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Langen et al.

[11] **3,845,852**

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[54] **CARTON LOADER**

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[51] **Int. Cl.** **B65g 47/26**

[58] **Field of Search** ..... 198/34 R, 110, 30, 168

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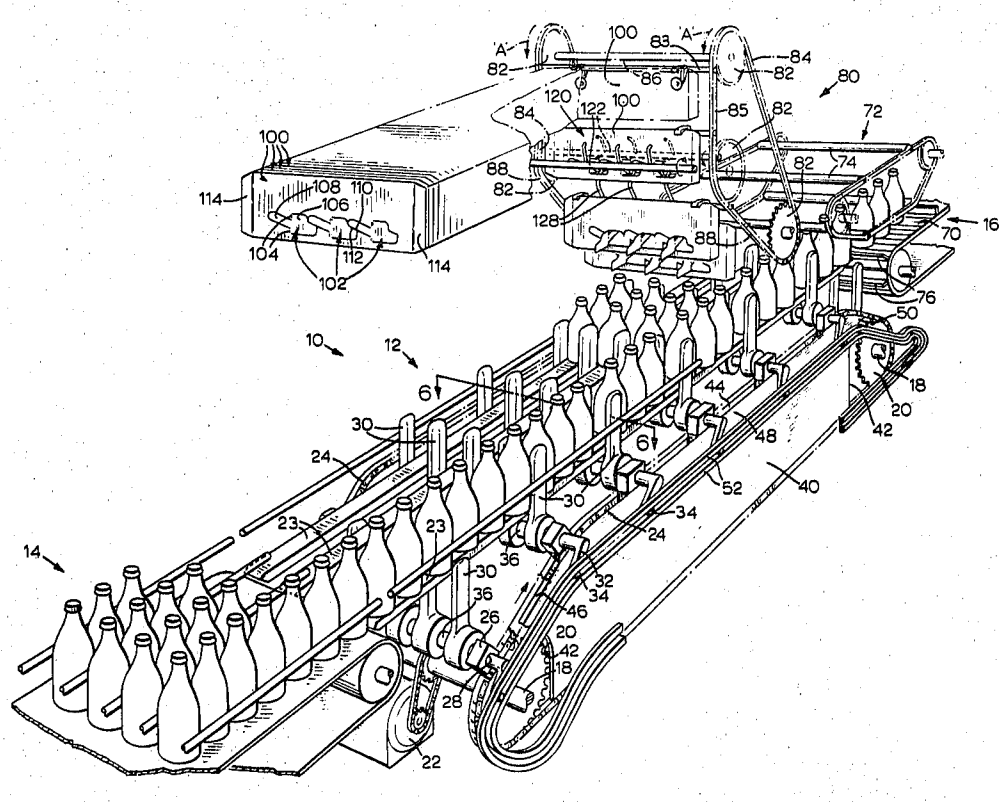
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Assistant Examiner—Richard K. Thomson
Attorney, Agent, or Firm—Fetherstonhaugh & Co.

[57] **ABSTRACT**

In a carton loading machine wherein a plurality of modular units, such as a load of bottles, are fed in continuous row into the carton loading machine, the improvement of a spacer mechanism for separating modular units which are to be loaded into one carton from the remaining modular units in a row which is being fed into the carton loading machine. The spacer mechanism includes modular units engaging means for engaging the leading modular unit in a manner suitable for moving it relative to the following modular units, and drive means for initially moving the modular unit engaging means into engagement with the leading modular unit while moving at the same speed as the leading modular unit and subsequently accelerating the engaging means to move the leading modular unit in the direction of a predetermined path away from the following modular unit, and thereafter to move the modular unit engaging means out of engagement with the leading modular unit while continuing to travel at the same velocity as the leading modular unit in the direction of the predetermined path of travel.

9 Claims, 7 Drawing Figures



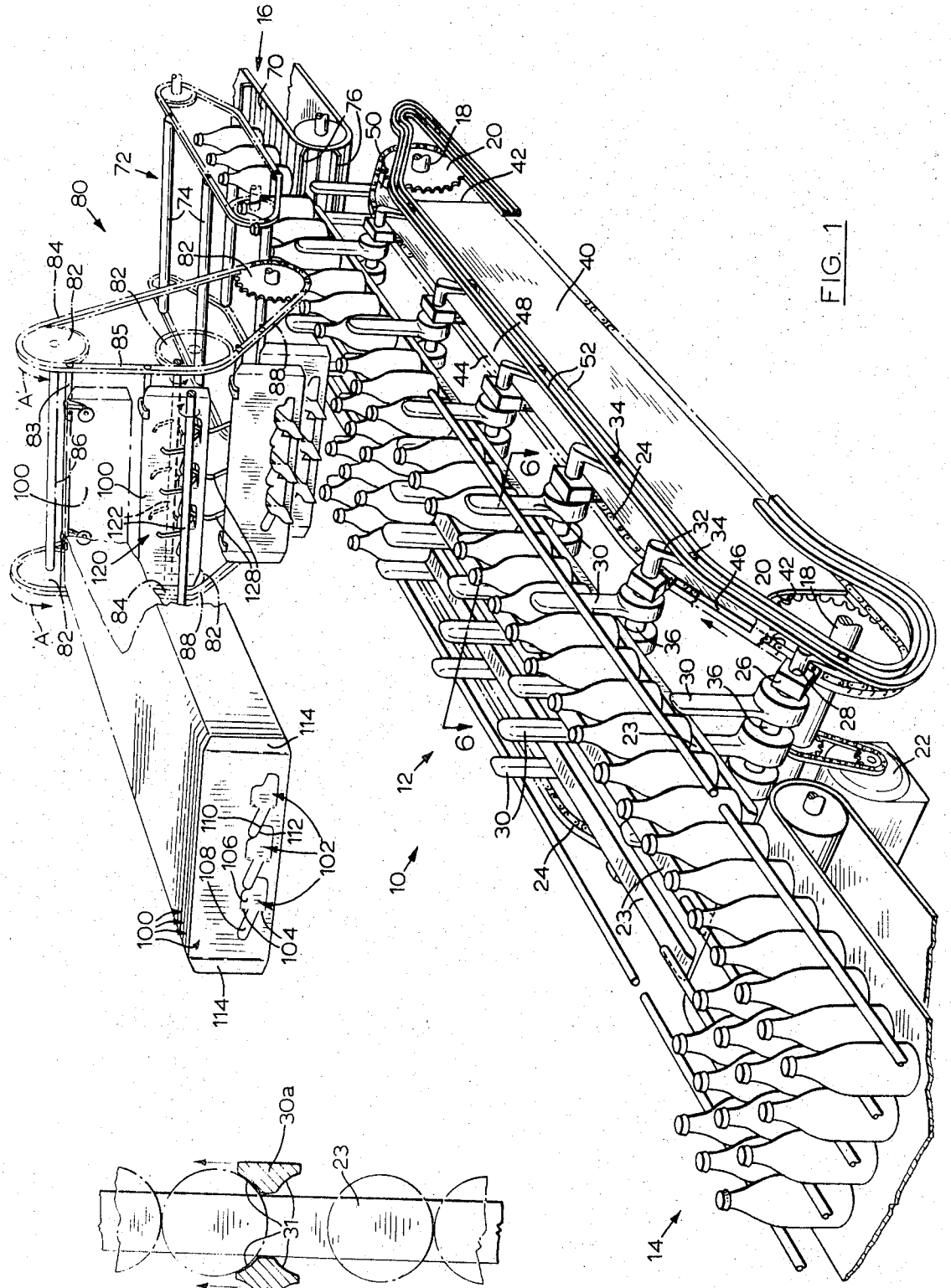


FIG. 1

FIG. 6

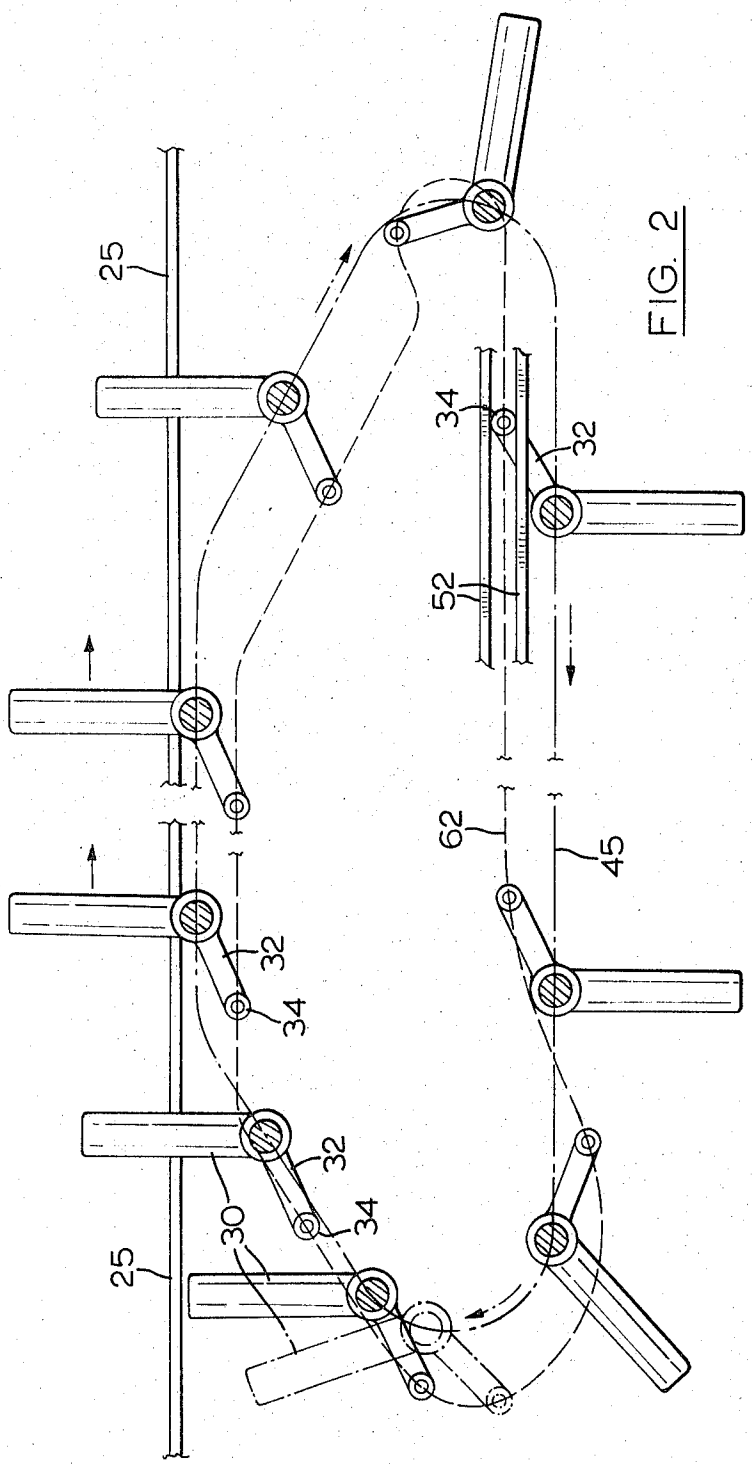


FIG. 2

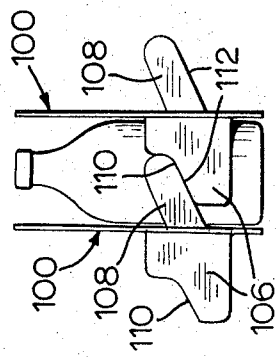


FIG. 5

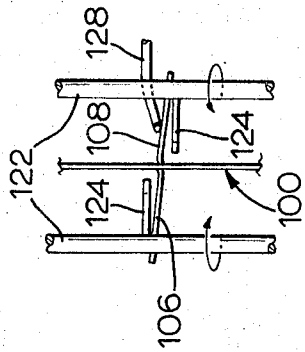


FIG. 4

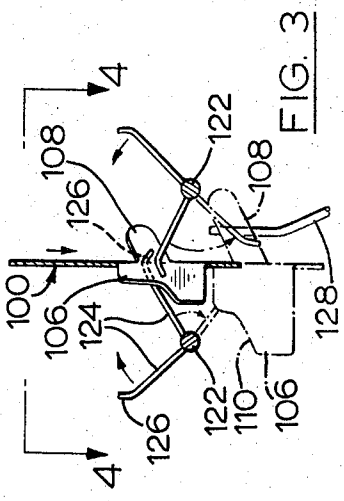


FIG. 3

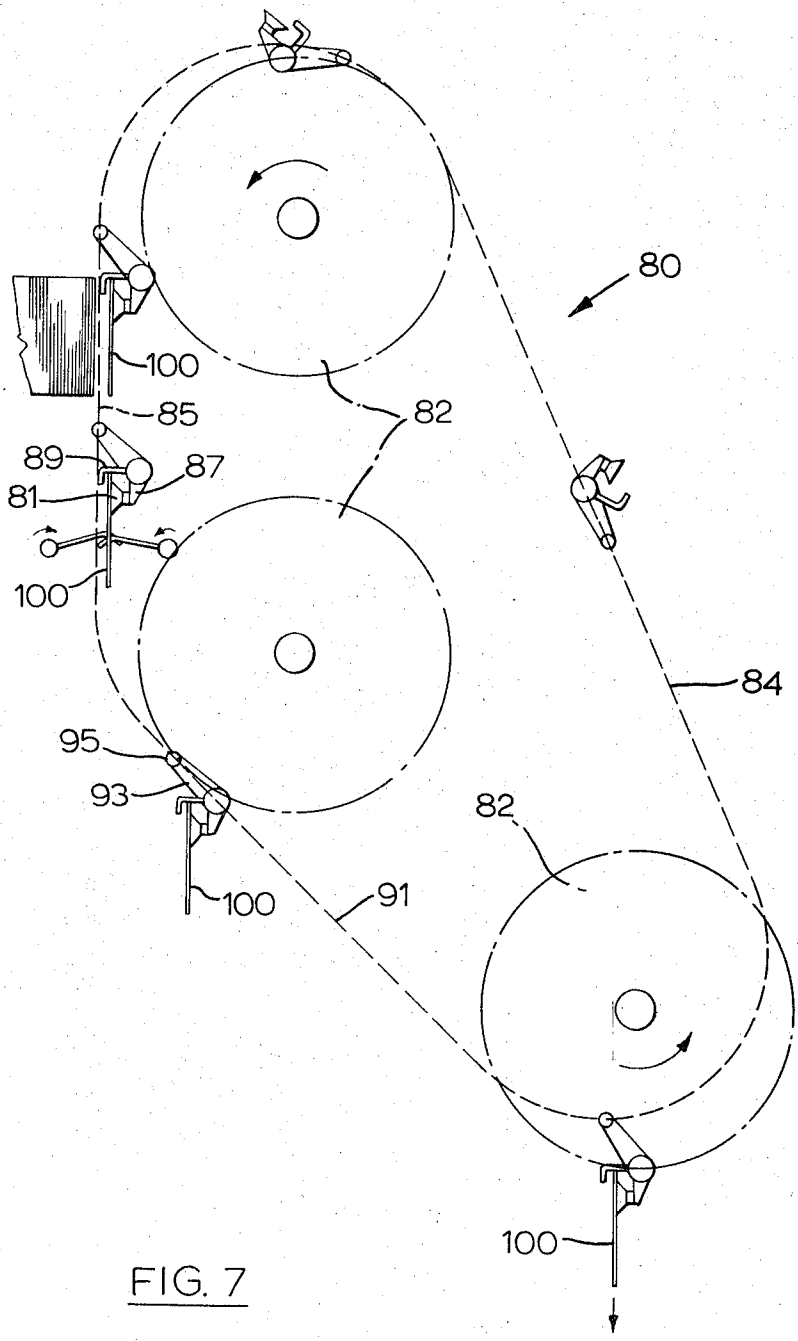


FIG. 7

CARTON LOADER

This invention relates to improvements in the art of loading containers into cartons. In particular, this invention relates to improvements in the spacing and dividing of a plurality of containers prior to loading into cartons.

PRIOR ART

In carton loading machinery, containers such as bottles, cans and the like are fed to the loader in a continuous stream and it is necessary to separate a group of containers which are to be located in one shipper package from the remainder of the containers of the continuous stream of containers. Conventionally, containers are separated into groups by intermittently interrupting the feed of the stream of containers at a point where the containers are moving along or onto a conveyor. In one known device, a plurality of fingers are adapted to extend upwardly into the path of movement of the stream of conveyors at predetermined intervals. The fingers temporarily interrupt the flow of containers and separate the containers into distinct modular units. As a result of the use of this type of apparatus, the containers which are being directed towards the separating or spacing station are repeatedly stopped in their path at spaced intervals of time so that a multitude of collisions occur between the containers in each row as they are advanced towards the spacing station. This repeated stopping and starting of the forward movement of the containers and the resulting collisions is particularly undesirable when containers such as glass bottles are being separated. Glass containers frequently break as a result of this operation. With the increasing use of non-returnable glass containers having a relatively thin wall thickness, the likelihood of breakage is quite substantial. Any attempt to speed up loading of cartons increases the number of breakages which occur by increasing the velocity of the containers at the point when the collisions occur.

A further difficulty which has been experienced in association with the end loading of cartons has been the location of a divider panel between the adjacent rows of containers. In a conventional carton such as a beer carton, a longitudinal divider panel and a plurality of transverse sub-divider panels are provided to divide the container space into a plurality of bottle receiving compartments so that the bottles are spaced from one another for shipping and handling purposes. This construction has been proved to be desirable in view of the fact that it prevents container to container contact so that the damage to the container during shipping and handling as a result of movement of the container within the carton is minimized. It has, however, not previously been possible to locate a divider and sub-divider panels between adjacent rows of containers in an automatic feeding apparatus.

The present invention overcomes the difficulties encountered with the spacing of containers by providing an apparatus wherein the leading group or modular unit of containers which are to be loaded are accelerated relative to the following rows of containers without requiring breaking of the following rows by engaging the leading unit by spacer finger means travelling at the same speed as the leading modular unit subsequently accelerating the finger means to cause the leading modular unit to be accelerated relative to the following rows to be spaced therefrom. This apparatus ensures that while the modular units which are to be loaded into the containers are spaced from one another prior to loading, the spacing is achieved without breaking of the following units so that no collisions occur. In addition to the advantages previously discussed, there is a substantial reduction in the noise level of operation of the carton loading machine resulting from the elimination of the collisions. The very high noise level resulting from the continuous collision of bottles on conveyors will be well known to those familiar with bottle filling plants and any apparatus which serves to reduce this noise level will considerably improve working conditions and reduce the likelihood of injury to the hearing of operators.

The present invention also provides a simple and inexpensive method of locating a divider panel and sub-divider panels between adjacent containers and adjacent rows of containers during the continuous movement of the containers along the moving conveyor. The positioning of the divider panels is achieved by simultaneously lowering the divider panels into the spaces between adjacent rows of containers and moving the divider panel as it is lowered in the direction of movement of the containers.

The present invention also provides an improved spacer for use in dividing adjacent rows of containers and sub-dividing adjacent containers wherein the sub-divider panels are arranged to extend from opposite sides of a divider panel and the first portion of the sub-divider panel arranged on one side of the main body having an upper edge disposed in a plane which is lower than the lower edge of the second portion of the sub-divider panel arranged in the opposite side of the main panel. As a result, by arranging adjacent panels so that the lower portion of the sub-panels is directed downstream and the higher portion of the sub-panels is directed upstream, the sub-panels will nest with one another when located between adjacent rows of containers.

According to an embodiment of the present invention, a spacer device for use in spacing a leading modular unit from following modular units of a single file row of closely adjacent modular units moving at a substantially uniform speed in a predetermined path comprises means for engaging the leading modular unit in a manner suitable for movement of the leading modular unit relative to the following modular units of the rows of units and drive means for initially driving said engaging means into engagement with said leading modular unit while moving at the same speed as said leading modular unit and subsequently accelerating said engaging means to move the leading modular unit in a direction of the predetermined path away from the following modular units and thereafter move the engaging means out of engagement with the leading modular unit while continuing to travel at the same velocity as the leading modular unit in a direction of the predetermined path.

According to a further embodiment of the present invention, a divider positioning means is provided for locating a divider panel between predetermined adjacent rows of the container. The divider positioning means comprises divider panel engaging means for engaging a divider panel disposed in a plane extending normal to the path of travel of the containers and located above the path of travel of the containers. Con-

veyor means is provided for simultaneously conveying the divider panel vertically towards the containers and longitudinally in a direction of travel of the containers to be located between predetermined adjacent rows of containers as the containers move continuously through the divider locating station.

According to a further embodiment of the present invention there is provided a carton divider comprising a main body portion and sub-divider panel means hingedly connected to said main body panel. The sub-divider panel means includes a first portion adapted to project outwardly from one side of the main body panel and a second portion adapted to project outwardly from the other side of the main body. The upper edge of the first portion is disposed in a plane below the plane of the lower edge of the second portion whereby the first portion of the sub-panel of one divider may be positioned below the second portion of the sub-panel of an adjacent divider in use.

The invention will be more clearly understood after reference to the following detailed specification read in conjunction with the drawings, wherein

FIG. **1** is a pictorial view of a bottle spacing device according to an embodiment of the present invention;

FIG. **2** is a diagrammatic side view of a portion of the spacing device of FIG. **1**;

FIG. **3** is a pictorial side view illustrating the apparatus used for positioning the sub-panels;

FIG. **4** is a front view of the portion of the apparatus of FIG. **3**;

FIG. **5** is a side view illustrating the manner in which the sub-panels of adjacent divider panels are nested in use;

FIG. **6** is a sectioned pictorial view of a pair of pusher fingers; and

FIG. **7** is a diagrammatic illustration of the divider locating mechanism.

With reference to the drawings, the reference numeral **10** refers generally to a spacer device for use in a bottle loading machine according to an embodiment of the present invention. The spacer device **12** of the present invention is located intermediate a bottle sorter **14** which arranges the bottles in a plurality of side by side rows and an end loading conveyor **16** from which the bottles, after having been spaced apart, are transversely loaded to end loading cartons. A typical end loading machine in which a spacer device of the present invention may be used to advantage is described in U.S. Pat. No. 3,645,368, issued Feb. 29, 1972. This prior patent discloses the sorter and a suitable end loading apparatus.

The spacer of the present invention includes a frame (not shown) in which a pair of transversely extending shafts **18** are mounted for rotation. A sprocket **20** is mounted on either end of each shaft **18.** One of the shafts **18** is rotatably driven by motor **22** and a chain **24** extends around the sprockets **20.** A plurality of bearing blocks **26** are mounted on the chain **24** at longitudinally spaced intervals for movement with the chain. Each of the bearing blocks **26** has a passage **28** extending therethrough, the passages **28** in the blocks **26** on opposite chains being axially aligned with one another to pivotably receive a transversely extending support shaft **36.** The support shaft **36** has a radially extending arm **32** at one end thereof terminating in a cam follower lug **34** which may be in the form of a roller.

In the embodiment illustrated which is designed for use in a device in which the bottles are arranged in four parallel rows, five fingers **30** are rigidly secured to each shaft **36,** the outermost fingers **30***a* having an inner surface formed with a pair of concave faces **31** and each of the side faces of the inner fingers **30***b* having separate concave side faces **31** as shown in FIG. **6** of the drawings so to conform generally to the curvature of the face of the containers between which the fingers are located in use. A guide rail or guide plate **40** is located between each chain and has end edges **42** spaced inwardly from the sprockets **20.** The upper edge **44** is of particular importance in the present invention in that it acts as a support and guide rail for the chain **24.** The upper edge has a front portion **46** which is upwardly inclined, a central portion **48** which is substantially parallel to the path in which the containers are to be moved, and a rear end portion **50** which is downwardly inclined towards the rear sprocket **20.**

An important feature of the present invention is that the fingers **30** are moved in the direction of travel of the containers at a speed equal to the speed of forward motion of the containers when the fingers are being elevated during passage along the upwardly inclined portion **46** of the guide rail. This is achieved by adjusting the linear speed of the chain and the angle of inclination of the upwardly inclined portion **46.**

At the rear end of the guide rail, the downwardly inclined portion is inclined at an angle sufficient to ensure that the fingers **30** are disposed below the level of the next following modular unit of containers before the following unit of containers has advanced to make contact with the finger which is being withdrawn.

In order to ensure that the fingers **30** are vertical during the elevating, pushing and lowering operations, a cam track consisting of a pair of spaced parallel rails **52** is disposed adjacent the guide rail **46.** The cam follower **34** is adapted to fit within the cam track and, as shown in FIG. **2** of the drawings, the path **62** of the cam track is positioned relative to the path **45** of the guide rail so as to cause the fingers **30** to pivot rapidly to the vertical position before the fingers **30** are raised above the level of the platform **25** of the spacer station, as shown towards the left of FIG. **2** of the drawings. Similarly, as shown towards the right of FIG. **2** of the drawings, the fingers **30** are maintained in the vertical position until the fingers drop below the level of the platform **25** and thereafter the fingers pivot rapidly out of the vertical and are returned to the front end of the device.

The platform **25** on which the containers move in passing through the separating station consist of four support paths **23** which are supported by the frame (not shown) in a generally horizontal position. The containers, after having been arranged in spaced apart modular units, are transferred to the conveyor **70** of the end loading device **16** by means of an overhead drive unit **72** which has a plurality of cross bars **74** which are driven during the angularly inclined portions of their path of travel at a speed which is equal to the speed of travel of the fingers **30** along the horizontal portion of the platform **25.** The conveyor **70** is provided with upstanding walls **76** which sub-divide the conveyor into compartments for receiving modular units of containers which are to be end loaded. The speed of movement of the conveyor **70** is synchronized with the speed of movement of the horizontal section of the conveyor device **72.** By ensuring that the transfer device **72** oper-

ates at a speed equal to the longitudinal speed of the fingers **30** in passing along the platform **25**, it is possible to prevent the trailing modular unit from which the leading modular unit has been separated from catching up to the leading modular unit during deceleration of the fingers **30**. It will be noted that the transverse pusher bars **74** are positioned to cause movement of the containers on the platform **25** before the fingers **30** pass onto the downwardly inclined section of the guide rail.

In operation, the motor **22** drives the shaft **18** which in turn drives the sprockets **20**. The sprockets **20** drive the chain **24** to cause the bearing blocks **28** and the shaft **36** to move in a direction of movement of the chain **24**. The chain **24** extends over the guide rail **46** so that the guide rail **46** determines the direction of movement of the support shaft **36** in a vertical and longitudinal direction. The angular position of the support fingers **30** relative to the vertical plane is determined by the position of the cam follower **34** in the cam track **52**. The longitudinal speed of the fingers **30** relative to the platform **25** is determined by the linear speed of the chain **24** and the position of the fingers relative to the track **52**. The longitudinal speed of the fingers **30** is adjusted so that, during the elevation of the fingers **30** resulting from the passage of the fingers along the upwardly inclined portion of the track, it is equal to the velocity of the containers as they enter the spacing station so that the fingers will rise to a position disposed between adjacent containers without causing any breaking of the forward motion of the containers which are downstream of the fingers as they rise between the containers. It will be apparent that when the pair of fingers are disposed on the horizontal section of the track, they are spaced apart a greater longitudinal distance than they are during the portion of the track in which they are being elevated, with the result that the containers on the platform **25** will be divided into spaced apart modular units by the acceleration of one set of fingers relative to the other set of fingers as a result of movement from the upwardly inclined portion of the guide track onto the horizontally extending portion of the guide track. Obviously if the fingers are lowered in the same manner in which they are raised, the containers would be grouped together again in the same abutting relationship which exists at the point where they are initially engaged by the fingers. This is prevented by the pick-off device or unloading device which engages the containers prior to or substantially simultaneously with the point at which the fingers are lowered. It follows that the space formed between each modular units of containers is retained and the modular units of containers pass onto the discharge conveyor **70** in a spaced relationship.

From the foregoing it will be apparent that the spacing device of the present invention ensures that the modular units or pay loads which are to be loaded into cartons are spaced apart while continuously moving, with the result that the collisions which were previously experienced no longer occur.

A further important feature of the machine of the present invention is the provision of a divider locating device **80**. The divider locating device **80** is illustrated in FIGS. **1**, **3**, **4** and **7** of the drawings and includes a pair of chains **84** which extend over two sets of sprockets **82**. Each set of sprockets **82** consists of three sprockets which are arranged in a spaced aligned relationship. The sprockets **82** are mounted on drive shafts **86** and the chains **84** extend thereabout and provide a substantially vertically extending section **85** and a downwardly and rearwardly inclined section **88**. A plurality of support bars **83** extend transversely between the chains **82** and each transverse bar **83** carries a pair of transfer elements **87**. Each of the transfer elements **87** consists of a hook-shaped lug **89** and a suction cup **81**. A cam track construction substantially in accordance with the cam track **52** is located in a position spaced outwardly from at least one of the chains **95** (see FIG. **7**). A lever arm **93** projects outwardly from the cross bar **83** at one end thereof and has a follower **95** which is engaged by the cam track **91** so as to control the angular position of the hooks **89** and suction cup **81** with respect to the chains **84** so that over the lengths **85** and **88** the divider panel **100** is retained in a vertical position.

In use, a plurality of divider panels **100** are located in a dispenser device capable of dispensing a single divider panel **100** into a position in which the upper edge is engaged by the hooks **89** and the outer face of the panel is engaged by the suction cups **81**. The divider panel **100** moves with the chains **84** through a sub-divider positioning station in which the sub-divider panels are positioned and passes along the angularly inclined portions **88** of the path of travel of the chain. The speed of travel of the clamps and the chains **84** is such that the velocity of the divider panels in the horizontal direction during travel along the angularly inclined sections **88** is equal to the velocity of the containers moving through the separating station so that the dividers are lowered into a position between rows of containers without disrupting the forward movement of the containers. When the divider panels are located in the required position, the suction cups **81** are released and the clamping assembly is elevated out of the path of travel of the containers.

The divider panels preferably include a plurality of sub-divider panels **102** which are hingedly connected to the main body of the divider panels along hinge lines **104**. An important feature of the sub-divider panels of the divider of the present invention is that the sub-divider panel consists of a first portion **106** and a second portion **108**, each having a nestable edge **110** and **112**. The nestable edge **110** is upwardly inclined in a direction away from the hinge line **104** while the nestable edge **112** is downwardly inclined in a direction away from the hinge line **104**. Each of the divider panels **100** also has end flaps **114**.

The sub-divider panels **102** are positioned prior to the location of the divider panel by means of a sub-divider location apparatus **120** which, as shown in FIGS. **1**, **3** and **4**, includes a shaft **122** which is mounted for rotation in a plane extending in a spaced parallel relationship transversely of the path of movement of the divider panels. The shaft **122** has a pair of legs **124** extending radially therefrom and each leg **124** has a foot portion **126** at the outer end thereof. In the embodiment illustrated, two legs **124** are shown because of the fact that the containers are arranged in modular units including three side by side parallel rows. If four rows of containers were used to form a modular unit, it would be necessary to provide a third leg **124** so as to group together three divider panels for location in each modular unit. In this regard, it will be noted that in FIG. **1** of the drawings two divider panels are shown closely

adjacent to one another on the divider location apparatus with the next following divider spaced a substantial distance therefrom to correspond with the spacing of the modular units. To assist in the opening operation, a guide rail **128** projects into the path of travel of the legs **124** in a spaced apart adjacent relationship with respect to each set of legs **124.**

In use, a carton **100** is lowered into the sub-divider locating station and the foot **126** of the leg **124** strikes the subdivider panel **102** causing the portion **108** to be directed downstream of the direction of travel of the containers with the portion **106** directed upstream. The relative positions of the portions **106** and **108** with respect to the direction of travel of the containers is important as this relationship permits one subdivider panel to be located after another in an overlying relationship.

FIG. **4** of the drawings shows the manner in which the guide rail **128** is located with respect to the legs **124** so that when the legs **124** drive a sub-divider panel to the open position, it is engaged and held in the open position by the guide rail **128.** The guide rail **128** is angularly inclined with respect to the longitudinal plane of the divider panel so as to force the sub-divider panels to an inclined position greater than 90° with respect to the plane of the main body of the panel so that the subdivider panels will be permanently set at an angle of at least 90° with respect to the main body of the panel and will not, therefore, tend to return to the plane of the main body of the panel after they are released by the guide rails **128** prior to the point at which they are located between the containers.

FIG. **5** of the drawings illustrates the importance of locating the sub-divider panels with the portions **108** directed downstream and the portions **106** directed upstream. As previously indicated, it is this relationship which permits the second and each subsequent panel of a set of divider panels being located one after the other in a series of panels.

From the foregoing, it will be apparent that the present invention provides a simple and inexpensive subdivider panel which may be located between adjacent rows of containers and a simple and inexpensive apparatus for locating the subdivider panel between adjacent rows of containers prior to loading of the containers into a carton.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A spacer device for use in arranging containers which are continually travelling in a predetermined path through a spacer station into space apart groups of containers comprising

a. guide track means having a first forwardly inclined extent which continues in a second longitudinal extent which in turn continues in a third inclined extent which projects from the longitudinal extent on the same side of the plane of the longitudinal extent as said first inclined portion,

b. fence means mounted at spaced intervals on said guide track means for movement along said guide track means, said fence means projecting in a plane which is substantially normal to the plane of the longitudinal extent when travelling along said first, second and third extents of said guide track,

c. drive means for driving said fence means along said track at a uniform speed relative to said track whereby the fences are moved towards the plane of the longitudinal extent in travelling along said first angularly inclined portion into engagement with containers at linear speed in a direction of the longitudinal plane equal to the speed of travel of the containers, said fences being accelerated linearly as said fences pass onto the longitudinal extent of said track so as to move the containers engaged thereby forwardly of the preceding containers to space the containers on the longitudinal extent and thereafter moving said fence means along said third extent part of the path of travel of said containers to withdraw said fences from engagement with said container, and

d. discharge means for engaging containers which have been spaced forwardly by said fences prior to withdrawal of said fences to discharge said container at a longitudinal speed sufficient to maintain a required space between the container being discharged and the next following containers.

2. A spacer device as claimed in claim **1** wherein said guide track means includes a pair of spaced parallel guide rails arranged one on either side of the path of travel of said container.

3. A spacer device as claimed in claim **2** wherein said fence means is mounted on a pair of continuous chains, one of which extends around each guide rail.

4. A spacer device as claimed in claim **3** wherein each of said fence means includes a support shaft extending between said chains and a plurality of fingers projecting upwardly from each of said shafts.

5. A spacer device as claimed in claim **4** including cam track means for maintaining said fingers in the vertical plane while transversing said first, second and third extents.

6. A spacer device as claimed in claim **5** including sprocket means aligned with said guide rail means for driving the engaging said chains.

7. A carton loading machine as claimed in claim **1** including cam track means extending adjacent said guide track means for controlling the angular position of said fence means relative to said predetermined path of said containers.

8. A spacer device as claimed in claim **1** wherein the angle of inclination, length and disposition of said first and second extents of said guide track are such as to cause said fence means to be elevated to a position in which they project a substantial height above the lower ends of the containers passing through said station, said height being sufficient to prevent rearward tipping of the containers during passage through said station.

9. A spacer device as claimed in claim **1** wherein said containers pass through said station in a plurality of longitudinally extending side-by-side rows, said fence means comprising a support shaft means extending transversely of said longitudinally extending rows and a plurality of fingers projecting as a set from each of said shafts to provide a pair of fingers arranged one on either side of each of said rows, the outermost fingers on said set of fingers having a leading face and a trailing face, each formed to the curvature of the circular section of the container so as to fit within a nip recess formed between adjacent containers of each row of containers, each of the other fingers of said set having a pair of leading faces and a pair of trailing faces each formed to the curvature of the circular section of the container so as to fit within a nip gap between adjacent containers of each row and of adjacent rows.

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