Jan. 12, 1971 C. ANGLADE, JR 3,553,927

APPARATUS AND METHOD FOR PACKING ARTICLES IN CONTAINERS

Filed March 13, 1968 4 Sheets-Sheet 1

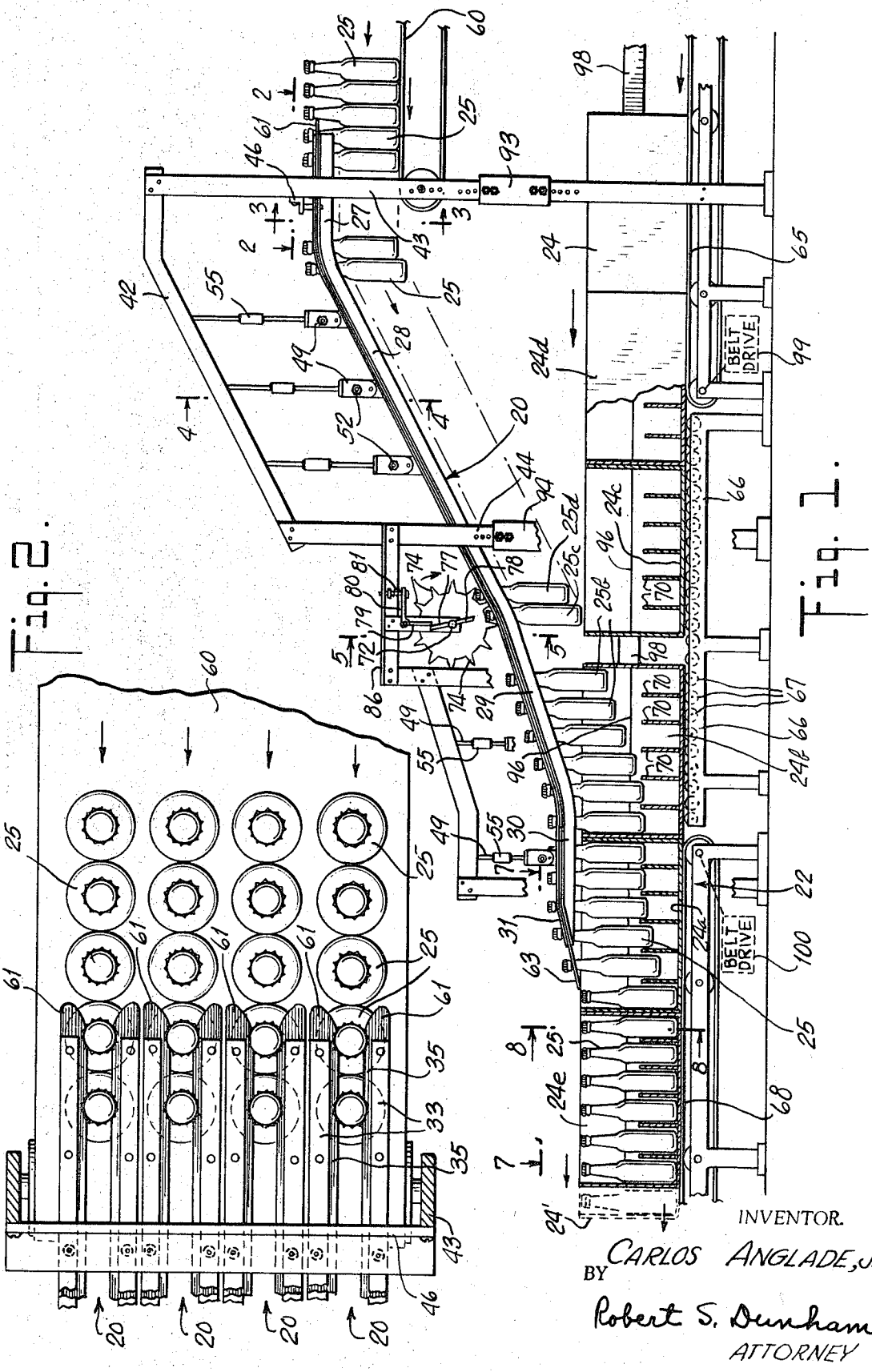


Fig. 1.

Fig. 2.

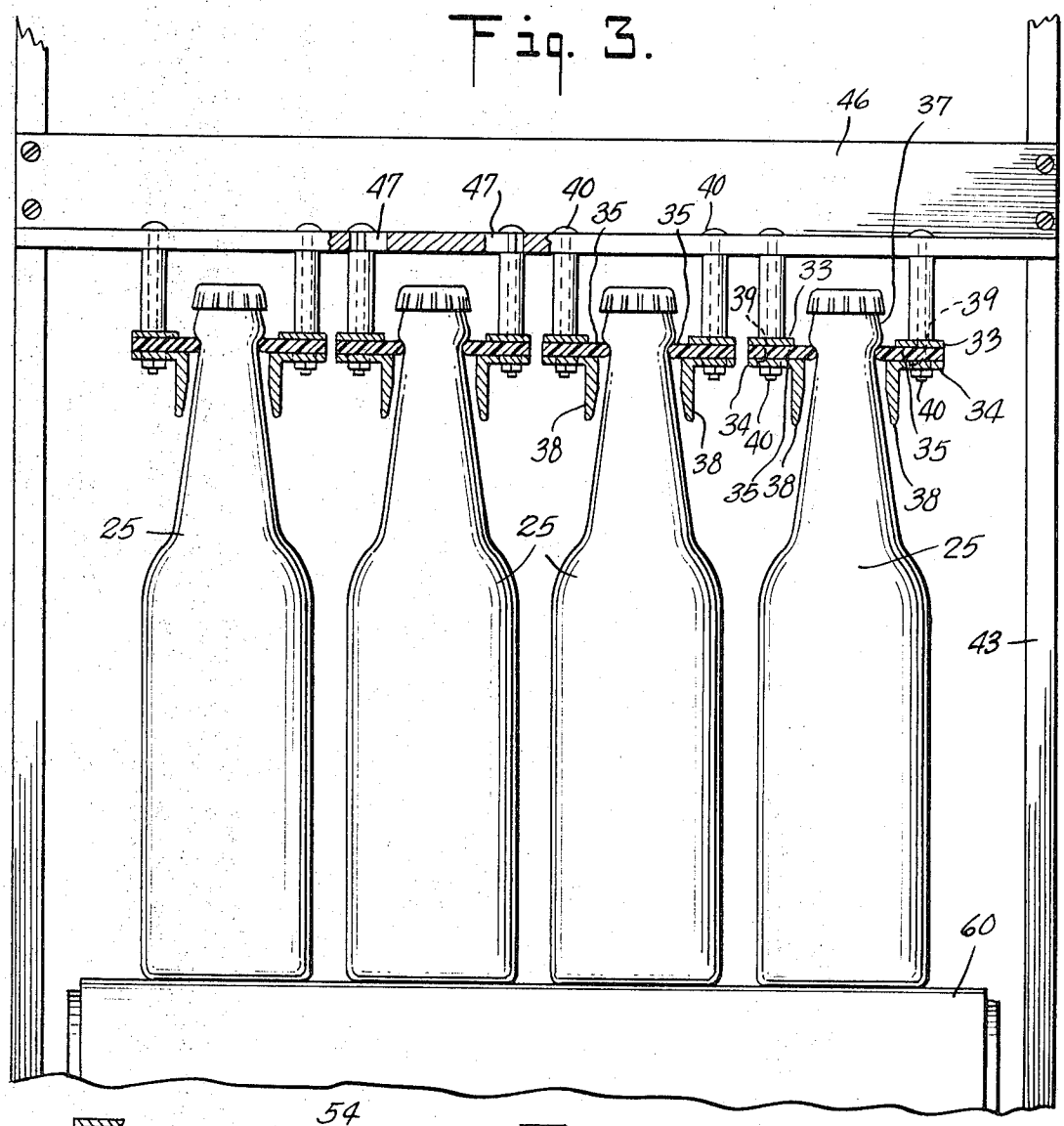
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APPARATUS AND METHOD FOR PACKING ARTICLES IN CONTAINERS

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Fig. 3.



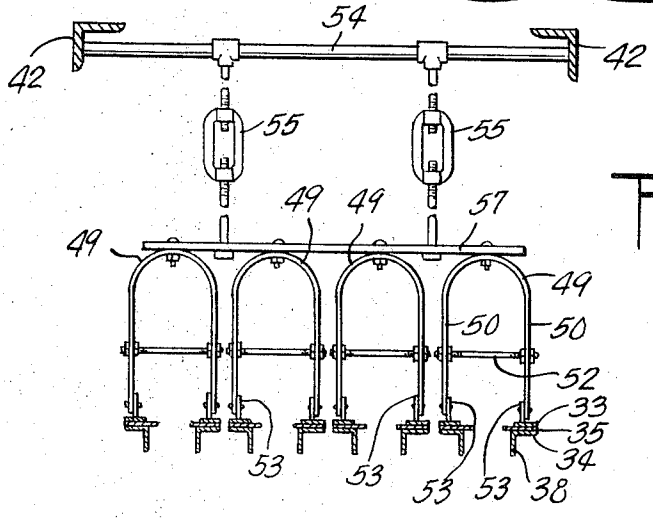


Fig. 4.

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APPARATUS AND METHOD FOR PACKING ARTICLES IN CONTAINERS

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Fig. 5.

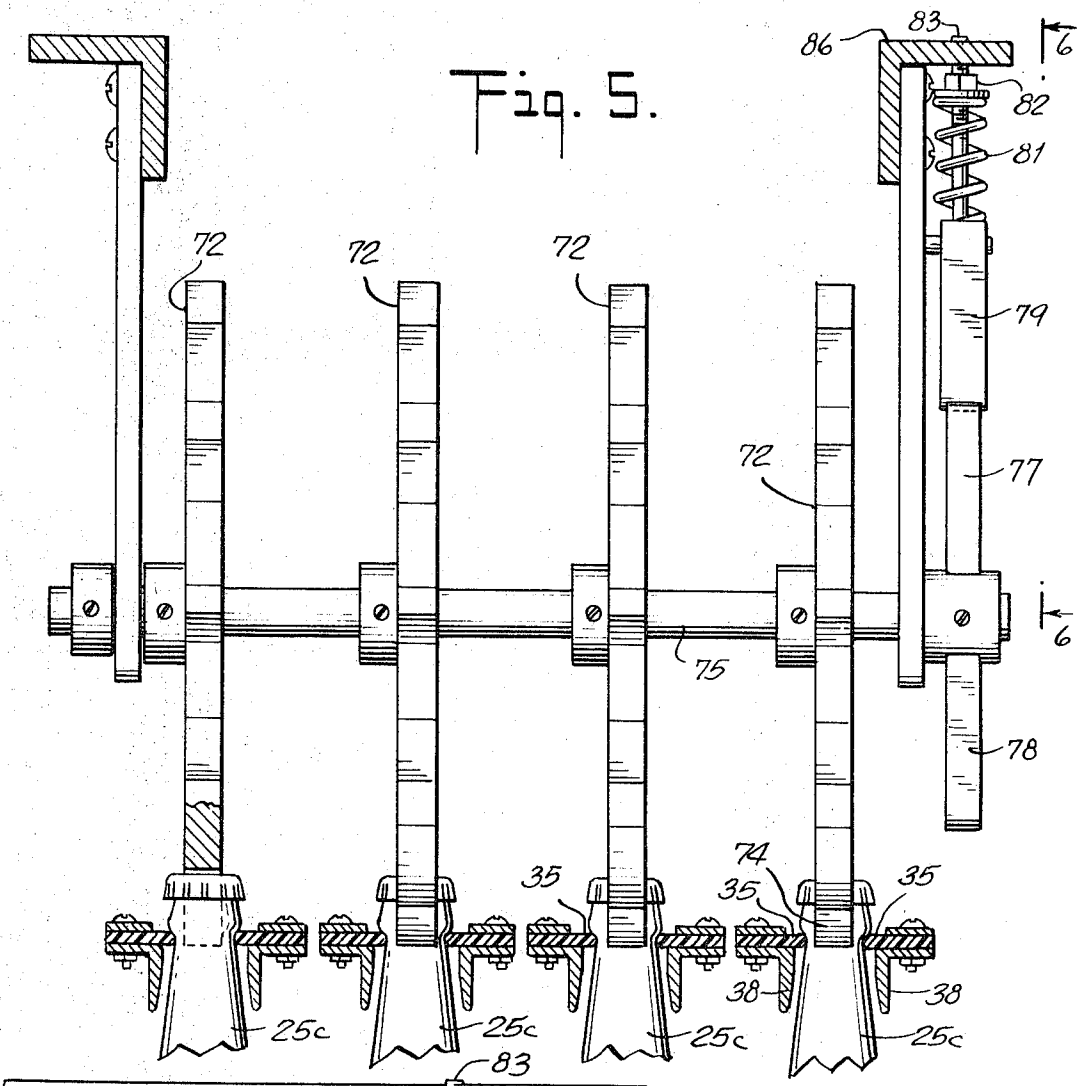


Fig. 6.

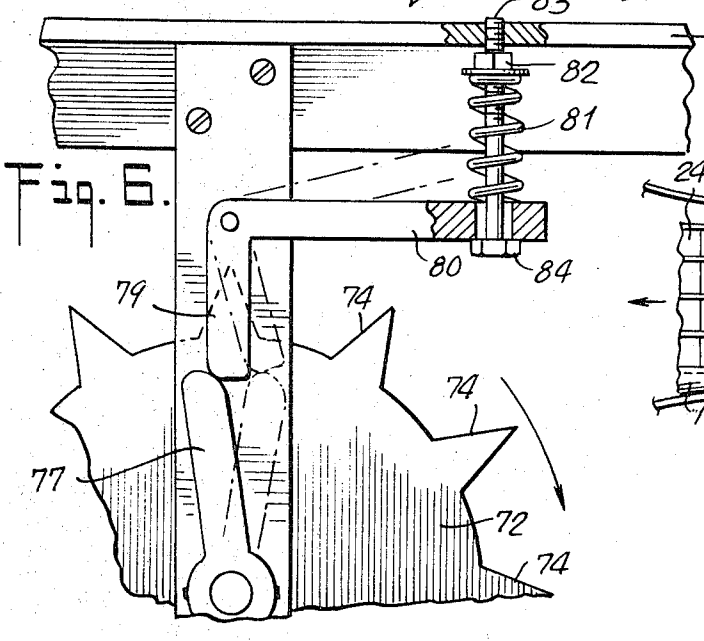
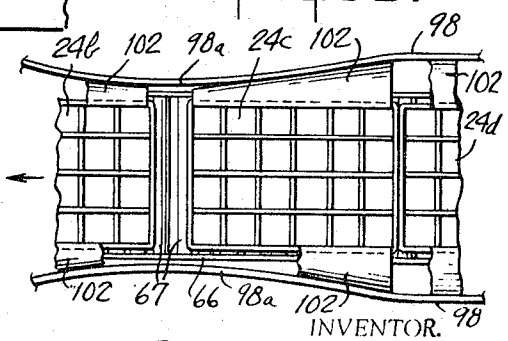


Fig. 10.



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Fig. 7.

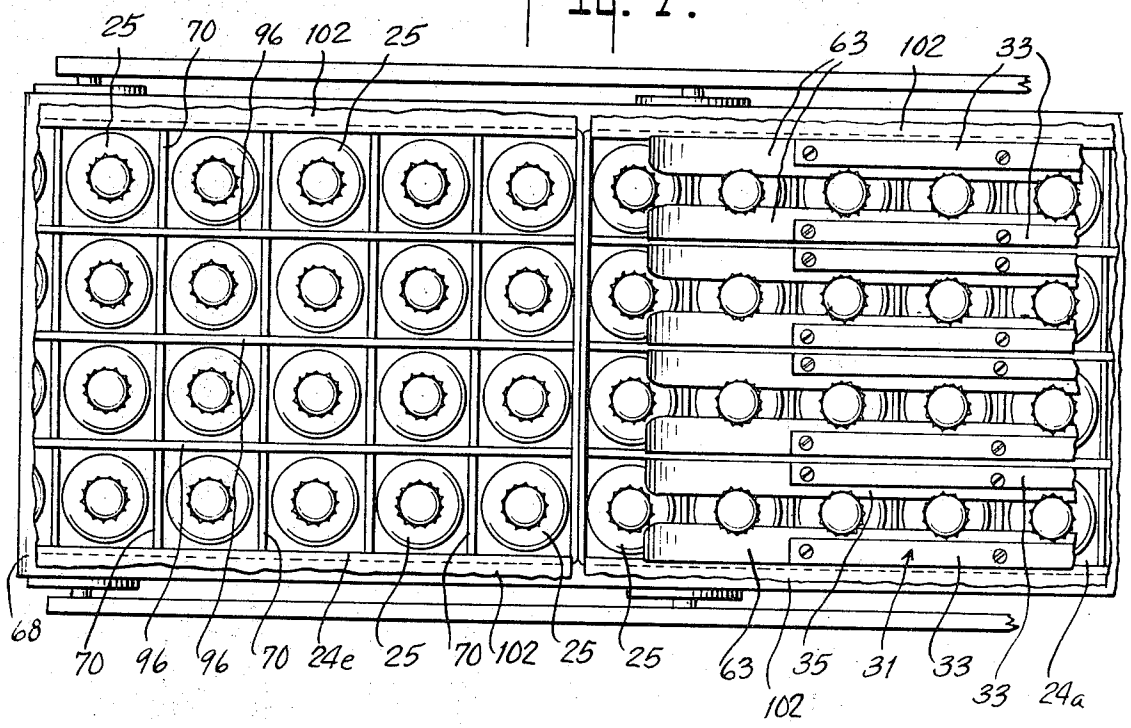


Fig. 8.

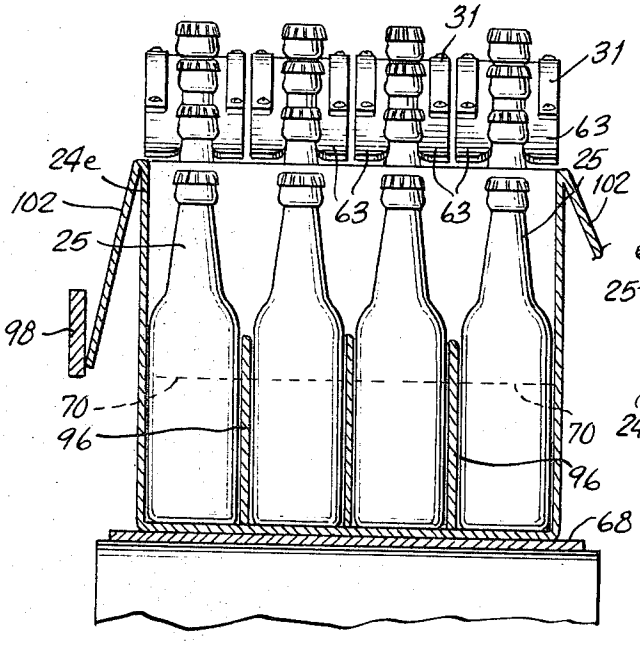
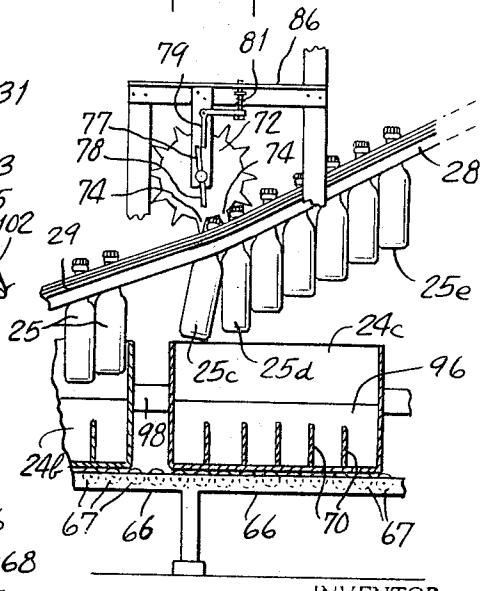


Fig. 9.



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3,553,927

APPARATUS AND METHOD FOR PACKING ARTICLES IN CONTAINERS

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Int. Cl. B65b 21/06
U.S. Cl. 53—26 18 Claims

ABSTRACT OF THE DISCLOSURE

For packing bottles or other articles into cases, the articles slide freely in a continuous file down an inclined track while suspended thereon, and beneath the track open cases are brought by a conveyor into a path which extends through a loading region to a second conveyor for removing filled cases. Travel of articles is intermittently arrested on the track to release successive groups of articles for further advance and proper entry into corresponding cases which may be successively retarded or stopped in the loading zone, the forward moving energy of the entering articles coacting to advance each case from such zone to the second conveyor while descent of articles into the case is completed. A plurality of parallel tracks each with article-counting arresting means serves for simultaneously filling parallel rows in each case. The apparatus provides rapid, essentially continuous, loading operation while insuring entry of article groups into the cases and if desired, proper deposit of articles into internal pockets of each case, in a self-synchronizing manner with simple mechanism.

BACKGROUND OF THE INVENTION

(1) Field of the invention

This invention relates to apparatus and methods for packing bottles or other articles into containers and particularly for operation whereby a continuous feed or supply of such bottles or articles is provided, causing the articles to advance along a descending path in continuous succession, while containers are advanced along a like path to receive successive groups of aligned articles. The invention is of notable utility in the packing of bottles, as for example bottled beverages, in open-topped cartons or cases that may or may not be provided with pocket-forming partitions, each to receive a group of bottles in a line, by deposit therein. In presently preferred embodiments, multiple means are provided for advancing continuous lines of bottles parallel to each other, so as to load the bottles substantially simultaneously in parallel groups in the receiving cartons or cases.

The apparatus and procedure of the invention are designed to afford reliable and rapid operation, in essentially automatic manner, whereby bottles advancing in successive abutment on linear paths are packed into succeeding cases or boxes with corresponding automatic delivery of filled containers.

(2) Description of the prior art

Various machines have been heretofore proposed for packing bottles or the like into boxes of cardboard, wood or plastic, a particularly common mechanism involving accumulating and segregating the bottles into groups, each appropriate for filling a box, then transporting each group horizontally to a packing locality while a box is brought up to said locality. Means are provided for then engaging the group of bottles and effecting movement of them downward into the box, the latter being thereafter removed, a complete cycle being repeated for each successive box or case. Such equipment ordinarily requires complex and correspondingly expensive mechanism for handling and displacing the bottles and bringing them into the boxes,

with difficulties of reliability and servicing and particularly with difficulty of timing and accuracy in endeavoring to increase a speed of operation for a higher rate of flow of bottles to the separating and grouping instrumentalities.

It has also been proposed to advance bottles along and down parallel sloping tracks, in suspended relation, while the upper ends of the bottles are engaged and moved by individual holding or retaining devices traveling with the bottles by appropriate mechanism, such proposal also including means for advancing successive cases or boxes to receive the bottles from the end of the track. Such proposed machine further required connecting or timing instrumentalities intermediate the bottle-engaging and advancing means and the case-moving parts so as to insure registration of the bottles with the pockets in the cases and to account for some spacing between successive, individually displaced cases.

A particular object of the present invention is to afford improved and highly efficient apparatus for depositing bottles into successive cases, such apparatus conveniently embracing feed of bottles essentially by free travel along a downward sloping track in suspended relation, and in such fashion as to afford more accurate, gentler and more rapid deposit of bottles into the receiving pockets of the cases. Special objects are to provide effective means obviating tendency of breakage of bottles or other damage to articles as found to be encountered with equipment of the sort mentioned above, a further aim being to dispense with special case-tilting arrangements and to effectuate mutual alignment of bottles and containers while requiring a minimum distance of fall of the bottle into the container. A still further object is the provision of an extremely rapid and simplified machine, adapted to function essentially continuously from continuously flowing lines of bottles fed thereto, for ultimate delivery of a flow of filled boxes or cases.

SUMMARY OF THE INVENTION

For the foregoing and other purposes, the apparatus of the invention, especially in its presently preferred embodiment for packing bottles in cases, comprises a downwardly sloping track which consists of a pair of rails spaced to accommodate the neck of a bottle and thereby suspend it by the rim or flange conventionally formed at the upper end of the neck, such track being arranged to receive a continuing line of bottles positively advanced to enter the track, and the apparatus further including means for advancing successive cases which are open or have been previously opened, e.g. boxes, cartons or the like, in a continuing, endwise-abutting line beneath and in vertical alignment with the track so that bottles approaching the lower end of the latter move into the cases and drop into such cases as they fall from the free end of the track. Most advantageously, according to present preference, the travel of the bottles along the track is effectuated by initial impulses and gravity, and the arrangement of means for advancing succesive cases and the pathway structure thereof is most desirably such that as the lower ends of the bottles enter significantly into the case that is expected to receive an aligned group of them, the further forward movement of the case is aided or indeed governed by the energy of the forward component of the motion of bottles along the track.

The system further includes means for positively displacing successive cases away from the locality of first introduction of bottles, such means preferably being arranged so that it carries the cases past the place where bottles actually, in succession, drop into the pockets. In coaction with the described means whereby successive bottles or other articles, and successive cases, are ad-

vanced to and into the loading localities, means are provided, most advantageously controlled essentially only by the descending bottles themselves, whereby successive groups of such bottles are temporarily arrested or retarded to insure proper registration of each such group with the arrival of the case to receive it. An effective embodiment of such means, for example, invloves a rotatable or other element engageable with successive individual bottles and selectively exerting restraining force, e.g. on the leading bottle of a predetermined number which constitutes the group, the restraining force being self-releasing by the accumulating load of bottles in the track, in such way as to accommodate the advance of the next case. This usually brief, temporary delay of bottle advance may advantageously occur with respect to bottles that are still elevated above the top edges of the arriving cases, whereby upon bottle release such articles and the cases in effect move simultaneously into position of actual entry of the articles below such edges. In this fashion, there is provided automatic yet extremely simple timing so as to accommodate the thickness of the abutting end walls of successive cases (which present somewhat greater spacing than thin individual partitions in each case) and indeed other circumstantial spacing between cases, the travel of the cases themselves being such as to tend to be arrested, subject to resumed advance by the energy of the entering bottles. Thus a slight delay or retardation of movement of a case being loaded away from the locality where advance is preferably governed by the energy of descending bottles, can be taken into account at the same time. Moreover, whereas the mutually abutting bottles can be self-guiding past the thin partitions in a case, at least some spacing is required to avoid difficulty in descent of bottles on opposite sides of the abutting walls of two successive cases.

Complete apparatus for loading cases or the like each having arrangements to receive two or more rows of articles, e.g. often three or four such rows, may include a plurality of side-by-side track structures down which the bottles or other articles advance in single file, with coacting restraining means for each track, preferably with a single release, so that the articles are simultaneously loaded into each row of the case in the manner explained. The bottle-suspending rails of each track are advantageously made of or faced with material to facilitate sliding of the bottles, and may include some adjustability of the mutual spacing of rails to accommodate bottles having different widths of neck. Likewise, as particularly permitted by the novel control of the advance of groups of bottles, in single file, and successive cases, to the initial loading locality, the vertical position of the entire track and bottle-carrying assembly can be vertically adjusted to handle bottles and cases of different heights. A still further feature of the combination and method is that the conveyor which removes cases from the initial loading locality while completion of descent of bottles is occurring is very preferably operated at high speed, i.e. more rapid than the advance of cases to such locality, with corresponding avoidance of any back-up or interference and most especially for ready accommodation to a high overall speed of operation.

Although the invention is applicable to the loading of articles into cases or the like which neither have nor require much or any guiding or supporting structure within the container, a particular feature in combination is that with cases having a rectangular partitioning grid, as conventional for beverage bottles, notably improved results in the employment of gravity advance and deposit of properly positioned bottles is achieved where the transverse partitions are substantially lower than the longitudinal partitions. In this fashion appropriate maximum guidance is obtained as between the adjacent, advancing rows or lines of bottles, while maintaining actual suspension of such articles for a maximum time and allowing more accurate self-guidance between the bottles of a group, with

the result that free fall of each bottle is minimized and thus there is optimum assurance that the bottles will not be broken or damaged.

As will now be seen, the invention involves an essentially new method of advancing successive bottles or other suspendable articles downward along a track, as by an initial impulse combined with gravity, while correspondingly advancing cases into, through and beyond localities for bottle deposit, under differently governed or controlled forces at successive regions or localities of the path and while regulating the gravity advance of bottles, essentially by groups and preferably in response only to the movement or energy of the bottles themselves, whereby synchronization of arrival of bottles and cases into loading relation is fully assured. As will also be appreciated, the apparatus and procedure provide an efficient packing operation, with an unusual minimum of mechanical instrumentalities, avoiding complex moving parts, structurally inter-related timing mechanisms or the like. At the same time all necessary synchronization is readily attained and the system is adapted for relatively high speed operation. Because of the structural simplification achieved by the novel principles of controlling advance of articles and containers, reliability of function and freedom from servicing of complex mechanisms is achieved, as likewise and very importantly, a ready adjustability of a given unit of the apparatus to handle a variety of sizes of bottles or the like and a variety of dimensions or types of cases or other containers. The equipment is adapted for receiving bottles from conventional filling machines, e.g. in simple, single-file rows of such articles in successive abutment, while the supply of cases is similarly expedited, the latter being handled in simple, succeeding abutment, without requiring any special mutual spacing either before or within the apparatus. In packing bottles, they are deposited in relatively gentle fashion, yet in accurate registration and with desirable rapidity, as indicated above.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and further features of the invention are more particularly set forth in the description hereinbelow, in reference to the accompanying drawings which show one embodiment of the invention in somewhat simplified form, by way of example. Referring to the drawings:

FIG. 1 is essentially a side elevational view of the complete apparatus;

FIG. 2 is a fragmentary, enlarged plan view essentially on the section line **2—2** of FIG. 1;

FIG. 3 is a fragmentary, enlarged, transverse elevation, partly in section, on line **3—3** of FIG. 1;

FIG. 4 is a fragmentary transverse elevation on line **4—4** of FIG. 1;

FIG. 5 is a fragmentary, enlarged, transverse elevation, partly in section, on line **5—5** of FIG. 1;

FIG. 6 is a fragmentary side elevation on line **6—6** of FIG. 5;

FIG. 7 is an enlarged, fragmentary plan view on line **7—7** of FIG. 1;

FIG. 8 is a transverse section on line **8—8** of FIG. 1;

FIG. 9 is a fragmentary side elevation, corresponding to FIG. 1, showing certain parts at about the moment of release of a group of bottles; and

FIG. 10 is a fragmentary plan view of the path of cases, showing case-retarding side rails.

DETAILED DESCRIPTION

While the invention is applicable to packing bottles, cans or any other suspendable articles, the apparatus is shown and described, for purposes of illustration, as designed for handling bottles, but will function similarly in handling other articles.

Referring to FIGS. 1 and 2, the illustrated unit of apparatus comprises a group of downwardly sloping track structures **20** supported over a conveyor path generally

designated **22** along which successive cases **24** are advanced while the bottles **25** descend the tracks and ultimately drop into the cases. The machine is shown for handling cases to contain 24 bottles, being four longitudinal rows, each receiving a group or line of 6 bottles, so that there are four track structures **20** (FIG. 2 and others) parallel to each other. Since the track structures can be identical in essentially all their parts, such elements of each will carry the same reference numbers, and the description will be primarily directed to a single track. As indicated, the invention can utilize any number of one or more tracks and can accommodate linear groups of bottles in each track, i.e. as received in the cases, of varying numbers, different from the illustrated example. The successive, abutting boxes or cases can, of course, be advanced with their longer dimensions across the path, if desired, for coaction with a suitable number of feed tracks, and indeed almost any shape of open-topped container (meaning any container which is open in construction or may have flaps or the like which are opened for packing) may be accommodated, as likewise any type of bottle, can or other article that may be suspended between a pair of rails.

The track **20** comprises an upper horizontal portion **27**, downwardly sloping portions **28, 29** and a final, conveniently horizontal portion **30** having a short, sloping discharge end **31**. The entire track assembly, i.e. each of the described sections, comprises a spaced pair of supporting rail strips **33, 33** coacting with a corresponding pair of lower rail and guide elements **34, 34** so as to clamp between them a corresponding spaced pair of functioning rail elements **35, 35** that may be made of suitable low-friction material such as Teflon or other plastic or resin of like properties, the rails **35, 35** being spaced to provide a continuous slot between them which will accommodate the neck of a bottle **25** immediately below the flange or rim **37** at the top of the bottle. Thus each bottle can slide freely the entire length of the track, being safely suspended between and upon the edges of the elements **35, 35**, the latter being such as to minimize friction and also to cushion the bottles slightly against damage. The parts **34, 34** also include depending flanges or guide plates **38** shaped to receive at least a portion of the bottle neck with clearance, for keeping the bottle in a substantially vertical position, against swinging sideways. The mounting of the strip guides **34–38** can be such as to permit adjustment of their position crosswise of the track, e.g. as by providing transverse slots (indicated at **39**) in the portions **34**, through which the mounting bolts **40** for the defined assembly pass. By such adjustment, various widths or shapes of bottle necks are handled between these guides.

The entire track system may be supported with an appropriate framework designated **42** and having suitable uprights **43, 44** and others as needed, the tracks being appropriately suspended from the framework. For example, the entering, horizontal track portion **27** is simply mounted below a cross member **46** by the bolts **40**, provision being made for adjusting the spacing of the two sides of each track, e.g. as indicated by the bolt-receiving slots **47** in the flange of the member **46**.

Another mode of suspending the tracks, presently preferred at least for the sloping portions **28, 29** and **30**, is particularly shown in FIGS. 1 and 4, and may comprise an inverted U-shaped element or yoke **49** having lower arms **50** that can be bent toward and away from each other and held in adjusted position by threaded locking means **52** so as to afford corresponding adjustment of the spacing of the rail assemblies **33–34–35** that are carried by suitable lugs **53, 53** at the lower ends of the arms **50**. The rail assemblies being advantageously mounted in a fashion indicated in FIG. 3, for separate setting of the guide strips **38, 38**, the described structure thus permits adjusting the basic width between the rails and likewise the spacing of the guide skirts. At each desired place of support of the pairs of rails, a similar yoke structure **49** is employed, as shown in FIG. 4, and these yokes may be suspended from the frame **42** in any appropriate manner, e.g., as from a transverse bar **54** of the latter, which carries two or more adjustable, threaded coupling members **55** that in turn directly support the yokes or a bar **57** carrying them.

Bottles **25** are brought to the entrance of each track by means such as a conveyor belt **60**; although they may more usually arrive in a random mass, they are simply shown as coming in single files, and in any case they are sorted into such files as their necks enter between the outwardly flaring ends **61, 61** of the rail parts **35, 35**. As will be understood, the required, continuing lines of bottles are thus advanced into and partly along the rail section **27**, arriving on the belt **60** from suitable mechanism (not shown) that has been employed for filling and capping the bottles. The force of the moving conveyor, transmitted through the bottles supported on it is sufficient to push the row of bottles along the horizontal track portion **27**, and through a part of the latter where the bottles are suspended, until they reach the downwardly sloping track section **28**. Preferably with considerable kinetic energy remaining from the conveyor action, the bottles then proceed to slide freely down the rails in a continuous abutting flow. As stated, the path of the rails includes the two sloping sections **28, 29** and also a further horizontal section **30**, where the positive advance of a case **24*a*** into which the bottles are falling takes over, to move the bottles along as explained hereinbelow. For gentle deposit, the remote end part **31** of the track section **30** slopes downwardly as indicated (FIGS. 1, 7 and 8) and the stiff, smooth bearing strips **35** may conveniently extend beyond the end of the rigid part **31**, as at **63**, thereby affording a slightly resilient track section that ultimately releases the bottle necks from its end. Indeed the strip portions **63** may be touched by the top edges of the case **24** and may spring down into the cases as the latter pass, so that the final drop of each bottle into its compartment or pocket is of minimum distance.

The path structure **22** for the cases or boxes **24** comprises three successive sections, viz. a long, entering conveyor belt **65**, a central conveyor table **66** having transverse, non-driven rollers **67** and a further, long take-off conveyor belt **68**. The dimensions and spacing of these sections are advantageously such that a case **24*c***, squarely positioned on the roll table **66** will be free of direct drive by the belt **65** (and will be far behind the case-removing belt **68**), and indeed will tend to be slowed and arrested (with the succeeding train of cases) as by friction or other means as explained below. In other words, unless at least some additional advancing force is applied to the case or box **24*c***, it tends to come to rest on the rollers **67**. Indeed the nature and drive (not shown) of the belt **65** and its coaction with the empty cases carried thereon is designedly such that the force or energy imparted to the case **24*c*** by the abutting case **24*d*** behind it (and the further cases that are coming up), may be alone insufficient to move the case **24*c*** forward (to the left, in FIG. 1) off the table, at least unless there is some additional forward force exerted as explained below. In any event, the situation of the table **66** and the belt **65** provides means whereby a case at the position **24*c*** is governed in its ultimate advance onto the belt **68** by the kinetic energy of the bottles **25*b*** moving downwardly into each case, it being understood that although shown separated for clarity, these bottles are actually more or less in mutual abutment, being ultimately slightly separated by the upstanding edges of the transverse partitions **70** so that the bottles finally slide into the pockets or compartments as shown respecting the case in position **24*a***.

In order to provide effective synchronism of the bottles and the cases, yet without requiring direct mechanical interconnection or any like mechanism associated with the track and the conveying system **65–67–68**, a separator device is employed, including a star-shaped or otherwise toothed wheel **72** disposed above the track and having

appropriately tapered teeth or detaining elements **74**, the wheel being mounted on a freely turning shaft **75** (FIG. 5) and the teeth **74** being spaced so that the cap or upper end of a bottle can be received between successive teeth, thereby turning or tending to turn the wheel as bottles are individually so engaged while they slide down the track more or less in succeeding abutment.

At its outer end the shaft also carries a pair of oppositely extending arms **77, 78**, thus turning with the wheel **72**, each arm at its end being adapted to strike a pivoted detent **79**, which has an L-shaped configuration about its pivot, including a spring-loaded horizontal arm **80** that keeps the arm **79** in the path of the arms **77, 78** (see also FIG. 6).

The arm **80** is thus normally biased to the downward position shown in solid lines in FIG. 6, as by a spring **81** under compression between a nut or collar **82** on a bolt **83**, and the upper side of the arm **80**, the head **84** of the bolt engaging the lower side of the arm and the bolt being secured at its upper end in a suitable cross member **86** of the frame. Hence when the wheel **72** is turned so that the arm **77** strikes the detent **79**, the wheel is arrested, but further forceable rotation of the wheel and arm **77** will, by the pressure of the end of the latter, cause the detent and lever **79–80** to rock counterclockwise (FIG. 6) against the spring **81**, thus permitting continued rotation of the wheel **72**.

Although other means, whether bottle-actuated or not, can be used, the device comprising wheel **72** and its detent provide effective separating function for successive groups of bottles. Thus where each group has six bottles, for filling a lengthwise row of one case, the wheel **72** has 12 teeth and thus 12 recesses between teeth, each adapted to receive the top end of a single bottle only. More particularly as each of the opposite detent arms **77, 78** is forced past the arm **79** and continues to turn until the other rotating arm strikes the arm **79**, six of the peripheral recesses of the wheel sweep past the region of juxtaposition of the wheel to the track and permit the corresponding passage of six bottles, under gravity, along the track. After this group has passed, the other turning arm strikes the arm **79** and is arrested, thereby halting the seventh bottle.

Succeeding bottles, which have been sliding down the track more or less freely without much force of mutual abutment, if any (since there is appreciable acceleration as the bottles descend the relatively long slope **28**), begin in effect to exert energy on the retained bottle **25***c* (FIGS. 2 and 9), so that by the kinetic energy of the bottles thus piling up, in single file, against the bottle **25***c* and by the potential energy of the position of the bottles on the sloping track, a large force is quickly developed against bottle **25***c* and also conceivably by the next bottle **25***d* against the next tooth **74** of the wheel **72**. In consequence sufficient torque is exerted on the wheel to push, for example, the arm **77** (FIGS. 1, 5, 6 and 9), past the arm **79**, i.e. rocking the structure **79–80** counterclockwise to the dotted line position in FIG. 6 against the spring **81**. The wheel then turns freely, allowing descent of six bottles in succession. When the seventh bottle **25***e* reaches the position last occupied by the bottle **25***c*, the other arm **78** on the wheel shaft strikes the arm **79**, arresting this leading bottle of the next group, for repetition of the described cycle.

In this fashion a brief delay is automatically introduced into the descent of bottles, following the travel of each of a series of a given number of bottles past the locality of the wheel **72**. By adjustment of the spring **81**, e.g. increasing or decreasing its force of compression, the time of delay may be accordingly adjusted and thereby the spacing of each group of six bottles from the preceding group that has advanced into the track section **29**. As at present contemplated, this delay is very brief and is terminated by the kinetic energy of the descending bottles as soon as a few of them have in effect piled up against the leading bottle **25***c*. The timing is specifically such as to permit the next case **24***c* to move its opening into position for receiving the first bottle **25***c* of the defined group, and indeed to slow down or stop, awaiting the bottles. Hence as the bottles are released by the star wheel **72**, they move forward and down, and begin to descend into the oncoming or stopping case **24***c*, whereby the first bottle **25***c* soon strikes the forward wall of the case and begins to move it over the table **66**, to pass through the position of case **24***b*. As will be apparent, there is a large tolerance for the slowed or arrested position of the case, to receive the bottles.

Similar wheels **72** are provided for each of the tracks **20** in the illustrated multi-track apparatus, also mounted on the same shaft **75** as apparent in FIG. 5, the teeth **74** of the wheels being aligned parallel to the shaft, for corresponding control of bottle advance in exact horizontal alignment in the several tracks. As shown, a single spring-loaded detent mechanism suffices to control the movement of bottles in all of the tracks together, the dimensions and compression of the spring being selected for appropriate response to the energy of the descending accumulation of bottles (e.g. chiefly or wholly kinetic energy, for rapid release in most instances), i.e. the total of energy thus available in the four rows taken together. While conceivably separate spring-loaded delay means can be provided for each track, the single structure for a group of tracks is deemed sufficient in many cases and affords simplification of the initial required adjustment of spring force.

As will be appreciated, the wheel **72** may have other numbers of teeth and other arrangements of the rotating arms **77, 78** may be employed, including the use of only one or more than two arms, all as may be desired for structural convenience, and of course to provide control of the selected number of bottles in each packing group. While other bottle-counting and bottle-responsive means may be employed for effectuating the desired momentary delay or separation in the series of descending bottles, the disclosed mechanical arrangement of the star wheel **72** and the spring-loaded detent is considered particularly effective and free of trouble.

In the embodiment of FIG. 1, the track portion **28** is shown as having a steeper slope, i.e. down to the locality of juxtaposition of the wheel **72**, than the further portion **29** where the bottles begin to enter a case. In this fashion, sufficient kinetic enegry is achieved in the bottles descending the portion **28** for positive operation of the separator mechanism and for insuring desired, substantial uniformity of the delay or spacing there achieved between successive bottle groups. The somewhat more gentle slope in section **29** permits well-controlled entry of the bottles into the cases **24***c* and **24***b*, while retaining sufficient energy of the bottles or sufficient realization of such energy by the accelerative force of gravity, for necessary forward movement of the bottles and their assistance in forward displacement of such cases.

As the case gets onto the exit conveyor **68**, e.g. into the position **24***a*, this conveyor takes over the forward drive of both case and bottles, so that a horizontal or level section **30** of the track is presently deemed preferable to decelerate any downward component of bottle motion. Hence as the bottles slide off the short further slope **31** and the extended portion of the track elements **63**, the final fall of each bottle is short and in downward direction relatively gentle. As will be understood, the actual positioning of the sections **28, 29** and **30**, as regards degree of slope or use of a horizontal condition can be readily designed for optimum results, provided, moveover, that the track has a smooth and gradual curve, rather than a sharp angle, at each change of slope. Since the suspending structures for the track sections **28** to **30** all conveniently include vertical adjustment means **55**, setting of the track in the desired positional configuration is readily achieved.

For adaptability of a unit of equipment to handle

various dimensions of bottles and cases, the vertical position of the supporting frame **42** can be adjusted by appropriate means in the upright members thereof, for example as indicated by the adjustably bolted plates or channels **93, 94** in the members **43, 44**. When the desired vertical spacing of the track above the conveyor path **22** is achieved (with corresponding adjustment of the level of the bottle feed belt **60** to suit the bottle height) there may be of course some further adjustment of the position of the track sections, with the aid of the elements **55**, i.e. to attain optimum positioning of the track and its configuration to agree with the selected size of bottles and cases.

As has been indicated, a special feature of the invention involves the employment of boxes or cases **24** wherein the transverse partitions **70** are substantially shorter, in vertical direction, than the longitudinal partitions **96** (FIGS. 1 and 7); thus by way of example, a case suitable for holding bottles of the general character illustrated and having side walls about equal to the bottle height, may have the longitudinal partitions **96** terminating at least about halfway between the bottom and top of the case, with the transverse partition **70** extending about one-third of such distance, or perhaps even less.

It will be understood that references to longitudinal and transverse dispositions of the partitions are solely concerned with the direction of travel of the cases in the path **22**; if the cases or boxes are disposed with their longer dimension across the path, the partitions here identified as longitudinal will be those that extend across the shorter dimension of the case, while the lateral partitions will be correspondingly longer. With such structure of the cases, essentially maximum lateral guidance of the descending and entering bottles is achieved, i.e. between the parallel files of bottles coming down the respective tracks, while at the same time the sloping section of the track can extend to a relatively very low position, for optimum control of each group of bottles, e.g. each row of six bottles in the apparatus of FIG. 1, as the group descends into the case.

This structural relation of the track and case partitioning is especially significant in the region of the case or box path above the table **66**. It permits lowering of the bottles by the track, with positive restraint on downward bottle movement, to a lowest possible position while the bottles are taking over, so to speak, the forward movement of the case and while the bottles are in course of self-alignment, e.g. among themselves, in preparation for entering the compartments or pockets and for ultimate drop at the end of the track. In other words, some necessary tolerance is afforded in bottle position while the track is allowing movement of such articles downward, yet the final drop, e.g. as the case proceeds beyond the position **24***a*, is as short as possible and still with full lateral guidance for each bottle.

Suitable side guiding means along the path **22** of the cases, e.g. on the conveyor **65**, over the table **66** and on the conveyor **68**, with appropriate elements for holding any flaps or lids open (if the boxes are provided with same), may be included, for instance as indicated by the lateral guide rail **98** in FIG. 1. The belts **65** and **68** have appropriate driving mechanisms, indicated diagrammatically at **99, 100**. As shown in FIG. 10, these rails **98** may be curved inward at **98***a*, so that as the case **24***c* is pushed (by the preceding case **24***d*) along the roller table **66**, the side flaps **102** of the case are bent down closer to the sides of the case against a tendency to spring out. Hence retarding force is there exerted on each case, tending to arrest it until a group of bottles is released and the forward movement of the bottles causes the case to advance beyond this locality.

The complete operation of the method and apparatus will now be readily apparent. The bottle feed conveyor **60** brings up a continuing line of abutting bottles **25** for entry into each track, the driving impulse of the bottles on the conveyor being sufficient to carry each bottle along the short remainder of the track section **27** and to impel it down the slope **28**, where it slides very freely by its neck, with the aid of gravity or conceivably in some cases by gravity alone, so that a single file of bottles moves freely down the track. Although it is conceivable that some supplemental mechanical means might be employed for aiding or otherwise contributing to the movement of the bottles along the track, yet in a preferably impositive way so as to permit desired function of the separator device **72**, a specifically advantageous aspect of the illustrated embodiment is in reliance essentially solely on one or both of the initial impulse or gravity for moving the bottles and for the actions governed or actuated by their movement.

While the flow of bottles is continuing along and down the track, a corresponding required feed of cases **24** is effectuated, in abutting succession, by the conveyor **65**, so as to move such cases successively onto the rollers **77** of the table **66**. Each group of six bottles is temporarily arrested by the wheel **72** and its spring-loaded detent, e.g., by temporarily stopping the first bottle **25***c*. As explained, this results in a rapid accumulation of the abutting bottles, most clearly illustrated in FIG. 9, which essentially repeats the showing of this part of FIG. 1 (wherein detail of the bottle accumulation is omitted for clarity), FIG. 9 indicating the position just as the bottles are about to be released, and just as the case **24***c* moves beyond its position in FIG. 1. Immediately prior to release, the leading bottle may actually be rocked forward at its lower end and some bottles remotely behind may be rocked the other way, depending upon the extent of build-up of a cluster during the brief period of delay. As the group is released they resume their descent in succession, now along the decline **29**, and move into the slowed or arrested case **24***c*, ultimately causing the latter to move forward on the table **66**, through the position indicated by the case **24***b*, while the bottles continue to descend into the case. This advance of the case is largely or can be wholly effected through the force of the bottles, especially as exerted by the leading bottle **25***c* on the forward wall of the case (with the aid, if necessary, of cases coming up behind). While conceivably the arrangement may in some cases be such as to maintain positive drive of the case from the succeeding cases on the conveyor **65** during the entire passage across the table **66**, especially advantageous results are considered to be achieved with the movement of the bottles in effect governing the case travel, at least as the case approaches the position **24***b* of FIG. 1.

During this phase of advance, the bottles, as at **25***b*, are being lowered into the case successively, and the leading ones begin to drop below the longitudinal partition **96**. It may be explained here that the length of the table **66** is preferably at least such that for some distance each case **24** is supported essentially wholly by the table, and is under such restraint that the force of the advancing bottle or bottles is required to get the case onto the exit belt **68**. The location of the separating device **72** is preferably such as to release each group of bottles as the front wall of the corresponding case **24** has passed and the case is stopping or at least slowing down (on the table **66**), so that the bottles can catch up with it and effect its further advance. In such relation, the desired synchronization of bottle groups and cases is effectively achieved, the positioning of the track (with change of slope conveniently at this locality) being such that the lead bottle **25***c* (which is the lowest) is above the upper edge of the forward wall of the case until both such bottle and the case have moved appreciably beyond the locality of bottle release, indeed preferably with more or less advance of the case relative to the bottle position so that despite any angular aspect of the lead bottle it may properly descend behind the front wall.

With the bottles **25***b* being lowered into the case at **24***b*, and with the preferred operation of case advance governed by the bottles, the case moves onto the exit

conveyor **68**, which begins to assume the forward drive of the case. By this time, the bottles are self-oriented in an essentially true vertical position and ready for final alignment and descent within the compartments bounded by the partitions **70**. Note that the weight of bottles is preferably not received by a case until it is on conveyor **68**, thus aiding the above-described self-synchronization involving coaction of bottle groups in moving the cases on the table **66**. The belt **68** advantageously moves at a substantially faster speed than the feed belt **65**, thereby rapidly carrying the case into the position **24***a* and along for eventual discharge and further handling as desired. Indeed in practice the effect is to space successive cases significantly from one another along this belt, rather than to allow them to remain in abutment as actually shown in FIG. 1 for simplicity. Passing through and beyond the position **24***a*, the bottles are first moved by and with the case, finally dropping from the end portion **63** into the successive pockets or compartments with a minimum of shock. Each loaded case, as at **24***e*, is, as stated, moved rapidly to the desired place of further disposition, not shown.

Recapitulating, the conveyor **68** may move the cases away at a high speed and in practice separates them, as partially indicated by the dotted line **24'** in FIG. 1. It will also be understood that although for clarity the bottles at **25***b* and further in the track are shown with mutual spacing, these bottles may or may not actually have some abutment with each other, in the course of re-alignment, the ultimate registration of the bottles with the compartments being readily achieved by the guiding influence of the thin partition **70** in all instances.

The operation thus proceeds continuously, filling successive cases with bottles from all four lines of track, while maintaining a continuing flow of bottles along and throughout each track, the actual bottles being only omitted from most of the track section **28** (which is filled with them) in FIG. 1 for simplicity of illustration. The separafor device **72** functions to maintain synchronization of bottle groups and cases and the entire system and operation is self-regulating and largely self-controlling, as for example in that if any stoppage of bottle or case feed occurs as in the regions of the table **66** or the exit conveyor, the various articles and cases are brought to rest in position for resumption of operation, the belt **65** simply slipping beneath the arrested line of cases **24**. Likewise if interruption of bottle feed occurs, there may be no more than at most a single improperly filled case, in that without advance of bottles (in the preferred arrangement of the invention) no case can proceed beyond the position **24***b* on the table **66**. The entire system functions automatically, with a minimum of mechanical parts and with adaptation to a large variety of shapes and sizes of bottles or other articles and cases or boxes in which the same are to be packed. Especially because of its simplicity and its effectiveness, high speeds of operation are attainable, while the bottles are handled with a very minimum of free fall and with best assurance against breakage or damage of any sort. Timing of arrival of bottles and cases is readily set, as with preliminary testing at the beginning of an operation, by adjusting the force, e.g. compression, of the spring **81** for the detent **79–80** by means of nut **82** on the bolt **83**; once such adjustment is made respecting the brief delay or retardation of the bottle groups, good synchronization is thereafter maintained as explained.

It is to be understood that the invention is not limited to the specific structures and steps herein set forth but may be carried out in other ways without departure from its spirit.

What is claimed is:

1. In apparatus for depositing successive groups of aligned articles into successive containers, in combination, means including a downward-sloping, article-suspending track, for effectuating advance of articles in substantially continuous succession down said track while suspended therefrom, means for advancing successive containers to a locality beneath a lower part of said track, whereby successive groups of aligned articles move downwardly into correspondingly succeeding containers, and means associated with the track and effective with respect to each descending group of articles arriving at a place above said lower part, for temporarily interrupting advance of said last-mentioned group, to accommodate further advance of said last-mentioned group to a position of registration with the container which is to receive such group, said interrupting means comprising releasable arresting means at said place in the path of articles in the track, said arresting means being releasable upon force thereon of the accumulation of articles of the group moving down the track.

2. Apparatus as defined in claim **1**, in which said track is shaped to bring articles down into containers at the aforesaid locality, and which includes means providing a path for advance of successive containers to and past said locality, the aforesaid container advancing means comprising conveyor means for advancing the containers successively into the locality and said path means at said locality comprising container-supporting means allowing advance of each container beyond said locality only upon engagement of the container by at least one article moving into it along the track, said apparatus including means receiving successive containers that have been engaged by downwardly-entering articles, for advancing said containers beyond said locality, said track including a portion extending beyond said locality and over said last-mentioned advancing means, and said track being constructed and arranged for movement of each group of suspended articles at said locality partially into the container that is to receive them and finally releasing the group of articles from the track into the container after passage of the articles along said last-mentioned track portion while the container is advanced by the last-mentioned advancing means.

3. Apparatus as defined in claim **2**, which includes means for mounting the track above the container advancing means, adjustable in vertical position to accommodate articles and containers of different vertical dimensions.

4. Apparatus as defined in claim **3**, in which said adjustable mounting means comprises a frame from which said track is suspended, and adjustable means in the frame for varying the height of the frame above the container advancing means.

5. In apparatus as defined in claim **3**, in which said adjustable mounting means comprises a frame, means suspending the track from the frame, including means for adjusting the vertical extent of said suspending means.

6. In apparatus for depositing successive groups of aligned articles into successive containers, in combination, means including a downward-sloping, article-suspending track, for effectuating sliding advance of articles in substantially continuous succession substantially freely down said track while suspended therefrom, means for advancing successive containers to a locality beneath a lower part of said track, whereby successive groups of aligned articles move downwardly into correspondingly succeeding containers, and means associated with the track at a place above but near said lower part and responsive to arrival of the leading article of each descending group, for temporarily interrupting advance of said last-mentioned group and thereafter releasing said group, to effectuate further advance of said last-mentioned group to a position of registration with the container which is to receive the group, said last-mentioned means comprising means in the path of articles in the track, engageable by said leading article for arresting the same, and means responsive to the accumulating energy of following articles for releasing said arresting means after a predetermined interruption of article advance.

7. Apparatus as defined in claim **6**, in which said energy-

responsive means comprises biasing means adjustable to vary the duration of said interruption.

8. In apparatus for depositing successive groups of aligned articles into successive containers, in combination, means including a downward-sloping, article-suspending track, for effectuating sliding advance of articles in substantially continuous succession substantially freely down said track while suspended therefrom, means for advancing successive containers to a locality beneath a lower part of said track, whereby successive groups of aligned articles move downwardly into correspondingly succeeding containers, and means associated with the track at a place above but near said lower part and responsive to arrival of the leading article of each descending group, for temporarily interrupting advance of said last-mentioned group and thereafter releasing said group, to effectuate further advance of said last-mentioned group to a position of registration with the container which is to receive the group, said track being shaped to bring articles down into containers at the aforesaid locality, and said apparatus including means providing a path for advance of successive containers to and past said locality, the aforesaid container advancing means comprising conveyor means for carrying the containers in endwise abutment, and said path means including means therein beyond said locality and adapted to advance successive containers further along said path, while articles are finally released into the containers, and container-supporting means at said locality constructed and arranged to allow advance of a container from said locality on to the further advancing means only under control of downwardly received articles from the track, having energy of travel sufficient at least to aid initiation of such further advance of the container, said track including a portion which extends beyond said locality and over said further advancing means and which maintains the articles in suspended sliding relation while partly received in the container, said track being arranged for said final release of the articles into the container only after the container has moved onto said further advancing means and after said further advancing means has advanced the container and the suspended partly received articles beyond said locality.

9. In apparatus for depositing successive groups of articles into successive containers, in combination, means including a downwardly-sloping track adapted to receive such articles in suspended retention adjacent the upper end of each article, for effecting downward travel of a substantially continuous line of articles along the track, and means providing a path for advance of successive containers to and past a locality beneath a lower part of said sloping track, said track being shaped to bring articles down into containers at said locality, said path means including conveyor means for advancing the containers successively into said locality, and said path means at said locality comprising non-driven, container-supporting means allowing advance of each container beyond said locality only upon engagement of the container by at least one article moving into it along the track, said path means including a second conveyor means receiving containers from said container-supporting means for advancing containers successively away from said locality after each container has been engaged by at least said one article of a group of articles which have been brought down into the container, said track having a portion extending over said second conveyor means and arranged to release the group of articles finally into the container only when the second conveyor means is advancing the container beyond said locality.

10. In apparatus for depositing successive groups of articles into successive containers, in combination, means including a downward-sloping track adapted to receive such articles in suspended retention adjacent the upper end of each article, for effecting downward travel of a substantially continuous line of articles along the track, means providing a path for advance of successive containers to and past a locality beneath a lower part of said sloping track for entry of articles into the containers, said path means including conveyor means for advancing the containers in endwise abutment successively into said locality, means in said path beyond said locality and adapted to advance successive containers further along said path, while articles are finally released into the containers, said path means at said locality including means allowing advance of said containers onto the further advancing means only under control of downwardly received articles from the track, having energy of travel sufficient at least to aid initiation of such further advance of the container, said track having a portion extending over said further advancing means and arranged to effect said final release of a group of articles into the container only after said further means has begun to advance the container, and means controlled by successive groups of articles advancing down the track toward said locality, for temporarily delaying each such group for registration with corresponding, successive containers moving into said locality, said last-mentioned means comprising means for arresting the leading article of each such group and means responsive to force of the resulting accumulation of such group of articles for releasing the arresting means after a predetermined interruption of article advance.

11. In apparatus for depositing successive groups of articles into successive containers, in combination, means including a downward-sloping track adapted to receive such articles in suspended retention adjacent the upper end of each article, for effecting downward travel of a substantially continuous line of articles along the track, means providing a path for advance of successive containers to and past a locality beneath a lower part of said sloping track for entry of articles into the containers, said path means including conveyor means for advancing the containers in endwise abutment successively into said locality, means in said path beyond said locality and adapted to advance successive containers further along said path, while articles are finally released into the containers, said path means at said locality including means allowing advance of said containers onto the further advancing means only under control of downwardly received articles from the track, having energy of travel sufficient at least to aid initiation of such further advance of the container, and means controlled by successive groups of articles advancing down the track toward said locality, for temporarily delaying each such group for registration with corresponding, successive containers moving into said locality, said last-mentioned means comprising rotatable structure having elements in the path of the articles moving down the track, for engagement by said articles and releasable stop means associated with said rotatable structure for delaying advance of articles in the track, said stop means being releasable upon force of an accumulated group of articles, to effectuate spacing of said group from a preceding group for attaining the aforesaid registration with the next container.

12. Apparatus as defined in claim 10, in which the first-mentioned container advancing means comprises a conveyor belt moving the successive containers up and into said locality, said path means at said locality comprising roller conveyor means consisting of free-running non-driven container-supporting structure.

13. A method of packing bottles in aligned groups in successive open-topped containers comprising advancing the bottles in close succession in free travel along a downward slope while suspending said bottles by their necks, moving successive open containers into a locality intersecting the downward path of the bottles, each container being adapted to receive a group of bottles in successive alignment, and interrupting downward feed of bottles along said slope in accordance with successive advance of the bottles in such groups, for delaying arrival of each group into the depositing locality, to insure registration

of the group with the next succeeding container, said interruption of said downward feed being effected by arresting the leading bottle of each such group and terminating said arrest of said leading bottle in response to the accumulating energy of the following bottles of the group.

14. A method as described in claim 13, in which successive containers are positively advanced into the receiving locality while retarding positive advance of the container beyond the locality except under impulse of forward-acting force of bottles descending along the sloping path, said method further including moving the container away from said locality by supplying further advancing force to the container after said advance by said impulse, and completing release of the suspended group of bottles into the container only after the container has been moved away from the locality by said further advancing force.

15. In apparatus for depositing successive groups of articles into successive containers, in combination, means including a downwardly-sloping track adapted to receive such articles in suspended retention adjacent the upper end of each article, for effecting downward travel of a substantially continuous line of articles along the track, and means providing a path for advance of successive containers to and past a locality beneath a lower part of said sloping track, said track being shaped to bring articles down into containers at said locality and said track having a further portion extending beyond said locality so that the suspended articles are finally released only after moving along said track portion beyond said locality, said path means including means for advancing the containers successively into said locality and further means beyond said locality and beneath said further portion of the track, for advancing containers successively further along the path while articles are finally released into the containers, and said path means at said locality comprising container-supporting means allowing advance of each container onto the further advancing means only upon engagement of the container by at least one article moving into it along the track.

16. Apparatus as defined in claim 15, in which the path means for advance of successive containers is substantially horizontal, and in which said further portion of the track is substantially horizontal.

17. In apparatus for depositing successive groups of articles into successive containers, in combination, means including a downwardly-sloping track adapted to receive such articles in suspended retention adjacent the upper end of each article, for effecting downward travel of a substantially continuous line of articles along the track, and means providing a path for advance of successive containers to and past a locality beneath a lower part of said sloping track, said track being shaped to bring articles down into containers at said locality so that a group of articles on the track becomes suspended by the track substantially within each container, said path means including means for advancing the containers successively into said locality and for advancing containers successively further along the path away from said locality and said track having a further portion disposed closely over the containers on the path means and extending to and terminating at a place substantially beyond said locality so that each group of articles that is suspended in a container is finally released in the container only after said group and said container have advanced to said plate.

18. A method of packing bottles in aligned groups in successive open-topped containers comprising advancing the bottles in close succession in free travel along a downward slope while suspending said bottles by their necks, moving successive open containers into a locality intersecting the downward path of the bottles, each container being adapted to receive a group of bottles in successive alignment, and interrupting downward feed of bottles along said slope in accordance with successive advance of the bottles in such groups, for delaying arrival of each group into the depositing locality, to insure registration of the group with the next succeeding container, said method including positively advancing successive containers into the receiving locality while retarding positive advance of the container beyond the locality except under impulse of forward-acting force of bottles descending along the sloping path, said method further including moving the container away from said locality by supplying further advancing force to the container after said advance by said impulse, and completing release of the group of bottles from neck-suspended condition into the container only after the container has been moved substantially away from the locality by said further advancing force.

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