United States Patent

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[54] **DENESTING MACHINE**
8 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **221/11,** 221/251
[51] **Int. Cl.** **G07f 11/12,** B65g 59/00, B65h 3/00
[50] **Field of Search** 221/251, 11

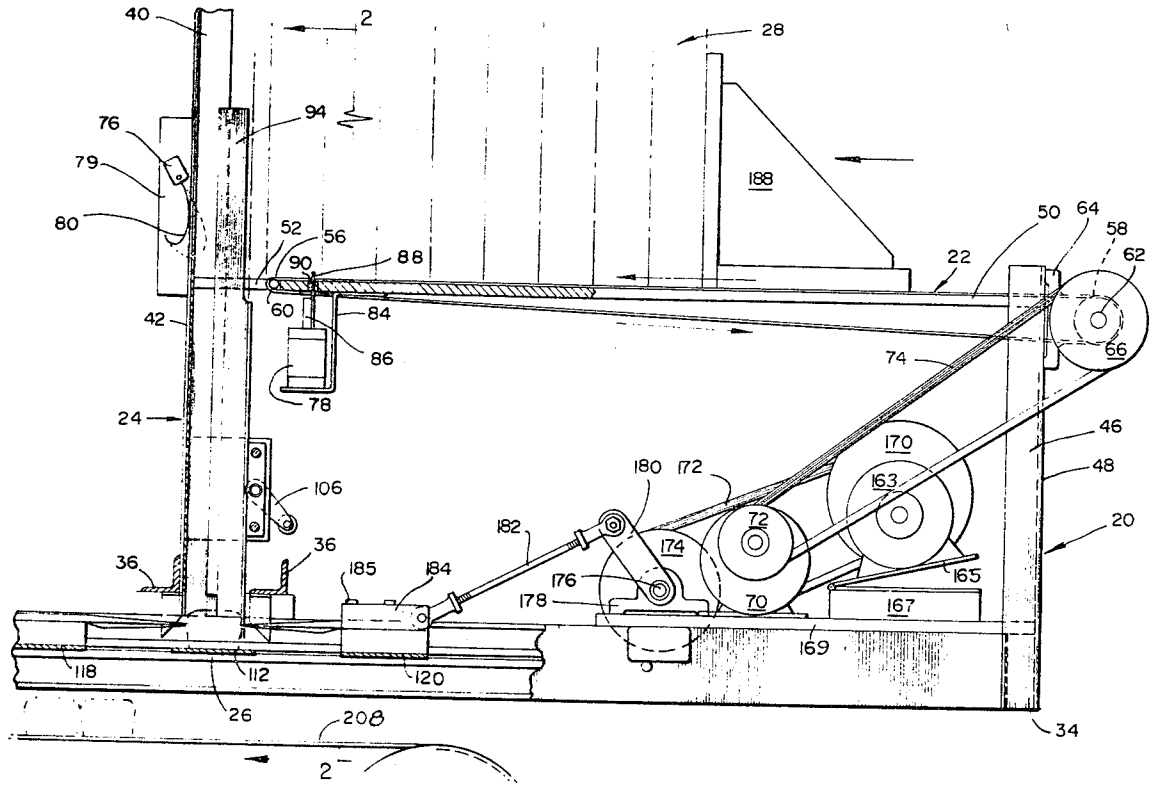
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ABSTRACT: A machine for denesting and dispensing individual containers comprising a magazine for holding a stack of containers, conveying means for delivering additional stacks of containers to the magazine, and a release mechanism mounted for reciprocal movement transversely to the bottom end of the magazine for selectively denesting and discharging individual containers from the magazine. The reciprocal release mechanism comprises oppositely mounted members which are alternately inserted between the two lowermost containers in the magazine so as to release only the lowermost container while holding the balance of the stack within the magazine.



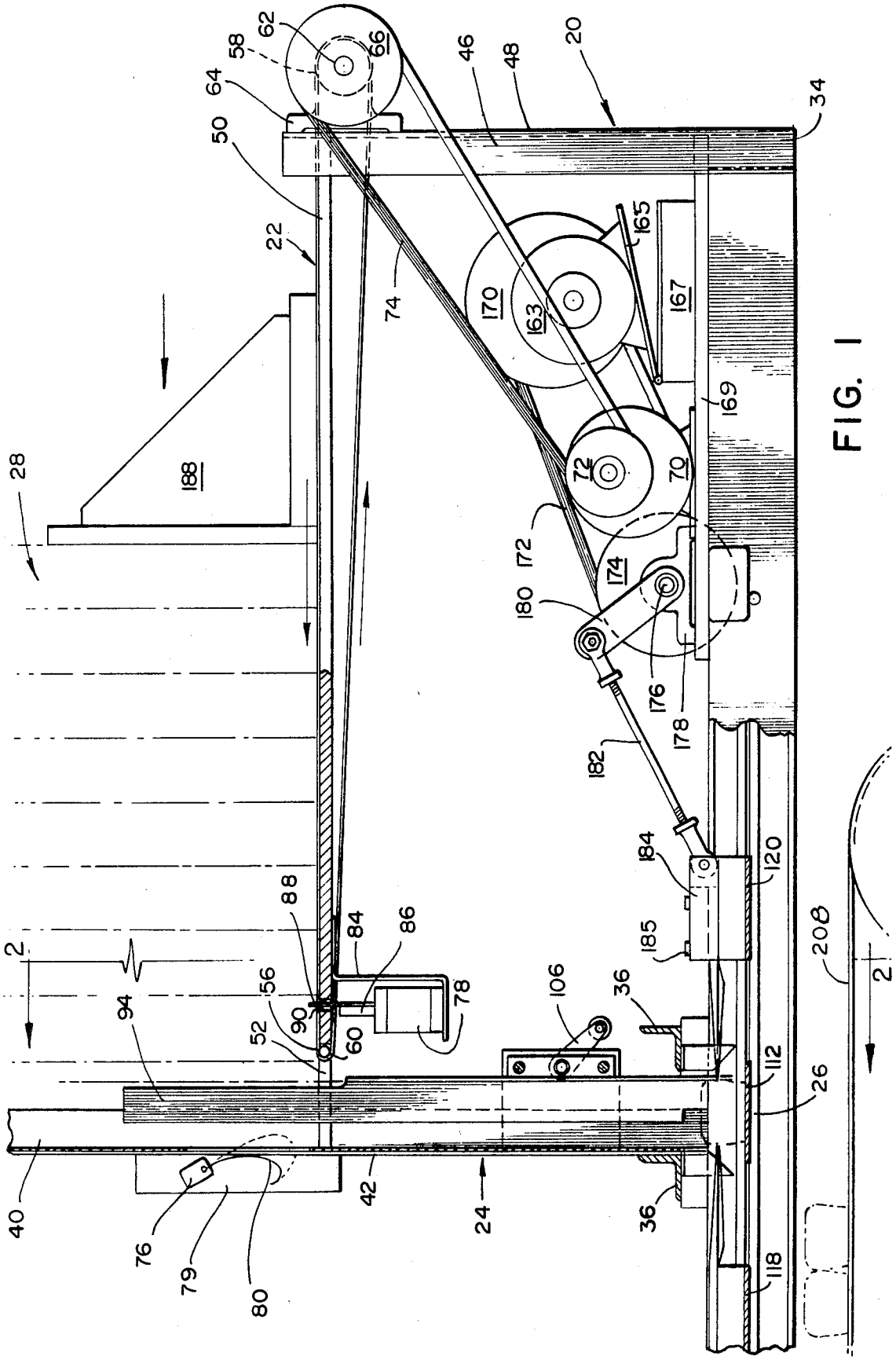

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FIG. 1

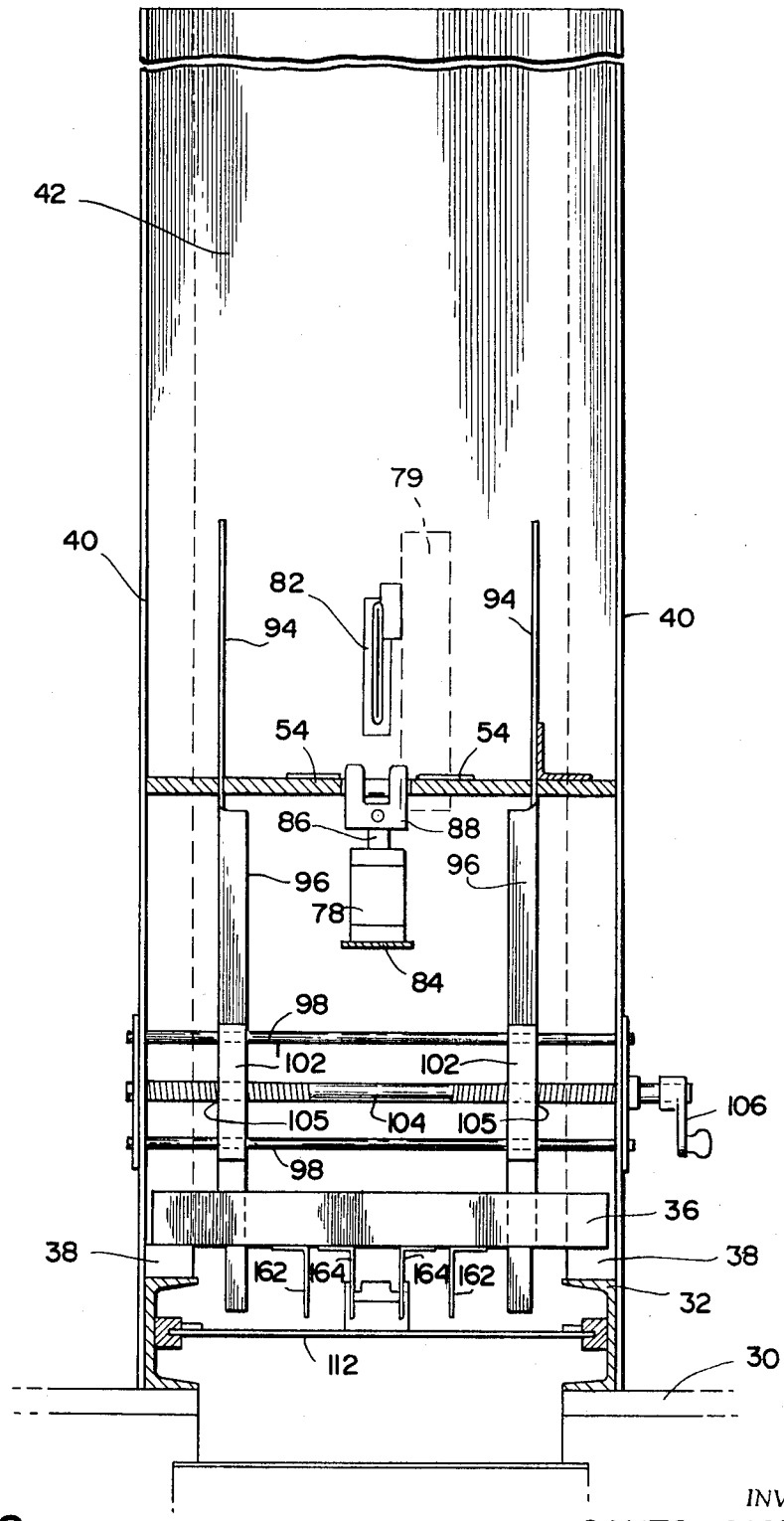


FIG. 2

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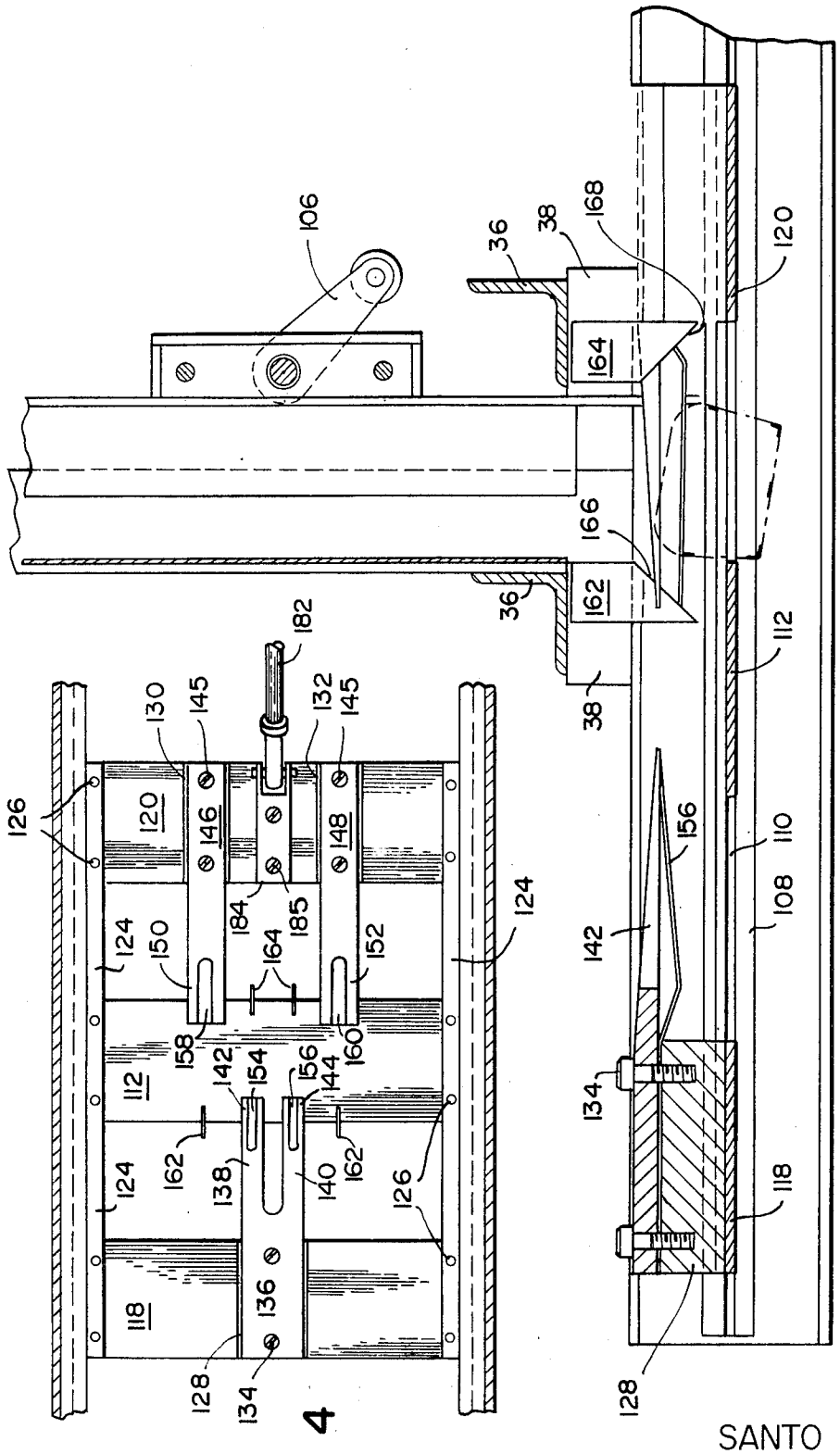


FIG. 4

FIG. 3

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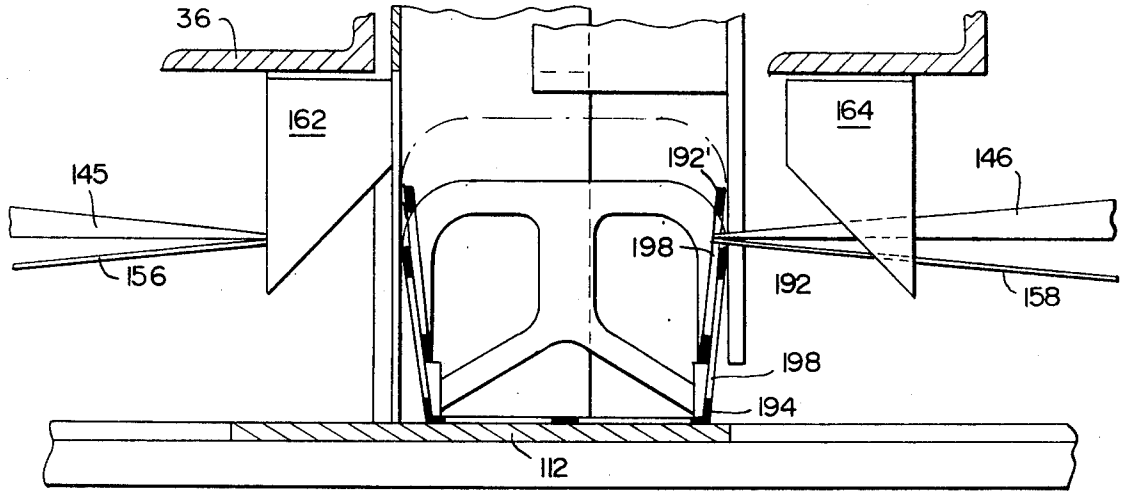


FIG. 5

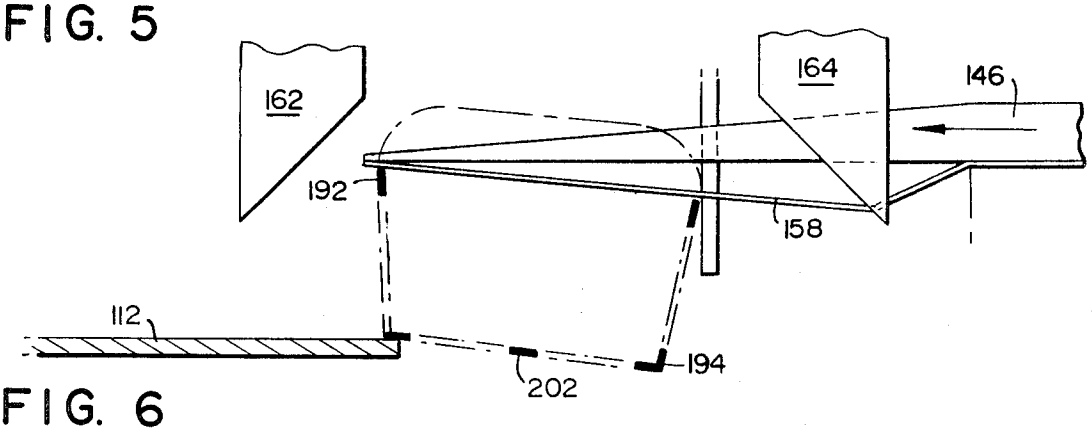


FIG. 6

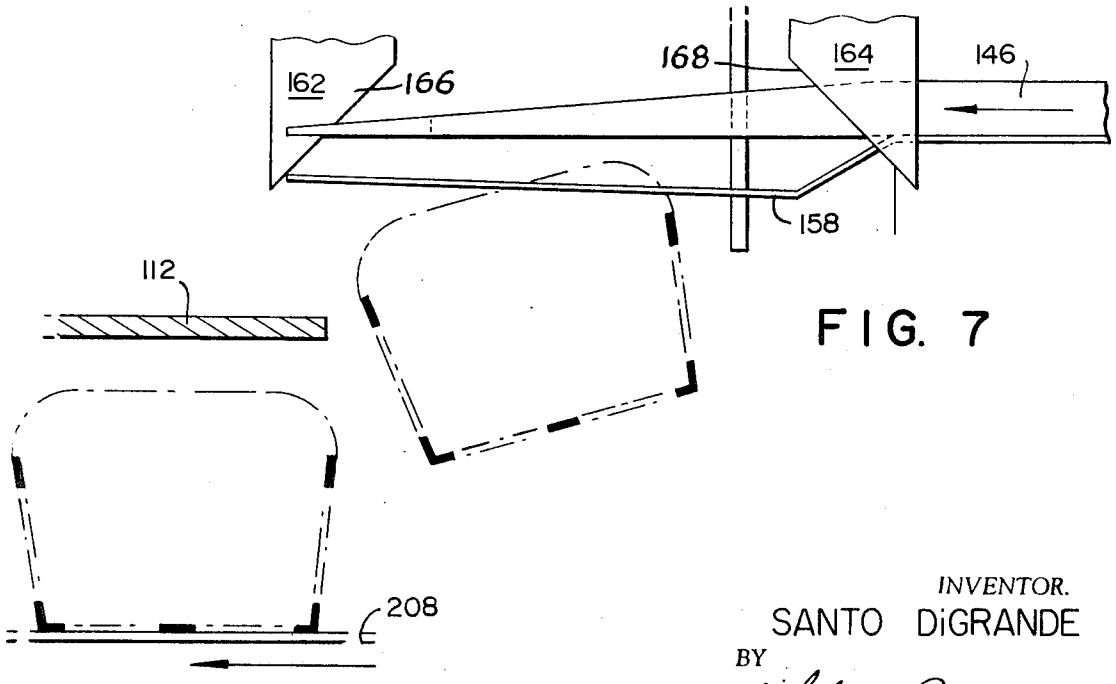


FIG. 7

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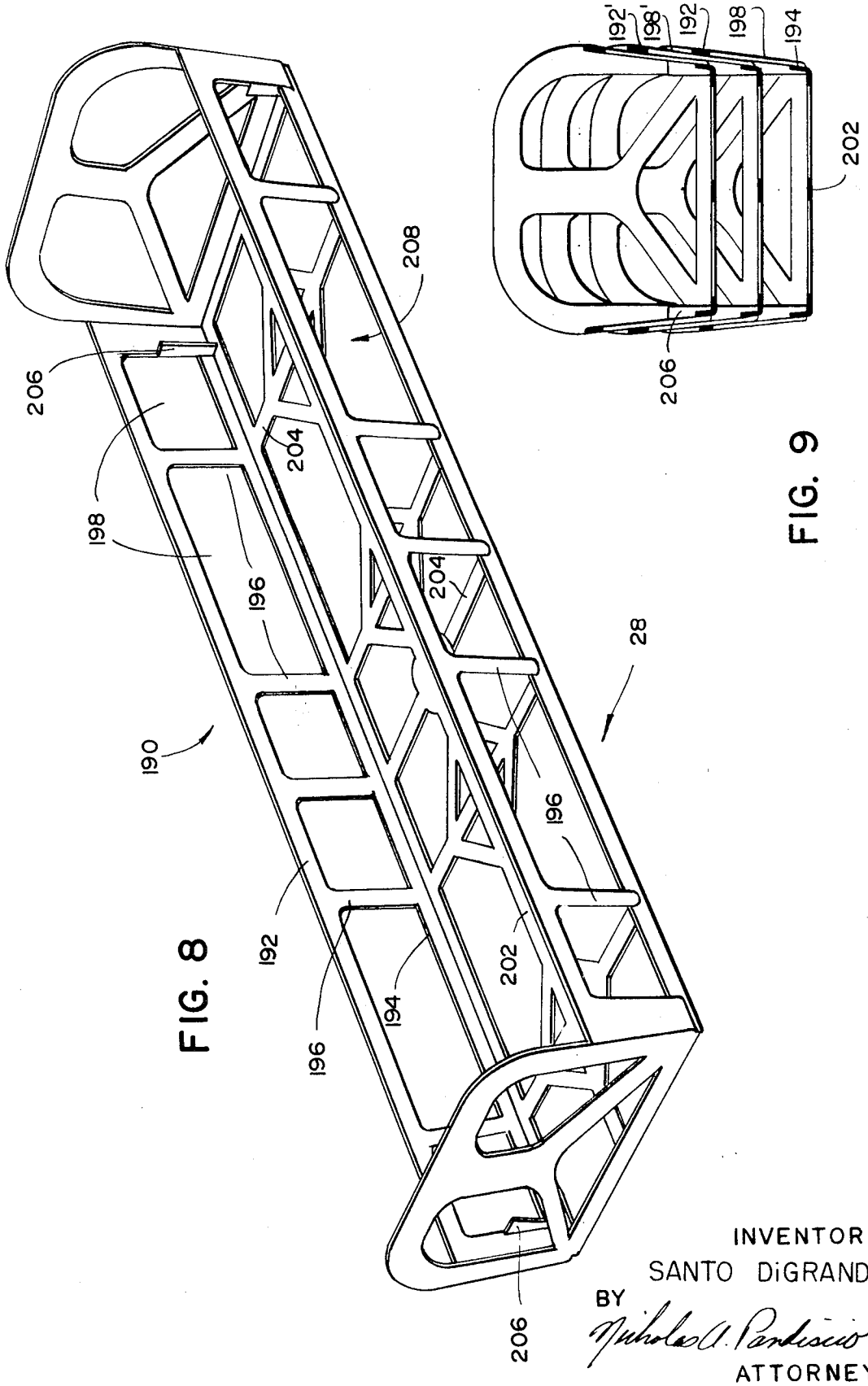


FIG. 8

FIG. 9

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DENESTING MACHINE

This invention relates to unstacking equipment and more particularly to a machine for separating and removing individual containers in the form of baskets or trays from a nested stack of such containers.

In the packaging of fresh vegetables and more specifically tomatoes and the like for retail sale, it is common practice to pack the product into containers in the form of open top baskets or trays. These containers may be of heavy paper, corrugated paperboard, fiberboard or the like, but usually are formed of a plastic material and are characterized by side and end panels having an open-grid construction made up of horizontal rails and vertical struts. This construction permits the contents to be readily visible and also provides a lightweight, sanitary and relatively inexpensive "throwaway" container. Although the use of these plastic baskets has proven to be a convenience for the user, sorting and handling them has been a considerable problem for the packer. Normally, empty baskets are received by the packer from the manufacturer in the form of nested stacks and the packer is required to separate them and then place them in upright position for filling. Heretofore this has been performed manually, making it a costly and time-consuming operation.

Accordingly, the primary object of the present invention is to overcome the above limitations by providing a machine for mechanically separating individual baskets from a stack thereof.

Another object is to provide an improved machine which delivers stacks of containers to a magazine, selectively separates individual containers from those within the magazine, and then delivers the separated containers to a product filling station.

A more specific object is to provide an apparatus which includes a delivery conveyor which automatically indexes stacks of empty baskets to a denesting station, and a moveable release mechanism which automatically and continuously separates the lowermost basket within the denesting station and dispatches it in an upright position onto a takeaway device, such as a conveyor for delivery to a packaging station or line.

These and other objects are achieved by a device including a vertical, open-ended magazine for containing and supporting one or more stacks of baskets, means including a conveyor for indexing successive stacks of baskets into the magazine, and a basket-release mechanism mounted for reciprocal movement at the bottom and transversely to the lower end of the magazine. The reciprocating release mechanism includes opposed fork units and a plate which is located between but at a lower level than the fork units. The space between the opposed fork units is large enough to permit downward movement of the baskets out of the magazine onto the plate when the forks are properly positioned. When stacked in nested fashion, the baskets are vertically spaced so that the upper edges of the side panels of each lower basket lie below horizontal rails of the side panels of the next higher basket by an amount sufficient to expose openings in the side panels of the next higher basket which are large enough to permit a fork to be inserted below the horizontal rails of the next higher basket. The plate is at a level such that when the stack of baskets is resting thereon, the exposed openings in the side panel of the next-to-last basket are in line with the aforesaid forks. This arrangement permits the next-to-last basket (and all baskets above it) to be supported by a fork or forks inserted in its side panels and the lowermost or bottom basket to be supported by the plate. By reciprocally moving the release mechanism, opposed forks will be alternately inserted into the stack of baskets, with each unidirectional stroke of the mechanism serving to release the then lowermost basket. Should the lowermost basket tend to remain in nested relation when it should separate from the next higher basket, each fork unit may be provided with means designed to produce a downwardly acting force which will pry apart the lowermost basket from the stack.

Other features and many of the attendant advantages of the present invention are set forth in or rendered obvious by the following detailed description which is to be considered with the accompanying drawings, wherein:

FIG. 1 is a side elevation, partly in section, of apparatus embodying the present invention;

FIG. 2 is a vertical section taken along lines 2–2 of FIG. 1;

FIG. 3 is an enlargement of a portion of FIG. 1 showing a basket being removed from the magazine;

FIG. 4 is a top elevation of the reciprocating mechanism;

FIGS. 5, 6 and 7 are fragmentary side elevation views, on an enlarged scale, partly in section, showing how baskets are separated and discharged from the magazine;

FIG. 8 is a perspective view of a preferred form of basket which may be handled by apparatus embodying the present invention and

FIG. 9 is a cross-sectional view of three nested baskets of the form shown in FIG. 8, showing the relationship between the horizontal rails and openings of the side panels.

Referring first to FIGS. 1 and 2, the illustrated apparatus has a frame 20 which supports an endless conveyor 22, magazine 24, and basket-release mechanism 26 which is mounted for reciprocal movement transversely to the supply of baskets in the magazine. The conveyor 22 serves to feed stacks of baskets, identified at 28, into the magazine from which they are individually released by the reciprocal release mechanism 26.

Frame 20 is rigidly formed of structural materials, such as steel or the like, which are secured together by suitable means such as riveting, bolting, welding or the like. The frame is adapted to rest on a suitable support 30 and includes a base portion which comprises a pair of parallel and spaced channel bars 32 positioned on their side so that the open portion of each channel faces the other. These channel bars are joined at one end by a laterally extending horizontal crossbeam 34 and intermediate their length by a pair of laterally extending horizontal angle-iron struts 36. The latter are secured to the channels by a pair of spacer blocks 38. Also shown are a pair of vertically extending opposite side panels 40 which are secured to the outside surface of channel bars 32 and a flat, vertically extending end panel 42 whose side edges abut and are secured to the side panels 40. The lower portion of end panel 42 is braced by the adjacent angle-iron strut 36 to which it is secured. The bottom edge of end panel 42 is located short of the channel bars 32. As is rendered obvious hereinafter, panel 42 forms part of the magazine 24.

The frame 20 also includes a pair of vertical angle-iron bars 46 which are secured to the horizontal channel bars 32 and serve to support another end panel 48. Extending between end panels 42 and 48 and secured thereto and also to side panels 40 and vertical angle-iron bars 46 is a floor member 50 which serves to support stacks of baskets and with which is associated the endless conveyor 22. As shown in FIG. 1, that end of floor member 50 which is supported by side panels 40 is notched so as to provide a rectangular opening 52 which exceeds the width and length of baskets 28.

Conveyor 22 may comprise a single relatively wide conveyor belt, but preferably it consists of two or more spaced belts. The illustrated embodiment consists of a pair of spaced, endless conveyor belts 54 of wire mesh, rubberized fabric or the like. These belts are mounted for movement around a horizontally mounted, relatively small-diameter guide pulley 56 and a horizontally mounted drive pulley 58. Guide pulley 56 is rotatably supported by a shaft 60 attached to the floor member, (by means not shown) and extending laterally across the opening 52. Drive pulley 58 is mounted on a shaft 62 which is supported by bearing blocks 64 secured to the upper ends of the end panel 48. Affixed to shaft 62 is another pulley 66. The conveyor belts are driven unidirectionally so that their upper runs move toward opening 52 as indicated by the directional arrows. The driving force for the belts is provided

by an electric motor 70 whose output shaft is provided with a drive pulley 72. The latter is coupled to and drives pulley 66 by means of a drive belt 74.

Means are also provided for controlling feeding of baskets by the conveyor 22 so that baskets 28 will be automatically transferred from the conveyor into the magazine 24, as needed. Such means may provide for intermittent stop-and-go indexing of the conveyor. Alternatively, the conveyor may be allowed to operate continuously and means may be provided for impeding forward movement of the stacks of baskets by the conveyor except when additional baskets are required to be added to the magazine. This second approach is used in the illustrated embodiment of the invention.

Referring now to FIGS. 1 and 2, the means for controlling feeding of the baskets to the magazine includes a contact switch 76 electrically coupled to a solenoid 78. Switch 76 is of the direct-contact type commonly referred to as a limit switch. It is mounted on the outside surface of end panel 42 by a support member 79 and comprises a movable, spring-loaded contact arm 80 which projects through a vertical slot 82 formed in end panel 42. As shown in FIGS. 1 and 2, a portion of contact arm 80 extends through slot 82 into the space just above the rectangular opening 52 in floor member 50. Solenoid 78 is supported by a bracket 84 which is attached to the underside of floor member 50 and is located substantially between the conveyor belts 54. The armature 86 of solenoid 78 carries a bifurcated arm 88 which is disposed so as to be extended vertically through an opening 90 formed in floor member 50. Switch 76 and solenoid 78 are electrically connected to a power supply (not shown) so that so long as switch arm 80 is held in one position (the solid line position shown in FIG. 1), solenoid 78 will be deenergized and arm 88 will protrude above floor member 50, but when switch arm 80 is free to move to its second position (the position shown in dotted lines in FIG. 1), the solenoid will be energized and will retract arm 88 so that it no longer projects above floor member 50. When arm 88 projects above floor member 50, it is effective to impede movement of baskets into the magazine by the conveyor.

As indicated above, magazine 24 is comprised of end panel 42. It also includes a pair of vertically extending moveable sidewalls 94 which are parallel to and spaced within the side panels 40 and which extend vertically through opening 52. As shown in FIG. 2, the upper ends of walls 94 extend substantially above floor member 50 while their lower ends terminate slightly below the top surface of channel bars 32. Walls 94 have inwardly extending flanges 96 along their rear vertical edges i.e., the edges furtherest from end panel 42. Flanges 96 extend upward from substantially the lower ends of walls 94 to a point slightly below opening 52 in floor member 50. Walls 94 and their flanges 96 cooperate with end panel 42 to define a cross-sectional area for the magazine which can be adjusted, by moving walls 94 toward and away from each other, to accommodate baskets of different lengths.

Walls 94 are slidably supported by a pair of horizontal, laterally extending and vertically spaced parallel rods 98. The latter extend through suitable holes formed in support blocks 102 attached to the flanges 96 of walls 94, and are anchored in side panels 40. Movement of walls 94 is achieved by means of a laterally extending screw 104 which is rotatably supported by side panels 40. Screw 104 is disposed between and parallel to rods 98 and is sized to make screw engagement with threaded holes 105 formed in support blocks 102. Screw 104 is mounted in side panels 40 so that it can rotate but cannot move axially. One end of screw 104 carries a handle 106. Operation of the handle in one direction will cause the walls 94 to separate, while operation in the reverse direction will bring the two walls closer together.

The reciprocating basket-release mechanism will now be described with reference to FIGS. 1—4. As seen best in FIGS. 2—4, a pair of guide members 108 each having a longitudinal slide groove 110 (FIG. 3) are horizontally secured to the inside surfaces of channel bars 32. The basket-release mechanism comprises a moveable carriage which includes a basket-support plate 112 and two opposed fork-support plates 118 and 120. Plates 112, 118 and 120 are slidably mounted within grooves 110 of guide members 108 and are ganged together in parallel spaced relationship to one another by means of a pair of elongate narrow bars 124 which are secured thereto by means of screws 126. Attached to the upper side of plate 118 at substantially the center thereof is a fork-supported block 128. Attached to the upper side of plate 120 out of alignment with support block 128 are two additional fork-support blocks 130 and 132. Secured to block 128 by means of screws 134 is a dual fork 136 which consists of two spaced arms 138 and 140 that terminate in similar pairs of spaced fingers or tynes 142 and 144 respectively. Attached to blocks 130 and 132 by means of screws 145 are two single forks 146 and 148 that terminate in similar pairs of spaced fingers or tynes 150 and 152. As seen best in FIG. 3, a substantial section of each fork has a sloping upper surface, providing a tapered profile configuration which terminates in relatively thin finger tips. Associated with the arms 138, 140 of fork 136 are individual spring members 154 and 156. One section of these spring members is flat and is anchored between fork 136 and its support block 128. The remaining sections of spring members 154 and 156 are offset so that their free ends approach the tips of the fingers at an angle. The spring members are aligned with arms 138 and 140 and are wide enough to underlie the fingers on the ends of these arms. Two additional spring members 158 and 160 of corresponding profile configuration are mounted in corresponding manner with respect to forks 146 and 148.

The illustrated apparatus also includes means for camming the free ends of the spring members 154, 156, 158 and 160 downwardly away from the tips of the fingers of forks 136, 146 and 148. Such means comprises two opposing pairs of cams 162 and 164. These cams are mounted above the level of plates 112, 118 and 120. Preferably they are anchored to the underside of the horizontal angle-iron struts 36. As shown in FIG. 4, one cam 162 is aligned with the gap between fingers 152. Cams 164 are aligned with the corresponding gaps between fingers 142 and fingers 144. The lower ends of cams 162 have inclined cam surfaces 166 as shown in FIG. 3. The lower ends of cams 164 have oppositely inclined cam surfaces 168. Cams 162 depend far enough for their cam surfaces to be in the paths of movement of spring members 158 and 160 when the carriage is to the left as viewed in FIGS. 1 and 3. Cams 164 depend far enough for their cam surfaces to be in the paths of movement of spring members 154 and 156 when the carriage moves to the right.

Reciprocal motion is imparted to the carriage by a motor 163 which is mounted to frame 20 by a motor-support plate 165 which is hinged to a block 167 secured to a mounting platform 169. The latter is secured to the channel bars 32. Power is transmitted from motor 163 by means of a cone drive pulley 170 attached to its shaft, a belt 172 and a pulley 174 attached to a shaft 176 which is rotatably supported by a pair of bearing blocks 178 secured to platform 169, a crank arm 180 affixed to one end of shaft 176, and a lever 182 pivotally connected at one end to the crank arm and at the other end to a block 184 attached by means of screws 185 to fork-support plate 120. Unidirectional rotation of shaft crank arm 180 by motor 163 causes the carriage to reciprocate back and forth along the grooves 110 of guides 108.

Operation of the machine described above is believed to be obvious to persons skilled in the art and is briefly described as follows: The machine may be started by placing a stack of baskets in the magazine so that the stack is supported by plate 112 and contact arm 80 of switch 76 is held by the pressure of the stack in the dotted line portion shown in FIG. 1. The operator then places several additional stacks on the upper run of conveyor 22; each stack being positioned so that the elongated dimension of the trays is at right angles to the direction of travel. Since the stacks tend to lean, a moveable stack support 188 may be placed on the conveyor, as shown in FIG. 1, to provide support to the various stacks so that they

will not tumble backwards away from the magazine. The conveyor motor is now started, with the result that the belts will tend to move the stacks of baskets toward the magazine. However such movement is prevented by arm **88** which is in an elevated position due to the solenoid being deenergized (the solenoid is deenergized because switch arm **80** is held in the "off" position by the stack of baskets in the magazine). It is to be noted that the bottom of the baskets also has an open-grid construction made up of longitudinal and transverse members, as shown in FIG. **8**, and that the solenoid is located so that arm **88** can project upwardly into an open area in the bottom of the lowermost basket of the stack which is immediately adjacent to the magazine, thereby restraining that stack so that it cannot come into contact with the baskets in the magazine. When (because of discharge of baskets from the bottom end of the magazine) the stack in the magazine drops below switch arm **80**, the switch arm will automatically move under the influence of the spring bias exerted thereon to the "on" position. When this occurs, solenoid **78** will be energized and arm **88** will retract. This allows the stack of baskets nearest to the magazine to be moved into the magazine by the conveyor belt. At the same time the succeeding stacks of baskets will be driven forward by the conveyor. As soon as the new stack of baskets drops into the magazine, the switch contact arm **80** will be restored to its original "off" position causing the solenoid to become deenergized and allowing arm **88** to move up again under the influence of the spring-biased armature. Arm **88** moves up in time to penetrate the bottom of the lowermost basket in the next stack and hold the latter in the original position of the stack that has been previously delivered to the magazine.

The action involved in separating baskets from the stack in the magazine and releasing them so that they will be discharged out of the bottom of the magazine can best be described with reference to FIGS. **5**, **6**, **7**, **8** and **9**.

Referring specifically to FIGS. **8** and **9**, as previous stated, the side panels **190** of each basket **28** are comprised of upper and lower horizontal rails **192**, **194** interspaced by vertical struts **196**. The spaces between rails **192**, **194** and struts **196** are identified as openings **198**. The bottom panel of each basket is comprised of a longitudinal rail **202** and transverse strut members **204** which are integrally connected to lower horizontal rails **194**. Also provided are two pairs of corner lugs **206**, which, as shown, are disposed inside each basket at opposite ends thereof, and are integrally connected to the inside of side panels **190**. When the baskets are stacked in nested fashion, the lugs **206** in each lower basket support the bottom panel of the next higher basket and thereby maintain the basket in a vertical spaced relationship. Also, when the baskets are nested, the upper edges of rails **192** of each lower basket lie below the upper horizontal rails **192'** of the next higher basket, and the upper portions of the openings **198'** in the side panels of the next higher basket are also exposed above the top edge of rails **192** of the lower basket, thus making it possible for the fingers of the various forks to penetrate opening **198'** and thereby engage and support the next higher basket (and all those above it) while leaving the lower basket free to be separated from the stack by gravity or otherwise. As shown in FIGS. **5** and **6**, the forks are at a height such that their fingers will engage and support the next higher basket, i.e., the next to the last basket, when the lowermost basket rests on support plate **112**. The forks **146** and **148** also are spaced from fork **136** a distance somewhat in excess of the width of the baskets. The width of a basket is the maximum horizontal dimension thereof as shown in FIGS. **5** and **9**. Accordingly, at no time can the fingers of forks **146** and **148** and the fingers of fork **136** all be in engagement with baskets in the magazine. Once the carriage begins to reciprocate, forks **146** and **148** will move into and out of the stack of baskets in the magazine while simultaneously fork **136** will move out of and into the same stack.

As forks **146** and **148** move into the stack of baskets, the basket-support plate **112** will move out from under the lowermost basket (see FIG. **5**). As forks **146** and **148** reach the limit of their penetration, plate **112** will have moved far enough to release the basket resting thereon (see FIGS. **6** and **7**), whereupon the released basket will fall down and be discharged onto, for example, a takeaway conveyor **208** (FIG. **1**). The remaining baskets will continue to be supported by forks **146** and **148**. This support ceases when the forks are withdrawn. However, before the forks are fully withdrawn, the basket-support plate **112** will have moved back below the magazine. Hence as soon as forks **146** and **148** are clear of the stack, the latter will settle onto plate **112**. Continual movement of the carriage will cause fork **136** to penetrate the stack in the same manner as forks **146**, **148**, thereby providing support for all baskets except the lowermost basket. The latter, however, will continue to be supported by plate **112** until the latter has moved far enough to the right to release it.

In most cases the weight of gravity is sufficient to cause denesting, i.e., to separate the lowermost basket from the stack. However, because plastic baskets are not made to close tolerances and because the stack may have been compressed, successive baskets may be frictionally locked to each other to the extent that they will not separate fully under gravity alone. The tendency to remain nested is overcome by the spring members **154**, **156**, **158** and **160**. Consider, for example, the action of spring members **158** and **160**. As the forks **146** and **148** penetrate the stack of baskets in the magazine, the spring members **158** and **160** approach cams **162** and engage cam surfaces **166**. The latter cause the spring members to be deflected downward (see FIG. **7**), and this downward action has the effect of forcing the lowermost basket down, freeing it from the next higher basket. The spring members return to their original undeflected position as the forks are withdrawn. The spring members carried by fork **136** operate in a similar manner.

An important advantage of the invention as represented by the illustrated embodiment is that one basket is released for each half cycle of reciprocating movement of the carriage and that such release is effected by maintaining positive control over the stack in the magazine as the lowermost tray is being denested. A further advantage is that the apparatus is capable of the denesting baskets even when they are tightly stacked. Other advantages are obvious to persons skilled in the art.

Obviously certain changes may be made in the above apparatus without departing from the scope of the invention herein involved. Particularly it should be noted that while the above description has been directed to a carriage mounted for reciprocal linear movement within a pair of guide channels **108**, the carriage may be secured to a pair of pendulum arms or the like that are pivotally connected to the side panels **40**. With this alternative arrangement, the reciprocating motion of the carriage will be along an arc which, by appropriately adjusting the length of the pendulum arms, will enable the forks to penetrate the stack of baskets in the magazine and plate **112** to move under the same stack, substantially in the same manner as described hereinbefore. Reciprocating movement of the pendulum-mounted carriage may be achieved by attaching lever **182** to one of the pendulum arms. It should also be noted that the spring members carried by the forks may be deflected by means other than described. For example, each spring member may be provided with an extension that projects upwardly through a hole in the fork to which it is attached, and such extension may terminate in a roller-type cam follower disposed so as to contact and be cammed downward by a fixed cam mounted adjacent to the magazine as the carriage moves along its arc.

Still other modifications are obvious to persons skilled in the art. Therefore it is intended that the foregoing description shall be interpreted in an illustrative rather than a limiting sense, with the scope of the invention to be determined by the following claims considered in the light of the teaching herein presented.

What I claim is:

1. A machine for denesting and dispensing individual baskets from a stack of baskets which are characterized by side panels having an open-grid construction made up of substantially vertical struts and horizontal side rails and which when stacked in nested fashion are vertically spaced so that the upper edges of the side panels of each lower basket lie below horizontal rails of the side panels of the next higher basket, said machine comprising:

a vertical magazine for containing and supporting at least one stack of said baskets, and

a release mechanism mounted for reciprocal movement transversely to the bottom end of said magazine, said mechanism comprising means for releasing only the lowermost basket from said magazine while supporting the next-to-the-lowermost basket and all baskets above it within the magazine, said release mechanism comprising a plate disposed to move below said stack in supporting relation therewith and at least one fork unit mounted for movement into an exposed opening of said next-to-the-lowermost basket, said fork unit and plate being arranged so that said fork unit may support said next-to-the-lowermost basket and all baskets above it as said plate moves out from under the lowermost basket, to be supported by said plate whereby said lowermost basket may be discharged from said stack.

2. A machine according to claim 1 wherein said release mechanism comprises opposed fork units and a plate which is fixably located between but at a lower level than the fork units, the space between said fork units being large enough to permit downward movement of the baskets from the magazine onto said plate when the forks units are moved to a first predetermined position, said plate also being at a level such that when the stack of baskets is resting thereon, said exposed openings in the side panels of said next-to-the-lowermost basket are in line with said fork units, and further including means for reciprocating said release mechanism so that each successive lowermost basket is released by said plate as one of said opposed fork units is inserted into said opening in said next-to-the-lowermost basket.

3. A machine as described in claim 2 further including means coupled to each fork unit for producing a downwardly acting force when said each fork unit is inserted within said exposed openings so as to pry apart the lowermost basket from the stack.

4. A machine of claim 2 further including means for indexing successive stacks of baskets to said magazine, said means for indexing comprising a conveyor for carrying said stacks to said magazine, first means for preventing movement of said stack by said conveyor, and second means for operating said first means so as to permit movement of said stacks by said conveyor, and third means for actuating said second means when the supply of baskets in said magazine has been depleted by a predetermined amount.

5. A machine according to claim 1 further including:

means connecting said plate and said at least one fork unit so that said plate and said at least one fork unit are adapted to move in synchronism with one another; and

means for effecting reciprocal movement of said plate and said at least one fork unit.

6. A machine according to claim 3 wherein said means for producing a downwardly acting acting force is an elongate spring member having one end affixed to said fork unit and the other end free to bend away from said fork unit and further including means for bending each spring member away from each fork unit as said each fork unit penetrates said stack.

7. A machine for denesting and dispensing individual containers from a stack of containers, said machine comprising:

a vertical magazine for containing and supporting at least one stack of said containers; and

a release mechanism adapted to release only the lowermost container from said mechanism while supporting the next-to-the-lowermost container and all containers above it within the magazine, said release mechanism comprising a carriage mounted for reciprocal movement transversely to the bottom end of said magazine and provided with first means disposed to move under said stack to support the same and second means disposed to engage said stack to simultaneously release only the lowermost container and support the next-to-the-lowermost container and all containers above it when said first means moves out from under said stack.

8. A machine according to claim 7 wherein said first means includes a plate and said second means includes spaced opposed fork units with said plate being located between and below said fork units.