April 8, 1969 A. DUERKSEN 3,437,200

BOTTLE SORTING APPARATUS

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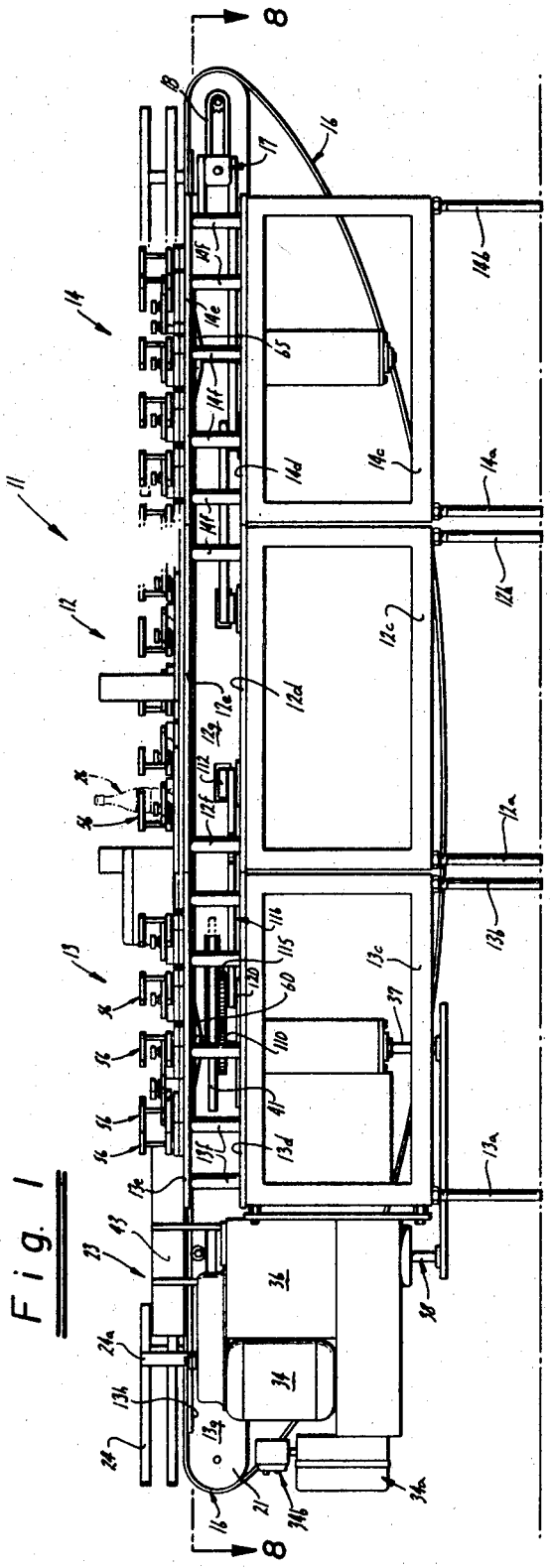


Fig. 1

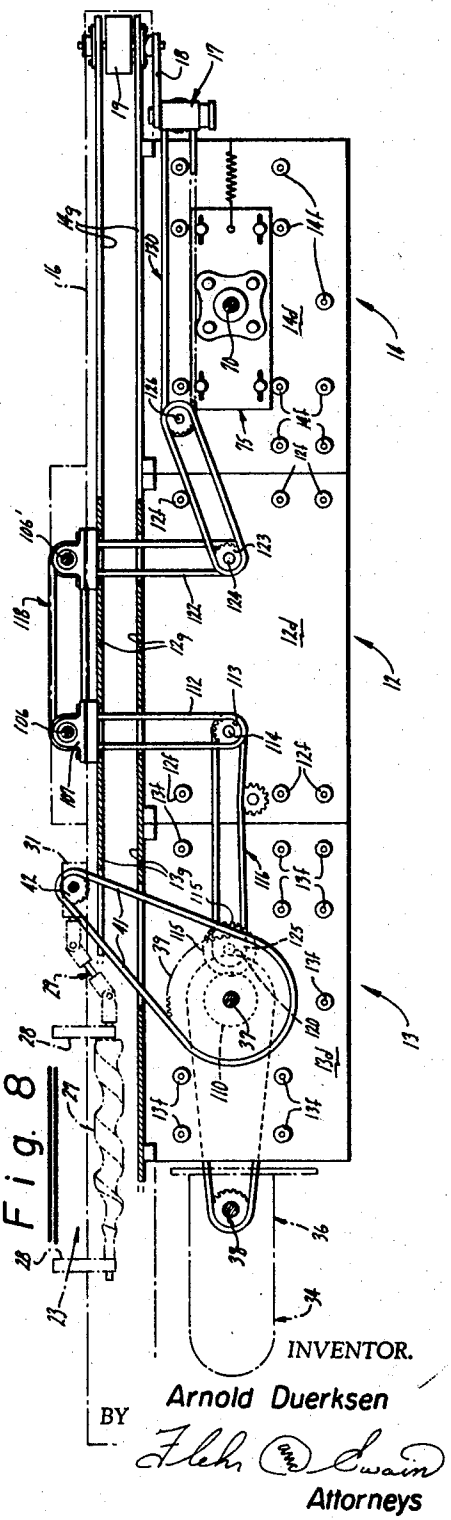


Fig. 8

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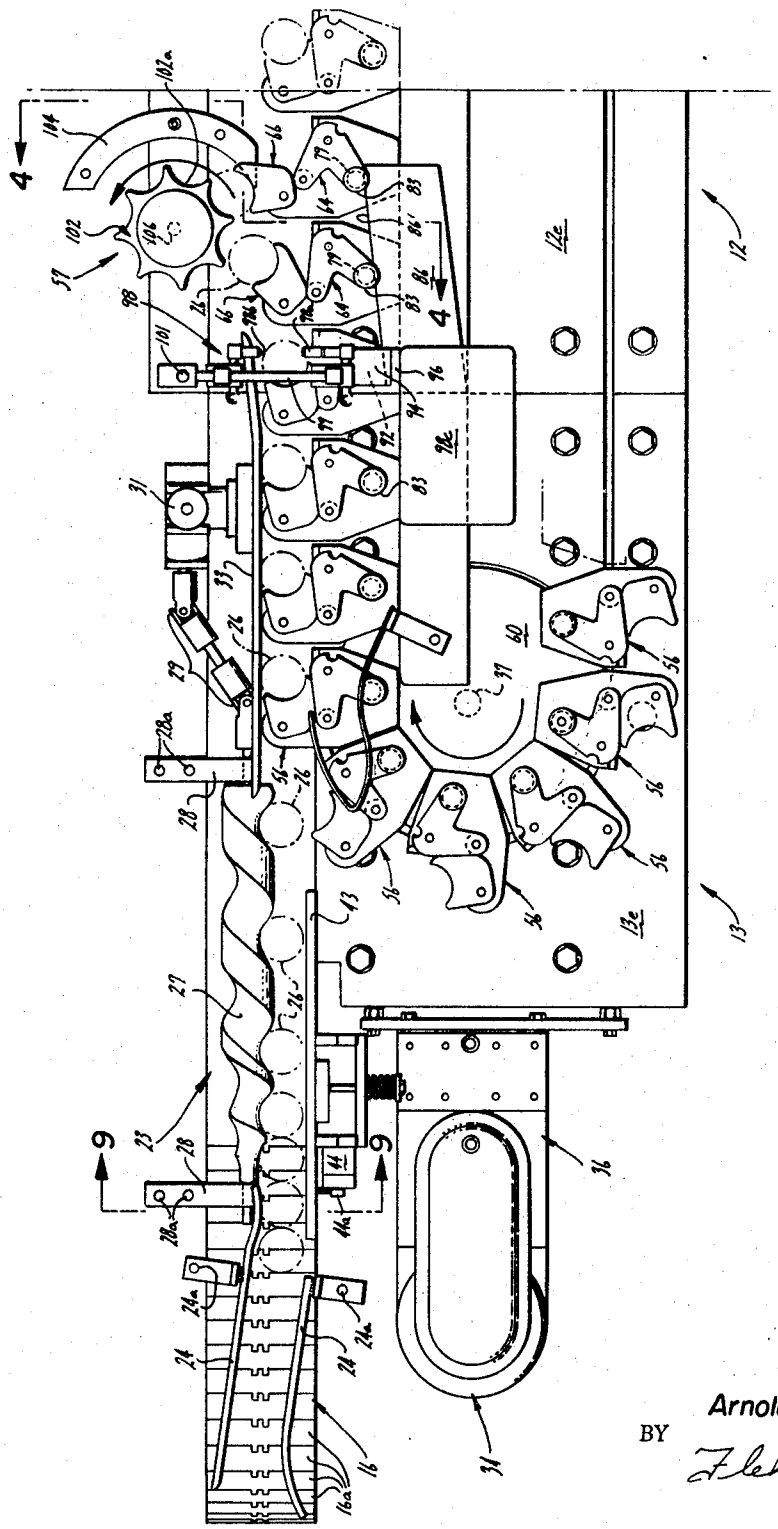


Fig. 2

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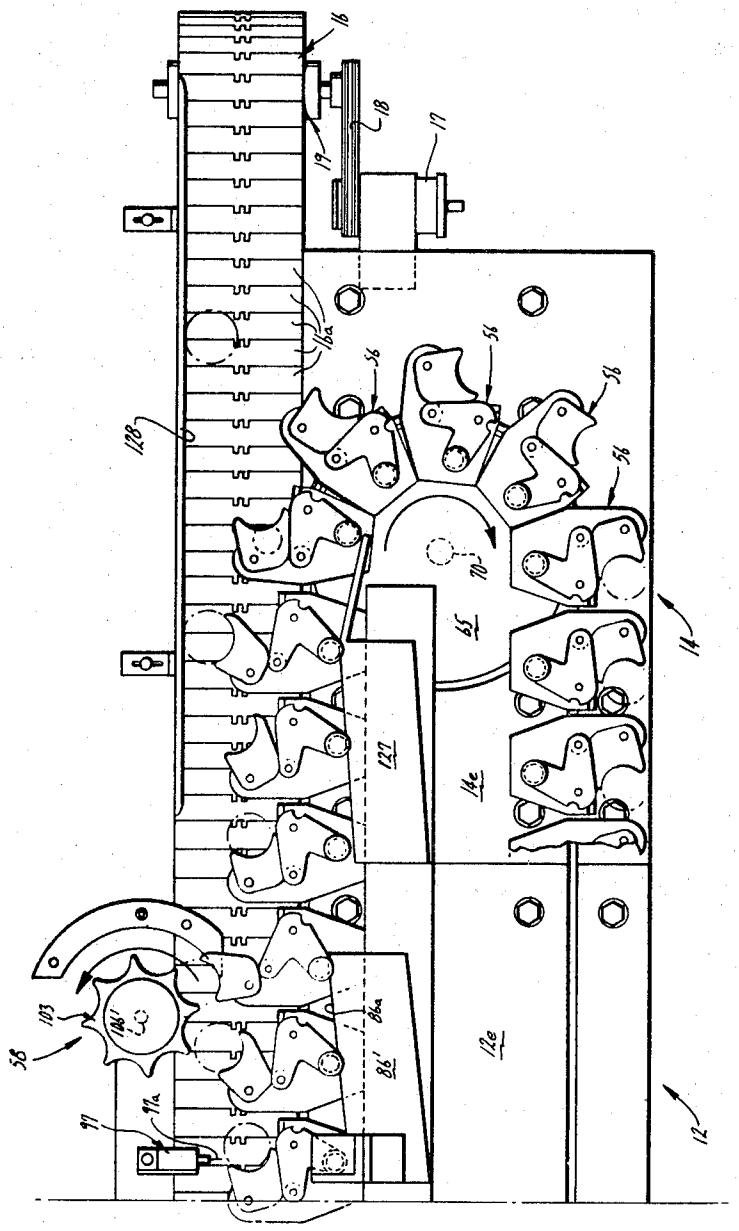


Fig. 3

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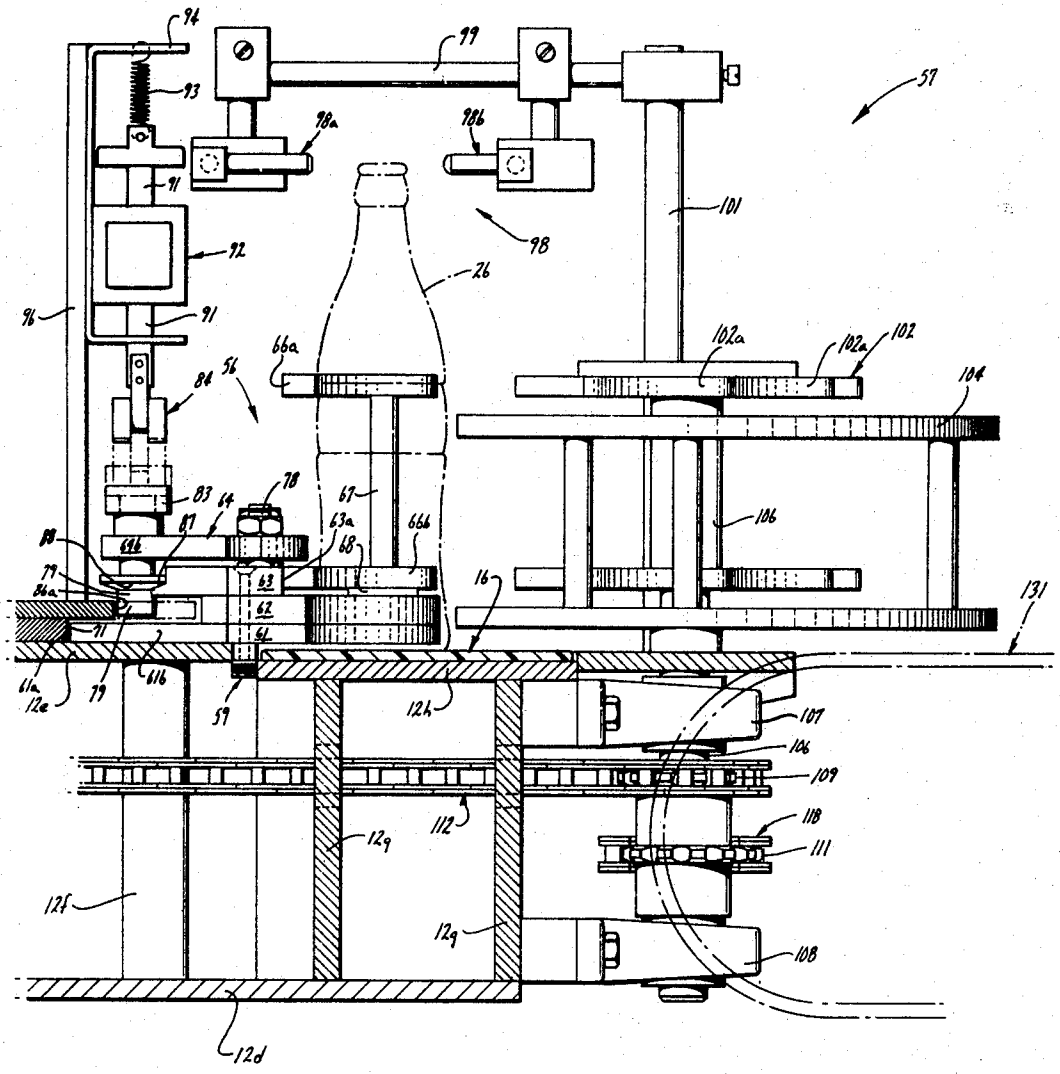


Fig. 4

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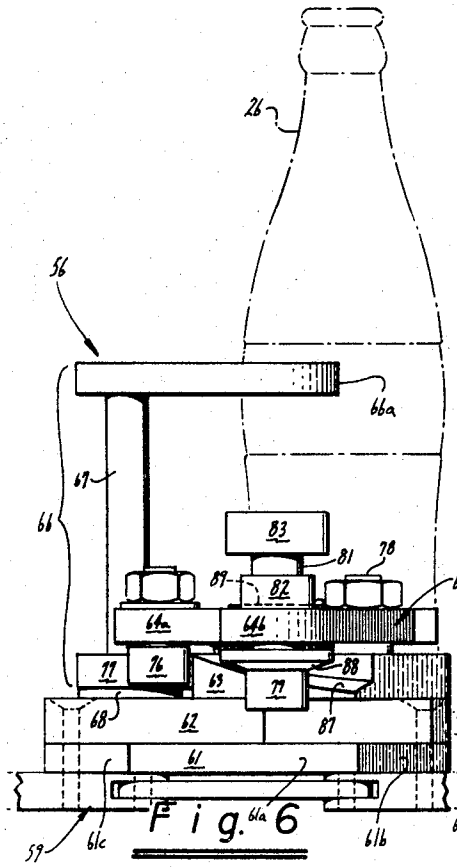


Fig. 6

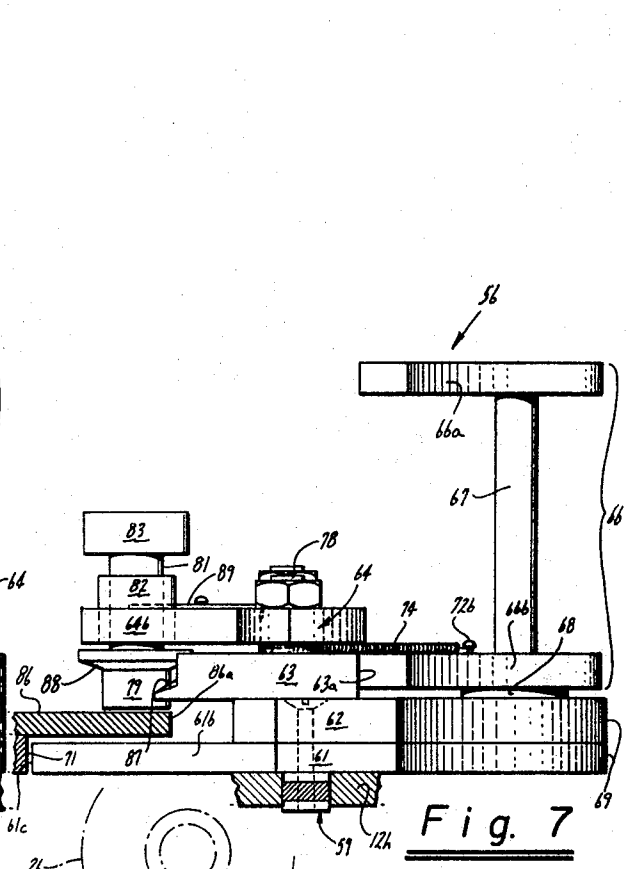


Fig. 7

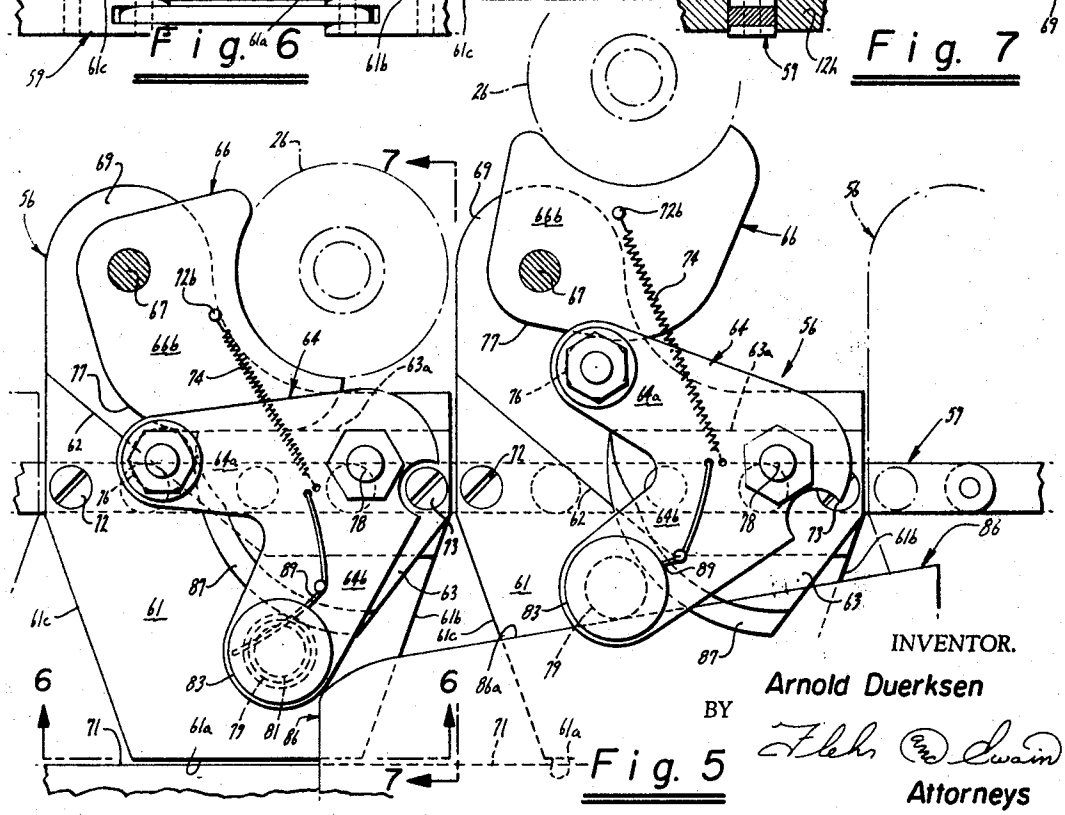


Fig. 5

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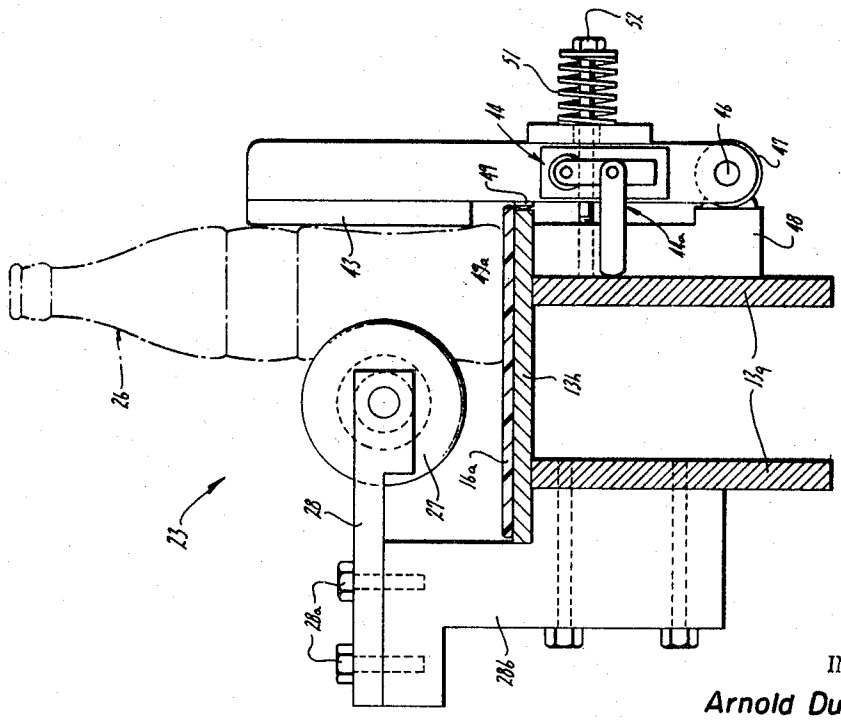


Fig. 9

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United States Patent Office 3,437,200
Patented Apr. 8, 1969

3,437,200

BOTTLE SORTING APPARATUS

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Filed Oct. 6, 1965, Ser. No. 493,515
Int. Cl. B07c
U.S. Cl. 209—73 24 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for sorting bottles of different characteristics separates the bottles into groups having the same characteristics. A conveyor brings the bottles to be sorted past a station where a designated characteristic of the bottle is sensed. In accordance with the characteristic sensed, bottles are removed from the conveyor. Bottles may be segregated according to height, diameter, configuration or color.

This invention pertains to apparatus for sorting like articles from a series of unlike articles, and more particularly, it relates to an improved machine for sorting bottles of dissimilar character.

One may observe in a supermarket a variety of beverages contained in reuseable bottles of various shapes, sizes and colors, according to the beverage and brand. Commonly, such bottles are returned in cases to the bottler for refilling and it frequently occurs that bottles pertaining to different brands of beverages, particularly soft drinks, may be contained in the same case.

A bottler of beverages generally finds it convenient to segregate his bottles from those of another bottler, and also to segregate his own bottles according to size, capacity or character of the beverage sold therein. The bottle segregating or separating operation is usually performed before the bottle washing, sterilizing or inspection operation to achieve efficiency in those latter operations.

Machines have been suggested, and some have been provided, for sorting bottles being that both the volume of bottles and the cost of labor to sort them are high. However, those machines which have been provided have been limited in the variety of bottles they are able to handle. Further, such machines are of such an expense to the small or middle size bottler as to substantially limit their application and many of such bottlers continue to sort bottles manually.

In view of the above, it is a general object of this invention to provide an improved apparatus for sorting articles, such as bottles and the like, which is adapted to sort a wide variety of articles of different character.

Another object of the invention is to provide an apparatus of the type described having a capability for enlargement to accommodate the separation of additional varieties of bottles or the like.

Still another object of the invention is to provide an apparatus of the type described adapted for installation in a bottling operations line to be operated in association with the bottle conveyors therein.

Yet another object of the invention is to provide a sorting apparatus for selecting bottles or the like according to height, width or color.

Still another object of the invention is to provide apparatus of the type described for positively selecting bottles from an advancing line thereof to transfer selected bottles for conveyance in a second line.

A further object of the invention is to provide an improved sorting apparatus for articles, such as bottles and the like, which is automatic in operation, easy to maintain, and which is adapted for efficient selection of like articles from an array of unlike articles.

Additional objects of the invention will appear from the following description in which the preferred embodiment of the invention has been set forth in detail in conjunction with the accompanying drawings, in which:

FIG. 1 is an elevation view of an article sorting apparatus made in accordance with and embodying the principles of the present invention;

FIG. 2 is an enlarged plan view of the left-hand portion of the apparatus shown in FIG. 1;

FIG. 3 is a plan view on the scale of FIG. 2 of the right-hand portion of the apparatus shown in FIG. 1;

FIG. 4 is an enlarged, fragmentary, vertical sectional view taken generally in the direction of the arrows along the line 4—4 of FIG. 2;

FIG. 5 is an enlarged, fragmentary, plan view of two of the article engaging devices included in the present invention;

FIG. 6 is a vertical sectional view taken generally in the direction of the arrows along the line 6—6 of FIG. 5;

FIG. 7 is a vertical sectional view taken generally in the direction of the arrows along the line 7—7 of FIG. 5;

FIG. 8 is a horizontal sectional view taken generally in the direction of the arrows along the line 8—8 of FIG. 1;

FIG. 9 is an enlarged sectional view taken in the direction of the arrows along the line 9—9 of FIG. 2.

The present bottle sorting apparatus generally is comprised of a bottle receiving station and a plurality of bottle separating stations arranged along an operations path. A continuous conveyor traverses the path bringing bottles to the receiving station where they are arranged at a predetermined spacing for receipt by individual bottle engaging devices which move the bottles individually over the conveyor to the receiving stations. Bottle sensing means are disposed at each receiving station and are responsive to bottles of a particular characteristic. When a bottle of the particular characteristic is sensed, the bottle engaging device removes the bottle from the operations path and moves it towards a star-wheel arrangement which conveys the removed bottle to a second conveyor line. In this manner bottles may be segregated according to height, diameter, etc.

Referring now to the drawings, particularly to FIGS. 1–3, it will be seen that there is shown an apparatus, designated generally by the numeral **10**, adapted to sort articles, such as bottles and the like, which is made in accordance with and embodies the principles of the present invention. The sorting apparatus **10** has a general configuration of an elongated table **11** which is composed of a plurality of sections, in the present case three; these being an intermediate section **12** to the left of which is arranged a receiving section **13**, a terminal section **14** being disposed to the right of the intermediate section **12**, as shown in FIG. 1.

Each of the three sections **12–14** is equipped with its own self-supporting framework which, in the case of the intermediate section **12**, includes the floor-engaging leg members **12***a* and **12***b* which are arranged in pairs, only one of each pair being shown. The leg members **12***a* and **12***b* are, at their upper ends, threadably mounted for purposes of vertical adjustment in a generally rectangularly shaped frame **12***c* which may be made up from angle iron or the like structural elements. A horizontally disposed mounting plate **12***d* is rigidly secured to the frame **12***c* to provide a platform for mounting various drive elements for the machine **10**, to be fully described hereinafter. Arranged above the mounting plate **12***d* and co-extensive therewith is a horizontally disposed working-surface plate **12***e* which is maintained in spaced relation from the mounting plate **12***d* by a plurality of spacer columns **12***f*. Thus, the frame structure is arranged to provide adequate space between the plates **12***d* and

12*e* to afford working access to the drive elements arranged upon the mounting plate 12*d*. A spaced apart pair of back plates 12*g* extends upwardly from the mounting plate 12*d* (see FIG. 4) and are covered at the top by a cap plate 12*h*.

Although the sections 13 and 14 each differ in its respective function from that of the intermediate section 12, the receiving section 13 and the terminal section 14 is each equipepd with a framework generally similar in construction and arrangement to that of the intermediate section 12. Thus, the receiving section 13 is equipped with legs 13*a* and 13*b*, a frame 13*c*, a mounting plate 13*d*, a working-surface plate 13*e*, spacer columns 13*f*, back plates 13*g*, and a top plate 13*h*. The terminal section 14 is, like the intermediate section 12, equipped with legs 14*a* and 14*b*, a frame 14*c*, a mounting plate 14*d*, a working-surface plate 14*e*, spacer columns 14*f*, back plates 14*g*, etc.

An endless conveyor 16 is disposed adjacent to one side margin of the table 11 and is comprised of a multiplicity of flat plates 16*a* interlinked with one another, the top run of the conveyor 16 being in sliding engagement with the cap plates 12*h*, 13*h* and 14*h*, see FIGS. 4 and 9. The upper surface of the top run of the conveyor 16 lies in a horizontal plane and is arranged just slightly below the top surface of the working plate 13*e*, as clearly shown in FIG. 4.

The endless conveyor 16 is caused to move from left to right, as viewed in FIGS. 1–3, by power supplied to a right angle drive 17 (see FIG. 3) by the associated drive chains 18 which serve to rotate a drive sprocket assembly 19 mounted between the pair of back plates 14*g* on the terminal section 14, as shown in FIG. 8. Power is transmitted to the drive 17 through a drive train fully described below. The opposite or unpowered end of the conveyor 16 is supported from a bracket 21 which encloses the idler sprocket (not shown), the bracket 21 being mounted with respect to the receiving section 13 by conventional supporting structure well known in the art (not shown).

From FIGS. 1–3, it is clear that the conveyor 16 extends the entire length of the sorting apparatus 10, but along its length the conveyor 16 performs and furnishes different functions in relation to the receiving section 13, the intermediate section 12 and the terminal section 14. More particularly, the initial function performed by the conveyor 16 is to convey articles with respect to a receiving station designated generally 23 arranged on the receiving section 13.

Referring now particularly to FIG. 2, it will be understood that in this preferred embodiment of the invention the sorting apparatus 10 is adapted to sort bottles according to sizes and brands, although it is within the purview of the invention to sort other articles with the mechanism constructed within the principles of the present invention. In FIG. 2, it is contemplated that bottles 26 with their necks pointing upwardly will be delivered to the left or receiving end of the conveyor 16 by auxiliary conveying apparatus (not shown) to what is called the receiving or loading station. A spaced pair of upstanding guide rails 24 are arranged on brackets 24*a* over the conveyor 16 to guide the incoming bottles along a predetermined path to align them on one side margin of the conveyor 16 adjacent to the edge of the working-surface plate 13*e*.

After the bottles are advanced by the conveyor 16 from the receiving station 23 they are advanced into a bottle spacing station. A bottle spacer member 27 having a helical configuration is mounted in the station, as shown in FIG. 2, so that it overlies the conveyor and extends longitudinally of the conveyor 16. The bottle spacer member 27 is rotatably mounted in a pair of brackets 28 secured by fasteners 28*a* to an upstanding lug 28*b* [shown in FIG. 9] mounted on the inner one of the back plates 13*g*. The member 27 is rotated by a drive train including a universal joint equipped drive shaft 29 communicating with a reduction gear box 31 secured to a vertically arranged plate 33 on the receiving section 13, as shown in FIGS. 1 and 8. Motion means, such as an electric motor 34, connected to a reduction gear box 36 drives a main shaft 37 through a sprocket wheel and chain arrangement 38. The main shaft 37 is equipped with a relatively large diameter sprocket wheel 39 and a second drive chain 41 which serves to drive a smaller sprocket wheel 42 mounted on a shaft of the gear box 31. The motor 34 is suitably equipped with a starting box 34*a* and an off-on switch 34*b*. Operation of the motor 34 through actuation of the switch 34*b* supplies power to rotate the bottle spacer member 27 so as to successively spread the bottles 26 further apart as they are advanced along the conveyor 16.

Referring now to FIGS. 2 and 9, to maintain the bottles 26 in the selected path adjacent to the margins of the conveyor 16 and in operative confronting relation with the bottle spacer member 27, an abutment or guide member 43 is disposed in the spacing station and extends longitudinally of and along the margin of the conveyor 16. It is also spaced from the recesses in the rotatable bottle spacer member 27 a distance substantially equal to a bottle's diameter.

To guard against crushing of oversized bottles between the abutment or guide member 43 and the bottle spacer member 27, or the crushing of a bottle which may fall over on the conveyor 16, the guide member 43 is yieldably mounted to cooperate with a motor cut-off switch 44 having an actuating pivot arm assembly 44*a*. More particularly, it will be seen from FIG. 9 that the guide member 43 is mounted for pivotal movement about a horizontal axis established by a pin 46 mounted in a boss 47 extending from a pad 48 secured to the outer one of the back plates 13*g* of the receiving section 13. A resilient bumper 49 mounted on the member 43 engages the top plate 13*h* and thereby limits pivotal movement of the member 43 towards the bottle spacer member 27. Outward pivotal movement of the guide member 43 about the pin 46 is yieldably constrained by a compression spring 51 co-axially arranged about a fastener 52 which extends through the member 43 and is threadably secured in the pad 48. Thus, outward movement of the guide member 43, due to an oversized or a fallen bottle or to a bottle riding on the lands between the recesses of the spacer member 27, compresses the spring 51 and causes the actuating pivot-arm 44*a* of the cut-off switch 44 to pivot and break the electric circuit to the motor 34 and stops rotation of the bottle spacer member 27.

From the above, it will be understood that at the receiving station 23 bottles are received from an incoming conveyor means [not shown] and deposited upon the endless conveyor 16 to be guided by the rails 24 along a predetermined path adjacent the margin of the conveyor 16 and into engagement with the bottle spacer member 27 to issue therefrom with a predetermined spacing so that each bottle 26 may be received by one of a plurality of spaced bottle engaging devices 56. Each bottle engaging device 56 serves to carry one of the bottles 26 from the receiving station 23 on the receiving section 13 towards one of the spaced separating stations 57 arranged on the intermediate section 12 where bottles of a particular configuration are segregated according to their individual physical characteristics.

It will be seen from FIGS. 2 and 3 that the bottle engaging devices 56 are connected in an endless line, one portion of which travels adjacent to and along the conveyor 16 from the spacing station and through the separating stations 57. Each of the devices 56 is secured to an endless chain 59 [see FIG. 4] arranged below the working plates 12, 13*d* and 14*e*, the chain 59 being driven by a sprocket wheel 60 driven by the shaft 37, as shown in FIG. 8. An idler sprocket wheel 65 is mounted on a shaft 70 extending from a chain tensioner assembly 75

mounted on the plate **14***d* of the terminal section **14**. The assembly **75** serves to maintain the chain **59** under proper tension.

Referring now particularly to FIGS. 5–7, it will be seen that each device **56** includes a stacked arrangement of generally planar members which are, from bottom to top, a sliding or bottom plate **61**, a spacer **62** and a segment plate **63**, each fixedly secured to the sliding plate **61**. A rocker **64** is mounted for pivotal movement upon a pin **78** extending through the segment plate **63**, and a bottle engaging member **66** is mounted for rotational movement on a shaft **67** which is received at its bottom end in the bushing **68** mounted in a nose-shaped portion **69** of the juxtaposed sliding plate **61** and spacer **62**.

The sliding plate **61** is attached to the endless carrier chain **59** by the fasteners **72** and **73**, the latter extending through the segment plate **63** and spacer **62** as well. A portion of the sliding plate **61** is generally trapezoidal in plan, as considered from the line extending between the fasteners **72** and **73**, and has a straight side edge **61***a* which, when the device **56** traverses the working or feed run along the machine **10**, confronts a substantially straight way **71** [see FIGS. 2 and 3] which extends from the spacing station fully across the separating stations **57** and **58** and onto the terminal section **14**, as shown in FIG. 3. The way **71** and side edge **61***a* serve to maintain the device **56** in the desired alignment as the device travels adjacent the predetermined path for the bottles.

The converging fore **61***b* and aft **61***c* and edges of the bottom plate **61** permit the series of devices **56** to traverse the semi-circular return portions at each end of the machine **10**, as shown, respectively, in FIGS. 2 and 3, and thus permit the devices **56** to be mounted in a closely spaced relationship on the endless chain **59**.

Referring to FIG. 4, it will be understood that as the devices **56** are moved from the receiving station **23** to one of the separating stations **57** a portion of the bottom plate **61**, extending from the side edge **61***a* to the point of chain attachment, slides across the working-surface plates **12***e* and **13***e* while the portion of the bottom plate **61** extending from the point of chain attachment to the nose portion **69** is disposed over the conveyor **16**.

The bottle engaging member **66** also extends over the conveyor **16**, the member **66** having an upper crescent-shaped pusher member **66***a* and a similarly shaped bottom pusher member **66***b* which together receive the bottle **26** and urges it along the path. It will be understood that the device **56** is caused to move at a slightly greater speed than the conveyor **16** so as to permit the bottle **26** to settle into the "pocket" defined by the crescent-shaped members **66***a* and **66***b*.

The member **66** is arranged to rotate on the shaft **67** from a first position, as shown to the left in FIG. 5, for conveying bottles **26** along an operations path, to a second position, as shown to the right in FIG. 5, for removing a bottle **26** from said path at a separating station. More particularly, the member **66** is maintained in the first position by a tensioned return spring **74** secured to one end to a pin **72***a* arranged in the bottom pusher member **66***b*, the other end of the spring **74** being fixed to the segment plate **63**, as shown in FIG. 7. The tension in the spring **74** serves to urge and maintain the bottom pusher member **66***b* against an abutment or stop defined by an edge **63***a* of the segment plate **63**, as shown in FIG. 5.

The member **66** is urged from the first to the second position by a fixed cam-follower **76** [see FIG. 6] which engages a cam surface **77** disposed along the corner of the member **66***b* remote from the shaft **67**, as shown in FIG. 5. More specifically, the rocker **64** is generally V-shaped in configuration having arms **64***a* and **64***b* and is mounted for pivotal movement about the pin **78** arranged at the apex of the rocker **64**. The fixed cam follower **76** is mounted on the arm **64***a* and extends therebelow in adjacency to the cam surface **77** of the bottom pusher member **66***b*.

The arm **64***b* of the rocker **64** is equipped with a vertically shiftable, selector cam-follower **79** mounted at the end of an axially movable shaft **81** which extends through a bushing **82** disposed in the arm **64***b*. The upper end of the shaft **81** is provided with a cylindrical pad **83** adapted to cooperate with a plunger **84** [see FIG. 4] to shift the selector cam-follower **79** from the out-of-the-way or raised position, as shown in FIGS. 6 and 7, to the operative or lowered position, shown in FIG. 4, so as to permit the follower **79** to engage a selector-cam **86** or **86'** arranged at a separating station.

As may be seen from FIGS. 2, 3 and 5, the selector-cam **86** is mounted on the way **71** and extends inwardly thereof toward the conveyor **16**, the cam **86** having a cam surface **86***a* which projects progressively inwardly in the direction of conveyor travel from the way **71** towards the conveyor **16**. When the selector-cam follower **79** is disposed in the lower position, as shown in FIG. 4, it will engage the selector cam surface **86***a*. As the device **56** is carried forwardly, the follower **79** will follow the cam surface **86***a* and pivot the rocker **64** about the axle **78** serving to move the member **66** into engagement with the ejection cam surface **77** on the bottom pusher member **66***b*. As the selector cam-follower **79** traverses the cam surface **86***a*, the member **66** is pivoted from the first position, as shown in FIG. 5, to the second position shown therein.

It will be observed from FIGS. 4 and 7 that the sliding plate **61** is arranged to pass beneath the selector cam **86** and that the segment plate **63** is arranged on the carrier **56** so as to extend above the selector cam **86** as the device **56** moves past the selector cam **86**.

When the device **56** has advanced along the operations path to a point where the selector cam-follower **79** has traversed to the limit the selector cam surface **86***a*, the member **66** and the rocker **64** are returned to the first position, as shown in FIG. 5, by the tension in the spring **74**. The spring **74** causes the member **66** to rotate to swing the ejection cam surface **77** against the fixed cam-follower **76** carried by the rocker **64**. This causes the rocker **64** to pivot about the pin **78** so as to place the selector cam-follower **79** in a position where it would engage a subsequent selector cam **86'** arranged along the operations path. However, to obviate re-engagement of the selector cam-follower **79** with a subsequent selector cam surface **86***a* along the operations path once a bottle **26** has been ejected from the device **56**, a self-cancelling or "cocking" feature is included on the device **56** which serves to shift the follower **79** upwardly to an out-of-the-way position where it may pass over successive selector cams along the operations path.

More specifically, the segment plate **63** is provided with a cancelling cam surface **87**, as shown in FIGS. 5 and 6, which is arranged to incline upwardly in the direction towards the member **66**. A cancelling cam-follower **88** is mounted on the shaft **81** immediately above the selector cam-follower **79**. The cancelling cam-follower **88** has a general configuration of a truncated cone and, as arranged on the shaft **81**, extends horizontally over the cam surface **87** so that when the plunger **84** has thrust the selector cam-follower **79** into the lower position, as shown in FIG. 4, the cancelling cam-follower **88** is disposed in engagement with the cam surface **87**. Then as the rocker **64** is caused to pivot from the first to the second position, as shown in FIG. 5, the cancelling cam-follower **88** rolls upwardly on the ramp-like cam surface **87** reaching the top thereof and thereby raising the cam follower **79** at the time when the follower **79** has completed its traverse of the cam surface **86***a*.

To maintain the cam **79** and shaft **81** in the upper position, a detent **89** is arranged on the rocker **64**, the detent taking the form of a wire-like element which extends through a horizontal slot in the bushing **82** to engage within a complementary recess within the shaft **81**, as shown in FIG. 5. When the shaft **81** is forced downwardly, the arm of the detent **89** is urged outwardly

from the slot and conversely, as the shaft **81** is raised in response to the action of the cancelling-cam, the wire-like detent **89** snaps back into the recess to hold the shaft **81** and its associated cam-follower in the out-of-the-way position.

Previously mentioned was that at a separating station **57** the plunger **84** could be caused to descend to engage with the pad **83** so as to push the shaft **81** and its associated cam-follower into the lowered position, and thus to cause a bottle **26** to be removed from the operations path. The plunger **84** is arranged on the lower end of a vertically reciprocable shaft **91** which forms the core of a solenoid **92**, the upper end of the shaft **91** being biased by a spring **93** secured to a C-shaped bracket **94** to return the shaft **91** to its raised position upon completion of the downward stroke. The bracket **94** and the solenoid **92** are supported by a vertically disposed standard **96**, as shown in FIG. 4.

The solenoid **92** is energized through a relay [not shown] which is actuated in response to a sensing device responsive to the physical characteristics of bottles **26** passing along the operations path. More specifically, the sensing device may take the form of a photo-electric cell arrangement, as shown in FIG. 4, at the first separating station **57** or the form of a "tickler" actuated switch **97**, having a tickler **97***a*, as shown in FIG. 3, and disposed at the second separating station **58**.

Considering now the bottle size sensing device at the first separating station **57**, reference is had to FIG. 4 wherein there is shown a photo-electric sensing arrangement **98** which includes a light source **98***a* and receiver **98***b* arranged in a horizontal plane at an elevation from the conveyor **16** corresponding to the height of a particular size of bottle **26**. The light source **98***a* and receiving mechanism **98***b* are suitably mounted on a cross arm **99** adjustably secured at one end to a vertically arranged standard **101** at the first separating station **57**. Should it be desired to separate at the station **57** bottles of a height differing from those separated in the previous run, the sensing means **98***a* and **98***b* may be raised and/or lowered on the standard **101** to detect a bottle having a greater height than that permitted to pass through the station **57**.

When a bottle **26** passing through the separating station **57** breaks the light beam between the elements **98***a* and **98***b*, the photo cell mechanism **98***c* [see FIG. 2] permits the relay [not shown] to convey current to the solenoid **92** causing the plunger **84** carried by the shaft **91** to descent to engage the pad **83** to force the selector cam-follower **79** to the lowered position for engagement with the selector cam surface **86***a* causing the device **56** to remove the bottle **26** from the operations path.

Bottles **26** may be selected according to diameter at the second separating station **58** from contact of a bottle with the tickler sensing switch **97**, the switch **97** being of the variety well known in the art and including a projecting wire-like element **97***a* which extends towards the operations path for engagement with bottles having a diameter greater than those permitted to pass through the station **58**. The switch **97** cooperates with a relay [not shown] and a solenoid in the manner previously described in regard to the separating station **57**. Various other sensing means responsive to bottle size, bottle color, and the like, may be arranged at the sensing stations on the machine **10**.

To convey bottles away from the conveyor **16** after they have been ejected by the device **56**, a rotatable star-wheel **102** is arranged at the first separating station **57**, a second star-wheel **103** being similarly arranged at the second separating station **58**, as may be seen from FIGS. 2 and 3 respectively. Each star-wheel **102** and **103** rotates in the direction of the arrows shown respectively in FIGS. 2 and 3. An arcuate guide **104** is spaced from the star-wheel a distance to permit bottles **26** to be carried in the pockets **102***a* of the wheel **102**.

Suitable endless conveyors **131** [as seen in FIG. 4] may be arranged at the exit point adjacent to a star-wheel **102** or **103** to convey bottles separated at a separating station to another portion of the plant for further processing.

Referring to FIG. 4, it will be seen that the star-wheel **102** includes a vertically arranged drive shaft **106** which extends downwardly beneath the plane of the conveyor **16** and is journaled at its lower end to the outer back plate **12***g* in the spaced apart pillow blocks **107** and **108**. A chain sprocket **109** is suitably mounted on the shaft **106** intermediate the pillow blocks **107** and **108** so as to rotate the star-wheel **102** in response to movement of a drive chain **112** driven from an idler sprocket **113** mounted on the counter shaft **114** [see FIG. 8] which, in turn, is driven through a chain and sprocket arrangement **116** which is driven from the shaft **37** through a gear **110** mounted thereon and meshing with a gear **115** which is secured to a shaft **120** upon which there is mounted a sprocket **125** for driving the chain and sprocket **116**.

The second star-wheel **103** at the second separating station **58** is driven from the shaft **106** of the first star-wheel **102**, the shaft **106** having below the sprocket **109** a sprocket **111**. A chain and sprocket arrangement **118** is provided on the drive shaft **106'** of the second star-wheel **103** and cooperates with the sprocket **111** to rotate the second star-wheel **103**. A chain take-off from the shaft **106'** [see FIG. 8] which includes the chain **122**, and sprocket **123** and shaft **124** furnished power to an idler shaft **126** which, through a sprocket and chain arrangement **130**, supplies power to the right angle drive **17** which powers the endless conveyor **16**.

It will be understood that the star-wheel **102** and **103** are rotated at a speed so as to synchronize with the movement of the devices **56** through the separating stations so as to receive the bottles **26** as they are ejected from the operations path by the member **66**.

Bottles which have not been separated at the stations **57** and **58** are ejected from the operations path near its terminal portion through the encounter by the devices **56** with a terminal cam **127** disposed on the terminal section **14**, as shown in FIG. 3. The cam **127** is arranged above the working plate **14***e* a distance so as to engage the selector cam-follower when it is in the raised position. Thus, any bottles remaining in a device **56** are ejected from the path before the series of devices **56** make the return run to the spacing station. When ejected on the terminal portion **14**, the bottles may be carried along on the conveyor **16** to be received by another conveyor [not shown] and taken to another portion in the plant for further processing. A guard **128** is mounted along the outer margin of the conveyor **16** to ensure that bottles carried therealong are maintained upon the conveyor.

It will be observed from FIGS. 2 and 3, taken in conjunction with FIG. 8, that the separating stations **57** and **58** are both contained upon the intermediate section **12***e*. Further, in FIG. 8, it is seen that the drive of the separating stations is also so disposed mounted upon the plate **12***d*. Where additional separating stations are desired in the machine constructed in accordance with the invention, additional intermediate sections **12** may be supplied and the drive train arranged to accommodate such new sections. Thus, the machine of the instant invention is advantageously of modular design flexibly adapted to the requirements of small, intermediate or large bottle separating operations.

To summarize the operation of the article separating machine **10**, the initial step is to actuate the off-on switch **34***b* to set the motor **34** into operation. The motor **34**, through the drive train previously described, causes the endless conveyor **16** to advance from left to right, as shown in FIGS. 2 and 3. Simultaneously, the spacer member **27** is caused to rotate in the direction to advance the

bottles in the direction of conveyor movement. The procession of devices **56** is also placed in motion in a clockwise direction as viewed in FIGS. 2 and 3. The first **102** and the second **103** star-wheels are also placed in rotation in the direction of the arrows, as shown respectively in FIGS. 2 and 3.

Let it be assumed that a supply of bottles, which include bottles of different sizes and shapes, is placed upon the left end of the conveyor, as viewed in FIG. 2, these bottles will be carried between the guide rails **24** to be conveyed into engagement with the spacer member **27**. Here, the bottles will be spaced at a predetermined pitch so that when exiting from the spacer member **27** each bottle **26** will be properly disposed as to be received in the member **66** of one of the devices **56**.

The series of devices **56** convey the bottles at a slightly greater speed than the conveyor **16** so that each bottle **26** is secured within the "pocket" defined by the pusher elements **66***a* and **66***b* of the devices **56**. By reason of this differential in speed the bottle is urged against the pushers **66***a* and **66***b* and maintained in a vertical position as it is carried along the operations path.

To be further assumed is that the sensing devices **97** and **98** have been each pre-set according to the physical characteristics of the bottles desired to be separated respectively at the first and second separating stations. For example, bottles may be separated at the first separating station **57** according to the height while at the second separating station **58** bottles may be separated according to diameter.

As a bottle **26**, having a height greater than the elevation of the photo-electric sensing means **98** at the first separating station **57** passes through and breaks the light beam the solenoid plunger mechanism **94** descends to place the selector cam-follower **79** in the lower position so that it may engage the selector cam **86** at the first separating station **57**. As the selector cam-follower **79** traverses the selector cam surface **86***a* the member **66** pivots from the first to the second position, as shown in FIG. 5. When the member **66** is extended to the second position, the bottle **26** therein is so disposed as to be received by the star-wheel **102** and within one of its bottle carrying "pockets" and conveyed from the operations path in the direction of the arrow, as shown at the separating station **57** in FIG. 2. From the star-wheel **102** the bottle may be conveyed to another position in the plant by the conveyor means **131** shown in broken lines in FIG. 4.

Bottles which do not actuate the photo-electric cell sensing means at the first separating station **57** pass through the first to the second separating station **58**. Here, each bottle confronts the diameter sensing mechanism **97**. Should a bottle be of a greater diameter than that for which the mechanism **97** is set a similar solenoid actuated plunger mechanism will depress the selector cam-follower causing it to engage the selector cam **86'** and thereby to eject the bottles to the selected size from the operations path for engagement with the second star-wheel **103** and to be carried thereby towards other conveyor means [not shown].

Bottles which have been carried by the devices **56** through both the first **57** and the second **58** separating stations are ejected from the operations path as the devices **56** pass along the terminal selector cam **127**. These bottles remain upon the conveyor **16** while the procession of devices **56**, now devoid of bottles, return to the receiving station **23**. At the end of the conveyor **16** the bottles may be received upon auxiliary associated conveying apparatus [not shown].

After each selector cam-follower has been caused to traverse a selector cam surface the cancelling cam-follower **88**, through engagement with the cancelling cam surface **87**, serves to urge the selector cam-follower **79** to the raised position. At this time, the yoke return spring **74** pulls the bottle engaging yoke **66** into the original first position, as shown in FIG. 5.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

I claim:

1. In a botle sorting apparatus for sorting bottles of different characteristics into separate groups of botles with each group of bottles having the same characteristic, a conveyor travelling in a predetermined path and having portions thereof forming a receiving station and a plurality of spaced separating stations, the bottles to be sorted being delivered to the receiving station by the conveyor so that they are advanced by the conveyor along the predetermined path, means travelling substantially in synchronism with the conveyor and engaging the spaced bottles as they are advanced by the conveyor, sensing means for sensing the desired characteristics of the bottles to be sorted and means operatively connected to said sensing means and to said means travelling substantially in synronism with the conveyor for causing said means travelling substantially in synchronism with the conveyor to remove the bottles from the predetermined path in the separating stations in accordance with the characteristics sensed.

2. Apparatus as in claim **1** wherein the portion of the conveyor travelling through the receiving station and the discharge stations is disposed in a substantially horizontal plane and wherein the bottles are resting upon the conveyor with their necks facing upwardly.

3. Apparatus as in claim **2** wherein said conveyor is endless and wherein said means travelling substantially in synchronism with the conveyor engaging the spaced bottles includes a plurality of bottle engaging devices and means connecting the bottle engaging devices into an endless loop, each of the bottle engaging devices having a bottle engaging member, the bottle engaging member being movable between a bottle retaining position and a bottle removing position, said bottle engaging member overlying the conveyor when the bottle engaging member is in said bottle engaging position.

4. Apparatus as in claim **3** wherein each of the bottle engaging members has a recess, said bottle engaging devices being arranged so that the bottle engaging members engage the trailing side of the bottles as the bottles are advanced on the conveyor.

5. Apparatus as in claim **1** together with means mounted adjacent the conveyor ahead of the separating stations and after the receiving station for arranging the bottles received in the receiving station in a predetermined space relationship.

6. Apparatus as in claim **1** together with means in each separating station for receiving each of the bottles removed in the separating station, said means for receiving the bottles in each separating station including an arcuate guide member having one portion of the same adapted to engage the bottle when it has been moved out of the predetermined path by the bottle engaging member, a star-wheel, and means for rotating the star-wheel, said star-wheel being disposed adjacent the arcuate member and having bottle receiving recesses adapted in cooperation with the arcuate guide member to carry the bottles away from the conveyor.

7. Apparatus as in claim **1** wherein said means operatively connecting the sensing means to said means travelling substantially in synchronism with the conveyor and engaging the spaced bottles includes a cam member in each of the separating stations, each of the bottle engaging devices having a cam-follower movable between a cam engaging and an out-of-the-way position, and solenoid-operated means connected to the sensing means for moving the cam-follower from the out-of-the-way position to the cam engaging position adjacent a separating station when a bottle of the desired characteristics has

been sensed having a characteristic corresponding to the characteristic of the bottles to be removed at said separating station.

8. Apparatus as in claim 7 together with means for causing said cam-follower to return to the out-of-the-way position after a bottle has been removed from the predetermined path.

9. Apparatus as in claim 8 wherein said last named means includes an additional cam member in each bottle engaging device, and an additional cam-follower adapted to engage the additional cam member mounted on the bottle engaging device and means connected to the additional cam-follower for causing said first named cam-follower to return to the out-of-the-way position when the additional cam-follower engages the additional cam member.

10. Apparatus as in claim 1 wherein said sensing means includes means for sensing the height of the bottles on the conveyor.

11. Apparatus as in claim 1 wherein said sensing means includes means for sensing the diameter of the bottles on the conveyor.

12. In a bottle sorting apparatus for sorting bottles of different characteristics into separate groups of bottles with each group of bottles having the same characteristics, a conveyor travelling in a predetermined path and having portions thereof forming a receiving station and a plurality of spaced separating stations, said conveyor in said receiving station and in said separating stations having a surface travelling in a horizontal plane whereby the bottles may be delivered to the receiving station so that they rest upon the conveyor with their longitudinal axis perpendicular to said surface, means mounted adjacent the conveyor for arranging the bottles delivered to the receiving station so that they have a predetermined spacing on the conveyor, means including a plurality of bottle engaging devices travelling at a speed just slightly greater than the speed of movement of the conveyor, each of said bottle engaging devices including a bottle engaging member movable between a bottle retaining position and a bottle removing position, sensing means for sensing the desired characteristics of the bottles to be separated, and means operatively connected to said sensing means and to said means including a plurality of bottle engaging devices for causing the bottle engaging member of the bottle engaging device having a bottle of a predetermined characteristic therein to move to the bottle removing position to thereby remove the bottle having the predetermined characteristic from the predetermined path in the separating station receiving bottles having said predetermined characteristic, and means mounted in each of the separating stations for removing the bottles which have been separated from the predetermined path.

13. Apparatus as in claim 12 wherein said means for arranging the articles so that they have a predetermined spacing on the conveyor consists of a helical member extending longitudinally of and overlying the conveyor and adapted to engage the bottles on one side as they adjacent the conveyor opposite the helical screw and extending longitudinally of the conveyor for guiding the opposite sides of the bottles as they are advanced on the conveyor, and means for rotating the helical member.

14. Apparatus as in claim 13 together with means mounting said guide member and permitting restrained movement of the same, and means sensing the movement of said guide member for stopping operation of said means for rotating the helical member when said guide member has been moved beyond a predetermined position.

15. Apparatus as in claim 12 wherein each of said are advanced by the conveyor, and guide means mounted article engaging members is provided with a recess and is advanced so that it overlies the conveyor and engages the traling side of the bottle and retains the bottle in engagement with the guide member, and wherein means is provided in each of the separating stations for removing the bottles which have been separated in the station, said means for removing the bottles including an arcuate guide member having a portion thereof overlying the conveyor in relatively close proximity to the predetermined path for the bottles and being adapted to engage bottles removed from the predetermined path by the bottle engaging member, a star-wheel, means for rotating the star-wheel, the star-wheel having bottle engaging recesses and being disposed adjacent the arcuate guide member whereby when a bottle is engaged by the arcuate guide member it is moved into a recess of the star-wheel and is advanced away from the conveyor by the star-wheel.

16. In a bottle sorting device for use in a bottle sorting apparatus of the type utilized for sorting like bottles from a plurality of unlike bottles as such bottles are conveyed along a predetermined path, said bottles sorting device comprising a base, a bottle engaging member mounted on said base for pivotal movements from a first position for engaging and transporting a bottle along said path to a second position for removing said bottle from said path, said device also including rocker means pivotally mounted on said base and engageable with said member to move the same from said first to said second position, a cam-follower associated with said rocker means and reciprocally movable between operative and an out-of-the-way position to cooperate with a cam arranged along said operations path when said cam-follower is reciprocated to its operative position, and cancelling means on said device for returning said cam-follower to said out-of-the-way position when a bottle has been removed from said path.

17. A bottle sorting device as in claim 16 wherein each said device includes a cancelling cam having a cancelling cam surface engageable by said cam-follower and inclined progressively upwardly in the direction of pivotal movement of said rocker means when the same moves said member toward said second position.

18. The device as in claim 16 together with spring means inter-connecting said member and said rocker means, said spring means being tensioned during movement of said bottle engaging member to said second position and serving to return said bottle engaging member to said first position upon disengagement of said cam-follower from said cam.

19. The bottle sorting device as in claim 16 in which said rocker means includes detent means serving to maintain said cam-follower normally in said out-of-the-way position.

20. In apparatus for selecting like articles from a plurality of unlike articles, a framework having portions thereon forming a receiving station and a plurality of separating stations, spacing means for arranging articles delivered to said receiving station in a predetermined spaced apart relationship, means including a plurality of article engaging devices arranged to receive such spaced articles from said spacing means and to retain and convey such articles along a predetermined path from the receiving station successively to each of the separating stations, each article engaging device being equipped with an article engaging member movable from a first position to engage and transport an article along said path to a second position wherein said member removes such articles from said path, article sensing means at each separating station responsive only to articles of a selective variety moving along said path, means co-acting with said sensing means and said article engaging device for moving said member from said first to said second position, and article receiving means arranged at each of said separating stations to receive articles of such selected variety removed from said path.

21. In apparatus for selecting like articles from a plurality of unlike articles, a supporting framework forming spaced receiving and separating stations, means including article engaging and retaining devices arranged to engage and convey such articles severally along a path extend-

ing from the receiving to the separating stations, sensing means at said separating station responsive only to articles of a selected variety, each article engaging device including a base, and an article engaging member mounted on said base for pivotal movements from a first position for engaging and transporting an article along said path to a second position for removing said article from said path, each of said devices also including rocker means pivotally mounted on said base and engageably with said member to move the same from said first to said second position, a cam-follower associated with said rocker means and reciprocally movable between operative and inoperative positions, a cam arranged at said separating station for cooperation with said sam-follower when the same is reciprocated to its operative position and serving to cause said rocker means to move said member from said first to said second position, reciprocating means actuated in response to said sensing means to urge said cam-follower into said operative position, and cancelling means on each of said article engaging devices for returning said cam-follower to said inoperative position when such article has been removed from said path.

22. Apparatus as in claim **21** wherein said cancelling means on each of said article engaging devices includes a cam having a cam surface engageable by said cam-follower and inclined progressively upwardly in the direction of pivotal movement of said rocker means when the same moves said member towards said second position.

23. Apparatus as in claim **21** together with spring means inter-connecting said member and said rocker means, said spring means being tensioned during movement of said bottle engaging member to said second position and serving to return said bottle engaging member to said first position upon disengagement of said cam-follower from said cam.

24. Apparatus as in claim **21** in which said rocker means includes detent means serving to maintain said cam-follower normally in said inoperative position.

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