United States Patent

Vergobbi

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[54] CLOSURE FEEDING AND ORIENTING APPARATUS

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[21] Appl. No.: **740,517**

[52] **U.S. Cl.**.....**198/33 AA,** 302/2
[51] **Int. Cl.**.....**B65g 47/24,** B65g 53/00
[58] **Field of Search**.....198/33 R, 33, 26; 221/10, 158; 133/8; 302/2; 250/223

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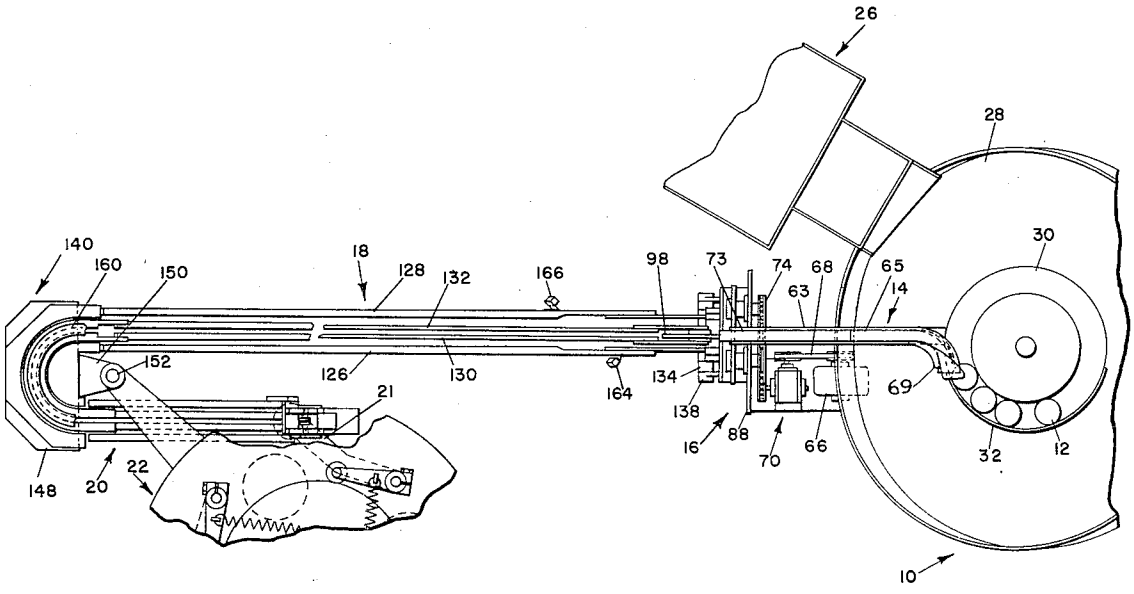
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Primary Examiner—Edward A. Sroka
Attorney—Robert R. Churchill

[57] **ABSTRACT**

Comprises a feeding device for initially aligning randomly arranged closures edge to edge in a row facing in either one direction or the other, and an orienting device for thereafter arranging all of the closures thus aligned to face in the same direction.

9 Claims, 11 Drawing Figures



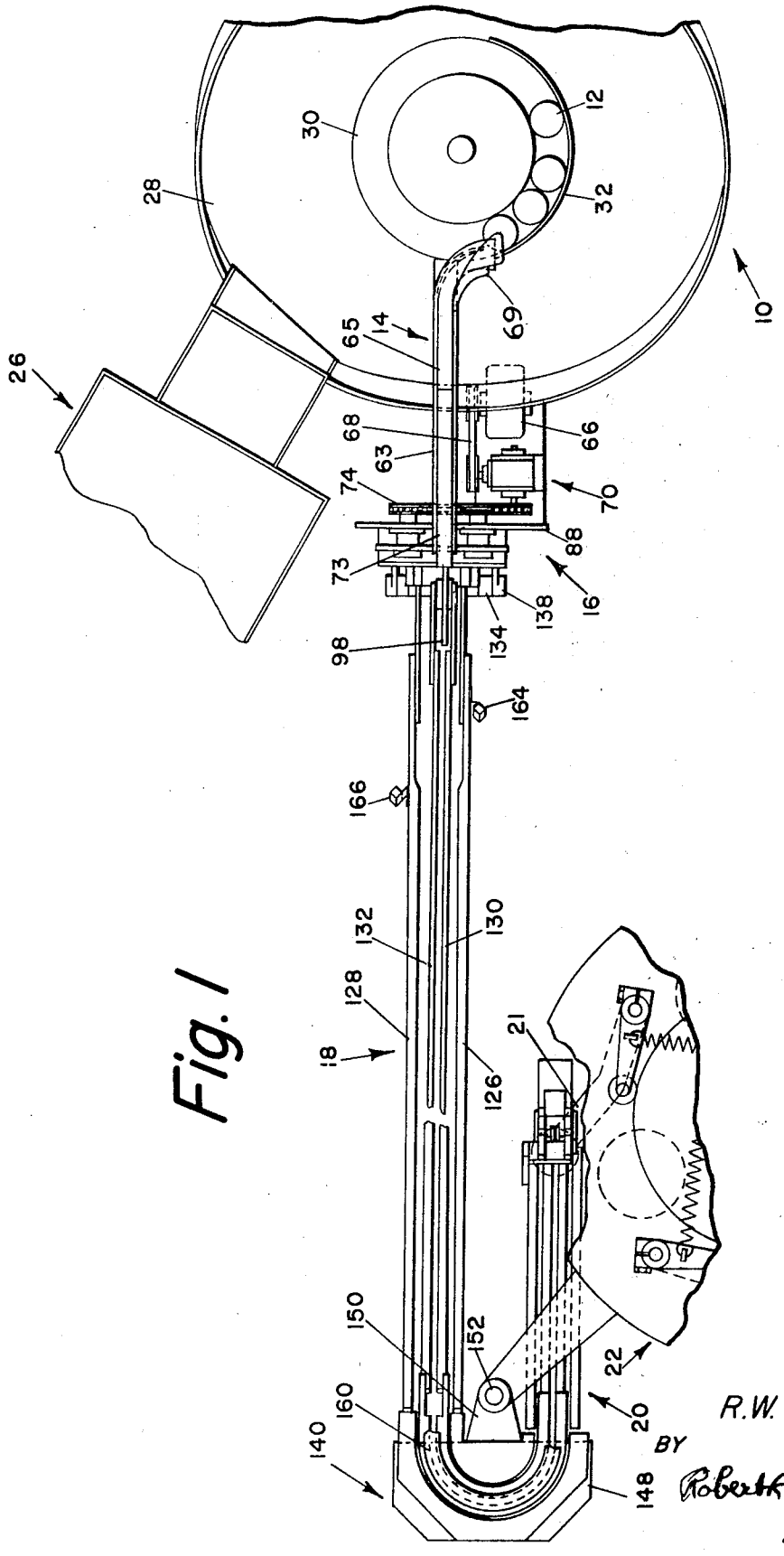


Fig. 1

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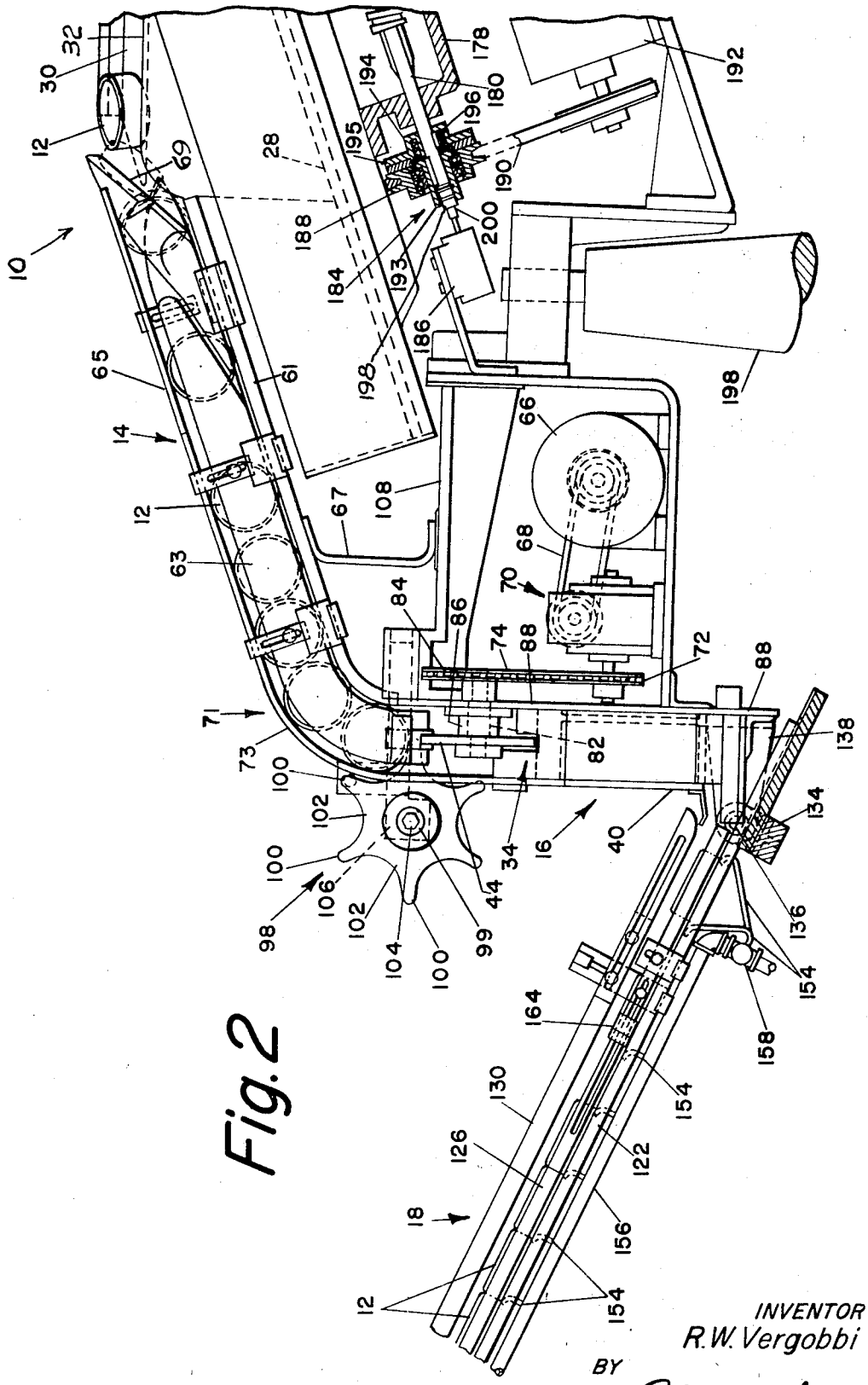


Fig. 2

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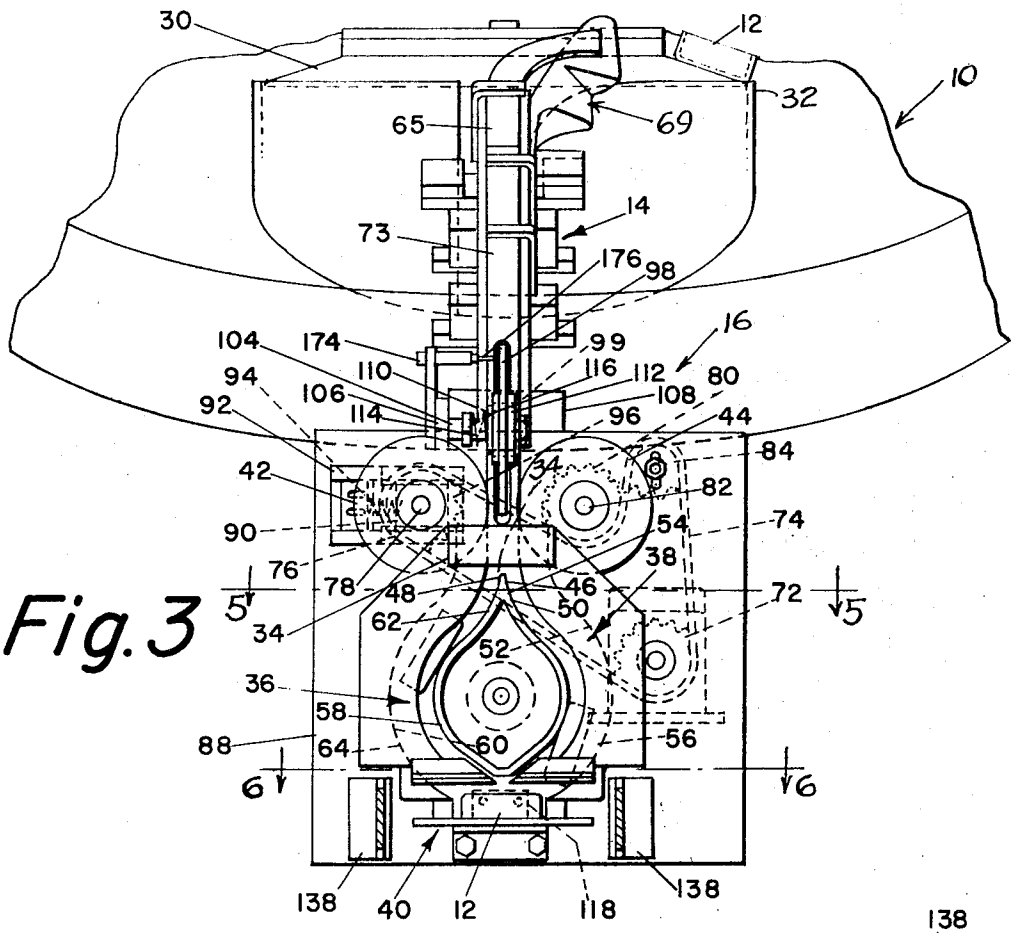


Fig. 3

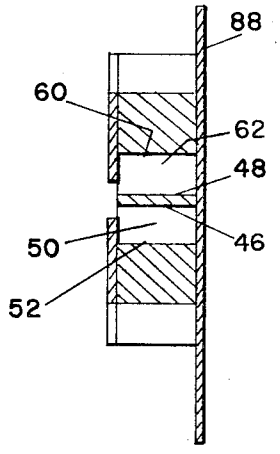


Fig. 5

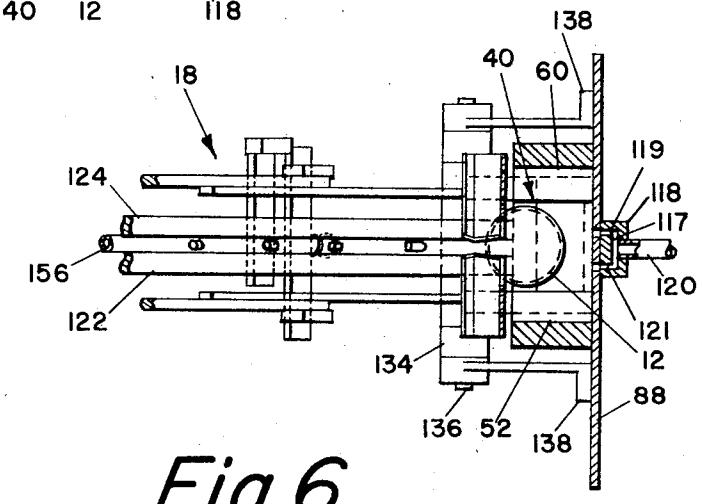


Fig. 6

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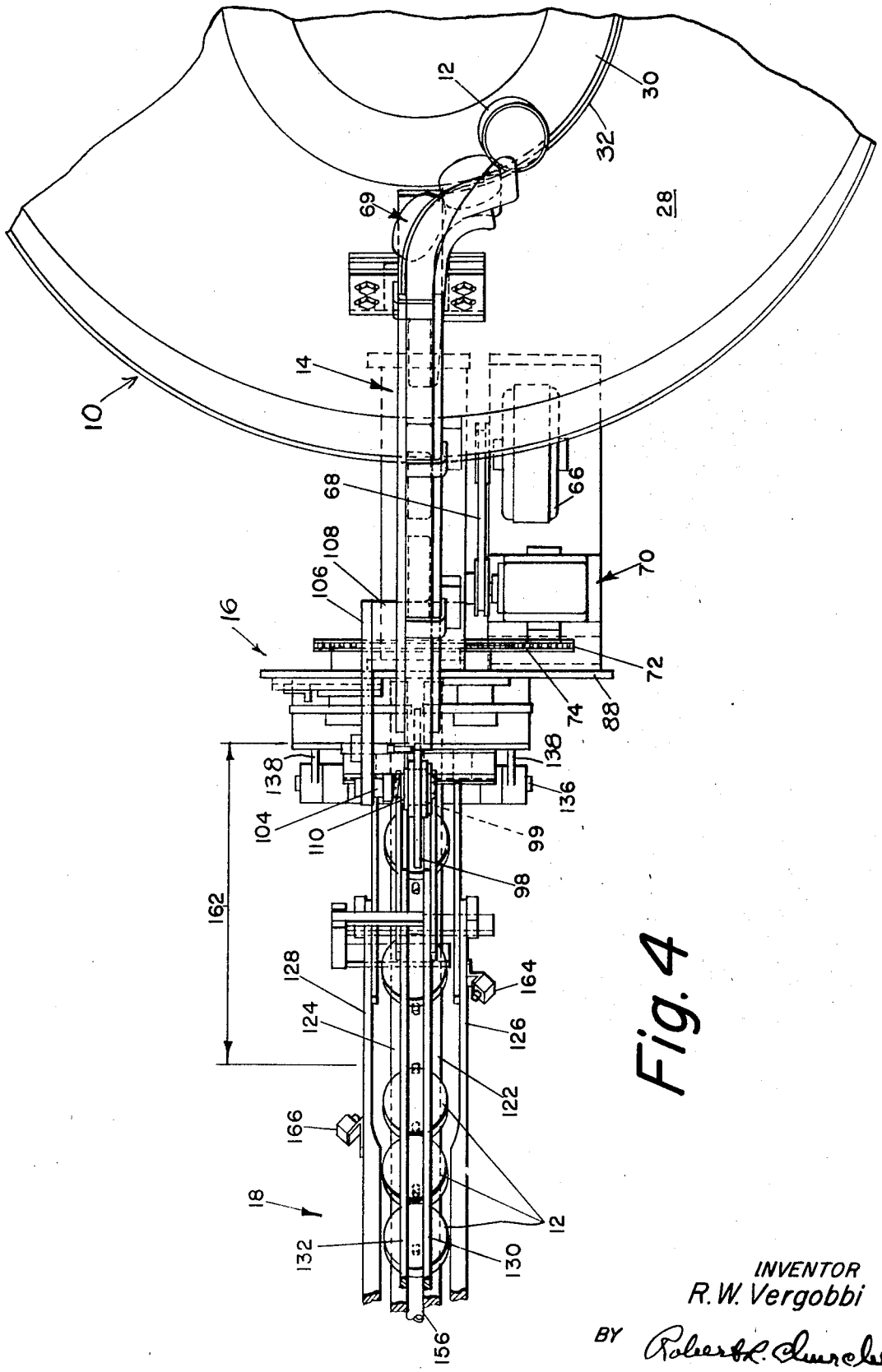


Fig. 4

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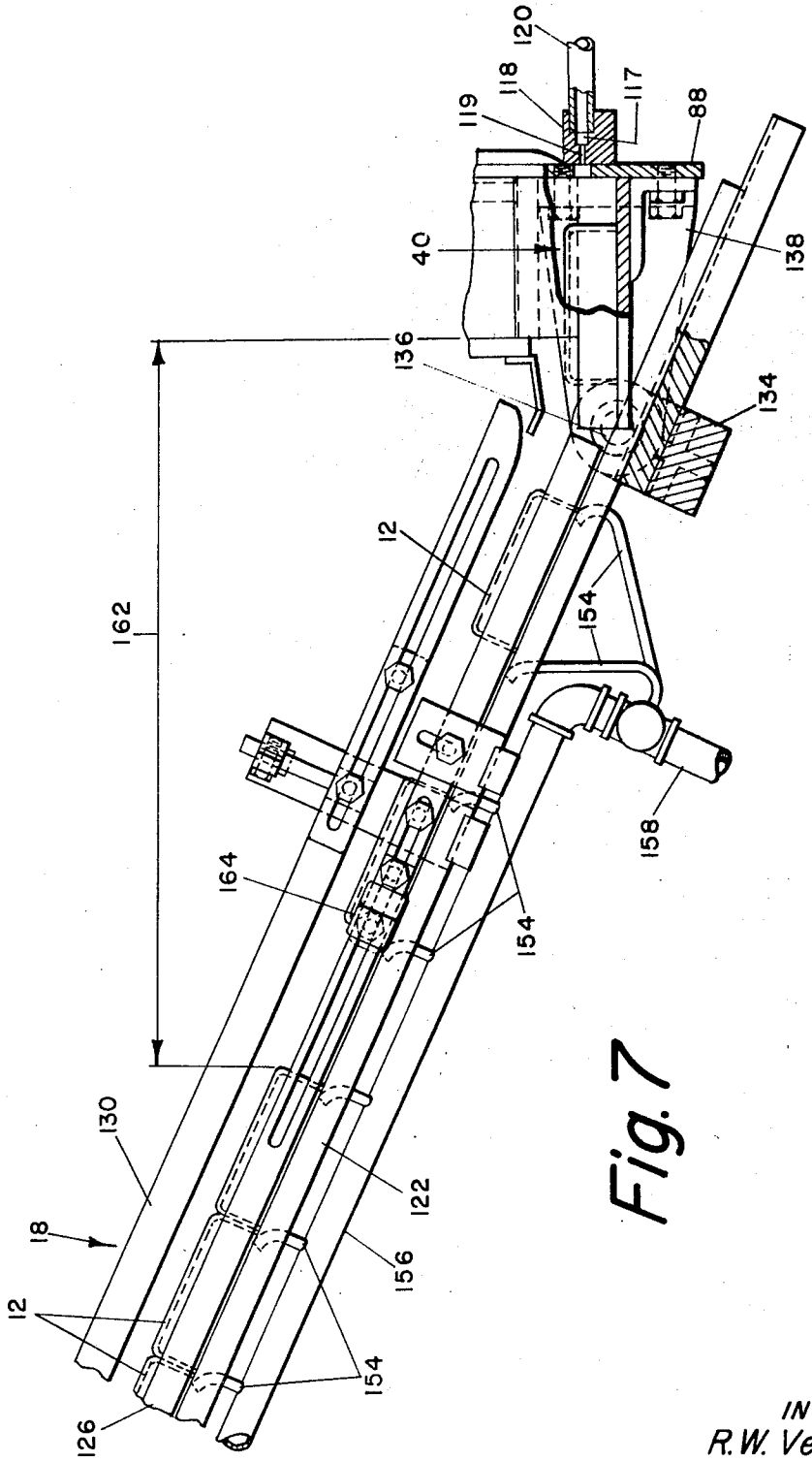


Fig. 7

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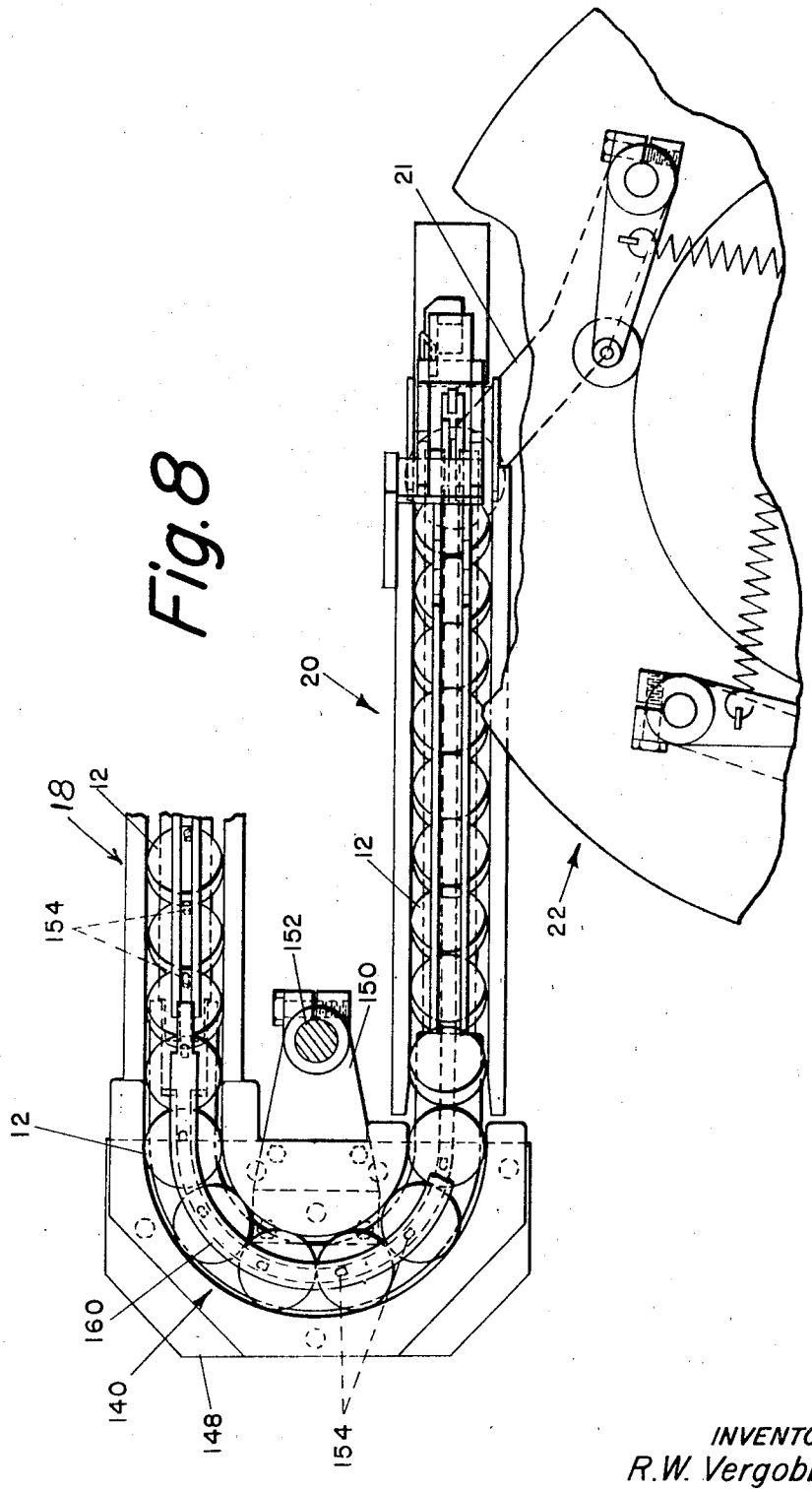


Fig. 8

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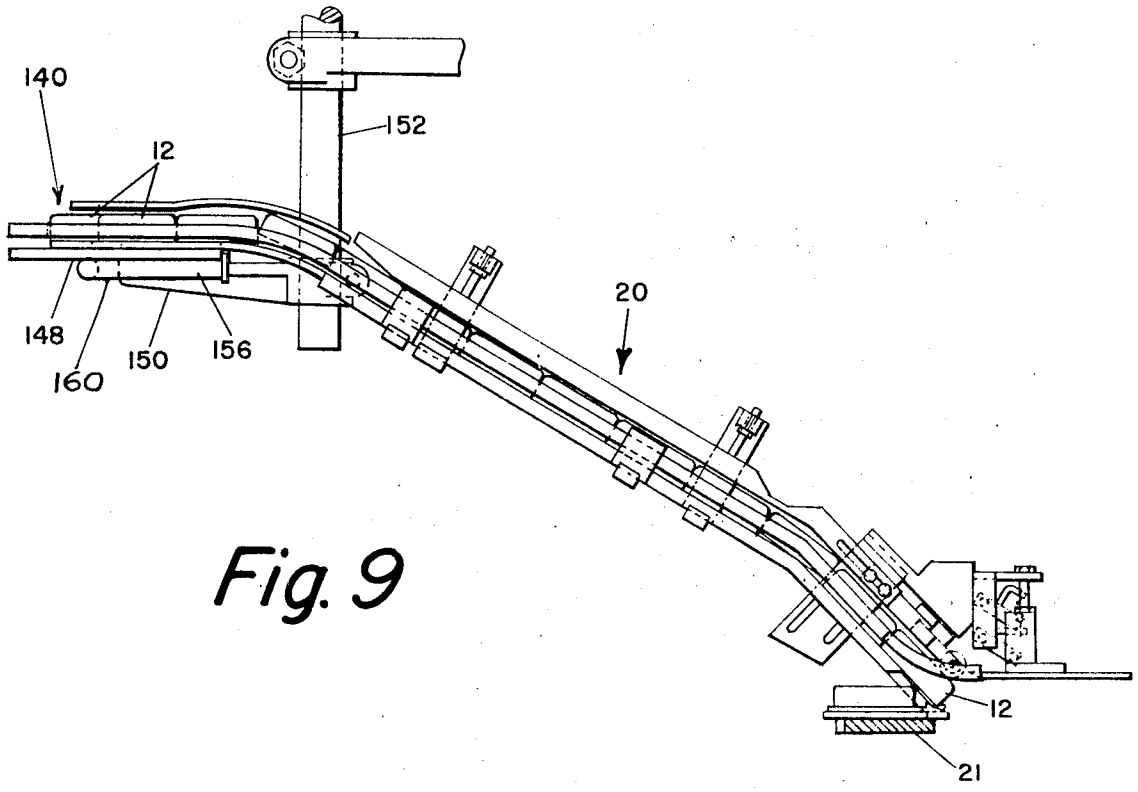


Fig. 9

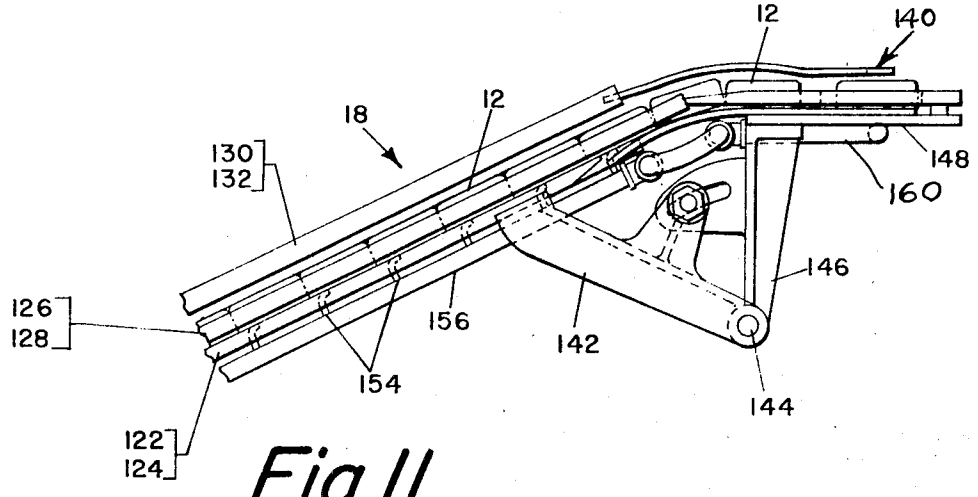


Fig. 11

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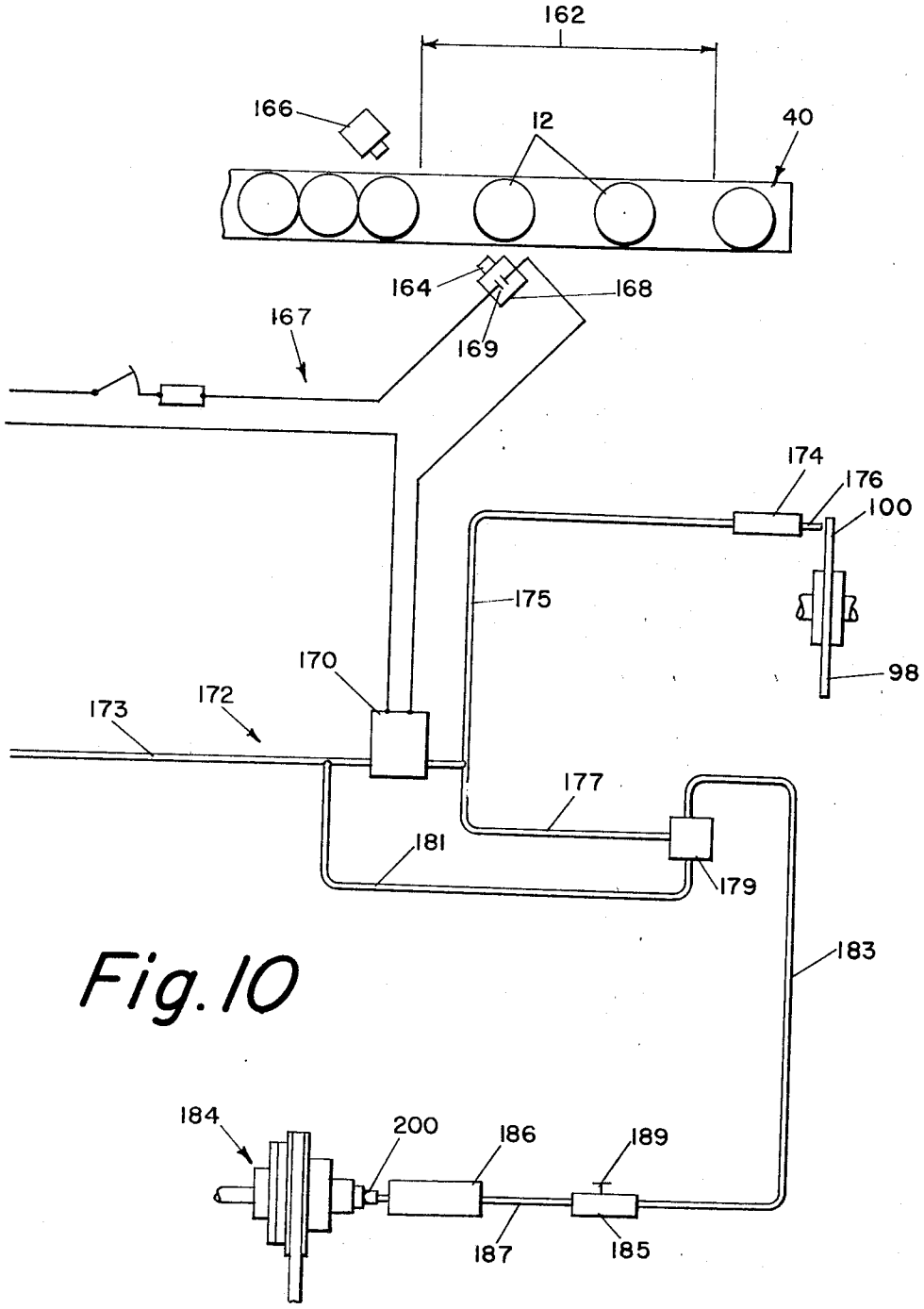


Fig. 10

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CLOSURE FEEDING AND ORIENTING APPARATUS

This invention relates to closure feeding and orienting apparatus.

The invention has for an object to provide novel and improved closure feeding and orienting apparatus capable of orienting and delivering closures at a rate such as to maintain a maximum supply of oriented closures in the delivery chute of a closure applying machine at all times.

The invention has for another object to provide novel and improved closure feeding and orienting apparatus of the character specified which comprises an improvement in the closure handling machine illustrated and described in the U.S. Pat. No. 2,715,978 assigned to the same assignee as the present application.

The invention has for a further object to provide novel and improved apparatus of the character specified embodying novel control means for maintaining a full supply of closures in the delivery chute including means for preventing overfeeding and possible jamming of the closures.

With these general objects in view and such others as may hereinafter appear, the invention consists in the closure feeding and orienting apparatus and in the various structures, arrangements and combinations of parts hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention:

FIG. 1 is a plan view outline of a closure feeding and orienting device embodying the present invention:

FIG. 2 is a view in side elevation of the auxiliary orienting apparatus shown in FIG. 1;

FIG. 3 is a front elevation of the orienting mechanism shown in FIG. 2; elevation of the orienting mechanism shown in FIG. 2;

FIG. 4 is a plan view of the orienting mechanism shown in FIG. 2;

FIG. 5 is a cross sectional view taken on the line 5—5 of FIG. 3;

FIG. 6 is a cross sectional view taken on the line 6—6 of FIG. 3;

FIG. 7 is a cross sectional view of the discharge end of the orienting device and the adjacent portion of a conveyer;

FIG. 8 is a plan view of the upper end of the conveyor and includes the closure delivery chute;

FIG. 9 is a view in side elevation of the delivery chute shown in FIG. 8;

FIG. 10 is a diagrammatic view of an electric circuit and an associated air circuit illustrating the control means embodied in the present machine; and

FIG. 11 is a view in side elevation of the upper end of the conveyer.

In general, the present invention contemplates an improvement in the closure handling machine shown in U.S. Pat. No. 2,715,978, issued Aug. 23, 1955, to Walter S. Sterling and assigned to the same assignee as the present application. Such prior machine is adapted for use with a closure applying machine wherein it is desired to deliver the closures, such as screw caps, in a line and oriented to face in the same direction. In operation, closures are withdrawn at random from a bulk supply thereof and are guided between supporting and advancing elements comprising the orienting mechanism arranged to maintain the closures in a position of equilibrium when they are presented therebetween in a predetermined position and arranged to reject the closures when they are presented between the supporting and advancing elements in other than the desired predetermined position. The balanced and oriented closures are advanced and delivered into the upper end of a feed chute from which they may be withdrawn and transferred into operative position to be received by successive capping heads of a bottle capping machine. In practice, the closures are arranged to be oriented in a natural or inherent position of equilibrium which may vary with different shapes and sizes of closures. Only those closures which assume and maintain such position are advanced into the delivery chute. All other closures in different positions are overbalanced and rejected to be returned to the main supply and again presented to the orienting mechanism, feed of oriented closures is sufficient to meet the normal demand of the closure applying machine.

In the operation of the machine disclosed in U.S. Pat. No. 2,715,978 the average rate of orientation of the randomly arranged closures withdrawn from the bulk supply is about 65 to 70 percent of the total number of closures arranged to pass through the orienting mechanism, leaving about 30 to 35 percent which are rejected and returned to the supply to be again passed through the machine. Thus, in practice, the rate of advance of the closures through the machine must be such that 65 to 70 percent of the total is sufficient to satisfy the demand of the closure applying machine. For example, assuming that the machine is run at a speed such as to advance about 400 closures a minute, which is about the maximum at which they may be advanced and still maintain control of the movements of the closures, then since on the average only 65 to 70 percent of this total are oriented, the number of oriented closures delivered to the closure applying machine would be from 260 to 280 a minute. This rate of feed of oriented closures is sufficient to meet the normal demand of the closure applying machine.

In accordance with the present invention provision is made for supplying a demand for an increased number of oriented closures, in the neighborhood of 360 closures a minute, without increasing the advance of the randomly arranged closures beyond the normal rate of 400 a minute. This is accomplished by modifying the closure handling machine so as to prevent or eliminate rejection of any of the closures being advanced at 400 a minute, the closures being arranged edge to edge with the open ends facing in either one direction or the other. The closures thus arranged are then guided into an auxiliary orienting device adapted to orient successive closures and deliver the same closed end up onto a conveyor for delivery to the upper end of a chute from which the closures are withdrawn by the closure applying machine.

In the preferred embodiment of the invention, the aligned and oriented closures are advanced at a rate of about 400 closures a minute in order to assure a constant supply at 360 a minute, and provision is made for controlling the advance to prevent overfeeding and jamming of the closures while maintaining a sufficient supply in the delivery chute to assure withdrawal of 360 closures a minute. The control mechanism herein shown comprises in general: means for rapidly advancing successive oriented closures from the discharge area of the orienting mechanism; means for detecting a buildup of closures adjacent said discharge area; means responsive to the detecting means for discontinuing the advance of closures into the orienting mechanism; and means including a time delay for thereafter discontinuing the operation of the closure handling machine in the event that normal operation is not resumed within a predetermined period of time.

Referring now to the drawings and particularly to FIG. 1, in general 10 represents the closure handling machine modified to arrange and advance the randomly arranged closures 12 edge to edge with their open ends facing in either one direction or the other. The closures thus arranged are guided through a chute 14 to auxiliary orienting mechanism indicated generally at 16 and which is adapted to receive successive closures facing in either direction and to discharge all of the closures facing in the same direction. The oriented closures are then advanced upwardly on a conveyor 18 and guided into the upper end of a delivery chute 20 from which successive closures are withdrawn by the transfer arm 21 of the closure applying machine indicated generally at 22.

The closure handling machine 10 may comprise a machine of the type illustrated and described in U.S. Pat. No. 2,715,978 wherein a bulk supply of closures 12 stored in a hopper 26 are delivered to a rotary inclined carrier 28, the closures being carried upwardly and guided into engagement with the beveled marginal edge of a rotary orienting disk 30.

As the closures are advanced along the edge of the orienting disk **30**, they leave the carrier **28** and are supported between the beveled edge and a cooperating stationary closure supporting rail **32**. In the operation of the machine shown in the patent, those closures assuming a desired predetermined position between the orienting disk **30** and the rail **32** are capable of maintaining their stability and are advanced into the upper end of a feed chute and those closures assuming a position other than the desired position are incapable of maintaining their stability between the disk and the rail and are permitted to fall back onto the carrier **28** to be again advanced into engagement with the beveled disk **30**.

In accordance with one feature of the present invention, the relationship between the orienting disk **30** and the supporting rail **32** is changed so that all of the closures guided between the disk and the rail assume a uniform position regardless of the direction of the open end and as a result none of the closures are rejected. The closures thus aligned with their open ends facing either way are guided into an upright or an edge position, as shown, and are caused to enter the chute **14** leading to the orienting mechanism **16**.

It will be understood that the disk **30** and rail **32** could be adjusted so as to accept only those closures facing in one direction. However, it is an object of the present invention to eliminate rejections so as to maintain a maximum rate of feed of about 400 closures a minute in order to satisfy the demand of the closure applying machine.

The auxiliary orienting mechanism **16** herein illustrated has an entrance portion **34** in communication with opposing arcuate tracks **36, 38** and a discharge portion **40** from which successive closures are transferred to the conveyor **18**. A pair of spaced driven rotary members **42, 44** disposed above the entrance portions **34** have their peripheries extended into opposite sides of the chute **14** for cooperation with successive closures. In operation, when a closure having its open end facing toward the right, as shown in FIG. **3**, is engaged between the opposing rotary members, the left hand member **42** engaging the closed end urges the closure to the right since the open end is able to straddle a portion of the periphery of the member **44**. As a result, the leading end of the closure is directed toward the right hand track **38**, the closed end engaging one side **46** of the wedge shaped track dividing web **48**. The closure travels by gravity between the inner and outer faces **50, 52**, respectively, of the groove track **38**, first passing through a concave portion **54** and then a convex portion **56** which serves to dispose the closed end of the closure up, in which position it is discharged through the portion **40**.

On the other hand, a closure having its open end facing to the left is capable of straddling a portion of the periphery of the rotary member **42** as urged by the member **44** engaging the closed end of the closure. As a result, the closure enters the left hand groove track **36** defined by the inner and outer faces **58, 60**, respectively. Likewise, the closure first passes by gravity through a concave portion **62** and then through a convex portion **64** which disposes the closure closed end up as it passes through the discharge portion **40**, thus effecting orientation of successive closures.

The chute **14** comprises a bottom rail **61**, side rails **63** and a top rail **65** and is supported by brackets **67** attached to the machine frame. The receiving end **69** of the chute is curved, as indicated, to receive the closures being advanced thereto by the beveled disk **30**. The lower end **71** of the chute **14** is curved downwardly as indicated at **73** for communication with the entrance portion **34** of the orienting mechanism **16**. The rails are adjustable to accommodate closures of different sizes.

The rotary members **42, 44** are continuously rotated through independent driving means including a motor **66** connected by a belt and pulley drive **68** to the input shaft of a speed reducing unit **70**. The output shaft is provided with a drive sprocket **72** connected by a chain **74** which runs over a sprocket **76** fast on a stud **78** which also carries the rotary member **42**, then under a sprocket **80** fast on a stud **82** which carries the rotary member **44**, then over an idler sprocket **84** and back to the drive sprocket **72**. The stud **82** is journaled in a bearing **86** secured to a supporting plate **88**. The stud **78** is journaled in a slide bearing **90** mounted for lateral movement in a grooved guide member **92** which is secured to the plate **88**. A spring **94** interposed between the slide bearing **90** and wall at one end of the guide member **92** urges the slide bearing to the right against a stop **96** at the other end of the guide member. The spring **94** permits yielding of the slide bearing **90** to the left to prevent damage to the parts in the event that an article greater in thickness than the normal spacing between the members **42, 44** is inserted therebetween. It will be understood that the chain **74** may be of a length such as to permit lateral movement of the sprocket **76** when required.

As illustrated in FIGS. **2** and **3**, provision is made for controlling the advance of the closures to present only one closure at a time between the orienting members **42, 44** whereby to prevent interference with a closure passing between the members by a succeeding contiguous closure. As herein shown, a star wheel **98** having a plurality of radial arms **100** forming pockets **102** therebetween is rotatably mounted with the arms **100** extended through the front of the chute **14** into the path of the closures confined in the chute **14**. The star wheel **98** is provided with a ball bearing **99** mounted to rotate on a stud **104** carried by a bar **106** attached to a frame member **108**. The stud **104** is adjustably mounted in the bar **106** to enable movement of the star wheel into cooperative relation to the closures in the chute. In operation, successive closures engage successive radial arms **100** and become seated in successive pockets **102**, the weight of the line of closures effecting rotation of the star wheel. The closures are thus separated to prevent interference one with the other as they pass between the rotary members **42, 44** of the orienting mechanism.

In order to control the rotation of the star wheel **98** and to prevent inadvertent rotation of the same, the latter is frictionally engaged on one side by a spring pressed washer **110**, the spring **114** being interposed between a collar **116** and the washer **110**. Thus, in operation, the star wheel is operated under the influence of the weight of the closures only, the pressure exerted by the spring **114** being adjustable by movement of the collar **116** as indicated. With this construction it will be seen that successive closures in the line are caused to pass between the rotary members individually so as to prevent interference of successive closures one with the other.

The oriented closures **12** discharged into the area **40** with their closed ends up are deposited at the lower end of the conveyor **18**. It will be apparent that the closures arriving at the discharge area **40** at the rate of 400 a minute must be quickly removed therefrom to avoid piling up and jamming of the closures. For this purpose an air block **118** attached to the plate **88** adjacent the discharge area **40** is provided with a pair of air jets **119, 121** aligned with openings in the plate arranged to continuously project streams of air in a direction to advance the oriented closures along the upwardly inclined conveyor **18** into contiguous engagement with preceding closures in the line. The air jets **119, 121** in the block **118** are provided with a connecting passageway **117** which is connected by tubing **120** to a regulated source of compressed air.

As herein illustrated, the upwardly inclined conveyor **18** comprises a pair of bottom rails **122, 124**, a pair of side rails **126, 128** mounted for lateral adjustment to accommodate different sizes of closures, and a pair of top rails **130, 132** mounted for vertical adjustment. The lower end of the conveyor is supported in a bracket **134** which is pivotally mounted on studs **136** carried by spaced brackets **138** attached to the supporting plate **88**. The upper end of the conveyor, which cooperates with a semicircular portion **140** of the conveyor, is supported by an angularly adjustable bracket **142** pivotally carried by a stud **144**. The stud is mounted in a bracket **146** depending from a bottom plate **148** supported by a bracket **150** mounted on an upright **152**. In practice, the angle of the conveyor **18** is required to be changed when the height of the closure applying machine **22** is adjusted to accommodate containers of different heights.

From the description thus far it will be seen that successive oriented closures discharged from the orienting mechanism **16** into the discharge area **40** are quickly advanced along the conveyor **18** by air streams emitted continuously from the jets **119, 121**. As herein shown, provision is made for continuing the advance of the closures up the conveyor **18** and around the semicircular portion **140** by streams of compressed air. The closures then flow by gravity down delivery chute **20** from which successive closures are withdrawn. The air streams are emitted from spaced jets **154** connected to an elongated air pipe **156** extending along the underside of the conveyor. The air pipe or manifold **156** is connected to a source of compressed air by a pipe **158**. The discharge ends of the air jets are disposed immediately below and at a slight upward incline with respect to the path of travel of the closures and eject continuous streams of air against the closures to move the same through the conveyor **18**, around the semicircular portion **140** and into the delivery chute.

As herein shown, the semicircular portion **140** of the conveyor is similar in cross section to the upwardly inclined portion **18** and is also provided with air jets **154** connected to a semicircular pipe **160** which in turn is connected to a source of compressed air. In side elevation the entrance to the semicircular portion **140** is curved downwardly for communication with the upper end of the inclined portion **18**, the structure being such as to permit angular adjustment of the inclined portion while maintaining a coextensive relationship between the inclined and semicircular portions of the conveyor. The exit end of the semicircular portion is also curved downwardly for communication with the upper end of the delivery chute **20**. The closures flow through the chute by gravity and the endmost closure in the chute is resiliently retained therein until withdrawn by a transfer arm **21** forming a part of the closure applying machine.

In operation, the closures **12** discharged from the orienting mechanism **16** are rapidly and gently advanced by air streams along smooth metal guide rails with a minimum of friction. One advantage of this structure as compared to a driven belt conveyor is that when the closures are restrained from being advanced on a belt conveyor the continuously driven belt sliding along the underside of the restrained closures build up frictional line pressure which is transferred to the closures in the delivery chute, and as a result thereof, the endmost closures may be forced out of the delivery chute **20**. It will be apparent that the gentle handling provided by the air streams will not cause a buildup of pressure in the line when the closures are prevented from being advanced and will provide better control of the closures.

In accordance with another feature of the present invention novel control means is provided for discontinuing the feed of closures **12** into the orienting mechanism **16** when the supply of the closures exceeds the demand and for again starting the feed of closures into the orienting mechanism when a demand for closures is again indicated. Provision is also made for discontinuing the operation of the closure handling machine in the event that an oversupply of closures is detected beyond a predetermined time interval after the feed of closures into the orienting mechanism is discontinued, such indication occurring, for example, when the closure applying machine is stopped and withdrawal of closures is discontinued.

In operation the closures are discharged from the orienting mechanism at a rate of about 400 a minute and the closures are withdrawn from the delivery chute at a rate of about 360 a minute. The closures in the conveyor **18**, semicircular portion **140** and in the delivery chute **20** form a reservoir which is constantly being depleted by withdrawals from the delivery chute and is being added to by the feed of closures from the orienting mechanism.

As herein shown, see FIGS. **4** and **10**, a clearance space **162** is provided between the discharge area **40** and the endmost closure in the reservoir so as to permit immediate advance of the closures out of the discharge area **40** and so as to prevent jamming of the closures one upon another. The clearance space may comprise a length equal to about six closures, for example. At the start of a run, individual closures are advanced up the conveyor, through the portion **140** and into the delivery chute. In operation, since the closures are being fed faster than they are being withdrawn, the line of closures will gradually be extended to form a reservoir and eventually the endmost trailing closure will occupy a portion of the clearance space **162**.

Provision is made for detecting the entrance of a closure into said clearance space **162** and, as herein shown, see FIG. **4**, an electric eye **164** on one side of the conveyor cooperates with a light source **166** on the other side of the conveyor. The electric eye forms part of a circuit **167**, see FIG. **10**, which includes a photoelectric relay **168** arranged to close normally open contacts **169** and further includes a normally closed solenoid valve **170** forming a part of a compressed air circuit **172**. The air circuit is provided with an air cylinder **174** having a piston stem **176** disposed adjacent the star wheel **98**, said stem being movable into and out of the path of rotation of the radial arms **100**.

In operation when the electric eye **164** detects a closure in the clearance space **162**, the circuit **167** is actuated to open a solenoid valve **170** which effects extension of the stem **176** into the path of rotation of an arm **100** of the star wheel **98**. The feed of closures into the orienting mechanism is thus discontinued until such time as subsequent withdrawals from the delivery chute permit advance of the closures beyond the clearance space **162**. It will be understood that in practice, when a closure is rapidly advanced from the discharge area **40** past the electric eye **164** and into engagement with the trailing end of the line, the relatively short time of passage of the closure through the light ray is not sufficient to trigger the photoelectric relay. However, when the trailing end of the line extends into the clearance space, the light is cut off for a length with the adjacent face of the drive pulley **188**. The hub **194** of the friction disk **195** is provided with a plurality of springs **196** which bear against one end of the bushing **193** to move the bushing and the pulley mounted thereon away from engagement with the friction disk to thus render the clutch normally disengaged. The drive pulley **188** is connected by a belt **190** to a motor **192**. The clutch **184** is arranged to be engaged by operation of an air cylinder **186** having a plunger **200** arranged to engage a thrust bearing **198** carried by the bushing **193** to move the bushing and its drive pulley into driving engagement with the friction disk **195**.

As illustrated in FIG. **10**, the air circuit **172** includes a main line **173** to the solenoid valve **170**; a line **175** from the solenoid valve **170** to the air cylinder **174**; a line **177** from the solenoid valve **170** to a normally open pilot valve **179**; a line **181** from the main line **173** to the pilot valve; a line **183** from the pilot valve to a variable flow control unit **185**; and a line **187** from the flow control unit to the air cylinder **186**. During the operation of the machine, air is closures through line **181**, through the open pilot valve **179**, line **183**, flow control valve **185** and line **187** to the air cylinder **186**. Air may flow freely through the control valve **185** in a direction toward the air cylinder **186** whereby to extend the stem **100** to effect and maintain engagement of the clutch **184**. However, upon opening of the solenoid valve **170**, the normally open pilot valve **179** will be closed and the air pressure to the cylinder **186** will be cut off. The pressure in the air cylinder is then permitted to bleed slowly through the unit **185** at a controlled rate, as adjusted by the handle **189**, until a point is reached where the reduction in pressure will permit the stem **200** to be retracted to permit disengagement of the clutch **184**. Subsequently, when the closure applying machine is again started to permit advance of the trailing of time sufficient to trigger the relay and to actuate the solenoid valve **170** to discontinue the feed of closures. It will thus be seen that during the continuous operation of the machine the feed of the closures being advanced to the delivery chute **20** is stopped momentarily until the closures subsequently withdrawn from the chute permit the trailing end of the line in the conveyor **18** to advance out

of the clearance space **162** whereupon the solenoid valve **170** is again closed to permit retraction of the stem **176** to free the star wheel **98** and again start feeding of closures into the conveyor **18**. The provision for thus starting and stopping the feed of closures in response to the demand therefor assures that the delivery chute **20** will have a full supply of closures at all times.

It will be understood that during such momentary holding back of closures from advancing into the orienting mechanism, any surplus closures at the trailing end of the line from the handling machine will be returned to the carrier **28**. On the other hand, in the event that the closure applying machine is stopped so that withdrawal of closures from the delivery chute **20** is discontinued, the star wheel **98** will be stopped, as above described, and after a suitable time delay the closure handling machine **10** will be stopped.

As herein shown, see FIG. **2**, the drive to the rotary carrier **28** os the closure handling machine **10** includes a gear box **178** containing a worm gear drive, the worm shaft **180** having a normally disengaged clutch unit **184** mounted thereon. The driving member of the clutch comprises a pulley **188** which is free to rotate on a bushing **193**. The bushing is keyed to rotate with the shaft **180** but free to move laterally thereon. The driven member of the clutch comprises the friction disk **195** keyed to the shaft **180** and provided with a facing of friction material for cooperation end of the line of closures out of the clearance space, the closure handling machine **10** will again be started and the star wheel **98** will be released to continue the feed of closures.

In operation, the flow control unit **185** serves as a time delay which permits retraction of the stem **200** and disengagement of the clutch **184** at a predetermined time after the solenoid valve is opened. It will be understood that during continuous operation of the machine the extension of the trailing end of the line into the clearance space is generally of short duration since closures will continue to be withdrawn from the delivery chute **20** while the star wheel **98** is temporarily stopped so that the latter will be released to continue the feed of closures into the orienting mechanism **16** and then into the conveyor **18** before sufficient time has elapsed to discontinue operation of the handling machine.

Referring again to FIG. **2**, it will be seen that during the operation of the machine the guide chute **14** is continuously supplied with closures **12** in edge to edge engagement at a potential rate of upwards of **400** closures a minute. In practice the closures move down the chute by gravity and the weight of the closures effects rotation of the frictionally mounted star wheel **98** to release the closure as fast as they are presented thereto. The rotary orienting members **42, 44** are driven at a rate such that they also advance the clsoures at a potential rate of upwards of 400 a minute.

As shown in FIGS. **3** and **4**, the closures **12** being advanced at approximately 400 a minute must of necessity pass through the divergent paths of the auxiliary orienting mechanism **16** by gravity at a relatively fast rate, and while the star wheel **98** assures passage of only one closure at a time through the rotary aligning elements **42, 44**, more than one closure at a time may be passing through the curved tracks **36, 38**. As illustrated in FIG. **3**, each track **36, 38** has a closure moving therethrough but which are sufficiently spaced so that they will not reach the discharge area at the same time. Likewise there may be two spaced closures in one track sufficiently spaced so as not to interfere one with the other at the discharge area. In practice the continuous streams of air from the jets **119, 121** which are arranged to advance the closures discharged into the area **40** are operative to start forward movement of a closure even before it lands on the bottom rails **122, 124** of the conveyor **18** whereby to further assure non-interference one with the other of successive closures.

The closures are then advanced by the air jets **154** through the clearance space **162** to join the trailing end of the line in the conveyor **18**. The closures being continuously withdrawn from the delivery chute **20** at the other end of the line at a rate of about 360 closures a minute permits advance of the trailing end of the line to accept the new closures being advanced at the rate of **400** a minute. As shown in FIG. **4**, in operation more than one closure may be in movement in the clearance space **162** because of the speed at which the closures are being advanced. While rapid passage of successive spaced closures past the detecting mechanism will not actuate the electric eye **164**, eventually the trailing end of the line will extend into the clearance space **162** to cut off the light source for a sufficient length of time to discontinue the feed because of the difference in the withdrawal rate and the supply rate, the feed being again started when the space **162** is again clear of closures.

From the above description it will be seen that the present improvement in closure handling machine enables a greater number of oriented closures to be delivered to the closure applying machine per unit of time than the number delivered by the prior closure handling machine without increasing the normal speed of such machine. It will also be seen that the present machine provides a line of oriented closures being advanced to the delivery chute without effecting any adverse line pressure tending to force the closures out of the chute.

Having thus described the invention, what is claimed is:

1. In a closure handling and orienting machine, in combination, a closure aligning means comprising a rotary disk in cooperation with a stationary rail adapted to align the closures edge to edge with their open ends facing in one or the other direction to provide a supply thereof, a guide chute for receiving said aligned closures, a pair of spaced rotary members between which successive closures are passed arranged to effect diversion of the closures in one or the other direction to present the closures with their open ends up, separate paths comprising opposed semicircular portions for receiving said diverted closures and arranged to invert the same, said paths having a common discharge area to which the closures are presented in an oriented position with their open ends facing down, means for controlling the feed to said rotary members to avoid interference of successive closures one with the other, an upwardly inclined guideway extending from said discharge area, air jets disposed to rapidly advance successive closures from said discharge area into said guideway, air jets arranged to advance the closures up the inclined guideway, a semicircular guideway connected at one end to the upper end of the inclined guideway, and a delivery conveyor connected to the other end of said semicircular guideway and from which successive closures are withdrawn, the rate of supply of closures being greater than the rate of withdrawal, and control means for periodically discontinuing the supply to effect conformance of the supply with the guideway, and a delivery conveyor connected to the other end of said semicircular guideway and from which successive closures are withdrawn, the rate of supply of closures being greater than the rate of withdrawal; and control means for periodically discontinuing the supply to effect conformance of the supply with the rate of withdrawal.

2. In a closure handling and orienting machine, in combination, closure feeding means including means for aligning and guiding hollow closures on edge and with their open ends facing either right or left, a star wheel having radial arms forming spaced pockets for controlling the advance of the closures, means for diverting said closures to the right or left as determined by said facing direction to present the closures with their open ends facing up, separate paths for said diverted closures shaped to invert the same, said paths having a common discharge area presenting the closures with their open ends facing down, a conveyor associated with said discharge area and along which successive oriented closures are advanced, and a delivery chute associated with said conveyor and from which successive closures are withdrawn, said conveyor and said delivery chute forming a line of closures comprising a reservoir and providing a clearance space between the trailing end of said line and said common discharge area, means for rapidly advancing successive closures from said discharge area

to join the trailing end of said line, and control means including means for detecting a surplus of closures in said reservoir adjacent said discharge area as indicated by extension of the trailing end of the line into said clearance space, and means responsive to said detecting means and engageable with said wheel for stopping the same and discontinuing the feed of closures to said diverting means.

3. A machine as defined in claim 2 wherein the rapid advancing means comprises air jets.

4. A machine as defined in claim 2 wherein the rapid advancing means comprises air jets adjacent said discharge area, and wherein said conveyor comprises a guideway extended upwardly at an angle, said upwardly extended guideway having a plurality of air jets cooperating therewith for advancing the closures up the conveyor and into said delivery chute.

5. A machine as defined in claim 2 which includes means for driving the machine, and wherein a surplus of closures in said reservoir is indicated by extension of the trailing end of the line into said clearance space, said feed being again started upon withdrawal of closures from said delivery chute and advance of the trailing end of the line out of said clearance space.

6. A machine as defined in claim 5 wherein the control means further includes means also responsive to said detecting means for discontinuing the driving means a predetermined time after detection of said surplus.

7. A machine as defined in claim 6 wherein the detecting means comprises an electrical circuit having a photoelectric unit for detecting the presence of closures in said clearance space, a normally closed solenoid valve in said electric circuit adapted to be opened upon detection of said surplus, and an air circuit controlled by said solenoid, said air circuit having an air cylinder actuated upon opening of said valve and arranged to discontinue the feed of closures.

8. A machine as defined in claim 7 wherein the driving means includes a normally disengaged clutch, and wherein the means for discontinuing the driving means includes a second air cylinder in said air circuit for cooperation with said clutch.

9. A machine as defined in claim 8 wherein the air circuit includes a normally open pilot valve and a flow control unit between the pilot valve and said second air cylinder, said pilot valve being closed upon opening of said solenoid valve to permit bleeding of air from the second air cylinder through said flow control valve whereby to effect disengagement of said clutch at a predetermined time after said solenoid valve is opened.

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