

CARTON ERECTING MECHANISM

This invention relates to packaging of primary articles such as cans and bottles in multiple packaged cartons and is more particularly concerned with feeding such cartons in collapsed condition from a hopper and for initiating and then completing a set up operation of cartons in sequence.

The majority of known packaging machines are dedicated machines which construct only one size of one type of carton. Therefore, modern bottling plants are required to use a plurality of packaging machines to package different carton types, each machine taking up considerable floor space and being expensive to both purchase and operate.

A limited number of packaging machines are capable of packaging different sizes of cartons, for example six, eight or twelve packs of a wraparound carton. All such machines require adjustment when switching from one size or type of carton to another. This adjustment includes the manual removal of all of the cartons within the packaging machine and possible the mechanical adjustment of components in the machine. During this change over period, which can be thirty minutes or more, a machine cannot be used (known as "downtime"), which is an expensive delay in a bottling plant. Such a delay may even result in downtime for the entire bottling line, not just the packaging machine, if problems arise during the changeover period.

The present invention seeks to overcome the commercial disadvantages of known packaging machines by providing a feeder mechanism which is able to set up more than one type of carton. Further, the invention is capable of switching from one carton type to another, or between sizes with minimum downtime. The modular nature of the present invention enables a "fully flexible" machine to be constructed which overcomes, or at least mitigates, the problems of known machines.

The present invention can be used with a packaging machine described in a corresponding application (Applicant's reference D-7725 . It is envisaged that the present invention can be used in various other types of packaging machine.

Alternatively, the erecting mechanism of the present invention can be sold as an individual module to be fitted to new equipment or to existing equipment on a retro fit base.

UK 2053133 concerns an apparatus for removing/holding box blanks from a stationery magazine and erecting and transferring the blanks. The apparatus comprises transfer members which are mounted on four point linkages and arranged on a rotary carrier controlled by cans. During rotation, to facilitate the removal of the blanks, such members are stationary. During transfer of the erected blanks to the transport device the section members are moved synchronously with the transport device.

US Patent 4625575 concerns a can assembly for a feeder mechanism in which a can plate is provided having a continuous can track including a deep section and a shallow can trap section. Can track follow arms are used for relative movement within the deep and shallower can tracks. Pick up means is connected to the can arm by an eccentric arm and the can tracks cause the pick up mean to move to an outwardly extended position and turn inwardly retracted position.

WO 92/15450 concerns a carton set up machine which has a suction device for withdrawing collapsed sleeve type cartons from a magazine. The suction device moves inwardly and outwardly on a slidable rod as it orbits about a central rotating shaft. An oscillating gripper mounted outside the orbit of the suction device pulls outwardly on an outer panel of the collapsed carton to being opening it.

These references in the prior art refer to primary carton pick up means but do not address a problem associated with the erection of cartons from a flat

condition. The present invention addresses the difficulties associated with separating opposing panels of different cartons after they have been stored in a flat condition and which can be easily modified for different carton types.

5 Accordingly, the present invention seeks to overcome or at least mitigate the problems of the prior art.

One aspect of the invention provides an apparatus for sequentially manipulating out of a hopper collapsed cartons having oppositely disposed panels and for initiating set up thereof, said machine comprising, carton pick up means for sequentially engaging one of said opposed panels and for withdrawing from the
10 hopper a collapsed carton which includes said one panel, means for transferring said carton orbitally about a rotatable axis from said hopper to an infeed end of a packaging machine and wherein panel engaging means is disposed outside the path of orbit for engaging the other of said opposed panels so as to pull said other panel in a direction away from the carton pick up means thereby to initiate opening of the
15 carton characterised in that said panel engaging means is mounted to a guide rail and a transverse carriage moveable in a first plane along said guide rail.

According to an optional feature of this aspect of the invention, the panel engaging means may be moved in the first plane by a linear servo motor.

20 According to another optional feature of this aspect of the invention, said panel engaging means may be mounted to a slide member in a substantially perpendicular relationship with said guide rail and said slide member may be moveable relative said guide rail whereby said panel engaging means is moveable in two planes.

25 According to a further optional feature of this aspect of the invention, said panel engaging means is moved in a second plane by a linear servo motor.

According to yet a further optional feature of this aspect of the invention, control means may be arranged to control the movement of the panel engaging means.

5 According to another optional feature of this aspect of the invention, said panel engaging means may comprise a suction cup and cup holder mounted onto said slide member, said suction cup being connected to a vacuum supply during said carton opening.

According to yet a further optional feature of this aspect of the invention, said face contacting panels may comprise opposite side walls of the carton.

10 An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of the infeed of a packaging machine illustrating the back feeder mechanism of one embodiment of the invention;

15 FIGURE 2 is a perspective view from the opposing side of the packaging machine illustrated in Figure 1;

FIGURE 3 is an enlarged perspective view of a back feeder mechanism illustrated in Figure 1 ;

FIGURES 4 to 6 are perspective views illustrating a back feeder mechanism separating opposing panels of a carton; and

20 FIGURES 7a, 7b and 7c are side elevation views of the basket type carton, fully enclosed carton for eight bottles and a fully enclosed carton for twelve bottles.

FIGURE 8 illustrates four graphs showing one example of the distance, velocity, acceleration and derived acceleration plotted against time of the linear servo motor controlling the X coordinates of the suction cup; and

5 FIGURE 9 illustrates four graphs showing one example of the distance, velocity, acceleration and derived acceleration plotted against time of the linear servo motor controlling the Y coordinates of the suction cup.

10 A mechanism according to the present invention is capable of erecting a variety of carton type for example, wraparound, fully enclosed and basket type cartons. Any reference in this specification to carton type includes different sizes of a particular carton style. For example, the mechanism can load fully enclosed cartons for eight or twelve articles.

15 Referring to Figures 1 and 2 of the drawings there is shown a machine 10 for processing cartons of the type outlined above. The upstream end of the machine includes a dual hopper 12, 14 in which a multiplicity of cartons for example basket type and fully enclosed cartons 16, 18 in a collapsed condition which are held ready for processing. In this embodiment, each hopper 12, 14 is a gravity feed type whereby the carton blanks are held in their respective hoppers at an incline to provide a positive feed.

20 A rotary vacuum feeder 20, positioned adjacent the dual hopper 12, 14, removes a carton sequentially from the hopper unit and transfers the carton in a rotary path "Z" to a paper feed chain 22 shown in Figure 3. The paper chain 22 is provided to transfer cartons downstream to the loading station 24.

25 As the carton is removed from the hopper unit 12 and rotated by the rotary feeder 20, a back feeder mechanism 30 is used to separate opposing panels and to assist in part erecting the carton. In the embodiment illustrated in the drawings,

the carton being transferred by the rotary feeder is a fully enclosed carton, shown in Figure 7b, in a flat collapsed condition.

5 In order for the carton to be transferred from the inclined position in the hopper 12, 14 to a vertical plane in the paper feed chain 22, it is necessary to offset the axis of rotation of the rotary feeder 20 from the vertical plane, as illustrated in Figures 1 and 2. Therefore, the back feeder 30 should also be offset tangentially of the orbital path of a carton.

Turning to the construction of the back feeder 30, shown in Figure 3, there comprises suitable engagement means for engaging one or more walls of the
10 carton. In the present embodiment, the engagement means comprises a suction cup 32 supported on a cup holder 34 which is mounted onto a slide member 36. Suitable means is provided to move the engagement means in "X" and/or "Y" directions. For example the slide member 36 is in turn mounted onto a transverse carriage 38 and is capable of being moved in a direction designated by the letter X
15 relative the transverse carriage. The transverse carriage 38 is preferably connected to a guide rail 39 which is fixed to a support frame (not shown): the transverse carriage being adapted to move the suction cup and slide member in a direction designated by the letter Y, relative the guide rail 39. Thus, the suction cup 32 is capable of moving towards or away from the rotary vacuum feeder 20 and/or in a
20 parallel direction to the orbital path Z of a carton. If desired, limit stops may be included at the ends of the slide member and/or guide rail.

It is envisaged that alternative components or configurations can be used to provide an assembly which can move in X-Y directions.

25 The slide member 36 is moved by first drive means, for example a first linear servo motor (not shown) which is controlled by a suitable control system and the transverse carriage 38 is moved by second drive means, for example a second linear servo motor (not shown) which is also controlled by the control system. In

some embodiments, the control system is programmed to pre-set suitable X - Y co-ordinates and to define the path of the suction cup. The control means may be a dedicated processor or may be a control means for a packaging machine in which the backfeeder is used. Alternatively, the control means may preferably be a known programmable servo control means may preferably be a known programmable servo control system. Manual input means may be included to change the particular "X" or "Y" co-ordinates. More details of one type of control system are provided in the corresponding application (Applicant's reference D-7725).

In use , the back feeder 30 separates one of the walls 40 of the carton from the opposing wall 42 held by the rotary feeder 20. In this embodiment, the opposing walls used are the side walls 40, 42. As the rotary feeder 20 transfers the carton, the suction cup 32 of the back feeder 30 is moved forward into contact with a side wall 40 of the collapsed carton 18, shown in Figure 4. Preferably, the point of contact is at an approximately central portion of the wall being separated. Vacuum is applied to the suction cup 32 to hold the side wall 40. As the rotary feeder 20 continues to rotate the carton forward, the back feeder suction cup 32 moves away from the rotary feeder 20 to separate the two side walls, shown in Figure 5. In this embodiment, the leading pair of suction cups 44 of the rotary feeder release the leading end panel 46. Thus, the carton is folded in to a part erected condition with the side and end walls being separated . The back feeder vacuum supply is then disconnected and the carton is released from the back feeder shown in Figure 6.

Whilst it is preferred to use a suction cup to hold one of the walls, some embodiments may adopt alternative components, for example, mechanical connection means.

The carton 18 continues on its orbital path until it comes into contact with the paper feed chain 20. In particular, the leading edge 48 of the carton comes into

abutment with the leading lug 50 of the paper feed chain 20. The leading lug 50 guides the leading edge 48 away from the suction cups 44, 52 of the rotary feeder 26, thereby placing the front end panel 54 and side panel 40 in a substantially perpendicular relationship. At the same time, the rear lug 56 moves into contact with the rear end panel 58 to assist in completing the set up. Thereafter, the suction cups 44, 52 of the rotary feeder 26 release the carton and continue to move in direction "Z" and the carton 30 is moved downstream to the loading station 60 by the paper feed chain.

As explained above, the preferred "pick up" position 62 of the back feeder suction cup, shown at Figure 7, is at an approximate central point of the carton side panel. However, this position will vary according to the type of carton, and in particular the dimensional variations of the side and end walls for each carton type and for different carton sizes. Examples of these positions applied to a basket type carton and larger size of fully enclosed carton are illustrated in Figure 7a and c. Likewise, the path of the suction cup separating the two walls will also vary according to the particular carton type being erected. It is envisaged that the suction can follow an oscillatory path similar to that disclosed in WO 92/15450. Alternatively, a rotary path could be used for some cartons. An advantage of the backfeeder described above is the flexibility offered by the system. Therefore, the position of the back feeder suction cup 32 can be moved to any desired position or to adopt any number of paths with the end stop limits of the slide member 36 and the guide rail 39. Thus, the backfeeder can be programmed to follow a path and/or move to a pick up position for a particular carton type, the path and position being changeable according to the carton type. An example of the path of the suction cup, velocity and acceleration of the linear servo motors controlling the X and Y direction of the suction cup, when constructing a fully enclosed carton as shown in Figures 8 and 9.

By pre-programming the control system, the position and paths of the suction cup 32 can be pre-set, thus reducing the amount of down time when

interchanging carton types or styles. According to this invention, the speed of operation of the apparatus is improved as well as its efficiency and durability.

While the preferred embodiment described herein is for loading bottles into cartons, it will be recognised that the invention is not limited to cartons for bottles.
5 The invention may be used with machines for packaging cans, paperboard "bricks" and other containers into cartons.

Moreover, while the preferred embodiment described herein is shown as part of a machine for loading containers into vertically-loaded sleeve-type carton, the invention is not limited to cartons of this type. As will be recognised by those
10 skilled in the art, the invention may be used with wrap-around or end-loaded cartons.

It will be understood that the back feeder mechanism of the invention has been illustrated with reference to a specific embodiment and that numerous modifications are possible within the scope of the invention. The back feeder
15 mechanism is able to process cartons comprising numerous configurations of groups of articles covering a range of carton size and shape, for example, four, six, eight and twelve bottles without undue time being spent in adjusting the mechanism.



CLAIMS

1. An apparatus for sequentially manipulating out of a hopper collapsed cartons having oppositely disposed panels and for initiating set up thereof, said machine comprising carton pick up means for sequentially engaging one of said
5 opposed panels and for withdrawing from the hopper a collapsed carton which includes said one panel, means for transferring said carton orbitally about a rotatable axis from said hopper to an infeed end of a packaging machine and wherein panel engaging means is disposed outside the path of orbit for engaging the other of said panels so as to pull said other panel in a direction away from the
10 carton pick up means thereby to initiate opening of the carton characterised in that said panel engaging means is mounted to a guide rail and a transverse carriage moveable in a first plane along said guide rail.
2. The apparatus according to claim 1 wherein the panel engaging means is moved in the first plane by a linear servo motor.
- 15 3. The apparatus according to claim 1 or claim 2 wherein said panel engaging means is mounted to a slide member in a substantially perpendicular relationship with said guide rail and wherein said slide member is moveable relative said guide rail whereby said panel engaging means is moveable in two planes.
4. The apparatus according to claim 3 wherein said panel engaging means is
20 moved in a second plane by a linear servo motor.
5. The apparatus according to any preceding claim wherein control means are arranged to control the movement of the panel engaging means.
6. The apparatus according to claim 5 wherein the control means is arranged to control the speed of the panel engaging means.



7. The apparatus according to claim 5 or claim 6 wherein the control means comprises means for receiving information regarding the speed of cartons in orbital transfer.
8. The apparatus according to any preceding claim wherein said panel
5 engaging means comprises a suction cup and cup holder mounted onto said slide member, said suction cup being connected to a vacuum supply during said carton opening.
9. The apparatus according to any preceding claim wherein said face contacting panels comprise opposite side walls of the carton.