April 9, 1968 J. C. BERNEY 3,376,692

CARTON FLAP OPENER

Filed March 1, 1965 2 Sheets-Sheet 1

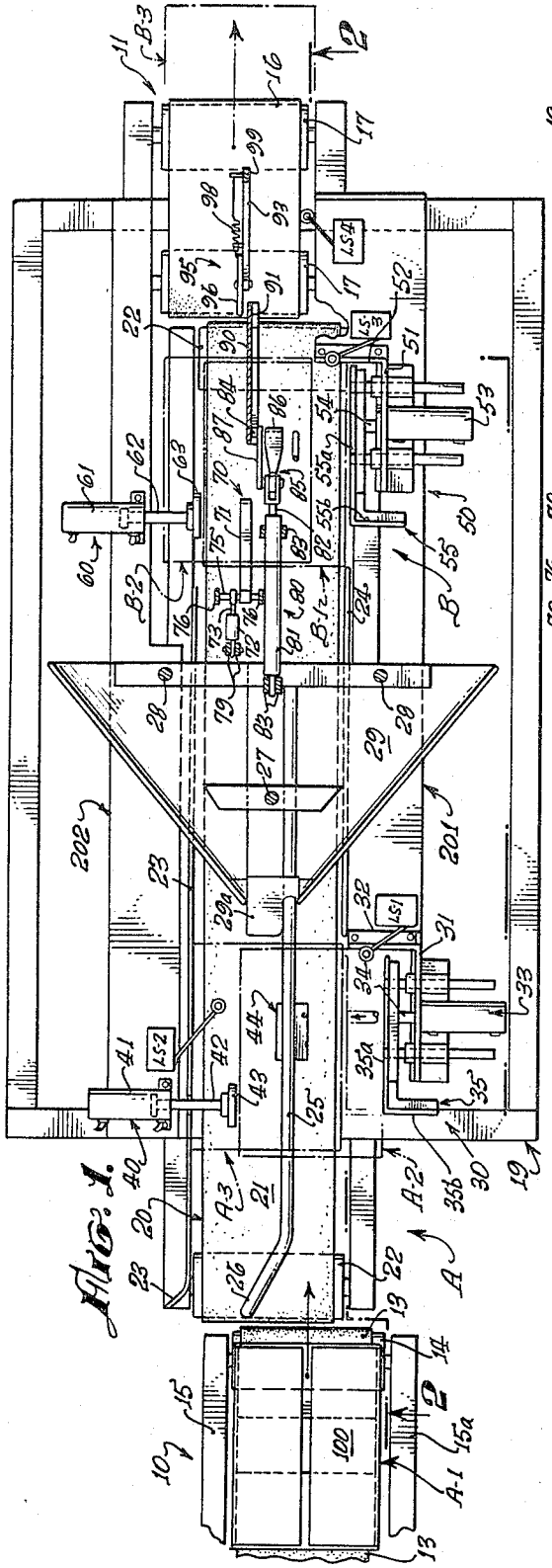


FIG. 1.

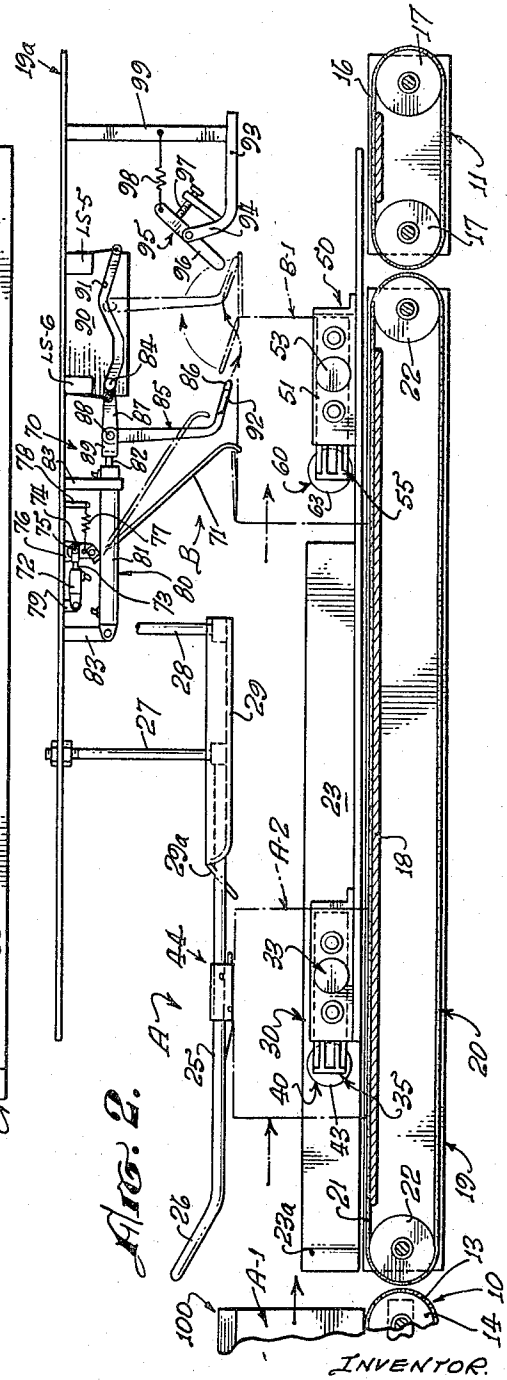


FIG. 2.

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CARTON FLAP OPENER

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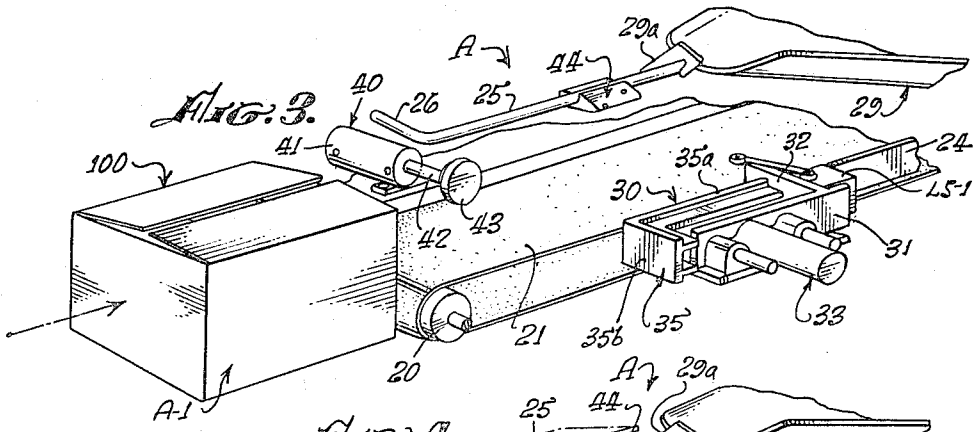


FIG. 3.

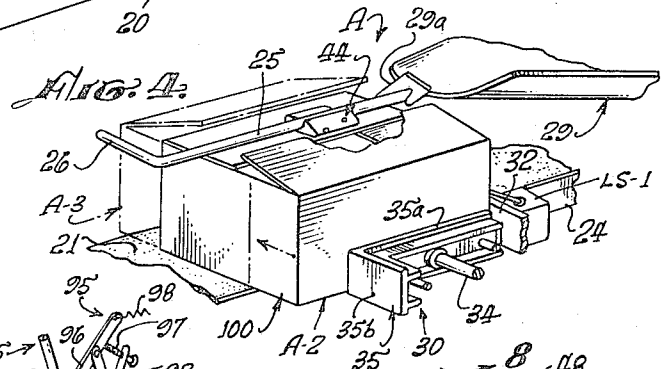


FIG. 4.

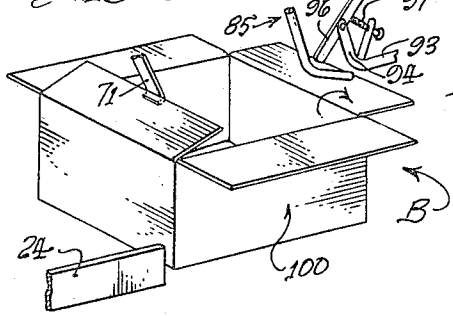


FIG. 5.

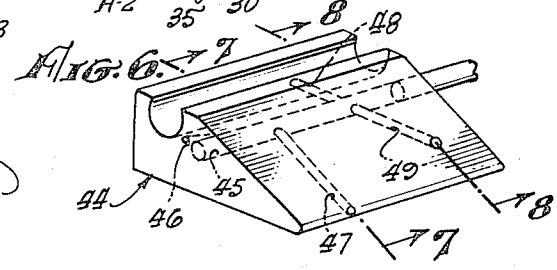


FIG. 6.

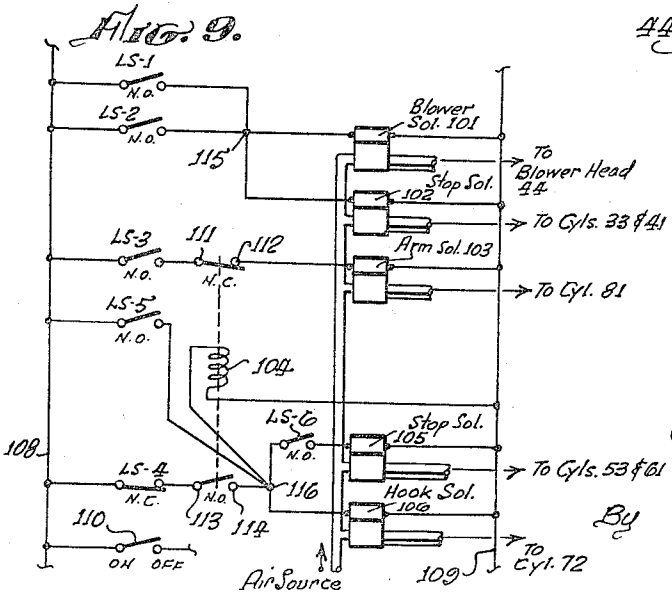


FIG. 9.

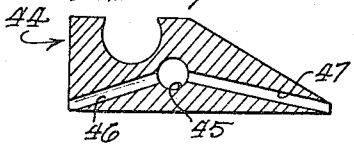


FIG. 7.

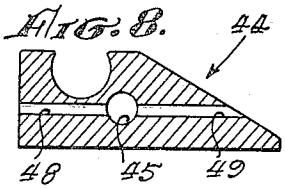


FIG. 8.

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3,376,692

CARTON FLAP OPENER

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13 Claims. (Cl. 53—382)

ABSTRACT OF THE DISCLOSURE

A case flap opener includes a blower which directs a jet of air under one side flap to partially raise that flap. The case is then shifted laterally and the blower directs an air jet under the other side flap to partially open that flap. A plow then engages the vertically opened side flaps and fully opens them as the case is conveyed on. Another blower directs a jet of air under the leading end flap to partially open that flat and a traveling hook completes opening of the leading end flat. A rotatably mounted stationary hook engages the trailing end flap and opens it.

Background of the invention

This invention relates to apparatus for opening cartons and more particularly to apparatus for opening the four top flaps of a conventional shipping container having two end flaps and two side flaps, such as one made from cardboard, corrugated board, or the like.

Four-flap corrugated cases in conventional use as shipping containers are mainly of two general types commonly known as RSC (regular slotted containers) and AFM all flaps meet) containers. In AFM cases all of the top closure flaps meet when in the closed position; that it, the end flaps meet when folded together and the longitudinal side flaps meet when folded together. In the RSC type of case the side flaps and the end flaps are of the same width, so on elongate cases the side flaps meet but the end flaps do not meet when in the closed position. The present invention is directed toward apparatus for fully opening all of the top flaps of the RSC type of case, it being readily apparent that the side flap opening mechanism of the present invention will also open the side flaps of the AFM type of case.

In modern canning and bottling plants the unloading of cans or bottles from shipping cases is accomplished mechanically. The cases of empty bottles or cans are typically received in an assembled configuration with the bottom flaps sealed and the top flaps unsealed but in a closed condition. Therefore, the cartons are passed through apparatus which fully opens their top flaps, the opened cartons then being fed directly to the apparatus for unloading them.

The typical prior art flap opening apparatus requires that the cartons be fed to the unloader apparatus in spaced relationship, the operation of various components of the apparatus being programmed as a function of time. This technique is not without attendant disadvantages. Relatively complex and costly apparatus and circuitry is required to maintain the necessary synchronization between carton spacing and the machine operating cycle. Also, the necessity for time synchronization in this technique is the dominant factor in determining the maximum feed rate of cartons into the flap opening apparatus, and hence into equipment located downstream from the flap opening apparatus. Furthermore, if a carton is not properly processed by the apparatus and is not discharged from the apparatus at the proper time, the apparatus must be shut down to prevent a jam-up and to allow correction. The present invention is directed

toward flap opening apparatus which obviates the aforementioned disadvantages.

In accordance with the present invention technique the various operational components of the flap opening apparatus are functionally synchronized, rather than time synchronized. That is, the operation of the various components of the present invention apparatus is controlled by movement of the cartons to various positions in the apparatus. The present invention apparatus includes a novel side flap opening mechanism comprising means for momentarily arresting motion of a carton and partially opening one of its side flaps, means for then moving the carton laterally and partially opening its other side flap, and means for then feeding the carton into a plow which fully opens the side flaps. The carton then is presented to an end flap opening mechanism comprising traveling hook means for opening the leading end flap and rotatably mounted, stationary hook means for engaging the trailing end flap, movement of the carton away from the stationary hook causing the trailing end flap to be opened.

The elimination of time synchronization circuitry and equipment results in a much simpler and less expensive apparatus. Elimination of the necessity for maintaining any certain spacing, or any spacing at all, between cartons fed into the present invention apparatus enables a significantly faster feed rate as compared with prior art apapratus. The present invention flap opening apparatus is capable of a higher feed rate than that of other material handling equipment commonly used in packaging and bottling plants, whereby the feed rate of the flap opening mechanism will not determine the flow rate of materials through the plant. Should a malfunction occur in the present invention apparatus whereby cartons are not discharged from the apparatus, there is no interruption of a timed sequence and hence no necessity for a complete shut-down and resynchronization.

Accordingly, it is an object of the present invention to provide improved carton top flap opening apparatus.

It is also an object of the present invention to provide an improved carton top flap opening apparatus capable of a high feed rate.

It is another object of the present invention to provide a relatively simple and inexpensive carton top flap opening apparatus.

It is a further object of the present invention to provide a carton top flap opening apparatus in which there is no necessity for maintaining spacing between cartons fed into the apparatus.

It is still another object of the present invention to provide a completely automatic carton top flap opening apparatus which is not programmed as a function of time.

It is a yet further object of the present invention to provide improved carton top flap opening apparatus in which synchronization is accomplished by the movement and positioning of cartons passing through the apparatus.

It is also an object of the present invention to provide an improved apparatus for opening the longitudinally extending top flaps of cartons.

It is yet another object of the present invention to provide an improved apparatus for opening the top end flaps of cartons.

It is a still further object of the present invention to provide improved flap opening apparatus wherein the opened cases may be held for release to downstream equipment in automatic synchronization with the need for cases by the downstream equipment.

The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages thereof will be better understood from the following de-

scription considered in connection with the accompanying drawing in which a presently preferred embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for the purpose of illustration and description only, and is not intended as a definition of the limits of the invention.

In the drawing:

FIGURE 1 is a plan view of a machine constructed in accordance with the present invention;

FIGURE 2 is a view taken along the line **2—2** of FIGURE 1;

FIGURE 3 is a partial perspective view of the side flap opening mechanism of the machine of FIGURE 1;

FIGURE 4 is a partial perspective view showing the side flap opening mechanism in operation;

FIGURE 5 is a pictorial view of a case, depicting operation of the end flap opening mechanism of the apparatus of FIGURE 1;

FIGURE 6 is a perspective view of an air blower head used in the side flap opening mechanism of the apparatus of FIGURE 1;

FIGURE 7 is a view taken along the line **7—7** of FIGURE 6;

FIGURE 8 is a view taken along the line **8—8** of FIGURE 6; and

FIGURE 9 is an electrical schematic diagram of the control circuit for the apparatus of FIGURE 1.

Referring now to the drawing, in FIGURES 1 and 2 there are shown plan and elevation views of a presently preferred embodiment of case opening apparatus utilizing the present invention concepts. For ease of explanation the machine may be functionally divided into a side flap opening mechanism A and an end flap opening mechanism B. The description of these mechanisms will be preceded by a general description of the complete machine and followed by explanations of the control circuit and operating cycle.

General description

An infeed conveyor **10** feeds the cases to be opened to the machine, and a transfer conveyor **11** is provided to transfer cases leaving the machine to an outfeed conveyor, not shown. A main conveyor **20** extends longitudinally through the machine and is slightly offset from the infeed and transfer conveyors, as can be best seen in the plan view of FIGURE 1. In the illustrated embodiment it is not necessary that the transfer conveyor **11** be offset from the main conveyor **20**; however, it is shown offset for the purpose of indicating how the operation of the present invention apparatus can be synchronized with the operation of other carton handling equipment by operating the transfer conveyor belt at a faster speed than the main conveyor belt to speed up the cases as they are discharged from the present invention apparatus. The conveyors **10**, **11** and **20** are in coplanar parallel alignment and in the illustrated embodiment are of the driven endless belt type, although various other types of conveyors, such as the roller type, are suitable. The infeed conveyor **10** comprises an endless belt **13** looped over a pulley **14** and another pulley, not shown, supported by side rails **15** and **15***a*. The transfer and main conveyors are similarly constructed, the transfer conveyor **11** having an endless belt **16** passing over a plurality of pulleys **17** and an intermediate support plate, the main conveyor **20** having an endless belt **21** passing over pulleys **22** and in intermediate support plate **18**. One or more of the pulleys of each of the conveyors are driven by a suitable mechanism, not shown, so that the uppermost belt run of each of the conveyors moves in a left-to-right direction in the drawing. The three conveyors are spaced closely together so that cartons leaving one conveyor will be picked up by the next succeeding conveyor. Cases leaving the infeed conveyor **10** are deposited by their own movement on the upper belt run of the main conveyor **20** and are first presented to the side flap opening mechanism A.

The side flap opening mechanism A, the end flap opening mechanism B, the main conveyor **20** and the transfer conveyor **11** are supported in the desired relationship by a framework, generally indicated by the reference numeral **19**.

The side flap opening mechanism A, which will be hereinafter described in detail, includes means for arresting forward movement of a carton, slightly opening one of its side flaps, laterally moving the carton into central alignment on the main conveyor belt while slightly opening the other side flap, and then resuming longitudinal movement of the carton into a plow which completely opens the side flaps. The end flap opening mechanism B, which will also be hereinafter described in detail, includes means for again arresting motion of the carton, opening its leading end flap, laterally moving the carton into central alignment on the belt of the transfer conveyor while bringing a hook into engagement with the trailing end flap, and then resuming longitudinal movement of the carton whereby movement of the carton will result in the trailing end flap being opened by the hook. Upon leaving the transfer conveyor **11** the opened carton is removed from the machine by suitable outfeed conveyor means, not shown.

Side flap opener

The side flap opener A comprises a side flap blower bar **25**, a plow **29**, a case positioning mechanism generally indicated by the reference numeral **30**, and a movable guide apparatus generally indicated by the reference numeral **40**. The base of the case positioning mechanism **30** is an L-shaped bracket **31** mounted to the supporting framework **19** near the front end of the main conveyor **20**. The base leg of the bracket **31** defines a stop bar **32** and, as can best be seen in FIGURE 1, the bracket **31** is disposed so that the stop bar **32** is in perpendicular alignment with the conveyor belts. The case positioning mechanism **30** and an opposing guide apparatus **40** are mounted on laterally movable side bars **201** and **202** respectively.

The movable portions of the side flap opener and end flap opener of the present invention apparatus are operated by air pressure, the apparatus employing various combinations of air cylinders commonly known as double acting cylinders, as distinguished from single acting air cylinders. The term "single acting air cylinder" refers to an air cylinder having its piston rod normally urged by spring pressure to its withdrawn position, application of air pressure to the head end of the cylinder causing the piston rod to move against the spring pressure to an extended position projecting a maximum distance from the cylinder body, the spring pressure returning the piston rod to its withdrawn position upon subsequent release of air pressure from the cylinder body. The term "double acting air cylinder" herein refers to an air cylinder in which air pressure can be supplied to either the head end or the rod end of the cylinder, there being no internal spring loading of the piston rod. Thus, to urge the piston rod to its withdrawn position, air pressure is applied to the rod end of the cylinder, the head end being relieved to atmospheric pressure. Conversely, to urge the piston rod to its extended position, air pressure is applied to the head end of the cylinder, the rod end being relieved to the atmospheric pressure. Control of the air pressure applied to both the single acting and double acting types of air cylinders enables selective movement of structural assemblies secured to the projecting ends of the piston rods, this control being achieved through the use of solenoid-operated 3-way and 4-way air valves. Such air valves are well known in the art and hence will not be described in detail. Although the operation of the air cylinders is controlled, in the illustrated embodiment, by the use of electrically operated air valves, those skilled in the art will appreciate that various other air control devices may be suitably employed.

A double acting air cylinder **33** is mounted to the elongate leg portion of the bracket **31** with its piston rod **34** projecting through a suitable aperture therein and in

parallel alignment with the first stop bar **32**. An L-shaped bracket **35** has an elongate leg portion **35***a* defining a pusher bar and a shorter base leg portion **35***b* defining a second stop bar. The pusher bar portion **35***a* of the L-shaped bracket **35** is secured to the projecting end of the piston rod **34** of the air cylinder **33**. Strength and stability during movement of the bracket **35** in accordance with movement of the piston rod **34** is achieved through the use of a pair of cylindrical support rods **36** which project from the pusher bar portion **35***a* and pass through suitable guide sleeves formed in the elongate leg portion of the bracket **31**. Thus, the bracket **35** is selective movable transverse to the conveyor belts and longitudinal axis of the machine, from a retracted position as shown by the solid lines in FIGURE 1 to an extended position indicated by dashed lines in FIGURE 1.

The movable guide apparatus **40** consists of a double acting air cylinder **41** having a support plate **43** secured to the projecting end of its piston rod **42**. The air cylinder **41** is mounted to the side bar **202** on the opposite side of the main conveyor from the case positioning mechanism **30**. The piston rod **42** of the air cylinder **41** is in perpendicular alignment with the conveyor belts and extends through an aperture in an upstanding guide rail **23** which extends longitudinally along the side bar **202**. A guide rail **24** extends longitudinally along the side bar **201** the guide rail **24** extending between the case positioning mechanism **30** and another case positioning mechanism **50**. The leading end of the guide rail **23** defines an outwardly curved portion **23***a* adjacent the input end of the main conveyor **20**, the purpose of the guide rails **23** and **24** being to maintain proper alignment of cases moving forward on the main conveyor.

The supporting framework **19** supports a vertically movable channel **19***a* to which is mounted the plow **29** and various other components. The plow **29** is mounted in a dependent position to the overhead channel **19***a* by means of support bars **27** and **28**. The side flap blower bar **25** is mounted to the underside of the plow **29** in a position off center with respect to the conveyor belt **21** of the main conveyor, and toward the case positioning mechanism **30**, as can best be seen in FIGURE 1. The nose of the plow **29** defines a downwardly turned portion **29***a* which is partially cut away to allow passage of the side flap blower bar **25**. The projecting end of the side flap blower bar defines a skewed end portion **26** which extends angularly upward and away from the main conveyor belt **21**.

An air blower head **44** is mounted to the side flap blower bar **25** in a position generally opposite the carton positioning mechanism **30**. As can best be seen in the various views of FIGURES 6, 7 and 8, one of the longitudinal side surfaces of the blower head **44** is substantially vertical while its other longitudinal side surface is angularly inclined. The blower head **44** is provided with a main interior passageway **45** which is connected through a suitable air line and control valve, not shown, to a source of air pressure. A series of air distribution passageways **46–49** are in communication with the main interior passageway **45** of the blower head **44** and terminate in orifices in the various surfaces of the blower head, thereby defining an air distribution manifold. Referring specifically to FIGURE 7, the air distribution passageway **46** is directed angularly downward and extends laterally from the main interior passageway **45** and terminates in an orifice at the junction between the vertical side and bottom surfaces of the blower head, and the air distribution passageway **47** is also directed angularly downward and extends laterally from the main interior passageway **45** and terminates in an orifice in the bottom surface of the blower head.

Referring specifically to FIGURE 8, the air distribution passageways **48** and **49** are horizontally directed and extend laterally away from the main interior passageway **45**, the passageway **48** terminating in an orifice in the vertical side surface of the blower head, and the passageway **49** terminating in an orifice in the angularly inclined side surface of the blower head. Upon the selective application of air pressure to the air distribution manifold of the blower head **44**, four air jets will be established which, in conjunction with controlled movement of a carton disposed beneath the air blower head, will sequentially, partially open the side flaps of the carton, as will be hereinbelow explained.

End flap opener

The end flap opener B comprises a case positioning mechanism generally indicated by the reference numeral **50**, an opposing guide apparatus generally indicated by the reference numeral **60**, a trailing end flap opening mechanism generally indicated by the reference numeral **70**, and a leading end flap opening mechanism generally indicated by the reference numeral **80**. The case positioning mechanism **50** and the opposing guide apparatus **60** are respectively identical to the hereinabove described case positioning mechanism **30** and movable guide apparatus **40**. The base of the case positioning mechanism **50** is an L-shaped bracket **51** mounted to the side bar **201** near the rear end of the main conveyor **20**. The base leg of the bracket **51** defines a stop bar **52** disposed in perpendicular alignment with the conveyor belt and extending over a portion of the main conveyor belt **21** into the path of a case moving on the main conveyor belt.

A double acting air cylinder **53** is mounted to the elongate leg portion of the bracket **51** with its piston rod **54** projecting through a suitable aperture therein and in parallel alignment with the stop bar **52**. An L-shaped bracket **55** has an elongate leg portion **55***a* defining a pusher bar and a shorter base leg portion **55***b* defining another stop bar. The pusher bar portion **55***a* of the L-shaped bracket **55** is secured to the projecting end of the piston rod **54** of the air cylinder **53**, the elongate leg portion of the bracket **51** being provided with guide sleeves through which extend a pair of cylindrical support rods **56** projecting from the pusher bar portion **55***a*.

The opposing guide apparatus **60** consists of a double acting air cylinder **61** having a support plate **63** secured to the projecting end of its piston rod **62**. The air cylinder **61** is mounted on the side bar **202** on the opposite side of the main conveyor from the case positioning mechanism **50** for coaction therewith in a manner to be hereinbelow explained.

The trailing end flap opening mechanism **70** includes an elongate hook **71**, a double acting air cylinder **72** having a piston rod **73**, and a crank arm **74**. The crank arm **74** is rotatably mounted by rigidly securing it to a shaft **75** journaled within a pair of support brackets **76** depending from the overhead channel **19***a*. The hook **71** is also rigidly secured to the shaft **75** for movement with the crank arm **74**. The air cylinder **72** is pivotally mounted between a pair of support brackets **79** depending from the overhead portion **19***a* of the supporting framework. The projecting end of the piston rod **73** of the air cylinder **72** is rotatably secured to the free end of the crank arm **74**. One end of a helically wound coil spring **77** is secured to a mounting bracket **78**, the other end of the coil spring being secured to an intermediate portion of the crank arm **74**.

The hook **71** is normally maintained in the raised position shown in FIGURE 2 by the selective application of air pressure to the rod end of the air cylinder **72**, which maintains the piston rod in its fully retracted position. Upon selectively relieving the air pressure from the air cylinder **72** the spring tension of the coil spring **77** causes counterclockwise rotation of the crank arm **74** and lowers the hook **71** in front of and slightly below the leading edge of the trailing end flap, as indicated by the dashed lines in FIGURE 2.

The leading end flap opening mechanism **80** includes a double acting air cylinder **81** having a piston rod **82** to

which is rotatably mounted a rigid arm assemblage generally indicated by the reference numeral **85**. The air cylinder **81** is mounted in horizontal alignment over the main conveyor belt **21** by means of a pair of support brackets **83** depending from the overhead portion **19***a* of the supporting framework.

The arm assemblage **85** comprises a bent lower arm **86** the upper end of which is rigidly secured to a shaft **88**, and an upper arm **87** one end of which is rigidly secured to the shaft **88** and in substantially perpendicular alignment with the upper portion of the lower arm **86**. The arm assemblage **85** is rotatably mounted by journaling the shaft **88** within a clevis **89** secured to the projecting end of the piston rod **82**. Projecting laterally from the other end of the upper arm **87** is a cylindrical follower roller **84**. An elongate guide block **90** is mounted to the overhead channel **19***a*, the guide block **90** defining an elongate curved guide slot **91**. The follower roller **84** of the arm assemblage is fitted within the guide slot **91** of the guide block and, upon extension of the piston rod **82** by application of air pressure to the head end of the air cylinder **81**, the arm assemblage **85** will move from left to right with a rocking type motion (the path of the lower arm portion being generally indicated by the dash line arrows in FIGURE 2). An air line terminating in a jet nozzle **92** is connected to the source of air pressure, the nozzle **92** being disposed adjacent the tip of the bent lower arm **86** when the arm is in its normal rest position shown in solid lines in FIGURE 2.

Disposed at the end of travel of the leading end flap opening mechanism **70** is a flap retaining mechanism generally indicated by the reference numeral **95**. The flap retaining mechanism **95** includes an elongate flap retaining member **93** having an upwardly curved end portion **94** to which is rotatably mounted a lever arm **96**. The lever arm **96** is normally urged in a clockwise direction against an adjustable stop **97** by a tension spring **98** which is secured between the upper end of the lever arm **96** and a mounting bracket **99** secured to the elongate member **93**.

Control circuit

Synchronized actuation of the various air cylinders in the illustrated embodiment is accomplished through the use of six limit switches, indicated by the reference characters LS–**1** through LS–**6**. The locations of the various limit switches are shown in FIGURES 1 and 2 of the drawing. Switch LS–**1** is a normally open switch and is positioned adjacent the case positioning mechanism **30** in such a manner that the switch will be closed by a case coming into contact with the stop bar **32**. The switch LS–**2** is a normally open switch disposed adjacent the opposing guide apparatus **40** in such a manner that the switch will be closed by lateral movement of a case on the main conveyor **20**. LS–**3** is a normally open switch disposed adjacent the case positioning mechanism **50** in such a position that the switch will be closed by a case contacting the stop bar **52**. LS–**4** is a normally closed switch disposed along an edge of the transfer conveyor **11** and arranged so that a case traveling along the transfer conveyor **11** will open the switch. LS–**5** and LS–**6** are normally open switches mounted to opposite ends of the elongate guide block **90**. The limit switch LS–**5** is adjusted for actuation by the end of the arm assemblage **85** when the piston rod **82** reaches its fully extended position. The switch LS–**6** is mounted so that it will be closed by the follower pin **84** when the piston rod **82** reaches its fully retracted position.

Referring now to FIGURE 9 of the drawing there is shown an exemplary electrical circuit for use with the illustrated embodiment. Electrical switching is accomplished by the limit switches and a double pole relay having a coil **104**, a set of normally closed contacts with terminals **111** and **112**, and a set of normally open contacts with terminals **113** and **114**. Air switching is accomplished by five solenoid-operated air valves. An air valve having a solenoid **101** is provided for the selective switching of air to the air blower head **44**. An air valve having a solenoid **102** is provided for the selective switching of air to the air cylinders **33** and **41**. An air valve having a solenoid **103** is provided for the selective switching of air to the air cylinder **81**. An air valve having a solenoid **105** is provided for the selective switching of air to the air cylinders **53** and **61**. An air valve having a solenoid **107** is provided for the selective switching of air to the air cylinder **72**. The air lines interconnecting the air valves and the various air cylinders and the blower head are not shown, suitable interconnections being readily apparent to those skilled in the art. The various solenoids and the relay may be positioned in any convenient location.

A pair of bus bars **108** and **109** are connected to a suitable source of electrical current through an on-off switch **110**. One contact of each of the switches LS–**1** and LS–**2** are connected to the bus bar **108**, the other contact of each of these switches being connected to an electrical junction **115**. The solenoid coils **101** and **102** are each connected between the electrical junction **115** and the bus bar **109**. One contact of the switch LS–**3** is connected to the bus bar **108**, the other switch contact being connected to the relay contact terminal **111**. The solenoid **103** is connected between the bus bar **109** and the relay contact terminal **112**. One contact of the switch LS–**5** is connected to the bus bar **108**, the other switch contact being connected to an electrical junction **116**. The relay coil **104** is connected between the electrical junction **116** and the bus bar **109**.

One contact of the switch LS–**4** is connected to the bus bar **108**, the other switch contact being connected to the relay contact terminal **113**, the relay contact terminal **114** being connected to the electrical junction **116**. The switch LS–**6** and the solenoid **105** are connected in series between the electrical junction **116** and the bus bar **109**. The solenoid **106** is connected between the electrical junction **116** and the bus bar **109**.

Operating cycle

The operating cycle of the illustrated embodiment of the present invention apparatus will be described by tracing the passage of a carton **100** through the apparatus, the carton **100** being shown in FIGURE 1 in a starting position labeled A–**1**. Successive positions of the carton are labeled A–**2**, A–**3**, B–**1**, B–**2**, and B–**3**, the carton **100** being indicated by phantom lines in these subsequent positions.

In the starting position A–**1** the carton **100** is shown in FIGURES 1 and 2 as approaching the end of the infeed conveyor **10**. In this starting position, and assuming that there are no other cartons in the apparatus, the operational components of the apparatus are in their normal rest positions. In the normal rest position air pressure is applied to the rod ends of the air cylinders **33** and **53** so that the case positioning mechanisms **30** and **50** are in the positions shown in FIGURE 1. Air pressure is applied to the head ends of the air cylinders **41** and **61** so that the support plates **43** and **63** are in their maximum extended positions shown in FIGURE 1. In the normal rest position air pressure is applied to the rod end of the air cylinder **81** so that the arm assembly **85** is in the position indicated by the solid lines in FIGURE 2. In the normal rest position of the air cylinder **72** air pressure is applied to its rod end so that its piston rod **73** is withdrawn, thereby maintaining the hook **71** in the raised position indicated by the phanom lines in FIGURE 2.

As the carton **100** leaves the infeed conveyor **10** it is picked up by the main conveyor **20**, the carton **100** being in an offset position with respect to the belt **21**, as indicated in FIGURES 1, 3 and 4 of the drawing. Consequently, as the carton **100** passes under the side flap blower bar **25**, the blower bar and the blower head will be positioned over the left hand longitudinal side flap of

the carton as it is viewed in FIGURES 3 and 4 of the drawing. As the carton **100** passes beneath the blower bar **25**, the blower bar **25** presses the left hand flap downwardly to a closed position.

As the leading end of the carton **100** approaches the stop bar **32** and reaches the position A–2 the carton closes the normally open switch LS–1. As can be seen from the circuit diagram of FIGURE 9, closing of the switch LS–1 completes the electrical circuit to the solenoids **101** and **102**, actuation of the blower solenoid **101** resulting in the application of air pressure to the blower head **44** and actuation of the solenoid stop **102**, thereby switching the air to the cylinders **33** and **41**. Switching of the air pressure to the head end of the air cylinder **33**, combined with relief of pressure in the rod end of the cylinder to the atmosphere in accordance with the usual operation of solenoid actuated air valves, causes extension of the piston rod **34** and movement of the L-shaped bracket **35** toward the air cylinder **41**. Switching of the air to the air cylinder **41** results in withdrawal of its piston rod so that the support plate **43** moves substantially in unison with the L-shaped bracket **35**. The case positioning mechanism **30** pushes the carton **100** laterally from position A–2 to the position A–3, the support plate **43** serving to prevent rotational movement of the carton which would otherwise be caused by movement of the main conveyor belt **21**.

As the carton **100** is being moved from position A–2 to position A–3 air jets are being blown from the various passageways of the blower head **44**. The air jet emerging from the passageway **47** is downwardly directed into the carton and causes the right hand side flap of the carton to be slightly raised. Slight raising of the right hand side flap causes the air jet emerging from the passageway **49** of the blower head to strike the underside of this side flap and to hold the side flap in a slightly raised position as the carton is undergoing lateral movement. Lateral movement of the carton with its right hand side flap slightly raised will cause the angularly inclined surface of the air blower head **44** to come into contact with the underside of the right hand side flap as the carton approaches the position A–3. The switch LS–2 is so arranged that lateral movement of the carton will close this switch before the carton breaks contact with the switch LS–1. Therefore, switch LS–2 closes prior to opening of the switch LS–1 to prevent interruption of the lateral movement of the carton and blowing of the air jets.

As the carton **100** is moved to the position A–3 which is in substantial alignment directly over the conveyor belt **21**, the blower bar **25** slides under the right hand side flap of the carton. As soon as the left side of the carton clears the blower head **44** the air jet emanating from the passageway **46** of the blower head will be directed downwardly into the left hand side of the box to slightly open the left hand flap (this flap no longer being held in a closed position by the blower bar **25**). Slight raising of the left hand side flap allows the air jet emanating from the passageway **48** of the blower head to strike the underside of this flap to thereby maintain this flap in a slightly open position.

During lateral movement of the carton **100** from the position A–2 to the position A–3 longitudinal movement of the carton along the main conveyor **20** is prevented by the stop bar **32**, acting in conjunction with the support plate **43**. As the carton reaches the position A–3 it then clears the stop bar **32** and it starts moving longitudinally along the main conveyor in accordance with the movement of the conveyor belt **21**, both of the side flaps being held in a slightly open position, the left side by air jets and the right side riding over the bar **25**.

As the carton **100** moves from position A–3 and begins its longitudinal movement through the machine it is maintained in alignment between the guide rails **23** and **24** which are mounted to the side bars **201** and **202**. It is presently preferred to provide for synchronized lateral adjustment of the positioning of the side bars in order to accommodate cases of different widths, and to provide for vertical adjustment of the channel **19***a* in order to accommodate cases of different heights. All during the time that the carton **100** was in the positions A–2 and A–3 the trailing end of the carton prevented a next succeeding carton from entering the machine. As the carton **100** leaves the position A–3, the solenoids **101** and **102** still being energized due to maintenance of the limit switch LS–2 in its closed position, a next succeeding carton will come into contact with the stop bar **35***b* and its motion will be arrested. Continuing longitudinal movement of the carton **100** brings the undersides of its side flaps into contact with the nose portion **29***a* of the plow **29**, further movement of the carton along the main conveyor resulting in complete opening of the side flaps by the plow **29**.

When the carton **100** has proceeded down the main conveyor **20** a sufficient distance to release the switch LS–2, this switch returns to its normally open position, thereby deenergizing the solenoids **101** and **102**. Deenergization of the solenoid **101** turns off the air to the blower head **44**, and deenergization of the solenoid **102** returns the piston rods of the air cylinders **41** and **33** to their normal rest position (as shown by the solid lines in FIGURE 1).

Return of the case positioning mechanism **30** moves the stop bar **35***b* out of the way of the next succeeding carton to allow it to move into contact with the stop bar **32** and depress the limit switch LS–1 to thereby begin another cycle of operation of the side flap opening mechanism A. The carton **100** then moves farther along the main conveyor and is presented to the end flap opening mechanism B with the side flaps of the carton fully open.

As the carton **100** reaches the position B–1 as indicated by the phantom lines in FIGURES 1 and 2 the front end of the carton depresses the normally open limit switch LS–3 to switch it to a closed position. As can be seen from the schematic diagram of FIGURE 9, closing of the switch LS–3 will result in energization of the arm solenoid **103**, energization of the arm solenoid **103** causing the application of air to the head end of the air cylinder **81** and relief of the pressure in its rod end to the atmosphere to thereby result in extension of the piston rod **82**. As the leading end flap of the carton **100** clears the bent lower arm **86** the air jet from the nozzle **92** is directed angularly downward into the front end of the carton, the air pressure causing the leading end flap of the carton to be slightly raised. As the piston rod **82** moves toward its fully extended position the bent lower arm **86** of the arm assemblage **85** engages the underside of the leading end flap of the carton and rotates it clockwise to a fully opened position. As the piston rod **82** moves to its fully extended position the follower roller **84** follows the contours of the guide slot **91**, thereby causing a rocking as well as translational movement of the arm assemblage **85** whereby the bent lower arm **86** will follow the path indicated by the phantom line arrows in FIGURE 2 of the drawing. This rocking motion of the bent lower arm **86** causes it to raise as it is passing over the leading edge of the carton and then lower to push the leading end flap into the fully open position. Throughout this operation the carton **100** is maintained motionless in the position B–1 since movement of the carton is impeded by the stop bar **52** of the case positioning mechanism **50**.

When the leading end flap opening mechanism **80** is in its rest position the follower pin **84** holds the normally open limit switch LS–6 in a closed position. As the piston rod **82** begins to move to its extended position upon energization of the arm solenoid **103**, the follower roller **84** moves away from the switch LS–6 allowing it to open to thereby provide a safety feature as will hereinbelow be explained.

As the piston rod **82** reaches its fully extended position the leading end flap of the carton having been opened

by the arm assemblage 85, the follower roller 84 actuates the normally open limit switch LS–5. As can be seen in the schematic diagram of FIGURE 9, closing of the switch LS–5 results in energization of the relay coil 104 and of the hook solenoid 106, energization of the stop solenoid 105 being prevented at this time by the open condition of the switch LS–6. Energization of the relay coil 104 interrupts contact between the terminals 111 and 112 and establishes electrical contact between the relay terminals 113 and 114. Disruption of the electrical connection between the relay terminals 111 and 112 causes deenergization of the arm solenoid 103, thereby again switching the air to the cylinder 81 and returning the piston rod 82 to its normal rest position and withdrawing the arm assemblage 85.

As the leading end flap of the carton 100 is swung to its fully open position by the arm assemblage 85, the flap momentarily depresses the lower end of the lever arm 96 causing the lever arm to be rotated in a counterclockwise direction. As the flap clears the lower end of the lever arm 96 the tension of the coil spring 98 causes clockwise rotation of the lever arm back to its rest position against the stop 97, the flap retaining mechanism 95 being shown in this rest position in FIGURE 2. Thus, the flap retaining mechanism 95 prevents the natural resiliency of the leading end flap from tending to rotate the flap toward the closed position upon withdrawal of the arm assemblage 85.

As the arm assemblage 85 begins to return to its normal rest position in accordance with the withdrawal of the piston rod 82, the limit switch LS–5 returns to its normally open position to prevent oscillation of the arm assemblage 85 which would otherwise result. However, note that due to energization of the relay coil 104, the electrical potential from the bus bar 108 will still appear at the terminal 116 because of the electrical connection established between the relay contacts 113 and 114. Hence, opening of the switch LS–5 will not cause deenergization of the relay coil 104 nor of the hook solenoid 106.

Initial energization of the hook solenoid 106 switches the air to the air cylinder 72 and causes movement of the piston rod 73 to a fully extended position, thereby allowing the tension of the coil spring 77 to cause clockwise rotation of the hook 71 (see FIGURE 2) from the phantom line position downwardly to the solid line position wherein the hook 71 engages the trailing end flap of the carton 100.

Return of the piston rod 82 to its withdrawn position as shown in FIGURE 2 causes the follower roller 84 to close the normally open limit switch LS–6, thereby energizing the stop solenoid 105. Energization of the stop solenoid 105 causes the switching of air to the air cylinder 53 and 61 to actuate the carton positioning mechanism 50 and the movable guide apparatus 60 and cause its operation in a manner similar to that hereinabove explained with reference to the case positioning mechanism 30 and the movable guide apparatus 40 of the side flap opening mechanism A. Actuation of the case positioning mechanism 50 and the movable guide apparatus 60 results in lateral movement of the carton 100 from the position B–1 to the position B–2, correct alignment of the carton during lateral movement being maintained by the contact of the stop bar 52 and the support plate 53 with the carton. During lateral movement of the carton the hook 71 is maintained in engagement with the trailing end flap of the carton, the edge of the flap sliding along the curved end of the hook. As the carton 100 reaches the position B–2 the leading end of the carton clears the stop bar 52, thereby allowing resumption of longitudinal movement of the carton. Longitudinal movement of the carton 100 moves the carton away from the hook 71, the spring pressure from the coil spring 77 maintaining the curved end of the hook in engagement with the trailing end flap to allow the trailing end flap to be raised as the carton 100 moves longitudinally away from the hook.

As the carton 100 leaves the main conveyor 20 it is picked up by the transfer conveyor 11 which carries the opened carton away from the present invention apparatus. As the carton 100 moves along the transfer conveyor belt 16 the carton will open the normally closed limit switch LS–4 and disrupt the connection between the bus bar 108 and the junction point 116 (the switch LS–5 being in its normally open position), thereby deenergizing the relay coil 104 and the solenoids 105 and 106. Deenergization of the stop solenoid 105 again switches the air to the air cylinders 53 and 61 and returns the case positioning mechanism 50 and the movable guide apparatus 60 to their respective rest positions shown in FIGURE 1. Deenergization of the hook solenoid 106 again switches the air to the cylinder 72 to cause withdrawal of its piston rod 73, thereby resulting in counterclockwise rotation of the hook 71 to the uppermost raised position shown by the phantom lines in FIGURE 2. Thus, upon opening of the switch LS–4 the end flap opening mechanism B is reset and is placed in readiness to open the end flaps of the next succeeding carton. When the carton 100 has passed far enough down the transfer conveyor 11 the switch LS–4 returns to its normally closed position. However, since the relay coil 104 has been deenergized, electrical contact between the terminals 113 and 114 is now interrupted so that closing of the switch LS–4 does not reenergize the relay coil 104 or the solenoids 105 and 106. These solenoids and relay coil are reenergized by closing of the switch LS–5 upon opening of the leading end flap of the next succeeding carton presented to the end flap opening mechanism.

Thus there has been described a presently preferred embodiment of apparatus for opening the four top flaps of RSC cases. Although the invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed. For exampe, although in the illustrated embodiment the cases are automatically discharged from the end flap opening mechanism in response to actuation of the switch LS–6 by return of the arm assemblage 85, the switch LS–6 could alternatively be located in other equipment located downstream from the present invention appartus, whereby discharge of cases from the present invention apparatus can be synchronized with the operation of the other equipment. Also, although the illustrated embodiment of the side flap opening mechanism A and the end flap opening mechanism B imparts lateral movement to the cases, in some applications lateral case movement is unnecessary. It is presently preferred to impart lateral movement to the cases so that the present invention apparatus may be utilized with various types of infeed and outfeed apparatus other than the infeed and transfer conveyors shown.

What is claimed is:

1. Flap opening apparatus for rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) Conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) Plow means disposed over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partially raised position;

(c) A side flap opening mechanism ahead of said plow means for partially raising the side closure flaps of the cases, said mechanism including means for partially opening one of the case side closure flaps and

means for then moving the case laterally and partially opening its other side closure flap; and

(d) An end flap opening mechanism behind said plow means, said end flap opening mechanism comprising traveling hook means for opening the leading end closure flap of a case emerging from said plow means, and rotatably mounted stationary hook means for engaging the trailing closure end flap of the case so that movement of the case away from said stationary hook means opens its trailing end closure flap.

2. Flap opening apparatus for rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) Conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) Plow means disposed over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partially raised position;

(c) A side flap opening mechanism ahead of said plow means for partially raising the side closure flaps of the cases, said mechanism including means for momentarily arresting forward motion of a case being carried by said conveyor means and partially opening one of its side flaps, and means for then moving the case laterally and partially opening its other side flap; and

(d) An end flap opening mechanism behind said plow means, said end flap opening mechanism comprising traveling hook means for opening the leading end closure flap of a case merging from said plow means, and rotatably mounted stationary hook means for engaging the trailing closure end flap of the case so that movement of the case away from said stationary hook means opens its trailing end closure flap.

3. Flap opening apparatus for rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) Conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) Plow means disposed over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partially raised position;

(c) Means ahead of said plow means for partially raising the side closure flaps of the case, said means including an elongate rod disposed above said conveyor means in substantially parallel alignment with the conveyor travel and blower means disposed along said elongate rod for directing air jets in an angularly downward direction and laterally from each side of said elongate rod, said elongate rod being substantially straight over most of its length and having its forward end curved generally upward in a skew angle with respect to cases on said conveyor means, said rod being disposed at such elevation that it is only slightly above the cases on said conveyor means when the flaps of the cases are completely closed, said rod being disposed laterally with respect to said cases so as to be directly over one of the side flaps of the cases on said conveyor means;

(d) Means for arresting forward motion of a case on said conveyor means below said elongate rod and then moving the case laterally on said conveyor means toward said elongate rod, whereby as the other side flap of the case approaches the elongate rod the air jets emanating from said blower means cause partial opening of said other side flap, further lateral movement of the case urging said other side over the elongate rod so that the elongate rod and the blower means support said other side flap in the partially opened condition, the air jets emanating from the blower means being directed angularly downward into the case beneath said one side flap as the other side flap rides up over said elongate rod to thereby cause partial opening of said one side flap, and means for then releasing said case to allow it to be carried by said conveyor means into said plow means; and

(e) An end flap opening mechanism behind said plow means, said end flap opening mechanism comprising traveling hook means for opening the leading end closure flap of a case emerging from said plow means.

4. Flap opening apparatus for rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) Conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) Plow means disposed over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partially raised position;

(c) Means ahead of said plow means for partially raising the side closure flaps of the case, said means including an elongate rod disposed above said conveyor means in substantially parallel alignment with the conveyor travel and blower means disposed along said elongate rod for directing air jets in an angularly downward direction and laterally from each side of said elongate rod, said elongate rod being substantially straight over most of its length and having its forward end curved generally upward in a skew angle with respect to cases on said conveyor means, said rod being disposed at such elevation that it is only slightly above the cases on said conveyor means when the flaps of the cases are completely closed, said rod being disposed laterally with respect to said cases so as to be directly over one of the side flaps of the cases on said conveyor means;

(d) Means for arresting forward motion of a case on said conveyor means below said elongate rod and then moving the case laterally on said conveyor means toward said elongate rod, whereby as the other side flap of the case approaches the elongate rod the air jets emanating from said blower means cause partial opening of said other side flap, further lateral movement of the case urging said other side over the elongate rod so that the elongate rod and the blower means support said other side flap in the partially opened condtion, the air jets emanating from the blower means being directed angularly downward into the case beneath said one side flap as the other side flap rides up over said elongate rod to thereby cause partial opening of said one side flap, and means for then releasing said case to allow it to be carried for then releasing said case to allow it to be carried by said conveyor means into said plow means; and

(e) An end flap opening mechanism behind said plow means, said end flap opening mechanism comprising traveling hook means for opening the leading end closure flap of a case emerging from said plow means, and rotatably mounted stationary hook means for energing the trailing closure and flap of the case so that movement of the case away from said stationary hook means opens its trailing end closure flap.

5. Flap opening apparatus for rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) Conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) Plow means disposed over said conveyor means to engage the side closure flaps on the case walls

extending parallel with the conveyor travel when such flaps are in a partial raised position;

(c) An elongate rod disposed above said conveyor means and in substantially parallel alignment with the conveyor travel, said rod being substantially straight over most of its length and having its forward end curved generally upward in a skew angle with respect to cases on said conveyor means, said rod being disposed at such elevation that it is only slightly above the cases on said conveyor means when the flaps of said cases are completely closed, said rod being disposed laterally with respect to cases approaching it on said conveyor means so as to be directly over one of the side flaps of the cases on said conveyor means;

(d) Blower means disposed along said elongate rod for directing air jets angularly downward and laterally from each side of said blower bar, said blower means projecting slightly below said elongate rod to depress said one side flap to a position slightly below the other side flap of a case on said conveyor means beneath said elongate rod;

(e) Means for moving a case laterally on said conveyor means as it passes beneath said elongate rod to bring the other side flap of the case closer to said elongate rod, whereby as said other side flap approaches the elongate rod the air jets emanating from said blower means cause partial opening of said other side flap, further lateral movement of the case urging said other side flap over the elongate rod so that the elongate rod and the blower means support said other side flap in a partially opened condition, the air jets emanating from the blower means being directed angularly downward into the case beneath said one side flap as the other side flap rides up over said elongate rod to thereby partially open said one side flap; and

(f) An end flap opening mechanism behind said plow means, said end flap opening mechanism including traveling hook means for opening the leading end closure flap of a case emerging from said plow means.

6. Flap opening apparatus for rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) plow means disposed over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partially raised position;

(c) an elongate rod disposed above said conveyor means and in substantially parallel alignment with the conveyor travel, said rod being substantially straight over most of its length and having its forward end curved generally upward in a skew angle with respect to cases on said conveyor means, said rod being disposed at such elevation that it is only slightly above the cases on said conveyor means when the flaps of said cases are completely closed, said rod being disposed laterally with respect to cases approaching it on said conveyor means so as to be directly over one of the side flaps of the cases on said conveyor means;

(d) blower means disposed along said elongate rod for directing air jets angularly downward and laterally from each side of said blower bar, said blower means projecting slightly below said elongate rod to depress said one side flap to a position slightly below the other side flap of a case on said conveyor means beneath said elongate rod;

(e) means for arresting forward motion of a case on said conveyor means below said elongate rod and then moving the case laterally on said conveyor means toward said elongate rod, whereby as the other side flap of the case approaches the elongate rod the air jets emanating from said blower means cause partial opening of said other side flap, further lateral movement of the case urging said other side flap over the elongate rod so that the elongate rod and the blower means support said other side flap in the partially opened condition, the air jets emanating from the blower means being directed angularly downward into the case beneath said one side flap as the other side flap rides up over said elongate rod to thereby partially open said one side flap; and

(f) an end flap opening mechanism behind said plow means, said end flap opening mechanism comprising traveling hook means for opening the leading end closure flap of a case emerging from said plow means, and rotatably mounted stationary hook means for engaging the trailing closure end flap of the case so that movement of the case away from said stationary hook means opens its trailing end end closure flap.

7. Apparatus for opening the side closure flaps of rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) plow means disposed over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partially raised position; and

(c) a said flap opening mechanism ahead of said plow means for partially raising the side closure flaps of the cases, said mechanism including means for momentarily arresting forward motion of a case being carried by said conveyor means and partially opening one of its side flaps, and means for then moving the case laterally and partially opening its other side flap.

8. Apparatus for opening the side closure flaps of rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) conveyor means for advancing the cases in an upright positions with their closure flaps folded inward in at least partial overlapping relation;

(b) plow means disposed over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partialy raised position; and

(c) a side flap opening mechanism ahead of said plow means for partially raising the side closure flaps of the cases, said mechanism including means for arresting motion of a case on said conveyor means and partially opening one of its side flaps, means for then moving the case laterally, partially opening its other side flap, and then releasing said case to allow it to be carried by said conveyor means into said plow means.

9. Flap opening apparatus for rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) plow means disposed over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partially raised position;

(c) means ahead of said plow means for partially raising the side closure flaps of the case, said means including an elongate rod disposed above said conveyor means in substantially parallel alignment with the conveyor travel and blower means disposed along said elongate rod for directing air jets in an angular-

ly downward direction and laterally from each side of said elongate rod, said elongate rod being substantially straight over most of its length and having its forward end curved generally upward in a skew angle with respect to cases on said conveyor means, said rod being disposed at such elevation that it is only slightly above the cases on said conveyor means when the flaps of the cases are completely closed, said rod being disposed laterally with respect to said cases so as to be directly over one of the side flaps of the cases on said conveyor means; and

(d) means for arresting forward motion of a case on said conveyor means below said elongate rod and then moving the case laterally on said conveyor means toward said elongate rod, whereby as the other side flap of the case approaches the elongate rod the air jets emanating from said blower means cause partial opening of said other side flaps, further lateral movement of the case urging said other side over the elongate rod so that the elongate rod and the blower means support said other side flap in the partially opened condition, the air jets emanating from the blower means being directed angularly downward into the case beneath said one side flap as the other side flap rides up over said elongate rod to thereby cause partial opening of said one side flap, and means for then releasing said case to allow it to be carried by said conveyor means into said plow means.

10. Apparatus for partially opening the side closure flaps on rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination:

(a) Conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation;

(b) An elongate rod disposed above said conveyor means and in substantially parallel alignment with the conveyor travel, said rod being substantially straight over most of its length and having its forward end curved generally upward in a skew angle with respect to cases on said conveyor means, said rod being disposed at such elevation that it is only slightly above the cases on said conveyor means when the flaps of said cases are completely closed, said rod being disposed laterally with respect to cases approching it on said conveyor means so as to be directly over one of the side flaps of the cases on said conveyor means;

c) Blower means disposed along said elongate rod for directing air jets angularly downward and laterally from each side of said blower bar, said blower means projecting slightly below said elongate rod to depress said one side flap to a position slightly below the other side flap of a case on said conveyor means beneath said elongate rod; and

(d) Means for arresting forward motion of a case on said conveyor means below said elongate rod and then moving the case laterally on said conveyor means toward said elongate rod the air jets emanating from said blower means cause partial opening of said other side flap, further lateral movement of the case urging said other side flap over the elongate rod so that the elongate rod and the blower means support said other side flap in the partially opened condition, the air jets emanating from the blower means being directed angularly downward into the case beneath said one side flap as the other side flap rides up over said elongate rod to thereby partially open said one side flap.

11. Apparatus for opening the leading end flap of a rectangular case of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising:

(a) Conveyor means for advancing the case in a substantially horizontal plane in an upright position with its side closure flaps open and with its leading end closure flap folded inwardly to a substantially closed position; and

(b) Traveling hook means disposed above said conveyor means, said traveling hook means including an elongate bent arm defining a lower end portion extending in a forward and slightly downward direction, said arm being rigidly secured at its upper end to rotatably mounted lever arm means constrained for movement along a predetermined sinuous path between first and second positions in axial alignment above said conveyor means, the lower end portion of said arm being slightly behind and slightly above the closed leading end flap of said case when said case is at a predetermined position on said conveyor means with said arm in said first position, blower means for directing an air jet angularly downward into the case beneath its leading end flap when the case is at said predetermined position on said conveyor means to thereby slightly raise its leading end flap sufficiently so that the edge of the flap is slightly above the projecting tip of the lower end portion of said arm, and means for selectively moving said lever arm means along said predetermined path from said first position to said second position when said case reaches said predetermined position on said conveyor means, the rate of movement of said lever arm from said first position to said second position being graeater than the rate of movement of said case on said conveyor means, whereby the lower end portion of said arm engages the underside of the leading end flap of said case and rotates it to a fully opened position.

12. Apparatus for opening the leading end flap of a rectangular case of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising:

(a) Conveyor means for advancing the case in a substantially horizontal plane in an upright position with its side closure flaps open and with its leading end closure flap folded inwardly to a substantially closed position;

(b) Traveling hook means disposed above said conveyor means, said traveling hook means including an elongate bent arm defining a lower end portion extending in a forward and slightly downward direction, said arm being rigidly secured at its upper end to rotatably mounted lever arm means constrained for movement along a predetermined sinuous path between first and second positions in axial alignment above said conveyor means, means for momentarily arresting forward motion of a case at a predetermined position on said conveyor means so that when said arm is in said first position said lower end portion slightly behind and slightly above the closed leading end flap of said case, blower means for directing an air jet angularly downward into the case beneath its leading end flap when the case is at said predetermined position on said conveyor means to thereby slightly raise its leading end flap sufficiently so that the edge of the flap is slightly above the projecting tip of the lower end portion of said arm, and means for selectively moving said lever arm means along said predetermined path from said first position to said second position whereby the lower end portion of said arm engages the underside of the leading end flap of said case and rotates it a fully opened position.

13. Flap opening apparatus for rectangular cases of the type provided with closure flaps hinged to the top edges of each wall, said apparatus comprising, in combination: conveyor means for advancing the cases in an upright position with their closure flaps folded inward in at least partial overlapping relation; plow means disposed

over said conveyor means to engage the side closure flaps on the case walls extending parallel with the conveyor travel when such flaps are in a partially raised position; a side flap opening mechanism ahead of said plow means for partially raising the side closure flaps of the cases and maintaining them in the partially raised position as the cases are carried by said conveyor means into engagement with said plow means; and an end flap opening mechanism behind said plow means, said end flap opening mechanism comprising traveling hook means for opening the leading end closure flap of a case emerging from said plow means, and rotatably mounted stationary hook means for engaging the trailing closure end flap of the case so that movement of the case away from said stationary hook means opens its trailing end closure flap, said traveling hook means including an elongate bent arm defining a lower end portion extending in a forward and slightly downward direction, said arm being rigidly secured at its upper end to rotatably mounted lever arm means constrained for movement along a predetermined sinuous path between first and second positions in axial alignment above said conveyor means; means for momentarily arresting forward motion of a case at

a predetermined position on said conveyor means so that when said arm is in said first position said lower end portion is slightly behind and slightly above the closed leading end flap of said case; blower means for directing an air jet angularly downward into the case beneath its leading end flap when the case is at said predetermined position on said conveyor means to thereby slightly raise its leading end flap sufficiently so that the edge of the flap is slightly above the projecting tip of the lower end portion of said arm, and means for selectively moving said lever arm means along said predetermined path from said first position to said second position whereby the lower end portion of said arm engages the underside of the leading end flap of said case and rotates it to a fully opened position.

References Cited

UNITED STATES PATENTS

3,241,292	3/1966	Berney	53—382
3,241,292	3/1966	McIntyre	53—382
3,309,842	3/1967	Arnett	53—382

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