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(54) METHOD AND APPARATUS FOR ORIENTING A PLURALITY OF CONTAINERS IN PREDETERMINED ARRANGEMENT IN A PACKAGE

(71) We, ILLINOIS TOOL WORKS INC., a corporation organized under the laws of the State of Delaware, United States of America, of 8501 West Higgins Road, Chicago, Illinois 60631, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

While it is to be understood that the present invention may be applied to a variety of containers, it is particularly useful in relation to packages of beverage cans. As is known, containers such as cans have long been assembled in packages containing two or more such containers retained together by a carrier. A variety of carrier structures have been proposed, and certain of these comprise members formed from plastics sheet material having a plurality of apertures therein for receiving and frictionally retaining the containers. In general, these heretofore proposed carriers engage end portions of the containers so that the remainder of each container is exposed. It is frequently desirable, for appearance or other reasons, to have the containers in such packages oriented or arranged in a predetermined manner.

This invention includes methods of orienting a plurality of containers assembled as a package with a carrier, each container being rotatable relatively to the carrier against frictional resistance exerted by the carrier, each container having a feature by which its rotational position can be identified, and each container being initially in random rotational position, the method comprising mechanically rotating the containers relatively to the carrier and ceasing the rotation of each container when it is in a respective predetermined position relative to the carrier.

The invention also includes apparatus for

carrying out the methods.

The accompanying drawings serve to illustrate the invention. In these drawings:—

Figure 1 is a fragmentary plan view of a portion of one apparatus according to the present invention;

Figure 2 is a fragmentary sectional view taken generally along the line 2—2 in Figure 1;

Figure 3 is a fragmentary partial sectional view taken generally along the line 3—3 in Figure 1;

Figure 4 is a fragmentary view taken generally along the line 4—4 in Figure 2;

Figure 5 is a fragmentary sectional view taken generally along the line 5—5 in Figure 1;

Figure 6 is an enlarged fragmentary partial sectional view taken generally along the line 6—6 in Figure 1;

Figure 7 is a perspective view showing a package after passing through the apparatus; and

Figure 8 is a simplified and partially schematic side elevational view of the apparatus.

The apparatus, shown in Figure 8, is designed to handle packages 12, as shown best in Figure 7. Each package 12 comprises six cans 14 retained in assembled side by side parallel relationship by a carrier 16.

The cans 14 are of known construction and, as shown best in Figures 6 and 7, each can has a radially projecting rim or bead 18 which joins its side wall with its upper end. The carrier 16 is of a type which includes means frictionally engaging peripheral surfaces of each can, preferably under the rims thereof. In the embodiment shown, the carrier is constructed substantially in the manner disclosed in British Patent No. 914202. Reference is made to this patent for a complete description of the carrier. It suffices to state herein that

[Price 25p]

the carrier 16 is formed from a sheet of plastics material and has apertures for receiving each of the cans. These apertures are defined by annular marginal portions 24 which snugly embrace and frictionally engage side surfaces of the cans beneath the rims, as shown best in Figure 6. The carrier 16 may be provided with finger holes 26 or other suitable handle means.

The cans have surface ornamentation such as labels 28. It is desired that the cans be oriented so that a particular element of the ornamentation faces in a predetermined direction. For example, it may be desired to have a particular part of the label 28 face outwards so that the overall appearance of the package will be neat and pleasing and so that a customer or user will be able to see clearly an advertising message, trademark or the like.

The apparatus 10 serves to turn and properly position the cans after the articles are assembled in the package with the carrier 16. As indicated in Figure 8, the apparatus 10 includes a first continuously driven conveyor 30 for receiving the series of packages 12 from a preceding conveyor apparatus which functions to apply the carriers to the containers. The carrier applying apparatus may be of known construction and need not be shown or described herein. The conveyor 30 has a plurality of pusher bars 31 spaced in accordance with the length of each package 12, for engaging and pushing the packages. Drive and control means including a motor, suitable drive gears, chains and the like of known construction, not shown, are provided for continuously driving the conveyor for advancing successive packages 12, usually in substantially abutting relationship, along a path of travel to, and in timed relationship with, a mechanism 32 which serves to turn and orient the cans as will be described in detail below. The packages with the properly oriented cans are then pushed from the mechanism 32 onto a discharge conveyor 34 which may be in the form of an endless continuously driven belt or any other suitable structure.

The mechanism 32 is shown in detail in Figures 1 to 5, and comprises a pair of guide rods 36 and 38 disposed in general alignment with the conveyors 30 and 34 and extending from a first station designated by the numeral 40 and, for convenience, identified as the clamping station, to a second station designated by the numeral 42 and identified as the orienting station (see Figures 1 and 8). Can support bars 43 and 45 are fixedly mounted between the guide rods for slidably receiving the articles in a package pushed from the conveyor 30 into the clamping station 40. In addition, an upright separator plate 48 is centrally fixedly mounted between the support bars for extending between the rows of cans in each package, as shown in Figures 1, 5 and 6, for maintaining the cans in a predetermined

separated and substantially parallel relationship. As shown in Figure 1, the support bars 43 and 45 terminate short of the orienting station 42, while the separator plate 48 extends the length of both the clamping station and the orienting station.

As previously indicated, the packages 12 are continuously advanced along the conveyor 30 towards the station 40. The orienting mechanism is provided with clamping means for ensuring proper positioning of the cans in the package at the station 40, and for accelerating this package to the station 42 sufficiently rapidly to separate this package from the next succeeding package 12 on the conveyor 30. The rapid acceleration of the package from the station 40 to the station 42 is sufficient to provide a time interval during which the cans may be turned and oriented at the station 42 while the next package is being advanced from the conveyor 30 to the station 40.

The clamping means for shifting the package from the station 40 to the station 42 comprises oppositely disposed clamp members 44 and 46, respectively having pocket portions 48 and 50 for engaging the cans at the opposite sides of the package, and shoulder elements 51 and 53 for engaging beneath the package and supporting it during movement to the station 42. The clamp members are formed with tubular portions 52 and 54 respectively slidably disposed on the guide rods 36 and 38.

In order to slide the clamp members along the guide rods 36 and 38 to and from the stations 40 and 42, cam and crank discs 56 and 58 are provided. These discs are respectively secured to upstanding shafts 60 and 62, which, as shown in Figure 2, have bevel gears 64 and 66 fixed to lower ends thereof and driven by complementary gears 68 and 70 fixed on a common drive shaft 72. A sprocket 74 is also fixed on the drive shaft and is adapted to be driven by a suitable motor 76 as indicated in simplified form in Figure 8.

The combined cam and crank discs 56 and 58 respectively have crank rollers 78 and 80 mounted adjacent to peripheries thereof and extending into elongated slots 82 and 84 in crank arms 86 and 88 respectively. These crank arms have outer ends supported by pivot pins 90 and 92 suitably mounted at fixed positions on the frame of the apparatus. Opposite ends of the crank arms are pivotally attached by swivel coupling means 94 and 96 to connector rods 98 and 100 which have their opposite ends attached by swivel means 102 and 104 to ears 106 and 108 respectively projecting from the clamp members 44 and 46. With this arrangement it is seen that, upon rotation of the discs 56 and 58, the clamp members will be reciprocated between the stations 40 and 42. The construction of these cam and crank elements is such that the drive therefor is incorporated in the previously men-

tioned drive and control means for the conveyor 30, so that when the clamp members 44 and 46 first engage the articles at the station 40 they are moving ahead at substantially the same lineal speed as the conveyor 30, whereupon the clamp members are accelerated to separate the engaged package from the next package.

As shown in Figure 5, levers 114 and 116 are pivotally mounted on pivot pins 118 and 120. Ends of these levers opposite from the pivot pins carry cam followers 122 and 124 respectively.

As is shown in Figure 5, the clamp members 44 and 46 are adapted to be pivoted to broken line positions for disengagement from the articles when the clamp members are to be moved back from the station 42 towards the station 40.

The clamp members are normally biased to their broken line positions by a compression spring 126 which extends between the members 114 and 116 as shown in Figures 1 and 5. The members 114 and 116, through the cam followers 122 and 124 respectively, engage cam tracks 128 and 130 extending longitudinally along substantially the length of the clamp members 44 and 46 so as to transmit the force of the spring 126 to bias the clamp members towards the broken line position shown in Figure 5. In order to pivot the clamp members against the action of the spring 126, the cam and crank discs 56 and 58 are respectively provided with peripheral cam surfaces 132 and 134 which engage cam followers 136 and 138 rotatably mounted on pivot pins 144 and 146 adjacent to the clamp members.

The levers 140 and 142 also carry cam followers 148 and 150 which engage cam tracks 152 and 154 extending longitudinally for substantially the full length of the clamp members 44 and 46. With this arrangement, rotation of the discs 56 and 58 causes raised lobe portions of the cam surfaces 132 and 134 thereon periodically to pivot the levers 140 and 142 towards their respective clamp members so that the rollers 148 and 150 push the clamp members against the action of the spring 126 from the broken line position to the solid line position shown in Figure 5. Of course, when the cam followers 136 and 138 ride down on the lower portions of the peripheral surfaces of the discs 56 and 58, the pivotal movement of the clamp members is reversed.

The construction of the cam surfaces on the discs 56 and 58, and of the cam tracks 128, 130, 152 and 154 of the clamp members, is such that, as the clamp members reach the end of their return movement from the station 42 towards the station 40, the clamp members are pivoted towards their closed position for gripping the cans therebetween. Then, as the clamp members are advanced for accelerating the package towards the station

42, the continued engagement between the cam tracks 152 and 154 on the outer sides of the clamp devices and their associated cam followers maintains the clamp devices in the can-engaging position. When the package is positioned at the station 42, continued rotation of the discs 56 and 58 permits the clamp members to pivot towards their open position. At the same time the clamp members are started back towards the station 40, and the cycle is repeated.

As shown in Figures 2 and 8, a motor unit 156 is mounted at the station 42 above the path of travel of the packages 12. This unit comprises an electric motor 158 coupled with a speed reducer and gear train 160 having a plurality of drive shafts 162. The drive shafts 162 correspond in number and arrangement with the cans in a package 12.

A drive member 164 is secured to each of the shafts 162 and has a friction end surface shaped for engagement with an end of a respective can in the package. During operation of the apparatus, the motor 158 is continuously energized, so that the drive members 164 are continuously driven. The cans in a package at the station 42 are pressed against the drive members 164 by means described in detail below, so as to accomplish turning of the cans to the desired arrangement.

The means complementing the drive unit 156 for accomplishing rotation of the articles is shown in Figures 2 to 4, and comprises a plurality of lifter members 166, respectively in axial alignment with the drive members 164. Each member 166 is rotatably supported by a bearing 168 on an upper end portion of a spindle 170 which is axially slidably supported in a tubular sleeve 172 mounted in a lifter frame 174. The lifter frame is adapted to be raised for simultaneously engaging the lifter members 166 against the cans and clamping the cans against the driving members 164 for turning the cans. Each spindle 170 is adapted to be individually lowered to disengage the can associated therewith from the driving head when that can has been turned to the desired position.

In order to raise and lower the lifter frame 174, a lifter cam 176 having the desired peripheral configuration is mounted on and rotated with the drive shaft 72. The cam engages a follower 178 mounted on an end portion of a lever 180 pivotally supported at 182 as shown in Figure 3. A connecting rod 184 extends between and is pivotally connected to the lever 180 and the lifting frame 174 by pins 185 and 186 respectively. A compression spring 188 extends between the lever 180 and a fixed frame member 190 of the apparatus for biasing the lever downwards as viewed in Figure 3 and maintaining the follower 178 in engagement with the cam 176. As will be understood, when the cam 176 is rotated for engaging a raised lobe portion thereof with the fol-

lower 178, the lever 180 is pivoted for raising the lifter frame 174 along fixed upstanding guide rods 181 and 183.

As previously indicated, the spindles 170 are supported so that they may be individually axially shifted downwards relatively to the lifter frame 174. As shown in Figure 2, each spindle 170 has a lower end portion extending into a spring cup 192 slidably mounted within the sleeve 172 and housing a compression spring 194. A transverse pin 196 passes through a slot 197 in the spindle 170 and so secures the spindle 170 with respect to the cup 192, and has end portions extending into slots 198 in the sleeve 172 so that the spindle and the spring cup 192 are capable of being moved axially in unison relative to the sleeve 172. Another spring 200 is mounted within the sleeve 172 and bears against the upper end of the cup 192 for biasing the cup and thus the spindle 170 downwards. However, the cup and spindle are normally and releasably maintained in the elevated position shown in Figure 2, with the pin 196 above the lower ends of the slots 198, by means of a latch 202. The latch is pivotally mounted within the lower end of the sleeve 172 by a pin 204, and has an upper end engageable with a cam follower 206 mounted on a pin 208 in a bifurcated lower end portion 210 of the spring cup.

A solenoid 212 is carried by the lifter frame and has a plunger 214 projecting for engagement with the latch 202. The arrangement is such that, when the solenoid is energized, the plunger is extended for rotating the latch in a clockwise direction as viewed in Figure 2, so as to disengage the latch from the roller 206. When this occurs, the spring 200 drives the spindle 170 and the lifter member 166 downwards, so that the can being supported thereby is disengaged from the corresponding drive member 164.

The apparatus is provided with means for sensing the position of the cans and for individually energizing the solenoids 212 when the cans associated therewith have been turned to a desired arrangement. This sensing means comprises photoelectric cells 216 disposed along opposite sides of the article package and respectively aimed at the individual cans in the package for sensing a feature constituted by a particular element of the label 28 on each package. The photoelectric cells are connected by suitable circuitry with a control panel 218 indicated schematically in Figures 1 and 2 which in turn is connected by wires 219 and 221 with the individual solenoids 212. The cells indicated in Figure 2 would in fact all be at the same level.

As previously indicated, each latch 202 is pivoted so as to release a spindle when its associated solenoid 212 is energized. The latches are reset at the completion of the can orienting process when the lifter frame 174

is lowered. More specifically, each latch 202 has a finger 222 projecting into a slot 224 in a fixed reset member 226. The lower end of this slot serves as one stop surface engageable with the finger 222, and the member 226 has another stop surface 228 at the upper end thereof which is engageable with previously mentioned pin 208 which serves to support the roller 206 and also as a reset pin.

The arrangement is such that when the lifter frame 174 is lowered, the outer ends of the pin 208, which project through elongated slots 234 in the sleeve member 172, engage the upper edge 228 of the reset member 226. This stops the spring cup 192 and the spindle 170 against further downward movement, while the lifter frame 174 continues to move downwardly. Thus the spindle is, in effect, raised with respect to the lifter frame back to the relative position shown in Figure 2. At the same time, the finger 222 of the latch 202 engages the bottom of the slot 224 so that the latch is pivoted back into engagement with the roller 206. In the meantime, the solenoid 212 has been deenergized and the structure is now ready to repeat the cycle.

The method of orienting cans in accordance with the present invention is accomplished by this apparatus in the following manner. The packages 12, each comprising six cans and the carrier 16, are arranged in series and conducted along a predetermined path of travel continuously by the conveyor 30. Each successive package 12 is positively, continuously advanced at a predetermined speed by the conveyor 30 to the station 40, where it is engaged by the clamp members and accelerated to the station 42 so as to be separated from the next succeeding package. Then the cans are released by the clamp members and substantially simultaneously engaged by the lifter members 166 which lift the cans and clamp them against the drive members 164. The amount which the lifter frame 174 is raised is slightly greater than necessary to clamp the cans between the members 164 and 166 and, as a result, the spring 194 associated with each of the lifter members is slightly compressed. This arrangement ensures proper clamping of the cans between the members 164 and 166, and enables the apparatus to compensate for slight variations in the length of individual cans.

The driving members 164 are continuously rotated, so that as soon as the cans are engaged therewith, the cans begin to rotate. A reed switch 230 is mounted for cooperative association with a permanent magnet 232 fixed on the lifter cam 176, which switch is electrically connected with the control panel 218 so that the photoelectric cells 216 are not activated for a very short time interval, which may for example be of the order of 0.1 sec. This time delay enables all the cans to start rotating before the photoelectric cells become

effective to sense the predetermined element on the labels. Then, upon activation of the cells, rotation of the cans continues. As this rotation progresses, each cell will individually sense when its associated can reaches the desired orientation, and the respective solenoid will then be energized for permitting the individual lifter member to drop downwards so that the can is declutched from the drive member.

The driving force applied to the cans is sufficient to overcome the frictional resistance to rotation applied by the carrier 16. However, when each can is declutched from its associated drive member, this frictional resistance serves to provide a brake against further rotation and also serves continuously thereafter to hold the can in the desired arrangement. All the cans are rotated sufficiently rapidly so that they are positioned in the desired arrangement prior to the time when the rotating lifter cam 176 permits lowering of the lifter frame 174. When the frame is lowered and the cans are disengaged from all of the driving members, the next can package is advanced by the clamp members and serves to push the oriented package onto the discharge conveyor 34.

WHAT WE CLAIM IS:—

1. A method of orienting a plurality of containers assembled as a package with a carrier, each container being rotatable relatively to the carrier against frictional resistance exerted by the carrier, each container having a feature by which its rotational position can be identified, and each container being initially in random rotational position, the method comprising mechanically rotating the containers relatively to the carrier and ceasing the rotation of each container when it is in a respective predetermined position relative to the carrier.

2. A method according to claim 1, applied to a package in which the containers are disposed in side by side substantially parallel relationship and the carrier frictionally engages sides of the containers.

3. A method according to claim 2, which includes clamping opposite ends of each container between opposed portions of drive means to thereby impart rotation to the container.

4. A method according to any of claims 1 to 3, comprising providing a series of packages each of which includes a plurality of containers assembled with a carrier, successively advancing the packages along a predetermined path of travel to a work station, and performing at the work station the steps of rotating the containers and ceasing the rotation.

5. A method according to claim 4, wherein the packages are advanced along the path of travel in substantially abutting relationship to a position adjacent to the work station, and successive packages are accelerated from that position towards the work station, to separate

them from the remaining packages in the series during the step of rotating the containers.

6. Apparatus for carrying out a method according to claim 1, comprising means for advancing a package to a work station, a plurality of mechanical means at the work station capable of rotatably driving each container relatively to the carrier, and means corresponding to each container at the work station, responsive to the rotational position of the respective container as indicated by the said feature, and connected to cause the respective driving means to cease driving the respective container when the respective container is in the said predetermined position.

7. Apparatus according to claim 6, wherein the driving means comprise pairs of first and second oppositely disposed members for engaging opposite ends of the containers, means for driving all of the first members, and means for relatively axially shifting the first and second members for clamping the containers therebetween so that the containers are driven by the first members.

8. Apparatus according to claim 7, wherein the shifting means comprises a frame carrying all of the second members, means for shifting the frame towards and away from the first members, and individual means supporting each of the second members from the frame for movement between extended and retracted positions with respect to the frame for enabling the second members to be individually retracted for disengaging the containers associated therewith from the driven first members.

9. Apparatus according to claim 8, which includes means for releasably locking the second members in the extended positions, and individual means responsive to the rotational position of each of the containers for actuating the locking means to release each of the second members when the article associated therewith is in the predetermined position.

10. Apparatus according to claim 9, wherein the advancing means comprises a clamping mechanism reciprocally mounted for engaging the containers in a package and advancing the containers simultaneously to a position between the first and second members of the driving means, and means for actuating the clamping mechanism in timed relationship with the driving means.

11. Apparatus according to any of claims 6 to 10, wherein the advancing means includes a first conveyor for advancing a plurality of packages in substantially abutting relationship at a predetermined speed, and a mechanism for successively accelerating the leading package on the first conveyor to separate each leading package from an immediately following package and for positioning each leading package in alignment with the driving means.

12. Apparatus according to claim 11, where-



effective to sense the predetermined element on the labels. Then, upon activation of the cells, rotation of the cans continues. As this rotation progresses, each cell will individually sense when its associated can reaches the desired orientation, and the respective solenoid will then be energized for permitting the individual lifter member to drop downwards so that the can is declutched from the drive member.

The driving force applied to the cans is sufficient to overcome the frictional resistance to rotation applied by the carrier 16. However, when each can is declutched from its associated drive member, this frictional resistance serves to provide a brake against further rotation and also serves continuously thereafter to hold the can in the desired arrangement. All the cans are rotated sufficiently rapidly so that they are positioned in the desired arrangement prior to the time when the rotating lifter cam 176 permits lowering of the lifter frame 174. When the frame is lowered and the cans are disengaged from all of the driving members, the next can package is advanced by the clamp members and serves to push the oriented package onto the discharge conveyor 34.

WHAT WE CLAIM IS:—

1. A method of orienting a plurality of containers assembled as a package with a carrier, each container being rotatable relatively to the carrier against frictional resistance exerted by the carrier, each container having a feature by which its rotational position can be identified, and each container being initially in random rotational position, the method comprising mechanically rotating the containers relatively to the carrier and ceasing the rotation of each container when it is in a respective predetermined position relative to the carrier.

2. A method according to claim 1, applied to a package in which the containers are disposed in side by side substantially parallel relationship and the carrier frictionally engages sides of the containers.

3. A method according to claim 2, which includes clamping opposite ends of each container between opposed portions of drive means to thereby impart rotation to the container.

4. A method according to any of claims 1 to 3, comprising providing a series of packages each of which includes a plurality of containers assembled with a carrier, successively advancing the packages along a predetermined path of travel to a work station, and performing at the work station the steps of rotating the containers and ceasing the rotation.

5. A method according to claim 4, wherein the packages are advanced along the path of travel in substantially abutting relationship to a position adjacent to the work station, and successive packages are accelerated from that position towards the work station, to separate

them from the remaining packages in the series during the step of rotating the containers.

6. Apparatus for carrying out a method according to claim 1, comprising means for advancing a package to a work station, a plurality of mechanical means at the work station capable of rotatably driving each container relatively to the carrier, and means corresponding to each container at the work station, responsive to the rotational position of the respective container as indicated by the said feature, and connected to cause the respective driving means to cease driving the respective container when the respective container is in the said predetermined position.

7. Apparatus according to claim 6, wherein the driving means comprise pairs of first and second oppositely disposed members for engaging opposite ends of the containers, means for driving all of the first members, and means for relatively axially shifting the first and second members for clamping the containers therebetween so that the containers are driven by the first members.

8. Apparatus according to claim 7, wherein the shifting means comprises a frame carrying all of the second members, means for shifting the frame towards and away from the first members, and individual means supporting each of the second members from the frame for movement between extended and retracted positions with respect to the frame for enabling the second members to be individually retracted for disengaging the containers associated therewith from the driven first members.

9. Apparatus according to claim 8, which includes means for releasably locking the second members in the extended positions, and individual means responsive to the rotational position of each of the containers for actuating the locking means to release each of the second members when the article associated therewith is in the predetermined position.

10. Apparatus according to claim 9, wherein the advancing means comprises a clamping mechanism reciprocally mounted for engaging the containers in a package and advancing the containers simultaneously to a position between the first and second members of the driving means, and means for actuating the clamping mechanism in timed relationship with the driving means.

11. Apparatus according to any of claims 6 to 10, wherein the advancing means includes a first conveyor for advancing a plurality of packages in substantially abutting relationship at a predetermined speed, and a mechanism for successively accelerating the leading package on the first conveyor to separate each leading package from an immediately following package and for positioning each leading package in alignment with the driving means.

12. Apparatus according to claim 11, where-

- in the mechanism comprises a reciprocally mounted clamping device including opposing clamp members shiftable between open and closed positions, and means for reciprocating the clamping device and for closing the clamp members during movement of the device in the accelerating direction and for opening the clamp members during reverse movement of the device.
- 5
- 10 13. A method according to claim 1 and sub-

stantially as described with reference to the accompanying drawings.

14. An apparatus according to claim 6 and substantially as described with reference to the accompanying drawings.

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