extending upwardly, the storage conveyor section operating to urge a line of abutted cases to move toward the delivery section, flap folding mechanism located between the conveyor storage and delivery sections, said mechanism comprising a support, a movable flap-folding member mounted on said support and arranged to move in a fixed path, the movement of the flap-folding member at one part of its cycle being in the direction of movement of cases on the conveyor, said flap-folding member including thereon a flap brushing section of limited length adapted to engage an edge of a case flap movable past the flap-folding member, a first propelling means for cases arranged to propel cases from the storage section of the conveyor in a direction past the flap-folding member, a second propelling means for cases located downstream from the first propelling means at a distance less than a case length to engage cases initially propelled by the first case propelling means and advance such cases onto the conveyor delivery section, means for actuating the first and second propelling means to advance cases at a speed greater than the speed of case travel on the conveyor storage section, said first propelling means acting to engage the leading case on the storage section to advance and space it from the next succeeding abutted case, means for actuating the flap-folding member at a speed in excess of that of the first propelling means to cause the flap brushing section to engage with a brushing action the leading upwardly extended, hinged flap on the leading case, advanced and spaced from its previously abutted, succeeding case on the storage section by the first propelling means, such flap brushing section acting to fold the case leading flap forwardly and downwardly while the case is being advanced, flap hold-down plow means extending along the conveyor delivery section from a point below the flap-folding member, the movement of the flap brushing section being timed with the first propelling means to start its brushing action on the leading flap of a leading case immediately after such case is engaged and starts to be propelled from the storage conveyor by the first propelling means, the length of the flap brushing section being so restricted that its brushing action will be discontinued when the leading case flap has been directed beneath the flap hold-down means, so that the trailing flap of the case will not be contacted by the brushing section, the case delivery section operating to continue advancement of the case along beneath the hold-down plow means.

4. The invention as defined in claim **3** in which at least

one of the case propelling means has members located at opposite sides of the flap-folding member to engage portions on opposite sides of the cases.

5. The invention as defined in claim 3 in which the brushing section of the flap-folding member comprises a series of closely spaced, flap-engaging fingers adapted successively to engage medially the outer free edge of the leading flap on a case propelled by the first propelling means.

6. The invention as defined in claim 3 comprising a separate, unitary frame on which the flap folding mechanism is supported, such frame being adapted to be assembled with and extend over a case conveyor of a case loader having frame members extending lengthwise above the conveyor of such case loader, spaced, upstanding frame sections on the unitary frame located to extend upwardly relatively to the case loader frame members, and means for securing said upstanding frame sections of the separate, unitary frame to the frame members of the case loader.

7. The invention as defined in claim 3 comprising a separate, unitary frame on which the flap folding mechanism is supported, such frame being adapted to be assembled with and extend over a case conveyor of a case loader having generally horizontal frame members extending lengthwise above the conveyor of the case loader, spaced, upstanding frame sections on the unitary frame located to extend above the case loader frame members, brackets on the upstanding frame sections positioned to extend over the horizontal frame members of the case loader, said brackets having vertically threaded apertures, vertically disposed frame-supporting and adjusting set screws receivable into said threaded apertures, the lower ends of the set screws being positioned to engage and be supported on the horizontal frame members of the case loader to support adjustably the unitary flap folding mechanism over the case loader conveyor.

8. Mechanism for folding case flaps, comprising an elongated conveyor having a case storage section and a delivery section, the cases to be treated being of elongated, rectangular shape, of generally uniform size and of the type formed from resilient paperboard, the end walls carrying hinged cover flaps thereon and the cases being placed on the conveyor storage section in end-to-end, abutted relation with their end wall flaps extending upwardly, the conveyor operating to urge a line of abutted cases to move toward the delivery section, flap folding mechanism located between the conveyor storage and delivery sections, said mechanism comprising a frame arranged above the conveyor, and endless, elongated flap folding member having spaced supporting means on the frame at the ends of the endless flap folding member over which it is adapted to travel in lengthwise relation to the conveyor, a first propelling means having members located on opposite sides of the conveyor for engaging and propelling each successive leading case from the conveyor storage section to cause it to advance beneath the flap folding member, a second propelling means having members located on opposite sides of the conveyor and spaced less than a case length from the first propelling means to continue the advance of cases from the first propelling means and onto the conveyor delivery section, means for actuating the first propelling means at a speed greater than the speed of travel of cases on the storage section, whereby the leading case on the storage section will be spaced ahead of its next succeeding case, means for actuating the second propelling means at a lineal speed not less than that of the first propelling means, the endless flap folding member having thereon a flap engaging section of restricted length to engage with a brushing action the free edge of a leading case flap while the case is advancing between the first and second propelling means, means for actuating the endless flap folding member to cause the flap engaging section to advance in the speed greater than the speed of a case traveling in the space between the two propelling means, whereby the leading flap will be folded forwardly and downwardly to direct its leading edge below a hold-down means, flap hold-down plow means extending along the conveyor delivery section from a point between the first and second propelling means and being in position to receive a case therebeneath and slidably hold its leading flap in downwardly and forwardly folded position, the movement of the flap engaging and brushing section being timed with the first propelling means to start its brushing action on the leading flap of a leading case immediately after such case is engaged and starts to be propelled from the storage conveyor by the first propelling means, the length of the flap brushing section being so restricted that its brushing action will be discontinued when the leading case flap has been directed beneath the flap hold-down means, so that the case trailing flap will not be contacted by the brushing section, the case delivery section operating to continue advancement of the case below the hold-down plow means.

9. The invention as defined in claim 8 in which the flap engaging section on the endless member comprises a limited length group of closely, spaced, radially extending, flap engaging fingers adapted to contact the outer free edge of an upwardly extended leading case flap.

10. Mechanism for folding case flaps, comprising an elongated conveyor having a case storage section and a delivery section, the cases to be treated being of elongated, rectangular shape, of generally uniform size and of the type formed from resilient paperboard, the cases having opposed, hinged cover flaps on their lateral walls and end walls and being placed on the conveyor storage section in end-to-end, abutted relation with their end wall flaps extending upwardly and their side wall flaps extended outwardly, the conveyor operating to urge the advancement of a line of abutted cases to move toward the delivery section, flap folding mechanism located between the conveyor storage and delivery sections, said mechanism comprising a support, a movable flap folding member mounted on said support and arranged to move in a fixed path, the movement of the flap folding member at one part of its cycle being in the direction of movement of cases on the conveyor, said flap folding member length to engage an edge of a leading case flap movable including thereon a flap brushing section of limited past the flap folding member, a first pair of sets of vertically related nip rolls rotatable on axes transverse to the travel of cases on the conveyor, one set of nip rolls being on each side of and at a level below the flap folding mechanism, each set of nip rolls being adapted to engage in gripping relation above and below the respective lateral case flaps, when outwardly extended, to propel the cases when the nip rolls are rotated, a second pair of sets of nip rolls spaced from the first nip rolls, said second nip rolls being generally similar to the first nip rolls, being adapted to engage the laterally extended flaps, and spaced downstream from the first nip rolls at a distance somewhat less than a case length, such second pair of nip rolls serving to advance treated cases to the conveyor delivery section, means for driving the four sets of nip rolls to advance a case past the flap folding mechanism at a speed in excess of the speed of travel of cases on the storage section of the case conveyor, the speed of the first set of nip rolls serving to advance each successive leading case on the conveyor storage section to space it ahead of its next succeeding abutted case, means for driving the flap folding member at a speed to cause the flap brushing section to advance at a linear speed greater than the speed of a case propelled by the first nip rolls, whereby the case leading flap will be folded forwardly and downwardly to direct its leading edge below a hold-down means, flap hold-down means extending along the conveyor delivery section from a point between the upstream and downstream sets of nip rolls and

being in position to receive a case therebetween and slidably hold its leading flap in downwardly and forwardly folded position, the movement of the flap brushing section being timed with the upstream nip rolls to start its brushing action on the leading flap of a leading case immediately after such case is engaged and starts to be propelled by the upstream nip rolls, the length of the flap brushing section being so restricted that its brushing action will be discontinued when the leading case flap has been directed beneath the flap hold-down means, so that the case trailing flap will not be contacted by the brushing section, the down-stream nip rolls serving to continue advancement of the treated case to advance it to the conveyor delivery section where it continues to move beneath the flap hold-down means.

11. Mechanism for folding case flaps, comprising an elongated conveyor having a case storage section and a delivery section, the cases to be treated being of elongated, rectangular shape, of generally uniform side, and of the type formed from resilient paperboard, the end walls of the cases carrying hinged cover flaps thereon and the cases being placed on the conveyor storage section in end-to-end, abutted relation with their end wall flaps extending upwardly, the storage conveyor section operating to urge a line of abutted cases to move toward the delivery section, flap folding mechanism located between the conveyor storage and delivery sections, said mechanism comprising a support, a movable flap folding member mounted on said support and arranged to move in a fixed path, the movement of the flap folding member at one part of its cycle being in the direction of movement of cases on the conveyor, said flap-folding member including thereon a flap brushing section of limited length adapted to engage an edge of a case flap movable past the flap-folding member, the first propelling means for cases arranged to propel cases from the storage section of the conveyor in a direction past the flap-folding member, a second propelling means for cases located downstream from the first propelling means at a distance less than a case length to engage cases initially propelled by the first case propelling means and advance such cases onto the conveyor delivery section, means for actuating the first and second propelling means to advance cases at a speed greater than the speed of case travel on the conveyor storage section, said first propelling means acting to engage the leading case on the storage section to advance and space it from the next succeeding abutted case, means for actuating the flap-folding member at a speed in excess of that the first propelling means to cause the flap brushing section to engage with a brushing action the leading upwardly extended, hinged flap on the leading case, advanced and spaced from its previously abutted, succeeding case on the storage section by the first propelling means, such flap brushing section acting to fold the case leading flap forwardly and downwardly while the case is being advanced, flap hold-down plow means extending along the conveyor delivery section from a point below the flap-folding member, the movement of the flap brushing section being timed with the first propelling means to start its brushing action on the leading flap of a leading case immediately after such case is engaged and starts to be propelled from the storage conveyor by the first propelling means, the length of the flap brushing section being so restricted that its brushing action will be discontinued when the leading case flap has been directed beneath the flap hold-down means, so that the trailing flap of the case will not be contacted by the brushing section, the case delivery section operating to continue advancement of the case beneath the hold-down plow means, a continuously driven motor, gearing connected to the motor to drive the second propelling means continuously, independent gearing associated with the motor to drive the first propelling means and the flap-folding member as a unit, said independent gearing including alternately operable electric clutch and brake mechanism to control the starting and stopping of the first propelling means and the flap folding member approximately simultaneously, a source of electric power, single-acting switch means including a normally open brake switch to retain the brake release, conductors connecting such switches to the power source, reversal of such single-acting clutch and brake switch means causing the clutch to be disengaged and the brake to be applied, resettable time delay switch means actuable by a case advancing on the case delivery section, means controlled by the time delay switch means for actuating the single acting clutch and brake switches to open the clutch switch to release the clutch and close the brake switch to engage the brake upon the timing out of the time delay switch means, the timing out period being in excess of the normal time required for an unobstructed case, moving past the switch, to clear the switch and allow it to reset to normal condition, thereby assuring normal flow of cases, termination of the timing out interval of the time delay switch means causing the time delay switch to actuate the switches for the clutch and brake mechanism to cause stoppage of the flap folding member and first propelling means just prior to the point where the flap brushing section is ready to be started to move into operative brushing relation with the upwardly extended leading flap of the leading case on the storage conveyor section, the advance of which case is ready to be initiated by the temporarily deactivated first propelling means, the resumed advance of the temporarily obstructed case on the delivery conveyor past the time delay switch serving to cause resetting of the switch, thereby reversing the brake and clutch control switches to reactivate the first case propelling means and the flap folding member.

12. A conveying means for cooperating with end folding flap mechanism for cases of elongated, rectangular shape, of generally uniform size, of the type formed from resilient paperboard and having hinged end and side wall flaps, an elongated belt conveyor on which the cases may be arranged and advanced on the belt in end-to-end abutted relation with their end wall flaps upstanding for close case abutment and with their side wall flaps extending substantially horizontally outward, said belt conveyor adapted to be located for traveling movement past a flap folding station, at which the upstanding leading end wall flaps of the cases may be folded forwardly and downwardly, two similar pairs of nip rolls, one roll of each pair being disposed over the other, said nip rolls having their axes extending transversely to the direction of travel of the belt conveyor, means for driving one nip roll of each pair in the same surface direction and at a faster lineal speed that the speed of the belt conveyor, the respective pairs of nip rolls being arranged symmetrically at each side of the belt in positions to engage the respective upper and lower surfaces of the opposite, outfolded side wall flaps of the belt to grip them and cause the advance of the cases in sliding relation to the belt due to their faster lineal speed, two additional pairs of nip rolls disposed one over the other and having their axes also extending transversely to the direction of travel of the belt, means for driving one of the nip rolls of each pair in the same surface direction and at a lineal speed not less than that of the driven rolls of the first pair of nip rolls, the latter respective pairs of nip rolls being also arranged symmetrically at each side of the belt in positions to engage the respective upper and lower surfaces of opposite, outfolded side wall flaps of cases on the belt to grip them and cause the advance of cases on the belt, the latter pairs of nip rolls being located at less than a case length from the first mentioned nip rolls to receive the cases being discharged from the first pairs of nip rolls and continue their advancement at an accelerated rate and for a limited distance along the belt.

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