United States Patent

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[72] Inventors **Gunther Bargel**
Dortmund;
Robert Eggert, Dortmund; Wilhelm Kurtenbach, Castrop; Helmut Lorken, Dortmund, all of, Germany

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[73] Assignee **Holstein & Kappert Maschinenfabrik Phoenix GmbH**
Dortmund, Germany

Division of Ser. No. 683,218, Nov. 15, 1967.

[54] **APPARATUS FOR INTRODUCING BOTTLES INTO CRATES OR THE LIKE**
14 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **53/61,** 53/166, 53/247, 53/248
[51] **Int. Cl.** **B65b 57/10,** B65b 35/30
[50] **Field of Search** 53/61, 62, 166, 247, 248

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Primary Examiner—Travis S. McGehee
Attorney—Michael S. Striker

ABSTRACT: Apparatus for introducing arrayed bottles into crates comprises an arraying table which receives randomly distributed bottles from an upper feed conveyor and includes devices for arranging the bottles in a series of rows so that the foremost bottle of each row advances toward and tilts one of a series of control levers. When all of the levers are tilted by the bottles of the resulting array on the table, they permit a light-sensitive signal generator to actuate a transfer unit which comprises pneumatically operated grippers movable along a path having vertical, horizontal and downwardly inclined portions. The grippers then move downwardly to engage the bottles of an array, upwardly above the table, sideways along a horizontal, thereupon along a downwardly inclined and finally along a vertical portion of the path to introduce the array into a crate which is held in raised position by a vertically reciprocable platform forming part of a lower feed conveyor which advances empty crates to receiving positions located below and laterally adjacent to the arraying table. The crates are staggered during movement with the second feed conveyor, and the apparatus is further provided with guides which engage and guide the bottles of an array during downward movement with the grippers toward a raised crate.

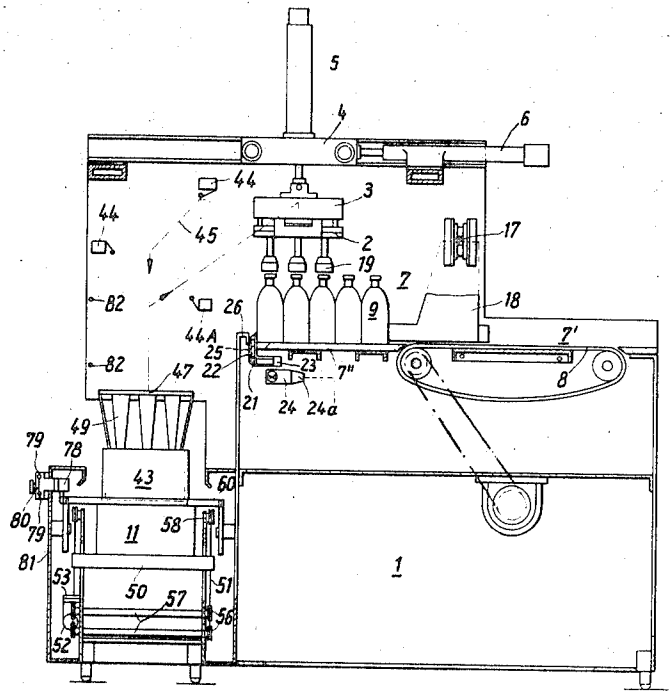
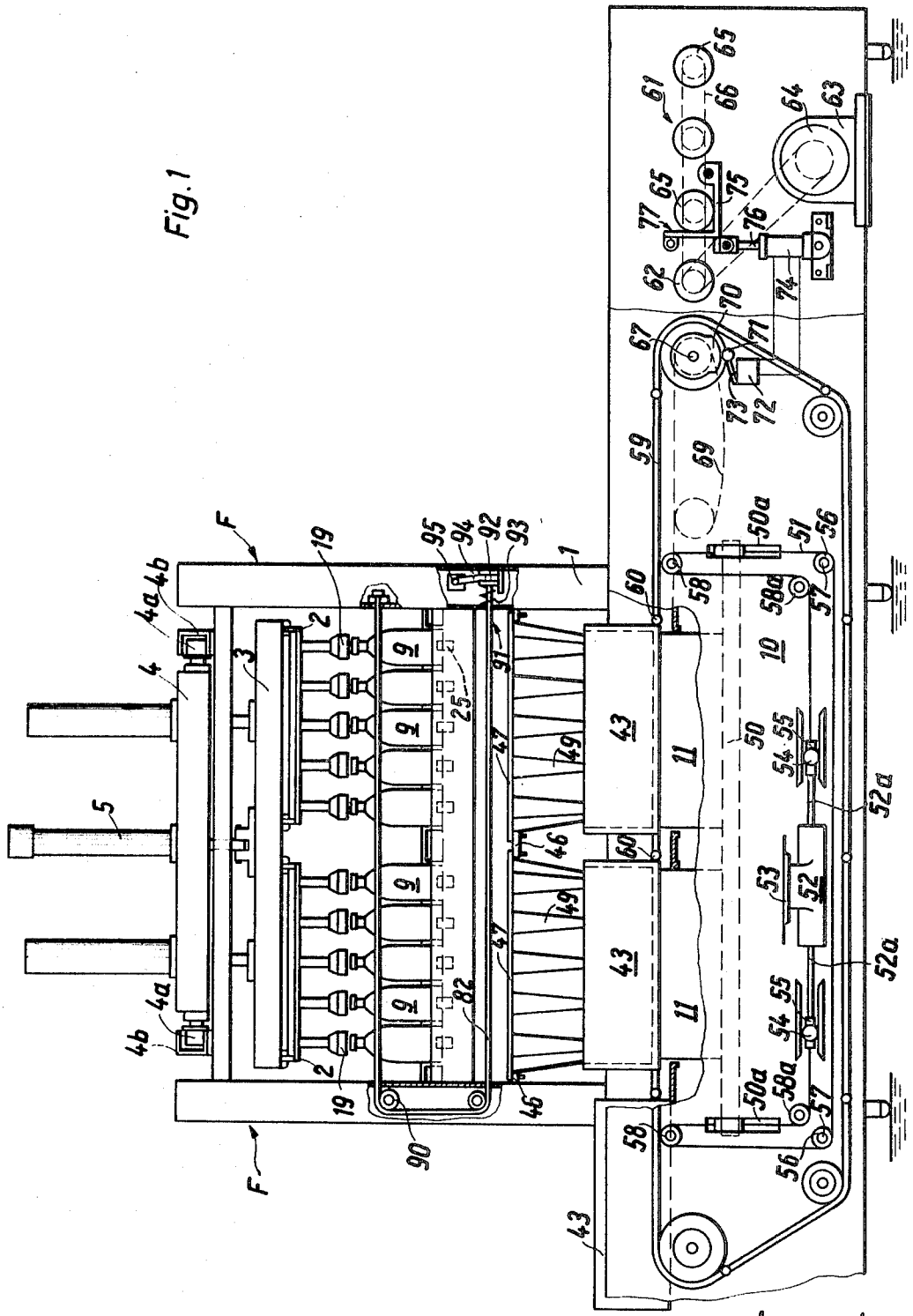


Fig. 1



Inventor:
GÜNTHER BARGEL
ROBERT EGGERT
WILHELM KURTENBACH
HELMUT LORKEN
BY Michael S. Striker
their ATTORNEY

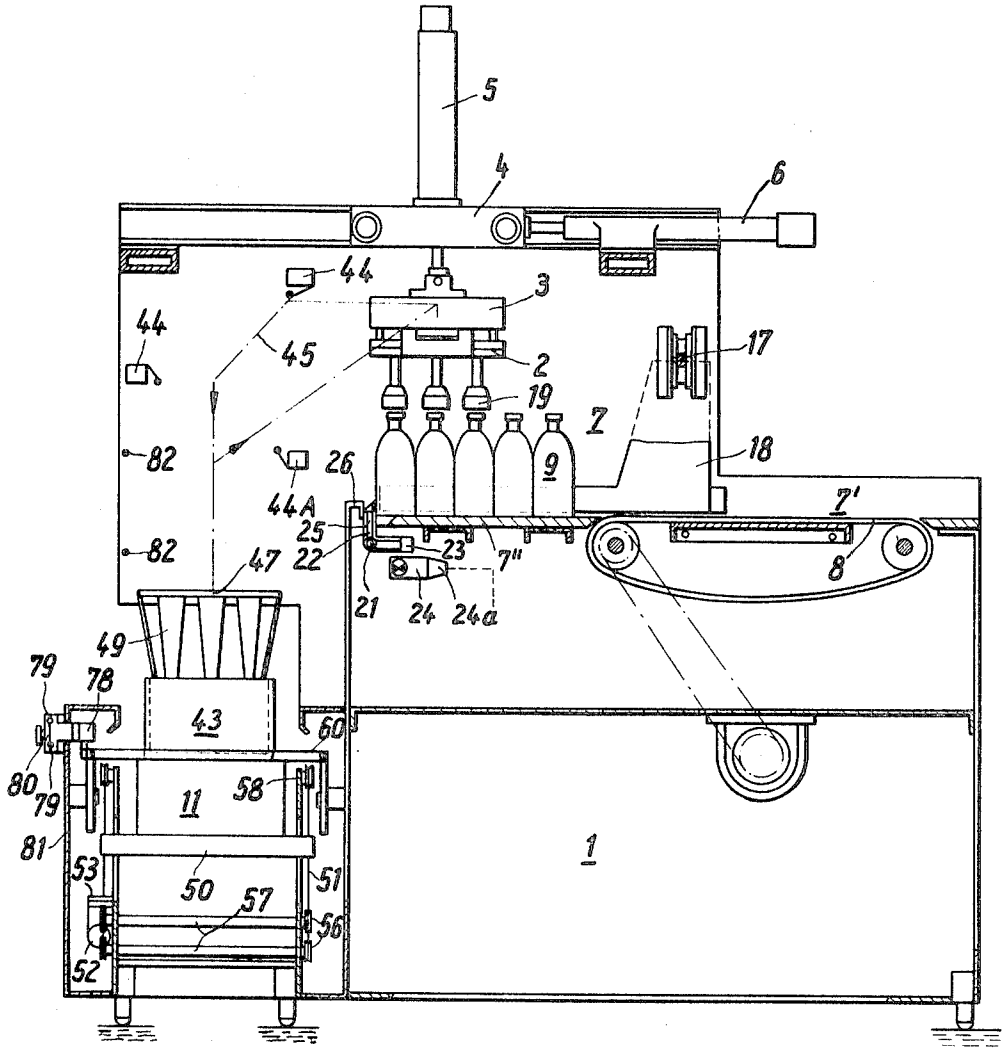


Fig.2

Inventor:
GÜNTHER BARGEL
ROBERT EGGERT
WILHELM KURTENBACH
HELMUT LORKEN
BY Michael S. Striker
their ATTORNEY

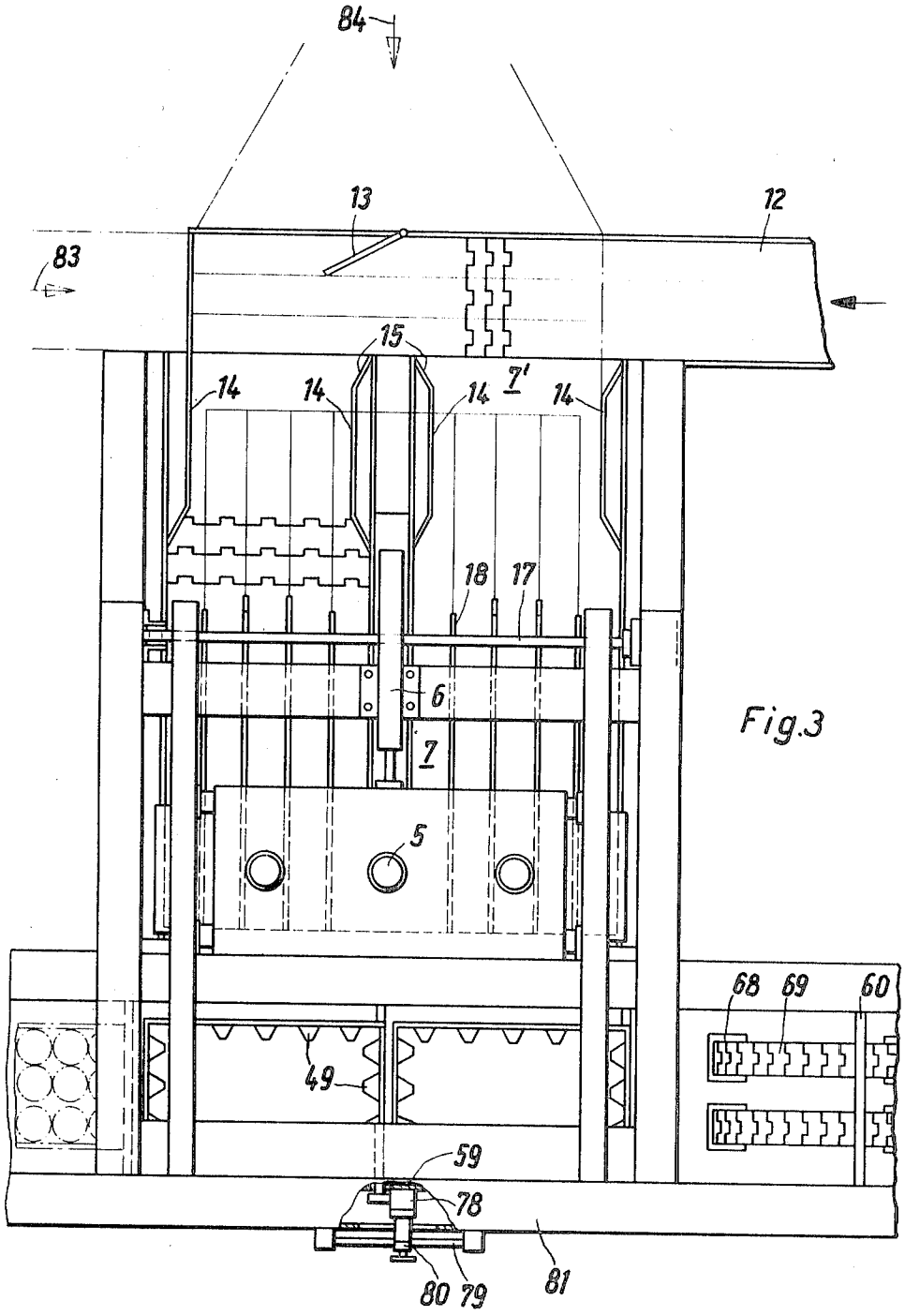


Fig.3

Inventor:
GÜNTHER BARGEL
ROBERT EGGERT
WILHELM KURTENBACH
HELMUT LORKEN
BY: Their ATTORNEY

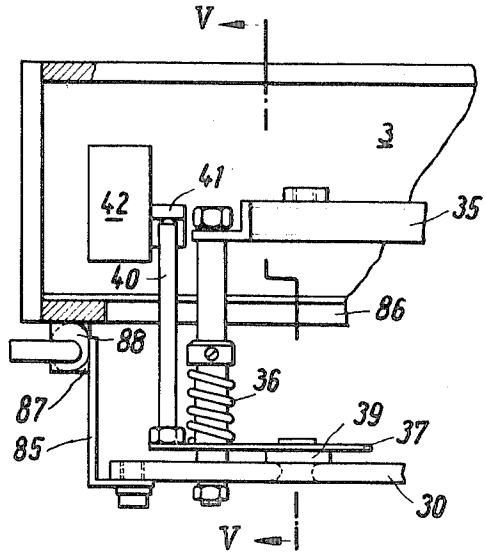


Fig. 4

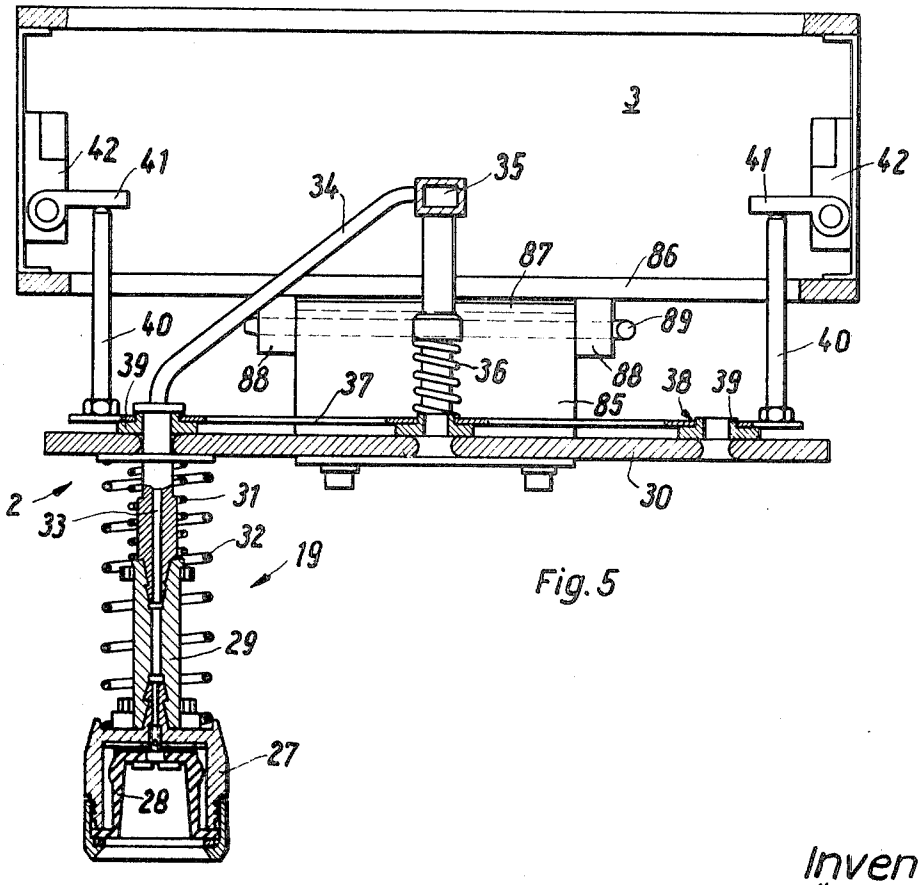


Fig. 5

Inventor:
GÜNTHER BARGEL
ROBERT EGGERT
WILHELM KURTENBACH
HELMUT LORKEN
BY Michael Huber
their ATTORNEY

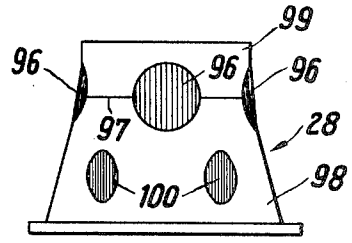


Fig. 6

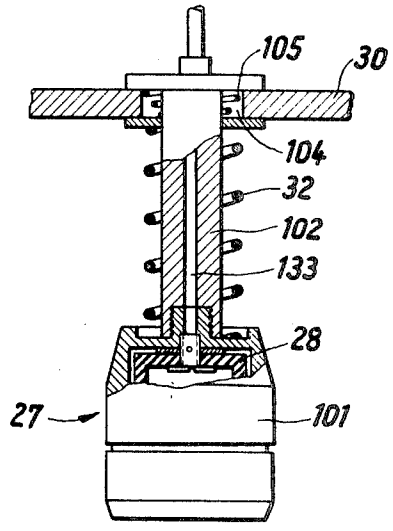


Fig. 7

Inventor:
GÜNTHER BARGEL
ROBERT EGGERT
WILHELM KURTENBACH
HELMUT LORKEN
BY their ATTORNEY

APPARATUS FOR INTRODUCING BOTTLES INTO CRATES OR THE LIKE

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a division of our U.S. Pat. application Ser. No. 683,218, filed Nov. 15, 1967.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for introducing bottles or like articles into cardboard boxes, wooden crates or analogous receptacles. More particularly, the invention relates to improvements in an apparatus for introducing arrays containing predetermined numbers of bottles into crates or boxes.

Many presently employed apparatus for filling boxes, crates or like receptacles (hereinafter called crates for short) with arrayed bottles comprise two feed conveyors which are disposed at different levels. The upper conveyor feeds a stream of randomly distributed bottles to an arraying table where the bottles are arranged in rows or other formations corresponding to the desired distribution of bottles in the crates, and the lower conveyor feeds empty crates. A transfer unit is employed to remove arrays of bottles from the table and to deliver the thus removed arrays into empty crates. The transfer unit comprises a carriage for a set of pneumatically operated grippers which is lowered to engage the tops of bottles on the arraying table and is thereupon moved upwardly, laterally and downwardly to deposit an array of bottles into an empty crate. The grippers are then returned to a starting position at a level above the table. A serious drawback of such apparatus is that their output is not satisfactory because much time is lost while the carriage for the grippers changes the direction of its movement, first from downward movement (engagement of grippers with the tops of bottles) to upward movement, thereupon from upward movement to lateral movement (placing the grippers into registry with the compartments of a crate), then from lateral movement to downward movement (introduction of bottles into a crate), from downward movement to upward movement (lifting of grippers above the freshly loaded crate), and from upward movement to lateral movement (returning the grippers to starting positions above the arraying table). The control elements of the programming system require some time to perform their functions and, in the long run, the combined delay resulting from repeated changes in direction during a complete cycle affects considerably the output of such apparatus.

In the aforediscussed conventional apparatus, the upper feed conveyor delivers bottles to an arraying table which is provided with longitudinally extending partitions to arrange the bottles in several parallel rows. Bottles supplied by the upper feed conveyor exert pressure upon the bottles on the table and move the foremost bottle of each row against a stop which actuates a switch. When all of the switches are actuated by the respective stops, the carriage for the grippers moves downwardly and the grippers engage a requisite number of bottles for transfer into an empty crate. Such arraying systems are unsatisfactory when the apparatus is to be used for transfer of different types of bottles. The distance between the partitions must be changed whenever the apparatus is converted from loading of crates with smaller-diameter bottles to loading of crates with larger-diameter bottles or vice versa. Moreover, the number of switches must be changed and such changes involve considerable work for rewiring of the electrical control system.

Additional problems arise when the apparatus must be converted from loading of crates with relatively short bottles to loading with longer bottles or vice versa. The path of grippers is determined in advance and, in order to prevent breakage of short bottles during descent into an empty crate, the lower feed conveyor must be raised and lowered in synchronism with operation of the transfer unit to insure than the distance

covered by a bottle subsequent to release by the gripper and prior to reaching the bottom wall of an empty crate is sufficiently short to prevent breakage or misalignment. The lower feed conveyor must maintain an empty crate in an accurately determined position to insure that the bottles of an array which descends with the grippers find their way into the interior of the crate, particularly if the crate is provided with customary partitions to provide individual compartments for the bottles. Lifting of empty crates is normally effected by means of hydraulic or pneumatic cylinders; however, it is also known to employ rather complicated systems of lifting levers and vertical guideways to prevent misalignment of empty crates during lifting. As a rule, such lifting devices can manipulate only one crate at a time.

SUMMARY OF THE INVENTION

It is an object of our invention to provide a novel and improved apparatus for loading bottles or like containers into crates in such a way that a large number of containers can be transferred within short periods of time and with a requisite degree of accuracy to prevent breakage and/or misalignment of containers during arraying and during transfer into crates.

Another object of the invention is to provide an apparatus of the just outlined character according to which two or more crates can be loaded simultaneously and according to which the crates can be filed with shorter, longer, smaller-diameter and/or larger-diameter bottles or like containers.

An additional object of the invention is to provide the apparatus with novel feed conveyors for bottles or like containers and for empty crates.

Still another object of the invention is to provide a novel transfer unit which can be utilized in the just outlined apparatus to transfer arrays of containers into successive empty crates or into successive groups of empty crates.

Another object of the invention is to provide a novel arraying device which can be used in an apparatus of the above described type.

A concomitant object of the invention is to provide novel grippers which can be used in the improved transfer unit.

An ancillary object of the invention is to provide novel lifting means for empty crates.

One feature of our invention resides in the provision of an apparatus for introducing bottles or like articles into crates or analogous receptacles. The apparatus comprises means for converting randomly distributed articles into at least one array at an arraying station which preferably accommodates an arraying table and means for arresting the articles of the thus obtained array, preferably by arresting the foremost articles of the array, means for advancing an empty receptacle to a predetermined receiving position on a suitable platform which is adjacent to, laterally spaced from and located at a level below the array, and means for transferring the array from the arraying station into the empty receptacle. This arraying means includes means for raising the array and thereupon moving the array laterally and downwardly into registry with the empty receptacle in receiving position, raising the receptacle above the receiving position, and depositing the array in the thus raised receptacle.

The arraying station preferably receives articles in the form of one or more streams of randomly distributed articles and the transferring step preferably further includes lowering the filled receptacle back to receiving position and advancing the filled receptacle sideways from the receiving position to provide room for an empty receptacle. The steps of advancing articles to the arraying station and of advancing receptacles to and from the receiving position preferably include moving the articles and the receptacles along substantially horizontal paths. During transfer of an array from the arraying station into a raised receptacle, the articles preferably move along vertical, horizontal and downwardly inclined portions of a path. During transfer, the articles are preferably gripped by pneumatically or hydraulically operated grippers which en-

gage the top portions of articles and are arranged to automatically release the articles when the array reaches its lower end position and registers with an empty receptacle which has been raised above the receiving position. The articles are guided during downward movement toward a raised empty receptacle to insure that the entire array can properly enter the interior of the receptacle.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partly front elevational and partly vertical sectional view of an apparatus which embodies our invention;

FIG. 2 is a side elevational view as seen from the right-hand side of FIG. 1;

FIG. 3 is a top plan view of the apparatus;

FIG. 4 is an enlarged fragmentary vertical sectional view of the transfer unit;

FIG. 5 is a section as seen in the direction of arrows from the line V—V of FIG. 4;

FIG. 6 is an enlarged side elevational view of a diaphragm in the article-engaging portion of a gripper; and

FIG. 7 is a partly elevational and partly vertical sectional view of a modified gripper.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 to 3, there is shown an apparatus 1 which is utilized to introduce arrays of bottles 9 or like articles (hereinafter called bottles) into crates 43. The apparatus comprises an upper feed conveyor 12 which delivers randomly distributed or partially arrayed bottles 9 to an arraying unit including a table or support 7 located at an arraying station, a lower feed conveyor 10 which moves empty crates 43 into requisite position for reception of arrayed bottles, and a transfer unit including one or more sets or groups of pneumatically operated grippers 19 movable between a starting position of registry with arrayed bottles on the table 7 and a position of registry with the compartments of empty crates 43 on the lower feed conveyor 10. The transfer unit of FIGS. 1 to 3 comprises two portions 2 each of which includes a predetermined number of grippers 19. The portions 2 are mounted on a crosshead or carrier 3 supported by a horizontally reciprocably carriage or dolly 4 which is provided with wheels 4*a* arranged to travel along rails 4*b* supported by a stationary frame F. The drive means for moving the carriage 4 along the rails 4*b* comprises a horizontal fluid-operated cylinder and piston unit 6 whose cylinder is fixed to the frame F and whose piston rod is coupled to the carriage 4. A vertical fluid-operated cylinder and piston unit 5 has a cylinder which is fixed to the carriage 4 and whose piston rod is connected with the carrier 3. Thus, the carrier 3 and the grippers 19 can move up and down while the carriage 4 travels along the rails 4*b*. The units 5 and 6 are preferably operated by means of a suitable hydraulic fluid.

The arraying table 7 supports several belt or apron conveyors 8 which serve to advance bottles 9 coming from the upper feed conveyor 12. As shown in FIG. 3, the upper feed conveyor may include one or more conveyors which can deliver bottles 9 from a single source or from several sources. For example, the feed conveyor 12 may include a single conveyor which delivers a stream of randomly distributed bottles in the direction indicated by arrow 83, 83*a* or 84, or two or more conveyors which deliver bottles in directions indicated by arrows 83, 83*a* or 83, 84 or 83*a*, 84 or 83, 83*a*, 84. For the sake of simplicity, the apparatus 1 is assumed to comprise a single feed conveyor 12 which delivers bottles in the direction indicated by the arrow 83*a* and it is further assumed that the conveyor 12 is an apron conveyor having aprons 12*a* shown in FIG. 3.

The lower feed conveyor 10 advances crates 43 along a horizontal path and in a direction at right angles to the direction of travel of bottles on the conveyors 8 of the arraying table 7. The conveyor 10 is provided with lifting means including a vertically reciprocable platform 11 which can lift one or more crates 43 at a time. As shown in FIG. 3, the direction of travel of crates 43 on the lower feed conveyor 10 is parallel to the direction of travel of bottles 9 on the upper feed conveyor 12. The latter conveyor is associated with an adjustable deflecting lever 13 (FIG. 3) which changes the direction of arriving bottles 9 and causes such bottles to travel sideways and onto the conveyors 8 which are supported by the rearmost or receiving portion 7′ of the arraying table 7. This receiving portion 7′ further supports four upwardly extending guide members 14 of sheet metal or the like. The two central guide members 14 are disposed mirror symmetrically with reference to each other on the central part of the receiving portion 7′ and together form a wedge or cam 15 serving to divide the stream of arriving bottles 9 into two streams so that such bottles can form two arrays, one below each of the two portions 2 of the transfer unit. It is clear that the central guide members 14 (wedge 15) can be omitted if the apparatus 1 is to load one crate 43 at a time or that the apparatus can comprise six or more guide members 14 if it is to load three or more crates 43 in a simultaneous operation. The conveyors 8 insure that the bottles are held against piling up on the receiving portion 7′ and that they are continuously urged toward the arraying station on the foremost or discharging portion 7″ of the table.

The guide members 14 are located upstream of a set of elongated arraying members 18 in the form of plates which are mounted on a common elongated support 17 and are movable back and forth in directions parallel to the axis of the support 17. The purpose of the plates 18 is to convert the two streams of randomly distributed bottles 9 into a plurality of rows and to thus help build up two arrays, one below each set of grippers 19. The support 17 is rocked back and forth by means of suitable drive means 20 which may constitute a linear motor or a vibrator. The frequency at which the drive means 20 rocks the support 17 is a function of the desired output of the apparatus 1. The rows of bottles 9 formed by the arraying plates 18 advance toward the lower feed conveyor 10 and reach the discharging portion 7″ of the arraying table 7. Such advance takes place in response to pressure of bottles which are deflected by the lever 13 and under the action of conveyors 8.

The foremost part of the discharging portion 7″ is adjacent to a row of control elements in the form of bellcrank levers 22 best shown in FIG. 2. These levers are turnable on a transverse horizontal shaft 21 and their upper arms 25 normally extend into the path of movement of the foremost bottles 9 of the respective rows, there being one lever 22 for each of the rows formed by the arraying plates 18. When the upper arm 25 of a lever 22 is engaged by the foremost bottle 9 of the respective row, the lever is caused to turn in a counterclockwise direction, as viewed in FIG. 2, and to raise its lower arm 23 so that such lower arm moves away from the path of a light beam issuing from a light source 24 and directed against the light-sensitive surface of a photosensitive receiver or signal generator 24*a*. The upper arm 25 then bears against a stationary barrier or stop 26 mounted on the discharging portion 7″ of the arraying table or directly on the frame F. When all of the control levers 22 assume the positions shown in FIG. 2, the light beam issuing from the source 24 can reach the signal generator 24*a* which then causes the transfer unit to move the grippers 19 downwardly so that each gripper can engage the top portion of a bottle 9. For example, the signal generator 24*a* can energize a solenoid valve (not shown) which admits a pressure medium to the upper chamber of the cylinder in the unit 5 so that the piston rod of this unit moves downwardly and lowers the carrier 3 with all of the grippers 19.

Each portion 2 of the transfer unit comprises a bottom wall 30 (see FIGS. 4 and 5) located below the carrier 3 but above the respective group of grippers 19. Each bottom wall 30 is mounted on upwardly extending supporting arms 85 secured to the bottom wall 86 of the carrier 3 by an eye 87 whose axis is parallel with the plane of the bottom wall 86. Additional eyes 88 are secured to and extend downwardly from the bottom wall 86 and straddle the eyes 87 on the supporting arms 85 (see FIG. 5). A horizontal pintle 89 is inserted through the registering openings of eyes 87, 88 and is secured in such inserted position by a cotter pin, a bayonet lock or the like to prevent unintentional disengagement. Upon removal of a set of pintles, the corresponding portion 2 of the transfer unit can be removed from the apparatus to be replaced by a similar portion or by a portion which supports a different number of grippers and/or a set of differently distributed grippers. Such interchange or replacement of portions 2 can be carried out with little loss in time and by resorting to rudimentary tools or by hand.

FIGS. 5 and 6 illustrate the construction of grippers 19. Each of these grippers comprises an article-engaging portion including a centering bell 27 which contains a cupped diaphragm 28. The number of grippers 19 in each of the two portions 2 of the transfer unit corresponds to the number of bottles 9 which can be accommodated in a crate 43. FIG. 6 shows that the diaphragm 28 is provided with several (preferably three or more) wartlike projections 96 which extend to both sides of a line 97 separating a cylindrical upper portion 99 of the diaphragm from a downwardly and outwardly tapering conical portion 98. Additional wartlike projections or protuberances 100 can be provided at the outer side of the lower portion 98. The projections 100 are preferably staggered with reference to the projections 96, as seen in the circumferential direction of the diaphragm 28.

The projections 100 and/or 96 reinforce the diaphragm 28 and insure that an air-receiving chamber is provided at all times between the outer side of the diaphragm and the internal surface of the bell 27, irrespective of the condition of the transfer unit and regardless of the dimensions of top portions of the bottles.

The centering bell 27 is supported by a downwardly extending elastically deformable hose 29 shown in FIG. 5. The upper end portion of the hose 29 extends through the bottom plate 30 of the respective portion 2 and the bell 27 is biased downwardly by two helical expansion springs 31, 32 which surround the hose 29. In this way, the bell 27 can be moved up or down but is normally biased to the lower end position with reference to the plane of the bottom plate 30. The diaphragm 28 can contract in response to admission of compressed air or another fluid medium through a flexible pipe 33 which extends through the hose 29. The upper end of the pipe 33 is connected with a supply pipe 34 which receives compressed or pressurized fluid from a distributor 35 mounted in the carrier 3.

The bottom wall 30 is located at a level directly below a switching plate 37 which is biased downwardly by one or more prestressed helical springs 36 shown in FIGS. 4 and 5. The switching plate 37 has openings 38 registering with openings provided in the bottom wall 30 and receiving coupling sleeves 39 provided at the upper ends of the hoses 29. The four corner portions of each switching plate 37 are connected with upwardly extending actuating posts or trips 40 each of which can actuate a movable contact 41 provided on an arresting switch 42. The switches 42 are mounted in the carrier 3. The purpose of parts 37 and 39–42 is to automatically arrest the drive 5, 6 of the transfer unit when one of the grippers 19 strikes against a misaligned bottle 9. Thus, when the bell 27 shown in FIG. 5 meets an obstruction (for example, the top portion of a misaligned bottle 9 on the discharging portion 7'' of the arraying table 7), the hose 29 moves its sleeve 39 upwardly and changes the inclination of the switching plate 37 so that at least one of the trips 40 actuates the associated arresting switch 42. The latter then arrests the unit 5 to prevent further downward movement of the grippers 19.

When the bells 27 of the grippers 19 fail to meet an obstruction during lowering of the carrier 3 by means of the piston rod in the unit 5, a limit switch (not shown) actuates a valve which admits compressed air to the distributors 35 as soon as the bells 27 reach their lower end positions in which each diaphragm 28 surrounds the top portion of a bottle 9. The diaphragms 28 are thereby caused to contract and to grip the top portions of adjoining bottles so that the bottles are properly held during transfer into an empty crate 43. The valve or valves for the unit 5 then receive a suitable impulse to cause upward movement of the carrier 3 through a relatively short distance which suffices to insure that the bottoms of bottles 9 held by the grippers 19 are lifted above the barrier 26 at the foremost end of the discharging portion 7''. Two empty crates are held ready or approach the raised positions in which their compartments can receive arrays of bottles 9. The valve or valves for the unit 6 receive a signal when the bottoms of bottles 9 are lifted above the barrier 26 and the piston rod of the unit 6 then moves the carriage 4 along the rails 4 *b*. A control switch 44 shown in FIG. 2 (or two or more control switches) is mounted adjacent to the path of the carriage 4 and is actuated by the carriage or by another part of the transfer unit to admit a pressure medium into the upper chamber of the cylinder in the unit 5 so that the carrier 3 begins to move downwardly (see the phantom-line path 45 in FIG. 2) even before the piston rod of the unit 6 completes its working stroke, i.e., before the grippers 19 move the bottles 9 into registry with the compartments of two empty crates 43 on the lower feed conveyor 10. Such mode of transporting the bottles from the table 7 into the crates saves much time because the grippers 19 can begin to move downwardly prior to complete stoppage of the unit 6.

Referring again to FIGS. 1 to 3, the apparatus 1 further comprises two guides which confine arrays of bottles 9 during descent with the grippers 19 toward two empty crates on the platform 11. These guides comprise apertured panels 47 (hereinafter called grates) which are loosely suspended on holders 46 secured to the frame F. Each grate 47 carries a set of downwardly extending laminations or tongues 49 which are flexible and taper downwardly and inwardly toward the center of the respective aperture. The lower end portions of the tongues 49 extend into the interior of two crates 43 when the platform 11 is moved to its upper end position. Upward movement of the platform 11 preferably begins when the carriage 4 moves along the rails 4*b* to move the grippers 19 and two arrays of bottles 9 in a direction toward the right-hand control switch 44 shown in FIG. 2. The means for lifting the platform 11 comprises two endless chains 51 which can raise and lower a base 50 for the platform 11. The operation of the drive for the chains 51 is synchronized with the operation of the transfer unit including the carriage 4. The drive for the chains 51 comprises a cylinder 52 which is mounted on a bracket 53 of the frame F. Each chain 51 is trained around sprocket wheels 56, 58 and 58*a*. The sprocket wheels 56 are fixedly mounted on two shafts 57 so that a single cylinder 52 suffices to operate both chains. The base 50 is secured to vertical stringers of the chains 51 by clamping members 50*a*. The cylinder 52 has two piston rods 52*a* which are connected to two runners 55 by means of articulated joints 54. When the runners 55 are moved toward each other (as viewed in FIG. 1), the clamping members 50*a* move upwardly to raise the base 50 and the platform 11 together with two empty crates 43 above a receiving position so that the lower end portions of tongues 49 extend into the interior of the respective crates. When the carrier 3 reaches its lower end position, the fluid pressure against the outer sides of the diaphragms 28 is terminated so that the grippers 19 release the bottles 9. The carrier 3 is thereupon lifted by the cylinder and piston unit 5, and the cylinder 52 causes its piston rods 52*a* to move apart and to lower the platform 11 with two loaded crates 43 thereon back to the receiving position. The runners 55 are attached to one of the chains 51. The lower feed conveyor 10 further comprises a pair of endless chains or belts 59 carrying transversely extending motion transmitting members or pushers 60 which

engage the two loaded crates 43 and move them away from receiving positions or registry with the guides 47 by simultaneously advancing two fresh empty crates into receiving positions on the lowered platform 11. The chains 59 receive empty crates 43 from a driven roller conveyor 61 which is best shown in FIG. 1. The foremost roller 62 of the roller conveyor 61 is driven by a prime mover here shown as an electric motor 63 through the intermediary of an infinitely variable-speed transmission 64. The remaining rollers 65 of the conveyor 61 are driven by a chain 66 which receives motion from the foremost roller 62. This foremost roller 62 is located directly upstream of the rear upper sprocket wheel for the chains 59. The just mentioned sprocket wheel is mounted on a horizontal shaft 67 which carries a cam 70 cooperating with a follower 71 provided on the moving part 73 of an air valve 72. The shaft 67 further drives endless apron conveyors 69 which advance crates 43 from the roller conveyor 61 into the range of pushers 60 on the chains 59. As shown in FIG. 3, the feed conveyor 10 comprises two apron conveyors 69. The upper stretches of the conveyors 69 pass through openings 68 provided in a supporting plate 150 along which the crates 43 advance toward the platform 11.

The aforementioned air valve 72 controls the operation of a staggering device 75 which serves to stagger the crates 43 in the longitudinal direction of the feed conveyor 10. The valve 72 directly controls a pneumatic or other motor 74 which can move the staggering device 75 into and from the path of movement of crates 43 on the roller conveyor 61. The device 75 comprises a two-armed lever the upper arm of which carries a roller 77. The lever is mounted on the piston rod 76 of the motor 74. The roller conveyor 61 advances the foremost empty crate 43 into abutment with the roller 77 on the lever of the staggering device 75. The roller 77 then prevents further advance of empty crates toward and onto the apron conveyors 69. When the chains 59 are set in motion, the shaft 67 drives the cam 70 which actuates the valve 72 so that the latter admits compressed air to the motor 74 and the latter moves its piston rod 76 upwardly as soon as an empty crate 43 reaches the apron conveyors 69. The piston rod 76 then maintains the roller 77 in the path of movement of the next-following empty crates until after the conveyors 69 advance the foremost crate through a certain distance. The roller 77 is then lowered again to admit a second crate 43. Proper alignment of two empty crates with the grates 47 is insured by the pushers 60 of the chains 59. A limit switch or stop switch 78 (see FIG. 2) is provided to arrest the chains 59 when two empty crates 43 register with the guides 47. The limit switch 78 is mounted on twin rails 79 and is coupled thereto by a clamping device 80. The rails 79 are bolted to a member 81 of the frame F and extend in the longitudinal direction of the chains 59. By loosening the clamping device 80, the switch 78 can be moved to a different position to permit conversion of the apparatus for loading of smaller or larger crates. The switch 78 is always positioned in such a way that it arrests the chains 59 at a time when two empty crates 43 assume accurately determined receiving positions on the platform 11.

FIG. 1 illustrates a safety device including a cord or cable 82 which forms part of means for automatically arresting the apparatus in response to unauthorized or unintentional interference with operation of the transfer unit by an attendant. One end of the cable 82 is fixed to the frame F and this cable is trained around rollers or pulleys 90 to assume the shape of a U. The other end 91 of the cable 82 carries a trip or actuating member 92 which is movable against the opposition of a return spring 93 to engage the movable contact 94 of a safety switch 95 which effects immediate stoppage of the drive for the transfer unit. Thus, if an operator exerts a pull or a pressure against the cable 82, the safety switch 95 immediately arrests the unit 5 and/or 6 to prevent damage and/or injury.

The operation of the apparatus shown in FIGS. 1 to 3 will be readily understood upon perusal of the preceding description. The upper feed conveyor 12 delivers randomly distributed bottles 9 which form two streams in response to engagement with the deflecting lever 13 and move onto the arraying table 7 to form thereon two sets of rows. The foremost bottle of each row engages the upper arm 25 of the respective control lever 22 and moves this arm against the barrier 26. When the discharging portion 7'' of the table 7 accumulates two complete arrays of bottles 9 (for example, 2 times 12 bottles), the signal generating device 24*a* which receives light from the source 24 causes the unit 5 to lower the grippers 19 and to engage the two arrays. The unit 5 then moves the carrier 3 upwardly and the unit 6 begins to move the carriage 4 in a direction to the left, as viewed in FIG. 1, until the right-hand control switch 44 of FIG. 2 actuates the unit 5 and causes the carrier 3 to move in a direction to the left as well as to descend so that bottles 9 suspended on the grippers 19 enter the apertures of the respective grates 47 and are guided by their tongues 49 to enter the compartments of two empty crates 43 on the raised platform 11. The platform 11 then descends and the unit 5 receives a signal to raise the carrier 3. A control switch 44A (FIG. 1) then receives an impulse from the rising carrier 3 and actuates the unit 6 which begins to move the carriage 4 in a direction to the right so that the grippers 19 rapidly return into registry with fresh arrays of bottles on the discharging portion 7'' of the table 7. At the same time, the chains 59 remove the two freshly loaded crates 43 from the lowered platform 11 and deliver two empty crates. Such crates are fed by the roller conveyor 61 and can move onto the apron conveyors 69 at intervals determined by the staggering device 75. The chambers surrounding the diaphragms 28 of the grippers 19 receive compressed gas when the grippers descend toward the discharging portion 7'', and such gas is permitted to escape when the carrier 3 assumes its lower end position above the grates 47.

The signal generating device 24*a* which cooperates with the light source 24 and actuates the cylinder and piston unit 5 of the drive for the carrier 3 and grippers 19 constitutes a very simple, reliable and inexpensive means for permitting rapid conversion of the apparatus for manipulation of different numbers and/or differently dimensioned articles. The number and distribution of control levers 22 can be changed with little loss in time whenever the apparatus is to be converted for transfer of different arrays.

Since the arrays which are being transferred from the arraying station on the discharging portion 7'' of the table 7 into empty crates 43 (while such crates are being held in raised positions above their receiving positions at the level determined by the upper stringers of the chains 59) move along vertical, horizontal and downwardly inclined portions of the path 45, the transfer of arrays takes up less time than in presently known apparatus wherein the arrays are moved either vertically or horizontally but not in both directions at the same time. The same applies for the length of time which is required to return the grippers 19 from registry with freshly filled crates 43 back into registry with fresh arrays of bottles 9 on the discharging portion 7''.

Referring finally to FIG. 7, there is shown a modified gripper 101 which can be used as a substitute for the aforementioned grippers 19. The gripper 101 also comprises an article-engaging portion including a centering bell or head 27 which accommodates a deformable cupped diaphragm 28. However, the flexible hose 29 is replaced by a rigid tubular member 102 which is threadedly or otherwise connected with the bell 27. A prestressed helical spring 32 operates between the bell 27 and bottom plate 30 to urge the bell downwardly. The tubular member 102 extends with some clearance through an opening 104 in the bottom plate 30 and is surrounded by a relatively short cone-shaped helical spring 105. The opening 104 allows for some tilting of the tubular member 102 to permit certain changes in the position of the bell 27 when the latter engages a slightly misaligned bottle 9 on the table 7 and/or when the bell engages a bottle which is slightly longer or shorter than a standard bottle. The spring 105 tends to maintain the tubular member 102 in upright position but can yield to a certain pressure when the bell 27 is tilted or

otherwise displaced. This spring 105 operates between the surface surrounding the opening 104 and the peripheral surface of the tubular member 102. The latter has an axial bore 133 which can admit compressed air to the chamber around the diaphragm 28. The manner in which the tubular member 102 can be lifted to effect upward movement of a switching plate corresponding to the plate 37 of FIG. 5 is not shown in FIG. 7.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of our contribution to the art.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. Apparatus for introducing bottles or like articles into crates or analogous receptacles, comprising first feed conveyor means arranged to advance a supply of randomly distributed articles in at least one predetermined direction; arraying means positioned to receive articles from said first feed conveyor means and to assemble such articles into a succession of arrays, said arraying means comprising a support provided with arraying members arranged to guide the articles in the form of plural rows and control means for arresting the foremost articles of such rows so that at least the thus arrested foremost articles of the rows form an array; second feed conveyor means arranged to advance empty receptacles to a receiving position laterally adjacent to and at a level below said arraying means and including means for lifting empty receptacles above said receiving position; and transfer means including grippers operative to engage the articles of an array on said support and to deposit such articles in raised receptacles, and drive means for moving said grippers between positions of registry with the articles of an array on said support and positions of registry with receptacles above said receiving positions along a composite path located partly in a vertical plane, partly in a horizontal plane and partly in an inclined plane.

2. Apparatus as defined in claim 1, wherein said predetermined direction is inclined with reference to said rows and wherein said arraying means further comprises deflecting means for changing the direction of travel of articles during movement from said first feed conveyor means onto said support.

3. Apparatus as defined in claim 1, wherein said control members comprise levers and said arraying means further comprises a horizontal shaft normal to said rows and rockably supporting said levers, each of said levers having a first arm normally extending into the path of movement of the foremost article in a row on said support and a second arm normally extending across the path of a light beam emitted by a fixed light source, a signal generator positioned to receive light from said source and to thereby start the drive means for said grippers when all of said levers are rocked by the foremost articles of the respective rows.

4. Apparatus as defined in claim 1, wherein said support comprises a plurality of endless conveyors having upper stringers arranged to advance rows of articles toward said control means.

5. Apparatus as defined in claim 4, wherein said arraying members comprise plates extending between said rows of articles on said support and means for moving said plates with reference to said support.

6. Apparatus as defined in claim 1, wherein said transfer means further comprises a carrier connected with said drive means, a support for said grippers, and means for releasably coupling said last-mentioned support to said carrier.

7. Apparatus as defined in claim 1, further comprising staggering means for intermittently admitting empty receptacles to said receiving position.

8. Apparatus as defined in claim 7, wherein said second feed conveyor means comprises a driven shaft, a cam provided on said shaft, and a motor controlled by said cam, said staggering means comprising a stop movable by said motor into and from the path of movement of empty receptacles in synchronism with operation of said second feed conveyor means.

9. Apparatus as defined in claim 1, further comprising adjustable stop means for said second feed conveyor means arranged to move between a plurality of positions each of which corresponds to a setting of said second feed conveyor means for delivery of differently dimensioned receptacles to said receiving position.

10. Apparatus as defined in claim 9, wherein said stop means comprises a limit switch and further comprising elongated guide means and clamping means releasably securing said limit switch to said guide means.

11. Apparatus as defined in claim 1, wherein each of said grippers comprises a fluid-operated article-engaging portion and a rigid elongated tubular portion having a lower end connected with the respective article-engaging portion and an upper end tiltably supported by a carrier of said transfer means, said tubular portions of said grippers being movable up and down against and under the bias of resilient means, each of said grippers further comprising additional resilient means yieldably opposing tilting movements of the respective tubular portion, each of said tubular portions being arranged to supply a fluid medium to the respective article-engaging portion.

12. Apparatus as defined in claim 1, wherein each of said grippers comprises a fluid-operated article-engaging portion and each of said article-engaging portions comprises a hollow centering portion and a diaphragm received in the respective centering portion and arranged to contract and to engage a portion of an article in response to admission of fluid into a chamber provided between such diaphragm and the respective centering portion, each of said diaphragms having a plurality of projections abutting against the respective centering portion.

13. Apparatus as defined in claim 1, wherein said transfer means comprises a carrier arranged to support said grippers for movement up and down, switching means provided on said carrier and displaceable with reference thereto in response to upward movement of a gripper when the latter meets an obstruction during lowering into engagement with an article of an array on said support, and means for arresting said drive means in response to displacement of said switching means, said transfer means further comprising resilient means for biasing said switching means downwardly, said switching means comprising a plate connected with said grippers.

14. Apparatus as defined in claim 1, further comprising a safety device operative to arrest said drive means in response to interference with movement of said grippers, said safety device comprising a normally idle safety switch for said drive means and cable means encircling the area accommodating said grippers and operatively connected with said safety switch to operate the same in response to flexing of said cable means.