

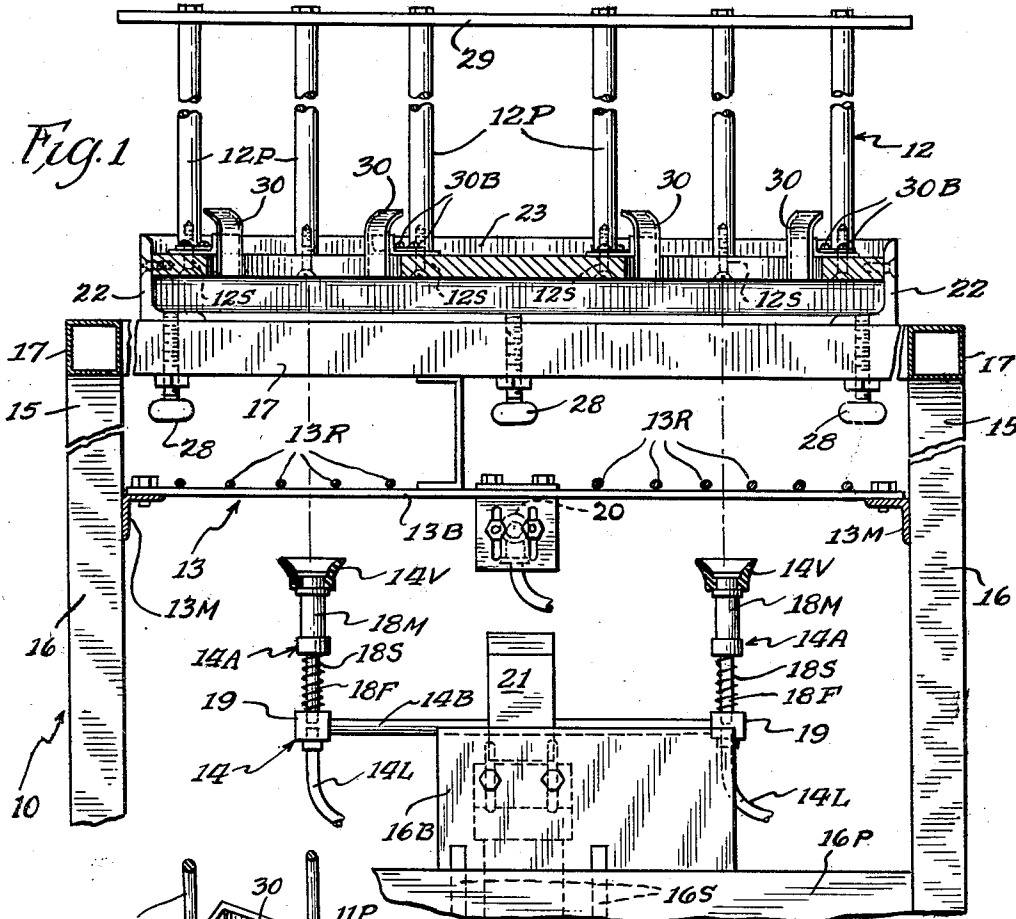
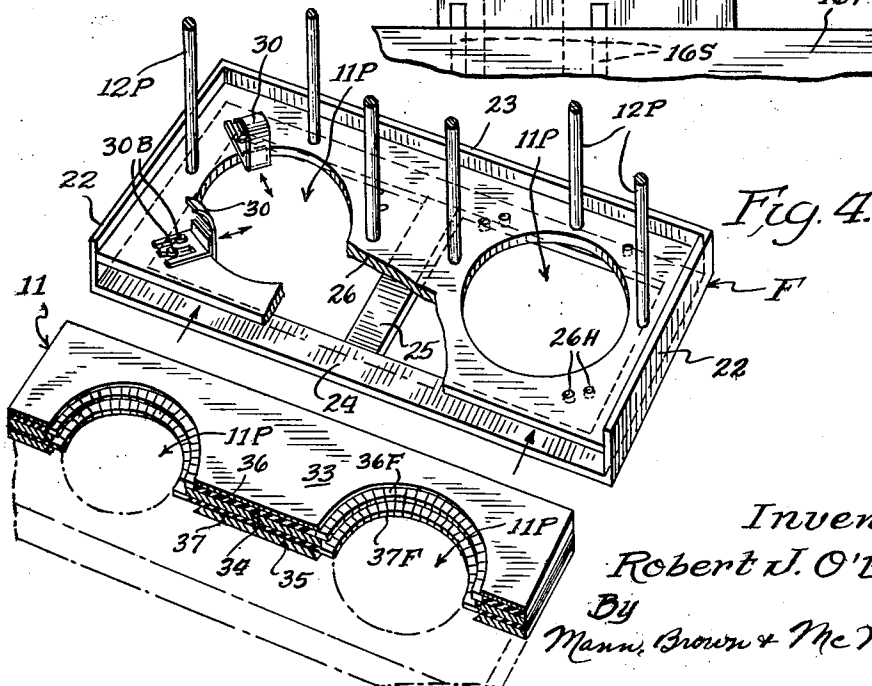
Oct. 29, 1963

R. J. O'BRIEN
APPARATUS FOR SEPARATING AND
DEPOSITING NESTED CONTAINERS

3,108,714

Filed Nov. 6, 1959

4 Sheets-Sheet 1



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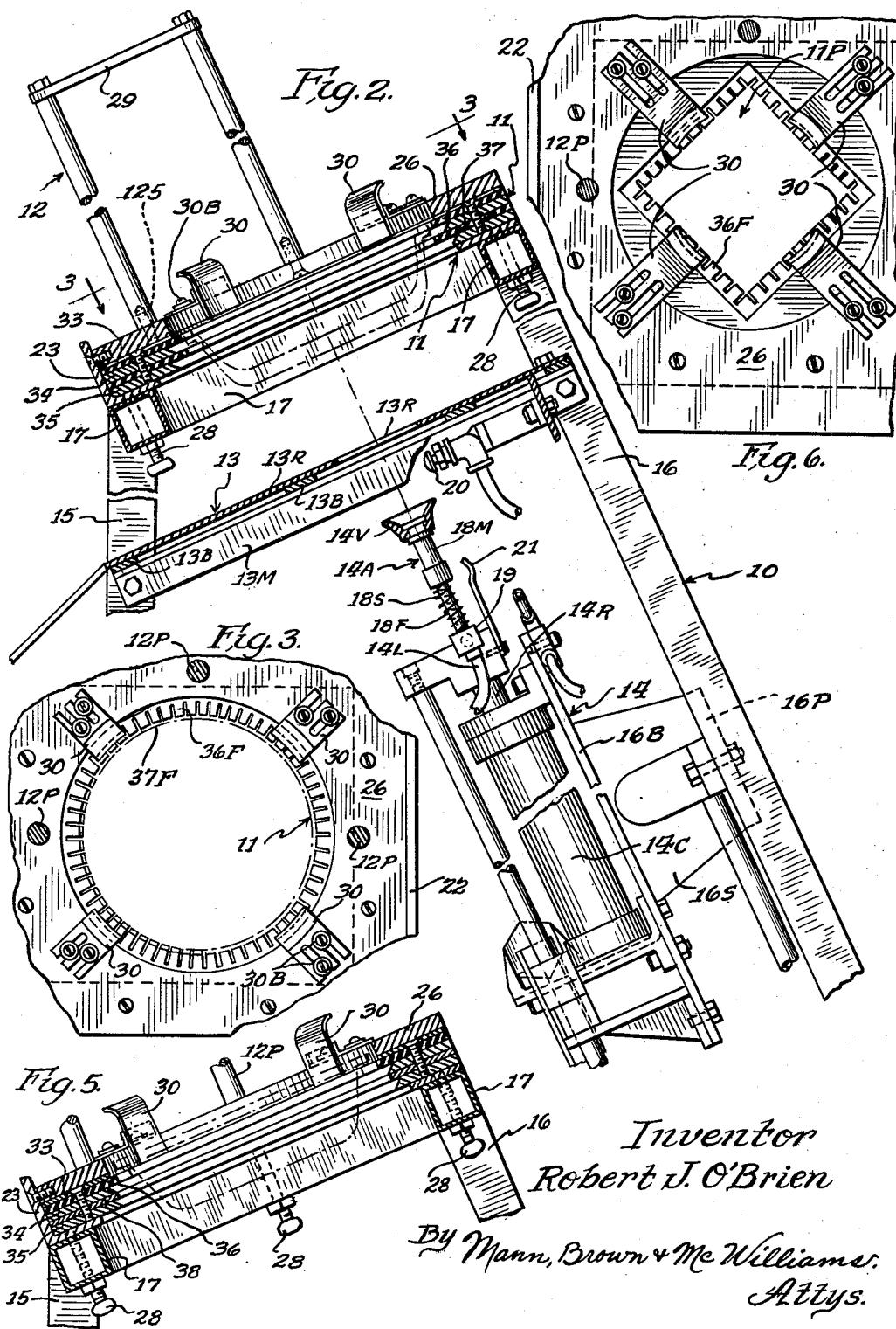
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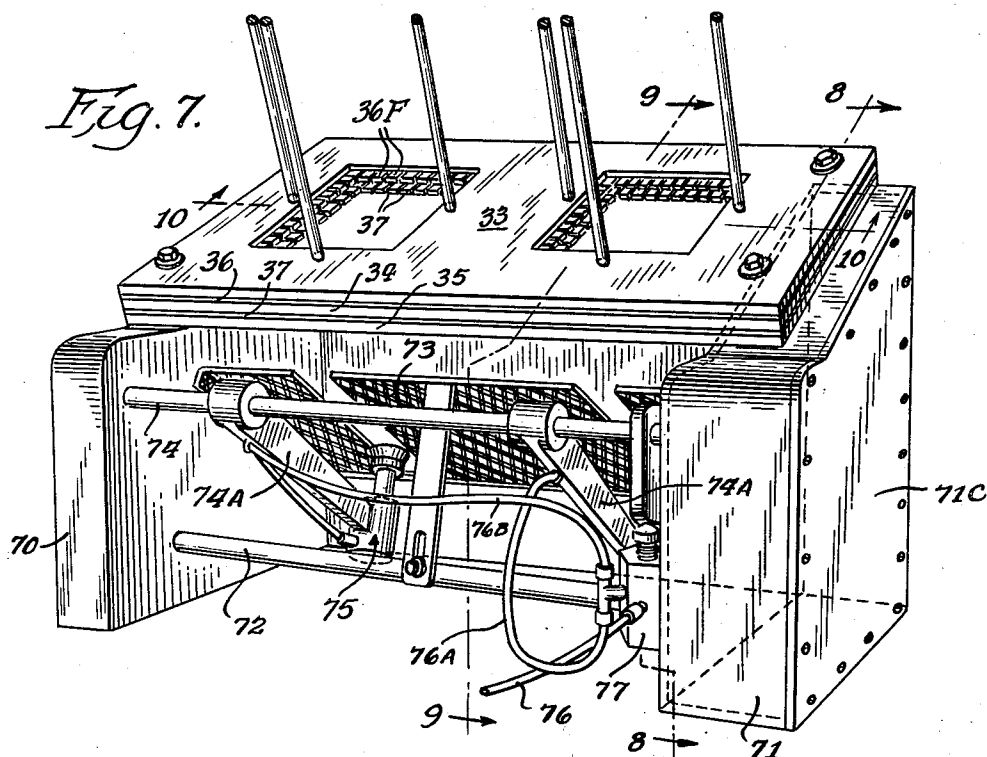
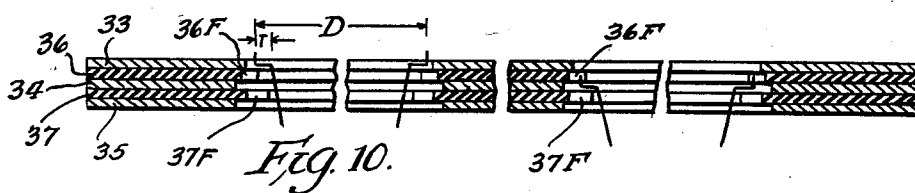
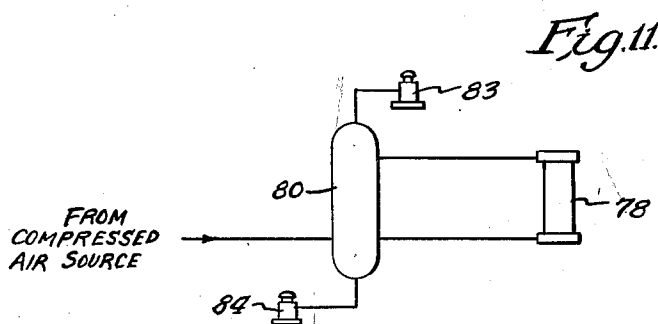
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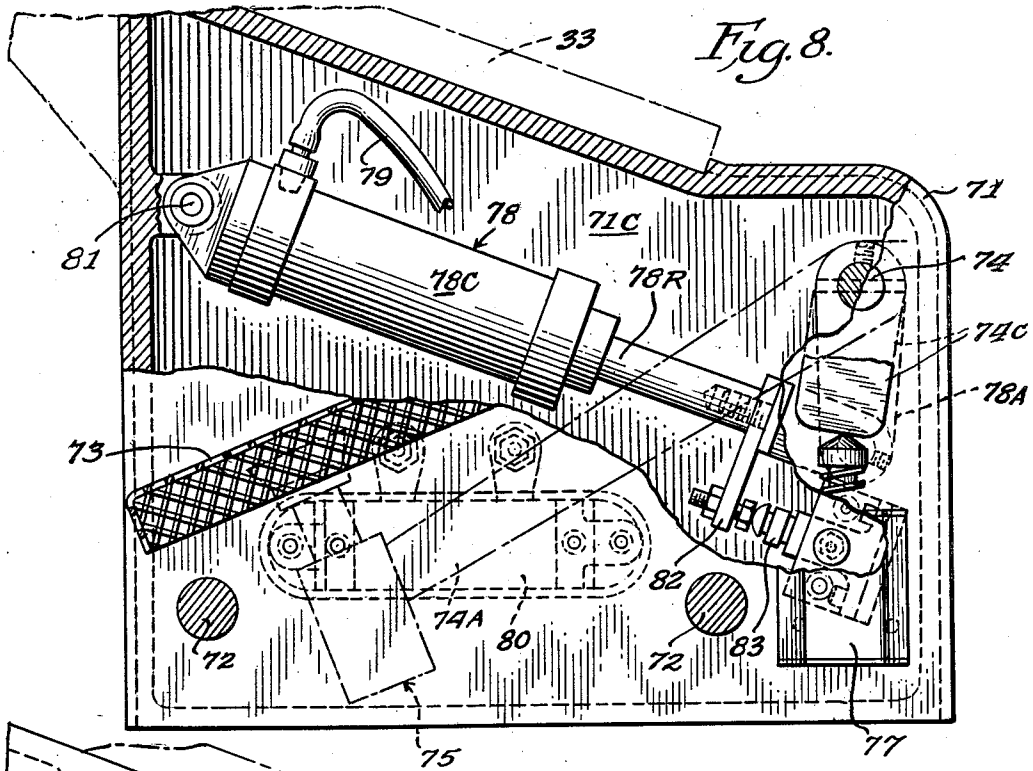
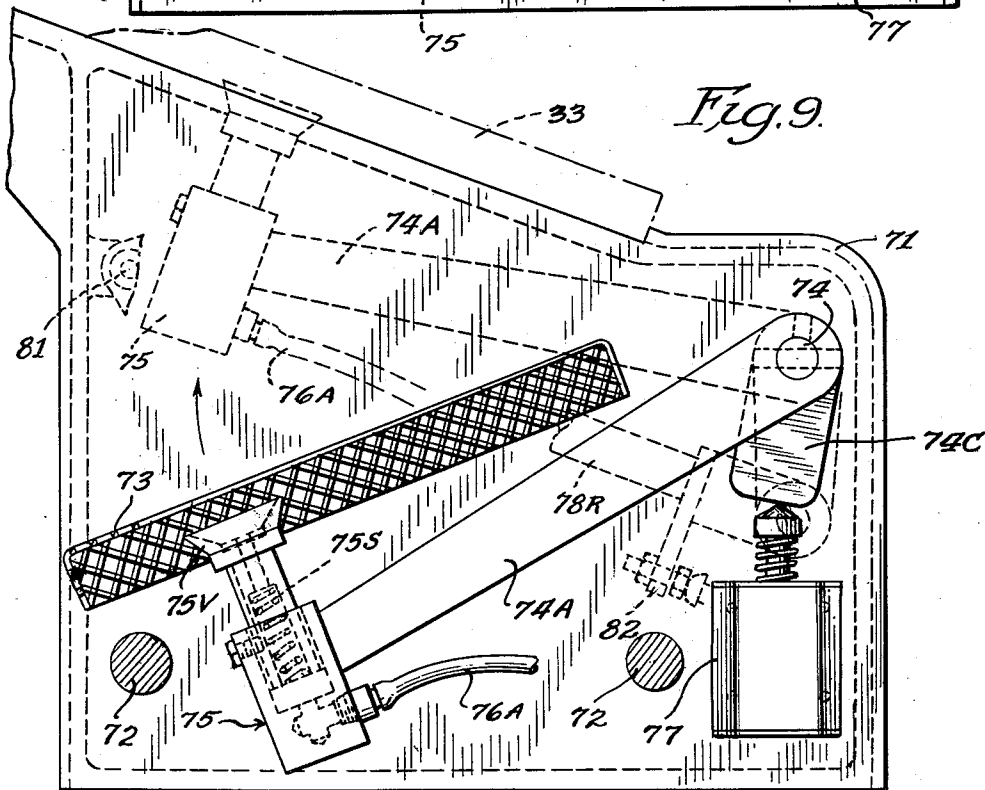
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4 Sheets-Sheet 4



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3,108,714

APPARATUS FOR SEPARATING AND DEPOSITING NESTED CONTAINERS

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9 Claims. (Cl. 221-211)

This invention relates to an apparatus for separating and depositing nested containers of the type having a marginal stiffener rim and this designation includes containers of the types commonly identified as vertical flange, vertical curl flange, and full curl rim, and, more particularly, this invention is concerned with a separating frame having a central opening bordered by resiliently distortable lip structure of novel form that supports the container stack by rim engagement with the bottom-most container of the stack and that yields to allow passage through the frame of but one container at a time.

The principal object of the invention is to provide a separating and depositing apparatus for nested containers that will automatically and reliably feed containers one at a time from the bottom of a stack of nested containers.

Another object of the invention is to provide a separating and depositing apparatus having a novel mounting nest construction for releasably retaining one of a number of replaceable separating frame assemblies to accommodate interchangeable frame assemblies and thereby permit a single basic apparatus arrangement to handle containers of various sizes and shapes.

Still another object of the invention is to provide a separating frame construction comprising a laminar, intercalated, assembly of rigid plates and rubber mats, with the mats having integral confronting fingers forming a resiliently distortable two stage retaining lip structure in the frame opening through which the containers are drawn.

Other objects and advantages will become apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same;

FIG. 1 is a fragmentary rear elevational view of the separating and depositing apparatus of this invention, with the view being taken looking angularly downwardly through the inclined main frame, separating frame, and delivery ramp, with parts of the main frame and delivery ramp being shown in section;

FIG. 2 is a fragmentary side view of the apparatus of FIG. 1, with its separating frame shown in section;

FIG. 3 is a fragmentary plan view taken approximately on the line 3-3 of FIG. 2;

FIG. 4 is a fragmentary perspective view illustrating the insertion of the separating frame into its main frame mounting nest with parts of the separating frame and mounting nest being broken away and sectioned for clarity of illustration;

FIG. 5 is a fragmentary side sectional view through a simplified separating frame construction;

FIG. 6 is a fragmentary plan view corresponding generally to that of FIG. 3 and illustrating a different sepa-

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rating frame having a square-shaped opening for containers of square configuration.

FIG. 7 is a rear perspective view of a depositing apparatus of simplified construction;

FIGS. 8 and 9 are cross-sectional views of the depositing apparatus and taken substantially along the lines 8-8 and 9-9 of FIG. 7;

FIG. 10 is a sectional view through the removable separating frame of the apparatus of FIG. 7; and

FIG. 11 is a schematic diagram of the compressed air control and actuating circuit for the apparatus of FIG. 7.

Referring now to the drawings and more particularly to FIGS. 1 and 2 thereof, the container separating and depositing apparatus is shown as including a main support framework, designated generally at 10, mounting container separating mechanism that is here shown as a separating frame 11 for passing containers one at a time, a hopper structure or storage chute 12 extending upwardly from the separating frame having a generally downwardly opening outlet and arranged to receive and maintain in alignment a nested stack of containers, a delivery ramp 13 arranged beneath the separating frame for advancing containers deposited thereon after passage through the separating frame, and a vacuum cup type extractor mechanism movable upwardly through the ramp to engage the underneath side of the bottom-most container for drawing this container through the separating frame, thereafter releasing the container to permit it to fall onto the ramp by gravity.

In the apparatus illustrated herein for purposes of disclosure, the separating frame 11 is arranged with two container passage-defining openings 11P, the extractor mechanism 14 includes two vacuum cup units, and the hopper 12 is arranged with two sets of guide post arrangements for handling the two separate stacks of containers.

The main framework includes a pair of generally vertical front struts 15, an inclined pair of rear struts 16, and a set of 4 top cross-pieces 17 of square-shaped, tubular construction. As best seen in the rear view of FIG. 1, the rear struts 16 are interconnected by a horizontal cross-support plate 16P to which parallel side plates 16S are fixed, with the side plates 16S carrying a mounting bracket 16B for the ram unit 14R of the extractor mechanism 14. The delivery ram 13 comprises inclined, laterally spaced angle-iron mounts 13M, horizontal support bars 13B bridged across the mounts at spaced points therealong, and slide rods 13R arranged crosswise of the support bars, with the centermost slide rods being terminated intermediately of their length to leave an opening for the vacuum cup of the extractor mechanism 14.

The extractor mechanism includes a main piston-like ram 14R reciprocable in a cylinder 14C that is fixed to the mounting plate bracket 16B. The ram carries a cross-bar 14B, with the vacuum post assemblies 14A being mounted on the opposite ends of the cross-bar and comprising a fixed post 18F having a coil spring 18S in telescoping relation thereover and reacting against a movable post 18M, the upper end of which carries the vacuum cup 14V of soft rubber or similar material.

A separate vacuum line 14L is connected to each vacuum post assembly through its cross-bar mounting and connector block 19, and the control mechanism for the vacuum lines is omitted to simplify the disclosure.

The spring-loaded soft rubber vacuum cup arrangement permits the soft cup 14V to be brought into engagement with the bottom-most container without destructive impact against the solid column presented by the containers. It also allows the cup to reliably engage and withdraw the bottom-most container even when the container is out of alignment. As the vacuum cup assembly moves upwardly and the cup engages the bottom-most container, the soft rubber-like cup material conforms as necessary to the container's shape and orientation and the coil spring 18S yields to cushion the impact of the cup.

The control mechanism includes a poppet valve 20 which is tripped by a resilient bracket arm 21 carried on the cross-bar 14B of the ram 14R. As the ram moves upwardly and the bracket arm 21 actuates the poppet valve 20, vacuum is applied to each vacuum post assembly to permit the vacuum cup threeof to reliably grip the bottom-most container of the container stack. As the ram moves downwardly and the bracket arm again actuates the poppet valve, each vacuum cup releases its container and permits it to fall onto the slide rods of the ramp.

The top cross-pieces 17 of the main frame permanently mount a framework F (see FIG. 4) which is open at its top and bottom faces to accommodate passage of containers and which is open along one of its edge faces to replaceably receive a separating frame unit 11. This framework includes side angle-iron members 22 connected at corresponding ends thereof by a rear angle-iron member 23 and a front slat 24, with a flat slat 25 arranged in the bottom of the framework intermediately of the angles 22 to connect the rear angle-iron 23 and the front slat 24. A top guide and hopper support plate 26 is secured to the angle-iron members adjacent the upper edges of their vertical legs and, with the aforementioned framing members, defines a drawer-shaped mounting nest for the separating frame 11. This mounting nest is rigidly mounted atop the cross-pieces 17, and releasable clamps 28 are mounted in the cross-pieces to extend through the horizontal legs of the angle-iron members 22 and 23 and engage the separating frame 11 and retain it in fixed position within the mounting nest.

The plate 26 is provided with a number of bolt openings, and the hopper posts 12P are fixed in some of these openings by mounting screws 12S (see FIGS. 1 and 2) to extend upwardly and provide three-point edge contact with a stack of nested containers for guiding and aligning the stack. A header plate 29 connects the upper ends of the posts 12P to give rigidity to the hopper structure. Container guides 30, preferably four in number for each container passage, are adjustably mounted on the support plate 26 by mounting bolts 30B which are anchored in mounting holes 26H provided in the plate. The guides 30 consist of vertically extending plates projecting into the container passage opening and flaring outwardly at their upper ends to receive and accurately control the position of the bottom end of the stack. The adjustable guides 30 are quite important since the hopper structure is of fixed size but must receive container stacks of various cross-sectional shapes and sizes. It will be appreciated that there will be a number of replaceable separating frames 11 intended for individual application to the mounting nest, and these various separating frames will have container-passage openings for containers of various sizes and configurations.

In the separating frame illustrated in FIGS. 1-4 of the present disclosure, the container-passage opening is circular; however, the separating frame illustrated in FIG. 6 has a square-shaped container-passage opening 11P and it is intended for substitution in the mounting nest to convert the apparatus for use in separating and depositing square-shaped containers. An important feature of this invention resides in its use with additional separating frame structures having container openings of square, circular, or other configuration, with the openings cover-

ing a full range of sizes and thus one basic apparatus arrangement is suitable for all present day container shapes and sizes.

In addition to the important versatility which the replaceable separating frame and mounting nest construction of this invention gives to the depositing apparatus, there is specific merit in the construction of the separating frame itself. In the preferred form of FIGS. 2 and 3, the separating frame comprises a bolted laminar assembly of top, bottom, and intermediate metal reinforcement plates 33, 34 and 35, respectively, and upper and lower rubber mats 36 and 37, with the mats being intercalated between the metal plates and having integral, inwardly extending, confronting fingers 36F and 37F forming individual marginal lip structures that border and define the container passage of the separating frame. In the preferred constructional embodiment illustrated herein for purposes of disclosure, each mat is $\frac{1}{8}$ " thick and is of 40 durometer rubber.

For purposes of illustrative disclosure and as best shown in FIG. 10, with containers having an external rim diameter (D) of $7\frac{1}{4}$ " and a support shelf thickness (T) of $\frac{5}{16}$ ", the fingers of the upper rubber mat 36 are $\frac{3}{8}$ " long and define an opening of $7\frac{1}{8}$ " diameter and the fingers of the lower mat 37 are $\frac{5}{8}$ " long and extend inwardly of the upper fingers about $\frac{1}{4}$ " to define an opening of $6\frac{5}{8}$ " diameter.

With this construction, the lip structure of the upper mat is sufficiently sturdy to support the weight of a stack of containers by engagement with the rim of the bottom-most container. However, as the extractor mechanism draws the bottom-most container through the upper mat, its fingers 36F undergo a resilient swinging follower movement and as the container passes free of the fingers they snap back to engage the rim of the next container and restrain this container from following the first container.

In practice, a single lip structure has proven highly effective in separating the nested containers and permitting but a single container to pass the separating frame. FIG. 5 illustrates a separating frame construction in which a single rubber mat 36 is employed, and in this instance, 4 metal plates are shown, the additional plate being indicated at 38 and merely serving to fill out the drawer space of the mounting nest and afford a snug mounting relationship for the separating frame. Where a single mat is used, the fingers comprising the lip structure preferably are $\frac{3}{4}$ " in length and define a container opening of 7" diameter for containers having an external rim diameter on the order of $7\frac{1}{4}$ ".

In the preferred practice of the invention, however, it is desirable to include the lower set of fingers which provide a secondary lip structure located slightly beneath the first set for catching any container that may accidentally slip through the first set of fingers. In this situation, the main body of the container stack would be supported on the upper lip while a single container would be supported on the lower lip, and as the extractor mechanism rises and engages the now separated bottom-most container and pulls it through the lower set of fingers, the remainder of the container stack, as well as the upper set of fingers, remains substantially undisturbed. The security afforded by the secondary lip structure represents an important advance in this art since it becomes virtually impossible for the depositing apparatus to misfeed.

An improved depositing apparatus of simplified construction is disclosed in FIGS. 7-11, and, as viewed in FIG. 7, it includes individually standardized left and right-hand side castings 70 and 71, respectively, bridged by stiffener bars 72, an expanded metal ramp 73 and a separating frame comprised of reinforcement plates 33, 34 and 35 and upper and lower mats 36 and 37, respectively, intercalated between the plates and providing separate sets of confronting fingers 36F and 37F. At its op-

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posite ends, a rock shaft 74 is journaled in these side castings and it is shown provided with two support arms 74A carrying vacuum cup assemblies 75 which are movable through suitable openings provided in the expanded metal ramp 73.

A common main vacuum line 76 feeds through a control valve 77 mounted on the inner face of casting 71 and controlled by a depending cam 74C carried by the rock shaft, with individual vacuum lines 76A and 76B extending from the control valve 77 to the vacuum cup assemblies 75. The cam 74C is positioned on the rock shaft to apply vacuum only during the interval when the vacuum cup assemblies are gripped against the bottom-most container and drawing it downwardly towards the ramp.

As best shown in FIG. 9, each vacuum cup assembly has a vacuum cup 75V of soft rubber, and the cups are biased upwardly by yieldable springs 75S to cushion their impact against the column of containers.

The rock shaft is actuated by the mechanism housed within the right hand side casting 71 behind its protective cover 71C. This mechanism includes a compressed air operated double acting cylinder and ram unit 78 (see FIG. 8) having its ram 78R connected by a crank arm 78A to one end of the rock shaft 74 and reciprocable under the control of an air line 79 which feeds through a four-way air valve 80 having separate lines connected to opposite ends of the ram cylinder 78C (see FIG. 11). The ram unit is capable of limited swinging movement about the pivot axis 81 and its ram 78R carries a radially projecting arm 82 for engagement with a vent type poppet valve 83 fixed in the side casting 71 and connected for operation, upon actuation thereof by the arm 82, to reverse the air valve and thereby to reverse the ram stroke. A second vent type poppet valve 84 is associated with the other end of the air valve and may be under the control of the machine to which depositing apparatus is supplying containers. Thus the operation of the depositing apparatus is synchronized, as necessary, with the other handling equipment for the containers.

Any suitable form of double acting cylinder and ram unit and four way valve known to those skilled in this art may be employed in the practice of this invention.

In the improved construction of FIG. 7, it will be noted that the hopper bars 12P are formed rigidly and permanently with the separating frame. When it is desired to revamp the unit for handling containers of a different size or different configuration, the entire separating frame and hopper unit is merely unbolted and removed in favor of the desired replacement unit. This arrangement thus provides standardized part construction for the side castings and the operating equipment. The separating frame and hopper are handled as a single unit and may be pre-filled with containers to facilitate rapid transaction from one size container to another. Finally, the arrangement has the additional advantage that the same side castings may be employed for depositing apparatus constructions of various width dimensions. For example, a unit for depositing three, four, or more containers simultaneously can readily be provided by substituting longer crossbars 72, a longer rock shaft 74, additional vacuum cup assemblies 75, and a longer ramp 73 without modifying the side casting and operating mechanism construction.

It should be understood that the description of the preferred form of the invention is for the purpose of complying with Section 112, Title 35 of the U.S. Code and that the claims should be construed as broadly as prior art will permit.

I claim:

1. A machine for depositing containers of a type having a marginal rim, said machine comprising side castings secured in spaced apart relation by connector bar structure, one of said side castings being hollow, a delivery ramp extending between said side castings, a separating frame bridged across said side castings above said ramp

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and having a resiliently distortable lip structure bordering and defining a central frame opening, a hopper upstanding from said frame for receiving an aligned nested stack of containers, with said lip structure being engageable with the rim of the bottom-most container to support said stack and being yieldable to accommodate passage of a single container through said frame opening, a rock shaft journaled in said side castings and carrying a radial support arm intermediately therealong, means housed in said hollow side casting for reversibly swinging said rock shaft, a vacuum cup assembly fixed on said support arm and swingable therewith through an opening provided in said ramp for engaging the underneath side of the bottom-most container of said stack, drawing such container through said frame opening, and depositing such container on the ramp, with said lip structure yielding momentarily as the container moves therethrough and immediately restoring its shape to engage the rim of the next container for supportingly retaining the remainder of the stack, and means for applying vacuum to said cup assembly operable only when said vacuum cup assembly is moving into engagement with said bottom-most container and is drawing such container through said frame opening.

2. The arrangement of claim 1 wherein a valve is mounted to one of said castings and controls the means for applying vacuum and said rock shaft has a cam adjacent one end thereof and swingable therewith for engagement with said valve only when said rock shaft is swinging said vacuum cup assembly into engagement with said bottom-most container and is drawing such container through said frame opening.

3. The arrangement of claim 1 wherein the means housed in said hollow side casting includes a compressed air operated double acting cylinder and ram unit having a ram connected to said rock shaft by a crank arm for reciprocally driving said rock shaft, means including a four-way air valve controllable for supplying compressed air to opposite ends of the cylinder and vent valves controllably connected to the air valve and operable at each end of the strokes of the ram to reverse the same.

4. Apparatus for depositing nestable containers of a type having a marginal rim and comprising a storage chute having a generally downwardly opening outlet, container separating mechanism disposed beneath the outlet of said chute and providing a central passage leading generally downwardly from said outlet, and extractor mechanism reciprocally movable through said passage between a pick-up position wherein it grippingly engages a central region of the bottom-most container in said chute and a release position below said separating mechanism wherein it frees the gripped container after having drawn the same through the separating mechanism, said separating mechanism comprising upper and lower sets of flexibly resilient fingers, with each set bordering and defining a portion of said passage that is complementary to and slightly smaller than a container rim configuration, each set of fingers, when in neutral support position being engageable underneath a container rim and being resiliently yieldable in response to downward container movement produced by said extractor mechanism to undergo generally vertical swinging follower movement and thereafter to restore to support position wherein the upper set of fingers supports the containers remaining in the chute and the lower set of fingers supports any container slipping through the upper set by virtue of having been nested within the gripped container in effectively masked relation to the fingers of the upper set during movement of the gripped container therethrough.

5. Apparatus for depositing nestable containers of a type having a marginal rim and comprising a storage chute having a generally downwardly opening outlet, container separating mechanism disposed beneath the outlet of said chute and providing a central passage leading

generally downwardly from said outlet, and extractor mechanism reciprocally movable through said passage between a pick-up position wherein it grippingly engages a central region of the bottom-most container in said chute and a release position below said separating mechanism wherein it frees the gripped container after having drawn the same through the separating mechanism, said separating mechanism comprising upper and lower sets of flexibly resilient fingers, with each set bordering and defining a portion of said passage that is complementary to and slightly smaller than a container rim configuration, each set of fingers, when in neutral support position being engageable underneath a container rim and being resiliently yieldable in response to downward container movement produced by said extractor mechanism to undergo generally vertical swinging follower movement and thereafter to restore to support position wherein the upper set of fingers supports the containers remaining in the chute and the lower set of fingers supports any container slipping through the upper set by virtue of having been nested within the gripped container in effectively masked relation to the fingers of the upper set during movement of the gripped container therethrough, and said extractor mechanism having a container contacting gripper element resiliently retractable in a direction lengthwise of said passage in response to engagement with a container disposed between said upper and lower sets for effectively shortening the travel of the extractor mechanism to accommodate gripping of such container without crushing the same prior to drawing it through the lower set of fingers.

6. Apparatus for depositing nestable containers of a type having a marginal rim and comprising a storage chute having a generally downwardly opening outlet, container separating mechanism disposed beneath the outlet of said chute and providing a central passage leading generally downwardly from said outlet, and extractor mechanism reciprocally movable through said passage between a pick-up position wherein it grippingly engages a central region of the bottom-most container in said chute and a release position below said separating mechanism wherein it frees the gripped container after having drawn the same through the separating mechanism, said separating mechanism comprising upper and lower sets of flexibly resilient fingers, with each set bordering and defining a portion of said passage that is complementary to and slightly smaller than a container rim configuration, each set of fingers, when in neutral support position being engageable underneath a container rim and being resiliently yieldable in response to downward container movement produced by said extractor mechanism to undergo generally vertical swinging follower movement and thereafter to restore to support position wherein the upper set of fingers supports the containers remaining in the chute and the lower set of fingers supports any container slipping through the upper set by virtue of having been nested within the gripped container in effectively masked relation to the fingers of the upper set during movement of the gripped container therethrough, and said extractor mechanism having a gripper resiliently biased towards said chute to accommodate sufficient retraction thereof in a lengthwise direction of said passage for effectively shortening the travel of said gripper whenever a container is disposed between said sets, said gripper being in the form of a vacuum cup of soft resilient material, and said extractor mechanism including means for applying vacuum in predetermined timed relation to said cup to establish and maintain gripping contact for engaging and withdrawing the lowermost container from the chute.

7. In a machine for depositing nestable containers of a type having a marginal rim, said machine including a hopper providing a generally downwardly opening discharge chute for storing a stack of nestable containers, container separating mechanism disposed beneath the bottom of said chute for separating the bottom-most con-

tainer from said stack, and extractor means movable generally vertically through the lower end of said chute for grippingly engaging the underneath side of the bottom-most container in the chute, drawing such container downwardly through said separating mechanism and thereafter releasing such container, improved container separating mechanism comprising upper and lower resiliently distortable tip structures each bordering and defining a central opening complementary to and slightly smaller than the container rim configuration, said upper lip structure contacting and supporting said stack by underneath container rim engagement therewith at its lower end and being yieldable marginally to undergo momentary follower deflection with downward movement therethrough of the container gripped by said extractor means and thereafter restoring for underneath container rim engagement at the lower end of the remainder of said stack, and said lower lip structure having underneath container rim engagement with said gripped container and being yieldable marginally to undergo momentary follower deflection with downward movement therethrough of the gripped container and thereafter restoring for underneath container rim engagement with the next container to be deposited.

8. In a machine for depositing nestable containers of a type having a marginal rim, said machine including a hopper providing a generally downwardly opening discharge chute for storing a stack of nestable containers, container separating mechanism disposed beneath the bottom of said chute for separating the bottom-most container from said stack, and extractor means movable generally vertically through the lower end of said chute for grippingly engaging the underneath side of the bottom-most container in said chute, drawing such container downwardly through said separating mechanism and thereafter releasing such container, improved container separating mechanism comprising upper and lower resiliently distortable lip structures each bordering and defining a central opening complementary to and slightly smaller than the container rim configuration, said upper lip structure contacting and supporting said stack by underneath container rim engagement therewith at its lower end and being yieldable marginally to undergo momentary follower deflection with downward movement therethrough of the container gripped by said extractor means and thereafter restoring for underneath container rim engagement at the lower end of the containers remaining in said stack, and said lower lip structure having underneath container rim engagement with said gripped container and being yieldable marginally to undergo momentary follower deflection with downward movement therethrough of the gripped container and thereafter restoring for underneath container rim engagement with any container slipping through the upper lip structure by virtue of being nested within the gripped container in effectively masked relation to the upper lip structure during passage of the gripped container through the upper lip structure, and said extractor means having a container contacting element resiliently retractable in response to engagement with a container disposed between said upper and lower lip structures for effectively shortening the motion of the extractor means in accordance with the lower position of such container.

9. A machine for depositing articles of a type having a marginal rim, said machine comprising a main frame mounting a hopper for receiving an aligned nested stack of articles, said frame having, at the base of said hopper, upper and lower sets of flexibly resilient fingers rigidly anchored thereon and extending into internal confronting relation to border and define a central passageway complementary to and slightly smaller than the rim of each article, with the fingers of said upper set being engageable underneath the rim of the bottom-most article to support the stack, and with the fingers of the lower set projecting inwardly of the fingers of the upper set, a delivery ramp

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beneath said passageway for advancing articles deposited thereon, extractor means movable between said ramp and said sets of fingers for engaging the underneath side of the bottom-most article of said stack, drawing such last named article through said passageway, and depositing 5 such article on the ramp, with the fingers of both said sets undergoing independent vertical swinging follower movement in response to downward movement of such article to admit passage of the bottom-most article only and thereafter restoring to initial position for engaging the 10

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rim of the next article and supporting and retaining the remainder of the stack, and means for successively actuating said extractor means.

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