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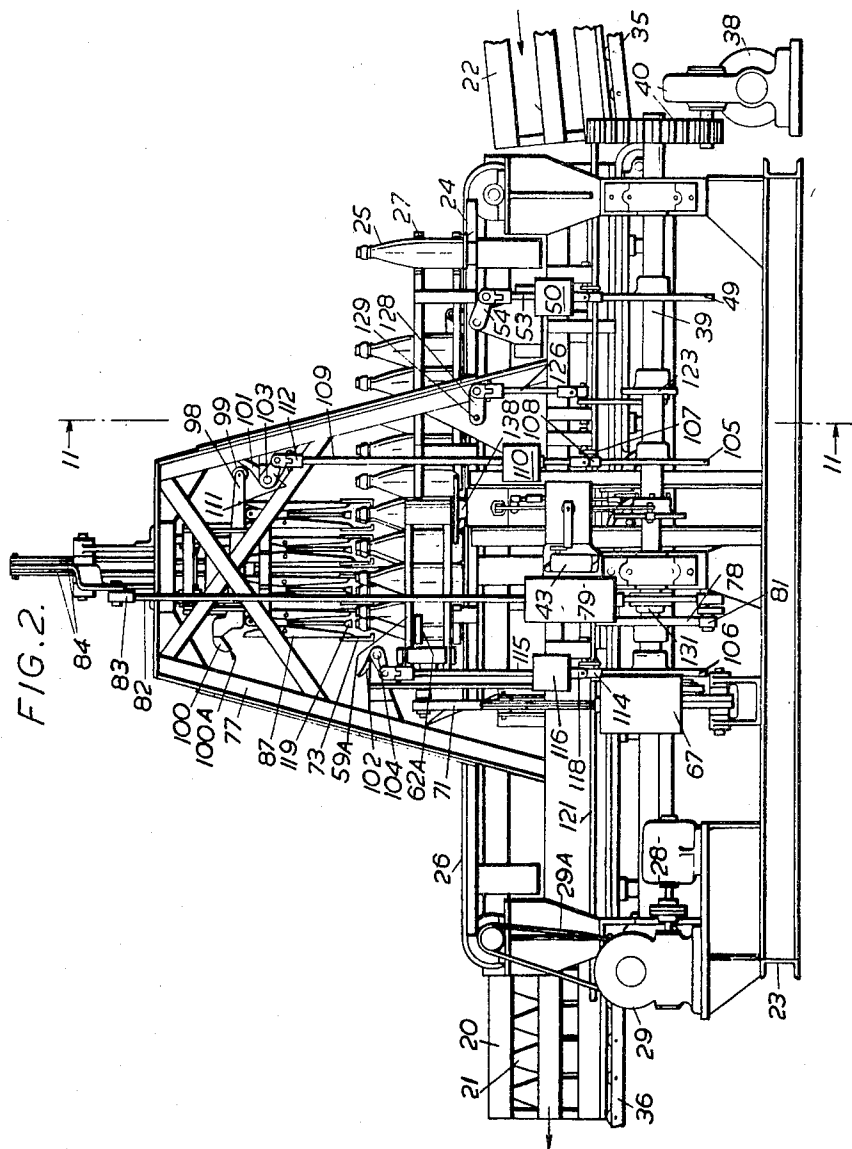
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2,729,374

MACHINES FOR PACKING ARTICLES INTO CONTAINERS

Filed Dec. 28, 1951

5 Sheets-Sheet 2



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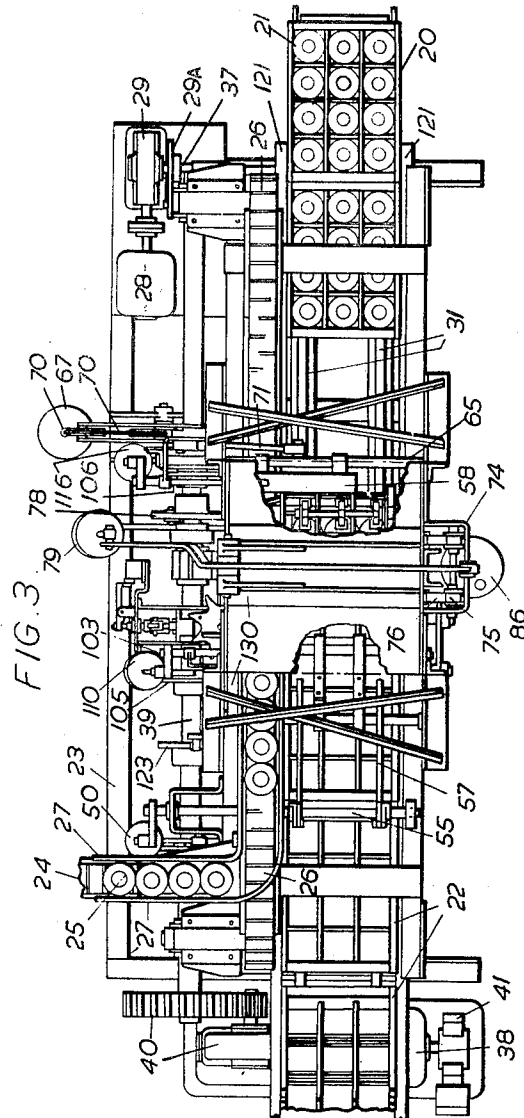
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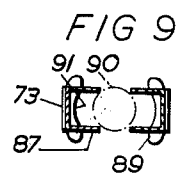
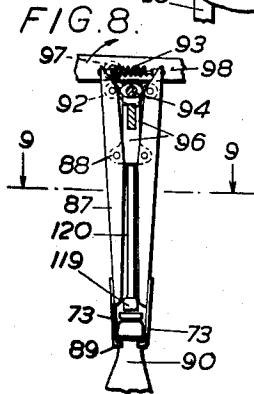
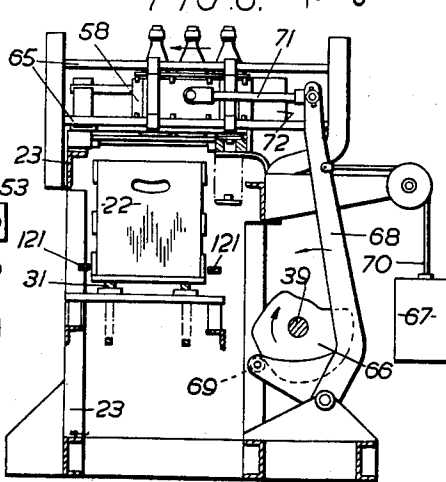
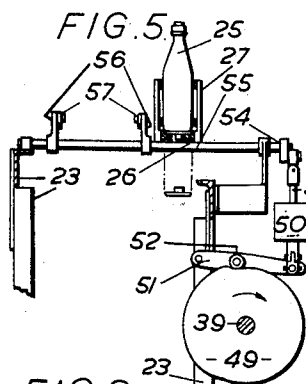
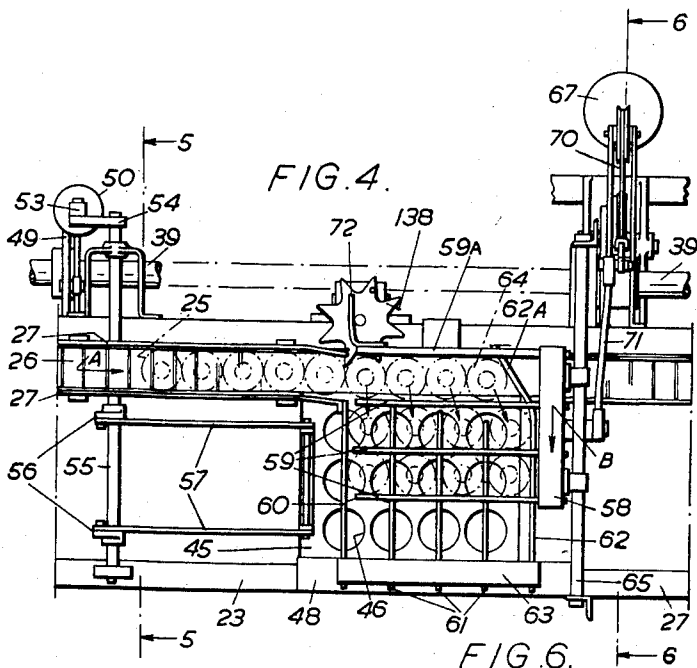
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5 Sheets-Sheet 4



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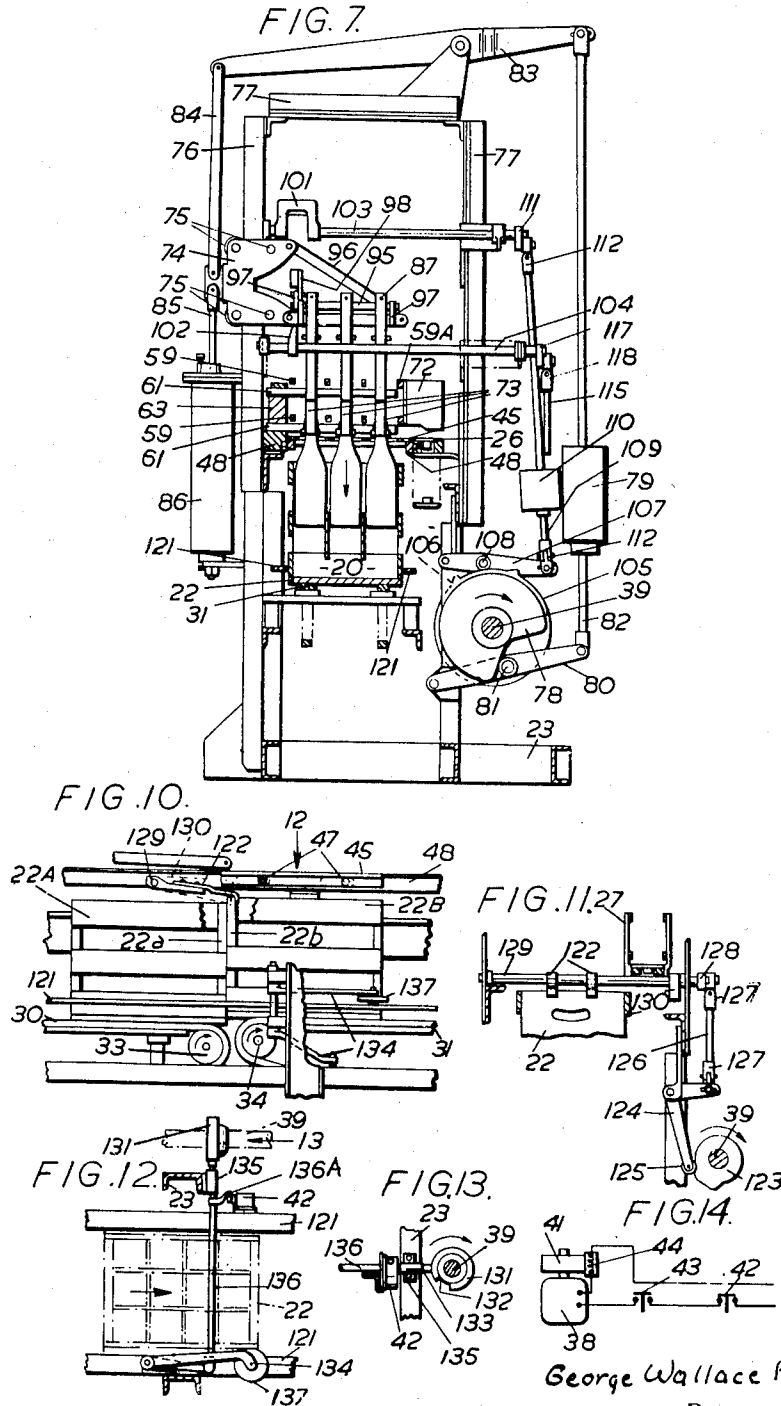
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5 Sheets-Sheet 5



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MACHINES FOR PACKING ARTICLES INTO CONTAINERS

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Claims priority, application Great Britain January 1, 1951

13 Claims. (Cl. 226—14)

This invention relates to packing machines, that is to say machines for packing bottles, jars and like articles (hereinafter generally called "articles") into cases, boxes, cartons and like containers (hereinafter generally called "containers").

The invention relates more particularly to packing machines as aforesaid of the type comprising a supply conveyor for conveying the articles in succession, means for marshalling the conveyed articles in successive groups at a packing zone, a conveyor for conveying empty containers to, and removing filled containers from the packing zone, means for locating the empty containers one at a time in the packing zone and article-packing mechanism operating in the packing zone for packing the container there with a group of the articles.

According to the present invention, the article-marshalling means in a packing machine of the type stated comprises an article-locator and mechanism for displacing the article-locator step-by-step a number of times to receive the articles in the same number of successive rows, these rows of articles forming the requisite group, and transfer each group of articles to the packing zone.

Where the containers are such that the articles must be spaced apart, for instance, where bottles have to be packed into cases partitioned into individual-bottle compartments, guiding spacers may be provided to co-operate with the article-locator, said spacers being arranged to extend transversely between each two articles in the successive rows as the article-locator is displaced.

The machine may include a stop device working in timed relationship with the marshalling means for stopping the supply of articles thereto during absence of the article-locator from an article-receiving position.

Such a stop device may be contrived also to function as what might be called an article-counter, in which capacity the device serves to stop the operation of the marshalling means and article-packing mechanism in the event that the required number of articles for any row of the ultimate group is not supplied and the arrangement may be such that when at least the deficiency in the number of articles has been made good the article-packing mechanism either automatically re-starts or the starting gear of said means and mechanism is set for hand-starting.

Also according to the invention, article-packing mechanism in a packing machine of the type stated comprises article-grippers movable from an upper position, in which they seize the articles of a group individually, to a lower position in which the grippers put the articles into, and release the articles in, a container below, mechanism for lowering and raising the grippers between said positions and devices acting on the grippers to close and open them, in combination with an article-support, upon which the group of articles are positioned in order to be seized by the grippers, and mechanism for retracting the article-support into a position opening the way for the articles to be lowered through the support into the container.

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The article-support may be a plate, or tray, formed with a group of openings, one for each article, and movable between a supporting position, in which the articles rest upon opening-surrounding portions of the plate, and a retracted position in which the articles register with the openings and can pass through them.

The machine may include means associated with the container conveyor for aligning the incoming empty containers and guiding them to the packing zone in combination with a device for engaging each successive incoming container temporarily to hold it correctly located in said zone during the packing operation.

The container conveyor may be stepped to facilitate correct engagement of the containers in succession by the engaging device.

Means in the nature of a detector also may be provided in association with the container conveyor for stopping the operation of the marshalling means and article-packing mechanism in the contingency that there should not be a container correctly located in the packing zone for the packing operation, and the arrangement may be such that subsequent locating of a container correctly in said position either re-starts the marshalling means and article-packing mechanism automatically or sets the starting gear of said means and mechanism for hand-starting.

The invention will now be described, by way of example, as embodied in a machine for packing bottles into cases which are divided into compartments.

In the drawings:

Fig. 1 is an elevation of the machine as viewed from one side thereof and Fig. 2 is an elevation as viewed from the opposite side. Fig. 3 is a plan, portions being broken away to reveal working parts at a lower level. Fig. 4 is a fragmentary plan of the machine, being drawn to a larger scale than Fig. 3. Fig. 5 is a transverse view of a component of the machine and its operating mechanism, the view being a section approximately on the line 5—5 of Fig. 4. Fig. 6 is a transverse view of the machine, being a section approximately on the line 6—6 of Fig. 4. Fig. 7 is a transverse view of the machine, being a section approximately on the line 7—7 of Fig. 1. Fig. 8 is a detail view of a bottle gripper as already shown in Fig. 1, Fig. 8 being to a larger scale. Fig. 9 is an enlarged sectional view on the line 9—9 of Fig. 8. Fig. 10 is an elevation illustrating the passage of bottle-receiving cases on conveying means leading to and through the position in which bottles are received by the cases, the view showing parts as already shown in Fig. 1 but in greater detail. Fig. 11 is a section approximately on the line 11—11 of Fig. 2. Fig. 12 is a plan of a safety device co-operating with the cases, the view being in the direction of the arrow 12 in Fig. 10. Fig. 13 is a detail view in the direction of the arrow 13 in Fig. 12.

Fig. 14 is an electrical diagram illustrating the circuit of the machine which drives the main cam shaft of the machine.

The machine according to the example is designed for packing the bottles supplied to it into cases which are each divided by criss-cross partitions into a dozen compartments which are arranged in three longitudinal rows to contain four bottles each and also four transverse rows to contain three bottles each. The arrangement will be clear from Figs. 1, 2 and 3, in which there are shown two outgoing cases 20 each filled with a dozen bottles 21. The incoming empty cases are indicated by 22. It will be seen that the bottles of every row, whether longitudinal or transverse, are spaced apart from the bottles of each adjacent row by at least the thickness of the intervening partition.

The general frame of the machine is indicated by 23. This frame has associated with it a transverse conveyor

24 (Fig. 3) by which bottles 25 are fed to the machine, this feed-in conveyor being of any appropriate bottle-handling class and not being a component of the packing machine according to the present invention. The machine includes a supply conveyor 26, which is of any appropriate class usual in machines for working on bottles and which is shown as consisting of an endless series of slats, the upper working run of which is between guide rails 27 that curve from the delivery end of the feed-in conveyor 24. The bottles, as they move along with the supply conveyor 26, form themselves between the rails 27 in a continuous single-file procession, standing with their bottoms slidably resting on the conveyor slats. These slats travel at a speed such that the conveyor 26 is capable of supplying bottles at a rate rather greater than that at which the machine can pack bottles, the conveyor 26 being continuously driven by an electric motor 28 through worm-gear reduction gearing in a casing 29 and a chain-and-sprocket drive 29A (conventionally shown).

The conveyor for delivering the incoming empty cases to the packing zone and delivering the outgoing filled cases from said zone comprises two endless travellers 30, 31 conveniently (but not necessarily) inter-connected to work in tandem. In the example the travellers 30, 31 are inter-connected by a chain drive 32, conventionally shown, between them. Each endless traveller consists of a pair of side-by-side endless belts or chains which are trained around terminal pulleys 33, 34 and on which the bottoms of the cases 20, 22 slidably sit. The incoming traveller 30 is arranged at a slightly lower level than the outgoing traveller 31 (see Fig. 1). Roller conveyors 35 and 36 lead to and from the travellers 30 and 31, respectively. The delivery conveyor 30, 31 is driven by the same electric motor 28 as the supply conveyor, the drive to the delivery conveyor including a cross-shaft 37 from the worm-wheel of the gearing in the casing 29.

Both the supply conveyor 26 and the delivery conveyor 30, 31 extend longitudinally of the machine, the supply conveyor being arranged above but offset transversely to one side of the delivery conveyor, as Fig. 3 shows.

The mechanisms, apart from the conveyors 26 and 30, 31, of which the machine is composed are operated by a separate electric motor 38 which can be stopped and re-started without affecting the continuous running of the conveyors. The said mechanisms are operated from a main cam shaft 39 which is driven by the motor 38 through gears 40. The motor drive is provided with an electro-magnetic brake 41 which comes into operation instantaneously to prevent over-running whenever the motor 38 is cut-out. The electric circuit of the motor 38 is shown in the diagram according to Fig. 14. This circuit incorporates two switches 42 and 43 in addition to the coil 44 of the brake 41.

The machine includes a retractible bottle support 45, functioning like a "trap-door" (see Fig. 4). The support is a plate formed with a dozen holes 46 which are somewhat larger than the bottles and which are arranged and spaced in rows similarly to an assembled group of bottles. The plate 45 has side rollers 47 (Fig. 10) which run along tracks formed for them in side members 48 incorporated in the machine frame 23, so that the bottle-supporting surface of the plate 45 comes substantially flush with the supply conveyor 26. The members 48 in effect constitute a slideway. This slideway is arranged in the place herein called the "packing-zone." That is to say, the slideway is directly above that portion of the conveyor traveller 31 where each successive case 20 is located temporarily (see Fig. 7) to receive its dozen bottles. The bottle-support is movable, to an extent equal to only half the pitch of two adjacent transverse rows of three bottle holes, by means of a link-and-lever mechanism, which is operated by a cam 49 on the main cam shaft 39 against the return action of a counter-weight

50. The mechanism comprises, as Figs. 4 and 5 show: a lever 51 with a cam-following roller 52; a rod 53 linking the lever 51 to a crank arm 54 on a cross-shaft 55 journaled on the frame 23, the weight 50 being carried by the rod 53; crank arms 56 linked by push-pull rods 57 to the bottle support 45.

The machine also includes a bottle-locator which comprises a displaceable carrier 58 (Fig. 4) with a set of longitudinal fingers 59, 59A and which, in the example, co-operates with a stationary set of transverse bottle-guiding spacers 60, 61, 62.

Each of the stationary transverse spacers 60, 61 or 62 consists of a pair of members (see also Fig. 7) arranged one above the other and spaced apart. The spacers extend towards the supply conveyor 26 from a fixed support 63 on the frame and are arranged in the packing zone above the bottle-support 45. There are five of these spacers, three intermediate spacers 61 are arranged to come between four transverse rows of three bottles, and the two outer spacers 60, 62 form the longitudinal limits for each group of bottles. Thus, the five spacers form four transverse "gangways" for the bottles, each gangway having accommodations for three bottles. The proximal limit spacer 60 is joined to the adjacent guide rail 27 of the supply conveyor 26 so as, in effect, to serve as a right-angled continuation of said rail. The distal limit spacer 62 has an inclined extension 62A across the supply conveyor 26 adapted to intercept the leading bottle 64 (Fig. 4) of every four, and the extension 62A is curved to guide every four bottles appropriately during transfer to the bottle support 45. Moreover, the ends of the intermediate spacers 61 are arranged to allow the bottles to pass from the supply conveyor 26 to the bottle support 45.

The displaceable set of longitudinal fingers 59, 59A of the bottle-locator extend in pairs opposite to the bottle-supply direction A, Fig. 4, from the carrier 58, which is arranged on a transverse slideway formed by guide rails 65 (Fig. 6) incorporated in the machine frame 23. The two fingers 59 or 59A forming each pair are vertically spaced apart. There are four pairs of these fingers 59, 59A, and they define what may be called "bottle receivers," each of which can accommodate four bottles. The carrier is operated through a link-and-lever mechanism, hereinafter described, by a cam 66 on the main cam shaft 39 acting against a returning counter-weight 67, the arrangement being such that, in the cycle of operations, the carrier 58 adopts four successive positions and, between them, receives three transverse steps from the cam 66 (Fig. 6) in the direction, see arrow B, Fig. 4, away from the supply conveyor 26, and thereafter a return movement from the weight 67. In the first, second and third positions of the carrier, the first, second and third receivers, respectively, are aligned in succession with the supply conveyor 26 so that each receives its supply of four bottles. These three positions are reached one at a time by the return movement and the first two steps thereafter. Fig. 4 shows the bottle locator at the end of the second of these steps. At the third step, the carrier reaches and dwells in a position where all three receivers are in the previously mentioned packing zone, in which they cross the transverse spacers 60—62 and co-operate with them to form a dozen bottle compartments and thus simulate the partitioned case 22 into which the bottles are to be packed. That is to say, the fingers 59, 59A and the spacers 60—62 constitute criss-cross partitions similar to the partitions of the cases, and they function to maintain a space between every two rows of bottles, both longitudinal and transverse. The arrangement is such that the dozen bottle compartments formed by all the members 59—62 are in superposed registration with the case compartments below, the cases themselves being precisely located in succession as hereinafter described.

The mechanism operated by the cam 66 and counter-

weight 67 comprises: a lever 68 with a cam-following roller 69; a flexible connection 70 from the weight 67 to the lever 68; a push-pull link 71 coupling the lever 68 to the carrier 58. It will be apparent that the action of the bottle-locator cam 66 on the link-and-lever mechanism is such that if, for any cause, the bottle-locator 58 cannot return from the packing zone, the cam 66 turns idly clear of the roller 69 and so cannot damage said mechanism.

Moreover, in view of the contingency that the bottle-locator might not return as aforesaid, the bottle-locator has an auxiliary bottle-stop 72 (Figs. 4, 6 and 7) consisting of a member which extends transversely from the outer pair of fingers 59A so as to serve as a barrier across the supply conveyor 26 when the bottle-locator 58 is in the packing zone.

The machine also includes bottle-packing mechanism comprising a group of twelve bottle-neck grippers 73 suspended from a cross-head 74 (Figs. 7 and 8) forming the uppermost component in the packing zone. The cross-head 74 is movable up-and-down on rollers 75 along vertical guides 76 incorporated in a superstructure 77 on the machine frame 23 (Figs. 1 and 7). The cross-head is arranged to move downwards, when loaded, against the control action of a single-acting cam 78 on the main cam shaft 39, to which cam the cross-head is applied through link-and-lever mechanism, hereinafter described. In the example, the cross-head is loaded by its own weight and the weight of a group of a dozen bottles when such are gripped by the grippers 73, less the counteraction of a weight 79 fitted to the link-and-lever mechanism because the combined weights of the cross-head and bottles are undesirably great.

The mechanism operated under the control of the cam 78 comprises, as Fig. 7 shows: a lever 80 with a cam following roller 81; a rod 82 linking the lever 80 to an overhead lever 83 and carrying the weight 79; links 84 coupling the lever 83 to the cross-head 74. The arrangement is such that in a normal cycle of operations, the cross-head 74 moves downwards against the controlling influence of the cam 78 and is immediately thereafter positively forced to return upwards by the cam.

The cross-head 74 also is linked by a rod 85 to a pneumatic dash-pot 86 serving to oppose yieldingly, and thus cushion the descent and to some extent the ascent of the cross-head 74.

Each gripper 73 (Fig. 8) comprises a pair of blades extending from approximately vertical dependent legs 87, each fulcrumed at 88 to the cross-head framework 96. Each gripper blade 73 has an intumed toe 89, the two toes of the pair serving to grip resiliently a bottle neck 90 and being, for this purpose, formed with concave portions 91, Fig. 9, adapted partially to embrace said bottle neck. The two legs, near their top ends, carry rollers 92 which, under the pull of a spring 93 interconnecting the top ends, bear at opposite sides of an oval cam 94 for opening and closing the gripper 73. Each gripper forms one of a row of three grippers, the three cams 94 for which are all formed on one of four similar parallel cam shafts 95 (Fig. 7), which are journaled in the framework 96 of the cross-head. The four cam shafts, respectively, have crank arms 97 (Figs. 1, 7 and 8) which are coupled by a longitudinally displaceable horizontal connecting rod 98, with a roller 99 at one end and a hook-like projection 100 at the other end. The arrangement is such that, when the connecting rod 98 is displaced by force applied to the roller 99, the four cam shafts 95 turn in unison through a right angle to force the grippers 73 to close; whereas, when the rod 98 is returned by force applied to the hook-like projection 100, the cam shafts 95 turn back and the grippers are pulled open by their springs 93.

The normally uppermost position of the cross-head 74 is such that, as Figs. 1 and 2 show, the grippers 73 are disposed at the appropriate gripping level in relation to bottles on the bottle support 45 in the packing

zone, the arrangement being such that when the bottles are being transferred by the bottle-locator 58 along the four gangways from the supply conveyor 26 to the packing zone their necks pass freely between the intumed toes 89.

The gripper-operating movements of the connecting rod are imparted to it by two strikers, namely a gripper-closing striker 101 and a gripper-opening crank-like striker 102. These strikers are arranged in the machine frame at opposite sides of the cross-head's vertical path and at positions approximately corresponding to the normally uppermost and lowermost levels of its range of down-and-up movement; in the example, the gripper-opening striker 102 is located slightly above the position corresponding to the extreme lowermost level. Each of these strikers is an arm secured to a rock-shaft 103 or 104 and arranged under the control of one of two gripper-operating cams 105 and 106 on the main cam shaft 39, which cams act through link-and-lever mechanisms on the respective rock-shafts 103 and 104.

The mechanism operated by the cam 105 comprises, as Fig. 7 shows: a lever 107 with a cam-following roller 108; a rod 109 carrying a counter-weight 110 and linking the lever 107 to an arm 111 on the rock-shaft 103; universal joints 112 between opposite ends of the rod 109 and the parts 107, 111 linked by it.

The mechanism operated by the cam 106 comprises: a lever 113 (see Fig. 2) with a cam-following roller 114; a rod 115 carrying a counter-weight 116 and linking the lever 113 to an arm 117 (see Fig. 7) on the rock-shaft 104; universal joints 118 between the rod 115 and the parts 113, 117 linked by it.

Provision is made whereby, in the contingency that a bottle is obstructed during the operation of lowering a group of bottles into a case, all of the grippers shall remain closed, so that all the bottles are lifted again to the level of the bottle-support above, the entire cycle thus being an idle one. In the example, the means provided consist of buffers 119 (see Fig. 8), there being one of these for each gripper 73. Each buffer is at the foot of a rod 120 which extends rigidly downwards from the crosshead framework 96 centrally between the legs 87 of the associated gripper and reaches a selected level in relation to the intumed toes 89. The arrangement is such that if a buffer 119, during descent of the cross-head 74, strikes and is stopped by the associated bottle top at any level before the hook-like projection 100 of the connecting rod 98 has reached the level of registration with the gripper-opening striker 102, then this striker will miss when it is actuated by the cam 106 at its predetermined time in the cycle of operations; and so the twelve gripper cams 94 will not be operated, and the grippers 73 will all continue to grip the bottle necks 90. It is in view of the need for precision in the action of the gripper-opening striker 102 that the associated end of the connecting rod has a hook-like projection 100, this projection terminating in an edge 100A (Figs. 1 and 2) such that the projection will be either effectively engaged if struck, or left unmoved if missed, by the striker.

The machine also includes means for locating the incoming empty cases 22 one at a time in the packing zone. In the example, the means provided comprise two contrivances. The first of these comprises fixed guide rails 121 ensuring that each case shall follow a substantially central longitudinal path through the packing zone. The second of these contrivances is to ensure that each case is stopped at the correct location in said path. This contrivance is a two-part pivotal catch 122 (Figs. 10 and 11) operated through a link-and-lever mechanism (hereinafter described) by a cam 123 on the main cam shaft 39. In the example, the catch is arranged to drop and engage the rear wall of each case 22 to be located. It is in order to facilitate and render surer the work of the catch 122, namely to engage the rear wall only, that the delivery conveyor is provided as two endless travellers 30,

31 at different levels, so that there is a step up from one to the other at the place where the leading wall of each case enters the packing zone, as Fig. 10 shows. The step is arranged so that the front wall of each case in succession can pass clearly beneath the catch 122 when the latter is in its dropped position and thereafter acts to up tilt the case as it moves into said zone, after which the case levels itself again as it is about to be correctly located in said zone. Fig. 10 shows one case 22A at the lower level position, in advancing from which its leading wall 22a will pass beneath the catch 122, and a case 22B in the packing zone ready to receive a group of bottles, its rear wall 22b being held by the catch.

The mechanism operated by the cam 123, as Fig. 11 shows, comprises the following: a bellcrank lever 124 with a cam-following roller 125; a rod 126 linking the lever 124 through a pair of universal joints 127 to an arm 128 on a cross-shaft 129 to which the two-part catch 122 is secured; a counter-weight 130 (see Figs. 3, 10 and 11), in the form of an overhanging weighted lever, fixed to the cross-shaft 129 and holding the roller 125 in contact with the cam 123.

In order to ensure that a case will be located in the packing zone at the time in the cycle of operations when the bottles are lowered by the cross-head 74, a safety device is provided. This device comprises two components which, under abnormal conditions, inter-act to stop the main cam shaft. One of these components is driven by the main cam shaft 39, being a stop-wheel 131 thereon (see Figs. 12 and 13) with a notch 132 in its rim. The other component is a detector in the form of a tongue 133 attached by a rod 136 to a two-armed stop lever 134. The tongue 133 is movable in a guide 135 so arranged on the frame 23 that the tongue co-operates with the rim of the stop-wheel and can enter the notch. The lever is spring loaded by means of the previously mentioned electric switch 42. This is a spring-actuated self-opening switch which presses against an arm 136A on the rod 136. The lever 134 carries a roller 137 which is contractible by the side of each empty case 22 entering the packing zone. The action of such a case on the roller 137 is to hold the lever 134 from the rim of the wheel 131 so that the tongue 133 cannot enter the notch 132 under the action of the spring. If however no case is in the packing zone when the cross-head 74 is about to descend, the tongue 133 will enter the notch 132 under the spring action, so that the stop lever 134 will turn under the self-opening action of the switch 42, which is connected with the circuit of the cam shaft motor 38 (see Fig. 14) thus stopping the motor. The arrangement is such that when a case enters the proper location, the lever 134 is again actuated and allows self-closure of the switch 42 thus either causing the motor 38 to re-start automatically or setting it for hand-starting.

The machine also includes a bottle stop device associated with the supply conveyor and so contrived that it serves two functions, namely:

(1) The device stops the advance past it of the bottles on the supply conveyor during each movement of the bottle-locator and while it is in the packing zone;

(2) so long as the supply of bottles remains regular, the stop device allows the operations of the main cam shaft 39 to continue, but whenever a stoppage or other irregularity in the supply of bottles occurs the device operates to stop the motor which drives the main cam shaft. The stop device is adapted either to cause the motor to re-start or to set the starting gear for hand-starting. Thus, in the example, the stop device is designed to open the previously mentioned switch 43 (Fig. 14) and thus stop the cam shaft motor 38 in the event that less than the requisite four bottles, or even no bottles at all, are fed by the supply conveyor 26 to any one of the three bottle receivers presented to the supply conveyor by the bottle-locator 58.

The mechanism of the stop device includes a star-wheel

138 which is turnable step-by-step in the manner of a turnstile by the bottles 25 as they travel in single file along the conveyor 26 (see Fig. 4).

The mechanism and operation of the stop device, as applied to a packing machine according to the present invention, are particularly described in the specification and drawings of my co-pending patent application No. 263,773 and therefore no further particulars are given herein.

A cycle of operations of the machine according to the example will now be described.

Bottles 25 fed to the supply conveyor 26 (Fig. 3) by the feed-in conveyor 24 are advanced by the conveyor 26 in single file to the star wheel 138 (Fig. 4) of the stop device. The bottles move past the star wheel, turning it as they pass, in the manner of persons passing a turnstile; and the bottles immediately enter the innermost bottle-receiver of the bottle-locator 58.

On passage of a row of four bottles to the bottle-receiver, the star-wheel 138 is temporarily locked while the bottle-locator transfers them from the conveyor 26 and over the bottle-support 45 a step towards the packing zone. The same procedure takes place in respect of the next row of four bottles, which enter the second bottle receiver and are advanced with the first row in the next step of the bottle-locator 58 towards the packing zone. The same procedure takes place with the third row of four bottles which enter the third bottle receiver, the entire group of twelve bottles now being advanced the third or final step which brings them all upon the bottle-support 45. The star-wheel 138 locks all the following bottles on the conveyor 26 for a period long enough to permit the subsequent operations of the cycle to take place.

It will be apparent that, in the three steps taken by the bottle-locator 58, the bottles move along the four transverse gangways provided by the stationary spacers 60, 61, 62, which thus co-operate with the bottle-receivers to locate the bottles finally.

It will be apparent from Fig. 2 that the portions of the bottles (namely, their necks immediately below the customary top collar or protuberance) is maintained by the bottle-support 45 precisely coplanar with the intumed ends of the gripper blades 73, so that when the bottles are located finally by the bottle-locator 58, the said portions move into the grippers, which are held stationary by the cross-head 74 and are still open. That is to say, when the bottles are being finally located, the cross-head is at rest at the top of its ascent.

The grippers 73 of the still stationary cross-head 74 are actuated by the striker 101 to grip the bottle necks (Fig. 1). If desired the cross-head 74 may be actuated by a small formation on the cam 78 so as to rise slightly and lift the bottles clear of the bottle-support 45. The bottle-support is actuated so that it moves precisely into the packing zone, in which the holes 46 through said support register with the bottoms of the bottles. That is to say, the bottles are now left supported by the grippers 73, from which they hang suspended in space. The cross-head 74 performs its downward movement (Fig. 7).

By this stage in the cycle of operations, an empty case 22 has been advanced by the container-conveyor travellers 30 and 31, so that it is located on the upper level traveller 31 (in the position 22B, Fig. 10) correctly in the packing zone immediately below the bottle support 45 above and the cross-head 74 still higher. Accordingly, the bottles are lowered by the cross-head through the bottle-support holes into the empty case 22B. At the end of the descent of the cross-head 74, which occurs at a point slightly before the bottles reach the bottom of the case, the grippers 73 open by the action of the striker 102 and the bottles drop upon the case bottom. The case is now released by the means, namely the catch 122 (Fig. 10), by which it is located and passes along with the delivery-conveyor traveller 31 to the delivery point 36 (Figs. 1

and 2). Meantime, the crosshead 74 rises again to its initial position, the bottle-support 45 moves into its bottle-supporting position (Fig. 4) and the bottle-locator 58 returns to that position in which the innermost bottle-receiver is again in alignment with the supply conveyor 26.

In the event that one or more of the bottles should be obstructed in their descent into the empty case 22B, the one or more buffers 119 (Fig. 8) concerned will come into action so that all the grippers will be left to retain their grip on the bottles. Thus, on the ascent of the cross-head 74 the bottles will be returned through the bottle-support holes 46 into the bottle receivers of the bottle-locator 58, and the bottles themselves, being still gripped, will prevent the bottle-locator 58 from returning to its proper starting position in relation to the supply conveyor. It has already been explained how the auxiliary bottle stop 72 on the bottle-locator acts as a barrier to the bottles in the conveyor 26 during the remainder of any such fruitless cycle of operations. Meantime, the faulty case is released and is delivered empty by the delivery-conveyor traveller 31, and a new case is brought into position to receive the returned group of bottles during the next cycle.

In the event that an empty case should not be correctly located to receive a group of bottles, the safety device 131-137 (Figs. 10, 12 and 13) associated with the container-conveyor 30, 31 will stop the main cam shaft 39, as hereinbefore described.

Any of various modifications may be made.

The case locating means in the example (see the catch 122, Fig. 10) is suitable only for uniformly sized cases. Instead, there may be provided a group of dependent bottle-guides for guiding the bottles individually into the compartments intended to receive them in the case below. These guides may have a stationary mounting beneath the bottle support, in which event each case to be packed would be raised prior to, or concurrently with, each packing operation, so that the guides enter the case, and would be lowered after each packing operation. The means for raising and lowering the cases conveniently could be a platform or support associated with the mechanism of a catch for engaging the leading edges of the case bottoms.

Although in the example various working parts of the packing machine are operated by cams on a rotary main shaft, they may instead be operated by pneumatic or other pressure fluid units under the control of a rotary valve or valves, or by electro-magnetic solenoids under the control of a rotary contactor or contactors.

The twelve grippers 73, instead of being operated individually by the twelve cams 94 (Fig. 8), may be mechanically interconnected in groups of three grippers each; and each of these groups of grippers may be operated by one of four rotatable cams.

Instead of the mechanical grippers 73 described, pneumatic grippers can be used. Such a gripper comprises a suction cup the interior of which is connected with a suction-pump system and which is engageable with the top of an article to be gripped. The arrangement is such that a rotary air valve or other contrivance driven by the machine is timed to connect the grippers with the suction system at the stage when the articles are to be gripped and to connect the grippers with atmospheric or other pressure at the stage when the articles are to be released. Such grippers are especially suitable where the articles are short-necked flat-topped jars or the like.

It will be obvious that it is merely by way of illustration that the machine according to the example has been described for packing cases which receive one dozen bottles grouped in three and four rows of four and three bottles respectively. The machine can be readily designed to pack cases (or other containers) which receive any ordinary number or arrangement of bottles (or other articles).

I claim:

1. A packing machine having a packing zone and comprising a supply conveyor for conveying articles in succession, an article-locator for marshalling the conveyed articles in successive groups at the packing zone and consisting of a transversely displaceable carrier with longitudinally projecting members to define spaced-apart receivers for rows of said articles, means for displacing the carrier step-by-step in one direction to receive the articles row-after-row and form a group and for reversing the carrier thereafter to return in the opposite direction, means associated with said article-locator to maintain a space between every two adjacent articles in each row, a conveyor for conveying empty criss-cross partitioned containers to, and removing said containers when filled from the packing zone, article-packing mechanism operating in the packing zone for packing the container there with a marshalled group of the articles, said article-packing mechanism comprising article-grippers movable direct from an upper position, in which they seize the articles of a group individually, to a lower position in which the grippers put the spaced-apart rows of spaced-apart articles into inter-partition compartments of a container below, said upper position being directly above said lower position, mechanism for lowering and raising the grippers between said positions and devices acting on the grippers to close and open them so that they seize and release the articles.
2. A packing machine according to claim 1 including also an article-support upon which the spaced-apart rows of spaced-apart articles are positioned in order to be seized by the grippers, means for raising the grippers temporarily to lift the articles clear of said support, and mechanism for retracting the article-support into a position opening the way for the lifted articles to be lowered through the support into the container.
3. A packing machine according to claim 1, in which the means associated with the article-locator consist of article-guiding spacers extending transversely, said spacers extending across the packing zone and being positionally related to said article-locator and co-operating with said longitudinally projecting members to define therewith spaced-apart article-receiving compartments directly above the lower position in which the grippers put the articles into a container below.
4. A packing machine according to claim 1 in which the grippers consist of pairs of pivotal legs with resilient article-gripping blades, springs urging the legs to pivot and bring the blades into their open position and cams which when turned force the legs together to bring the blades into their gripping position.
5. A packing machine having a packing zone and comprising a supply conveyor for conveying articles in succession, an article-locator having longitudinal members defining receivers for the articles, mechanism for displacing the article-locator step-by-step a number of times to receive the articles in the same number of successive rows and transfer the group thus formed to the packing zone, said longitudinal members serving to space said successive rows apart, article-guiding transverse members defining transverse guideways for the articles and associated with said article-locator to maintain a space between every two adjacent articles of each longitudinal row, a conveyor for conveying criss-cross partitioned containers to, and removing said containers from the packing zone, article-grippers movable direct from an upper position, in which they seize the articles of a group individually, to a lower position in which they put the spaced apart rows of spaced-apart articles into inter-partition compartments of a container below, said upper position being directly above said lower position, and both being in said packing zone, mechanism for lowering and raising the grippers between said positions and devices acting on the grippers to close and open them so that they seize and release the articles.
6. A packing machine according to claim 5 including also an article-support upon which the spaced-apart rows

of spaced-apart articles are positioned in order to be seized by the grippers, means for raising the grippers temporarily to lift the articles clear of said support, and mechanism for retracting the article-support into a position opening the way for the lifted articles to be lowered through the support into the container.

7. A packing machine according to claim 5 in which the article locator consists of a transversely displaceable carrier with longitudinally projecting members spaced apart to define spaced-apart receivers for the rows of articles and means for displacing the carrier step-by-step in one direction for the group-forming operation and for reversing the carrier thereafter to return in the opposite direction, and in which the article-guiding transverse members extend across the packing zone and are positionally related to said article-locator and co-operate with said longitudinally projecting members to define therewith spaced-apart article-receiving compartments directly above the lower position in which the grippers put the articles into a container below.

8. A packing machine according to claim 5 in which the grippers consist of pairs of pivotal legs with resilient article-gripping blades, springs urging the legs to pivot and bring the blades into their open position and cams which when turned force the legs apart to bring the blades into their open position and cams which when turned force the legs apart to bring the blades into their gripping position.

9. A packing machine having a packing zone with an upper position and a lower position directly below and comprising a supply conveyor for conveying articles in succession, an article-locator having longitudinal members defining receivers for the articles, mechanism for displacing the article-locator step-by-step a number of time from an initial position clear of the packing zone to receive the articles in the same number of successive rows, these rows of articles forming the requisite group, and transfer the group thus formed to the upper position of the packing zone, said longitudinal members serving to space said successive rows apart, article-guiding transverse members defining transverse guideways for the articles and associated with said article-locator to maintain a space between every two adjacent articles of each longitudinal row, a conveyor for conveying empty criss-cross partitioned containers to, and removing said containers when filled from the lower position of the packing zone, article-packing means, guide means constraining said article-packing means to up-and-down movement in the packing zone between said upper and lower positions, and mechanism operating said article-packing means to grip the spaced-apart rows of spaced-apart articles in the upper position, lower them to the lower position and put them in a container there.

10. A packing machine having a packing zone and comprising a supply conveyor for conveying articles in succession, an article-locator having longitudinal members defining receivers for the articles, mechanism for displacing the article-locator step-by-step a number of times from an initial position clear of the packing zone to receive the articles in the same number of successive rows, and transfer the group thus formed to the packing zone, said longitudinal members serving to space said successive rows apart, article-guiding transverse members

defining transverse guideways for the articles and associated with said article-locator to maintain a space between every two adjacent articles of each longitudinal row, a conveyor for conveying criss-cross partitioned containers to, and removing said containers from the packing zone, a frame which incorporates vertical guide means, a cross-head movable down-and-up along said guide means between upper and lower superposed positions in the packing zone, a group of longitudinally and transversely spaced grippers dependent from the cross-head and movable in unison with it, a double-acting member carried by said cross-head and displaceable across it, devices interposed between said double-acting member and the grippers to effect closure and opening thereof, strikers located on said frame at upper and lower levels to engage said member and displace it in one or other direction, and mechanism for lowering and raising the cross-head so that when the cross-head is raised the double-acting member is displaced by the upper level striker to effect closure of the grippers and seizure of the articles thereby in said upper position and so that when the cross-head is lowered to a lower position in said zone the lower level striker returns the double-acting member to effect opening of the grippers and release the articles within one of said containers in said lower position.

11. A machine according to claim 10 in which the upper-level striker is movable into and out of engagement with the double-acting member and including an element connected with said striker, and a cam co-operating with said element for displacing said element to bring the striker into engagement with said double-acting member in order to effect gripper closure while the cross-head is at rest in the upper position.

12. A machine according to claim 10 in which the lower-level striker is movable into and out of engagement with the double-acting member and including an element connected with said striker, and a cam co-operating with said element for displacing said element to bring the striker into engagement with said double-acting member in order to effect gripper opening in the lower position of the cross-head.

13. A machine according to claim 10 in which the cross-head has a group of safety buffers, one for each gripper, each buffer being arranged to engage the article gripped by its gripper in the event that the article is obstructed while the cross-head is being lowered, said buffer then preventing further lowering of the cross-head and thus rendering the gripper-opening striker ineffective.

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