PRODUCT TRANSFER MECHANISM

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ABSTRACT

The product transfer mechanisms of this invention increases the performance of automatic packaging machines by deflecting product as it falls from a transfer container into a box with a slide, thus reducing damaging effects of free-falling product collisions and enabling simple, efficient maintenance and sanitizing of surfaces contacting the deflected product. The improved product transfer mechanism has a transfer container composed of a lightweight, transparent material enabling a visual inspection of the product as it travels through the product transfer mechanism while reducing the weight of component parts of the product transfer mechanism.
PRODUCT TRANSFER MECHANISM

SCOPE OF THE INVENTION


[0002] This invention relates to loading stations for automatic packaging machines and particularly to fast acting loading stations with greatly increased efficiency in sanitizing and maintaining surfaces contacting product and reducing damage to product as it is loaded by volume into a package.

BACKGROUND OF THE INVENTION

[0003] Automatic packaging machines usually have a magazine filled with cardboard blanks which are picked up one at a time by vacuum cups, formed into boxes, and inserted into individual mandrels. The mandrels are carried by an endless link chain, which circles a table. As the mandrels pass various work stations, the boxes are filled with product, closed, sealed and discharged. As the link chain carries the mandrels around the table, they circle back to receive the next empty boxes after filled boxes are discharged.

[0004] Automatic packaging machines, such as that shown in U.S. Pat. No. 5,010,929, greatly increased fill speed, eliminated gates for transferring product from cup to box, enabled a full recovery of the product, and increased the wear resistance of component parts. This was accomplished by providing two or more fill stations, each with an endlessly circling series of transfer containers, each cup being made of a highly wear-resistant material. The cups slide along a wear-resistant surface which functions as the bottom of the cups and retains any product therein. A series of boxes carrying mandrels move under the wear-resistant surface, in synchronization and alignment with the transfer containers at each of the filling stations. The conveyor carrying the transfer containers also carries a number of enclosed chutes or chutes to direct and guide product falling from the transfer container into the box.

[0005] However, the enclosed nature of the funnel or chute design possibly leads to an accumulation of product which acts as a piston to build-up an air displacement problem within the funnel. Particularly, air displaced from the boxes might be forced back up into the funnel, affecting product flow, and possibly blowing product from the box.

[0006] According to the invention, the conveyor carries boxes past a fill station where it encounters chute means in the form of a slide for dumping product into the boxes. If the product has a physical characteristic (particulate matter, for example) which may form a piston and compress air within a closed tube, it might cause a puff of air to blow back and divert some of the product away from the box. Hence, instead of a closed tube, the invention provides chute in the form of an open topped and inclined slide having raised slides for guiding and directing product into the box. Since the product slides down an incline, the product falls into the box over a time period and since the top of the slide is open and is not a closed tube, there is no sudden compression of air to cause a puff to blow back.

[0007] Additionally, product free-falls from the funnel to the box, which can cause damage resulting from collisions between free-falling product with other product falling into a box. Further, it can be difficult to reach and clean product contact surfaces in the enclosed tubes for sanitizing and maintaining. That difficulty is overcome with the open topped tube.

[0008] Therefore, an object of this invention is to improve the ability of product to flow at a point where the product enters a package and to eliminate the effects of compressed air displacement in the funnel.

[0009] Another object of the present invention is to decrease product-damaging collisions by product free-falling into a package

[0010] Yet another object of the present invention is to enable simple and efficient sanitizing and maintenance of the means for product transfer into boxes.

SUMMARY OF INVENTION

[0011] These and other objects are accomplished by an inventive automatic packaging machine comprising a product source and a plurality of transports, comprising volumetric or measuring cups, for successively moving a measured volume of the product from the source to a plurality of stations where the measured volume of product is deposited in a box. The inventive automatic packaging machine further comprises a link chain carrying mandrels for presenting a sequence of empty boxes to the fill stations. The transfer mechanisms converge with the boxes at the stations, whereupon, the transfer container releases the measured volume of product held within onto an open topped slide and into boxes at a fill station. The slide design eliminates the displaced air flow problems commonly associated with previous automatic packaging machines by allowing air to freely move as the product flows through the transfer mechanism and into a box, as distinguished from compressing air within a tube. The access provided by the open-sided slide also enables sanitizing and maintenance of the slide without an undue amount of disassembly of the machine.

[0012] The transfer mechanism components in the inventive automatic packaging machine use lighter weight materials and require less material to construct, resulting in less effort to move the transfer mechanism and reduced wear on automatic packaging machine components. The sidewalls of the transfer container are composed of transparent acrylic plastic enabling visual inspection of a measured volume of product as it flows from the transport through the transfer container and into a box.

BRIEF DESCRIPTION OF DRAWINGS

[0013] FIG. 1 is a perspective view of a packaging machine with the inventive transfer mechanism;

[0014] FIG. 2 is a cross-sectional view taken along line 2-2 in FIG. 1 of a filling station showing the inventive transfer mechanism;

[0015] FIG. 3 is an exploded perspective view of the inventive transfer mechanism;

[0016] FIG. 4A-4C are cross-sectional views of three different sized transports illustrating how the measured volume of product may be changed;

[0017] FIG. 5 is a perspective view of one of the transports of FIGS. 4A-4C;
FIG. 6 is a perspective view of a cam pin used to direct a transfer container to release a volume of product held within;

FIG. 7A is a cross-sectional view of a transfer mechanism controlled by the cam pin of FIG. 6, with the cam pin in an elevated position;

FIG. 7B is a cross-sectional view of a fragment of the device of FIG. 7A with the cam pin in the lowered position;

FIG. 8 is a plan view of a cam slot system in which the cam pin of FIG. 6 travels; and

FIG. 9 shows a part of a cam pin track, of the system shown in FIG. 8.

DETAILED DESCRIPTION OF DRAWINGS

FIG. 1 shows the inventive product transfer mechanism integrated into the automatic packaging machine shown in U.S. Patent No. 5,010,929, which may be consulted for further information.

A superstructure raises and lowers a conveyor in the form of a merry-go-round 22 for carrying a number of transports comprising volumetric or measuring cups. An endless link chain conveyor 26 carries a number of transfer mechanisms 27 (FIG. 2). Each transfer mechanism comprising a bottomless, wear-resistant transfer container 28 and opened topped slide 34. Conveyor chain 42 carries a number of mandrels 44 for transporting boxes 46 past a filling station in alignment with transfer mechanisms 27. Slide 34 guides and directs a measured volume of product falling from transfer container 28 into box 46 as it passes through the filling station.

Any suitable sensor 43, 45 (FIG. 1) detects the presence of a mandrel 44 without a box. While any suitable sensor may be used, FIG. 1 shows a lamp 43 and photocell detector 45 positioned so that a box in a mandrel interrupts the beam of light produced by lamp 43 and thus actuates the detector 45. When the absence of a box in the mandrel is detected by the detector and a cam pin 74 (FIG. 2) is pushed down causing transfer container 28 to move outwardly and away from slide 34, for releasing a measured volume of product falling into a recycle bin.

If cam pin 74 is not pushed down, transfer container 28 does not move outwardly. When transfer container 28 does not extend outwardly, product is released onto slide 34 which releases product held within when sensor 43, 45 detects a box in mandrel 44.

The remaining parts of FIG. 1 are jack screws 50, 50 which may raise or lower the merry-go-round 22 to accommodate various size transport cups 24 (FIG. 2). A glue station 52 seals the filled boxes. Any suitable product discharge device 54, such as a conveyor, may pick up boxes after they are filled and sealed. A product source 56 may be provided in the form of a suitable funnel, chute or the like, for filling the transport cups 24 on merry-go-round 22. A nut 58 may be removed to disassemble the feed mechanism for cleaning, repair or maintenance.

FIGS. 4A-4C shows three different and exemplary sized transport cups 24 in greater detail. Each transport cup 24 is a bottomless, volumetric or measuring cup which slides along surface 66, which functions as the bottom of the cup for holding the product therein. An interruption 102 (FIG. 2) in the surface of transfer plate 66 enables the product to fall from transport cup 24 and into an underlying transfer container 28.

Each transport cup 24 has the same diameter so that all sizes may be loaded in the same holes 60 (FIG. 5) in merry-go-round 22; therefore, the distances a, b, c between merry-go-round 22 and the surface of transfer plate 66 are different in order to provide different volumes of transport cup, which may be selected when the packaging machine is set up for a given run. Jack screws 50, 50 (FIG. 1) are driven to lift or lower merry-go-round 22 to the proper height a, b, c for the selected cups when they are put into current use. Preferably, the heights are programmed into a control system for driving the jack screws 50, 50 so that a worker only has to set an identification of a cup size.

A free and telescoping ring 65 (FIGS. 4A-4C) surrounds transport cup 24 and slides over the surface of transfer plate 66. Ring 65 rests under gravity against surface 66 and is able to slide up and down or to tip slightly to accommodate any small unevenness in surface 66, if any.

FIG. 5 shows that each transport cup 24 has a collar 25 for receiving set screw 29 which locks it in hole 60. A skirt 51 depends from collar 25 for receiving and moving ring 65 (FIG. 2). One side of the collar has an indentation or cut out part 33 enabling it to slip over detent 35 projecting from inside wall 62.

Merry-go-round 22 has a series of holes 60 arranged in a circle (FIG. 1) which is concentric to the periphery of and centered on the axis about which merry-go-round 22 turns. Each hole has a sidewalk 62 (FIG. 5) shaped and sized to receive collar 25, with an accurate fit. Ledge 63 extends inwardly from the bottom of sidewalk 62 to provide a seat on which collar 25 may rest. The peripheral or outside circumferential wall 67 of merry-go-round 22 is fairly close to the hole 60 so that set screw 29 may be loosened or tightened from a convenient location at the front of merry-go-round 22. Index markings 71, 73 are provided on the surface of merry-go-round 22 and on the top of transport cup 24. When these marks are aligned and transport cup 24 is dropped into hole 60, indentation 33 passes over detent 35. Ring 65 (FIG. 2) is positioned on top of surface 66 and in a location for skirt 31 of transport cup 24 to pass through. The underside of collar 25 sets within hole 60 and on ledge 63. By rotating transport cup 24 detent 35 is captured within groove 37. Then, set screw 29 is tightened to lock transport cup 24 in place.

To change the size of the transport cup, each set screw 29 is loosened. Each transport cup 24 is rotated until marks 71, 73 are in alignment. Then, the cup may be lifted from hole 60 with the indentation 33 passing over detent 35. Jack screws 50, 50 (FIG. 1) are driven to move merry-go-round 22 up or down to a proper distance a, b, c (FIGS. 4A-4C) from surface 66. Ring 65 having a proper height is set on top of surface 66 and under hole 60. A new size of transport cup 24 is passed through hole 60 and ring 65, and then rotated to capture detent 35. Next, set screw 29 is tightened.

The transfer container 28 and slide 34 of the inventive transfer mechanism 27 are best seen in FIGS. 2-3.
Transfer container 28 comprises a bottomless receiving portion 30 affixed to the top of sleeve 32. During part of the conveyor’s 26 path, transfer container 28 is held under interruption 102 (FIG. 2) in surface 66 and over the horizontal plate 36 of slide 34. Product falling from transport cup 24 through interruption 102 is guided by the concentrically and downwardly slanted interior walls 31 of receiving portion 30 and into sleeve 32. In this closed arrangement, the bottom of sleeve 30 contacts plate 36, forming a temporary bottom to transfer container 28.

[0035] In one embodiment of the inventive transfer mechanism, sleeve 32 is composed of a transparent acrylic plastic. Such sleeves are lightweight and can be inexpensively manufactured from a transparent acrylic pipe cut to suitable lengths. The transparent transfer container 28 provides a good means for visually inspecting a measured volume of product held within. Visual inspection may occur either manually by the machine’s operator or by integrating automatic inspection means into the machine.

[0036] FIGS. 2 and 3 show an example of how the boxes carried by the conveyor are filled at a work station in the automatic packaging machine. As here shown, box 46 has been carried to a fill station by the conveyor. In this particular example, the box is resting on a shelf at the bottom of the mandrel. A product may be dropped through an inclined somewhat elongated and funnel-shaped slide 38 and into box 46. The top end of the inclined slide is attached to platform 36 and has upturned edges 88 positioned over open box 46 to guide and direct product when product moves from sleeve 32 to box 46 which is filled. When the box 46 is under the slide, the product in the sleeve 32 slides off platform 36, down the slide 38, and into the box 46. An advantage of the slide construction is that the product is not dropped through a closed tube which might choke or otherwise fail, perhaps as a result of a puff of air being forced out of the box by the falling product. This is particularly important when the product is a particulate matter which might tend to plug a closed tube. The design of slide 34 allows air to be freely displaced from the box 46 as the product flows from sleeve 32 into the box. The open design of slide 34 also enables simple and efficient sanitizing and maintenance of slide surfaces contacting measured volumes of product.

[0037] FIGS. 6 and 7A-7B show the cam pin 74 structure and operation in detail. Cam pin 74 extends through cam pin holder block 72 and comes to rest in a cam slot 94 (FIG. 6). A groove in the bottom of pin 74 receives and holds retainer ring 86 (FIG. 7B), keeping cam pin 74 from being removed from holder block 72. The top of cam pin 74 is a dome 76 that may or may not encounter a downward deflecting surface during its travel along the conveyor. The deflection or non-deflection is responsive to a signal from sensor 43, 45 (FIG. 1), depending on whether product held in a transfer container is to be released. A circumferential groove 78 around pin 74 receives spring-loaded detent 80 in holder block 72, which normally holds cam pin 74 in an elevated position, as seen in FIG. 7A. If cam pin 74 is lowered (FIG. 7B) responsive to encountering a deflection surface, it travels in cam slot 94 (FIG. 9) and cannot pass over an elevated surfaces of step S so that pin 74 is deflected into track 96 (FIG. 8).

[0038] FIGS. 2 and 6-9 show how a transfer container 28 is diverted to dump product either into a box carried by a mandrel or into a bin for return to product source 56 (FIG. 1). FIG. 9 shows, in perspective, the structure of grooves 94, 96 (FIG. 8). The left hand end of groove or track 94 has a depth H, which is continued into groove or track 96. At the junction of tracks 94, 96 there is a step S in the bottom of track 94, after which track 94 has a depth J. If cam pin 74 is down (FIG. 7B), the step S guides cam pin 74 into track 96 (path E). If cam pin 74 is elevated (FIG. 7A), it passes over step S and, since there is nothing to deflect the pin, it continues in track 94 (path D).

[0039] When cam pin 74 is the raised position, the bottom 84 cam surface (FIG. 5B) is substantially against the holder block 72. This enables bottom port 84 of the cam pin to travel over step S and on in cam slot 94 (FIG. 8) to release the product into box 46. In greater detail, receiving portion 30 guides product falling through opening 102 into a sleeve 32 of transfer container 28. Product is held in sleeve 32 until the cam pin 74, in a raised position, associated with a particular transfer mechanism continues over step S (FIG. 9) through slot 94 (path D) (FIG. 8), at which time the transfer cup 24 reaches interruption 102 and dumps the product in the box 46. When cam pin 74 is lowered, it cannot pass over step S (FIG. 9) and is diverted into cam track 96 (Path E). The transfer container holder 68 extend outwardly on rods 70 (FIG. 3), the bottom of transfer container 32 reaches a spot which dumps product into a recycle bin 7 (FIG. 8). For more information see U.S. Pat. No. 5,010,929.

[0040] In operation, the cam slot arrangement for releasing or holding product in transfer containers 28 is shown in FIGS. 8 and 9. The cam slot 94 is arranged in a race track pattern which follows and parallels the link chain conveyor 26. Cam pins 74 are orderly in the up position (FIG. 7A). Cam pins 74 are selectively pushed down by any suitable means in area 106 (FIG. 8), responsive to a signal from sensor 45 (FIG. 1) indicating that product should not be released from transfer container 28, i.e., a signal from detector 45 indicating the absence of a box in a mandrel. Cam pin surface 82 is deflect ed to path E and cam slot 96. By following path E, rods 70 extend outwardly through slot bearing 40 moving transfer container holder 68 and transfer container 28 outwardly. If the pin 74 is up, the container 28 is not deflected along path E. Since transfer container 28 does not move outwardly, contact between sleeve 32 and plate 36 gradually diminishes allowing product to fall from transfer container 28 onto slide 34 and into box 46.

[0041] In the area 98, the bottom of cam slot 96 raises cam pin 74 so that when cam slot 96 rejoins cam slot 94 at F, all cam pins 74 are in their normal raised position (as shown in FIG. 7A).

[0042] It will be apparent to those skilled in the art that modifications may be made without departing from the spirit and scope of the invention. Hence, all equivalents are to be considered within the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. An automatic packaging machine comprising:
   a source of product;
   a plurality of transport means for successively moving of product from the source toward a plurality of stations where product is deposited in a box.
a plurality of transfer means individually associated with each of the transport means also moving towards the stations in synchronism with the transport means for depositing the product into a box; and

a deflector means for deflecting all of the product into a box without enabling a blow back of air caused by the exiting product, the deflector means comprising a downwardly sloping elongated slide extending from the transfer container towards the boxes, said slide having an open top and upstanding slide walls to guide and direct product into the boxes.

2. The machine of claim 1 wherein the upper end of the slide is wider than the bottom end of the slide, and wherein the slide has guides for directing the product from the transfer container to the box located at the bottom end of the slide.

3. The machine of claim 1 wherein the plurality of transfer means are located in a side-by-side relationship, said transport means comprises conveyor means moving transfer means around one side of said packaging machine, and back opposite side of the packaging machine; and

diverting means operated responsive to a sensor finding an absence of a box for selectively causing the transfer mechanisms to dump the product into a recycle bin and for dumping product into a box when the sensor detects the presence of a box.

4. The machine of claim 3 wherein the diverting apparatus comprises a cam pin associated with a rod having a transfer means thereon, a movement of the rod determining the displacement or non-displacement of the transfer means, a cam slot for receiving the cam pin, the slot extending along the way followed by the conveyor means, the cam slot branching on each side of the way between a first path and a diverted path, and a control means responsive to the sensor for controlling the cam pin to cause it to follow the first path through the slot or to selectively depart from the first path and follow the diverted path at the branching on the side of the way where the box position is filled, thereby forming the diverting apparatus.

5. The machine of claim 4 wherein the cam pin comprises a two step cam pin having means for normally holding the cam pin on a first step, means responsive to the sensor for moving the cam pin to a second step before the cam pin reaches the branching cam slot to enable the transfer means to release the product into a recycle bin, and a second direction apparatus responsive to the cam pin on the first step for following the first path to deposit product into a box.

6. An automatic packaging machine comprising cup means for carrying a product to a fill station, conveyor means for transporting empty boxes to said fill station in order to receive said product carried in said cup, and an open top elongated and inclined slide means interposed between said carried cup and said transporting means for enabling said product to move from said cup into an empty box, whereby product slides down said open topped slide so that air is not compressed within a closed tube by product moving from said conveying means to said box.

7. The machine of claim 6 wherein slide means has raised walls at its opposite inclined edges to guide and direct product as it moves into said box.

8. The machine of claim 6 wherein the cup is an open bottom cup sliding over a surface which functions as a bottom of said cup, said surface having an interruption at a point where said product moves from said cup, onto said slide and into said box, said slide means comprises a platform under said interruption and extending to an upper end of said inclined slide means, whereby product falls through said interruption, onto said platform, onto said slide, and into said box.

9. The machine of claim 8 and means for sensing a presence or absence of a box, means responsive to a sensed absence of a box for diverting said cup away from and before said cup container reaches said interruption whereby said product is not released onto said slide in a place where there is no box, and means responsive to said diversion of said box for dumping said product into a recycle bin.

10. The machine of claim 9 wherein said diversion means comprises a two-step cam pin and a branched cam track having a step therein, said cam pin following one branch of said cam track when said cam pin is on one step and following a second branch of said cam track when said cam pin is on a second step, said interruption appearing in a first of said branches and said recycle bin appearing in a second of said branches.

11. An automatic packaging machine for loading a product which is divided into small particles that might clog a closed tube and act as a piston to compress air in said tube, said packaging machine comprises means for simultaneously conveying container of said particles and empty boxes to a fill station, an elongated and inclined open topped slide extending from said container to said empty box, said slide having upturned edges for guiding and directing said product from said container to said box, and means for dumping said product from said container to said box when said container and box arrive simultaneously at said slide.

12. The machine of claim 11 further comprising means for sensing an absence of a box, and means responsive to a sensed absence of said box for diverting said product away from said slide.

13. The automatic packaging machine of claim 12 wherein said slide comprises a platform having said inclined slide extending therefrom, said container having an open bottom which dumps said product from said container onto said platform.

14. The automatic packaging machine of claim 13 wherein said container is provided in different sizes which are interchangeable whereby different volumes of said product may be deposited in said boxes.

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