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Kinney

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[54] **SEPARATING AND DISPENSING MEANS FOR NESTED CONTAINERS**

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[52] **U.S. Cl.** **221/222**

[51] **Int. Cl.** **B65h 3/28**

[58] **Field of Search** 221/222, 26, 221, 223, 221/297; 214/8.5

[56] **References Cited**

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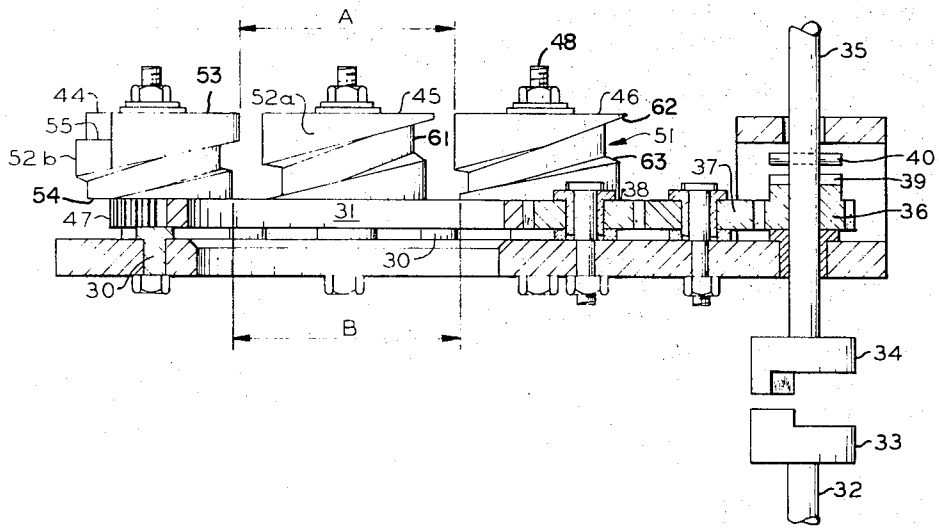
Primary Examiner—Stanley H. Tollberg

[57] **ABSTRACT**

Individual frustoconical containers having a rolled rim and an outwardly projecting annular stacking shoulder located a slight distance below the rim are separated from a nested stack of such containers by a plurality of cylindrical worm gears mounted in a circular array. Each worm gear has a spiral groove to simultaneously receive the rim of the lowermost container in the stack. The top cylindrical portion of each worm gear which is horizontally adjacent the stacking shoulder of the next to the lowermost container has a larger horizontal diameter than the cylindrical portion which is horizontally adjacent the stacking shoulder of the lowermost container.

6 Claims, 6 Drawing Figures



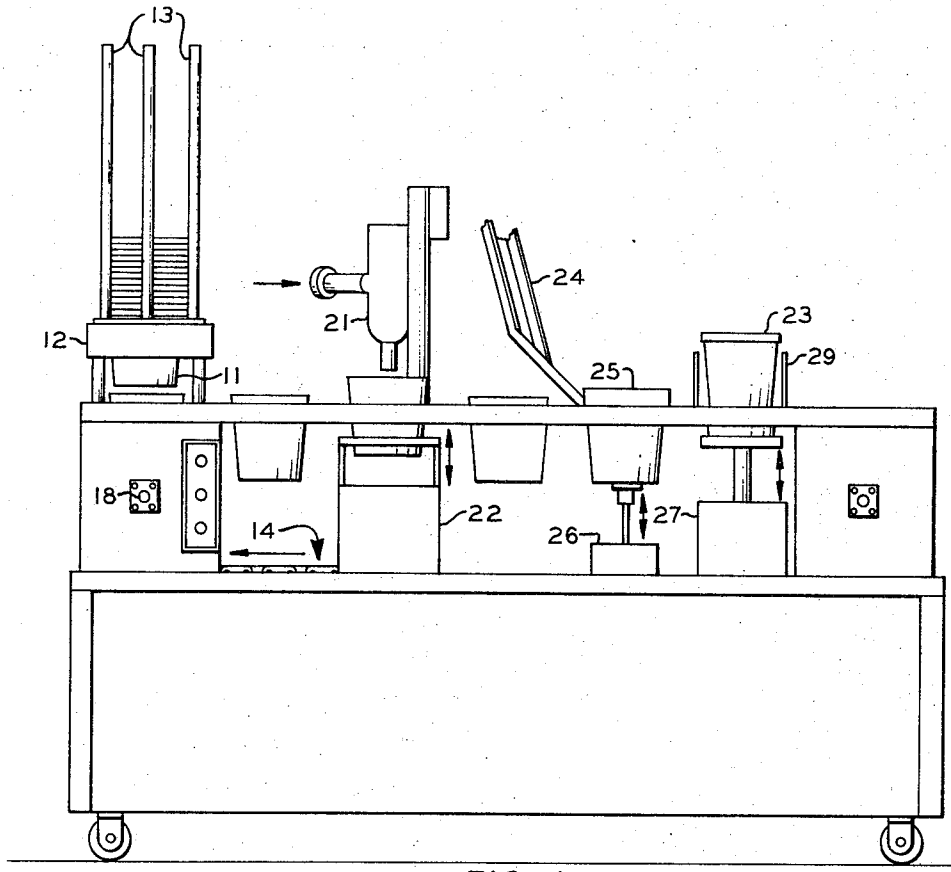

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FIG. 1

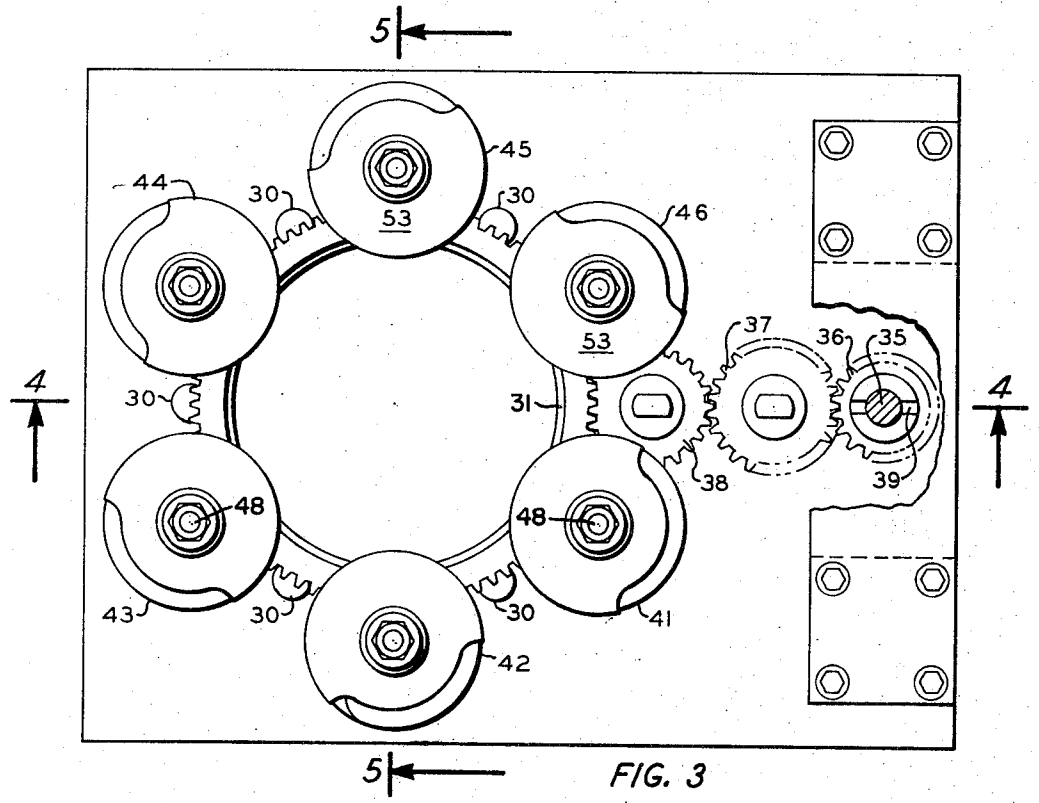
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FIG. 3

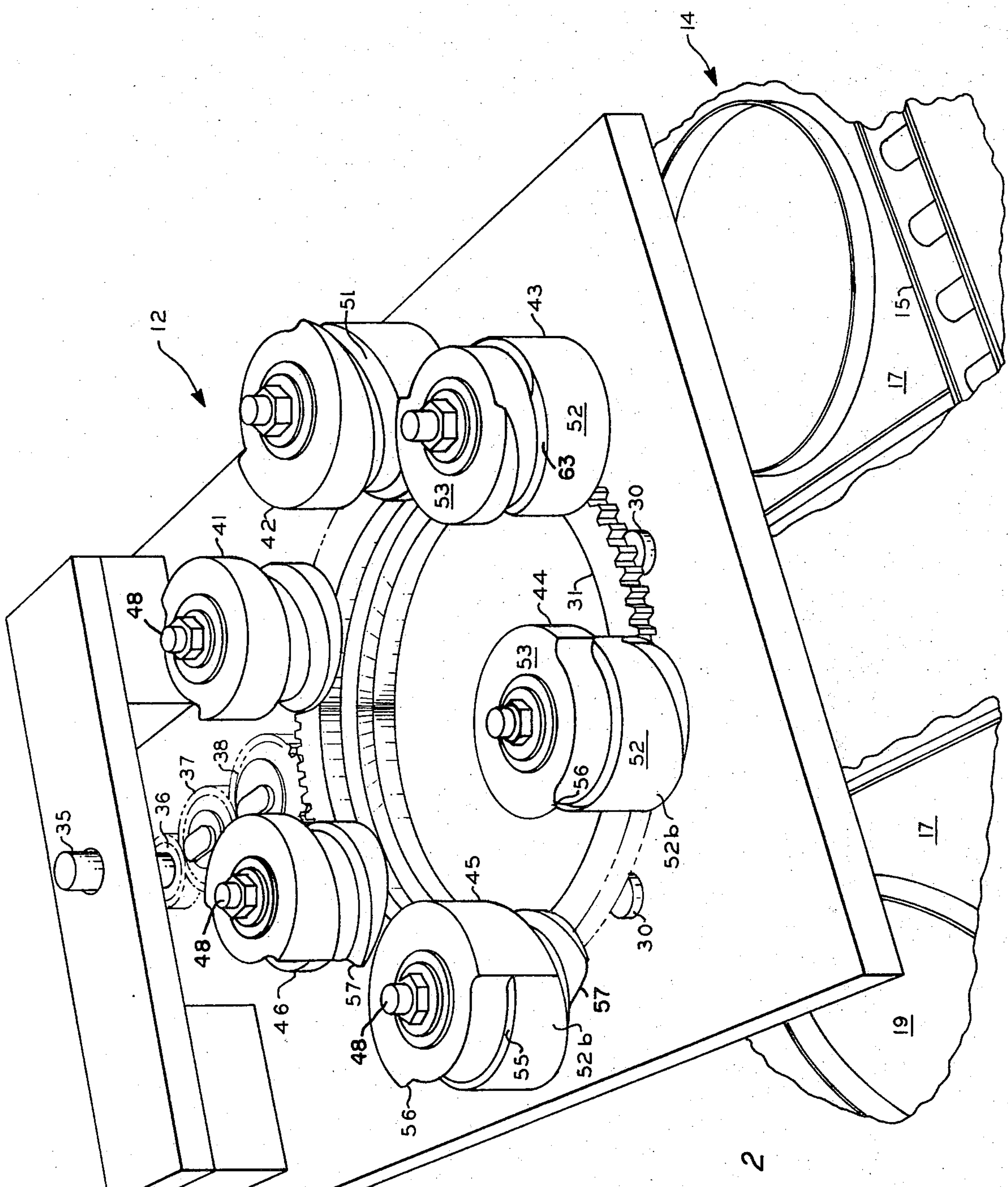
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FIG. 2

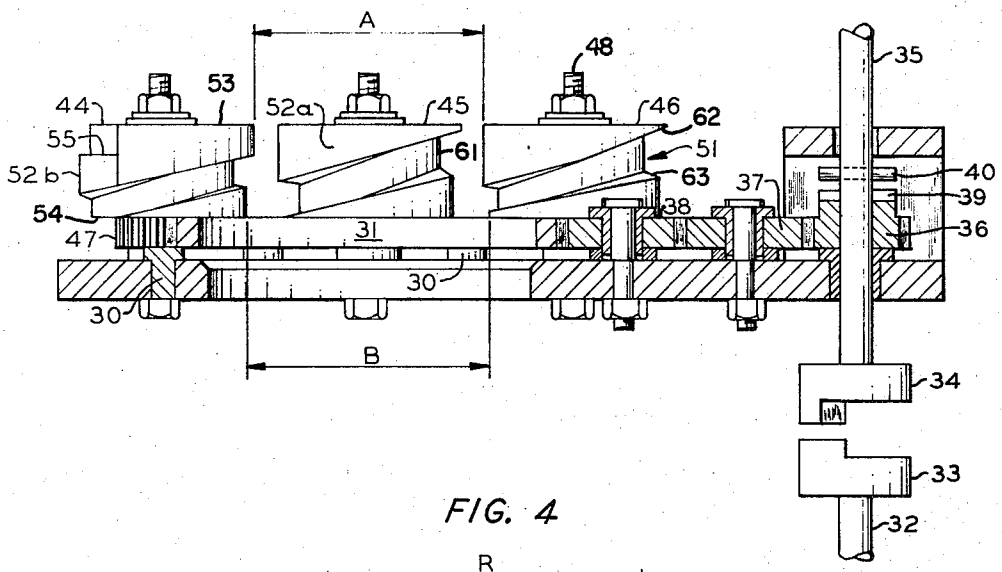

FIG. 4

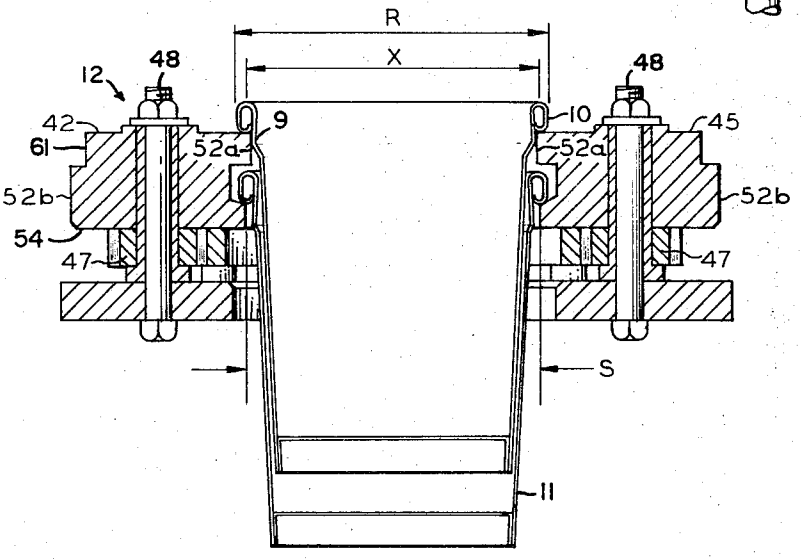

FIG. 5

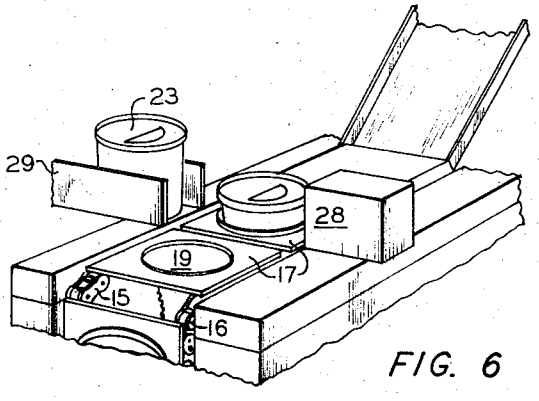

FIG. 6

SEPARATING AND DISPENSING MEANS FOR NESTED CONTAINERS

This invention relates to apparatus for denesting and dispensing containers.

It is known to utilize a plurality of cylindrical worm gears having a spiral groove and positioned in a circular array to separate and dispense frustoconical containers having a rolled rim from a nested stack thereof. In order to prevent the containers from being improperly dispensed, thereby possibly jamming the machine, it is necessary that the diameter of the gears be large enough to support the bottom surface of the rolled rim and to avoid the containers becoming canted. However, when the containers are provided with an outwardly projecting annular stacking shoulder slightly below the rim for stacking on the rim of the next lower container, interference between the stacking shoulder and the worm gears is frequently encountered, particularly for containers having a sidewall taper of less than about 3°. For containers having a rim diameter in the range of about 3 to about 8 inches and a sidewall taper of about 2 ½°, the separation (space) between the inside wall of the bottommost container and the outside wall of the next higher container is only about 0.01 inch, and is much less than this at the sidewall seam lap. Thus, pressure against the stacking shoulder can cause the inside surface of the lower container to rub against the outside surface of the higher container, creating a static buildup which can retard the free drop of the separated cup, resulting in a failure of the separated cup to be properly positioned in the conveying means.

Accordingly, it is an object of the present invention to provide new and improved apparatus for denesting and dispensing containers. Another object of the invention is to maintain containers in proper alignment in a dispensing mechanism. Yet another object of the invention is to minimize the rubbing of a container against the adjacent container in a dispensing mechanism. Other objects, aspects and advantages of the invention will be apparent from a study of the specification and the appended claims. In the drawings,

FIG. 1 is an elevational view of a filling and capping machine incorporating the present invention;

FIG. 2 is a perspective view of the container dispensing mechanism of FIG. 1;

FIG. 3 is a plan view of the container dispensing mechanism;

FIG. 4 is an elevational view in cross section taken along lines 4—4 in FIG. 3;

FIG. 5 is an elevational view in cross-section taken along line 5—5 in FIG. 3, with two containers added; and

FIG. 6 is a partial view in perspective of the mechanism for transferring filled and capped containers to an output chute.

Referring now to FIGS. 1 and 5, a nested stack of frustoconical containers 11 is supported by container dispensing mechanism 12 and four vertical guide rods 13 over an endless conveyor 14. Each container 11 has a generally circular horizontal cross section and is provided with an annular rolled rim 10 projecting outwardly and downwardly from the upper end or mouth thereof, and an outwardly projecting annular stacking shoulder 9 formed in the sidewall of the container a slight distance below the rim 10. The outside diameter of shoulder 9 is greater than the internal diameter of rim 10 so that the shoulder 9 of one container stacks on the top of the rim 10 of the next lower container. As shown in FIGS. 2 and 6, conveyor 14 comprises two parallel endless chains 15 and 16 and a plurality of container supporting members 17 carried by chains 15 and 16. Conveyor 14 is indexed in a stepwise manner by drive axle 18. During the dwell portion of each step or cycle, mechanism 12 separates the lowermost container 11 from the stack and drops the separated container into the opening 19 in the container supporting member 17 which is positioned in the container receiving station below dispensing mechanism 12. Filler valve 21 is actuated during the dwell portion of each cycle to introduce the material to be packaged into the container 11 positioned in the filling station of the conveyor. If desired, a container lift mechanism 22 can be employed to raise the container 11 to be filled so that the outlet end of filler valve 21 is inside the container and adjacent the bottom of the container before the filler valve 21 is actuated. Mechanism 22 can then gradually lower the container as it is being filled to provide uniform distribution of the product in the container.

Closures 23 are fed into chute 24, the lower end of which is positioned over conveyor 14, in such a manner that the leading edge of the lowermost closure is contacted by the leading edge of the rim of the container 11 as conveyor 14 indexes the container into the capping station. The forward motion of the container 11 draws the engaged closure 23 from chute 24, while the contact of the upper surface of the closure 23 with a horizontal plate 25 forces the closure 23 down onto the rim of the container 11. If desired, container marking mechanism 26 can be actuated during the dwell portion of each cycle to raise the container 11 and the associated closure 23 into firm contact with plate 25 to firmly position the closure 23 on the container 11 and to apply indicia to the bottom of the container.

During the dwell portion of each cycle, lift mechanism 27 is actuated to raise the filled and capped container which is in the transfer station of conveyor 14 to a position above conveyor 14 and then transfer mechanism 28 (FIG. 6) is actuated to move the elevated container laterally of conveyor 14 and onto an output chute 29.

In FIGS. 2 through 5, the container dispensing mechanism 12 is illustrated without its cover. A ring gear 31, having external gear teeth, is driven in the clockwise direction, as viewed in FIG. 3, by the drive system comprising drive shaft 32, clutch plates 33 and 34, clutch shaft 35, and gears 36, 37 and 38. Gear 31 is positioned on a plurality of bearings 30. Gear 36 has a slot 39 therein to receive pin 40 when clutch shaft 35 is in the down or engaged position. Pin 40, which extends through shaft 35 and is secured therein, engages gear 36 when shaft 35 is in the down position to rotate gear 36 responsive to the rotation of shaft 35. Shaft 35 can be latched in the up position by suitable means (not shown) to permit access to the container dispensing mechanism 12 without shutting down the remainder of the machine.

Each of the six feed worm gears 41–46 is provided with an interlocked gear 47 which engages ring gear 31. Feed worm gears 41–46 are rotated about their respective fixed shafts 48 in the counterclockwise direction, as viewed in FIG. 3, by the associated worm drive gear 47 and ring gear 31. The six worm gears 41–46 are po-

sitioned in a circular array which is coaxial with the stack of nested containers, with the cylindrical axis of each worm gear being parallel to the elongated, generally vertical, axis of the stack of containers. Each of the feed worm gears **41–46** is in the form of a cylinder having a groove **51** in the cylindrical surface **52** extending in a generally spiral form from the top **53** of the worm gear to the bottom **54** thereof. The vertical height between opposite sidewalls of groove **51** is greater than the vertical height of rim **10.** The groove **51** can be enlarged at the upper end thereof to provide an initial shoulder portion **55** which is at least generally perpendicular to the axis of the cylindrical surface **52.** Each of the worm gears **41–46** is positioned to simultaneously receive in the groove **51** thereof the rim **10** of the lowermost container **11** in the stack. Immediately prior to the discharge of the lowermost container **11** by the container dispensing mechanism **12,** the rim **10** of the next higher container is supported by the top surface of each of worm gears **41–46.** At the moment or shortly thereafter that the lowermost container **11** is discharged by the mechanism **12,** the worm gears **41–46** have rotated to the position where the initial shoulder portions **55** are under the rim of the next higher container and the rim of the second container is no longer supported by the upper surface **53,** thereby permitting the entire stack of nested containers to drop until the rim **10** of the new lowermost container **11** rests on initial shoulder portion **55** of each worm gear. The distance between initial shoulder portion **55** and the top surface **53** is slightly greater than the vertical height of the rim **10,** but is less than the container stacking distance, i.e., the distance from the bottom of the rim of one container to the bottom of the rim of the next higher container. Thus, on the continued rotation of worm gears **41–46,** leading point **56** of each of the worm gears **41–46** enters the space between the top of the rim **10** of the lowermost container **11** and the bottom of the rim **10** of the next higher container to support the second container on the top surface **53** while the descending path of groove **51** forces the lowermost container to separate from the second container and move downwardly. When the worm gears **41–46** have rotated to the point where the trailing edge **57** moves out from under the rim **10** of the lowermost container **11,** the lowermost container drops into the pocket **19** of the container supporting member **17** which is in the container receiving station of conveyor **14.**

Each groove **51** has an inner wall or bottom **61** generally parallel to the cylindrical surface **52** of the respective worm gears **41–46,** as well as an upper sidewall **62** and a lower sidewall **63.** The vertical height from the bottom sidewall **63** to the top sidewall **62** is slightly larger than the vertical height of the rim **10** of container **11.** The horizontal distance from the inner wall **61** of one of the worm gears **41–46** to the inner wall **61** of the opposite worm gears, i.e., the diameter of the smallest circle which is coaxial with ring gear **31** and tangent to each inner wall **61,** is slightly greater than the maximum horizontal diameter R of rim **10.**

In accordance with the present invention the cylindrical surface **52** is formed with a top section **52*a*** and a bottom section **52*b***, with the horizontal diameter of top section **52*a*** being slightly larger than the horizontal diameter of bottom section **52*b***. The top section **52*a*** is horizontally adjacent the stacking shoulder **9** of the next to the lowermost container **11,** i.e., the container which is supported by the upper surface **53** of each of worm gears **41–46,** while the bottom section **52*b*** is horizontally adjacent the stacking shoulder **9** of the lowermost container **11.** The stack of containers **11** is supported by the rolled rim of the next to the lowermost container resting on the top surface **53** of each worm gear **41–46.** This contact of surfaces **53** and the lowermost portions of rolled rim **10** of the next to the lowermost container occurs in a circular line. The diameter of this circular line is designated as X in FIG. **5.** The horizontal distance from the vertical surface of top section **52*a*** of one of the worm gears to the vertical surface of top section **52*a*** of the opposite worm gear, i.e., the diameter A of the smallest circle which is coaxial with ring gear **31** and tangent to the vertical surface of the top section **52*a*** of each of the worm gears, has to be smaller than the diameter X in order for the stack of containers **11** to rest stably on the top surfaces **53** of the worm gears. If the diameter A is increased to approach too closely to the diameter X, it will be greater than the maximum outside diameter S of the stacking shoulder **9** to the extent where the container **11** can move to one side enough for the opposite side support point of rim **10** to come off the surface **53,** causing that side of the container to drop slightly and jam in the worm gears. On the other hand, if the diameter A is decreased to approach the outside diameter of the container sidewall horizontally adjacent the lowermost point of rim **10,** the diameter A will be smaller than the maximum outside diameter S of shoulder **9** to the extent that the container **11** is prevented from falling properly into the starting land or initial shoulder portion **55.** Accordingly, it is desirable that the diameter A be only slightly smaller than diameter S to the extent that the lower curved surface of shoulder **9** permits the shoulder **9** of the next to the lowermost container **11** to be readily cammed into the diameter A while the cylindrical surfaces **52*a*** hold the container squarely and firmly.

However, if this desired relationship between diameters A and S were employed with worm gears having a single uniform cylindrical diameter, excessive pressure would be applied to the stacking shoulder **9** of the lowermost container. The partially dispensed lowermost container would have its sidewall pushed in against the sidewall of the next higher container, causing the inside surface of the lowermost container to rub or bind against the outside surface of the next to the lowermost container. This rubbing action results in a buildup of static electricity, which retards the free fall of the lowermost container at the time of disengagement with the worm gears. The pressure can also pull the lowermost container slightly out of vertical alignment and against one side of the succeeding container, causing the lowermost container to drop at an angle, thereby increasing the possibility of failure of the dispensed container to seat properly in the conveyor **14.**

The present invention achieves the desired relationship of the diameters S and A for the next to the lowermost container while avoiding the problem of pressure against the lowermost container by making the diameter B of the smallest horizontal circle concentric with the circular array of worm gears **41–46** and tangent to the cylindrical surface of bottom section **52*b*** of each worm gear **41–46** greater than the diameter S and smaller than the diameter X. In the practice of the present invention, the diameter A will be from about 1 to

about 40 mils, and preferably from about 3 to about 30 mils, smaller than diameter S, while diameter B will be from about 1 to about 40 mils, preferably from about 5 to about 30 mils, larger than diameter S. Although both of diameters A and B will be smaller than diameter X, the diameter B can approach diameter X more closely than can diameter A because the next to the lowermost container is held firmly by the upper sections **52***a* and provides limitations to the degree of lateral motion of the lowermost container **11**. The absence of pressure against the stacking shoulder **9** of the lowermost container provides the maximum clearance between the lowermost container and the next higher container for the passage of air into the lowermost container to relieve the vacuum created as the two containers are separated.

Sections **52***a* and **52***b* can be provided by utilizing two separate cylinders of different diameter which are coaxially secured together or sections **52***a* and **52***b* can be a single cylinder having two portions of differing diameters. Sections **52***a* and **52***b* can be divided by a horizontal line, or by a vertical line extending from one flight of groove **51** to the adjacent flight thereof as shown in the drawings. Section **52***b* can be formed as a shallow groove spaced from groove **51** and horizontally adjacent the shoulder **9** as the container **11** moves downward in the worm gears **41–46**. It is desirable that an even number, preferably at least four, and more preferably six, feed worm gears be employed so that the worm gears would be in direct opposition to each other.

Reasonable variations and modifications are possible within the scope of the foregoing disclosure and the appended claims to the invention.

That which is claimed is:

1. In a dispensing mechanism for dispensing frustoconical containers from a stack thereof, each of said containers having a rolled rim and an outwardly directed stacking shoulder formed in the sidewall of the containers a slight distance below the rim thereof, comprising a plurality of feed cylinders, each of said feed cylinders having a groove in the cylindrical surface thereof extending in a generally spiral form from the top of said cylindrical surface to the bottom of said cylindrical surface, means for positioning said plurality of feed cylinders in a circular array which is coaxial with said stack of containers with the cylindrical axes of said feed cylinders being parallel to the elongated axis of said stack of containers, with each of said plurality of feed cylinders being positioned to simultaneously receive in the groove thereof the rim of a container in said stack, and means for simultaneously rotating said feed cylinders to dispense a rimmed container from said stack, the improvement comprising the cylindrical surface of each of said feed cylinders having a top cylindrical section which is horizontally adjacent the stacking shoulder of the next to the lowermost container in said stack and a bottom cylindrical section which is horizontally adjacent the stacking shoulder of the lowermost container in said stack, the diameter of said top cylindrical section being greater than the diameter of said bottom cylindrical section.

2. Apparatus in accordance with claim **1** wherein the diameter of the smaller circle which is coaxial with said circular array and is tangent to the cylindrical surface of the top cylindrical section of each of said feed cylinders is smaller than the maximum outside diameter of said stacking shoulder by a first amount which permits the stacking shoulder to be cammed into the smaller diameter but which also permits the container to be firmly held in the proper vertical alignment.

3. Apparatus in accordance with claim **2** wherein the diameter of the smaller circle which is coaxial with said circular array and is tangent to the cylindrical surface of the bottom cylindrical section of each of said feed cylinders is larger than the maximum outside diameter of said stacking shoulder by a second amount but less than the diameter of the lowermost portion of said rolled rim.

4. Apparatus in accordance with claim **3** wherein said first amount is in the range of about 1 to about 40 mils and wherein said second amount is in the range of about 1 to about 40 mils.

5. Apparatus in accordance with claim **1** wherein said top cylindrical sections apply pressure against the stacking shoulder of the next to the lowermost container in said stack and said bottom cylindrical sections do not apply pressure against the stacking shoulder of the lowermost container in said stack.

6. Apparatus in accordance with claim **1** wherein the groove of each feed cylinder is provided with an initial portion having a substantially horizontal land to receive the next to the lowermost container as it becomes the lowermost container, and wherein the top cylindrical section and said bottom cylindrical section of each of said feed cylinders are separated by a vertical line extending downwardly from the leading edge of said initial portion of said groove to the next lower flight of said groove.

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