

[54] **BOX LID REMOVING APPARATUS**

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[22] Filed: Jan. 27, 1972

[21] Appl. No.: 221,177

[52] U.S. Cl. 53/381 A, 53/109, 214/1 BV

[51] Int. Cl. B65b 43/26

[58] Field of Search 53/381 A, 109;
214/304, 1 BV[56] **References Cited****UNITED STATES PATENTS**

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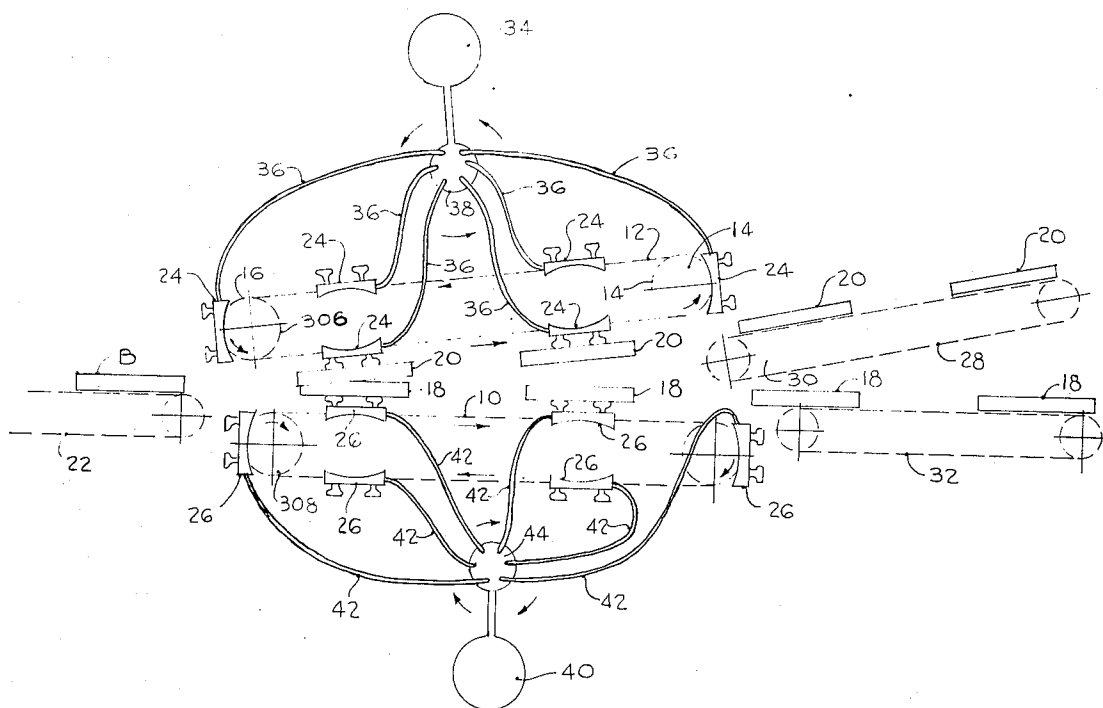
Attorney—Albert Sperry et al.

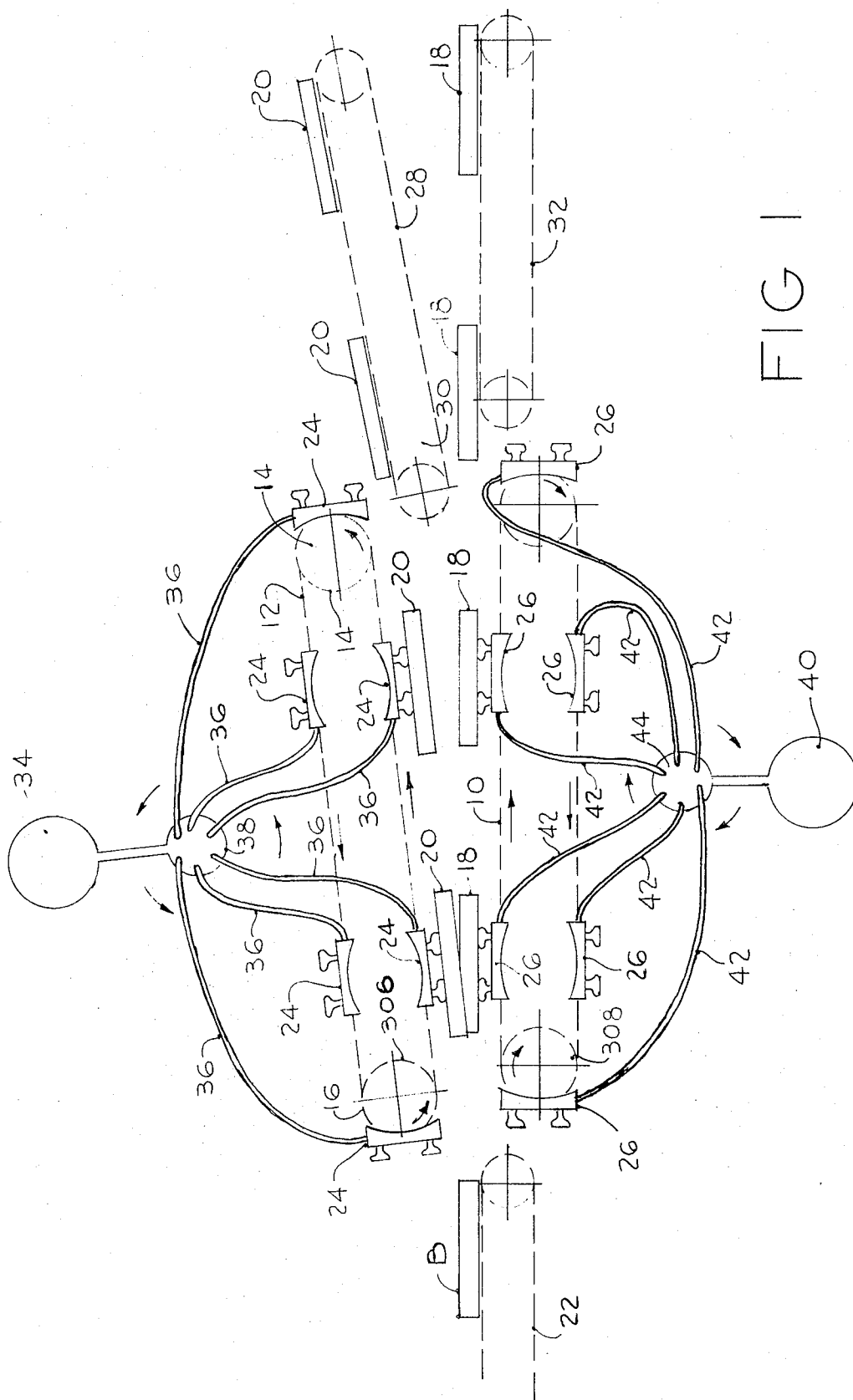
[57] **ABSTRACT**

A box lid removing apparatus is herein described including upper and lower chain link, endless conveyors. A plurality of box lid grabbing suction members are

mounted on the upper conveyor and a plurality of box base grabbing suction elements are mounted on the lower conveyor. The conveyors are arranged to convey a lidded box along a generally horizontal path. The upper conveyor may be arranged in the VERTICAL plane to diverge from the lower conveyor so that a box lid, held by a suction element on the upper conveyor, is removed from the box base as the box and lid are conveyed along the horizontal path defined between the two conveyors.

In one feature of the invention, flexible conduits connect the suction elements with a source of vacuum through a rotary sequencing valve. One such valve may be associated with the upper conveyor and may be positioned above and generally midway between the opposite ends of the horizontal extension of the upper conveyor. The rotary sequencing valve associated with the lower conveyor may be disposed below and generally midway between the opposite ends of the horizontal extension of the lower conveyor. The conveyors may be supported, from a front portion of the overall assembly, in a cantilevered fashion.

4 Claims, 6 Drawing Figures



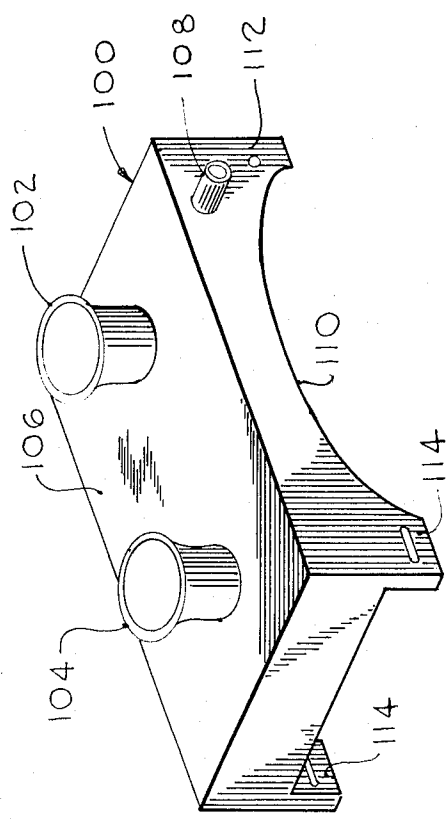


FIG 2

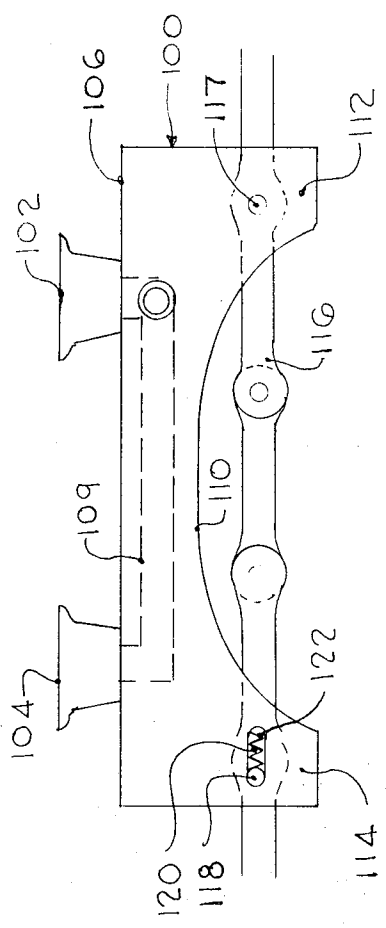
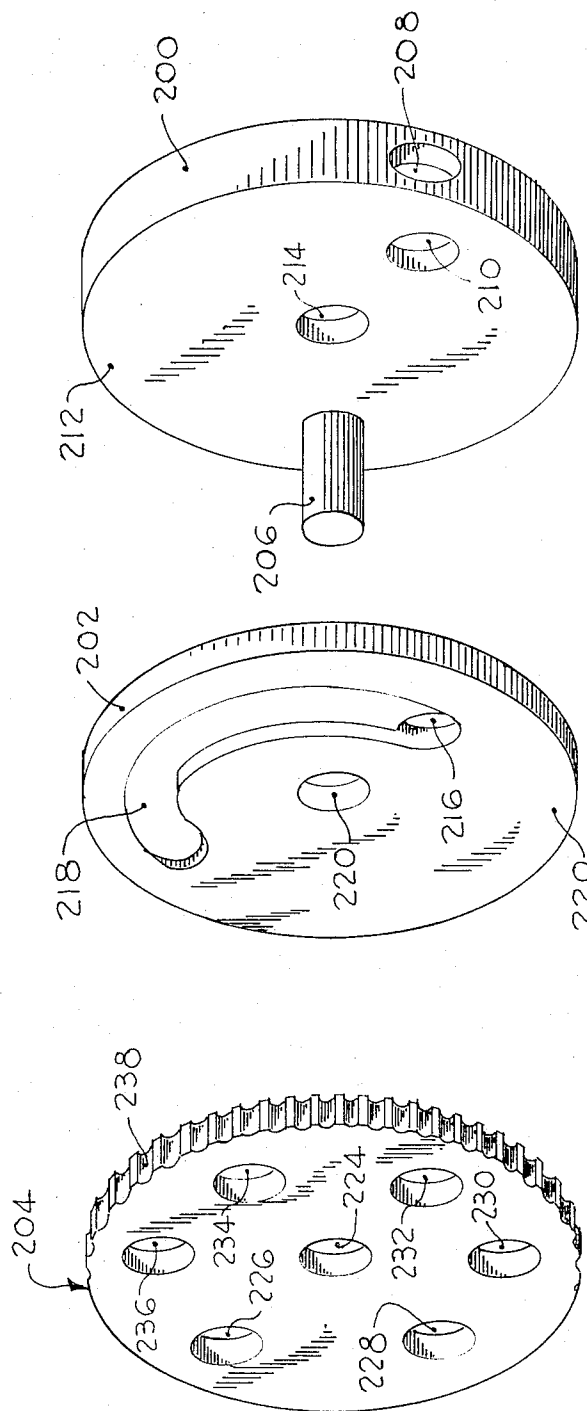


FIG 3



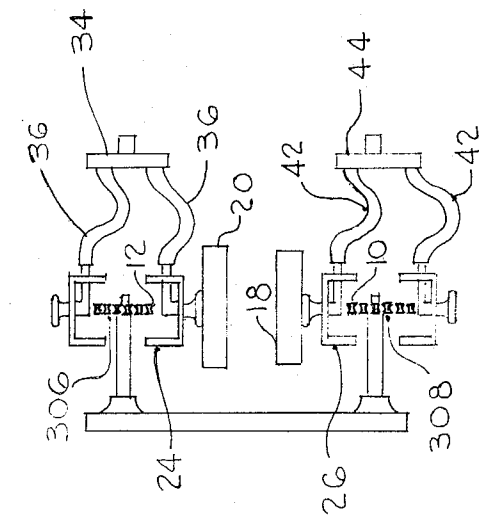


FIG 5

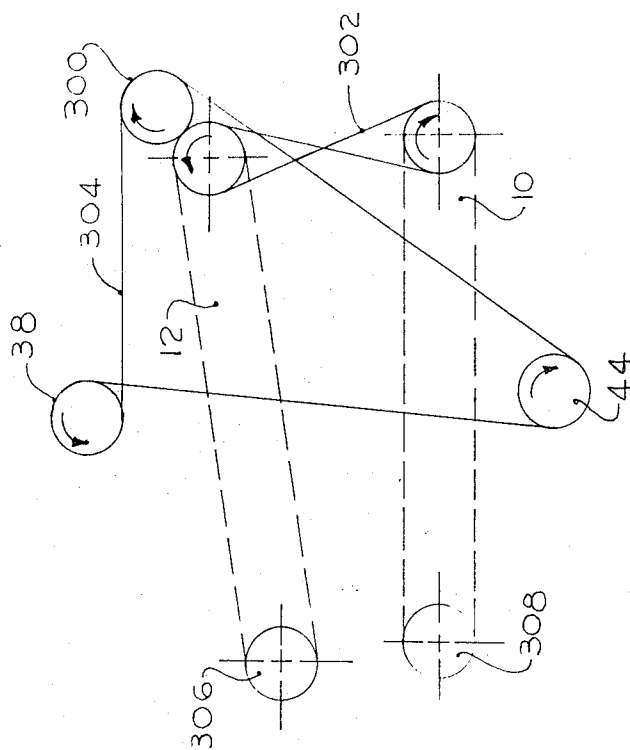


FIG 6

BOX LID REMOVING APPARATUS**BACKGROUND OF THE INVENTION**

The present invention relates to box opening apparatus and, more particularly, relates to conveyORIZED equipment for removing box lids from candy boxes, or the like.

Over the years, much attention has been directed to the development of assembly line methods and apparatus for packaging and opening containers.

In some industries, the boxes which are used to package manufactured goods, such as chocolate candies, are provided to the manufacturer as closed empty boxes. Accordingly, in order to fill the boxes with the manufactured goods, it is necessary to remove each lid from each box, to fill the box and then to re-lid the box.

For some time now, efforts have been made to devise a simple, conveyORIZED apparatus for removing the lid of each box, prior to the filling of the box with the appropriate manufactured goods. Existing apparatus generally include reciprocating parts, requiring an undesirably large working area. These machines are expensive and, due to the reciprocating parts, require an undesirable amount of maintenance.

It would therefore be advantageous, if a conveyORIZED box lid removing apparatus were provided which is simpler and less expensive to install and operate than existing box lid removers.

OBJECT AND SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a box lid removing apparatus which solves many of the problems confronting the industry today.

It is another object of the present invention to provide a box lid removing apparatus which is less complicated than existing such apparatus.

It is still another object of the present invention to provide a box lid removing apparatus which is less expensive than existing box lid removers.

It is yet another object of the present invention to provide a box lid removing apparatus which comprises a minimum of parts so as to facilitate manufacture.

It is yet a further object of the present invention to provide a box lid removing apparatus which is of such a configuration as to facilitate the maintenance thereof.

It is still a further object of the present invention to provide a conveyORIZED box lid removing apparatus which incorporates a mechanical synchronism of parts so as to insure the proper operation thereof.

It is yet a further object of the present invention to provide a conveyORIZED box lid removing apparatus which may be installed within existing conveyor assemblies of manufacturing plants.

It is still yet a further object of the present invention to provide a box lid removing apparatus which utilizes vacuum, but which requires a minimum of vacuum producing equipment.

It is a major object of the present invention to provide an improved conveyORIZED apparatus for removing box lids from boxes, prior to the filling of the boxes with articles of manufacturers, such as chocolate candies.

At least some of the above cited objects are achieved by the provision of apparatus including a plurality of box lid grabbing elements and a plurality of box base grabbing elements.

An assembly is provided for moving the box lid grabbing elements and the box base grabbing elements, in synchronism, so that one box lid grabbing element and one box base grabbing element generally simultaneously engage a lidded box and convey the lid and box along a path. Each of the lid and box base are positively held until released by the grabbing elements. The assembly is operable to move the lid grabbing elements and the box grabbing elements slightly divergently so the assembly conveys the lid and box along the path. Accordingly, the lid is removed from the box as the lid and box are conveyed along such path.

BRIEF DESCRIPTION OF THE DRAWINGS

While the invention is particularly pointed out and distinctly claimed in a concluding portion of the specification, a preferred embodiment is set forth in the following detailed description which may be best understood when read in connection with the accompanying drawings in which:

FIG. 1 is a schematic view of the preferred embodiment, according to the present invention;

FIG. 2 is a perspective view of a grabbing element according to the present invention;

FIG. 3 is a side elevation view of the grabbing element shown in FIG. 2;

FIG. 4 is an exploded view of a rotary sequencing valve utilized in the overall assembly set forth in FIG. 1;

FIG. 5 is a schematic view showing a preferred drive system for operating the conveyORIZED system set forth in FIG. 1;

FIG. 6 is a schematic end elevation of the construction shown in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, in which like numerals are used to indicate like parts throughout the various views thereof, FIG. 1 shows an overall assembly according to the present invention.

A lower endless chain link conveyor 10, and an upper endless chain link conveyor 12 may be provided.

The upper conveyor 12 may be mounted generally above and over the lower conveyor 10, so as to be vertically aligned therewith. However, the down-stream end 14 of the upper conveyor 12 may be positioned higher than the up-stream end 16, thereof, so that the conveyors 10 and 12 diverge, in the vertical plane, toward the down-stream portions thereof.

It will be noted, that the upper conveyor 12 moves in a counterclockwise direction; whereas, the lower conveyor 10 moves in a clockwise direction. Accordingly, objects engaged simultaneously, by portions of the two conveyors, will be moved down-stream from left to right, when the assembly is positioned as shown in FIG. 1.

Box B, comprising a box base 18 and a box lid 20 may be conveyed to the lid removing apparatus by a feed conveyor 22. Of course, a pusher arm or any form of conveying apparatus may be used to satisfy the function of the conveyor 22. Nevertheless, the boxes coming in on the feed conveyor 22 are preferably spaced to be properly engaged by box lid grabbing elements 24 and box base grabbing elements 26.

As a box B is disposed between a box lid grabbing element 24 and a box base grabbing element 26, the con-

veyors 10 and 12 cause the elements to engage the upper and lower surfaces of the box, at a point which is preferably somewhat forward of the center of the longitudinal extension of the box. When a box is so engaged, forward of its midpoint, the rear portion of the box has a tendency to rotate downwardly to facilitate the lid removing operation.

As will be noted, from a perusal of FIG. 1; as the elements 24 and 26 move the box along the horizontal path defined generally between the lower and upper conveyors 10 and 12, the divergent posture of the upper conveyor causes the lid portions 20 to be separated from the base portions 18, as the box is moved along such path.

A lid receiving conveyor 28 may be provided to receive the lids 20 as they reach the down-stream end 14 of the upper conveyor 12. The receiving end 30 of the lid receiving conveyor 28 is preferably disposed above the path of the box base portions 18, as the base portions are conveyed to another conveyor, which may be identified as a box base receiving conveyor 32.

Accordingly, the box lids 20; are engaged at the upstream end of the upper conveyor 12; are lifted from the box base, as the box moves along the overall conveyor path; and are deposited on the lid removal conveyor 28, upon the lid reaching the down-stream end 14 of the upper conveyor 12.

Similarly, the box bases 18 may be conveyed to the box base receiving conveyor 32, which then presents the box bases for filling with candy, or the like, before each filled box base is then re-lidded with one of the lids 20.

The grabbing action of the box lid grabbing elements 24 and the box base grabbing element 26 is provided by a vacuum system, comprising a plurality of flexible conduits connecting each of the grabbing elements with a source of vacuum, through a rotary sequencing valve.

Accordingly, the box lid grabbing elements 24 are connected with a source of vacuum 34 by flexible conduits 36, through a rotary sequencing valve 38.

In a similar manner, the box base grabbing elements 26 may be connected with a source of vacuum 40 by flexible conduits 42, through a rotary sequencing valve 44.

In operation, the rotary sequencing valves 38 and 44 are mechanically programmed to communicate suction to a box lid grabbing element 24 and a box base grabbing element 26, engaging a box at the upstream end of the conveyor assembly, upon the grabbing elements 24 and 26 engaging the box. Suction is applied to the elements 24 and 26, while the elements convey the box base and box lid along the conveyor path. When the elements 24 and 26 have reached the down-stream end of the conveyORIZED path, the valves 38 and 44 operate to release the vacuum, and the lid 20 is permitted to fall onto the lid removing conveyor 28. Similarly, the box base 18 is permitted to move onto the box base removal conveyor 32, for the subsequent filling thereof before relidding.

THE GRABBING ELEMENT

Referring now to FIGS. 2 and 3, a typical box lid or box base grabbing element is shown.

The element, in the preferred form, may comprise a generally block like platen member 100 having suction

cups 102 and 104 operatively mounted on an upper face surface 106 thereof.

The suction cups 102 and 104 may be connected by an associated flexible conduit 36 or 42, to a source of vacuum, through a ducting system 109 formed within the member 100. The ducting 109 may extend between each of the vacuum suction cups 102 and 104, and may then extend outwardly through the side of the member 100, in the form of a rigid nipple 108. As will be noted, the suction cups 102 and 104 are pressure communicated with each other through the ducting 109. Accordingly, a suction applied to the nipple 108 is effective to apply suction to both the cups 102 and 104.

A lower portion 110 of the platen member 100 may be formed to define an arcuate surface extending generally along the longitudinal extension of the platen to define two ears 112 and 114 on each end thereof. Means may be provided in the two ears, 112 and 114, for securing the platen 100 to the chain 116 of the endless conveyors 10 and 12.

Accordingly, pin 117 may be extended transversely through the chain 116, as an integral part thereof, and into the ears 112 of the overall platen 100, while pin 118 may be extended through the chain 116, as an integral part thereof, to engage within slot 120 formed in the ears 114 of the platen 100.

In this manner, the connection of the platen 100 with the chain, through the pin 117, is linearly fixed; whereas, the connection of the platen 100 with the chain 116 through pin 118 is linearly yieldable, within the limits of the slot 120. A spring biasing means 122 may be disposed longitudinally within the slot 120 to urge the pin 118 away from the pin 116 so that, as the chain 116 approaches a sprocket at either end of the conveyor, the distance between the pins 117 and 118 may be automatically adjusted to accommodate the new path configuration, by the yieldable nature of the connection of the pin 118 within the slot 120.

It should be noted, from FIG. 6 that the axles for the sprockets supporting the conveyors 10 and 12 should be cantilever supported from the front of the assembly, so as to leave the rear portion of the assembly free for the rotational movement of the flexible conduits 36 and 42.

THE ROTARY SEQUENCING VALVES

It has been found that, when the rotary sequencing valve 38 is disposed above and generally midway between the ends of the upper conveyor 12 and at one side of the assembly; and when the rotary sequencing valve 44 is disposed beneath and generally midway between the ends of the lower conveyor 10 and at the rear side of the assembly; no tanglement of the flexible conduits 36 and 42 occurs.

Of course, the motion of the rotary sequencing valves and of the grabbing elements 24 and 26 must be synchronized to prevent twisting of the flexible conduits. This synchronizing will be explained in detail, in connection with FIG. 5.

Referring now to FIG. 4, a simplified structure of a rotary sequencing valve is shown in exploded view.

Essentially, the valve comprises a valve body 200, a valve port plate 202 and valve rotor 204. A shaft 206 may be provided for rotatably mounting the valve rotor 204 on the relatively stationary valve body 200 and valve port plate 202.

The valve body 200 may be formed with a side inlet 208 for communication with a source of vacuum.

The inlet 208, in turn, may be communicated with an opening 210 formed to extend axially through a face portion 212 of the valve body 200. A central aperture 214 may be provided for fixedly mounting the valve rotor shaft 206.

The valve port plate 202 may be formed with an inlet opening 216, which is alignable with the opening 210 of the valve body 200, for communication with a source of vacuum connected with the inlet 208 of the valve body 200. An arcuate groove 218 may be formed in a face portion 220 of the valve port plate so as to provide an arcuate area of available vacuum, when the inlet 216 is communicated with a source of vacuum.

Of course, a central aperture 220 may be formed to permit the valve rotor shaft 206 to extend through the valve port plate and into the valve rotor 204. The valve body 200 and valve port plate 202 are preferably fixed, with the openings 210 and 216 of the body and port plate, respectively, in axial alignment.

The valve rotor 204 may be formed with a central aperture 224 to receive the shaft 206, for the rotatable mounting of the rotor. A plurality of openings 226, 228, 230, 232, 234 and 236 may be formed axially of the valve rotor, in spaced relationship on radials generating from the central aperture 224.

It will be noted, that when the valve rotor 204 is mounted on the shaft 206, projecting through the valve port plate 202, each opening 226 through 236 communicates with the arcuate area 218 of the valve port plate for approximately 125° of a 360° revolution. Accordingly, it is only during that 125° portion of a full revolution that each opening 226 through 236 is operable to communicate vacuum to a flexible conduit, operatively connected with that opening, 226 through 236.

Accordingly, the rotary sequencing valve may be calibrated so that a vacuum is communicated through the flexible conduits 36 and 42 to the suction elements 24 and 26, respectively, only during that portion of conveyorized travel extending from the upstream portion to the down-stream portion of the overall conveyor system.

Through such an arrangement, suction would be applied to the box B when it is initially impinged upon by two grabbing elements, 24 and 26, and would be released when the lid reaches a down-stream portion of the conveyor 12, just above the lid receiving conveyor 28. Likewise, when the box base gripping elements 26 arrive at the downstream portion of the conveyor 10, adjacent the box base receiving conveyor 32, the associated suction may be released so that the box base may be conveyed away from the lid removing assembly in order to fill the box base with articles of manufacturer, such as chocolate candies. However, since the box lid 20 is removed from the box base 18 well in advance of reaching the downstream end of the conveyor 10; the rotary valve 44 may be programmed to release the suction to element 26 before suction to element 24 has been released.

SYNCHRONIZING SYSTEM

It will be noted, that the valve rotor, shown in FIG. 4, is provided with a sprocketed peripheral edge 238. Of course, a sprocket may be mounted over a rotor plate, having a smooth periphery, by means of an interference fit, or the like. Nevertheless, it is preferred that

the valve rotor 204 be directly driven by a chain drive which may be best understood by reference to FIG. 5.

Referring to FIG. 5, a schematic view is shown of the preferred driving arrangement according to the present invention.

A drive sprocket 300 may be provided, to drive the upper conveyor 12 which, in turn, may be directly, mechanically connected with the lower conveyor 10, by means of a chain drive 302. Through such an arrangement, the upper conveyor 12 and the lower conveyor 10 may be precisely, mechanically synchronized.

It has been found that it is advisable to have an upper conveyor chain which is somewhat shorter than the lower chain 10 in order to impart a retarding action to the box lid, with respect to the box base. By this arrangement, as the lid is separated from the box base; it not only rotates, because it is being held forwardly of the mid-point thereof, but is also retarded rearwardly so as to preclude engagement of the trailing edge of the box lid with the trailing edge of the box base, as the box is conveyed along the conveyor path.

In its preferred form, the apparatus according to present invention includes an upper conveyor 12, having 6 suction platens, and a lower conveyor 10, having 6 suction platens and an additional one-half link of chain between each platen compared with the normal number of links between each platen of the upper conveyor 12. It has been found that such a small difference, as three links, has imparted sufficient retarding action to preclude interference between the trailing edges of the box lids 20 and box bases 18, as the boxes are conveyed along the lid removal conveying system.

The drive sprocket 300 may be provided with a drive chain 304 for driving the sprockets of the upper rotary sequencing valve 38 and lower rotary sequencing valve 44.

Idler sprockets 306 and 308 may be provided at the upstream end of the conveyor system and the upper idler 306 may be vertically adjustable to accommodate various box sizes, and yet serve to assure movement of the box lid grabbing element 24 into engagement with the lid of each box as it moves downward about the idler sprocket 306.

It can thus be seen that an improved apparatus for removing box lids from boxes has been herein provided which solves many of the problems confronting industry today.

The apparatus, according to present invention, is more simple and less expensive than similar such apparatus and incorporates such a few number of parts as to facilitate the manufacturing and the maintenance thereof. Since the suction cycle may be controlled to within very strict limits, extensive auxiliary equipment for producing vacuum is not required. Since the mode of operation of the apparatus according to present invention is primarily of a rotary nature, the life expectancy of such a piece of equipment is markedly longer than that of a piece of reciprocating machinery. The apparatus according to present invention is uniquely adaptable for installation in existing conveyor assemblies and may be installed with a minimum of expense.

SCOPE OF THE INVENTION

While what has been described herein, is the preferred embodiment of the present invention, it is, of course, understood that various modifications and changes may be made therein without departing from

the invention. It is therefore intended to cover in the following claims all such modifications and changes as may fall within the true spirit and scope of the present invention.

What I claim is:

1. Apparatus for removing lids from boxes comprising:

two vertically aligned endless conveyors supported for movement along divergent paths from receiving points to discharge points;

platens carried by said conveyors and provided with suction cups;

means located adjacent the receiving points of said conveyors for successively moving boxes having lids thereon into positions wherein the suction cups on the platens carried by one of said conveyors will engage the bases of said boxes and the suction cups on the platens carried by the other of said conveyors will engage the lids of said boxes;

means for moving said conveyors along said diverging paths from said receiving points to said discharge points to separate the lids from the bases;

receiving means located adjacent the discharge points of said conveyors for receiving the separated lids and boxes from said conveyors;

a rotary sequencing valve associated with each of said conveyors having flexible tubes extending therefrom to the platens and suction cups carried by the conveyor with which it is associated;

a source of vacuum connected to each of said valves, and

means for rotating said sequencing valves in timed

relation to the movement of said conveyors to apply suction to the vacuum cups upon contact thereof with the bases and lids of the boxes at the receiving points of said conveyors and to terminate the application of suction to the platens and vacuum cups upon movement thereof to the discharge points of said conveyors to release the bases and lids of the boxes for movement to said receiving means.

2. Apparatus according to claim 1, wherein: said conveyors comprise two link chain, endless conveyors; and each said platen is secured to one of said conveyors by a linearly fixed, although pivotable, connection at one end of the platen and a linearly yieldable, pivotable, connection at the other end of said platen.

3. Apparatus according to claim 2, wherein: said fixed connection comprises a pin engaging both said chain and said platen;

said yieldable connection comprises a pin engaging said chain and projecting through a slot, formed on said platen to extend generally along the direction of chain movement; and

spring bias means is disposed in said slot to yieldably urge said second pin away from said first pin.

4. Apparatus according to claim 3, wherein: a portion of said platen, adjacent said chain and away from said face portion, is curved inwardly toward said face portion to define an arcuate cutout extending generally along said chain.

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