United States Patent

Sterling

[15] 3,635,325

[45] Jan. 18, 1972

[54] CLOSURE-HANDLING APPARATUS

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[73] Assignee: **Pneumatic Scale Corporation,** Quincy, Mass.

[22] Filed: **Nov. 24, 1969**

[21] Appl. No.: **879,334**

[52] **U.S. Cl.** **198/33**

[51] **Int. Cl.** **B65g 47/24**

[58] **Field of Search** ..... 198/33 AA; 221/160–161, 171, 173

[56] **References Cited**

UNITED STATES PATENTS

3,012,651	12/1961	Hawkes	198/33 AA
3,150,762	9/1964	Tricinci	198/33 AA
3,206,063	9/1965	Ricard	221/173

Primary Examiner—Edward A. Sroka

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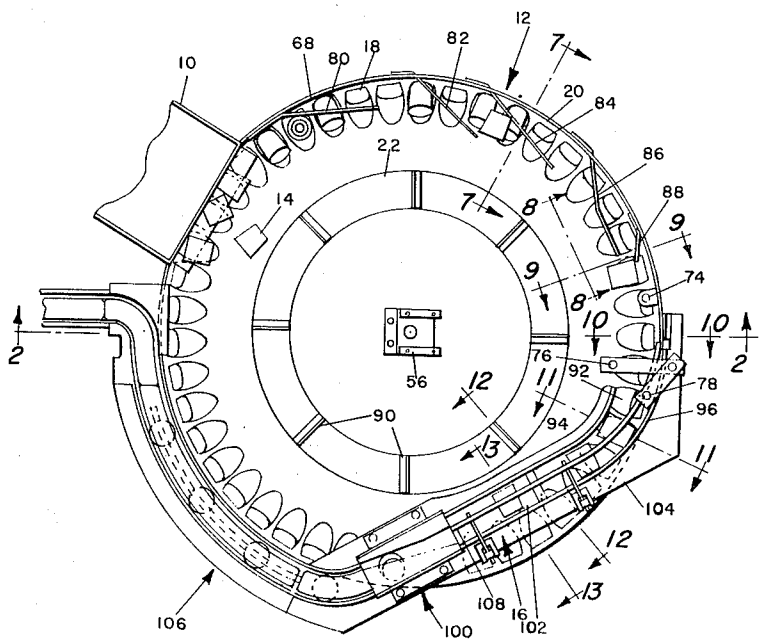
[57] **ABSTRACT**

The closure-handling apparatus is arranged to effect orientation of relatively large tapered closures heavier at the smaller closed end by providing moving pockets shaped to conform to the shape of the closures and into which a majority of the closures fall by gravity to assume an oriented position, provision being made for manipulating incorrectly positioned closures carried by the moving pockets into an oriented position in the pockets.

10 Claims, 14 Drawing Figures



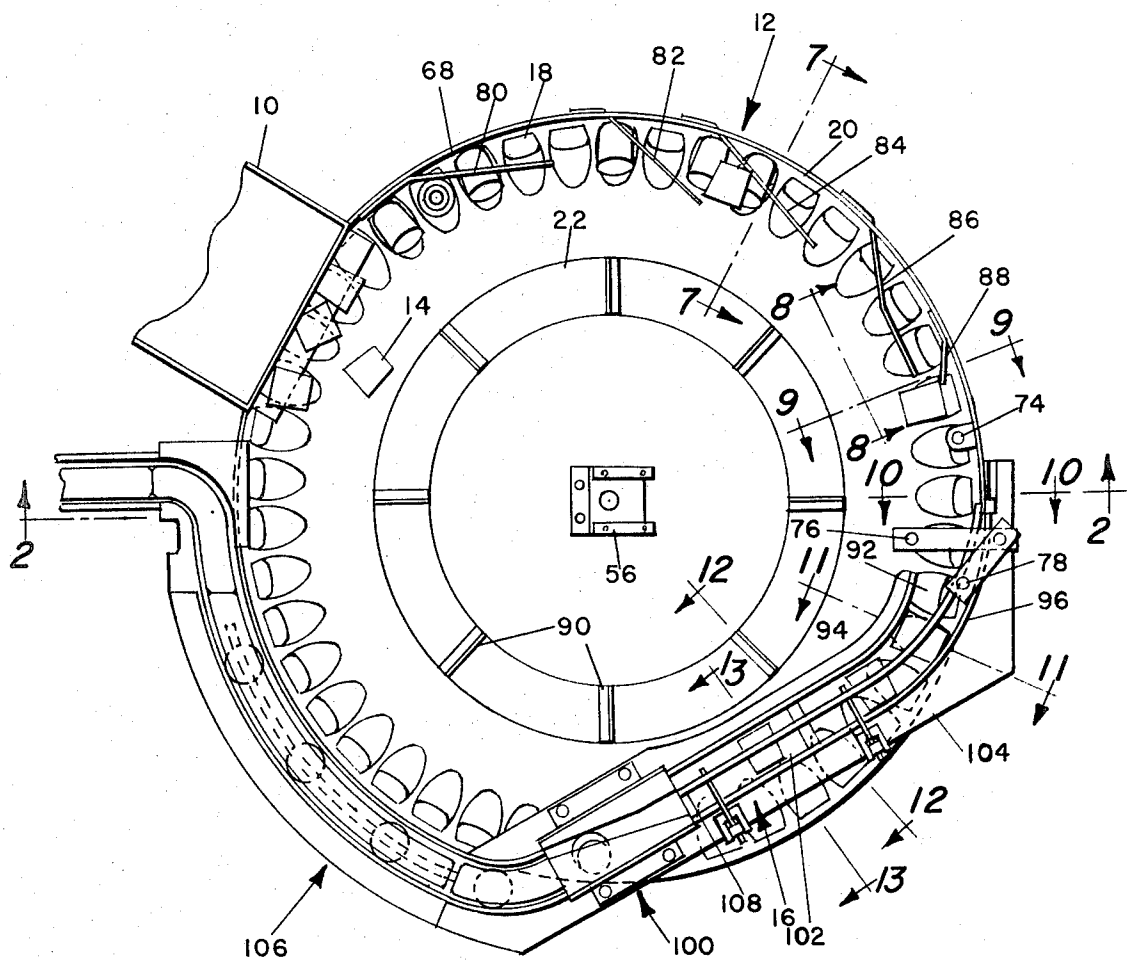


Fig. 1

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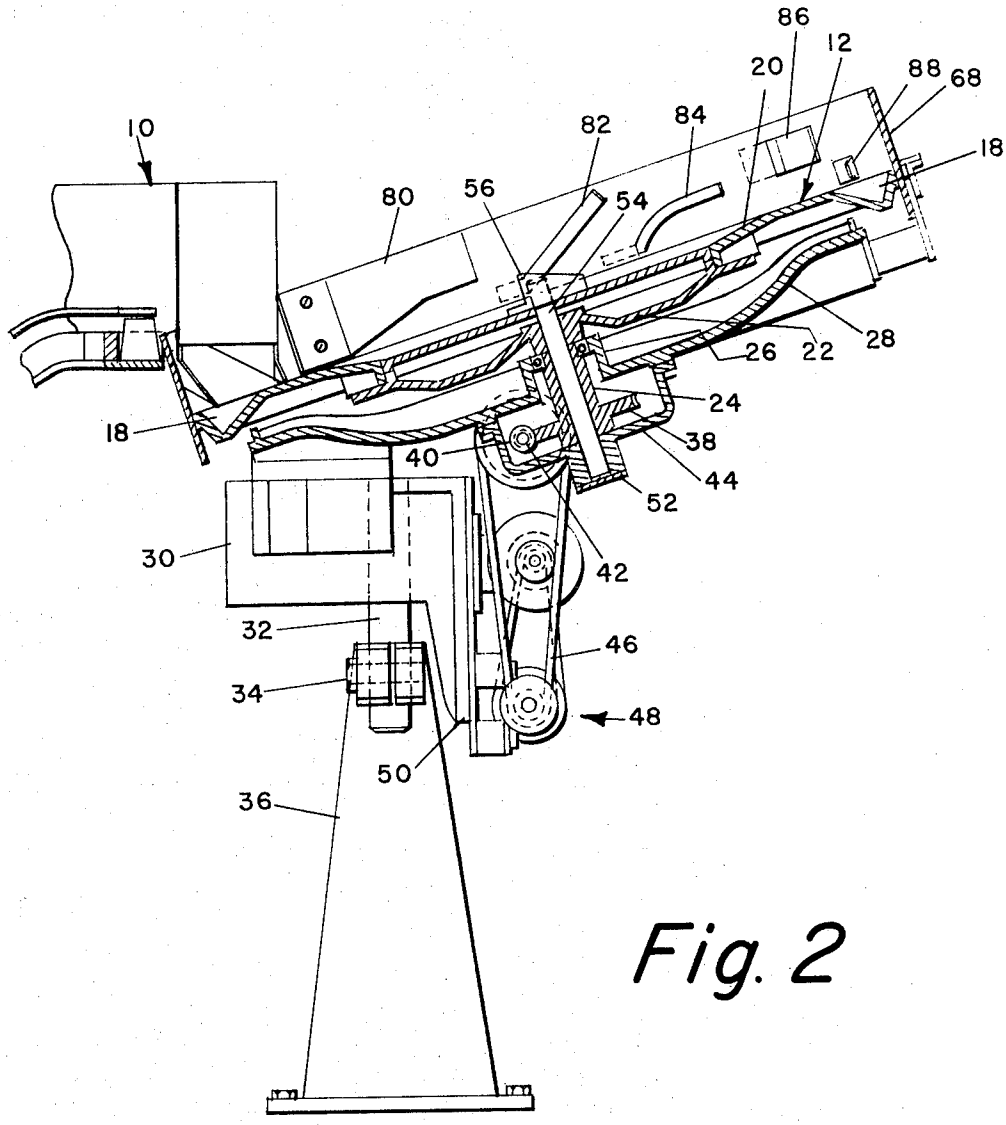

Fig. 2

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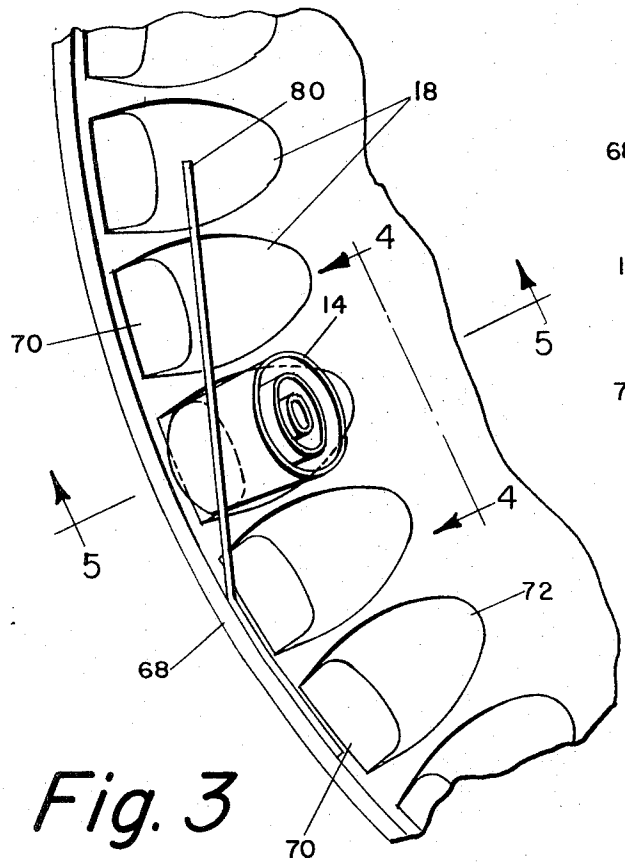

Fig. 3

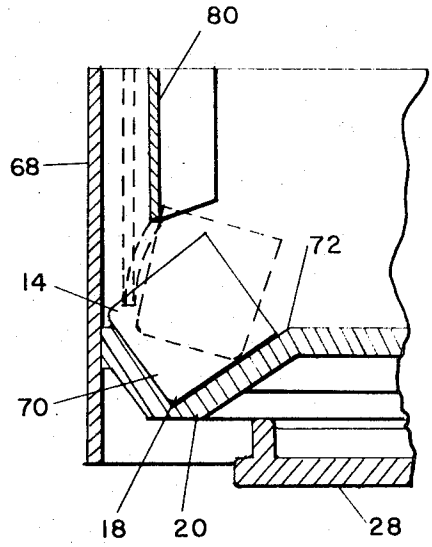

Fig. 5

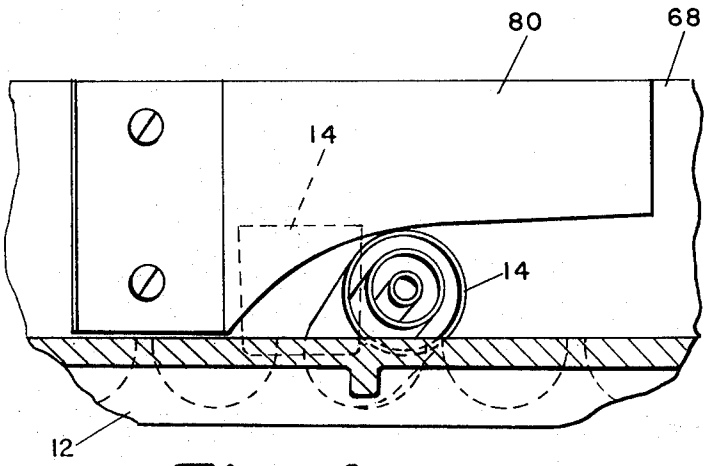

Fig. 4

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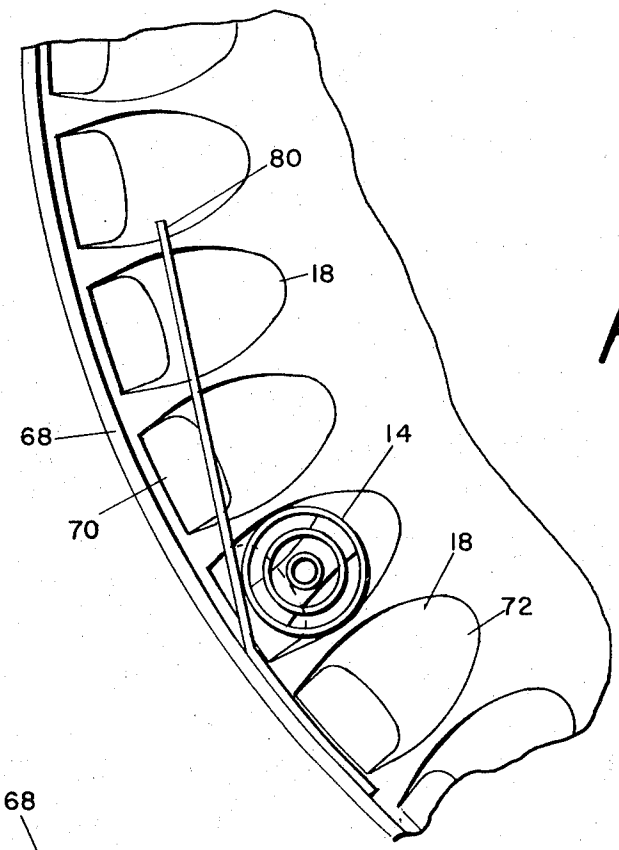

Fig. 6

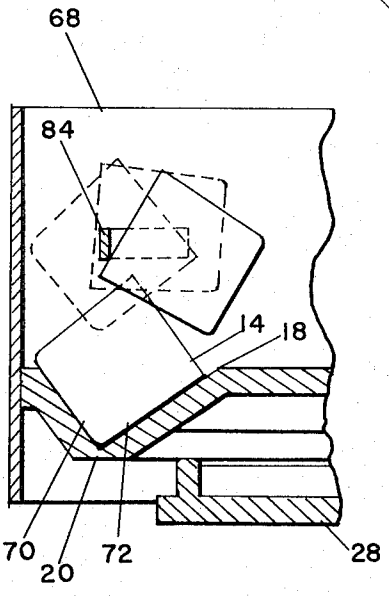

Fig. 7

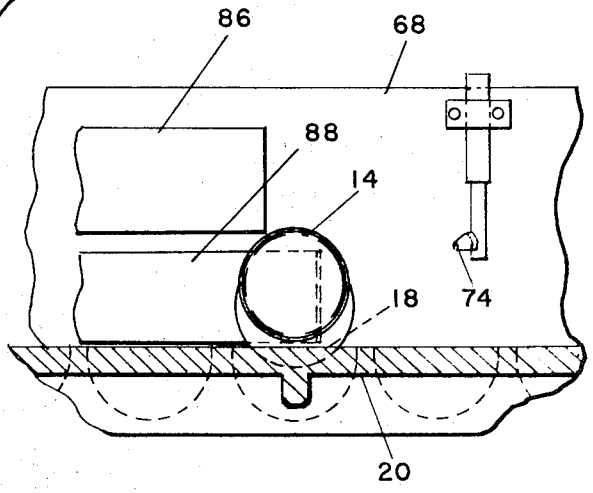

Fig. 8

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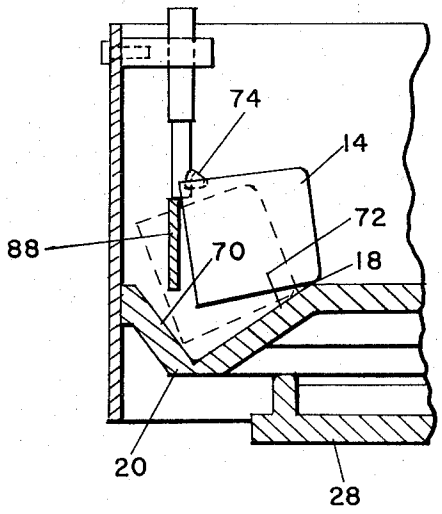

Fig. 9

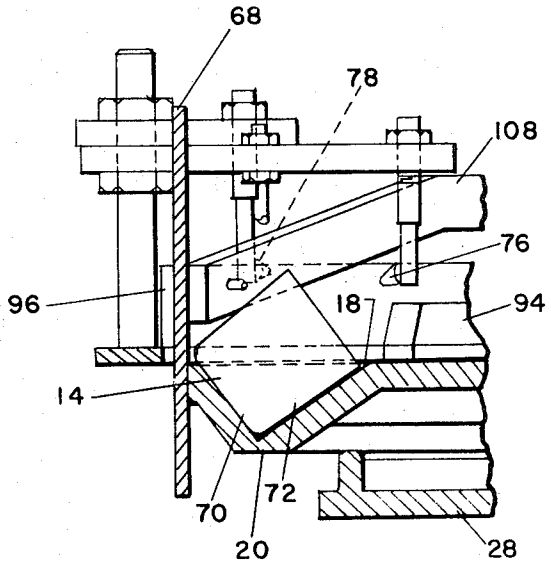

Fig. 10

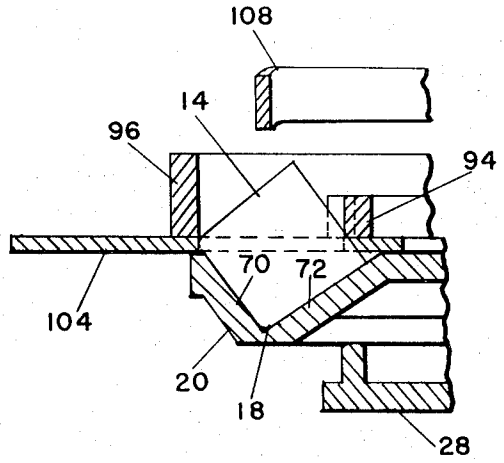

Fig. 11

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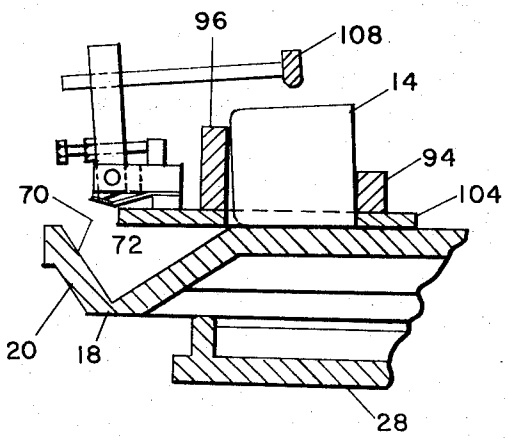
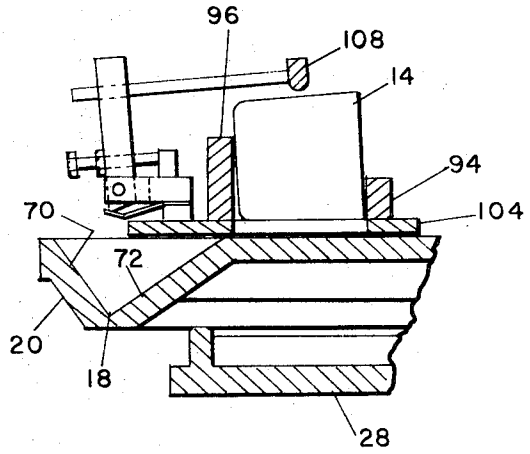


Fig. 12

Fig. 13



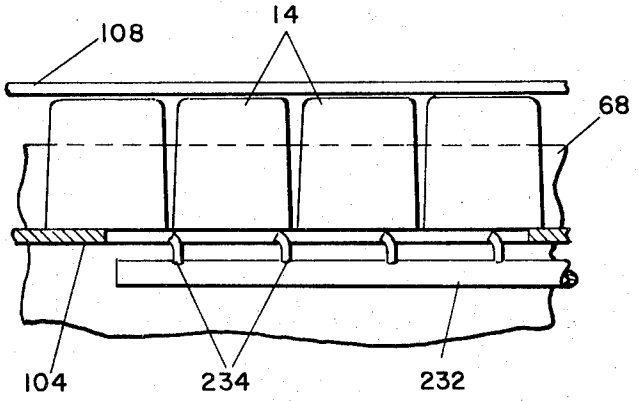


Fig. 14

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CLOSURE-HANDLING APPARATUS

BACKGROUND OF THE INVENTION

1. **Field of the Invention**

The present invention relates to closure-handling and orienting apparatus adapted to receive a supply of randomly arranged closures and to orient the same prior to depositing the oriented closures into a delivery chute from which the closures are withdrawn for application to containers.

2. **Description of the Prior Art**

Prior closure handling apparatus of the same general type is exemplified in U.S. Pat. No 2,715,978 issued to Walter S. Sterling and assigned to the present assignee. Such prior apparatus takes the form of an inclined rotary disk onto which randomly or haphazardly arranged closures are deposited from a bulk supply thereof. In operation, the closures carried up the rotary inclined disk are guided to be received between the beveled edge of a relatively small disk rotated in a substantially horizontal plane and a cooperating rail. Those closures which assume an oriented position between the beveled edge of the disk and the rail are enabled to maintain a position of equilibrium between the rail and the disk and are deposited into a chute for delivery to a closure applying machine. Those closures which assume a position other than an oriented position between the disk and the rail are overbalanced to fall onto the lower end of the inclined rotary disk to be again carried up and guided between the horizontal disk and the rail.

In such prior apparatus, the closures are arranged to be oriented in a natural or inherent position of equilibrium which may vary with different sizes and shapes of closures, and which may also vary in their distribution of weight, that is, one end may be heavier than the other, for example. In practice, the disk and rail device of the prior art effects removal from a group of randomly arranged closures only those closures which inherently assume an oriented position, those closures assuming a position other than a desired position of orientation being rejected to be returned to the lower end of the the inclined disk where they join with and are jostled by other closures to change their positions and to be again carried up the incline until they assume a desired position of orientation. In operation, it has been found that a great majority of the closures tend to assume a natural and substantially uniform position of rest or equilibrium in the desired position of orientation so that the efficiency of the apparatus is surprisingly high. However, relatively large closures of different shapes and weights cannot be conveniently handle on the prior disk and rail type of apparatus in its present form.

SUMMARY OF THE INVENTION

The present invention contemplates container handling apparatus particularly adapted for handling and orienting relatively large tapered closures which are heavier at their narrower closed ends that at their open ends and which cannot be efficiently handled in the disk and rail type of orienting or sorting mechanism because of their larger size and because they do not assume an at-rest position suited to handling in this manner. In practice, the majority of the relatively large tapered closures which the present apparatus is adapted to handled tend to assume an at-rest position lying on their sides so that they tend to roll on the inclined rotary disk. In accordance with the present invention, the apparatus provides a series of spaced, radially arranged pockets adjacent the marginal edge or periphery of the inclined rotary disk into which the closures will roll and be carried upwardly with the disk. In operation, when the tapered closure in the path of a pocket at the lower end of the inclined disk rests with its smaller and heavier closed end facing facing outwardly it will be properly seated in the pocket in an oriented position to be guided into a chute at the upper end of the disk. Those closures which rest in a position other than an oriented position and which are picked up by a pocket are arranged to be changed in position to assume an oriented position in the pocket during the movement of the closure on the inclined disk.

Accordingly, the present invention has for an object to provide novel and improved closure handling apparatus particularly adapted for handling relatively large tapered closures which are heavier at the smaller closed end in an efficient and superior manner.

The invention has for another object to provide novel and improved closure handling apparatus of the character specified characterized by provision for orienting the closures and for depositing the oriented closures into a chute.

With these general objects in view and such others as may hereinafter appear, the invention consists in the closure-handling apparatus as hereinafter described and particularly defined in the claims at the end of this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings illustrating the preferred embodiment of the invention:

FIG. 1 is a plan view of closure handling apparatus embodying the present invention;

FIG. 2 is a cross-sectional view taken on the line—2 of Fig. 1;

FIG. 3 is a plan view detail of the pockets showing the first manipulating bar;

FIG. 4 is a detail view in side elevation of a manipulating bar as seen from the line 4—4 of Fig. 3;

FIG. 5 is a cross-sectional detail view taken on the line 5—5 of FIG. 3 showing a closure in an oriented position in its pocket;

FIG. 6 is a view similar to FIG. 3 but showing a closure standing upright in the pocket with the closed end down;

FIG. 7 is a cross-sectional view taken on the line 7—7 of Fig. 1 showing one of the manipulating bars arranged to separate nested closures in a pocket;

FIG. 8 is a detail view in side elevation as seen from the line 8—8 of FIG. 1 showing a bar for dislodging a reversely positioned jammed closure and an air jet for removing the same from its pocket;

FIG. 9 is a cross-sectional view of the condition shown in FIG. 8 with the section taken on the line 9—9 of FIG. 1;

FIG. 10 is a side elevation partly in cross section as seen from the line 10—10 of FIG. 1;

FIG. 11 is a cross-sectional view of the chute showing a closure in its pocket at the entrance to the chute;

FIG. 12 is a similar view taken on the line 12—12 of FIG. 1 showing the closure removed from its pocket and engaged with the upper surface of the carrier:

FIG. 13 is a view similar to FIG. 12 but showing the closure lifted off the carrier and onto the bottom plate of the chute; and

FIG. 14 is a side elevation of the chute partly in cross section, as seen from the line 14—14 of FIG. 1, showing a portion of a manifold having a plurality of spaced air jets disposed beneath the chute.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and particularly to FIGS. 1 and 2, the closure handling machine therein shown comprises, in general, a hopper 10 in which a bulk supply of closures may be stored, and a rotary carrier indicated generally at 12 arranged at an inclined plane and which is adapted to carry upwardly closures 14 deposited by the hopper at the lower end of the carrier. Those closure assuming a desired position or orientation in their pockets are deposited into the open end of a chute 16 disposed at the upper end of the carrier. As herein shown, the rotary carrier 12 is provided with a plurality of closely spaced and radially arranged pockets 18 adjacent the marginal edge thereof, each pocket being shaped to receive and retain a closure and to carry the closure upwardly as described.

The particular closure 14 which the present apparatus is adapted to handle comprises a relatively large tapered closure open at its larger end and closed at its narrower end, the

closed end being heavier than the open end. The closed end is also rounded so as to render it difficult to stand upright, particularly on an inclined plane. In practice, each pocket **18** is shaped in cross section to conform substantially to the shape of a closure disposed on its side and with its narrower and heavier end directed radially outwardly and downwardly, the open end facing inwardly and upwardly as illustrated in FIG. **3**.

The rotary carrier **12** includes an annular member **20** in which the pockets **18** are formed and which is secured to a flange **22** keyed to a sleeve **24** rotatably mounted in a bearing **26** formed in a supporting disk **28**. The disk **28** is attached to a bracket **30**, the latter being secured to the upper end of a shaft **32** which in turn may be adjustably supported in a clamp **34** formed in a supporting column **36**. The sleeve **24** is formed integrally with a worm wheel **38** arranged to mesh with a worm wheel gear **40** fast on a shaft **42** journaled in a gear box **44** secured to the underside of the supporting disk **28**. The shaft **42** is connected by a belt and pulley drive **46** to a variable speed motor unit **48** adjustably secured to a depending portion **50** of the bracket **30**. The gear box **44** is provided with a hub **52** arranged to support a central stationary shaft **54** extending upwardly through the sleeve **24**.

As shown in FIG. **2**, the upper end of the stationary shaft **54** is arranged to support a bracket **56** forming part of the conventional sorting or orienting unit. In the present apparatus, the sorting unit is removed and a cover member **58** is fitted over the stationary bracket **56** as shown. An annular cover plate **60**, also secured to the stationary unit, is provided, the outside diameter of which extends into closely spaced relation with the inside diameter of the annular member **20** of the carrier. The supporting disk **28** is provided with an upstanding retaining band **68** surrounding and extending above the upper surface of the carrier **12** for confining the closures on the carrier.

The illustrated supply hopper **10** is supported adjacent the lower end of the carrier **12** and is provided with an opening through which the closures may flow by gravity onto the carrier. Any type of hopper containing a bulk supply of randomly arranged closures may be employed including those wherein provision is made for controlling the release of closures onto the carrier such as is illustrated and described in the U.S. Pat. to Walter S. Sterling, Nos. 3,079,042; 3,164,291 ; and 3,164,292.

In operation, the majority of the herein described closures **14** deposited on the lower end of the inclined carrier **12** lie or fall on their side and as the continuously moving carrier **12** carries the closures along therewith the closures tend to roll or gravitate into the radially arranged pockets **18**. The preferred position of orientation comprises the position shown in FIG. **5** wherein the narrower and heavier end of the closure **14** seats itself against the angular end wall **70** of the pocket and the side of the closure rests against the upwardly sloped bottom wall **72** thereof with the wider or open end of the closure facing toward the center of the disk. Since the closure is tapered with the closed end smaller in diameter than the open end, the pocket **18** is likewise tapered to conform to that portion of the oriented closure received in the pocket. Thus, if the closure is improperly carried by the pocket, it will extend above the height of an oriented closure. For example, if the closure is carried in a radial position but with the closed end facing the center of the disk, the wider diameter of the closure rests on the narrower portion of the pocket to elevate the closure above the level assumed by an oriented closure. Likewise, if a closure is standing on end in the pocket, it also will extend upwardly far above a point assumed by an oriented closure.

In accordance with a feature of the present invention, when a closure falls into a pocket **18** in a position other than the desired position of orientation, as shown in FIG. **5**, provision is made for turning or otherwise manipulating such closure to cause it to assume an oriented position or to reject the closure. In the illustrated embodiment of the invention a plurality of stationary and angularly extended manipulating bars are provided for engaging those closures improperly positioned in the pockets as herein shown, the manipulating bars extend from and are attached to the retaining band **68** and include bars **80**, **82**, **84**, **86** and **88**. In practice, a closure which is properly seated in an oriented position in its pocket will not be engaged by any of the manipulating bars since the highest portion thereof will be below the lower edge of such bars as illustrated in FIG. **5**. A closure which stands upright in its pocket, as illustrated in FIG. **6**, extends above the lower edge of the first bar **80**. Thus, in operation, a closure in such upright position with its closed and heavier end down will be engaged by the bar **80** and caused to lie down on its side with the open end facing toward the center of the disk or carrier **12**, the closure thus assuming an oriented position. In some instances the closure may require a second turning operation to cause it to assume an oriented position which may be accomplished by the second bar **82**. Also a closure may be carried past the bar **80** and then roll into a pocket to be turned into and oriented position by one or more of the succeeding bars. The bar **80** is made of considerable height to prevent a closure carried one on top of the other from rolling over and entering behind the bar. A closure standing upright in the pocket with its open and wider end facing down may also be oriented by engagement with one or more bars during the advance of the closures on the carrier, or if such closure fails to be oriented it will be rejected to roll back and join the group at the lower end of the carrier to be recirculated. In other words, it is possible that any of the closures carried by the pockets in other than an oriented position may be changed in position by engagement with one or more of the manipulating bars until the closure assumes a position with its heavier end directed downwardly and outwardly whereupon it will slide into a seated position in the pocket. It will be understood that those closures failing to be oriented will be returned to the group at the lower end of the inclined carrier to be again carried upwardly and deposited into a pocket as described.

As illustrated in FIG. **7**, the third bar **84** is designed to urge outwardly a closure which may be nested within an oriented closure. The fourth bar **86** is designed for the same purpose, that is, to effect complete separation of the nested closure from the oriented closure in the event that the same was not completely separated by the bar **84**.

Another position which a closure may assume in the pocket includes a backwards position, that is, a radial position with the wider end facing outwardly. Ordinarily, a closure in such position may be manipulated by the bars to orient or reject the same. However, it sometimes happens that a flexible closure may be jammed into the narrow end of the pocket. Provision is made for dislodging and rejecting such closure when this occurs, and as herein shown, the fifth bar **88** comprises a deflector positioned to engage and force a closure out of its jammed position in the pocket. Immediately thereafter a continuously operated air jet **74** directs a stream of air into the open end of the closure to blow it out of its pocket. It will be understood that the stream of air from The jet **74** is directed above a point which would affect a properly positioned or oriented closure.

These closures which are rejected at the upper half of the carrier **12** are retained by radially arranged flights **90** carried adjacent the inner marginal edge of the annular member **20** of the carrier and which release the closures by gravity as they rotate toward the lower half of the carrier. Such control of the release of the rejected closures serves to distribute the rejects into an area preceding the flow from the feed hopper so as to afford smooth operation.

The oriented closures which arrive at the upper end on the inclined carrier are transferred from their pockets **18** into the mouth or open end **92** of the chute **16**. Immediately prior to entering the chute, a second air jet **76** is arranged to blow into the open ends of successive oriented closures to assure that they are fully seated in their pockets. This is necessary to position the open end of a closure so that it will not become obstructed by the inner rail **94** of the chute as the closure is advanced into the chute. As herein illustrated, the chute is sup-

ported on a plate 104 attached to the underlying frame members 28, 30, the plate forming the bottom wall of the chute. The opposing rail 96 is curved at the entrance to the chute to conform to the curvature of the carrier, and immediately departs from such curvature to follow a substantially straight path 102 directed angularly across a portion of the face of the carrier. During the transition from a curved to a straight path the rail 96 in immediately departs engagement with the closed end of the closure will have a camming effect to urge the closure radially inwardly and upwardly out of the pocket onto the upper surface of the carrier. A third air jet 78 is disposed to assist advance of the closure along the chute at a point where the closure leaves its pocket and is required to ride up a small rise from the upper level of the carrier to the upper level of the bottom wall 98 of the chute. A top rail 108 is also provided to prevent upward displacement of the closures, a portion of the top rail being mounted to rock into and out of operative position as shown in FIG. 12. The chute is shaped, at an intermediate portion 100 thereof, to effect turning of the closures through 90 ° so as to present the closures in an upright position. After the turning operation, the chute is shaped to follow a circular path concentric with the carrier, as indicated at 106, 106, which terminates at a point substantially in line with the center line of the carrier, where it is curved through 90 ° to follow a radial direction to a point of withdrawal not shown. In practice, air jets may be used in any portion of the chute where necessary to facilitate passage of closures therethrough. As illustrated in FIG. 14, a manifold 232 connected to a source of compressed air extends along the underside of the chute and is provided with a plurality of spaced air jets 234 directed to advance the closures through the chute.

From the above description it will be seen that the present apparatus is adapted to handle relatively large, slightly tapered closures heavier at their closed and narrower ends in a manner such as to accept the closures in a desired position of orientation or to manipulate the closures into an oriented position. In operation, a majority of the randomly arranged closures deposited into the apparatus will be caused to assume an oriented position and will be deposited into the mouth of the supply chute. The present apparatus is adapted to handle closures measuring about 2¼inches high and about 2¼inches in diameter at the open end. In practice, it was found that about 80 percent of the closures delivered to the machine were presented in or manipulated into an oriented position, those closures rejected being returned to the group to be again carried upwardly on the carrier and engaged by a pocket.

As above described, the present apparatus comprises an adaptation of and improvement on the closure-handling apparatus illustrated and described in U.S. Pat. No. 2,715,978. In practice, the present apparatus may also be used for the smaller size conventional closures by replacing the carrier 12 with a conventional carrier and by adding the orienting or sorting unit to the bracket 56 so that the same machine may be adapted for both types of closures by interchangeably replacing the parts required for each type of closure.

Having thus described the invention, what is claimed is;

1. Closure-handling apparatus adapted to handle slightly tapered closures open at their larger ends and wherein the closed end is heavier than the open end comprising, in combination, a rotary carrier mounted to rotate in an inclined plane, means for depositing randomly arranged closures into the lower end of said carrier, said carrier having radially arranged pockets directed angularly downwardly and outwardly with respect to the face of the carrier, said pockets shaped to receive the closures with the smaller and heavier end bearing against the outer end of the pocket, a chute having an entrance opening at the upper end of said carrier adapted to receive the oriented closures, those closures carried by a pocket and assuming a position other than an oriented position having portions thereof extending above a position assumed by an oriented closure, and means extended into the path of the unoriented closures arranged to engage and turn the latter to a position such that the heavier end will fall by gravity against the outer end of the angularly arranged pockets in an oriented position.

2. Closure-handling apparatus as defined in claim 1 wherein the engaging means comprises at least one stationary bar extended into the path of a closure carried by a pocket in other than an oriented position.

3. Closure-handling apparatus as defined in claim 1, wherein the engaging means includes a plurality of stationary bars extended angularly in the path of a closure carried by a pocket in other than an oriented position, and wherein at least one of said bars is adapted to engage and remove a closure nested in an oriented closure.

4. Closure-handling apparatus adapted to handle slightly tapered closures open at their larger ends, and wherein the closed end is heavier that the open end, comprising, in combination, a rotary carrier mounted to rotate in an inclined plane, means for depositing randomly arranged closures to the lower end of said carrier, said carrier having radially arranged pockets formed therein shaped to receive said closures, a chute having an entrance opening at the upper end of said carrier adapted to receive those closures assuming a desired position of orientation in said pockets, means for manipulating those closures received in the pockets in other than a desired position of orientation to cause them to assume an oriented position, said manipulating means comprising a plurality of stationary bars extended angularly in the path of a closure carried by a pocket in other than an oriented position, said bars causing each closure to change its position in its pocket, and means for urging the oriented closures radially inwardly and upwardly out of their pockets while guided in said chute.

5 Closure-handling apparatus comprising, in combination, a rotary carrier mounted to rotate in an inclined plane, means for delivering closures to the lower end of said carrier, said carrier having pockets formed therein to receive said closures, a chute having an entrance opening at the upper end of said carrier adapted to receive those closures assuming a desired position of orientation in said pockets, and means for manipulating those closures received in the pockets in other than a desired position of orientation to cause them to assume an oriented position, and a deflector for dislodging a closure jammed in a pocket.

6. Closure-handling apparatus comprising, in combination, a rotary carrier mounted to rotate in an inclined plane, means for delivering closures to the lower end of said carrier, said carrier having pockets formed therein to receive said closures, a chute having an entrance opening at the upper end of said carrier adapted to receive those closures assuming a desired position of orientation in said pockets, and means for manipulating those closures received in the pockets in other than a desired position of orientation to cause them to assume an oriented position, a deflector for dislodging a closure jammed in a pocket, and an air jet directed radially inwardly for removing such closure from the pocket.

7. Closure-handling apparatus comprising, in combination, a rotary carrier mounted to rotate in an inclined plane, means for delivering closures to the lower end of said carrier, said carrier having pockets formed therein to receive said closures, a chute having an entrance opening at the upper end of said carrier adapted to receive those closures assuming a desired position of orientation in said pockets, and means for manipulating those closures received in the pockets in other than a desired position or orientation to cause them to assume an oriented position, and an air jet directing a stream of air radially outwardly to assure that an oriented closure is fully seated in its pocket prior to entering said chute

8. Closure-handling apparatus comprising, in combination, a rotary carrier mounted to rotate in an inclined plane, means for delivering closures to the lower end of said carrier, said carrier having pockets formed therein to receive said closures, a chute having an entrance opening at the upper end of said carrier adapted to receive those closures assuming a desired position of orientation in said pockets, and means for manipulating those closures received in the pockets in other than a

desired position of orientation to cause them to assume an oriented position, said chute including inner and outer rails between which the closures in their pockets are guided, said rails shaped to urge the oriented closures inwardly out of their pockets and onto the face of the carrier during rotation of the carrier.

9. Closure-handling apparatus as defined in claim 8 wherein the rails are supported on a bottom plate, the closures being guided up onto said bottom plate, and an air jet directing a stream of air into said chute to facilitate passage of the closures through the chute.

10. Closure-handling apparatus as defined in claim 9 wherein a portion of said chute is shaped to turn the closure 90 °to prevent the same in an upright position in said chute.

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