United States Patent [19]

Sterling

[11] **3,726,385**

[45] **Apr. 10, 1973**

[54] **CLOSURE HANDLING APPARATUS**

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

[22] Filed: **May 15, 1970**

[21] Appl. No.: **37,511**

[52] **U.S. Cl.** .....**198/33 AA,** 221/159

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

[58] **Field of Search**.....221/156–160; 198/33 AA, 40

[56] **References Cited**

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Primary Examiner—Richard E. Aegerter

Attorney—Robert T. Gammons

[57] **ABSTRACT**

Closure handling apparatus adapted to effect rapid and efficient orientation of cylindrical closures which are greater in diameter than in height. Closures deposited on a rotary disk are discharged substantially tangentially in either an open end up or an open end down position, provision being made for sorting one from the other to effect orientation prior to depositing the oriented closures into a chute.

14 Claims, 15 Drawing Figures

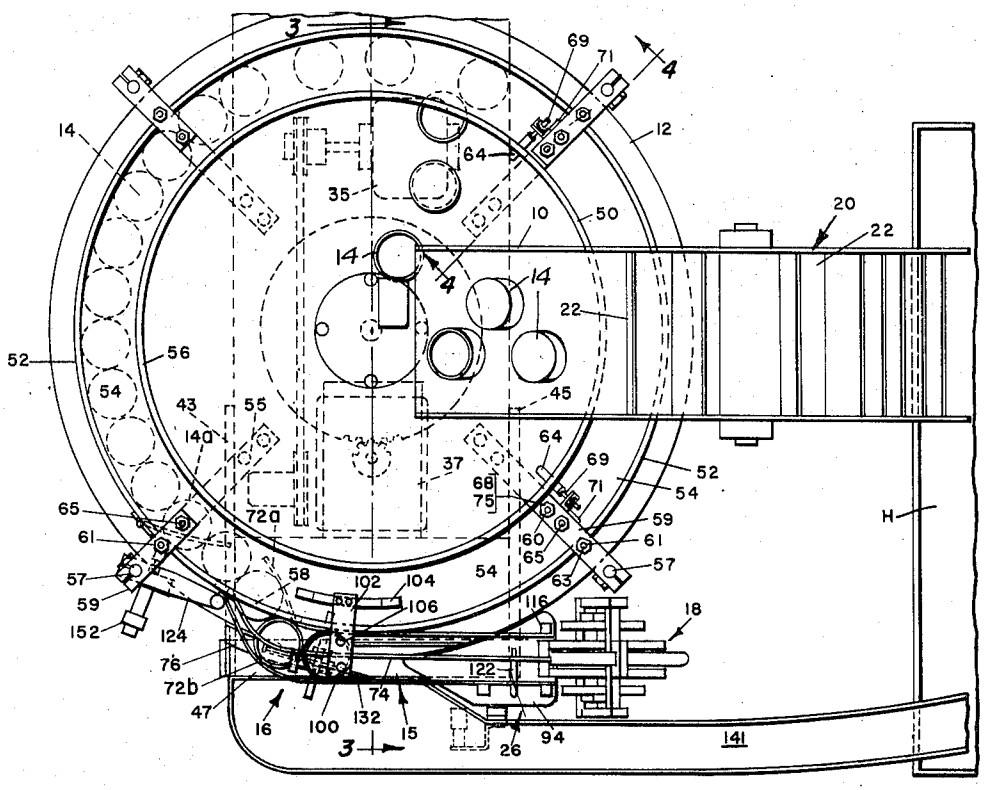
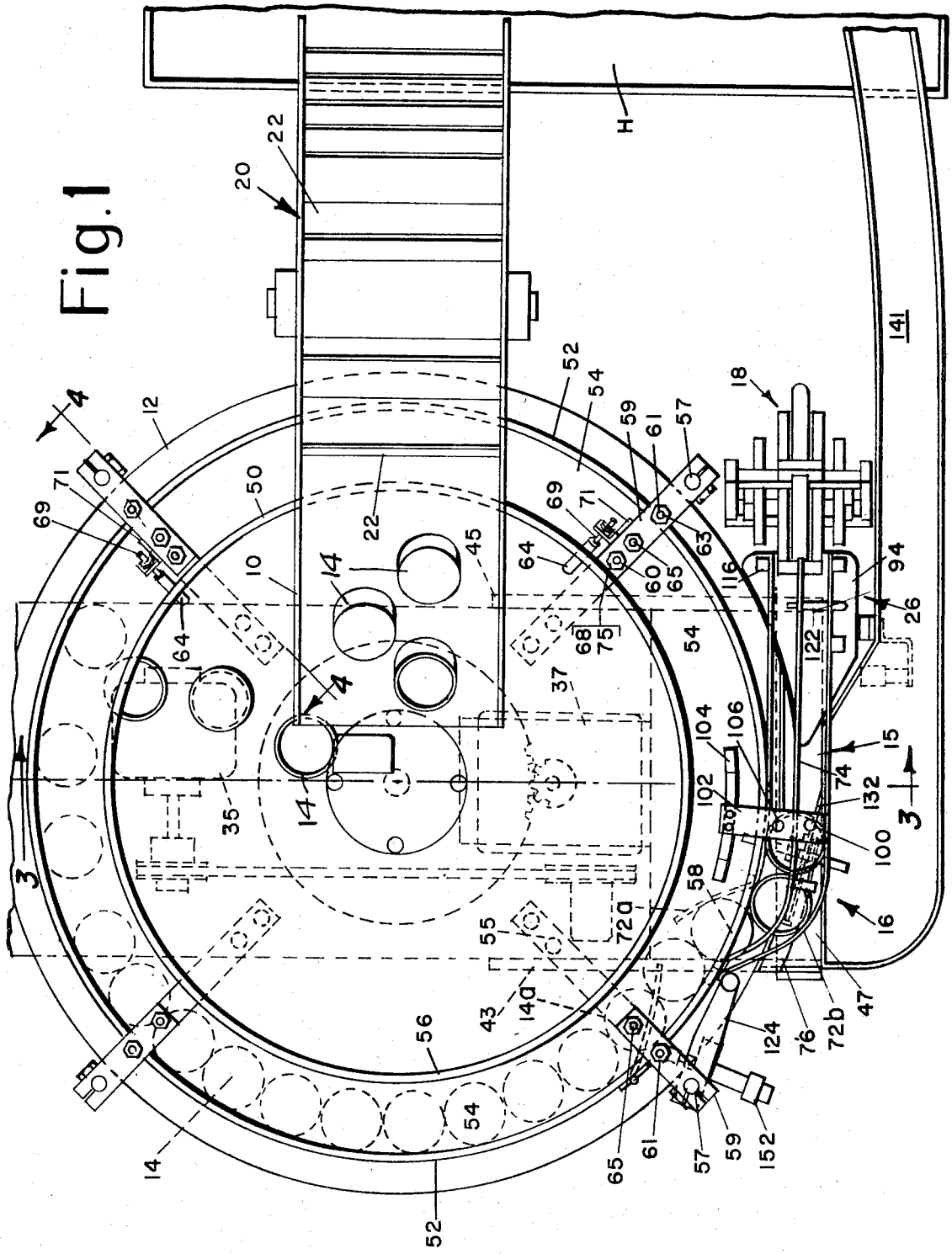


Fig. 1



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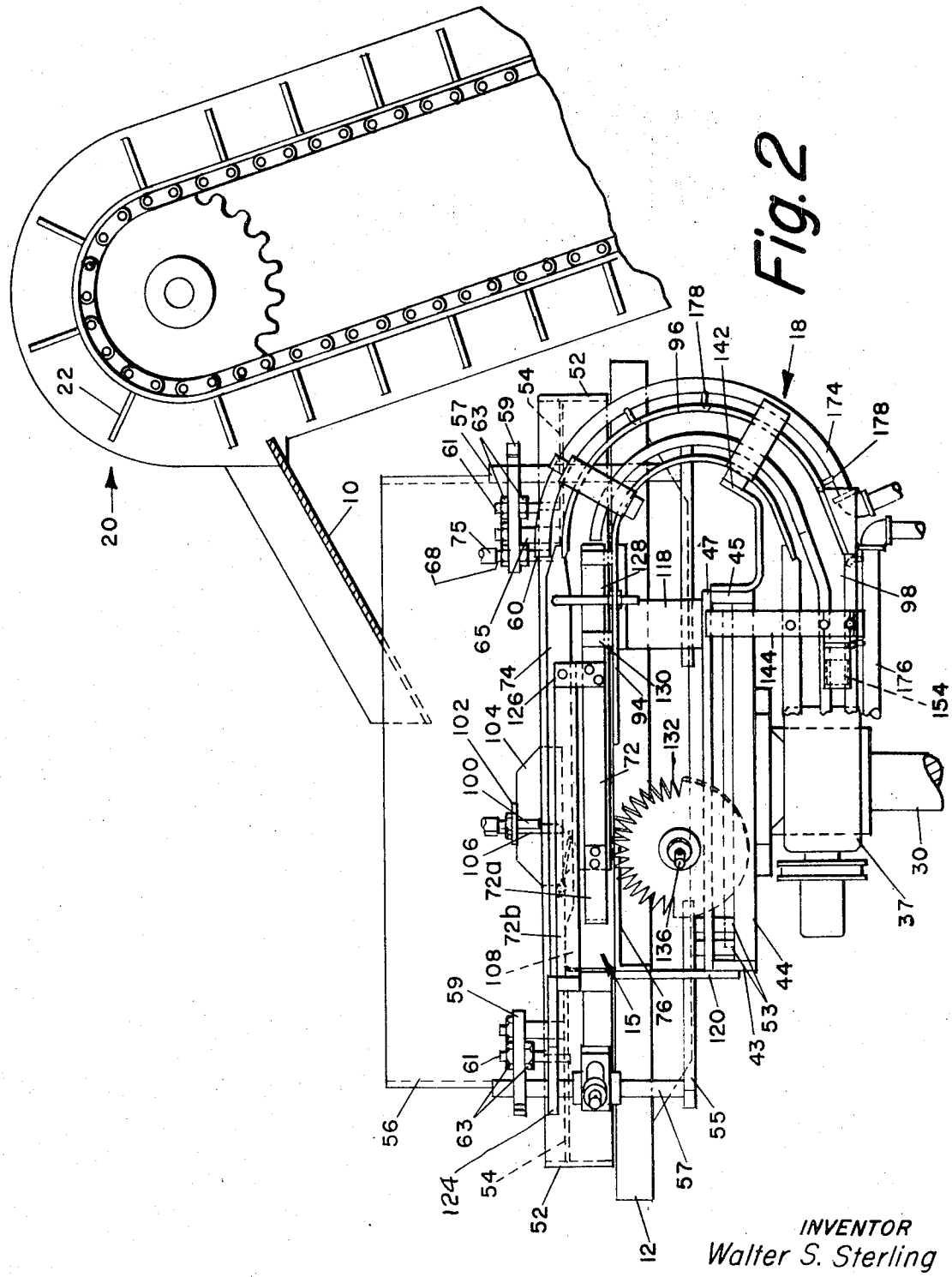


Fig. 2

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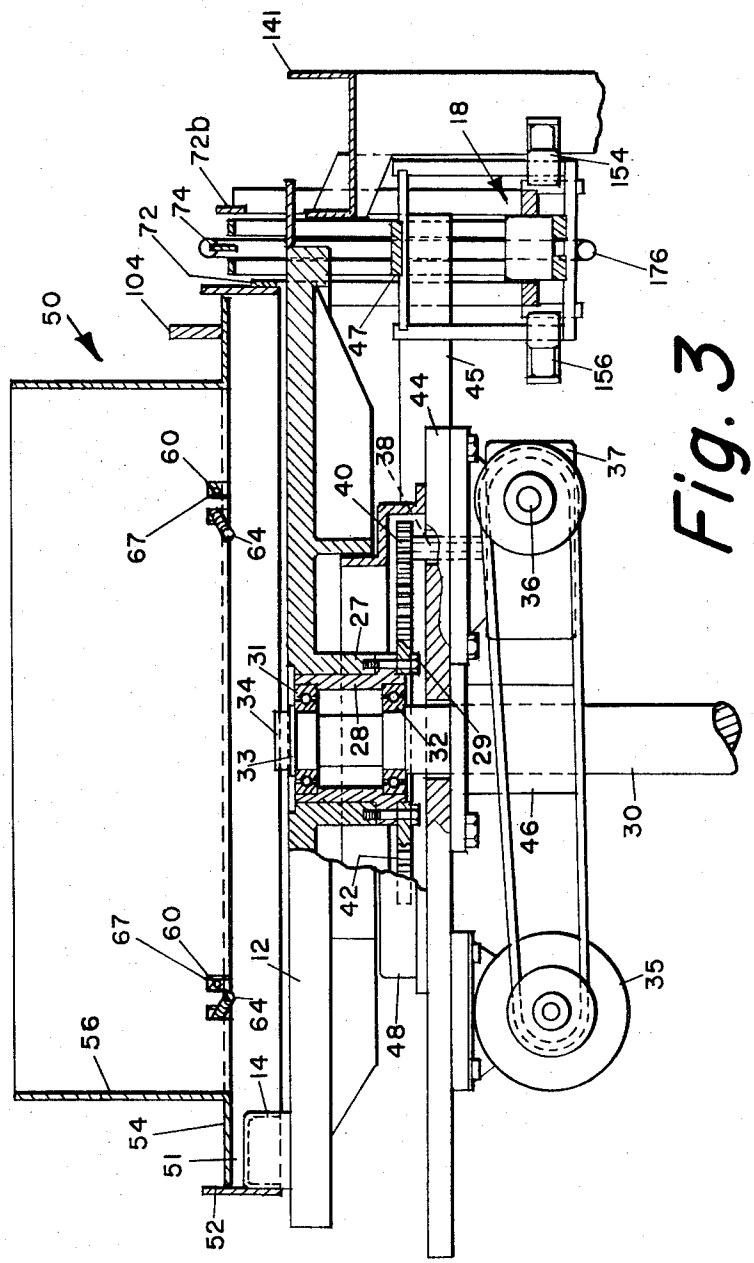


Fig. 3

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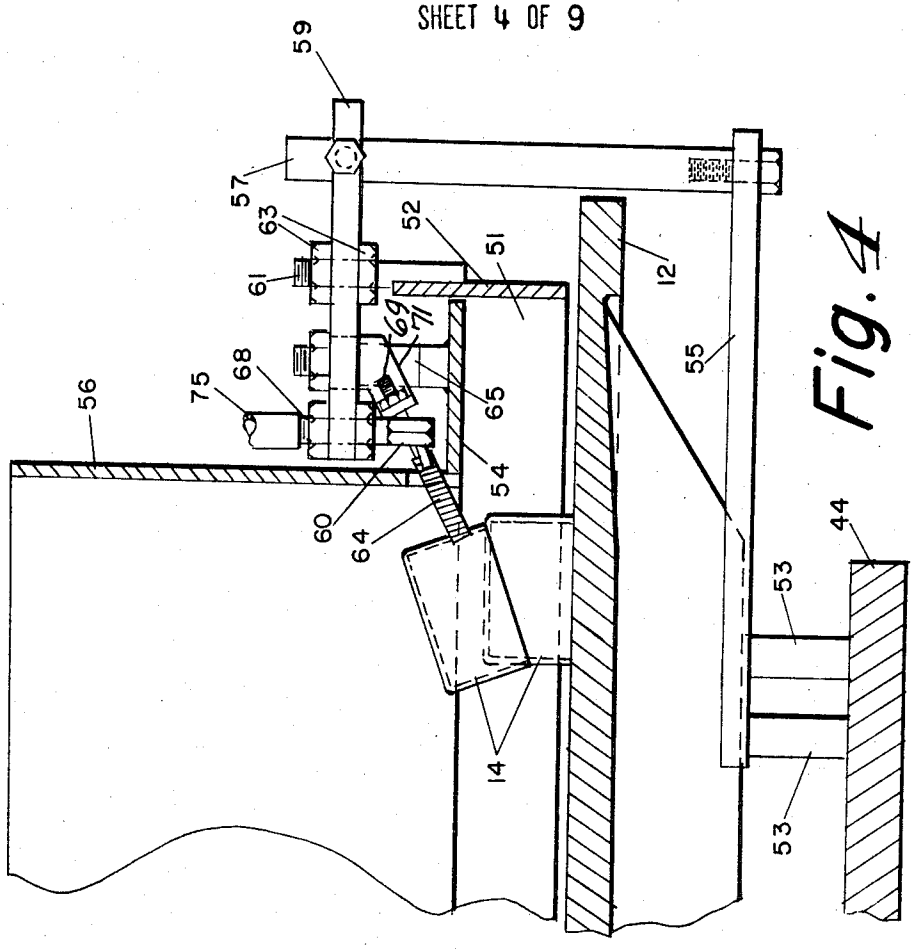


Fig. 4

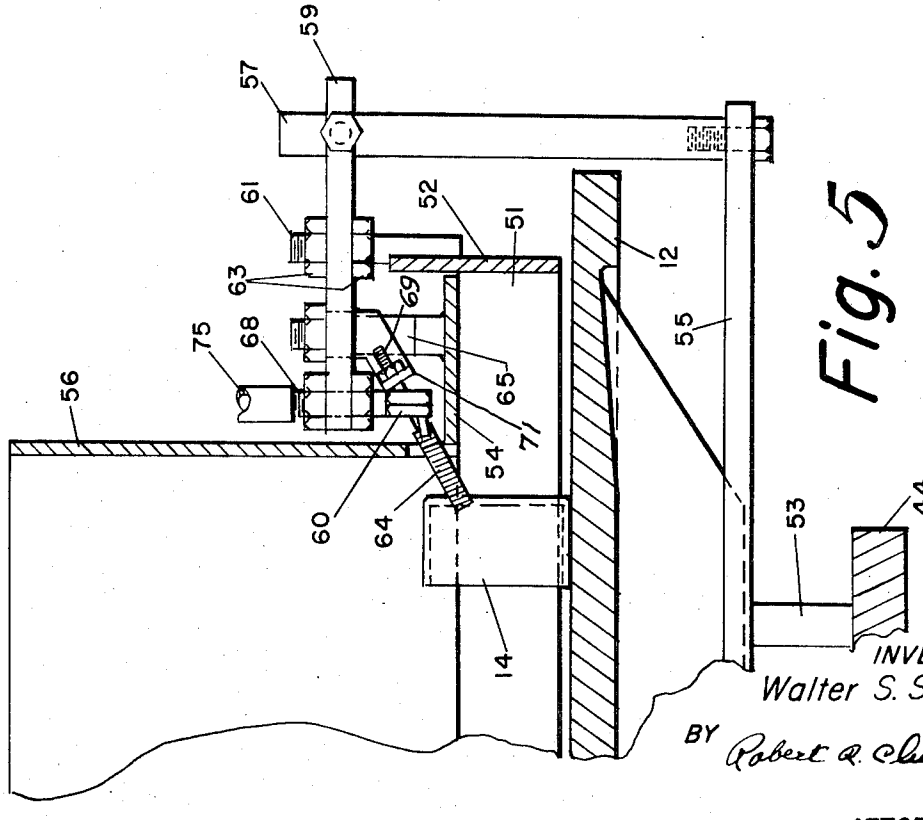


Fig. 5

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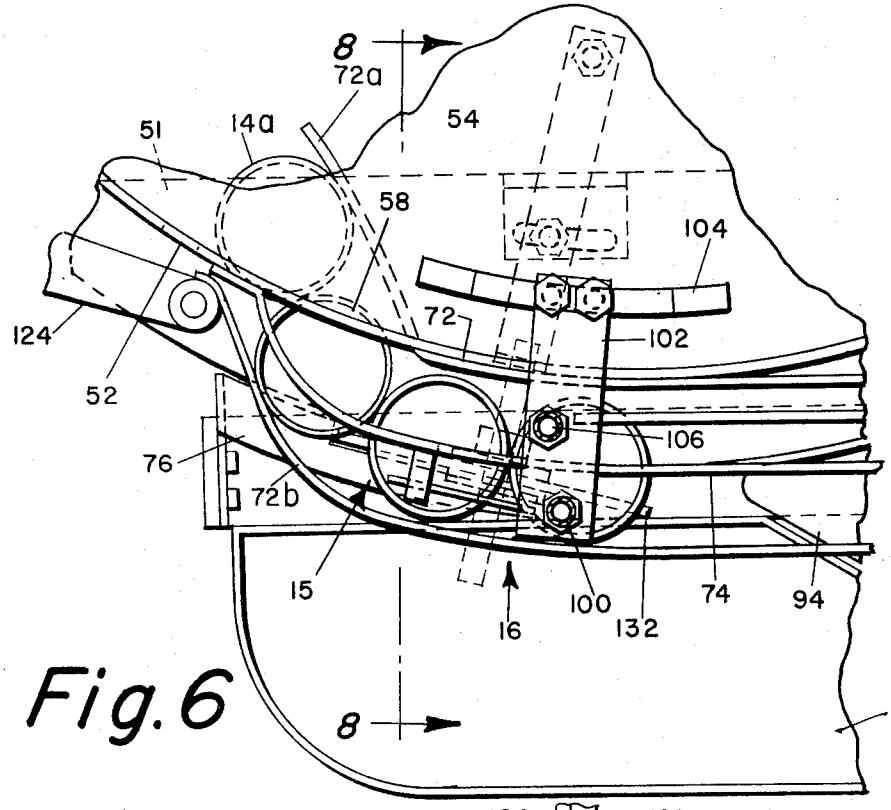


Fig. 6

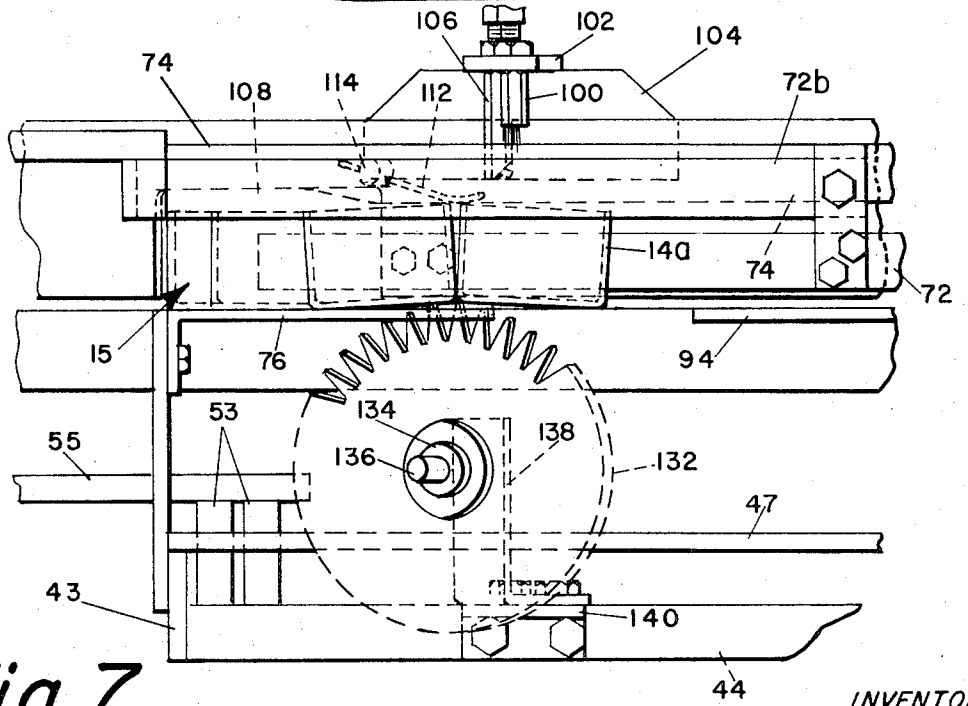


Fig. 7

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Fig.8

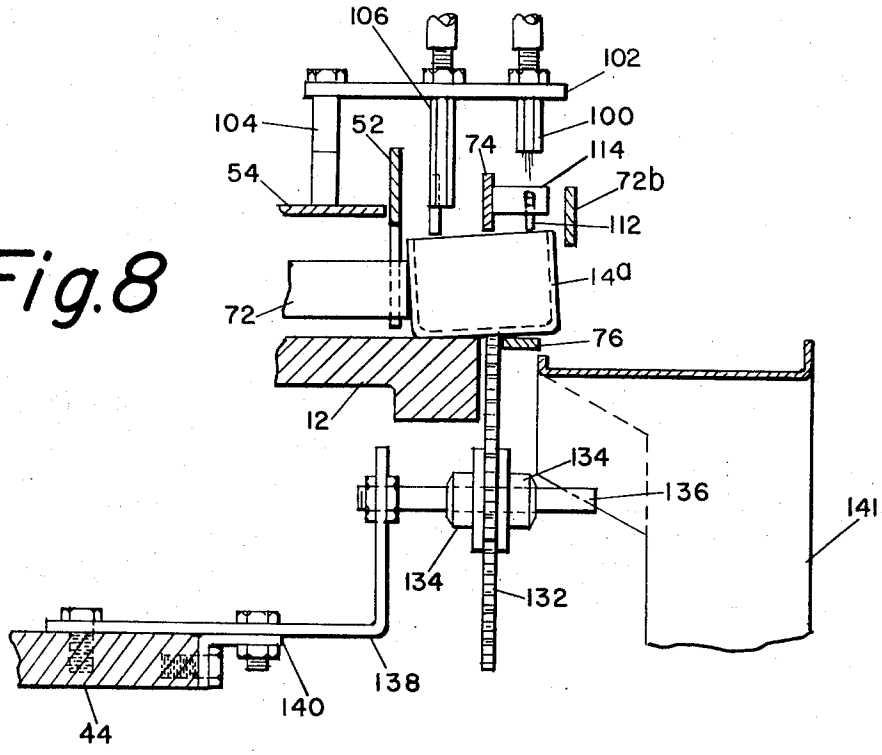
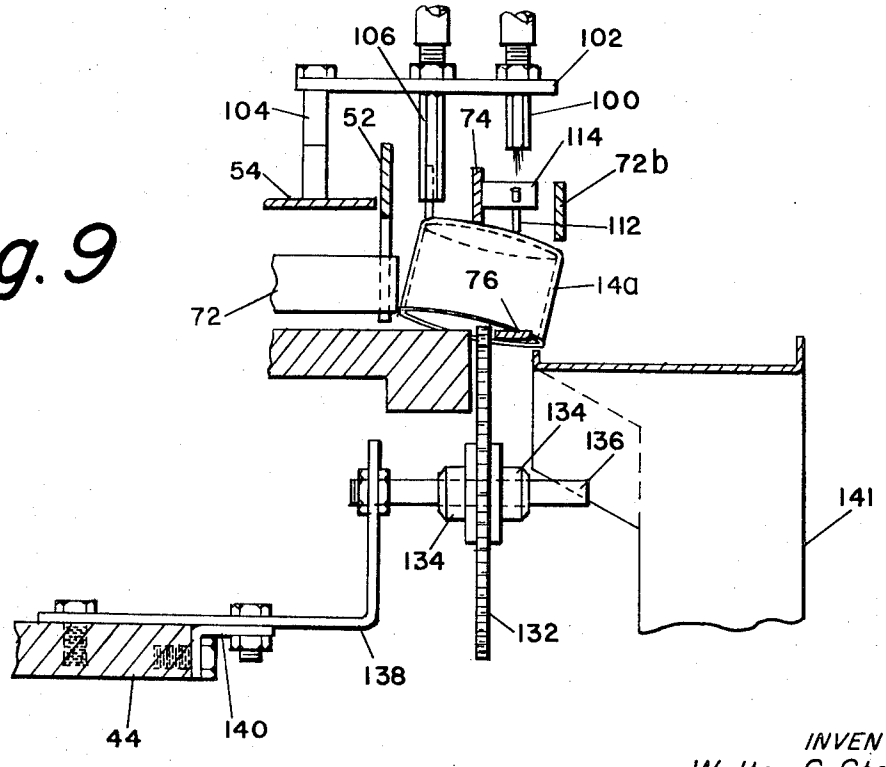


Fig.9



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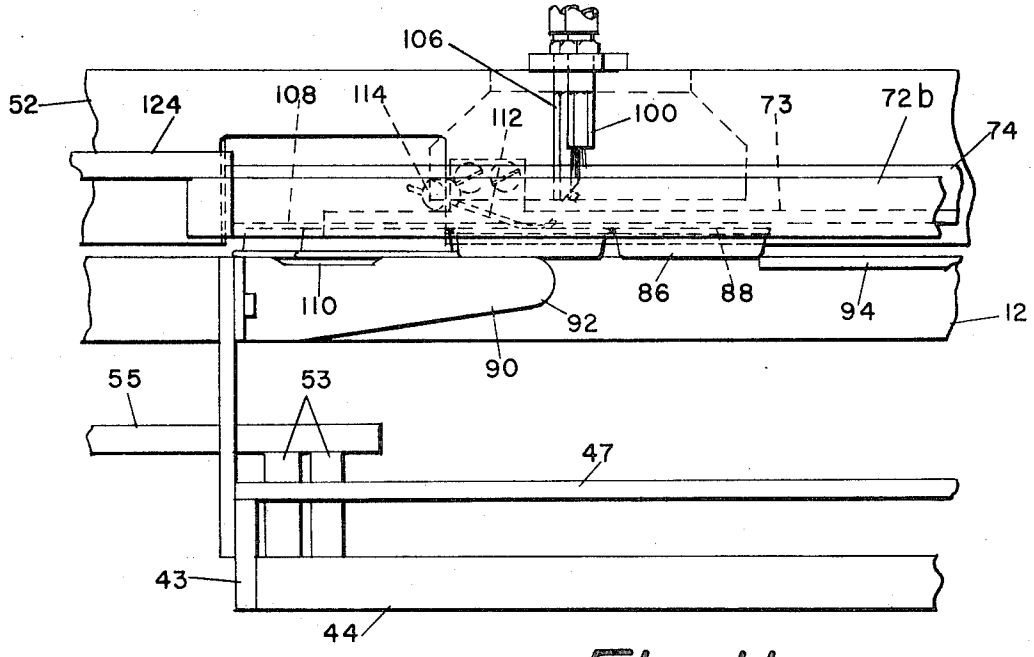


Fig. 11

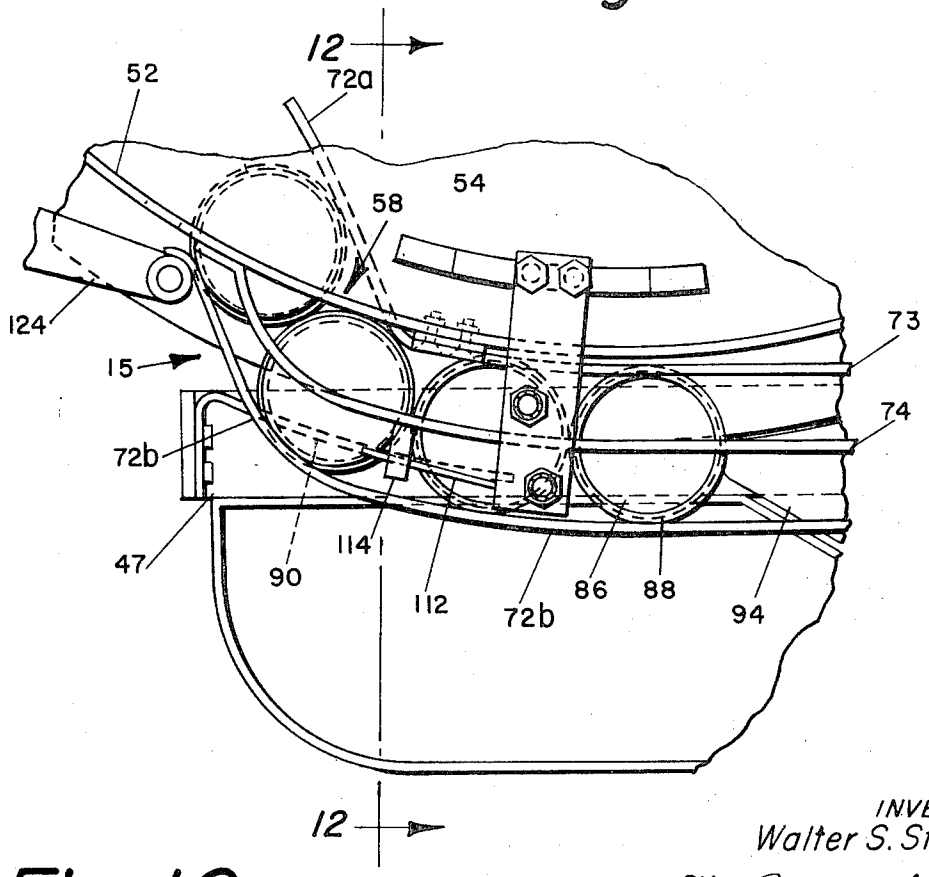


Fig. 10

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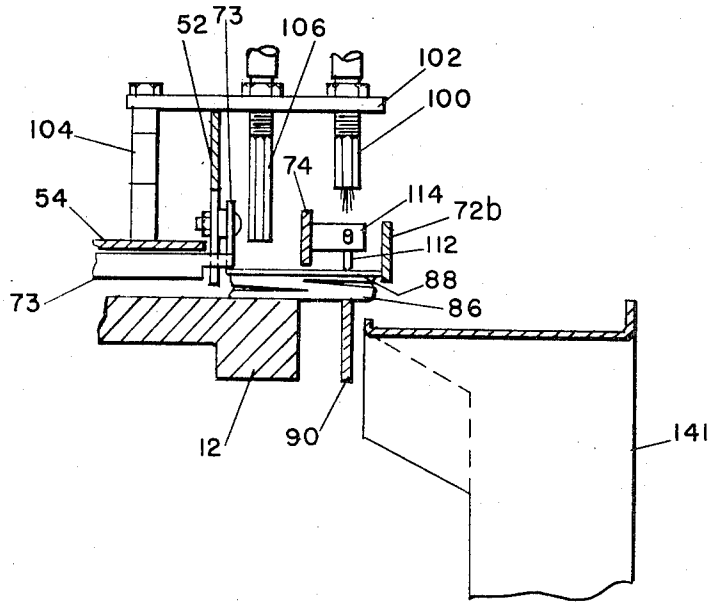
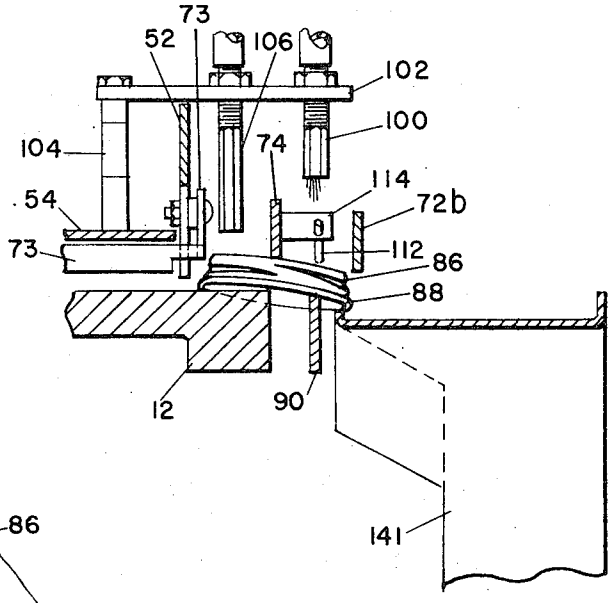


Fig. 12

Fig. 13



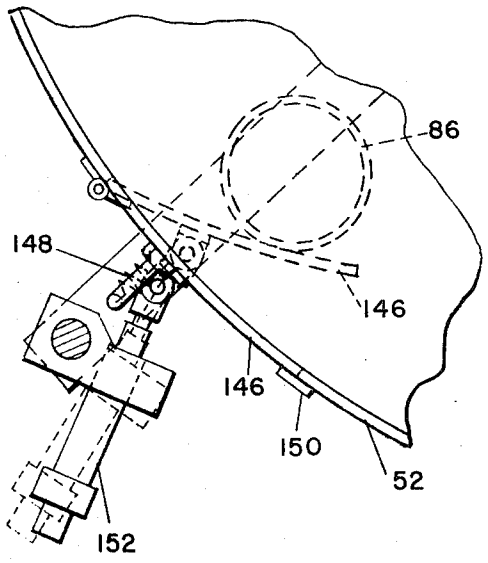


Fig. 14

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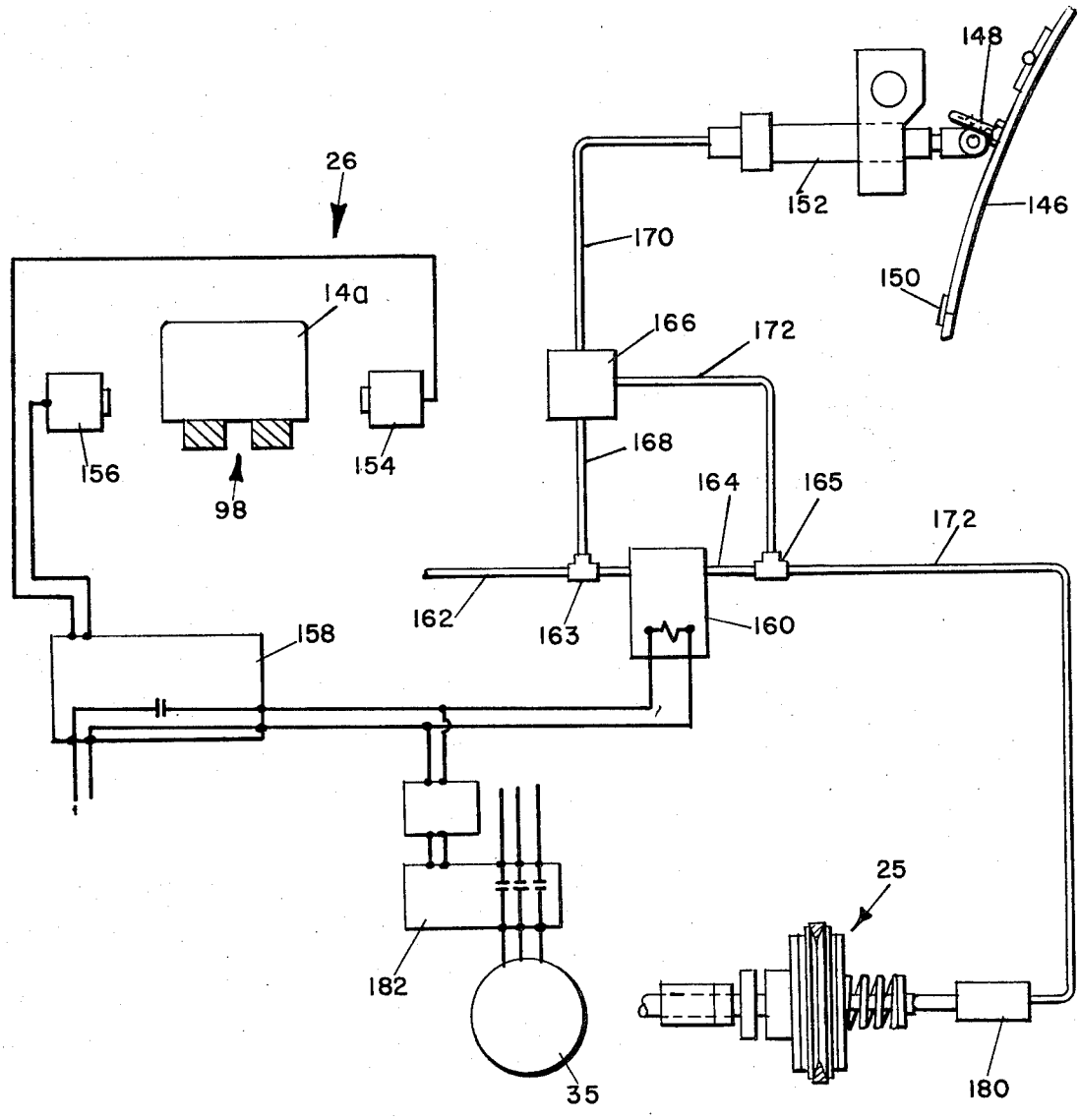


Fig. 15

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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 closures into a supply chute from which successive closures are withdrawn for application to containers.

2. DESCRIPTION OF THE PRIOR ART

Prior closure handling apparatus includes the apparatus illustrated and described in U.S. Pat. Nos. 2,715,978 and 3,300,022, issued to the present applicant and assigned to the same assignee. Each of these patents discloses apparatus arranged to receive randomly arranged closures which are formed into a single line and advanced through sorting or orienting mechanism adapted to reject those closures which assume a position other than a predetermined position of orientation, the oriented closures being delivered to the mouth of a supply chute from which successive closures are withdrawn. U.S. Pat. No. 2,715,978 shows apparatus provided with an inclined rotary disk wherein the closures are carried upwardly by the inclined disk and guided between the beveled edge of a small rotary disk and a cooperating rail. Those closures which assume an oriented position are enabled to maintain a position of equilibrium between the rail and the disk and are deposited into the supply chute, those closures assuming a position other than an oriented position being rejected. U.S. Pat. No. 3,300,022 shows a serrated rotary disk mounted to rotate in a horizontal plane and which is arranged to guide randomly arranged closures in a line toward the serrated periphery of the disk. Those closures facing with their open ends up are supported by the serrated edge to be deposited into a supply chute while those which assume a position with their open ends down will fall over the serrated edge to be rejected. While such prior closure handling apparatus is efficient in use, the shape and size of the closures adapted to be handled by such prior apparatus is limited. Furthermore, the structure of such prior apparatus is such as to preclude production of more than three hundred closures per minute.

SUMMARY OF THE INVENTION

In general, the present invention contemplates a closure handling machine for use in connection with the feeding mechanism of a closure applying machine where it is desired to deliver the closures, such as screw caps for bottles, or other containers, in a line and oriented to face in the same direction. In the illustrated embodiment of the invention, provision is made for withdrawing closures at random from a bulk supply thereof and for passing successive closures through sorting or orienting mechanism arranged to reject those closures presented to the sorting mechanism in other than the desired position of orientation. Those closures presented to the sorting mechanism in an oriented position are advanced and delivered to the upper end of a delivery chute from which they are withdrawn to be applied to a container.

The present apparatus is particularly adapted for handling in a rapid and efficient manner closures which are greater in diameter than in height. In a modified

form of the apparatus, provision is made for handling closures of this type which are of greater diameter at one end than at the other, such as a tapered closure or a closure having a laterally extended flange at one end. Novel structure is provided for arranging the closures in a line and for rapidly advancing successive closures to and through novel sorting mechanism arranged to reject those closures which do not assume a predetermined position of orientation, the rejected closures being returned to the bulk supply. Novel control mechanism is also provided for discontinuing the supply of closures to the apparatus and for preventing release of the closures from the rotary disk in the event that the supply of oriented closures exceeds the demand therefor. Provision is also made for stopping operation of the entire apparatus in the event that the excess supply in the delivery chute is not withdrawn within a predetermined time.

Accordingly, the invention has for an object to provide novel and improved closure handling apparatus particularly adapted for sorting and orienting in a rapid and efficient manner closures of the type which are greater in diameter than in height.

The invention has for another object to provide novel and improved apparatus of the character specified having provision for sorting and orienting in a rapid and efficient manner closures of the type which are greater in diameter than in height and which are also of greater diameter at one end than at the other.

A further object of the invention is to provide novel and improved apparatus of the character specified having novel control means for discontinuing the supply of closures to the apparatus in response to means for detecting a surplus of oriented closures and for discontinuing operation of the apparatus in the event that the surplus is not reduced within a predetermined time.

With these general objects in view and such others as may hereinafter appear, the invention consists in the closure handling apparatus and in the various structures, arrangements and combinations of parts 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 front elevation of the apparatus shown in FIG. 1;

FIG. 3 is a cross sectional view as seen from the line 3—3 of FIG. 1 showing the drives;

FIG. 4 is a cross sectional view taken on the line 4—4 of FIG. 1 showing means for separating nested closures;

FIG. 5 is a view similar to FIG. 4 showing a closure on its side adapted to be changed to an upright position;

FIG. 6 is a detail plan view of one form of sorting mechanism embodying the present invention;

FIG. 7 is a front elevation of the mechanism shown in FIG. 6;

FIG. 8 is a cross sectional view taken on the line 8—8 of FIG. 6 showing an oriented closure passing through the sorting mechanism;

FIG. 9 is a view similar to FIG. 8 showing a non-oriented closure being rejected;

FIG. 10 is a detail plan view showing a modified form of sorting mechanism embodying the present invention;

FIG. 11 is a front elevation of the mechanism shown in FIG. 10;

FIG. 12 is a cross sectional view taken on the line 12—12 of FIG. 10 showing an oriented closure passing through the modified sorting mechanism;

FIG. 13 is a view similar to FIG. 12 showing a non-oriented closure being rejected;

FIG. 14 is a detail plan view of a hinged gate forming a part of the control mechanism; and

FIG. 15 is an elementary wiring diagram embodying the present control mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings and particularly to FIGS. 1 and 2, the closure handling apparatus therein shown comprises in general: a guide chute 10; a rotary carrier disk 12 mounted to rotate in a horizontal plane and from which successive closures 14 in a line thereof are released onto a guideway 15; sorting mechanism 16 arranged to receive successive closures released from the carrier and by which closures assuming a position other than a predetermined position of orientation are rejected; and a delivery chute 18 into which the oriented closures are advanced and deposited.

In the embodiment of the invention illustrated in FIGS. 1 and 2, the randomly arranged closures 14 are delivered to the apparatus in controlled amounts by an upright conveyer 20 which is provided with a plurality of equally spaced flights 22. The outer run of the conveyer is arranged to cooperate with a bulk supply hopper associated therewith to pick up the closures on the flights 22 as the conveyer passes through the supply hopper. In operation, when the closures are carried over the upper end of the conveyer they fall off the flights 22 and are guided by the chute 10 onto the rotary carrier disk 12.

The conveyer 20 is driven through driving mechanism, including a normally engaged clutch 25, and is arranged to be pneumatically disengaged by control mechanism indicated generally at 26 to be hereinafter more fully described. The elevating conveyer 20 may comprise the conveyer illustrated and described in the U.S. Pat. to Sterling, No. 3,079,042, to which reference may be made for a more detailed description thereof.

As illustrated herein, the rotary carrier disk 12 is supported for rotation about a central supporting post or hollow column 30 attached to a suitable base not shown. The depending hub 27 of the disk 12 is provided with a sleeve 28 secured to the hub by bolts 29. The sleeve is provided with ball bearings 31, 32, the lower bearing 32 resting on a shouldered portion of the central post 30. A lock washer 33 and nut 34 threadedly engaged with the post 30 engage the upper ball bearing 31 as shown. The carrier disk 12 is arranged to be rotated through connections from a motor 35 belted to the input shaft 36 of a speed reducing unit 37. The output shaft 38 of the speed reducing unit is provided with a pinion 40 which is in mesh with a gear 42 connected to the lower end of the sleeve 28 by the bolts 29. The motor 35 and speed reducing unit 37 are attached to the underside of a mounting plate 44 supported on the post by a flanged hub 46. A casing 48 mounted on top of the plate 44 encloses the gearing. In operation, the disk 12 is arranged to be rotated in a counterclockwise direction at about 50 revolutions per minute, more or less. The mounting plate 44 is further provided with an extension comprising longitudinally extended side bars 43, 45 secured to two opposite sides of the plate and a cross bar 47 connecting the outer ends of the side bars. The extension is for the purpose of supporting the sorting mechanism 16 and the upper end of the supply chute 18 to be hereinafter more fully described.

As herein shown, the randomly arranged closures are confined on the carrier disk 12 by a circular retaining unit 50 stationarily supported above the disk 12. The lower portion of the retaining unit 50 is offset outwardly in cross section to provide an annular space 51 defined by an outer vertical wall 52 and an upper wall 54 extending horizontally and radially inwardly at right angles to the wall 52. An upstanding wall 56 extending from the inner edge of the wall 54 completes the circular retaining unit 50.

The annular space 51 provides clearance for the height of a closure being run, that is, the height from the face of the carrier disk 12 to the underside of the wall 54 is such as to permit upright closures to enter the annular space. Since the present apparatus is designed to handle closures which are greater in diameter than in height, it will be apparent that those closures lying on their sides or standing on edge cannot enter the annular space. In practice, most closures will inherently assume an open end up position since the normally heavier closed end will naturally fall with its closed end down. It will also be apparent that once a closure has entered the annular space in an upright position, it cannot tip over on its side but will remain in its upright position.

As shown in FIGS. 1 and 2, the circular retaining unit 50 is supported from the mounting plate 44, the supporting members including four equally spaced radially extending supports 55 secured to upright spacing members 53 bolted to the plate 44. Each support 55 carries an upright rod 57 at the outer end thereof which is provided with an inwardly extended bar 59 clamped thereto. Each bar 59 carries a vertical stud 61 which is threaded at its upper end and connected at its lower end to the outer vertical wall 52. The threaded end of the stud 61 extends through a clearance opening in the bar 59 and is adjustably secured thereto by upper and lower nuts 63 to permit vertical adjustment of the circular wall 52 relative to the bar 59. The bar 59 also supports the upstanding wall 56, the bar having an adapter 65 attached thereto, the lower end of which is connected to the horizontal wall 54 formed integrally with the upstanding wall 56. The horizontal wall and the upstanding wall are adjusted vertically by raising or lowering the clamped position of the bar 59 on the upright rod 57.

In operation, the centrifugal action caused by rotation of the carrier disk 12 urges the upright closures into the annular space, the closures bearing against the inner face of the wall 52 forming a circular line thereof. The upright closures are arranged to be released substantially tangentially of the disk 12 through the opening 58 in the wall 52.

During rotation of the disk 12, those closures which lie on their sides are carried around and jostled into dif-

ferent positions of engagement with other closures until they assume an upright position. In order to increase the jostling effect and to assist in causing the lying down closures, or those standing on edge, to assume an upright position, spaced flexible elements 64 extend inwardly through an opening in the wall 56 of the retaining unit 50 in a position to engage the upper portion of those closures lying on their sides. In the illustrated embodiment of the invention, the flexible elements 64 comprise coil springs which flex when engaged by a closure and then return to their initial position. This resilient action effects diversion of the closures and is conducive to changing the position thereof. In operation, air jets 60 cooperate with the flexible elements 64, the latter serving to divert a closure away from the annular space 51 while the air jets directed against the diverted closure serves to assist in changing the position of the closure from a lying down to an upright position as shown in FIG. 5. The diverting elements 64, together with the air jets 60, also serve to separate nested closures as shown in FIG. 4. In operation, it will be apparent that any closure assuming an upright position will enter the annular space 51, as described, while those lying on their sides will be changed in position by engagement with each other and with the flexible elements 64 as assisted by the air jets 60. As herein shown, the flexible elements are supported from their respective bars 59, each spring 64 being connected to a stud 69. The stud 69 extends through a clearance opening in one leg of an angle bracket 71, the other leg being bolted to its bar 59. The jets 60 are threaded at their upper ends and are adjustably secured to their respective bars 59 by upper and lower nuts to permit vertical and rotary adjustment thereof. The air streams from the jets are directed through openings 67 in the upstanding wall 56. The top of each air jet is provided with an adapter 68 connected by a flexible tube 75 to a regulated source of compressed air.

From the description thus far it will be seen that some of the randomly arranged closures deposited on the rotary carrier assume an upright position and are caused to enter the annular space 51 by centrifugal action to form a circular line thereof against the wall 52. It will also be observed that successive closures are released through an opening 58 in the wall 52 onto the guideway 15 to pass through the sorting or orienting mechanism 16. The released upright closures are either in an open end up position or in an open end down position when they enter the sorting mechanism 16. Provision is made for permitting those closures assuming an open end up position to pass directly into the mouth of the supply chute 18, while those assuming an open end down position are rejected. Provision is also made for returning the rejected closures to the bulk supply to be recirculated and again passed through the sorting mechanism 16.

Referring now to FIGS. 6 and 7, one type of closure which is greater in diameter than in height and which is adapted to be handled by the present apparatus comprises a relatively large closure 14*a* of uniform diameter, that is, having straight sides. As herein illustrated, successive leading closures of those following a circular path are guided out of the annular space 51 and through the opening 58 to enter the guideway 15 and the sorting or orienting mechanism 16 by the curved portion 72*a* of an inner side rail 72, the curved portion 72*a* extending into the annular space 51 in the path of the line of closures. The closures are guided by rails, including the inner side rail 72, an outer side rail 72*b*, and a top rail 74, the bottom of the closure being supported on one side by the marginal edge of the carrier disk 12 and on the other side by a short horizontally disposed flat plate 76. The closure thus supported in the guideway 15 then engages the top of a freely rotatable toothed wheel 132 near the end of the plate. The outside diameter of the wheel is arranged to extend a short distance above the upper surface of the carrier disk 12. In operation, when an open end down closure passes over the wheel, the edges of the closure will engage the bottoms of the teeth and be rocked downwardly as the wheel is rotated. It will be noted that the outer guide rail 72*b* is disposed at a height such as to provide clearance for the upper end or outer edge of an open end down closure which is caused to rock downwardly and outwardly. On the other hand, if the closure rides onto the wheel 132 with its open end up, the closure will be supported in an upright position between the inner and outer side rails, the top rail and the marginal edge of the carrier disk. The open end up or oriented closure is then guided onto a bottom support or plate 94 and into the mouth of the chute 18 as the guideway continues in a straight line and the marginal edge of the carrier leaves the guideway. Successive oriented closures are thus guided into the supply chute 18 which first follows a semicircular path 96 to present the closures in an open end down position along the lower run 98 of the chute in which position the closures are withdrawn from the discharge end of the chute not shown. It will be seen that the provision of a freely rotatable toothed wheel permits a free flow of the closures thereover and affords better control of the closures since the wheel turns in response to the movement of and engagement with the closures, thus producing a minimum of friction so that the closures may be rapidly and efficiently handled without jamming. As herein shown, the wheel 132 is mounted on ball bearings supported between collars 134 on a stud 136. The stud 136 is connected to one leg of an angle bracket 138, the other leg being pivotally connected to the mounting plate 44. A slotted angle member 140 connected to the end of the mounting plate 44 permits rotary adjustment of the toothed wheel mounting unit and the wheel itself is adjustable longitudinally of the stud 136. In the illustrated embodiment of the invention the rejected closures fall onto the upper end of a return chute 141 which leads to the bulk supply hopper, not show, associated with the upright conveyer 20.

It will be understood that if a closure is disposed with its open end facing up, the closed end of the closure will pass over the wheel 132 effecting rotation of the same as it passes on to be guided into the mouth of the supply chute 18. In practice, a great majority of the closures will assume an open end up position, the percentage of closures which assume this position when dropped onto a horizontal surface varying with each different style of closure. While the closure with its open end down will be overbalanced and rocked downwardly by gravity, it is preferred to assist the gravitational operation by providing a continuously

operated air jet **100** supported above the guideway **15** and arranged to direct a stream of air downwardly on top of the closure as it passes over the toothed wheel whereby to effect rapid removal of the non-oriented closure from the guideway.

As herein shown, the air jet **100** is adjustably supported in a bar **102** extended from a bracket **104** attached to the horizontal wall **54** of the retaining unit **50**. A second air jet **106**, also supported in the bar **102**, is arranged to release a continuous stream of air in the direction of movement of the closures to effect advance of an oriented closure onto the plate **94** and into the mouth of the chute **18**. Each jet **100**, **106** is provided with an adapter and a flexible tube connected to a source of compressed air.

As illustrated in FIG. **7**, the lower edge of the top rail **74** is offset upwardly at the entrance portion of the guideway **15**, as indicated at **108**, in order to provide ample clearance for successive closures entering the guideway **15**. The lower edge of the top rail **74** then resumes its normal height to more closely confine the closure as it passes over the toothed wheel **132**. Provision is also made for controlling the passage of the closure through the sorting device in a manner such as to prevent inadvertent upward displacement of the outer edge of the closure. As herein shown, the controlling element comprises a small diameter rod **112** adjustably secured in a stud **114** attached to the top rail **74**. The rod **112** may be bent downwardly, as shown, to a position such as to just clear the top of a closure passing thereby. It will be understood that a closure disposed with its open end up will be confined by the guide rails to prevent rocking thereof and will not be affected by the downwardly projected stream of air from the jet **100**. However, when it is advanced beyond the rail **90** it will be urged forwardly by the jet **106**.

The guide rails are adjustably supported to accommodate closures of different sizes and, as herein illustrated, the inner rail **72** is connected at one end to the outer wall **52** of the retaining unit **50** and at its other end to an upstanding block **116** attached to the bottom plate **94**. The bottom plate **94** is supported by a bracket **118** attached to the cross bar **47**. The flat plate **76** is supported by an upright bar **120** attached to the side bar **43** forming a part of the machine frame.

The top guide rail **74** is also connected at one end to the outer wall **52** and is connected at its other end to the horizontal leg of a bent rod **122**, the vertical leg being attached to the plate **94**. The outer side rail **72*b*** is also supported for adjustment, being connected at one end to a swivel carried by the outer end of an arm **124** which latter is clamped to an adjacent rod **57** as shown. The other end of the rail **72*b*** is connected to a short vertical bar **126**, the lower end of which is secured to a second rail **128** supported by upstanding blocks **130** attached to the bottom plate **94**. The blocks are adjustable in and out, and the arm **124** is arranged to be rocked in and out to effect adjustment of the rail.

Referring now to FIGS. **10** and **11**, the present sorting mechanism is also capable of handling closures which are not only larger in diameter than in height but which are also larger in diameter at one end than at the other. For example, the screw closure **86** illustrated is provided with a laterally extended lip **88** at its open end. The guide rails for guiding successive closures to the sorting mechanism are similar to those above described except that the inner rail **73** is spaced outwardly from the wall **52** and the lower edge of the rail **73** is spaced from the upper face of the carrier disk **12** a distance such as to provide a slight clearance for the height of the closure. As thus spaced from the wall **52**, the rail **73** serves as a holding rail.

In the embodiment of the invention illustrated in FIGS. **10** and **11**, the bottom of the closure is supported on one side by the marginal edge of the carrier disk **12** and on the other side by a short rail **90**, having a rounded end portion **92**. With this construction it will be seen that when a closure rides onto the short bottom rail **90** with its open end down, the closure will rock downwardly when it reaches the rounded end **92** of the rail **90** to cause the closure to be rejected from the guideway **15** leading to the mouth of the closure supply chute **18**. It will be noted that as previously described, the outer guide rail **72*b*** is disposed at a height such as to provide clearance for the upper end of an open end down closure which is caused to rock downwardly and outwardly. On the other hand, if the closure rides onto the short bottom rail **90** with its open end up, the closure will be supported in an upright position to be guided onto the bottom plate **94** and into the mouth of the chute **18** as described.

In operation, successive closures **86** engaged by the curved portion **72*a*** of the holding rail **73** and passed through the opening **58** in the wall **52** are guided between the wall **52**, outer rail **72*b*** and top rail **74**, one edge of the closure comprising the laterally extended lip **88** passing under the holding rail **73**. As herein shown, the closure is supported on its underside by the edge of the disk **12** on one side and by the short bottom rail **90** on the other side. When a closure assumes an open end up position, as shown in FIG. **12**, the closure is supported between the rails and by the disk **12** and rail **90** with the inner edge of the closure under the holding rail. Thus, when the outer edge of the closure is subjected to a downwardly directed stream of air by the jet **100**, the inner edge or lip portion **88** of the closure will engage the underside of the holding rail **73** to prevent rocking of the closure and to permit the same to be advanced into the mouth of the supply chute **18**. However, in the event that the closure assumes an open end down position, as shown in FIG. **13**, the smaller diameter closed end is capable of clearing the lower edge of the holding rail **73** when the outer edge of the closure is subjected to a downwardly directed stream of air. As a result, the outer edge of the closure will rock downwardly, as illustrated, so as to pass under the rail **72*b*** and the inner edge of the closure will move out from under the holding rail **73** to permit the closure to fall onto the return chute **141** which delivers the rejected closures to the bulk supply hopper **24**.

While the illustrated closure **86** is provided with a laterally extended lip **88** to provide a larger diameter portion at one end engageable with the lower edge of the holding rail **73**, it will be apparent that the illustrated structure is also adapted to handle tapered closures wherein the larger end of the taper comprises the open end.

It will be observed that in the embodiment of the invention shown in FIG. **13**, a portion of the upper edge of the rail **90** is cut out, as indicated at **110**, which in

cooperation with the upwardly offset portion **108** of the top rail **74** provide clearance for successive closures entering the guideway **15**.

While the sorting mechanism for the straight sided closure has been herein defined as including a toothed wheel **132**, it will be understood that the sorting mechanism defined by the short rail **90** may also be used for the straight sided closures. Likewise, while the sorting mechanism for the flanged or tapered closures has been defined as including a short rail **90**, it will be understood that these closures may also be handled by the toothed wheel **132**.

The return chute **141** effects delivery of the rejected closures by gravity to the bulk supply hopper associated with the conveyer **20**. However, in other embodiments of the invention, the bulk supply hopper is disposed in an elevated position, such as is shown in U.S. Pat. No. 2,715,978 above referred to. In such instances, the rejected closures may be returned to the elevated supply hopper in any usual or preferred manner. One expedient is to deposit the rejected closures into a pneumatic conduit adapted to carry the closures upwardly and to discharge them into the bulk supply hopper.

As above described, those closures presented to the sorting mechanism with their open ends up and which maintain their equilibrium are advanced along the guide rails to the mouth of the chute **18** by one or more air jets **106**. The chute follows through a semicircular path **96** at the upper end thereof in order to present the closures in an open end down position when they enter the lower run **98** of the chute which leads to the discharge end, not shown, and from which successive closures are withdrawn for application to containers. As shown in FIG. **2**, the semicircular portion **96** of the chute is supported by a bracket **142** attached to the side bar **45**. The lower run **98** of the chute is supported by means including a bar **144** attached to the machine frame.

From the description thus far, it will be seen that the present apparatus is adapted to handle closures which are greater in diameter than in height and which has provision for rejecting those closures which enter the sorting mechanism in other than an open end up position and for depositing the open end up closures into the supply chute. Since a majority of the closures delivered to the carrier disk **12** inherently assume an oriented or open end up position, few closures are subject to rejection, and as a result, a substantially continuous supply of oriented closures are deposited into the supply chute **18** to maintain an adequate supply therein to be withdrawn from the chute.

As illustrated in FIGS. **2** and **15** showing the control mechanism **26**, provision is made for controlling the operation of the apparatus by discontinuing the release of closures from the rotary carrier disk **12** to the sorting mechanism when the supply of closures exceeds the demand therefor as indicated by an accumulation of closures in the chute up to and beyond a predetermined point in the chute. Provision is also made for simultaneously discontinuing the operation of the upright supply conveyer **20** at such time.

As herein shown, a normally closed curved gate **146** hingedly connected to the outer wall **52** is arranged to be rocked inwardly into the path of the circular line of closures in the annular space **51** as shown in dotted lines in FIG. **1**. A coil spring **148** connected at one end to a stud fast in the wall **52** and its other end to a stud fast in the gate **146** urges the gate against a stop **150** into alignment with the circular wall **52**. An air cylinder **152** is arranged to engage and push the gate inwardly into the path of the closures when a surplus of closures in the chute is detected.

The control mechanism comprises a photoelectric device including a photocell **154** supported on one side of the lower run **98** of the chute and a light source **156** on the other side which are operatively connected to a relay **158**. Also included in the circuit is a normally open solenoid air valve **160** operatively connected to the relay **158**. An air line **162** leading from a regulated source of compressed air passes through a tee **163** and is connected to the inlet side of the valve **160**. The outlet side of the valve is connected to a line **164** and also passes through a tee **165**. A normally open air pilot **166** is connected on its inlet side by a line **168** leading from the tee **163**, the outlet side being connected by a line **170** to the air cylinder **152** associated with the gate **146**. A line **172** leading from the tee **165** is connected to the pilot of the valve **166**.

It will be observed that the semicircular portion **96** and the lower run **98** of the chute are provided with air manifolds **174**, **176**, respectively, each having spaced air jets **178** directed to rapidly advance successive oriented closures along the chute until they engage the endmost closure in the line. In practice, in the event that a surplus of closures is provided, the closures will accumulate to a point beyond the photocell so as to cut off the light source from the cell for a predetermined length of time. When this occurs, the air passing through the solenoid valve **160** is cut off and the pilot is released to permit air to pass from line **168** through pilot valve **166** and line **170** into the cylinder **152** which effects rocking of the gate **146** into the path of the closures in the annular space **51**, thus discontinuing release of the closures through the opening **58**. Simultaneously therewith, the air to a cylinder **180**, which normally holds the clutch **25** engaged, is cut off to permit disengagement of the clutch whereby to discontinue operation of the upright conveyer **20**. It will be understood that normally only a slight delay in supplying closures to the chute is sufficient to reduce the number of closures in the chute during continued withdrawal of closures therefrom whereupon the gate **146** will be retracted and the clutch **25** will be engaged to resume normal running operation. It will be understood that the photocell **154** connected in circuit with the relay **158**, as shown in FIG. **15**, may be adjusted through the relay so as to permit passage of successive individual spaced closures through the chute without activating the relay. It will also be understood that during the relatively short period when the gate **146** is closed, the closures in the annular space **51** are merely diverted while the carrier disk **12** continues to rotate.

As also illustrated in FIG. **15**, the electric motor **35** which drives the rotary carrier disk **12** is shown diagrammatically in circuit with a time delay relay **182** operatively connected in the photoelectric circuit. In the event that the surplus accumulation of closures in the chute is not reduced within a predetermined time

limit, such as within about thirty seconds, indicating that withdrawal of closures from the discharge end of the chute has been discontinued, the time delay relay **182** is arranged to open the circuit to the motor **35** to discontinue rotation of the carrier disk **12**.

From the above description it will be seen that the present closure handling apparatus is particularly adapted for handling closures which are greater in diameter than in height in a rapid and efficient manner and which provides novel and efficient means for orienting the closures prior to passing the closures to a guide chute and which further provides novel means for aligning and advancing successive closures to the orienting mechanism.

It will be understood that where the word "gap" occurs in the claims, it is intended to refer to the space between the end of the bottom plate **76** and beginning of the bottom plate **94** in FIG. **6**. In FIG. **10**, the gap is defined by the end of the rail **90** and the beginning of the plate **94**.

Having thus described the invention, what is claimed is:

1. Apparatus for handling closures open at one end comprising, in combination, means for supporting closures, guide means for guiding the supported closures in a line and in an upright position with their open ends up or down, and means for sorting the closures constructed and arranged to continue advance of those closures presented to the sorting means with their open ends up and to overbalance and reject those closures presented to the sorting means with their open ends down, said sorting means being disposed at a gap in said guide means, said sorting means including a freely rotatable toothed wheel disposed in said gap and adapted to support a closure with its open end up and permitting overbalancing of a closure with its open end down, the outside diameter of said toothed wheel extending only a slight distance above the bottom of said guide means, and an air jet arranged to direct a stream of air on top of successive closures to assist in rejecting overbalanced closures.

2. Apparatus for handling closures open at one end and which are greater in diameter than in height comprising, in combination, a rotary disk, a circular retaining wall and a top wall cooperating with said disk and providing an annular space for forming and advancing closures in a circular path and in an upright position with their open ends up or down, the space between the disk and the underside of the top wall being such as to block admission to said annular space of a closure lying on its side, said circular wall having an opening therein through which successive closures are guided and discharged, and means disposed adjacent said opening in the circular wall for sorting the closures adapted to continue advance of those closures having their open ends up and to reject those closures having their open ends down.

3. Apparatus for handling closures open at one end and which are greater in diameter than in height and which are also greater in diameter at one end than at the other, comprising, in combination, a rotary carrier disk, a circular retaining wall cooperating with said disk for aligning closures in a circular path and in an upright position with their open ends up or down, said wall having an opening therein through which successive closures are guided and discharged, supporting rails for supporting said closures as they are advanced in a line, and sorting means including a gap defined by discontinuance of a supporting rail for a short distance, and an air jet directing air against the tops of successive closures, said sorting means constructed and arranged so that a closure with its closed end down is capable of bridging said gap to continue its advance, and a closure with its open end down will be overbalanced and rejected when it reaches said gap, said guide rails including a holding rail spaced from an inner rail, the lower edge of said holding rail spaced upwardly from said disk to provide a slight clearance for the height of the closure and under which the larger diameter edge of an open end up closure engages to prevent overbalancing thereof when subjected to a stream of air on top thereof, said holding rail being disposed to permit rocking and overbalancing of an open end down closure to reject the same.

4. Apparatus for handling closures which are greater in diameter than in height comprising, in combination, a carrier disk for supporting closures mounted to rotate in a horizontal plane and onto which randomly arranged closures are deposited, a circular retaining wall and a top wall cooperating with said disk and providing an annular space for forming and advancing closures in a circular path and arranged to accept those closures assuming an upright position with their open ends either up or down, the space between the disk and the underside of the top wall being such as to block admission to said annular space of a closure lying on its side, said retaining wall having an opening therein through which successive closures are discharged, a feed chute, and sorting means disposed intermediate the retaining wall opening and feed chute to permit passage into the chute of those closures assuming an oriented open end up position, and to cause rejection of those closures in other than an oriented position.

5. Apparatus as defined in claim **4** wherein the sorting means is disposed intermediate said wall opening and the mouth of said chute.

6. Apparatus as defined in claim **4** wherein the sorting means includes an air jet for directing air downwardly against the tops of successive closures to assist in effecting rejection of an unoriented closure.

7. Apparatus as defined in claim **4** which includes means for depositing randomly arranged closures onto said disk from a bulk supply thereof, and means for returning the rejected closures to said bulk supply.

8. Apparatus as defined in claim **4** wherein the closures are moved into said annular space by centrifugal force to form a circular row thereof.

9. Apparatus as defined in claim **11** wherein flexible means arranged in the path of the closures being moved by said carrier disk is provided for diverting the movement of randomly arranged closures on the disk, and means for directing streams of air against such closures to cause them to change their position.

10. Apparatus for handling closures which are greater in diameter than in height comprising, in combination, a carrier disk mounted to rotate in a substantially horizontal plane, means for depositing randomly arranged closures onto said disk, a stationary circular retaining wall cooperating with said disk and providing an annular space arranged to bar entrance of closures

lying on their sides, and to receive by centrifugal force those closures assuming an upright position with their open ends either up or down to form a circular line thereof, said wall having an opening therein through which successive closures are guided and discharged in a line, a feed chute for receiving oriented closures and from which closures are withdrawn, guide rails including side rails and upper and lower rails for retaining the closures in said line, means disposed intermediate said wall opening and the mouth of the chute for sorting the closures, said sorting means adapted to permit oriented closures with their open ends up to continue their advance and to reject those closures with their open ends down, said sorting means including an air jet directing air against the top of successive closures to assist in rejecting the same, said sorting means being disposed at a gap in said guide means, said sorting means including a freely rotatable toothed wheel disposed in said gap and adapted to support a closure with its open end up, and permitting overbalancing of a closure with its open end down.

11. Apparatus as defined in claim **10** wherein the sorting means includes a short bottom rail rounded at one end, an open end up closure passing over said rail and into said chute, and an open end down closure being rocked downwardly as it passes over said rounded end to be rejected.

12. Apparatus as defined in claim **10** which includes means for controlling the operation of the apparatus, said control means comprising means for detecting a surplus of closures in said chute, and means responsive thereto for discontinuing the discharge of closures through said opening, and for simultaneously discontinuing depositing of closures onto said disk.

13. Apparatus as defined in claim **12** wherein the detecting means comprises a photoelectric unit, the means for discontinuing discharge of closures through said opening comprising a gate movable into said annular space.

14. Apparatus as defined in claim **12** wherein the control means includes an electrical circuit having a time delay relay arranged to discontinue rotation of said carrier disk after a predetermined time in the event that withdrawal of closures from the chute is discontinued.

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