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W. R. PATTON

3,296,769

DEVICE FOR OPENING CARTON FLAPS

Filed Sept. 26, 1963

5 Sheets-Sheet 1

FIG.6

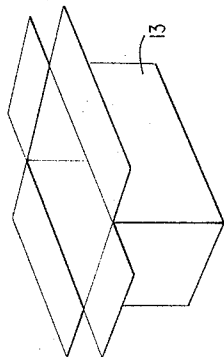


FIG.5

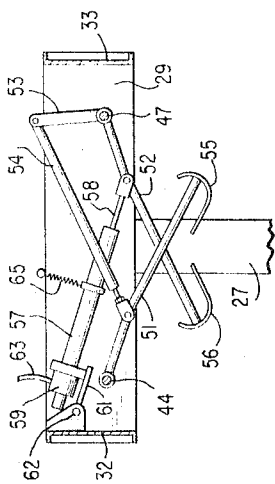
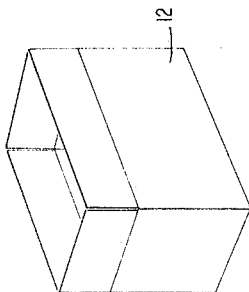
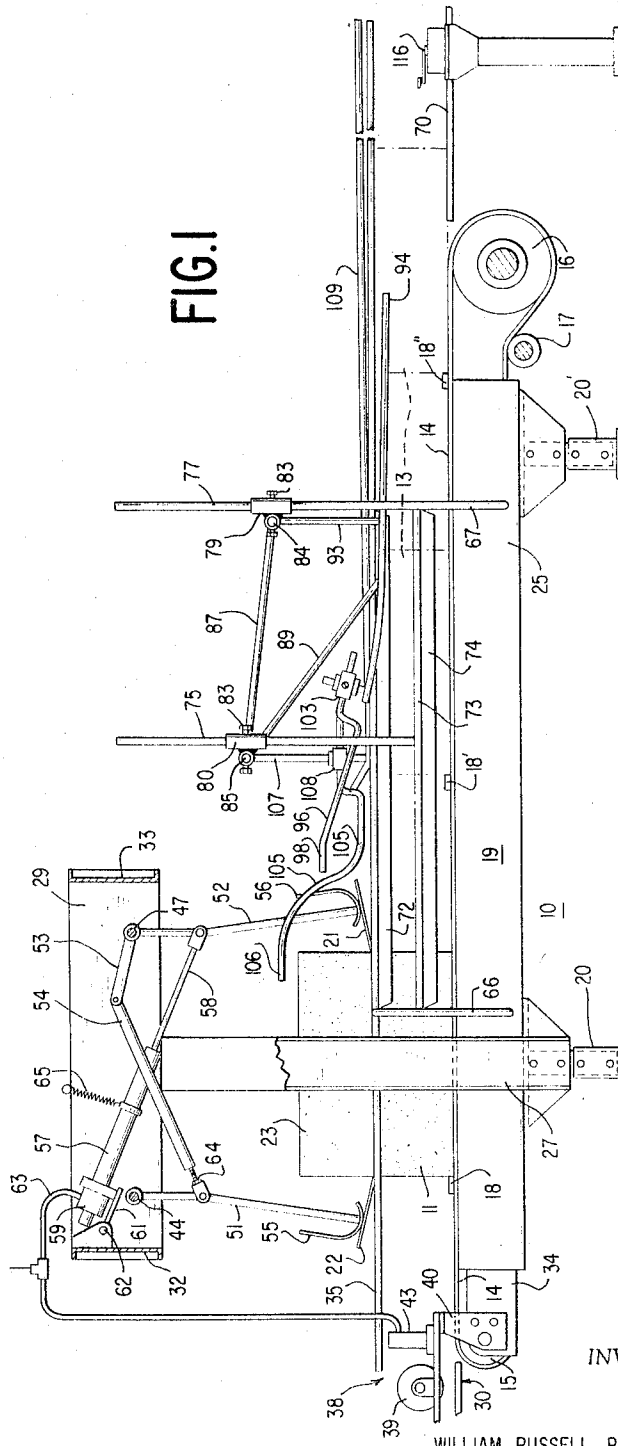


FIG.2

FIG.1



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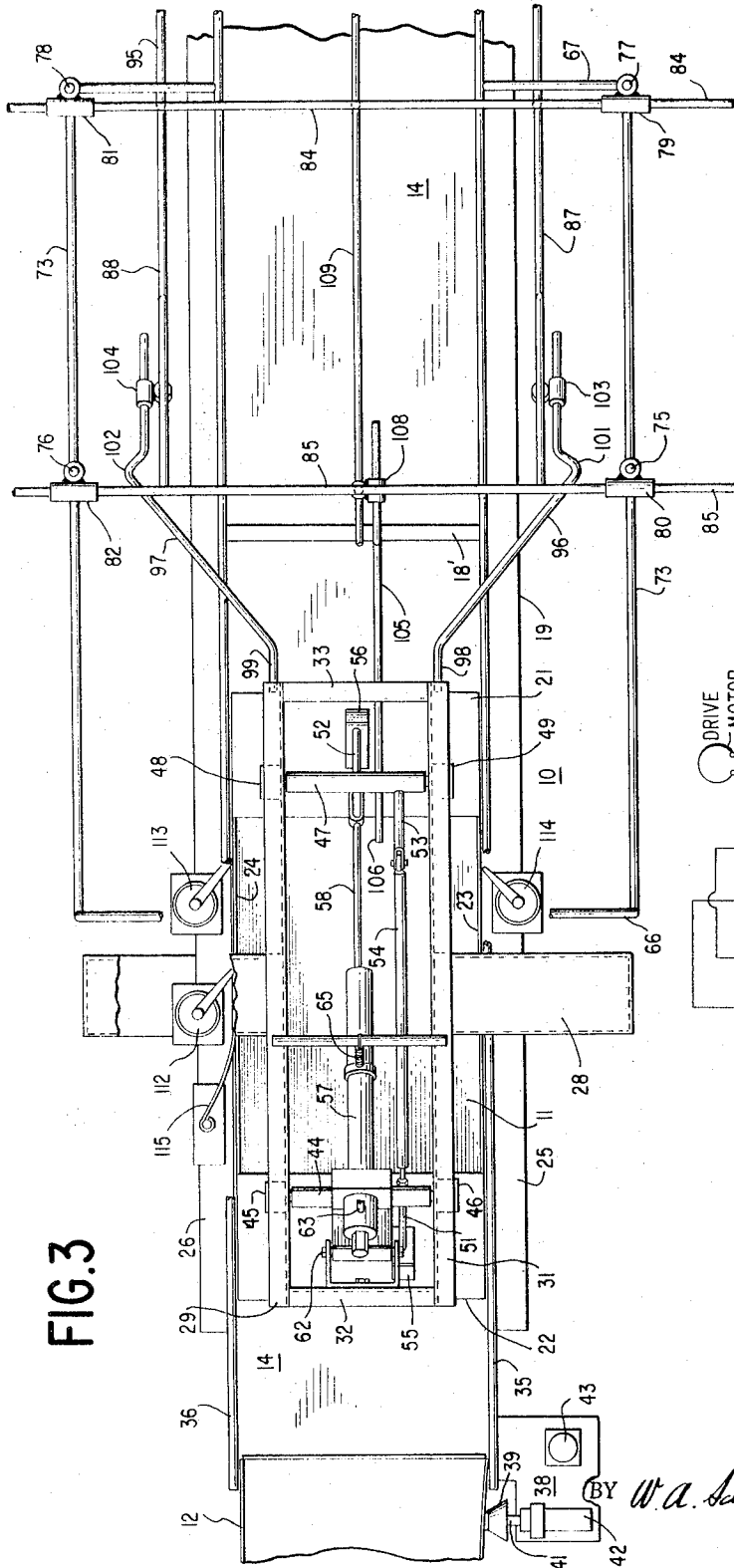
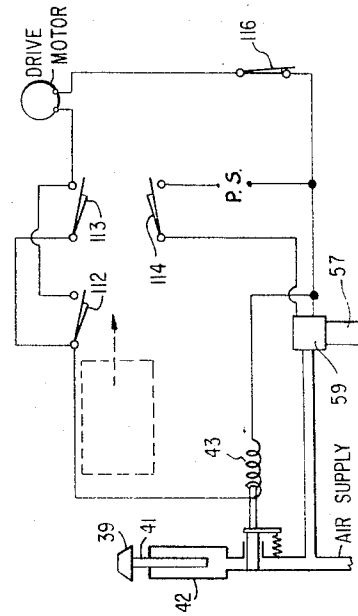


FIG. 3

FIG. 7



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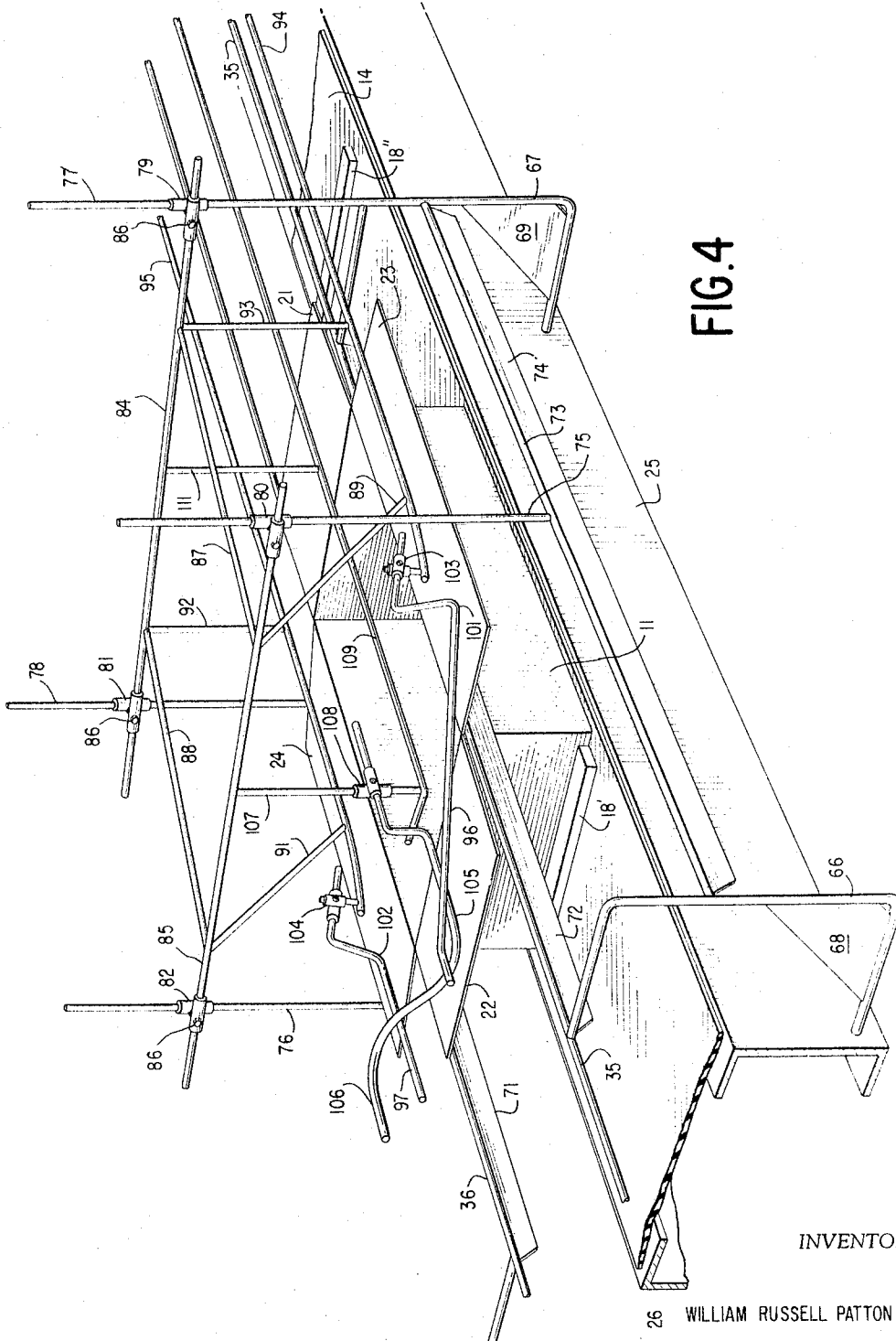


FIG. 4

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3,296,769

DEVICE FOR OPENING CARTON FLAPS
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11 Claims. (Cl. 53—76)

This invention relates generally to automatic packaging machinery and more particularly to apparatus for opening carton flaps preparatory to filling of the cartons as they enter the automatic filling machine.

In the art of automatic packaging where a number of articles are placed by machinery within a carton and the carton sealed or otherwise closed for shipment, devices employed for first opening the carton and then folding the flaps outwardly to prepare the carton for the filling operation have generally been complicated and have required considerable floor space because of the considerable number of steps used to perform these operations. Other apparatus has been devised for opening filled cartons in which the flaps are first plowed open and then folded back for discharging the contents from the carton. These devices are likewise complicated and expensive and consume considerable floor space, as previously known.

Manufactured articles to be packed in cartons are frequently brought along a production line to a packing machine which is supplied with cartons newly erected or assembled from flat stock in an adjacent machine such that the newly assembled carton sits upright on a conveyor having a pair of side flaps and a pair of end flaps upstanding in vertical planes as extensions of the side and end walls of the cartons. These flaps are ordinarily precreased to make folding thereof possible. The flaps nevertheless require the attention of an attendant to fold these flaps outwardly and away from the filling machine in order that the article placing mechanism can enter the upper portion of the carton as necessary for proper placement of the packed articles. While carton opening apparatus could be used in order to effect the flap opening operation, this has generally not been practiced because of the attendant disadvantages in floor space and cost of machinery for this purpose. A section of the conveyor bringing these cartons to the filling machine has been allocated for a hand opening operation, and automatic machinery for performing this function has generally not been available, or is too expensive and space consuming for this purpose.

It is accordingly an object of this invention to provide a compact machine for automatically folding back the flaps of successive newly erected cartons.

Another object is to provide a flap folding device for continuously moving cartons from a carton assembly station to a filling station at a rapid rate and spaced apart less than the length of a single carton.

Another object of the invention is to provide a simple inexpensive mechanism which may be employed to perform right angle bends in each of the flaps of newly formed cartons.

A further object of the invention is to provide a simple flap opening mechanism confined to minimum space along a conveyor in the order of two carton lengths.

A still further object of the invention is to provide a flap folding mechanism of lightweight tubular structure which may be adjusted to different carton sizes which at the same time is simple to operate and adjust.

These and other objects and features of the invention will be more clearly understood as the description of the invention proceeds in which FIG. 1 is a side elevation of the opening machine showing operated end flap opening means;

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FIG. 2 is a partial view of the machine of FIG. 1 with the opening means retracted;

FIG. 3 is a plan view of the mechanism of FIG. 1;

FIG. 4 is a perspective view of the final portion of the machine of FIG. 1;

FIG. 5 shows a carton in the newly erected position; FIG. 6 shows a carton with the end and side flaps open for filling; and

FIG. 7 is an illustrative wiring diagram for control of air cylinders and conveyor to provide automatically timed carton release and carton separation in the opening station.

Applicant achieves these objectives by providing a flighted conveyor section spaced between the termination of the infeed conveyor section for the delivery of newly erected cartons to the packaging machine and the work table or automatic machine in which the filling operation occurs, and provides a flap opening station at this portion of a conveyor. At the end of the infeed conveyor or chute is a device for releasing cartons one at a time to the opening station, which includes a conveyor belt to initially move the cartons along the conveyor section. A restraining mechanism which may be a flat spring delays each carton until engaged by one of equally spaced flights or cleats on the conveyor to equally space the cartons. A pair of switches is operated as each carton passes into the opening station being arranged to operate in sequence to stop the following carton before it enters the opening station and to release it as the flap opening arms are actuated to fold back the leading and trailing end flaps as the carton moves along through the station. Upon completion of the opening of the four flaps, the carton passes underneath retaining arms which hold the flaps in their outwardly extended positions and a switch is operated to restore the end flap opening mechanism to the normal condition for receipt of a following carton. Each following carton is released as the forward carton passes beyond the opening station and restores the pair of control switches to normal thus releasing the stopping mechanism as the forward carton passes from the station. Side flap opening is performed by spaced arms shaped to engage the side flaps and fold them outward as the carton passes to the discharge end of the station. Newly assembled cartons then enter the opening station 10 from the infeed conveyor or chute 30 which has discharged carton 11 while carton 12 remains at the entrance to the station, held by suitable arresting means later to be described. Carton 12 is illustrated in FIG. 5 in its newly assembled condition with the closure flaps upstanding from the sides and ends. A fully opened carton 13 is shown at FIG. 6 in the condition desired for filling at the work table of a filling machine (not shown) at the right of FIG. 1. A conveyor 14 is supported by an idler roll 15 and a driving roll 16 and is provided with a suitable tension roll 17 to maintain the conveyor in proper adjustment for the transport of cartons from the receiving to the discharge end of the station. Conveyor belt 14 is preferably supplied with cleats or flights 18, 18' and 18'' equally spaced therealong at a separation generally somewhat less than two carton lengths. The flights may extend across the upper face of the conveyor belt to engage the rearmost lower edge of carton 11 during its passage through the opening station. The mechanism provided for opening the flaps is supported by a rigid frame 19 on legs 20 preferably including web-joined upright and transverse portions to complete a box structure having sufficient rigidity to support the operating structure comprising the flap-folding and holding elements of this invention.

Carton 11 is illustrated as having first and second end flaps referred to hereinafter as "leading" and "trailing" end flaps 21 and 22 and first and second side flaps 23 and

24. The outwardly folded flaps are shown in FIG. 6 as the cartons pass through the opening machine to the filling machine or table at the discharge end of the conveyor shown generally at 70.

A supporting frame shown generally at 19 consists of side rails 25 and 26 arranged at either side of the conveyor 14 as the conveyor guide and support for transverse frame 28. Upright 27, which may consist of a U channel or box member, is preferably secured to leg 20 and to rail 25 with suitable web reinforcement to maintain member 27 in the upright position. A similar rail 26 supports an upright member corresponding to upright 27. Transverse frame member 28 extends across the station at the top of member 27 and corresponding upright member. A pair of longitudinal members 29 and 31 are attached to frame member 28 and are reinforced by corresponding end members 32 and 33 to form a box structure for the support of the end flap opening mechanism.

A support shown at 34 indicates suitable means for holding the roll 15 in fixed relation to the side rails 25 and 26. Rolls 16 and 17 likewise may be secured to a frame 19 by suitable means (not shown) with provision for adjustment of roll 17 or roll 16 to maintain appropriate tension in the conveyor 14.

At the receiving end of the conveyor there may be provided a supply conveyor or a sloping delivery chute for gravity feeding of cartons to the opening station, such delivery chute being adapted to feed carton 12 into the end of conveyor 14 between conveyor channel guides 35 and 36. Control of cartons entering the station may be effected by release mechanism shown generally at 38, which may consist of a rubber tipped stopper member 39 carried by shaft 41 of air cylinder 42 under control of a solenoid valve 43 which in turn is controlled by a switch arrangement later to be described, this assembly being supported adjacent the infeed end of the station as by bracket 40 from member 34.

Frame members 29 and 31 support a transverse shaft 44 on bearings 45 and 46. A second transverse shaft 47 is borne on bearings 48 and 49 by members 29 and 31. Shaft 44 carries pusher arm 51 for stroking in an arc therearound and shaft 47 carries pusher arm 52 strokable in an arc about the shaft 47. Crank arm 53 is keyed to shaft 47 at fixed rotational relationship to arm 52, also keyed to shaft 47. Linkage arm 54 connects to crank arm 53 and to pusher arm 51 at a distance from shaft 44 preferably a little greater than the length of crank arm 53. Arms 51 and 52 are interconnected by crank 53 and linkage 54 to cause flap pushers 55 and 56 to operate through like arcs as illustrated in FIGS. 1 and 2, and to move in opposite directions in downward and outward motion to engage flaps 21 and 22 of the carton 11, thereby to force them into folded open positions.

Arm 52 is actuated by a stroking mechanism preferably an air cylinder 57 having piston rod 58 extended to connect to arm 52 at a distance from shaft 47 somewhat greater than the length of crank 53 when it is desired to compensate for the forward motion of carton 11 on conveyor 14. Cylinder 57 is actuated by air pressure through fitting 59 and is supported by a pivoted fixture for rotation about pin 62 suitably supported on transverse member 32. An air connection 63 is shown broken away but extending to a conventional air supply system having, for example, 60 to 100 pounds' pressure. Control of intermittent pressure through the connection 63 effects the timing of the operation of cylinder 57 to control arms 51 and 52. Suitable adjustment may be provided by positioning the point of attachment of arms 54 and 58 to arms 51 and 52, and further adjustment may be effected by changing the relative position of rotation of crank 53 on shaft 47 with respect to arm 52. Arm 54 may, for example, be extensible for purposes of adjustment by means of a screw connection shown at 64 threaded into the end of arm 54 and connected to the selected point of attachment on arm 51. Likewise adjustable is the length of

stroke of piston rod 58 in cylinder 57 to effect similar motions of flap pushers 55 and 56. A spring 65 is preferably provided to relieve part of the weight of the cylinder 57 and to compensate for the weight of the linkage and moving arms described.

One of the features of the present invention is the inexpensive lightweight construction of the flap opening mechanism. To this end the structure described may be of lightweight aluminum and is normally constructed of usually stocked materials. Arms 51 and 52 may be of pipe such as $\frac{3}{8}$ " diameter, and each of the other linkages described is of lightweight material. Flap pushers 55 and 56 are of sheet material formed generally in the shape of a J and secured to the ends of arms 51 and 52 by welding or by means of a countersunk screw through the members 55 and 56 into arms 51 and 52. The attachment of pushers 55 and 56, as illustrated and described, provides for smooth transition from stationary upstanding positions for flaps 21 and 22 to the fully folded positions. At the same time resilience is provided particularly at the time of maximum stress in folding the flaps outwardly.

Side rails 35 and 36 are preferably mounted at an elevation above the conveyor 14 equal to the height of the carton when the flaps have been folded outwardly for filling. These rails extend the full length of the conveyor and serve to confine the movement of the carton to linear motion along the conveyor and to prevent outward bowing of the carton sides during the opening of the side flaps. Rails 35 and 36 are preferably supported each by a pair of angled uprights as at 66 and 67, which may be welded to rails 25 and 26 to provide support for rails 35 and 36 at inwardly turned ends of supports 66 and 67. Webs 68 and 69 are provided to strengthen the angled supports 66 and 67. Rails 35 and 36 are preferably supplied with welded supporting flanges 71 and 72 throughout the length thereof between points of support. A further support member 73 may extend between uprights 66 and 67 on one side of the station and may be strengthened by welded flange 74 to provide support for uprights 75 preferably of pipe or tubing welded to longitudinal member 73, with a corresponding structure supporting upright 76 on the opposite side. Uprights 66 and 67 are laterally displaced from the sides of the conveyor 14 sufficiently to permit the opening of the side flaps outwardly between the uprights 75 and 76. Uprights 77 and 78 are extensions of the upright 67, and the one corresponding thereto (not shown) on the opposite side of the conveyor, to form the corners of a rectangle of which uprights 75 and 76 form the remaining corners. Crossed tubing support fixtures 79, 80, 81, and 82 are attached to uprights 75, 76, 77 and 78 by means of adjusting screws as at 83 to permit vertical adjustment of cross arms 84 and 85 borne thereby and which may be similarly adjusted in lateral position by adjusting screws 86. Arms 84 and 85 are given rigidity by cross arms 87 and 88 which are welded to arms 84 and 85 to provide a rigid rectangle from the corners of which arms 89, 91, 92 and 93 depend rigidly to support flap hold down members 94 and 95 extending along the after portion of the opening station thus to retain the flaps in the outfolded position after they have been fully opened.

Plows 96 and 97 are preferably formed of tubing and have parallel ends 98 and 99 disposed equidistant from the center line of the conveyor at a separation less than the width of the carton and at a height to contact side flaps 23 and 24 as the carton moves along the conveyor after the end flaps have been opened. Forward ends 98 and 99 of the plows 96 and 97 are disposed preferably just beyond the position on the conveyor at which the flap pushers 55 and 56 have completed their function as described. Plows 96 and 97 have diagonally outwardly extending portions terminating in heels 101 and 102 outboard of the hold down members 94 and 95 so as to hold flaps 23 and 24 at or below the horizontal position, the sides of the carton being held in position

against the considerable outward bowing forces during the folding operation by reinforced rails 35 and 36. Adjustment is provided for plows 96 and 97 by means of crossed tubing holders 103, 104 held on upturned ends of members 94 and 95 to permit adjustment of height and angle of the ends 98, 99 and the heels 101, 102. Accordingly, as flight 18 moves carton 11 along the conveyor 14 the side flaps are folded upwardly by the plows 96 and 97 and retained in that position by members 94 and 95 until the carton is deposited on table 70 or the working table of the filling machine into which the opening station feeds.

As the end flap opening mechanism is operated to fold the flap 21 forward and the flap 22 to the rear, these flaps are released when the pusher mechanism is recycled to receive the next carton. In order to retain the flap 21 in its folded position an inverted plow 105 is provided with a termination 106 extending above the level of the upstanding carton flaps and has a curved portion effective to re-fold flap 21 in the event it returns part way to its vertical position as the arm 52 is retracted. Plow 105 is adjusted and held in position by vertical support 107 depending from horizontal member 85 holding the crossed tubing adjustable support 108. Vertical support 107 also carries hold down member 109, which is effective to hold open the end flaps after passing plow member 105, and which extends to the discharge table 70, supported at the after end by vertical member 111 rigidly depending from horizontal member 84.

As the carton 11 is moved to the opening station beneath the arms 51 and 52 these arms are actuated by outstroking of cylinder 57 to extend rod 58 and linkage 54 which folds end flap 21 forward and end flap 22 rearward as illustrated in FIG. 1. Flap 21 is folded down before the carton moves underneath the horizontal portion of member 105 and the end 106 is sufficiently elevated to permit folding motion of flap 21 as described. Flap 22 will generally be released before engagement with member 105, but the carton is moving in a direction to re-fold flap 22 in the rearward direction as the carton moves along the conveyor. Both end flaps thus pass underneath member 105 and are held in the folded position by the holding bar 109 as the carton passes beyond the conveyor to the work table.

Cycling of the mechanism is controlled by switches 112, 113, and 114. Switches 112 and 113 are wired in series with solenoid valve control 43 to a power supply to operate an air cylinder 42, or its equivalent, to out-stroke rubber stopper 39 attached to rod 41. Switches 112 and 113 are preferably normally open switches, positioned to actuate stopper 39 before the following carton has reached a position from which it could be carried forward by contact with flight 18 of belt 14. A following carton 12 may be stopped at the entrance of the station as stopper 39 presses the carton against rail 36 at a distance prior to operation of the cycling switch 114 sufficient to leave room for folding back of flaps 22. As soon as the carton passes the first of switches 112 and 113, when in series, or the second, when parallel-connected, the control circuit to valve 43 releases the following carton, which then passes onto the conveyor belt and is moved forward by friction until it reaches an arresting lever illustrated as leaf spring 115 tensioned to stop the progress of carton 12 along the conveyor until the next succeeding flight 18 engages its lower rear edge and positively pushes the carton forward to the opening station. Carton spacing is controlled by flight spacing, provided that cartons are released by stopper 39 in time to supply a carton for each flight, which may be at 30 inch separations. If stopper 39 delays the following carton for a longer time, the following cartons may be engaged only by alternate flights. Spacing is thus under control of the switching sequence, since switches 112 and 113 may be normally open and upon closing either one (when parallel) actuate the stopper for a time longer than the time

of passage of a carton leading edge between these switches. When the switches are in series and normally open both must be closed to actuate the stopper, and the duration of the carton delay is then made less than a carton length, as may be desired when cartons are of length more than half the flight separation. A single switch with make and break contacts controlled by an adjustable actuating arm may substitute for the two parallel-connected switches to similarly control the stopping period.

Stroking of the cylinder 57 is controlled by a series switch between a suitable power supply (not shown) and a suitable solenoid valve (not shown) controlling air to the cylinder 57. When switch 114 is operated the end flaps are immediately opened, and when the carton passes beyond switch 114 rod 58 is retracted as the air supply is cut off and the used air leaks from the cylinder 57 at a rate controlled by suitable vent means (not shown). Cooperating with the table 70 is a switch 116 arranged adjacent the passageway for open cartons underneath the ends of arms 94, 95 and 109. This switch may conveniently be normally closed and held open whenever a carton is in position beside the switch. Switch 116 may manually or automatically control the motor which drives the belt 14 and thus controls the entire operation of the carton opening mechanism. As soon as the carton passes beyond the switch 116, a carton being opened resumes its progress and the operation can be made entirely automatic.

While the invention is described in terms of an example of a flap folding device found efficient and effective as to speed, size, weight and cost, it will be understood that various modifications in the apparatus may be made without departing from the intended scope of the invention according to the appended claims.

What I claim is:

1. A machine for folding down the flaps of newly assembled cartons comprising a receiving channel, a discharge channel, a flap opening channel connecting said receiving and discharge channels, means moving cartons individually along said flap opening channel, pivoted arms disposed above a carton adjacent said point to allow arcuate motion downwardly into and toward leading and trailing ends, respectively, of said carton to fold outwardly leading and trailing end flaps thereof, means including a mechanical linkage connected to operate said arms, means actuated by a carton passing a predetermined channel point for activating said mechanical linkage, means holding said end flaps in the folded position as the carton moves into said discharge channel, means controlled by the position of a first carton in said opening channel for preventing entry of a second carton until the first carton has passed said position, plow means folding side flaps of a carton outwardly as the carton moves in said opening channel, and means holding said side flaps in folded position as the carton moves in the discharge channel.

2. A machine according to claim 1 including following carton arresting means comprising a stop member actuated according to the position of a carton within the opening channel and position sensing means for actuating said stop member for an interval less than the travel time of a carton past said point.

3. A carton flap folding machine arranged to cooperate with a conveyor moving cartons successively therethrough, comprising a sensing lever arranged to respond to arrival of a carton, thrust arm means controlled by said lever to fold forward a leading end flap of said carton upon sensing arrival of the carton, said arm means being retractable upon passage of the carton, an end flap plow member arranged to receive thereunder said leading end flap as the carton approaches said member and for folding rearwardly a trailing end flap as the carton passes under said member, side plow means engaging side flaps and being shaped to fold outwardly each of said side

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flaps, metering means releasing one carton at a time to said machine, and power means operating said thrust arm in response to actuation of said sensing lever.

4. A machine according to claim 3 wherein said metering means is controlled by spaced sensing devices operative to stop a following carton as a carton is moved thereagainst in passing through said machine.

5. A machine according to claim 3 wherein said thrust arm means comprises a pair of arms pivoted at respective points above a moving carton being arcuately movable to enter between said carton flaps from above and upon continued motion to outwardly fold the leading and trailing end flaps, and said control means including powered linkages simultaneously and arcuately operating said arm means in response to actuation of said sensing lever.

6. A machine according to claim 3 further including flap holding bars longitudinally extending from said machine along the line of motion of said cartons therefrom, said bars cooperating with said plow member and said side plow means in substantial end-to-end relation therewith, being at elevations adjusted to deliver therefrom cartons with said flaps in folded positions.

7. A machine according to claim 3, said metering means including sensing means for detecting the arrival of a carton thereat and for closing an actuating circuit for a carton restraining device at the entrance of the machine, said sensing means being operative during an interval less than the time of passage of a carton therepast, and carton restraining means actuated by said sensing means for less than the duration of passage of a carton therepast to separate successive cartons.

8. Means for folding flaps of cartons newly assembled from stock into opened out positions for facilitating filling by automatic machinery, comprising a traveling conveyor bed for transporting cartons from a receiving station through an opening station to a discharge station, reciprocating pusher arms pivotally mounted above said opening station and adjusted to engage in outwardly fold-

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ing movement leading and trailing end flaps of a carton in said opening station, position sensing means responsive to arrival of a carton at a fixed point in the station for applying cycling motive power to said arms, movement sensing means operative at a time before arrival of a carton at said point until after passage thereof, carton stopping means connected for response to operation of said movement sensing means to arrest the motion of a following carton at said receiving station and thereafter to release said following carton, and plow means disposed for outwardly folding side flaps of a carton as it passes from said opening station to said discharge station.

9. Means according to claim 8 wherein said conveyor bed includes spaced flights thereon separated more than one and less than two carton lengths, resilient lever restraining means delaying carton movement on said conveyor until arrival thereagainst of said flight.

10. Means according to claim 8 wherein said pusher arms move arcuately from raised crossed positions to substantially downwardly vertical positions separated by more than one carton length, and a powered extensible stroking member fixed at one end and engaging interlocking linkages to said arms to stroke out in response to application of said cycling motive power.

11. Means according to claim 8 including a carton sensing lever and control switch actuated thereby responsive to the presence of a carton in the discharge station for arresting the conveyor until said sensing lever is released.

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