United States Patent [19]

Doucette

[11] **3,867,807**

[45] **Feb. 25, 1975**

[54] **CARRIER APPLICATOR MACHINE FOR BOTTLES**

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[73] Assignee: **Owens-Illinois, Inc.,** Toledo, Ohio

[22] Filed: **Nov. 19, 1973**

[21] Appl. No.: **416,733**

[52] **U.S. Cl.** **53/48,** 53/196, 53/314

[51] **Int. Cl.** **B65b 21/00,** B65b 43/44

[58] **Field of Search** 53/48, 49, 196, 299, 313, 53/314

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Primary Examiner—Robert L. Spruill

Attorney, Agent, or Firm—J. R. Nelson

[57] **ABSTRACT**

The invention disclosed is a machine for applying in series a molded plastic shell-like carrier over a pre-arranged grouping of containers, such as bottles. The machine includes a storage magazine turret supplying the carriers in nested fashion to a hopper device at a feeding station. The magazine turret indexes a magazine to the feeding station and a camoperated device releases the nested carrier stack in a magazine to the underlying hopper. A carrier feed device continuously separates the lowermost carrier and drops it to an underlying carrier delivery conveyor. Bottles are advanced in parallel rows under the conveyor and past a carrier gate at the end of the carrier conveyor. First star wheel mechanism spaces the bottles on the conveyor to correspond as groups with compartment cavities in the carrier. Bottles moving through the first star wheel pull carriers from the feed gate; whereupon each such carrier falls over a group of bottles. A horizontal overhead guide rail holds down the carrier in a preliminary position of assembly whereat the bottles are each inserted into a compartment cavity of the carrier. The bottle conveyor moves bottles and carriers through a second star wheel device stabilizing the bottles under a rotary applicator wheel. The wheel has peripherally spaced pockets that coincide with the compartments of the carrier and the wheel, on a yieldable arm, bears against the carrier to seat the annular retaining bead in the carrier compartments over an enlarged end portion of the bottles. The grouping of bottles is held in the carrier as a packaged unit.

7 Claims, 8 Drawing Figures

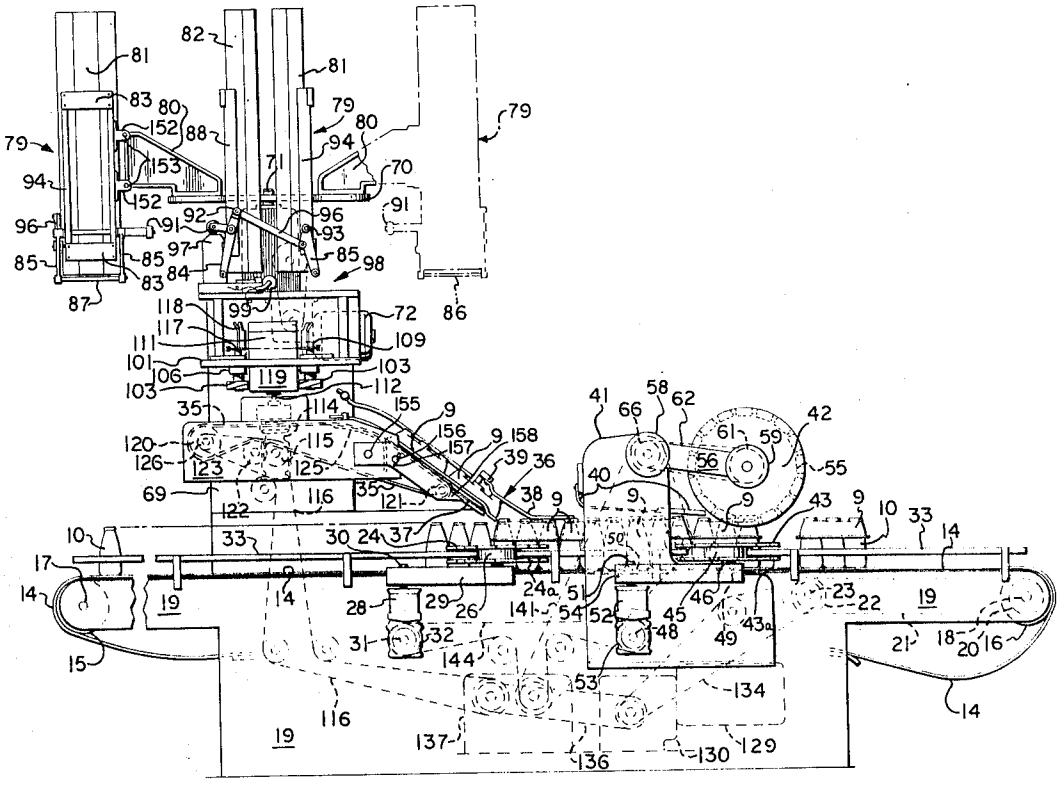
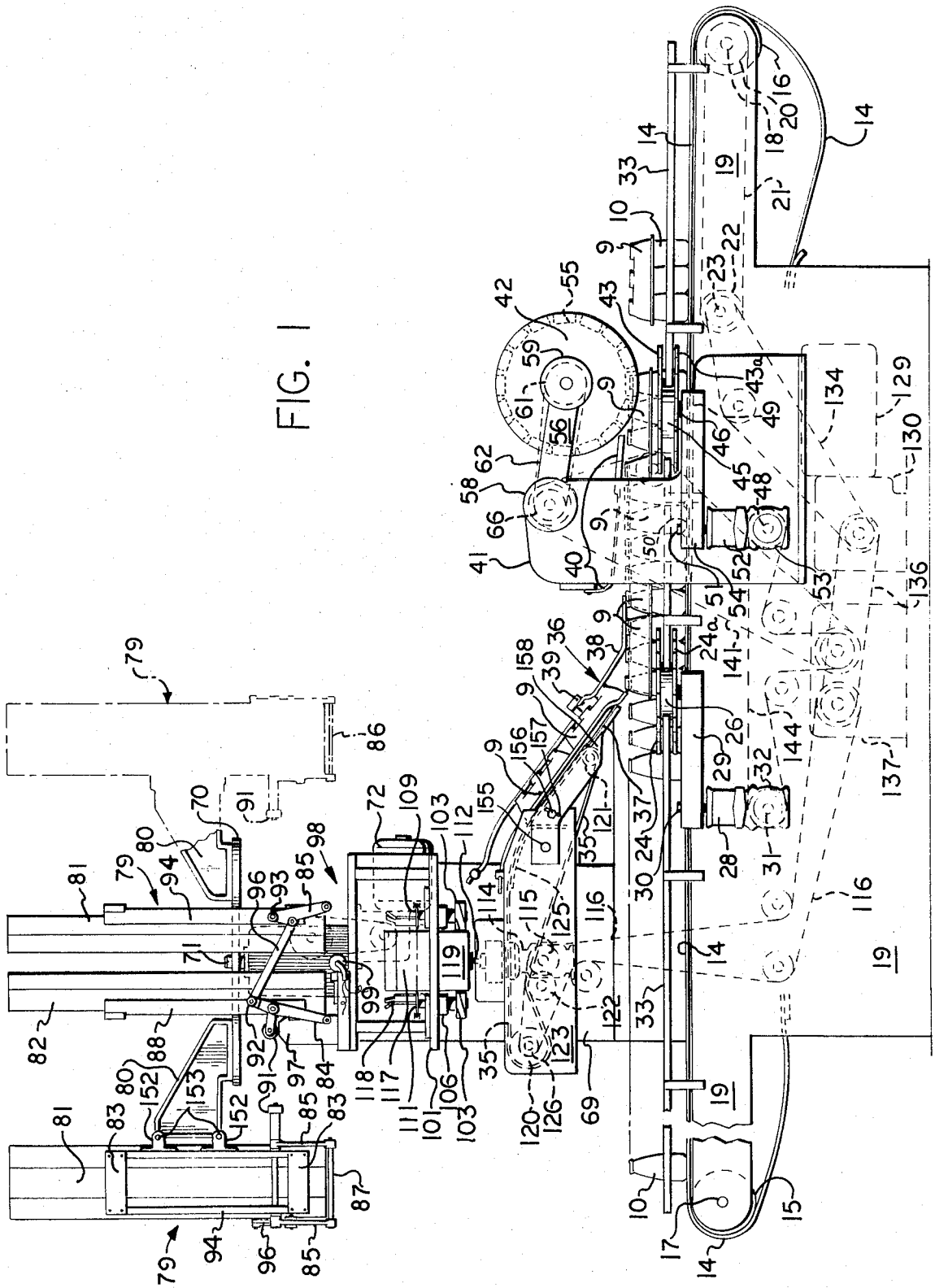


FIG. 1



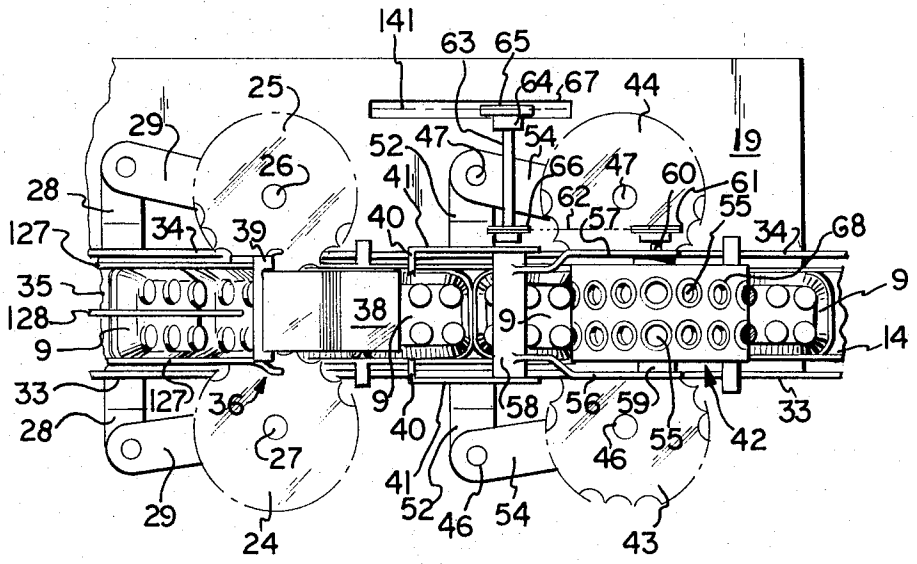

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FIG. 2

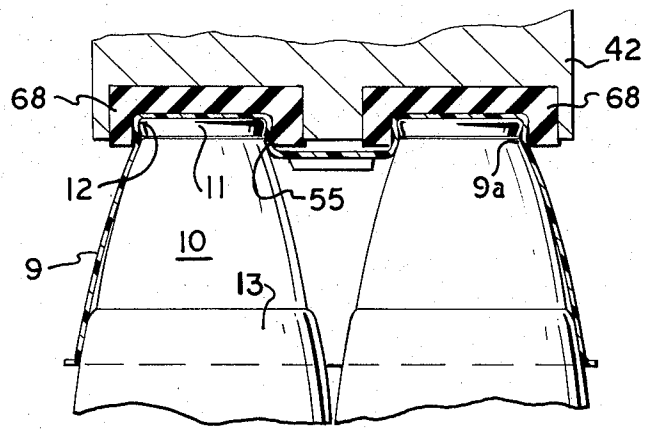

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9a
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9
13

FIG. 7

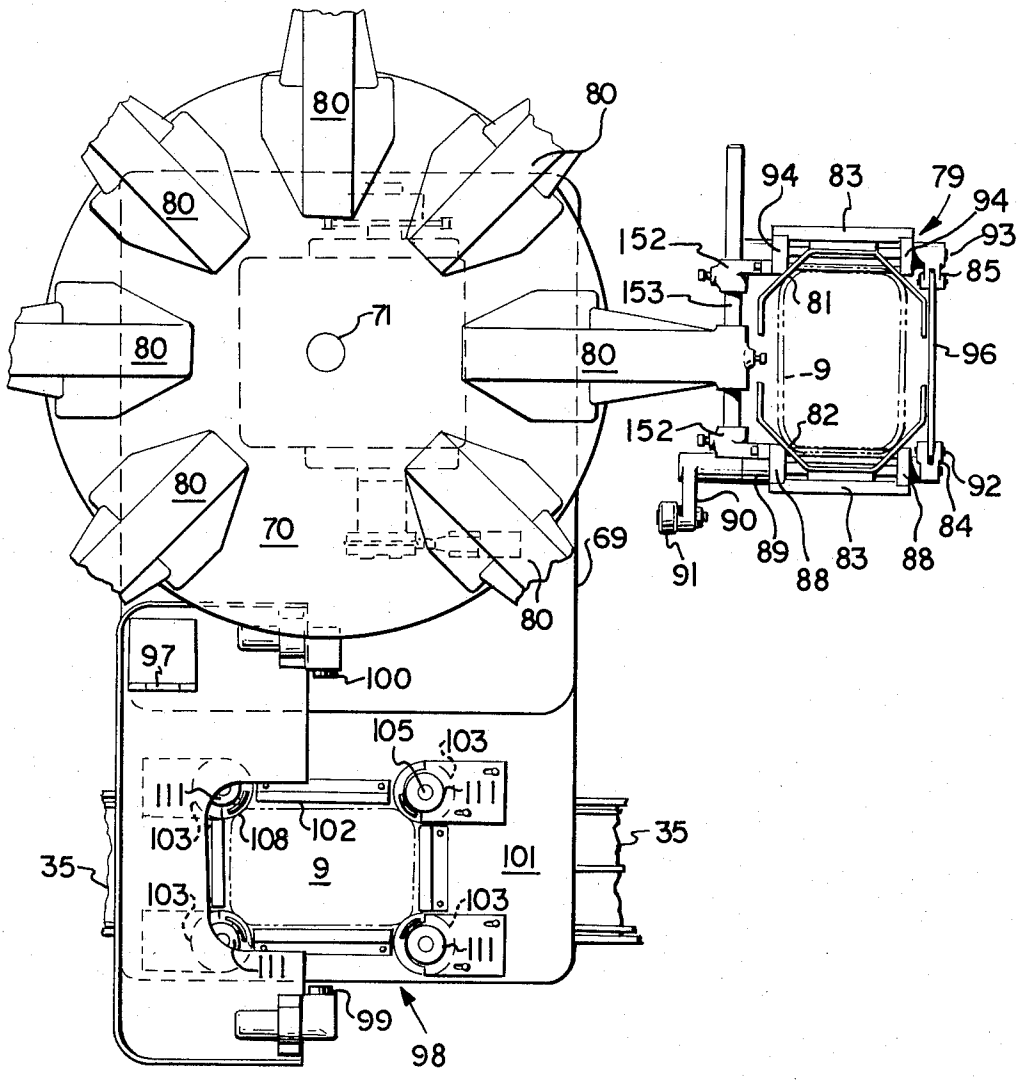

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FIG. 3

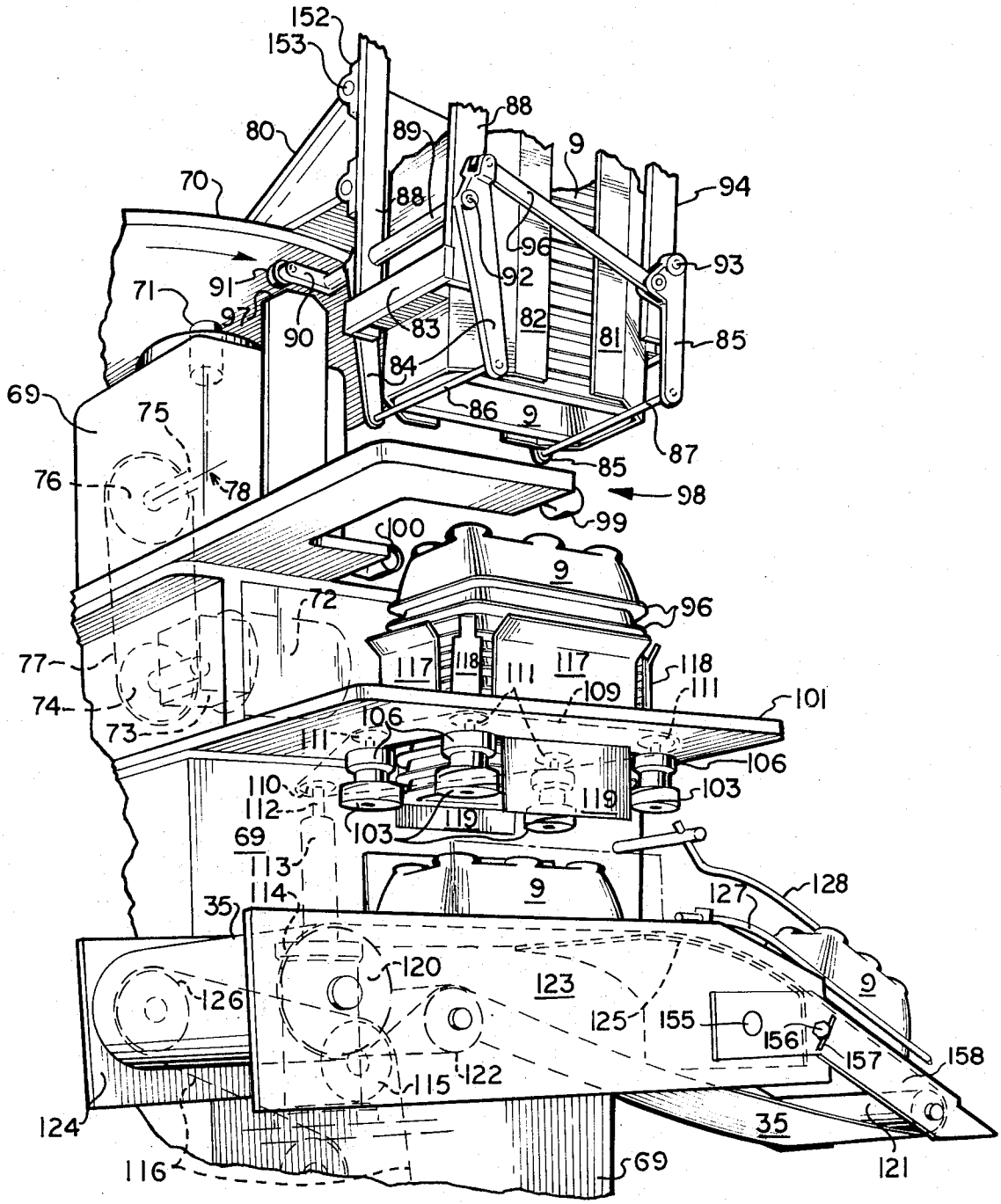

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FIG. 4

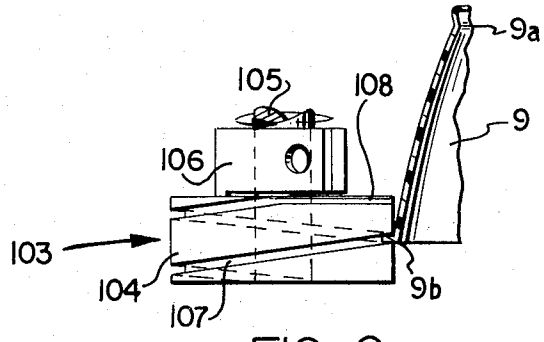

9a
105
108
9
106
103
104
107
9b

FIG. 6

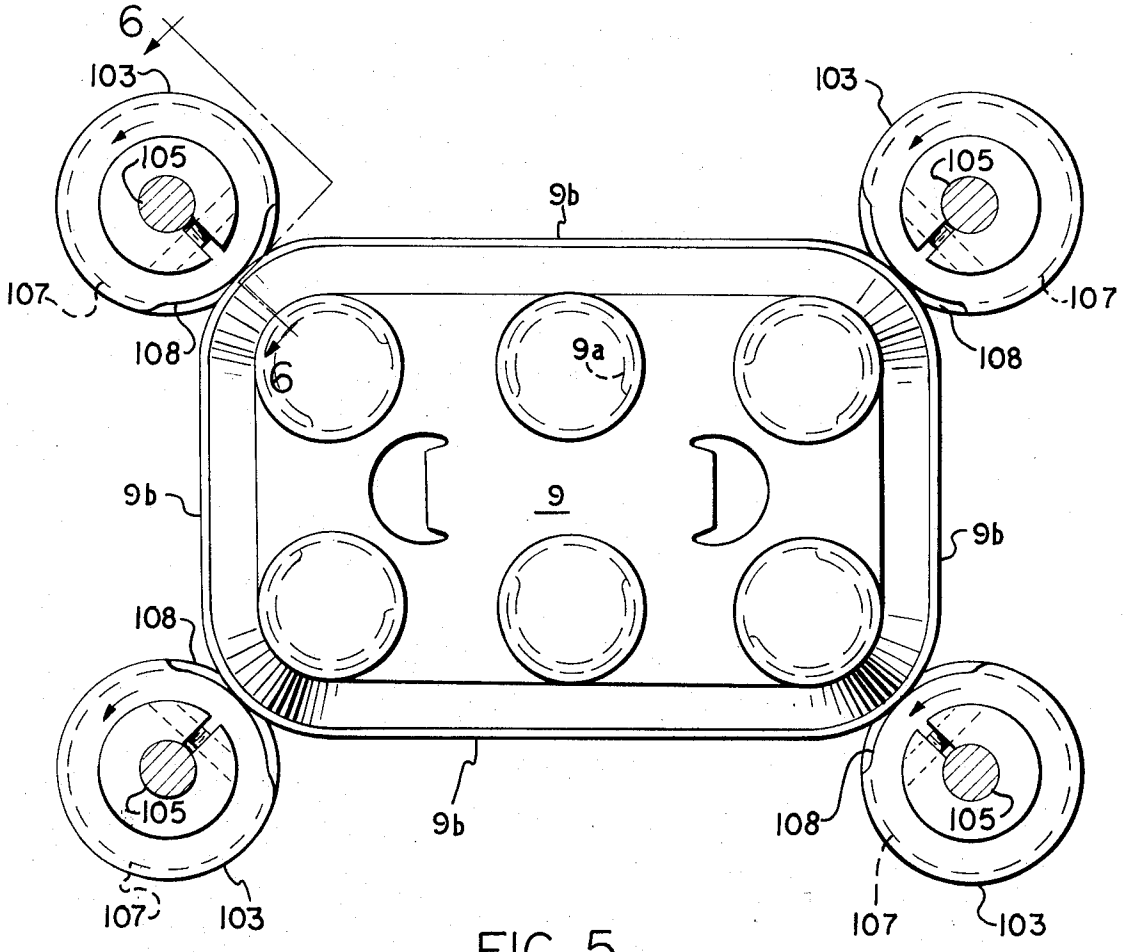

6
103
105
107
108
9b
9a
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107
108
9b
9b
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9b
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FIG. 5

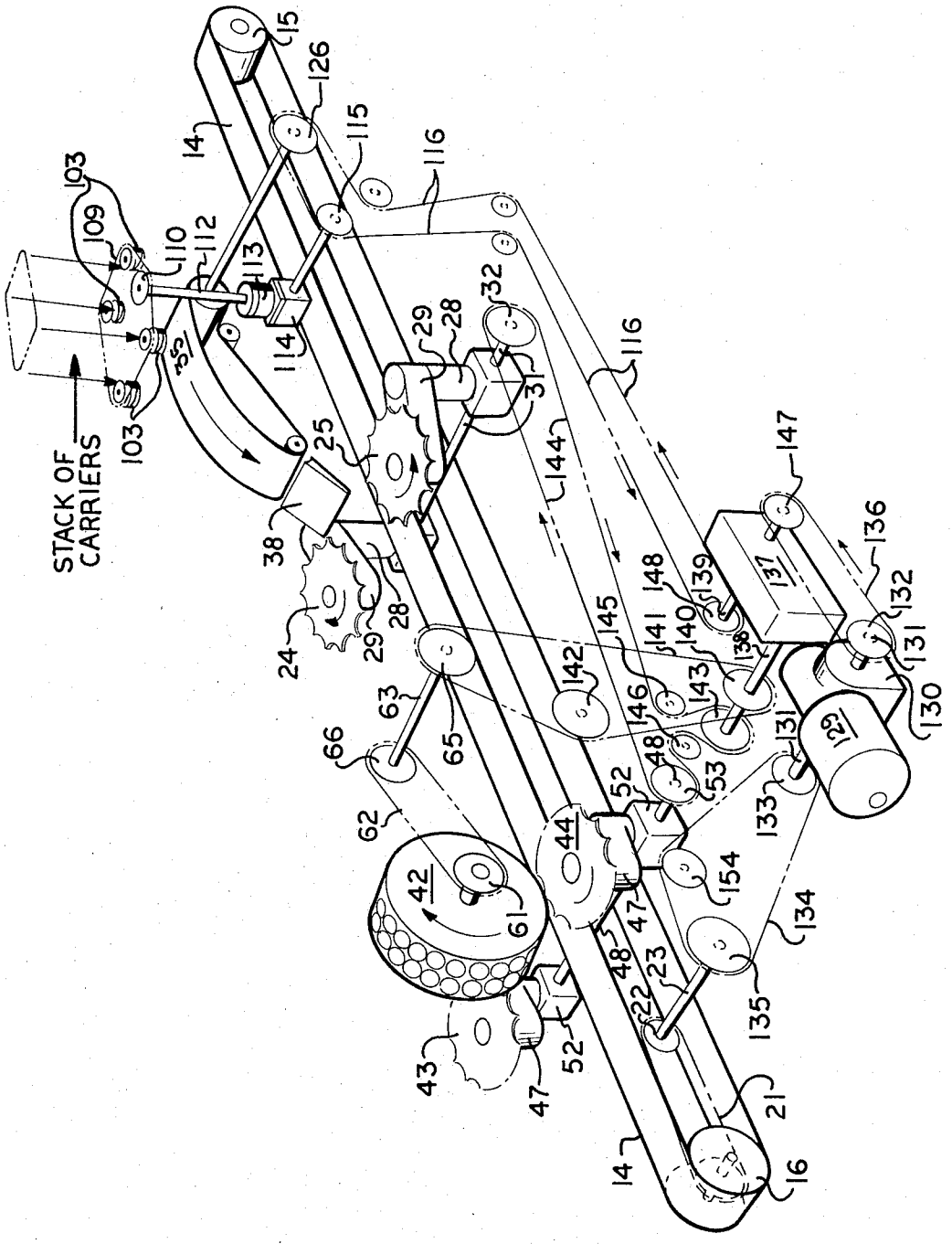

STACK OF CARRIERS
103
109
110
112
113
114
115
116
126
14
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28
29
31
32
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63
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FIG. 8

CARRIER APPLICATOR MACHINE FOR BOTTLES

There is devised a container carrier that is molded from plastic as a shell-like article having upstanding cells or compartments each provided with an internal annular bead or radial flange adapted to receive the neck and closure of a bottle product and retain the bottle in position in the compartment. Thusly, the group of product bottles comprise a carrier package. These carrier packages are often referred to as "six-paks" or "eight-paks," and most commonly used in the handling and marketing of carbonated beverages and beer products. This form of carrier is disclosed in U.S. Pat. No. 3,752,305 and copending application, Ser. No. 294,171 of J. Hatfield, filed Oct. 2, 1972, commonly owned with the present application.

The present invention provides a machine for the continuous assembly of a supply of containers or bottles into carrying packages with the aforementioned type of shell-like carrier.

The applicator machine provides a production capacity in fabricating and handling the assembled carrier packages. One sub-assembly of the machine provides for continuous supply of the plastic carriers that are stacked or nested in plural magazines. The several magazines are each on a radial arm of a turret that is indexed periodically about a vertical shaft. The turret is located at an upper level and the carriers are forced through the vertical magazines by gravity. At the bottom end of each magazine there are pivotally mounted carrier stack support bars. These are normally biased to close the lower end of the magazine and retain the stack of carriers in the magazine. By control system to the turret index drive, a magazine is advanced to a position at the carrier feed station. A full magazine, for example, is advanced into the feed station upon a photo beam signal that a prior magazine has been emptied of carriers, or is in fact empty. As the new magazine moves into place at the feed station by turret index, a cam follower of the carrier support arms (normally closed) engages a stationary cam on the frame of the machine in proximity of the feed station. The cam actuates the support bars to an "open" position, and a stack of carriers in this magazine is released for flow by gravity along the magazine vertical axis.

Underneath the magazine, just mentioned, is the feed station which is comprised of a hopper and the carrier feeder mechanism mounted in stationary position on the machine. The hopper receives the overhead stack of carriers and feeds carriers one at a time onto a carrier delivery belt. The belt single lines the carriers at a gate where each unit group of bottles passing through the machine picks up a carrier that is applied over the bottles. The carrier feeder includes the hopper comprised of a walled chute or box-like frame; and, four rotary feed worms are positioned at the corners along the bottom edge of the hopper frame. The feed worms are rotated in unison at a synchronous rate with carrier belt and bottle movement. Each of the wheels includes a helix land or surface engaging in succession the lower radial flange of the carriers in the stack. The helix surface is rotated such that it separates the lowermost carrier from the stack in the hopper and drops it from the lower, exit end of the feed chute onto the carrier delivery belt. The rest of the stack in the hopper is retained by the corner feed worms. The carriers in nested relationship as a stack in the hopper do have a tendency to stick together as a stack. The helical feed worms serve to separate the lowermost carrier from the stack, and then after such separation, drop the carrier out of the end of the carrier feed chute. The feed worms of the invention assure the individual separation of successive carriers and feeding them singly onto the moving carrier belt.

Just below the carrier feeder is a horizontal upper reach of an endless delivery belt followed by a downwardly inclined reach of the belt. The carriers drop from the feeder hopper by gravity onto this horizontal portion of the belt. This belt is timed in movement with rate function of the machine so as to receive the carriers from the feed device without interference or overlap and the carriers are laid in a single line on the belt. The carrier delivery belt, after traversing the horizontal span under the feeder worms, extends down the incline toward an end-turn and in a reversing direction. At the end of the inclined span of the belt, a pair of carrier retaining rods are fixed in position to normally prohibit carriers from falling from the end of the incline without further assistance, such as pulling them from the rods. Each carrier on the belt is held up by the retaining rods at this point until positively removed; which, in essence, defines the carrier gate at the end of the carrier delivery conveyor.

The bottle supply conveyor is positioned on the machine to extend under the carrier gate. The carrier delivery belt is operated at a linear speed to maintain a group of two or three carriers in end-to-end fashion backed up from the gate. In this manner, there is assured a carrier at the gate as the bottles in groups move along the path past the gate and just beneath it. There will be no gap between the carriers in this mode of operation.

Along either side of the bottle conveyor just before the point where the bottles enter into engagement with a carrier in the gate, there is a first set of pocketed star wheels. The set is comprised of a star wheel on either side of the conveyor so that the pockets engage the sides of the rows of bottles controlling their movement. The star wheels receive the bottles in the two rows and maintain their positioning in-line in the rows and laterally on the conveyor. The pockets of the star wheels further stabilize the bottles just prior to the carrier pick up from the gate. The set of star wheels are driven in synchronism one to the other and are driven at a rate compatible with the bottle conveyor.

As the leading pair of bottles in the two rows pass below the carrier gate, they engage the underside surface of a carrier protruding into the bottle path. The forward movement of the bottle group (six or eight) drags the carrier from the gate to fall over the top of the bottle group. Thereafter, the carrier moves with this bottle group.

Beyond the carrier gate there is an overhead horizontal guide bar supported on the machine frame and extending for a distance along the bottle conveyor. The guide bar assures that the carrier will remain in an initially assembled position over the bottle group until it passes through the rotary applicator wheel. The applicator wheel includes peripheral pockets spaced on radial centers of the wheel that correspond with center-to-center spacing of the compartments of the carrier. As the bottles move under the applicator wheel, a second set of opposed star wheels mesh with the rows of the bottle group to stabilize them in movement through

the applicator wheel. The rolling action of the applicator wheel over the carrier top snaps the retaining bead in the compartments of the carrier over the enlargement on the top end of each bottle in the group to retain them in the carrier. The means of retaining the bottle in the carrier is set forth in detail in the aforementioned patent and application.

The invention therefore resides in the machine and its component parts for efficiently and economically packaging container articles in contoured shell-like carriers.

The invention further provides a machine that is capable of assembling containers in carriers to form assembled packs of containers for carrying and producing them at a high rate of production.

Other aspects of the invention including further advantages provided thereby will become apparent from the following description of the exemplary form of the invention illustrated in the drawings, on which:

FIG. 1 is a side elevational view of the machine;

FIG. 2 is a top plan view of the carrier assembly station on the machine of FIG. 1;

FIG. 3 is a top plan view of the carrier supply turret and carrier feeding station on the machine;

FIG. 4 is a side perspective view of the carrier turret, feeding mechanism and carrier delivery belt of the machine;

FIG. 5 is a fragmentary sectional plan view of the carrier feeding worms shown on FIG. 3;

FIG. 6 is a partially sectioned, fragmentary view taken along line 6—6 on FIG. 5, illustrating one of the four corner feeding worms in engagement with the peripheral radial flange of a carrier;

FIG. 7 is a fragmentary, sectional view of the applicator wheel of the machine, shown seating the carrier sockets on the upper ends of containers advancing beneath the applicator wheel; and

FIG. 8 is a partially schematic and perspective view of the drive system for the machine showing the means for operation of various machine components simultaneously and synchronously by a single motor.

DESCRIPTION OF THE INVENTION

On the drawings is shown a bottle carrier applicator machine which will automatically dispense and apply carriers for 6-pack or 8-pack bottle groupings at relatively high rates of production, i.e., on the order of 800 bottles per minute.

THE CARRIER APPLICATOR MACHINE

The supply of bottles **10** filled with product, such as carbonated beverage or beer, advances them in two parallel rows from the left-hand side of FIG. **1**. The bottles **10** have a top closure **11** that provides a lip enlargement **12** (FIG. **7**) at the top end. In one form of bottles **10** shown on FIG. **7**, the major portion of the body side wall is covered with a layer of plastic **13** such as a shrunken sleeve of foamed polystyrene on the order of 30–35 mils in thickness. This layer coupled with the carrier **9** after it is applied provides substantially total light protection and scratch resistance protection for the glass bottle. However, the invention is not limited by the type of bottle that is packed into the carrier **9**, nor is the plastic layer **13** essential to the invention. The disclosed embodiment merely illustrates the versatility of the type of package that may be constructed using the invention.

Bottles **10** in one form or another are advanced by delivery conveyor equipment (not shown) onto the conveyor **14** (FIG. **1**), which extends longitudinally through the Applicator Machine. Conveyor **14** is reeved over end pulleys **15** and **16** pivotally mounted on shafts **17** and **18**, respectively, mounted for rotation in the machine frame structure **19**. Shaft **18** at the exit end of the machine includes a sprocket **20** connected thereon for driving the conveyor. Power is transmitted to sprocket **20** by chain **21** trained over drive gear **22** keyed on a horizontal shaft **23**. Synchronized drive system for powering the conveyor and other assemblies will be described hereinafter.

The two lines of bottles are carried forward into engagement with a first set of opposed star wheels **24** and **25** (FIG. **2**). Each star wheel **24** includes an upper star **24** and lower star **24a** attached to a central hub **26** which vertically spaces the two stars. The pockets at the periphery of stars **24**, **24***a* are shaped to correspond to the size (diameter) and shape of the particular bottle in production. Similarly, star wheel **25** includes an upper star **25** and lower star **25a** on a spacer-hub **27**. The assemblies **24** and **25** are therefore essentially duplicates, but will be driven in counter rotation to each other for controlled feeding of the bottles. The spacer-hubs **26** and **27** of the two star wheels each include a vertical shaft which extends below the bottom star wheel, **24***a* and **25***a*, respectively. The shafts each include a timing sprocket keyed thereon for rotating the star wheels and this sprocket is connected through a drive train, such as a timing belt, (not shown) to a sprocket of a right angle gear box unit **28**. The drive train between hub **26** and gear box **28** is enclosed by a guard **29**. Gear box **28** has a vertical output shaft **30** and a lower horizontal power input shaft **31**, the latter being driven by a sprocket **32** connected in the main drive system, to be described.

The pockets of the opposed star wheels are arranged in radial, angular spacing on the wheels **24** and **25** to receive the bottles and maintain precise center-to-center spacing of the bottles in each row and stabilize the bottles of the two rows prior to pick-up of the bottle carrier **9**. The opposed stars **24** and **25** extend inwardly of the stationary side rail assemblies **33** and **34** mounted on frame **19** along the sides of conveyor **14** and the pockets of the stars **24** and **25** mesh with the bottles to achieve this bottle spacing and stabilizing effect. The stars **24** and **25** are driven in opposite directions of rotation in synchronism with each other and with the line speed of the machine by the drive system.

The carriers **9** are advanced by the overhead carrier delivery belt **35** that is inclined downwardly at a carrier assembly gate (indicated generally at **36**) which comprises an inclined dead plate section **37** and overhead hold down guide **38**. Guide **38** is pivotally mounted at **39** on the upper carrier feeding assembly, to be described presently in more detail, and is tensioned by spring means (not shown) normally tending to rotate hold down guide **38** clockwise on FIG. **1** into top engagement with a carrier **9**. The guide **38** includes the upstream inclined segment attached to the pivot **39** and a terminal segment that extends horizontally when engaging the carrier top on a bottle grouping. The lowermost corner of a carrier **9** extends beyond the forward edge of dead plate **37** in the path of an oncoming grouping of bottles **10** on conveyor **14** as the grouping is in mesh with the first star wheel means **24**, **25** (FIG.

1). As this bottle grouping advances further, the front pair of bottles **10** thereof engages the front wall of this carrier **9** held in the carrier assembly gate **36** and pulls the carrier therefrom with the advance of the bottles. The trailing end of the carrier will leave the end of dead plate section **37** and rock down over the grouping of bottles **10** therebeneath assisted by hold down guide **38.** One such carrier **9** is shown in place over the bottle grouping near the middle of FIG. **1.** This performs the initial assembly function of the carrier on the bottles.

Thereafter, the bottle grouping and carrier advances by the conveyor **14** toward final application of the carrier on the bottles. A spring-like hold down shoe **40** is mounted in relatively fixed position on the upper frame **41** for the applicator wheel. This retains the carrier **9** in place over the bottle grouping during movement thereof into the applicator wheel **42.**

Beneath and just ahead of the applicator wheel **42** there is a second star wheel means comprised of opposed star wheels **43** and **44.** The star wheels in this second set are made up similar to the first set, described above. The star wheel (FIG. **1**) includes an upper star **43** and a spaced lower star **43***a* separated by the spacer-hub **45.** The pockets of the stars are shaped to conform to the bottles being processed, as were the star pockets of the first star wheel means described earlier herein. The star wheels **43** and **44** are rotated in counter directions to maintain the bottle grouping in oriented position and advance them without undue bottle-to-bottle contact. The stars **43** and **44** are each on vertical shafts **46** and **47,** respectively, and the lower end of shafts **46** and **47** are each connected with a timing sprocket that meshes with a timing belt **49** extending around drive sprocket **50** on the upper end of vertical output shaft **51** of the right angle gear box **52.** The horizontal input shaft **48** of the gear box **52** has a drive sprocket **53** keyed thereon which receives power from the drive system, to be presently described. The timing belt **49** is covered with a safety guard **54.**

The final application of carrier **9** to a bottle group is accomplished at the final assembly station located beneath applicator wheel **42** while the group of bottles is under guidance of the second star wheel means, and while the star pockets of stars **43** and **44** and the transverse rows of applicator wheel pockets **55** move in synchronism toward a diametric, vertical center plane of wheel **42.** At this point, the carrier is fully on two bottles. The peripheral speed of applicator wheel **42** matches the linear speed of the bottles at this point resulting in a "roll-on" action of the carrier to the group of bottles.

Applicator wheel **42** is supported by a pair of bifurcated side arms **56** and **57** integrally connected with the bearing trunion **58** that is rotatably supported at its ends in the upper frame **41.** The trunion **58** is allowed to pivot and therefore the applicator wheel is allowed to yield vertically, so that the pockets **55** mesh with the cell tops of the of the carrier **9** (FIG. **7**). The hub **59** of wheel **42** is connected to horizontal shaft **60** that extends through side arm **57** and is rotated by a sprocket **61** keyed on the outer end thereof. A horizontal shaft **63** is rotatably mounted at one end in upper frame **41** and is rotatable in a bearing **64** on the frame near its other end. A sprocket **65** is keyed on the outer end of shaft **63.** A drive chain **62** is on running engagement with sprocket **66** keyed on the opposite end of shaft **63** and sprocket **61** on applicator wheel shaft **60.** The applicator wheel **42** is rotated counter clockwise on FIG. **1** by a chain **141** of the drive system that passes through a slot **67** in the horizontal deck of frame **19.** The drive system, as will be presently described, operates the applicator wheel **42** in synchronism with the lineal movement of conveyor **14** and star wheels **43** and **44.**

In the event of any mis-alignment of the bottles and the applicator wheel pockets **55,** the applicator wheel **42** will be free to lift as needed by the yieldable type of mounting support, thus preventing any bottle breakage.

The applicator wheel **42** is constructed with rubber inserts **68** held in the periphery of the wheel to define the wheel pockets **55.** The inserts are preferably relatively soft and yieldable to prevent damage to the bottle carrier and bottles in the final assembly stage. The wheel **42** having a downward force component by its weight will exert a peripheral force downwardly at the base of each carrier cell neck to relatively nest the cells of the carrier in the pockets **55** and in turn snap on the cell of the carrier over the end enlargement **12** of the bottle and closure. The upper end of the carrier cells in a relaxed state contain the interior bead **9***a* that is of a lesser diameter than the bottle's enlarged diameter at the end section **12** (FIG. **7**). Therefore, in pressing the carrier at the pocket **55** the plastic of the carrier is enlarged in a force fit over the end section of the bottle until the carrier is in place on the bottle grouping. In such a position, the bottles are individually held in the carrier cells at the annular bead **9a** of the carrier and a resulting carrying pack of bottled product is formed.

As shown on FIG. **1,** the carrying pack of assembled bottles and carrier are moved beyond applicator wheel **42** by conveyor **14.** At this point, the carrying packs of product may be oriented and fed into cases or pallet loads or both for subsequent handling.

THE AUTOMATIC CARRIER FEED MECHANISM

Attached to operate in conjunction with the carrier applying machine, just described, is an automatic carrier supply and feed device.

Referring to FIGS. **1** and **3–6,** the device is supported on an upright frame **69** that is in part columnar in structure. The frame **69** may be connected to machine frame **19** or may be separated. The upper part of frame **69** provides a base for mounting rotary turret **70** by vertical pintle shaft **71.** The shaft **71** is connected with the output shaft of an intermittently indexing drive means, generally shown on FIGS. **1** and **4.** One such indexing drive means may be purchased from Commercial Cam and Machine Co., Chicago, Ill., Model No. CC8H32-270. The detailed description of this drive means is shown and described in one or more of the following U.S. Pat. Nos.: 2,986,949; 3,282,387; 2,999,311; 3,525,268 and 3,049,017. The indexing drive includes an electric motor **72** operated by a controller to index the turret ⅛ revolution or one position at a time. In the turret of the present disclosure of the invention, one revolution is accomplished through **8** indexing movements; however, any number of indexes per revolution may be obtained by control of the motor drive **72.** The motor controller is operated in response to a photocell **100** located just below the level of the magazine **79** of the mechanism. When the photo beam is interrupted, the controller keeps motor **72** in an inactive state. After the stack of carriers diminishes so as to project the light beam onto the photocell **100,** the magazine turret **71** will index one station or ⅛ revolution. If the magazine

at the next station is empty so that carriers do not interrupt the beam, the motor **72** is immediately energized to advance turret **71** another station, etc. until a loaded magazine is in position to interrupt the beam.

The motor **72** is connected to operate a gear reduction unit **73** having a drive sprocket **74.** The input shaft **75** of the turret drive includes a sprocket **76** connected thereon and power is transmitted between sprockets **74** and **76** by a drive chain **77.** As is schematically indicated on FIG. **4,** the input shaft **75** and turret shaft **71** are drivingly connected by the aforementioned indexing drive unit indicated generally at **78.**

Referring to FIGS. **1** and **3,** the turret **71** includes plural carrier magazines **79** that are fastened to the turret at equal peripheral intervals thereon by the radial arms **80.** In the example shown on the drawings (FIG. **3**), there are eight identical magazines on turret **71.** For sake of simplicity on the drawings in FIGS. **1, 3** and **4,** some of the magazines **79** are omitted from the showing. Each magazine **79** is constructed as a vertical chute having upright and opposed wall members **81** and **82** that define a vertical opening for the passage of a stack of nested carriers **9.** The wall members **81** and **82** are connected by lateral elements **83** and the box frame made by walls **81, 82** and elements **83** is fastened to a radial arm **80** by vertically spaced brackets **152** and cross-pins **153** extending through brackets **152** and apertures in the outer end of radial arm **80.**

Each magazine **79** will hold a stack of several nested carriers **9,** say about **80** such carriers to the stack. The stack is retained in the magazine by two pairs of rocker arms **84** and **85** that position two carrier stack support bars **86** and **87** across the lower end of the magazine chute. The support bars **86** and **87** are each end connected across the bottom end of the pairs of rocker arms **84** and **85,** respectively. The first pair of rocker arms **84** are pivotally connected on the vertical members **88** of the magazine mounting frame rigidly connected with the lateral elements **83** thereof by the rock shaft **89.** Shaft **89** includes a crank arm **90** on the inner end thereof and on the outer end of arm **90** there is a rotatably connected cam follower **91** (see FIG. **4**). Clockwise rotation (rocking movement) of arm **90** moves the first pair of rocker arms **84** outwardly (FIG. **4**) about pivot point **92** which in turn moves the stack support bar **86** out of its position for supporting carriers in the chute. The pair of rocker arms **85** are pivotally mounted at their upper end by a pivot pin **93** extending laterally across the opposite vertical members **94** of the magazine. The upper end of rocker arm **84** about pivot **92** on one side of the magazine is connected at the pin **95** to an intermediate point on the opposite rocker arm **85** by a rod **96,** whereby movement of arm **84** clockwise drives arm **85** counter clockwise about the pivot pin **93** and moves the second stack support bar **87** from its position for supporting the carriers in the chute. The bars **86** and **87** are moved in unison responsive to cam action between their "closed" and "open" positions with respect to the magazine chute. The cam follower **91** is carried by each of the magazines **79** in the path of a stationary plate cam **97** mounted on the frame structure. The cam **97** is located to trip or raise each cam follower of the magazines at the time each magazine enters a carrier feeding station, indicated at **98** on FIGS. **3** and **4.** The "open" position of the support bars **86, 87** is shown on FIG. **1** at station **98.** The indexing drive **72, 73** is under control of an "electric eye" comprised of a light source and a photocell **100** (FIG. **3**). Photocell **100** is in the control circuit for the motor **72.** The light beam is transmitted across the feeding station **98** and if a stack of carriers extends above the level of the light beam so as to break it, as shown on FIG. **4,** the drive for the turret **71** remains de-energized. As soon as the level of the carrier stack at station **98** descends below the light beam, the turret drive is energized to advance the next magazine **79** into the feeding station. As this next magazine arrives at station **98,** cam **97** opens the lower end of the chute of the magazine by pivoting the support **86, 87** in the manner described. The stack of carriers in the magazine falls by gravity onto the carriers piled below at station **98.**

The photocell level placement on the machine assures a stack of carriers in the hopper **117–119** above the feeder assembly to assure a supply or stack of carriers during the time it takes to index the next magazine **79** into position and "open" the support bars to release the next stack of carriers into the hopper.

The stack of carriers is now under control of the means for separating and feeding carriers onto the underlying carrier delivery belt **35.** Dispensing of carriers from the stack to the underneath carrier delivery belt is accomplished by a worm feed that is timed to supply carriers per machine speed demand. The separating and feeding means comprises a cantilevered frame **101** extending across the feeding station **98.** A center aperture **102** in frame **101** provides a feed path for the stack of carriers. On the underside of frame **101** are mounted plural rotatable members **103** located at the corners of aperture **102.** Each of the rotatable members **103** is constructed as shown on FIG. **6.** A cylindrical barrel **104** is attached for rotation by the vertical shaft **105** and supported thereon by an adjusting collar **106.** Barrel **104** includes a helical spline or groove **107** formed on its peripheral surface extending at least one full revolution on the barrel. As shown on FIG. **6,** groove **107** extends approximately 360° circumferentially on barrel **104** and travels axially approximately the height of barrel **104.** The groove size or width is just slightly more than the thickness of the peripheral flange **9b** of the plastic carrier **9.** The stack of carriers rests at its four corners by the lateral flange surface at **9b** which fits into an opening to the grooves **107** so as to initially rest upon the land surface at **108** on one side of the groove. The top open portion for entry of the flange into the four helical grooves **107** occurs for a short peripheral span, say 80°–90°. Thereafter, the helical groove **107** is made up of the two axially spaced, parallel side walls. (See FIG. **5**). The stack of nested carriers is compacted, and, as such, the carriers tend to stick together as a body. To first separate the lowermost carrier slightly from the rest of the stack, and, secondly, discharge this separated lowermost carrier vertically downwardly by gravity is achieved by rotation of the four rotary feed members **103** in unison. On FIG. **5,** members **103** are rotated counter clockwise.

The members **103** are driven by a link chain **109** reeved around a drive sprocket **110** and the four driven sprockets **111** each attached on the upper end of one of the shafts **105** of the rotary members **103.** Drive sprocket **110** is power rotated by a vertical shaft **112** supported in the sleeve bearing **113.** Shaft **112** is the output of a right angle gear box **114** fastened on frame **69** and having a power input sprocket **115** driven by a chain **116** (FIG. **1**), which is included in the synchro-

nized drive system to be described presently. The drive shaft **112** is rotated continuously and for every revolution imparted to the rotary members **103** thereby, one carrier **9** is separated and fed from the bottom of the stack of carriers at the feeding station.

The stack of carriers is stabilized in the aperture by the hopper walls extending above the cantilever frame **101.** The hopper is made of side wall plates **117** each flared outwardly at their upper ends and corner plates **118** interleaved between wall plates **117.** Corner plates **118** are likewise flared outwardly at their upper ends, the combined structure **117** and **118** forming a funnel-like entry to the hopper. Below the frame **101** there is a pair of opposite, spaced-apart guide plates **119,** which assure the drop of each carrier onto the underlying carrier delivery belt **35.**

Carriers **9** are dropped singly and in succession onto the top horizontal reach of the carrier delivery belt **35** which is guided around the end pulleys **120** and **121** and an intermediate idler **122** that serves as an adjustable belt tensioning device. The pulleys and idler are rotatable on horizontal shafts that are rotatably bearing mounted in the opposed side plates **123** and **124,** the side plate **124** being supported by the column of frame **69.** Extending interiorly laterally between plates **123,** 124 is a bent upper belt guide plate **125** (FIG. **1**) which provides a guide surface for defining a horizontal span and an adjacent downwardly inclined span of the belt **35** on the upper course of its closed path, the inclined span extending onto pulley **121.** The plate **125** also serves as a structural member to unify the delivery belt frame. Carrier delivery belt **35** is driven in a clockwise path (FIGS. **1** and **4**) by chain **116** that is drivingly engaged with an end sprocket **126** keyed on the end of the mounting shaft for the belt end pulley **120.** The chain **116** is powered by the drive system, and the belt **35** and rotary feed screws **103** are operated synchronously with each other.

As the carriers **9** are moved down the inclined section of belt **35,** they are subject to confinement in a path into the gate end of the mechanism by the spaced side guides **127** extending parallel and above the side of belt **35** and the parallel, central top guide bar **128.** Together, the inclined part of belt **35,** guides **127** and **128** direct the carriers in a single line into carrier assembly gate **36,** described earlier herein. The oncoming succession of bottles **10** processed into spaced, oriented groupings by the first star wheel means engages the forward edge of the carriers **9** by the front pair of bottles of the grouping and pulls them into a top assembly on the bottle grouping. The assembly of the carrier is performed by the applicator wheel **42** in the manner described earlier.

DRIVE SYSTEM

The integrated drive system for the applicator machine and the carrier feed device is shown schematically on FIG. **8.** All of the drive functions on the machine are integrally connected except for the indexing drive of magazine turret **70.**

A main electric drive motor **129** is connected to drive a gear reduction unit **130** that reduces shaft speed of motor **129** to a ratio of about **26** to **1.** A 1-½ hp motor (**129**) sold by Westinghouse Electric Corp., Pittsburgh, Pa., including an SCR drive that provides controlled acceleration and deceleration, overload protection, jog and variable speed control is preferred. The power shaft **131** of unit **130** includes two spaced-apart drive gears **132** and **133** on the power shaft.

The one drive sprocket **133** drives a chain **134** that meshes with a sprocket **135** on shaft **23** and an idler gear **154,** which operates bottle conveyor **14.** The other drive sprocket **132** is operatively connected by chain **136** to input shaft of a geared transmission unit **137,** such as sold by Eberhardt Denver Company, Model 2172.

Transmission **137** has two power output shafts **138** and **139.** The first shaft **138** drives sprocket **140** in running engagement with a chain **141** connected about sprocket **65** and an idler **142.** The chain **141** drives applicator wheel **42.** A second sprocket **143** on shaft **138** is connected for driving a chain **144** that is reeved about a first idler **145,** sprocket **32,** sprocket **53** and a second idler **146.** The chain **144** drives both the first and second star wheel means **24–25** and **43–44.** Thus, the applicator wheel and two star wheel means controlling bottle movement therebeneath are powered from the same shaft (**138**).

The second output shaft **139** of the transmission has its drive sprocket **148** in running engagement with the chain **116** reeved about two idlers **149** and **150,** then end sprocket **126** for the carrier belt drive, then input sprocket **115** for gear box **114,** about an idler **151** and back to sprocket **148.** The chain **116** drives the carrier delivery belt **35** and carrier feed screws **103** in unison.

ADJUSTABLE CARRIER DELIVERY BELT

As described earlier herein, the end pulley **121** for the delivery belt **35** and the deadplate section **37** are mounted on the side plates **123** and **124.** The vertical position of the carrier gate **36** is adjustable for various size or height of bottles **10** is achieved by the side plate extension **158** being connected by a pivot pin **155** onto the side plates **123** and **124.** The extensions **158** are fastened in place by a bolt **156** through arcuate slot **157.** By unscrewing bolt **156,** the side extension portions **158** carrying the shaft for the end roller **121** for the belt may be pivoted vertically up or down about the pin connection at **155** to adjust the height of end delivery of the conveyor for the carriers with relation to the bottles on the conveyor **14.** The angular relation of side guides **127** and the central top guide bar **128** may be adjusted by set screw connections thereof on the frame in a manner well understood by those skilled in the art.

Although a specific embodiment has been shown and described, it is with full awareness that many modifications thereof are possible within the skill of one versed in the art. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit and scope of the claims.

What is claimed as the invention is:

1. A machine adapted for applying a succession of molded shell-like carriers having a plurality of article receiving compartments formed therein to a procession of containers having necks and closures at the top end thereof to form carrying packs of the containers comprising, in combination

supply means supporting said carriers in a nested relation in a vertical stack,

separating and feeding means operable at the lower end of said stack for separating the lowermost carrier in succession and feeding it vertically below the stack,

carrier conveyor means below said separating and feeding means receiving said carriers and moving them horizontally to a preliminary assembly station spaced from said feeding means,

bottle conveyor means disposed beneath said conveyor means for directing a procession of containers to the preliminary assembly station,

means at the preliminary assembly station guiding the carriers serially over the top of the containers advancing by said last named means, said bottle conveyor means advancing the bottles and carriers horizontally to a final assembly station horizontally spaced from the preliminary assembly station, and

rotary assembly means mounted above said final assembly station for engagement with the top surface of said carriers,

said rotary assembly means comprising

a rotary applicator wheel mounted on an axle disposed horizontally and transversely to the movement of the containers, and

pockets in the peripheral surface of said wheel spaced around the circumference of said drum to correspond with the spacing of the tops of the compartments of said carriers, said pockets being shaped to receive a compartment top therewithin, and support means for the applicator wheel, including

a pivotal mounting arm, a pivotal connection at one end of said arm on the frame of the machine and a pivotal mounting at the other end of said arm for the applicator wheel axle, the support means permitting the applicator wheel to engage the containers at the final assembly station and relatively press the compartments and container tops into locking engagement, whereby each carrier compartment encircles a container neck and the carrier embraces the group of containers.

2. A machine for assembling containers into carrying packs comprising, in combination,

means for directing containers in a pair of lines to an elongated assembly station, said assembly station having an entrance and an exit,

means for feeding shell-like carriers having individual container compartments aligned parallel to each other in rows for embracing a container in each compartment, said means being disposed above the containers,

means receiving said carriers and directing them toward the assembly station over the tops of the containers,

first star wheel means rotatably mounted in the proximity of the entrance of the assembly station for engaging the containers of each of the lines successively as they are directed forwardly and spacing the several containers in parallel lines of common spacing therebetween in the direction of movement to correspond with the spacing of the compartments of said carriers,

means overlying the containers and said carriers at the assembly station entrance for engaging said carriers and guiding them downwardly over a group of containers in the assembly station and holding each of said carriers over a group of containers with the top ends of the latter inserted into compartments of said carrier,

a rotary applicator member mounted above the containers at the exit of the assembly station and engageable with the top portion of the carriers on the containers as they are advanced therebeneath, said applicator member pressing the walls of the carrier compartments into embracing engagement with the top of the containers locking them in the carrier as a carrying pack, and

a second star wheel means in the proximity of the exit of the assembly station engaging the grouped containers and advancing them through the exit of the assembly station and past said applicator member.

3. A machine for assembling a processing of containers into carrier packs held together by encircling compartmented carriers, embracing in said compartments the top ends of the containers, comprising, in combination,

a carrier supply means including a support for a vertical, nested stack of the carriers and dispensing elements engaging the lowermost carrier of the stack and feeding it by gravity from the stack,

a horizontal conveyor below said supply means receiving said carriers in succession and advancing them in an end to end series,

a carrier gate disposed along said conveyor, the said carriers at said gate being inclined with the forward edge in a lowermost exposed position, and adapted to engage and receive containers travelling beneath said gate,

means advancing a procession of containers in predetermined spaced relation to each other beneath said assembly gate and engaging said forward edge of a carrier in said gate, the containers pulling a carrier through said gate and in overlying relationship to said containers, the compartments of said carrier receiving the top ends of a group of containers,

hold down means for maintaining said carriers in registry and flat relationship overlying the containers,

an endless series of carrier applying elements, and

means for continuously moving said series of applying elements in procession through an endless path extending over said carrier and containers, said carrier applying elements engaging each of the carrier compartment walls and positively forcing them into firm engagement with the top ends of the respective containers in said carrier, whereby the containers are secured into packs within the carrier.

4. Apparatus for feeding a stack of shell-like carrier articles having a peripheral out-turned flange means thereon comprising

a vertical chute defined by plural vertical walls, the interior perimeter of said chute being slightly larger than the perimeter of the articles permitting vertical flow of the articles therein,

plural rotary feed means rotatably mounted adjacent said vertical wall structure, said feed means being rotatable about an axis parallel to said walls and having a helical means on each of said rotary feed means,

a horizontal conveyor spaced vertically below the chute for receiving the articles fed from the chute, comprising an endless traveling conveyor surface adapted to travel along an upper conveying span for receiving the articles and around an end turn changing direction of said traveling surface, and including a stationary gate means mounted at the end turn of the traveling surface in spaced horizon-

tal relation thereto, the gate means arresting movement of the carriers on the traveling surface for dispensing them singly upon demand from the gate by a positive force applied to the carrier from a source separate from the conveyor,

drive means,

means connecting the drive means to said plural rotary feed means for rotating the latter in unison in one direction of rotation, the helical means thereon positively guiding the articles one at a time out of the lower end of the chute, and

means connecting the drive means to said horizontal conveyor for moving the latter past the lower end of said chute,

the last two-mentioned means operating the feed means and horizontal conveyor at a synchronous speed, whereby the carrier articles are fed vertically onto said conveyor in a line moved by the conveyor away from the chute, and

a horizontal bottle conveyor extending beneath said gate means adapted to move a group of bottles in upright position past the gate, the bottle conveyor being spaced vertically from the gate such that the top end of upright bottles thereon engage the carrier article in the gate and pull it from the gate for overlying assembly on the group of bottles.

5. The apparatus of claim **4**, including a horizontal guide rail means and means mounting the guide rail means over the bottle conveyor downstream from said gate means and in closely spaced relation to the top end of the bottles thereon, said guide rail means holding a carrier article on the group of bottles during their movement under the guide rail means providing initial assembly of the carrier on the group of bottles.

6. The apparatus of claim **4**, including an applicator wheel, a horizontal shaft supporting said wheel for rotary movement, cantilevered support arms, the shaft being rotatably supported therein spaced from the one end and the one end being rotatable on stationary support means over said bottle conveyor, the applicator wheel being disposed in the path of the partially assembled carrier and bottle group on the bottle conveyor for engaging the top of the latter, whereby said wheel presses the carrier into final assembly over the group of bottles forming a carrying pack thereof.

7. A machine for assembling containers into carrying packs comprising, in combination,

means for directing containers in a pair of lines to an elongated assembly station, said assembly station having an entrance and an exit,

means for feeding shell-like carriers having individual container compartments aligned parallel to each other in rows for embracing a container in each compartment, said means being disposed above the containers,

means receiving said carriers and directing them toward the assembly station over the tops of the containers,

first star wheel means rotatably mounted in the proximity of the entrance of the assembly station for engaging the containers of each of the lines successively as they are directed forwardly and spacing the several containers in parallel lines of common spacing therebetween in the direction of movement to correspond with the spacing of the compartments of said carriers,

means overlying the containers and said carriers at the assembly station entrance for engaging said carriers and guiding them downwardly over a group of containers in the assembly station and holding each of said carriers over a group of containers with the top ends of the latter inserted into compartments of said carrier, and

a rotary carrier engaging member mounted above the containers at the exit of the assembly station and engageable with the top portion of the carriers on the containers as they are advanced therebeneath, said rotary member pressing the walls of the carrier compartments into embracing engagement with the top of the containers locking them in the carrier as a carrying pack.

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