United States Patent [19]

Kawamura et al.

[11] **3,805,476**

[45] **Apr. 23, 1974**

[54] **METHOD AND APPARATUS FOR ENCASING OF ARTICLES**

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[52] **U.S. Cl.** **53/26,** 53/35, 53/159, 53/160, 53/246, 53/251

[51] **Int. Cl.** **B65b 5/08,** B65b 5/10, B65b 35/44

[58] **Field of Search** 53/159, 160, 166, 244, 53/246, 247, 251, 26, 35

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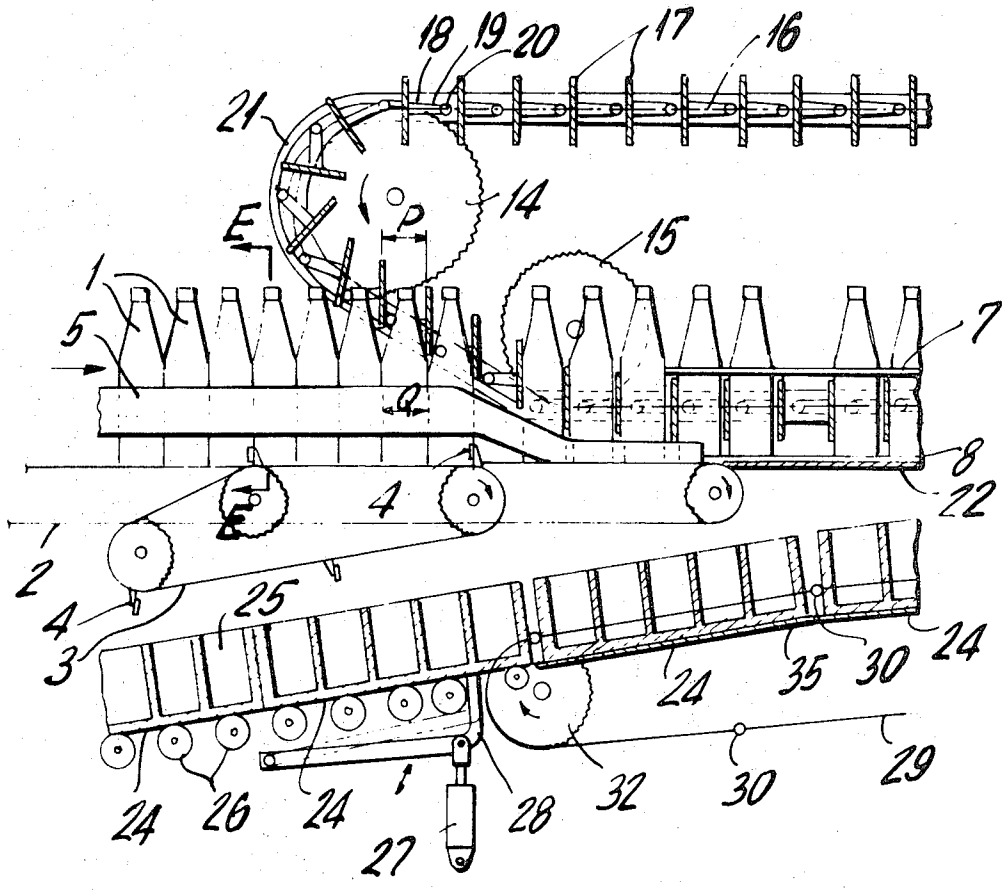
Primary Examiner—Robert L. Spruill
Attorney, Agent, or Firm—McGlew and Tuttle

[57] **ABSTRACT**

A method of loading cases with articles, comprises the steps of transferring the cases, each having therein a predetermined number of article-receiving compartments, along a path beneath an article path, to a discharging station through a space immediately below the terminal end of the article path, segregating the articles on the article transfer path into groups each of which consists of a predetermined number of articles arranged in regular rows and ranks, advancing the articles at a velocity synchronous with the travelling velocity of the cases such that the articles of the rows positioned on lines perpendicular to the article path are spaced apart from each other at the same intervals as are the case compartments, further guiding the articles by tilting them laterally relative to the advancing direction of the articles, and successively dropping the articles from the termination of the article path into the respective compartments in the case travelling just therebelow.

6 Claims, 15 Drawing Figures



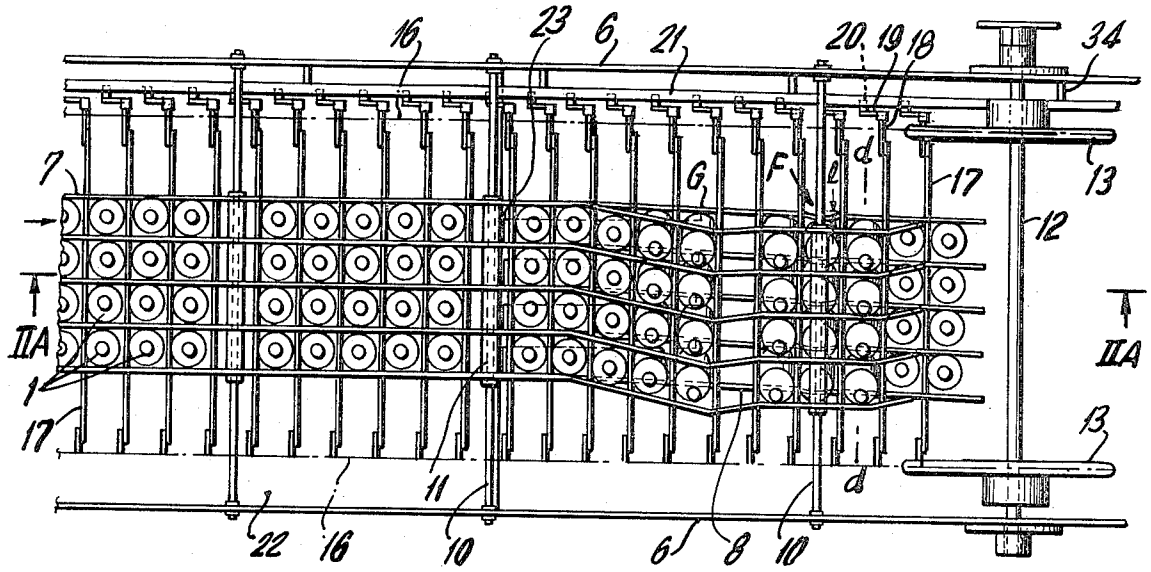

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FIG. 1A

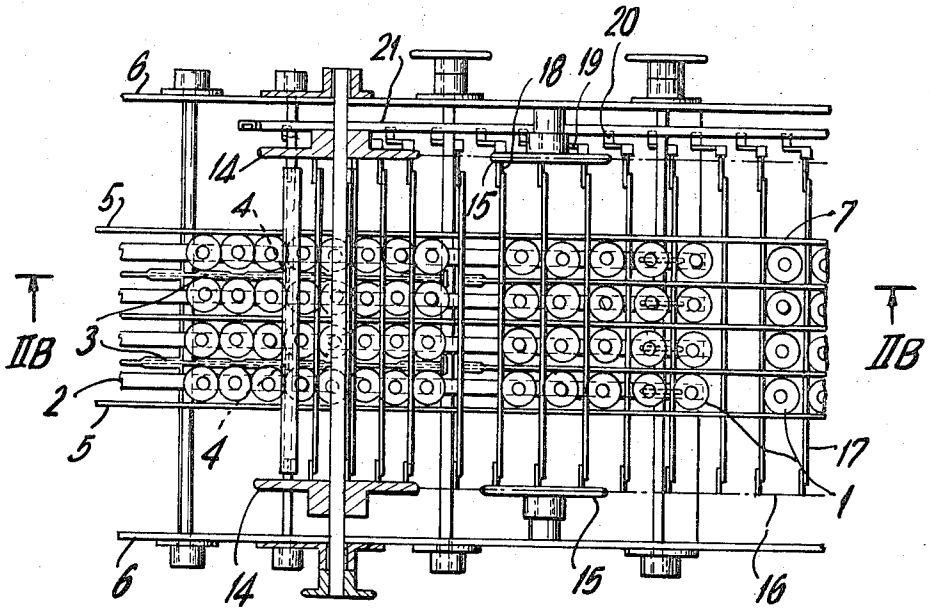
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FIG. 1B

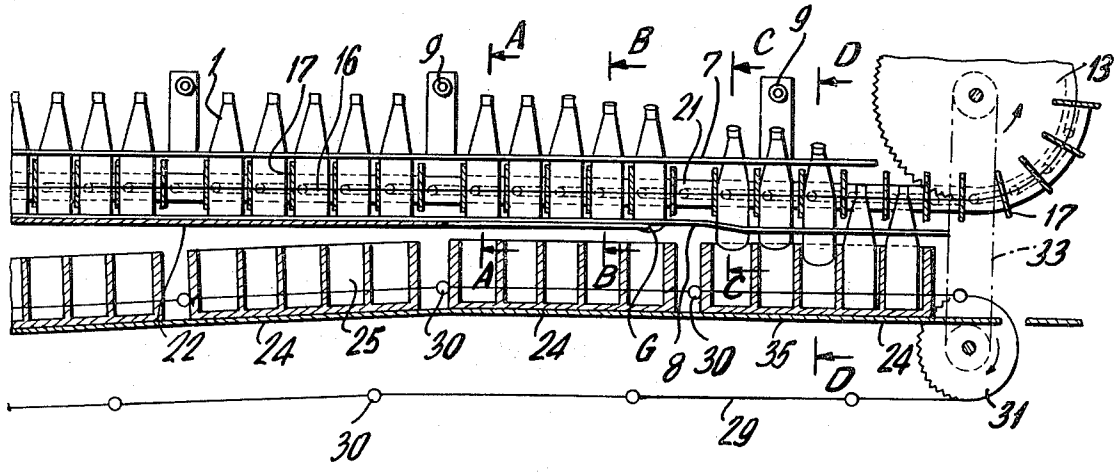
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FIG. 2A

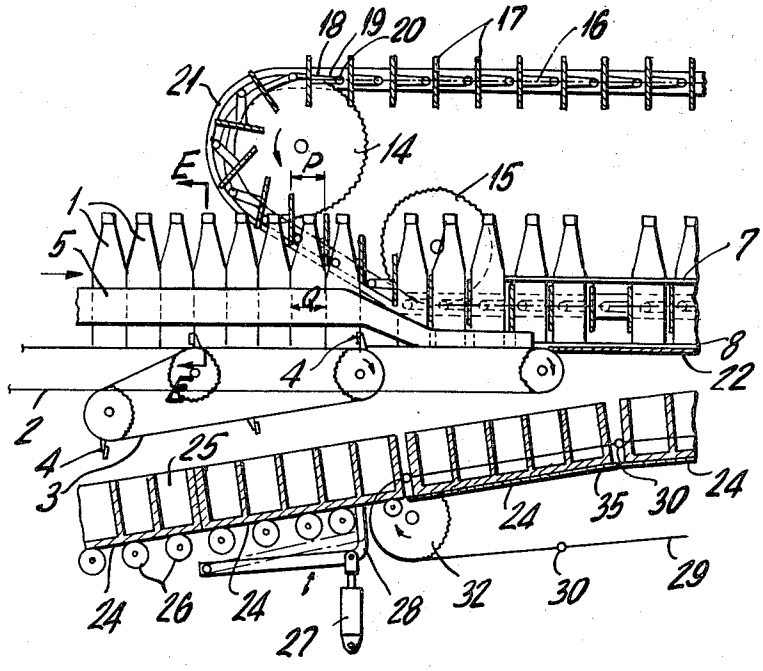
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FIG. 2B

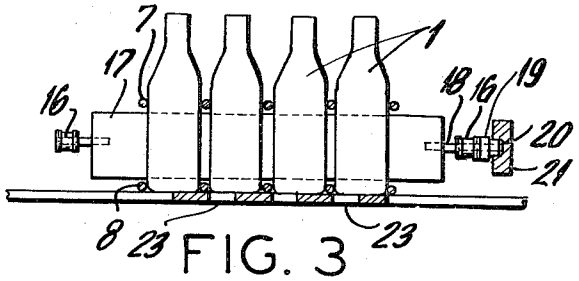

FIG. 3

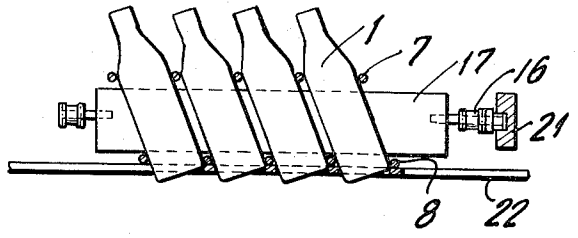

FIG. 4

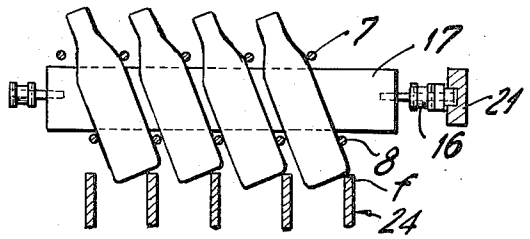

FIG. 5

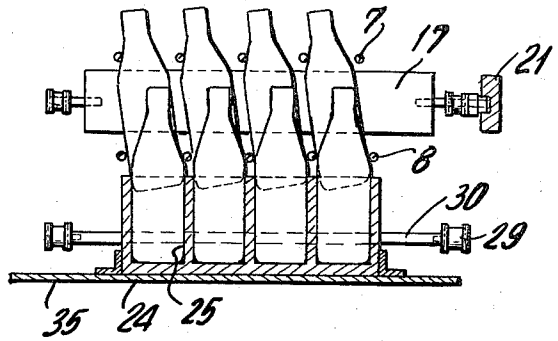

FIG. 6

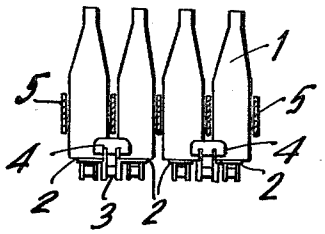

FIG. 7

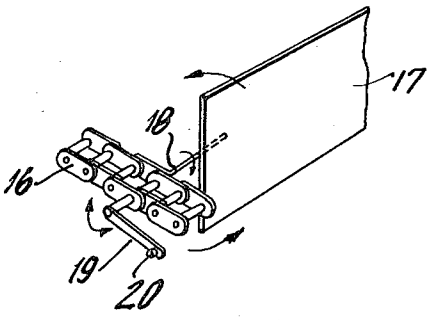

FIG. 11

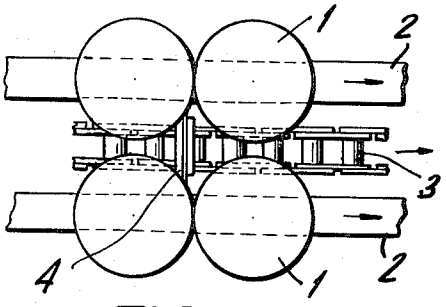

FIG. 8

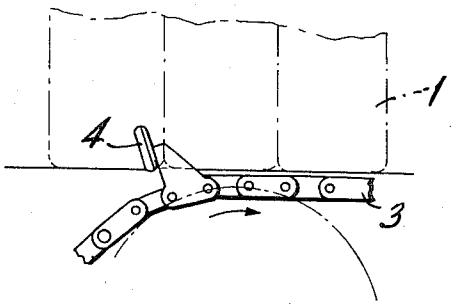

FIG. 9

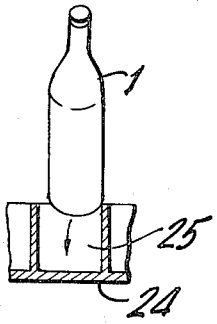

FIG. 12

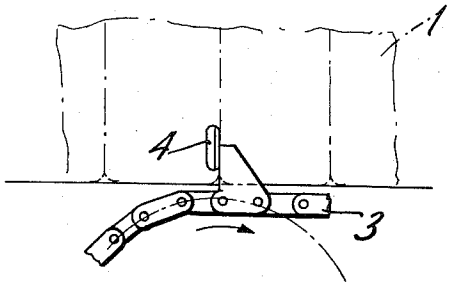

FIG. 10

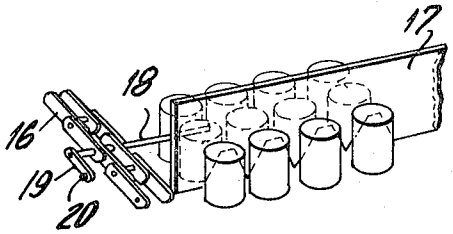

FIG. 13

METHOD AND APPARATUS FOR ENCASING OF ARTICLES

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to a method and an apparatus for automatically loading cases with articles, and more particularly it relates to an improved such method and apparatus in which the articles such as bottles, cans or the like, fed into the apparatus in continuous rows are first segregated into groups, each group consisting of a predetermined number of articles, on a transfer path, the grouped articles being transferred while being spaced apart from each other at the same intervals as are the compartments in each case, and upon arriving at termination of the transfer path, the articles are tilted sideways relative to the advancing direction of the articles and dropped, while maintaining a tilted state, into the respective compartments in the case which has just arrived therebelow.

Various methods for loading of cases with articles of the type described above have been proposed. A typical example of such methods is disclosed in U.S. Pat. No. 3,377,774 in which four rows of cans, segregated into groups, are fed in by means of freight bars, and both side edges of a supporting plate provided on the underside of the can transfer path are bent downwardly so that, by utilizing these bent portions, the cans on the lines on both sides of the can group are tilted outwardly, while in the meantime, the cases are supplied aslant upwardly from below the path such that the bottoms of the tilted cans on both sides are engaged with the inside of the front edge of the case, the latter being propelled forwardly along with the cans, so that the cans, starting with the ones at the leading position, are successively loaded into the case.

According to this method, each case is engaged by the outwardly tilted cans on both sides of the four cans wide group to transfer the case with the cans, so that it needs an arrangement such as to allow the case to arrive at the engaging position before the can group is transferred thereto. This requires complicated adjustment of transfer timing of both cases and cans, and therefore it is hardly possible with this method to realize high-speed loading operation. Further, according to this method, the cans on the two rows in the inside of the four-row can group are dropped, while keeping a substantially vertical position, into the case, so the cans, which are high in stature, may become unstable in their positions when they are dropped, thus retarding the smooth loading operation.

SUMMARY OF THE INVENTION

The present invention is intended to provide an improved method and apparatus which is free of the conventional defects such as mentioned above and which allows stable and high-speed article-encasing operation.

In brief, the present invention is characterized in that the cases, each having formed therein a predetermined number of article-receiving compartments, are transferred to a discharging station along a path beneath the article transfer path, and that the articles on the transfer path are segregated into groups each of which consists of a predetermined number of articles arranged in regular rows, the grouped articles being advanced at a

velocity synchronous with the travelling velocity of the cases such that the articles of the rows positioned on lines perpendicular to the transfer path are spaced apart from each other at the same intervals as are the compartments in each case, the articles being further guided while being tilted, at a point, laterally relative to the direction of movement of the articles, and finally the articles are successively dropped from the termination of the transfer path into the respective compartments in the case travelling just therebelow. Thus, according to the present invention, the articles are supplied in a tilted manner into the cases, each of which is partitioned in its interior into a predetermined number of compartments suited for containing the articles therein, and feeding of the articles and the cases are synchronized in timing to allow positive and stable automatic loading of cases with articles.

In the present invention, as viewed above, the cases, each having a plurality of compartments therein, are supplied from below the article transfer path and the articles are divided, while moving on the transfer path, into groups each of which consists of a predetermined number of articles, then the grouped articles are advanced at a velocity synchronous with the travelling velocity of the cases such that the articles are spaced apart from each other at the same intervals as are the compartments in each case, and, at a point in the transfer path the articles are tilted sideways relative to the direction of movement of the articles and guided up to the end of the transfer path, whereat the articles, while kept in a tilted state, are successively dropped into the respective compartments in the case which passes immediately below that part of the transfer path.

Since, in the present invention, the articles are supplied to move on their path at a speed synchronous with the travelling velocity of the cases in which they are to be loaded and also since the articles are transferred while spaced apart from each other at the same intervals as are the compartments in each case and are also moved in a state where they are tilted laterally relative to the direction of their movement as described above, there is no need of a rather complicated arrangement such as to hold a case at a position where loading is to be conducted as in the conventional devices. Also, since the articles are dropped, while in a tilted state, from the end of the passage, they can be encased in the respective compartments in each case smoothly and in a stable manner. Therefore, even if the article transfer is performed at high speed, it is possible to carry out the encasing operation always in a stable condition.

In accordance with the present invention, an article encasing apparatus comprises several conveyor units, for transferring the articles to be encased, article separating conveyors, disposed between the transfer conveyors and driven at a speed less than that of the transfer conveyors, the separating conveyors being provided with brake elements which are raised, from beneath the transfer path, and wedge themselves in between adjoining articles carried on the conveyors so as to separate the articles into groups each of which comprises a predetermined number of articles, and an article supporting plate provided contiguous to the transfer conveyors and formed, at its end or terminal portion, with elongated openings diverging toward one side of the article transfer path. These openings are provided in a number equal to the number of transfer conveyors. The apparatus further includes case transfer means for guiding, at

predetermined intervals, the cases along a path beneath the article transfer conveyors and toward a discharge station, through a space immediately below the article supporting plate. Each case has a predetermined number of article-receiving compartments therein. The apparatus also includes article transferring means mounted on the machine frame and driven in synchronism with the case transferring means, the article transferring means being arranged so that articles, in the rows positioned on lines extending transversely at right angles to the direction of movement of the articles, are transferred while being spaced apart from each other at intervals equal to the intervals between the compartments in each case. Article guiding means are included in the apparatus and are suspended from the machine frame, for tilting the articles laterally relative to the direction of movement in cooperation with the openings in the support plate, and guiding and supporting the articles which are dropped, in a tilted state or orientation from the end of the supporting plate into the case then travelling immediately therebelow.

The apparatus of the invention, being constructed in the manner described above, the articles fed in succession onto the transfer conveyors are regularly separated into groups by the article separating conveyors provided with brake elements and, of these grouped articles, those of the laterally ranked articles which are positioned in rows on lines perpendicularly to the direction of movement of the articles are moved on while being spaced apart from each other at the same intervals as are the compartments in each case by the article transferring means driven synchronously with the case transferring means. Then, the articles, while being moved on in the spaced-apart condition, are tilted, upon arriving at a certain point, laterally relative to their direction of movement by the joint action of the openings, provided in the article supporting plate, and the guiding means and, while maintained in a tilted state, they are dropped from the end of the supporting plate into the respective compartments in the case therebelow.

Thus, according to the present invention, the articles to be encased are regularly separated into groups and are carried forwards while being spaced apart at the same intervals as are the compartments in each case, and the articles are dropped, while kept in a tilted posture, from the end of the supporting plate, so that it is possible to load the compartments, in each case, with the articles positively and in an extremely well-poised manner.

Further, as compared with the prior art mechanism where the cases are held at an article-loading position before the articles arrive thereat and, when the articles arrive at that position, each case is engaged by a particular incoming article group itself so as to let the articles and case advance together to thereby perform the encasing operation, the present invention allows a smooth and effective article-encasing operation even if the moving velocities of the articles and cases are substantially enhanced, since the article transferring means is driven synchronously with the case transferring means, as described above. Thus, according to the present invention, the encasing operation of the above type can be greatly accelerated to make it possible to achieve significant improvement of work capacity.

For an understanding of the principles of the invention, reference is made to the following description of typical embodiments thereof, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings;

FIG. **1A** and FIG. **1B** are plan views of an embodiment of the present invention, with FIG. **1A** showing the right half and FIG. **1B** showing the left half.

FIG. **2A** is a sectional view taken along the line IIA–IIA of FIG. **1A**.

FIG. **2B** is a sectional view taken along the line II-B—IIB of FIG. **1B**.

FIGS. **3, 4, 5** and **6** are sectional views taken along the lines A—A, B—B, C—C and D—D of FIG. **2A**.

FIG. **7** is a sectional view taken along the line E—E of FIG. **2B**.

FIG. **8** is an enlarged plan view of a part of FIG. **7**.

FIGS. **9** and **10** are illustrations showing the relation of engagement between the bottles and a brake element.

FIG. **11** is a perspective view showing the mounting relation between a roller chain and a spacer plate.

FIG. **12** is an illustration showing a bottle as it is being encased according to the illustrated embodiment of the present invention; and

FIG. **13** is a perspective view of another embodiment of the spacer plate.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, the present invention will be described in detail by way of its most preferred embodiment, where the bottles are assembled into groups such that each group consists of a total of 20 bottles arranged in a row 4 bottles wide and in a rank 5 bottles long, and each of these bottles is encased in the corresponding one of the 20 compartments formed in a partitioned case, with reference to the drawings.

The bottles **1** fed, randomly from a preceding step, (not shown) are arranged into a quadruple file by means of guide plates **5, 5** and then carried in the direction of the arrow, by four conveyor chain units **2** (transfer conveyors). Disposed between these conveyor chain units **2** are two roller chain units **3** (article separating conveyors) which are arranged to be driven at a slightly lower speed than the conveyor chains and which are provided with brake elements **4, 4** projected upwardly, as shown in FIGS. **9** and **10**, such that they can wedge themselves in between the adjoining rows of bottles, as shown in FIGS. **7** and **8**, so as to arrange the rows of bottles into five ranks. As aforementioned, the roller chains **3** (article separating conveyors) provided with the brake elements **4** are driven to move at a slightly lower speed than the conveyor chains **2**, so that, when the brake elements descend from the conveyor chain level, the bottles **1** are allowed to advance while carried on the conveyor chains (**2**) and are thus assembled into a 20 bottle group which is separated from the succeeding bottles.

Passed round the chain pulleys **13, 14** secured to the machine frames **6, 6** there are chains **16, 16** adapted to travel in the direction of movement of the bottles **1** and disposed above the path of the bottles. To chains **16, 16** there are pivotally secured, through arms **18**, a plurality of spacer plates **17** provided at the same pitch as the compartments **25** formed in each of the partitioned

cases 24 to be discussed later. Each arm 18 carries at its free end a lever 19 which, in turn, carries at its end a roller 20 adapted to roll along a cam groove in a cam track 21 supported by brackets 34 at one side of the machine frames 6 along the locus of travel of the adjacent chain 16. The chains 16 are operatively connected, through a suitable connecting mechanism 33, to the case transferring chains 29, to be described later, so that both sets of chains are moved at synchronized velocities. As will be understood, the members 13 to 21, in combination, constitute an article transferring assembly.

As best seen in FIG. 2, spacer plates (17) are regulated in their orientation by the cam grooves, rollers 20, levers 19 and arms 18 and wedge themselves from above in between the adjoining ranks of bottles in each group, at a pitch P equal to the pitch Q of the bottle array in each group so as to separate the rows of bottles from each other and propel the bottles of each group onto an article supporting plate 22 mounted between the machine frames 6, 6 contiguous to the conveyor chains 2.

Each of the cases 24, which are to be loaded with the bottles 1, has formed therein the compartments 25 for receiving 20 bottles in the present instance. These cases 24 are carried on a roller conveyor 26 on which they are advanced upwardly and forwardly from below the conveyor chains 2, and are pushed out one by one in accordance with vertical movement of a hydraulic actuator 27 and a stopper 28 whose operation is controlled in conformity to the suitably adjusted operating cycle. Each case thus pushed out is placed between the case push rods 30 provided at suitable intervals on the case transfer chains 29 trained in tension between the chain pulleys 31, and 32 and is thereby carried forward riding on a case guide plate 35. The roller conveyor 26, hydraulic actuator 27, stopper 28, case transfer chains 29, case push rods 30, chain pulleys 31, 32 and case guide plate 35, in combination, constitute a case transfer assembly.

The bottles propelled by the spacer plates 17 on the article supporting plate 22 are also controlled by the guide members 7 and guide bars 8 suspended from the machine frames 6, 6 by means of suspending members 9, supporting bars 10 and spacers 11. The pitch of guide members 7 and guide bars 8 is in agreement with the pitch, in the lateral direction, of the compartments of cases 24. When the bottles 1, moving on the supporting plate 22, arrive at the position of the cut-away sections 23, diverging toward one side transverse to the moving direction of the bottles at the terminal end of supporting plate 22, the bottles begin to tilt laterally relative to the moving direction of the bottles due to these cut-away sections 23 with the aid of guide bars 8 as shown in FIG. 3. This lateral tilt is increased in accordance with divergence of cut-away sections 23 but is stopped at a certain point by the guide members 7 arranged to spread out laterally relative to the direction of movement of the bottles so as to hold the neck portions of the bottles as shown in FIGS. 4 and 5. These guide members 7 are bent inwardly at the terminal end point G of the supporting plate 22 and are further bent at a point passing the line d—d, as shown in FIG. 1A, so that their ends are located in the same vertical plane as the guide bars 8. On the other hand, the supporting plate 22 is terminated at the point G, so that the bottles, upon passing the point G, begin to fall off from the supporting plate 22 until their bottoms are caught and rested on the tops *f* of the partition walls in the case which is travelling immediately therebelow. Since the moving velocity of the spacer plates 17 is the same as that of the cases, the relative velocity between the bottles and the case therebelow is zero. Therefore, the bottles falling down from the edge G of the supporting plate 22 are successively dropped into the respective compartments 25 in the particular case 24, with the tilt of the bottles being slightly decreased (that is to say, the bottles being slightly raised toward the upright position) (see FIG. 6) since their falling posture or bearing is regulated by the spacer plates 17, guide members 7 and guide bars 8 bent outwardly by a distance *l* at a point F in FIG. 1A. It will be appreciated that guide members 7, guide bars 8, suspending members 9, supporting bats 10 and spacers 11, in combination, constitute an article guiding assembly.

In this embodiment of the present invention, as described above, the bottles to be encased are assembled into groups, each group consisting of a total of 20 bottles arranged in rows 4 bottles wide and in ranks 5 bottles long, and being moved along a supporting plate 22, while being spaced apart from each other at intervals corresponding to those of the compartments 25 in each case 24 and, upon arriving at the terminal end of the supporting plate, the bottles are tilted by means of the four laterally aligned cut-away sections 23 formed at the end of the support plate and the guide members 7 bent in a specific configuration. Movement of the spacer plates 17 in synchronized in velocity with that of the cases 24 and the bottles are dropped, while maintaining a tilted posture, from the terminal end of the supporting plate 22 into the respective compartments 25 in the case 24 thereunder, with such tilted posture of the bottles being regulated by the spacer plates 17, guide members 7 and guide bars 8, so that the bottle encasing operation can be performed in a stable manner smoothly, positively and at high speed.

Further, according to the present invention, since the bottle encasing is conducted by tilting the bottles, in case the bottles to be encased have a roundish sectional configuration at their bottoms, should the positions of the compartments in the case be somewhat deviated from the center of the bottles, centering of the case is automatically effected by the roundish configuration of the bottle bottom and the weight of the bottles, thus allowing even more effective encasing operation.

In the figures, numeral 12 designates a driving shaft for the chains 16 and 15 the guiding chain pulleys for the chains 16.

Each of the spacer plates 17 secured to the chains 16 may be formed with serrated notches at the bottom edge, as shown in FIG. 13, whereby, in case the articles to be encased have flanges or rims at both upper and lower peripheral ends, such as cans, the protruding portions at the bottom of the spacer plate 17 will be placed in the spaces formed by the adjoining cans (articles), allowing to space the cans from each other at a pitch equal to the pitch Q of the compartments 25 in each case 24. Also, although the spacer plates 17 are so arranged as to wedge themselves in between the rows of bottles from above the bottles 1 in the illustrated embodiment, it is possible to let them wedge themselves in laterally of the bottle rows.

Further, in the instant embodiment, the cam plates 21 are provided on only one side of the machine frames

6, 6, but they may be provided on both sides. Also, cam grooves are provided in cam plates 21 so that the rollers 20 may roll therein, but such grooves may not necessarily be provided and instead the inner peripheral faces of the cam plates 21 may be utilized for the same purpose.

What we claim is:

1. A method of loading cases with articles, comprising the steps of moving the articles along an article transfer path including an article support surface formed with a preset number of slots, adjacent the terminal end of the transfer path, each widening progressively to a width, equal to the width of the articles, at the terminal end of the transverse path; transferring cases, each having therein a predetermined number of article-receiving compartments arranged in rows and ranks of rows along a path beneath the article transfer path and through a space immediately below the terminal end of the article transfer path, to a discharging station; segregating the articles on the article transfer path into groups each consisting of such predetermined number of articles arranged in regular rows each including such preset number of articles, extending at right angles to the direction of article movement and regular ranks of rows, with the spacing of the articles being equal to the spacing of the article-receiving compartments of the cases; advancing the articles at a velocity so synchronized with the travelling velocity of the cases that, as the leading row of article-receiving compartments in a case is immediately below the terminal end of the article transfer path, the leading row of a group of articles is at the widest ends of the slots and in vertical alignment with such leading row of article-receiving compartments; and successively dropping the rows of articles of each group directly through the widest ends of the slots into the respective rows of compartments in the case then immediately below the terminal end of the article transfer path; and including the step of, as the bottom ends of the articles are moving along the slots in the support surface in advance of the terminal end of the article transfer path, further guiding the articles by shifting the upper ends of all the articles in each row in the same lateral direction to tilt the articles laterally of their direction of movement to engage edges of their bottom ends into the slots in advance of discharge of the articles into the cases.

2. A method of loading cases with articles, as claimed in claim 1, including the further step of, as each article enters a compartment of a case, guiding the articles, by shifting the upper ends of all the articles in each row in the same opposite lateral direction, to have a substantially vertical orientation.

3. Apparatus for loading cases with articles, comprising, in combination, plural transfer conveyor units extending in spaced parallel relation along an article transfer path to transfer articles to be encased along the article transfer path; driving means for said transfer conveyor units; article separating conveyors each disposed between a pair of adjacent transfer conveyor units; driving means operable to drive said separating conveyors at a speed less than that of said transfer conveyor units; brake elements secured to said separating conveyors at uniform longitudinal spacings therealong; said brake elements, responsive to movement of said separating conveyors, being inserted from below between adjoining articles on said transfer conveyor units to separate the articles into groups each including a predetermined number of articles arranged in regular rows, extending transversely of said transfer conveyor units, and ranks of rows; a horizontally oriented article support plate having an entrance end receiving the groups of articles from said transfer conveyor units, and having a terminal end for discharge of the articles; case transfer means operable to transfer, along a case transfer path located beneath said article transfer path, cases each having a number of article-receiving compartments equal to the number of articles in each group, with the compartments being arranged in regular rows and ranks at spacings equal to the spacings of the articles in each group; said case transfer means transferring the cases in predetermined spaced relation, through a space immediately below the terminal end of said support plate; stationary guide means extending in laterally spaced relation longitudinally along and above said support plate, said guide means engaging laterally opposite sides of each article in said rows; article transfer means engaging the articles in each group on said support plate and transferring the articles between said stationary guide means along said support plate toward and beyond the terminal end of said support plate; and driving means driving said case transfer means and said article transfer means at velocities so synchronized with each other that, as the leading row of compartments in each case arrives at the terminal end of said support plate it is vertically aligned with a leading row of articles of a group travelling along said support plate; whereby the articles of each row, guided laterally solely by said stationary guide means, are successively dropped, solely by gravity, directly from said transfer means into the corresponding rows of each case as each row of articles reaches the terminal end of said support plate; said support plate, adjacent its terminal end, being formed with a plurality of elongated slots, equal in number to the number of transfer conveyors, each widening laterally toward the same side of the article transfer path to a width, equal to the width of the articles, at the terminal end of said support plate; said stationary guide means, along said slots, being offset laterally toward the opposite side of the article transfer path to tilt the upper ends of the articles laterally toward said opposite side to engage the edges of the bottom ends of the articles in said slots in advance of discharge of the articles directly through the widest ends of the slots into the cases.

4. Apparatus for loading cases with articles, as claimed in claim 3, including a machine frame; said stationary guide means are suspended from said machine frame to cooperate with said slots in tilting the articles.

5. Apparatus for loading cases with articles, as claimed in claim 4, in which said stationary guide means, at the ends of said slots, are offset again toward said same side of the article transfer path to guide the articles back into a substantially vertically orientation as they enter the respective compartments of each case.

6. Apparatus for loading cases with articles, comprising, in combination, plural transfer conveyor units extending in spaced parallel relation along an article transfer path to transfer articles to be encased along the article transfer path; driving means for said transfer conveyor units; article separating conveyors each disposed between a pair of adjacent transfer conveyor units; driving means operable to drive said separating

conveyors at a speed less than that of said transfer conveyor units; brake elements secured to said separating conveyors at uniform longitudinal spacings therealong; said brake elements, responsive to movement of said separating conveyors, being inserted from below between adjoining articles on said transfer conveyor units to separate the articles into groups each including a predetermined number of articles arranged in regular rows, extending transversely of said transfer conveyor units, and ranks of rows; a horizontally oriented article support plate having an entrance end receiving the groups of articles from said transfer conveyor units, and having a terminal end for discharge of the articles; case transfer means operable to transfer, along a case transfer path located beneath said article transfer path, cases each having a number of article-receiving compartments equal to the number of articles in each group, with the compartments being arranged in regular rows and ranks at spacings equal to the spacings of the articles in each group; said case transfer means transferring the cases in predetermined spaced relation, through a space immediately below the terminal end of said support plate; stationary guide means extending in laterally spaced relation longitudinally along and above said support plate, said guide means engaging laterally opposite sides of each article in said rows; article transfer means engaging the articles in each group on said support plate and transferring the articles between said stationary guide means along said support plate toward and beyond the terminal end of said support plate; and driving means driving said case transfer means and said article transfer means at velocities so synchronized with each other that, as the leading row of compartments in each case arrives at the terminal end of said support plate it is vertically aligned with a leading row of articles of a group travelling along said support plate; whereby, the articles of each row, guided laterally solely by said stationary guide means, are successively dropped, solely by gravity, directly from said transfer means into the corresponding rows of each case as each row of articles reaches the terminal end of said support plate; said article transfer means comprising a pair of laterally spaced endless conveyors extending above and longitudinally of said article transfer path; a plurality of plates pivotally supported on said endless conveyors for swinging about substantially horizontal axis, said plates being spaced longitudinally a distance equal to the longitudinal center-to-center spacing of said case compartments; cam track means extending along each of said last-named endless conveyors; and respective arms projecting from each plate and having free ends engaged in said cam track means; said arms, in cooperation with said cam track means, pivoting each plate, as the plate moves downwardly toward an article group, to a vertical orientation to insert each plate vertically between adjacent rows of articles, and maintaining the associated plates vertically oriented during engagement with the articles.

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