United States Patent [19]

Sterling

[11] **3,910,407**

[45] **Oct. 7, 1975**

[54] **CLOSURE HANDLING AND ORIENTING APPARATUS**

[75] Inventor: **Walter S. Sterling,** Quincy, Mass.

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

[22] Filed: **Dec. 18, 1972**

[21] Appl. No.: **315,996**

Related U.S. Application Data

[62] Division of Ser. No. 93,554, Nov. 30, 1970, Pat. No. 3,706,368.

[52] **U.S. Cl.** **198/268;** 198/279; 198/288

[51] **Int. Cl.²** **B65B 47/24**

[58] **Field of Search** ..... 198/262, 268, 274, 275, 198/279, 288, 32; 193/31 R

[56] **References Cited**

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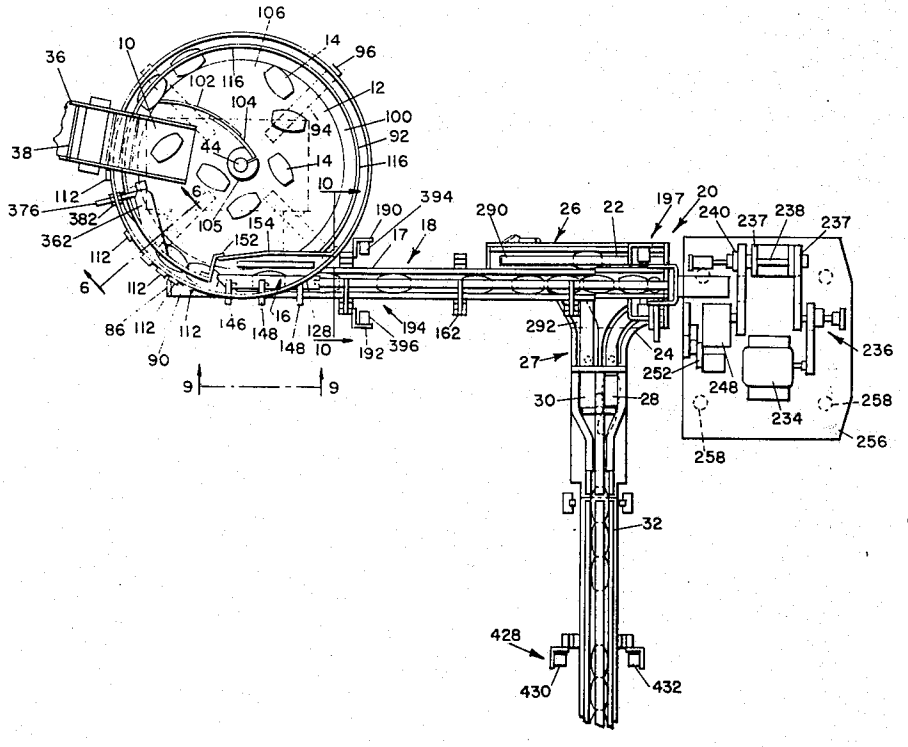
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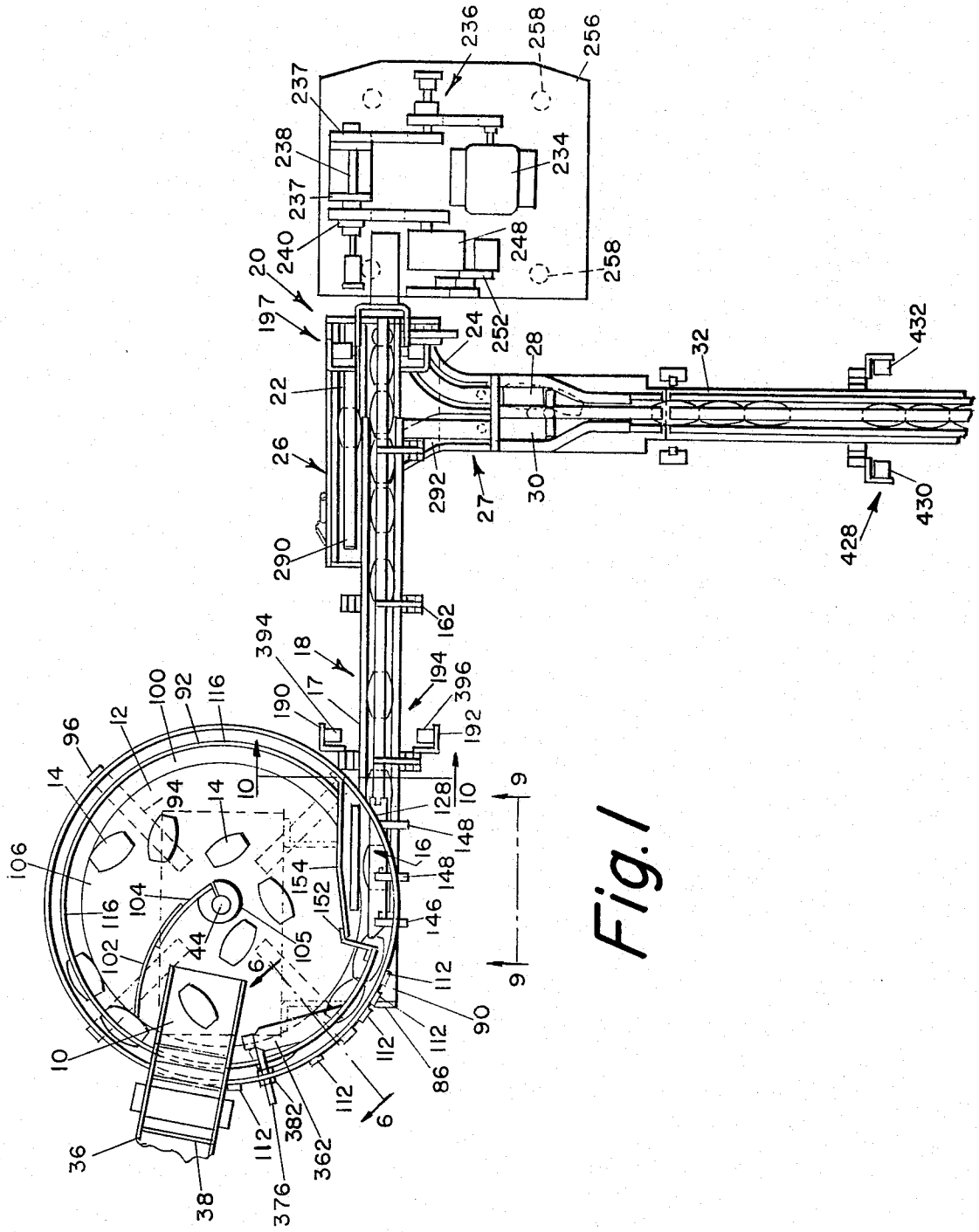
Primary Examiner—Evon C. Blunk
Assistant Examiner—Douglas D. Watts
Attorney, Agent, or Firm—Robert T. Gammons

[57] **ABSTRACT**

Apparatus particularly adapted for handling oblong closures having printing thereon wherein the closures are first aligned end to end in a row regardless of whether or not the printing on adjacent closures reads in the same direction, and thereafter the closures are oriented and realigned with the printing on all of the closures oriented to read in the same direction.

12 Claims, 24 Drawing Figures




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Fig. 1

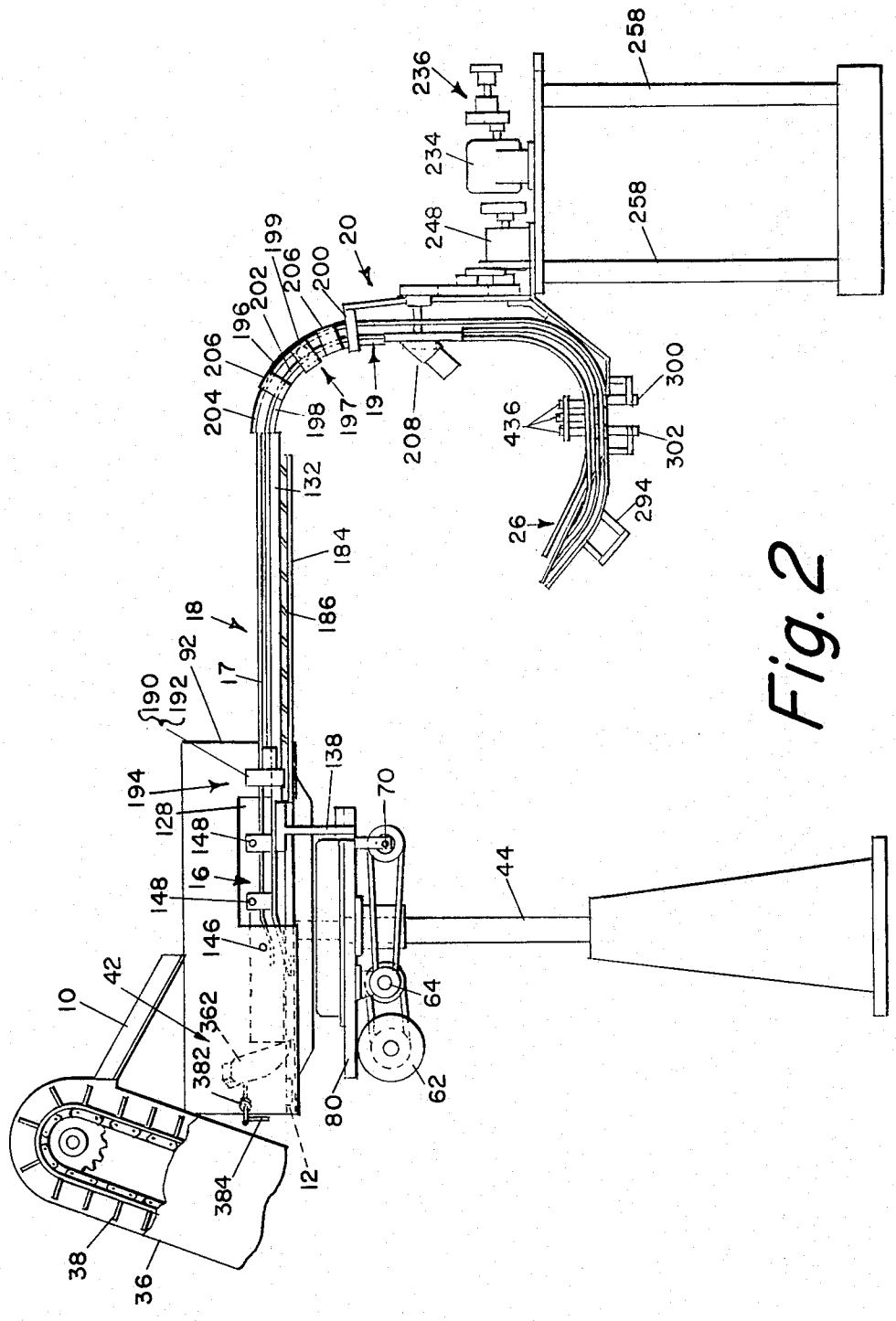

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Fig. 2

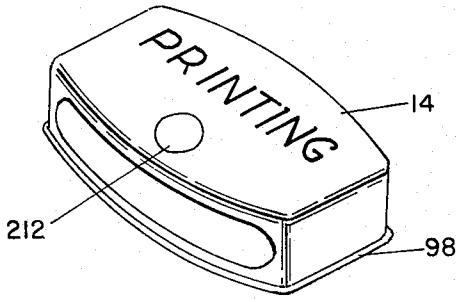


Fig. 3

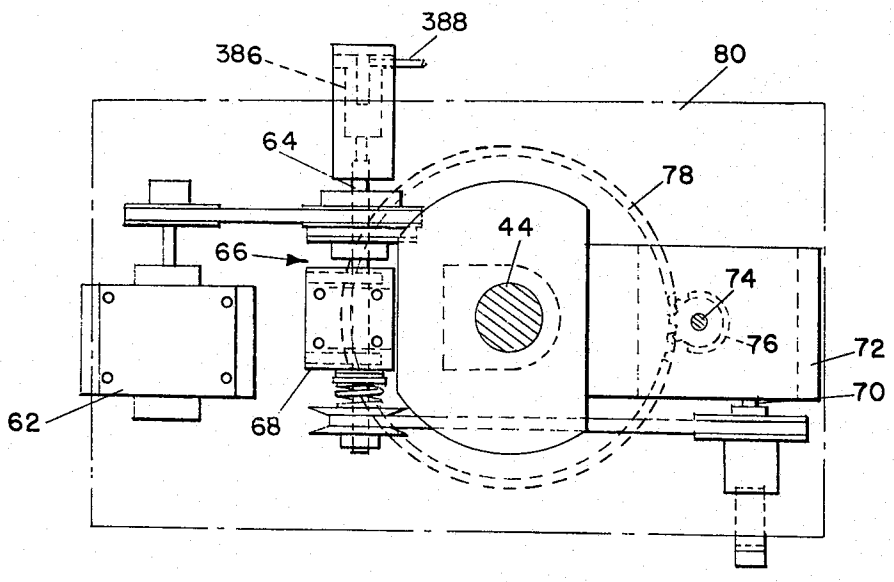


Fig. 4

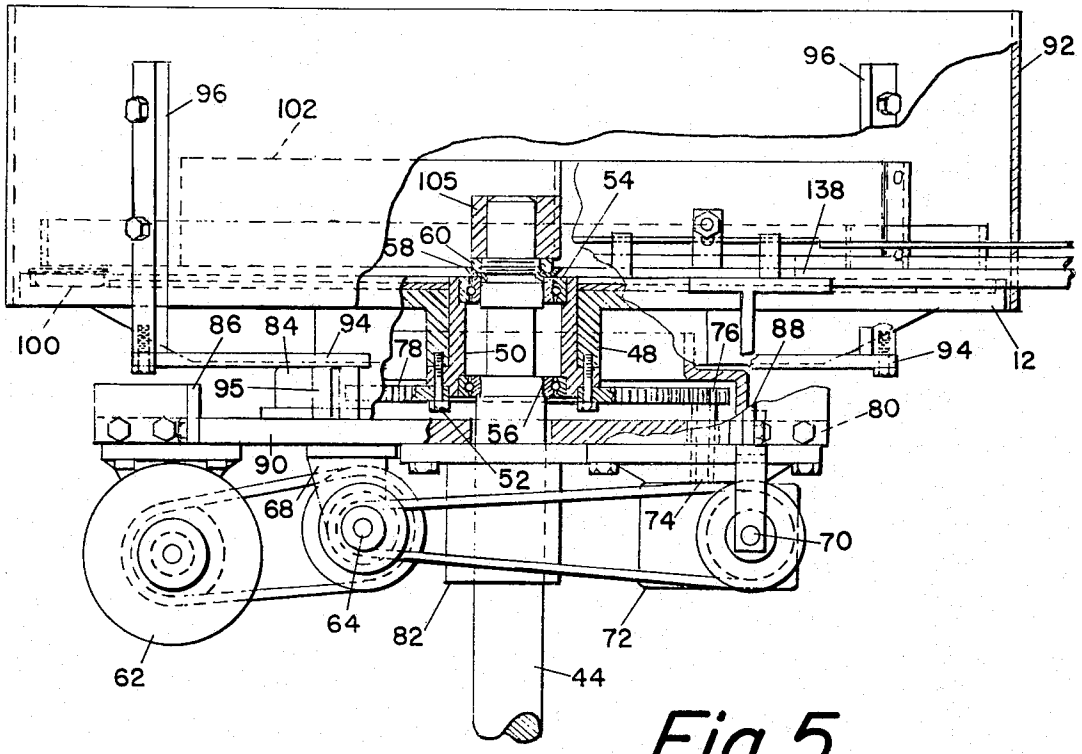

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Fig. 5

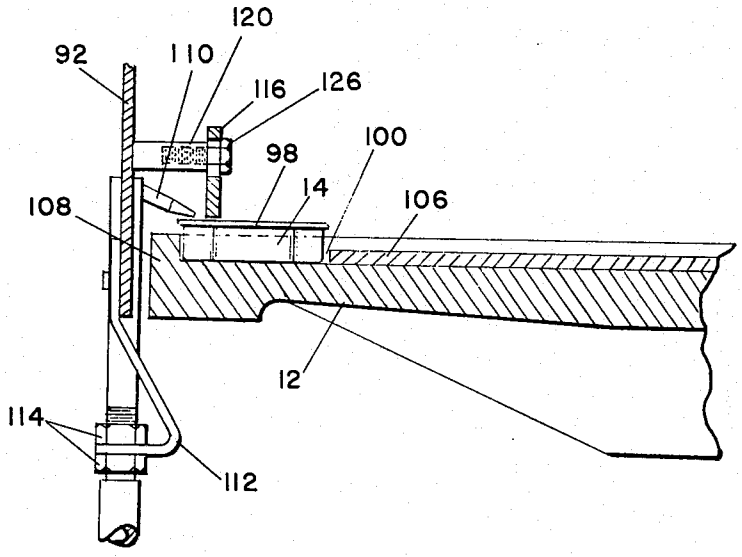

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Fig. 6

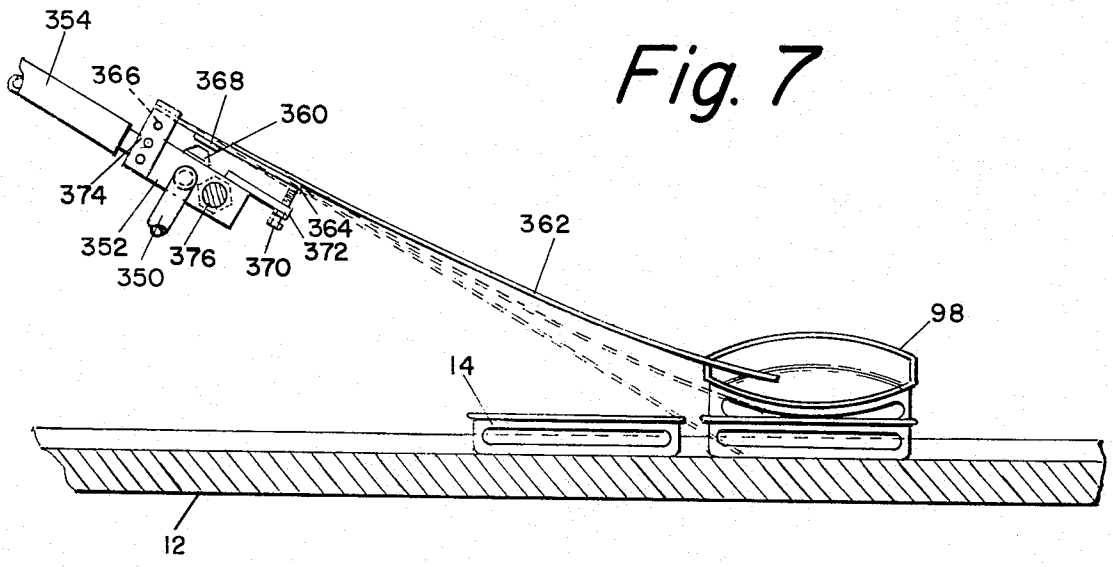

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Fig. 7

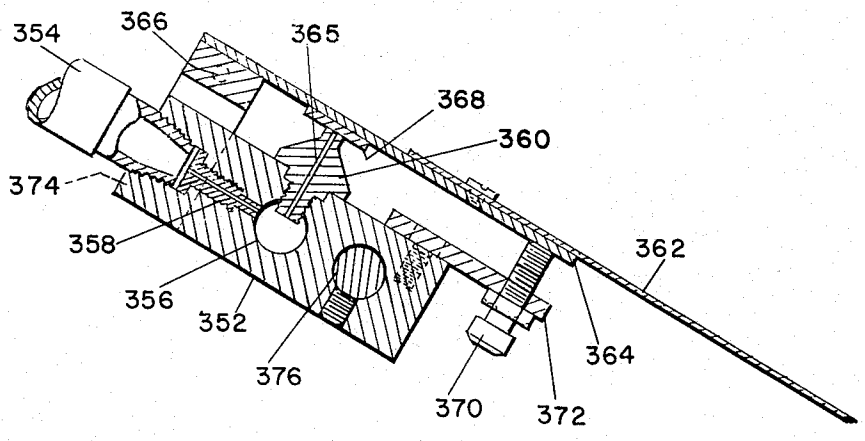

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Fig. 8

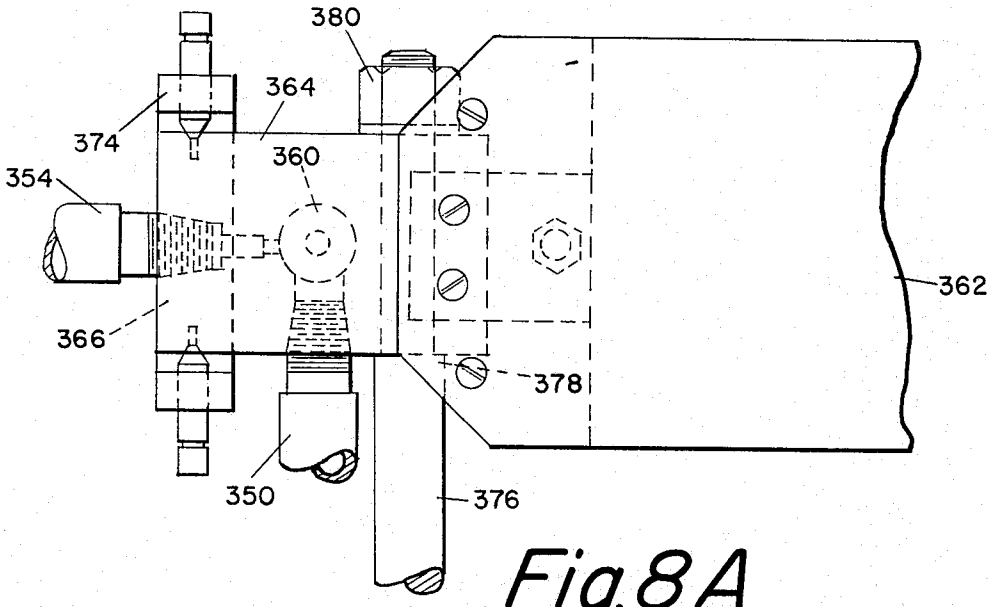

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Fig.8A

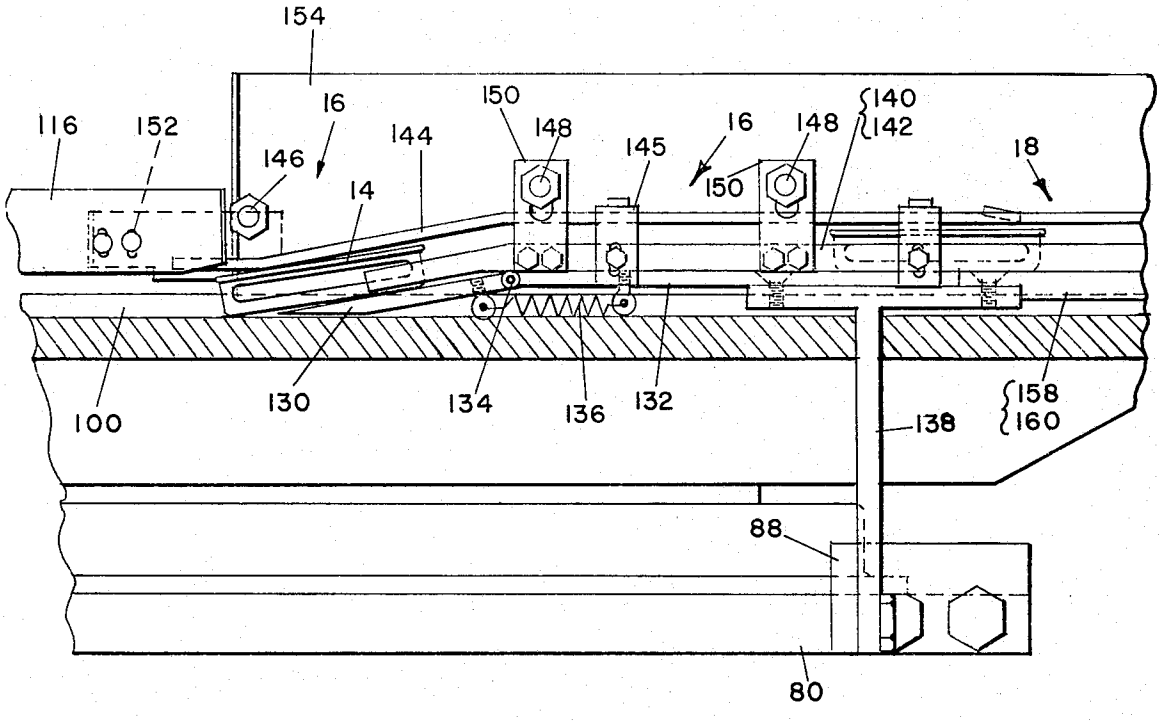

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Fig.9

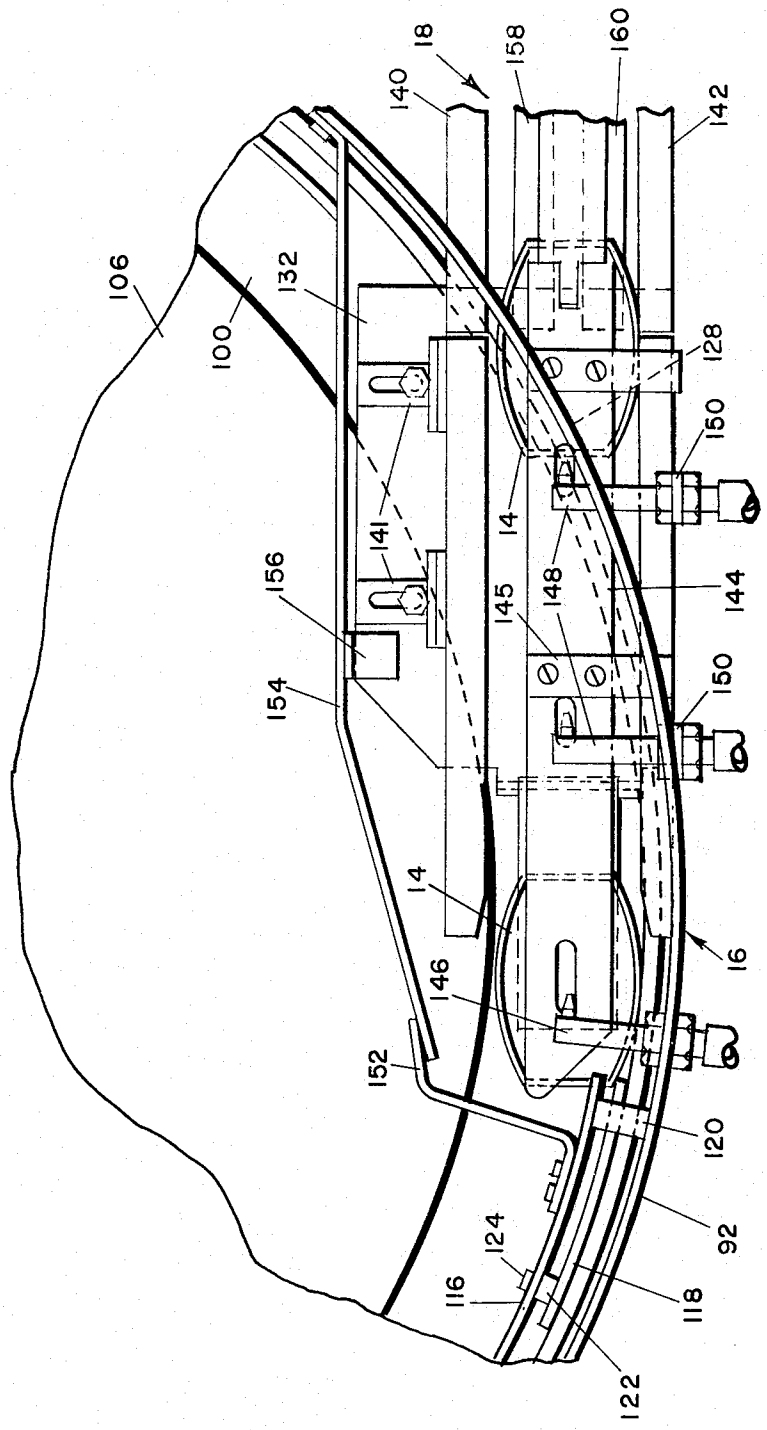

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Fig. 9A

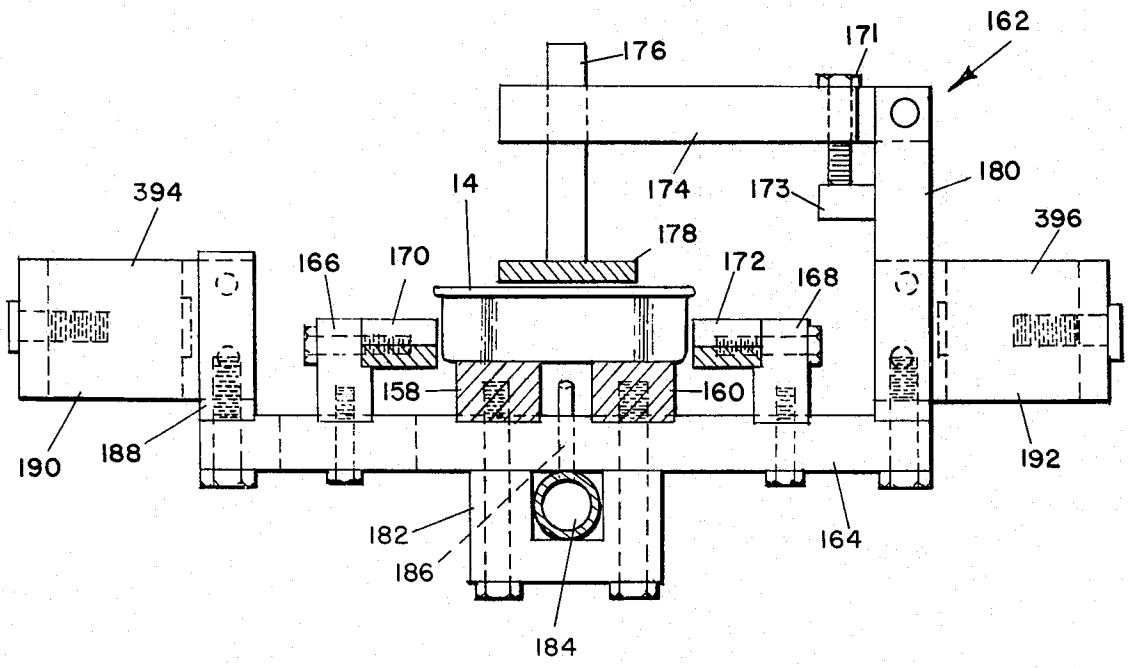


Fig. 10

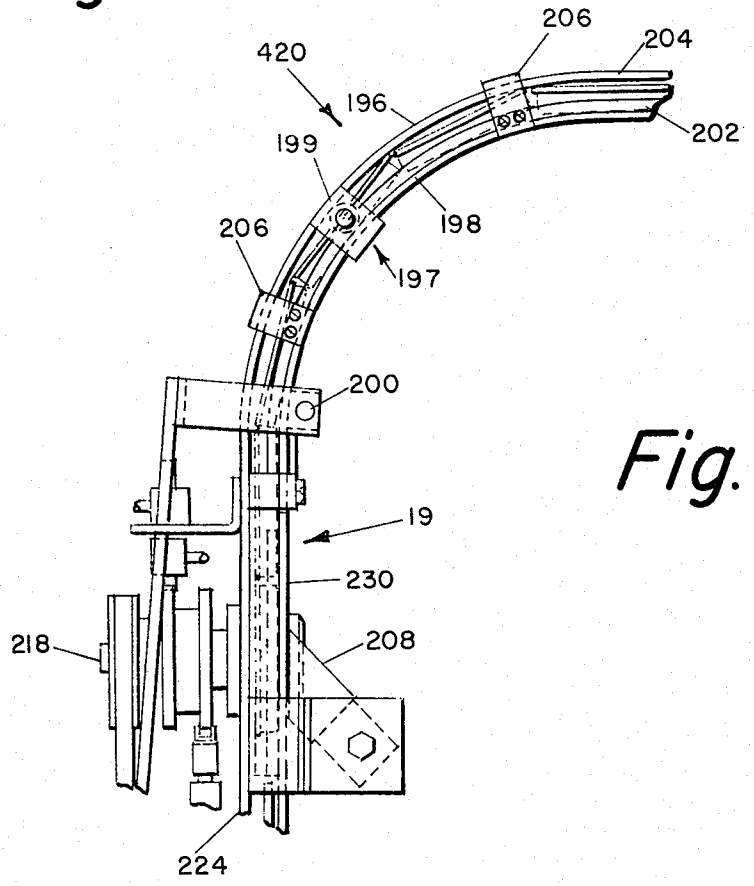


Fig. 13A

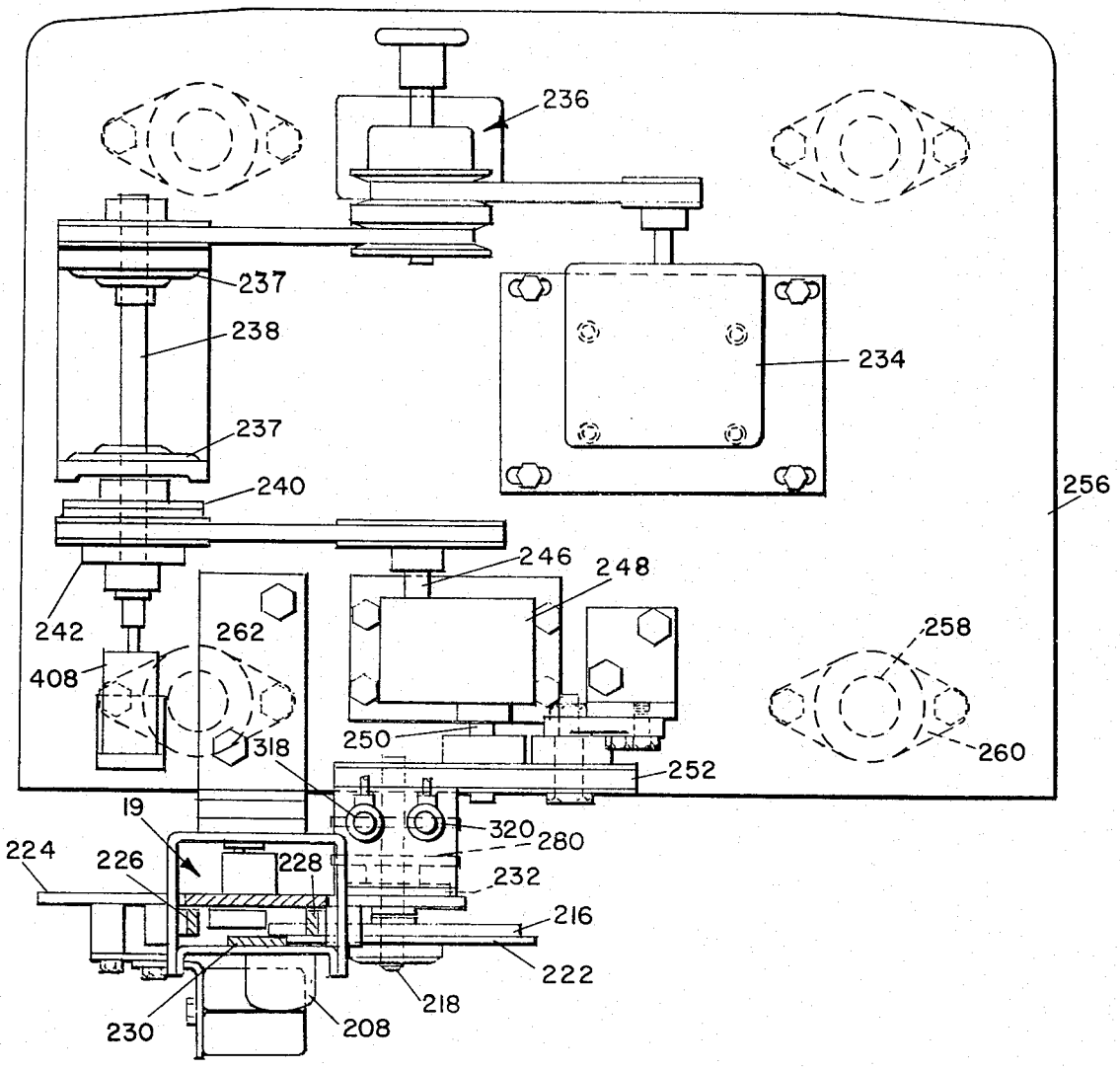

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Fig. 11

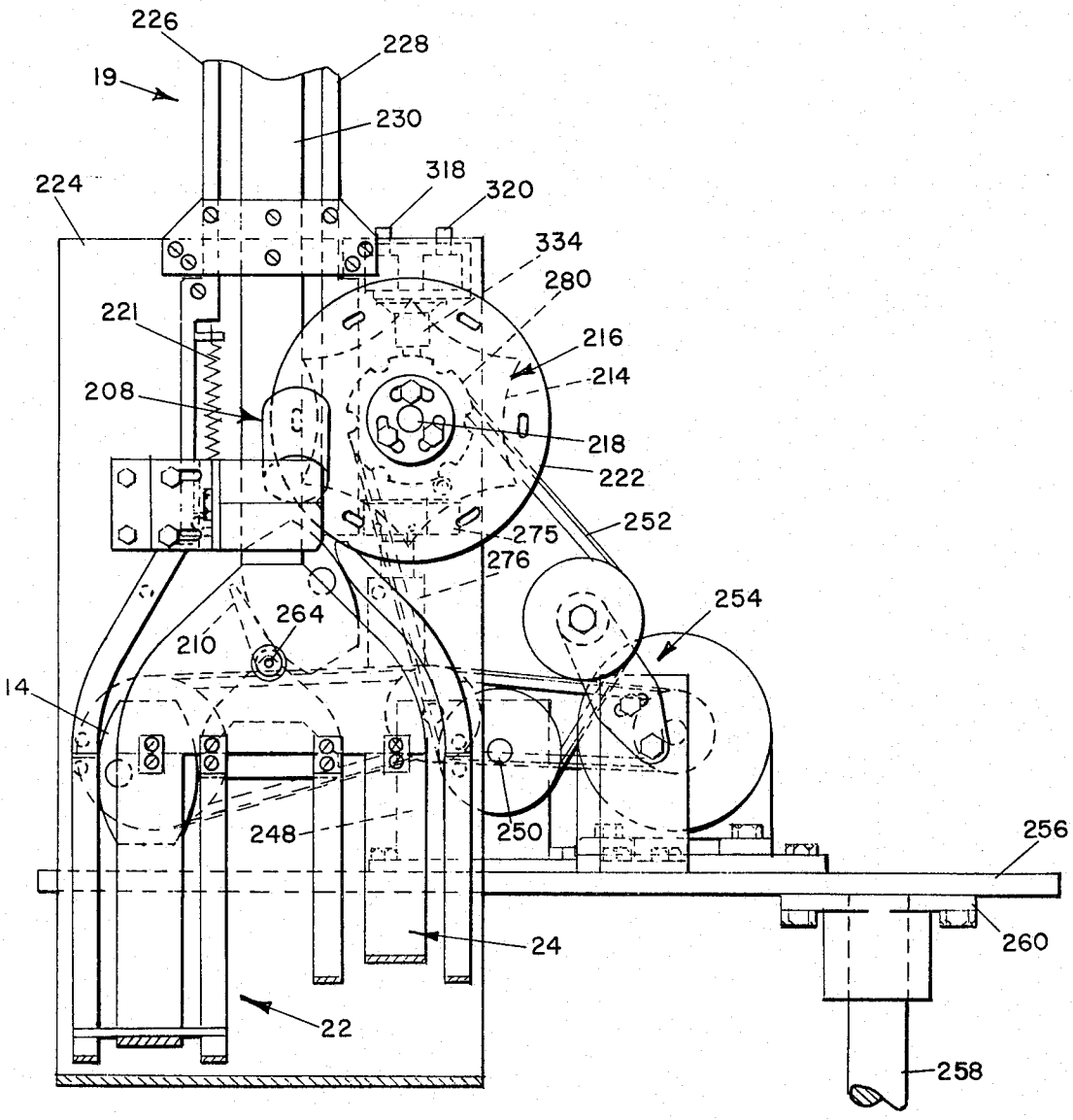
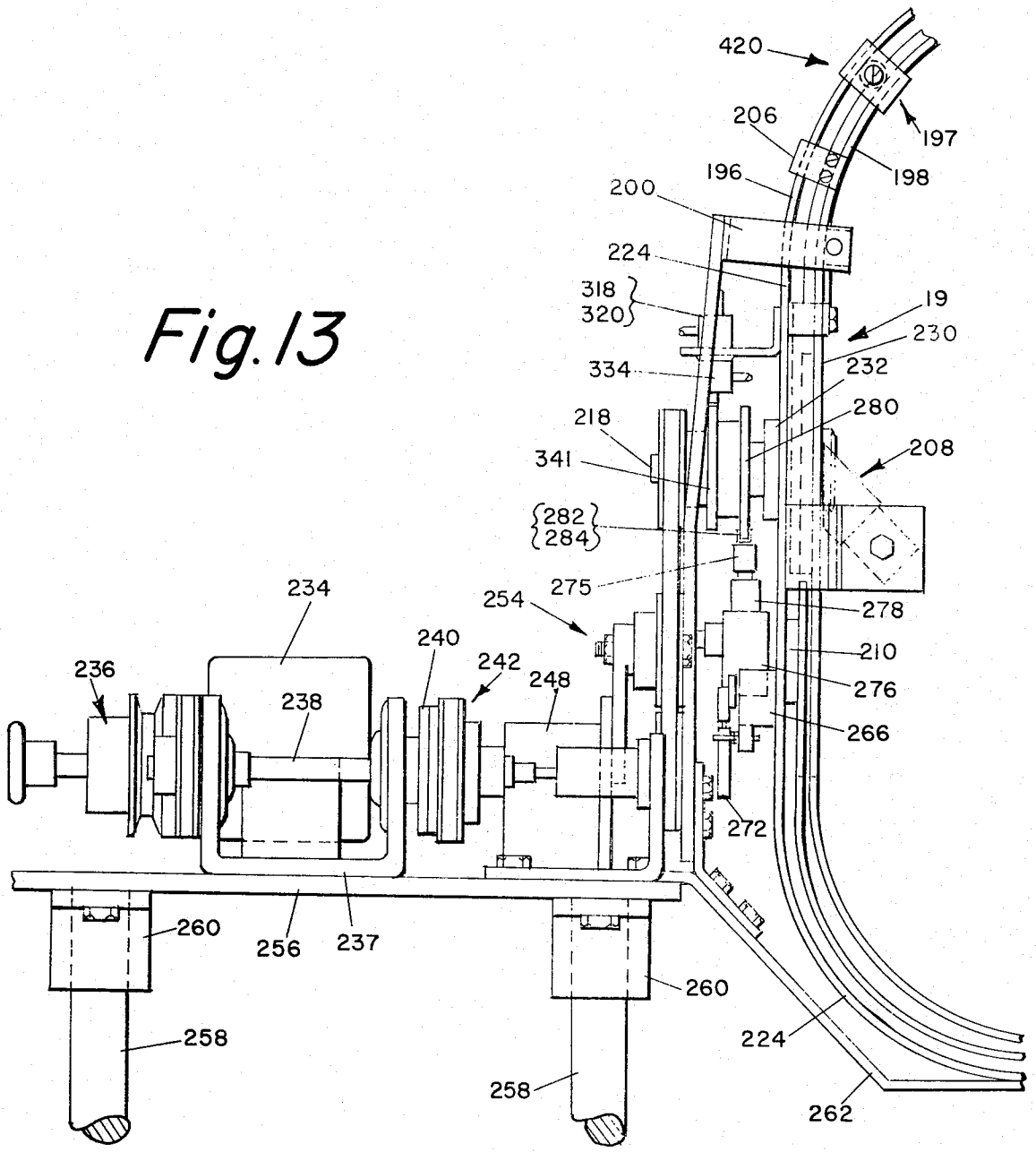

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Fig. 12

Fig. 13


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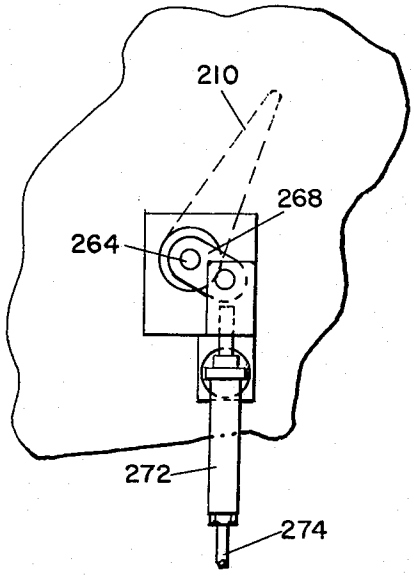


Fig. 15

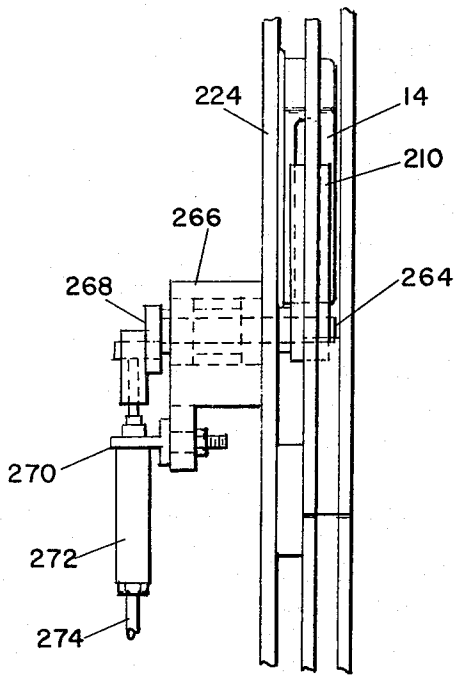


Fig. 14

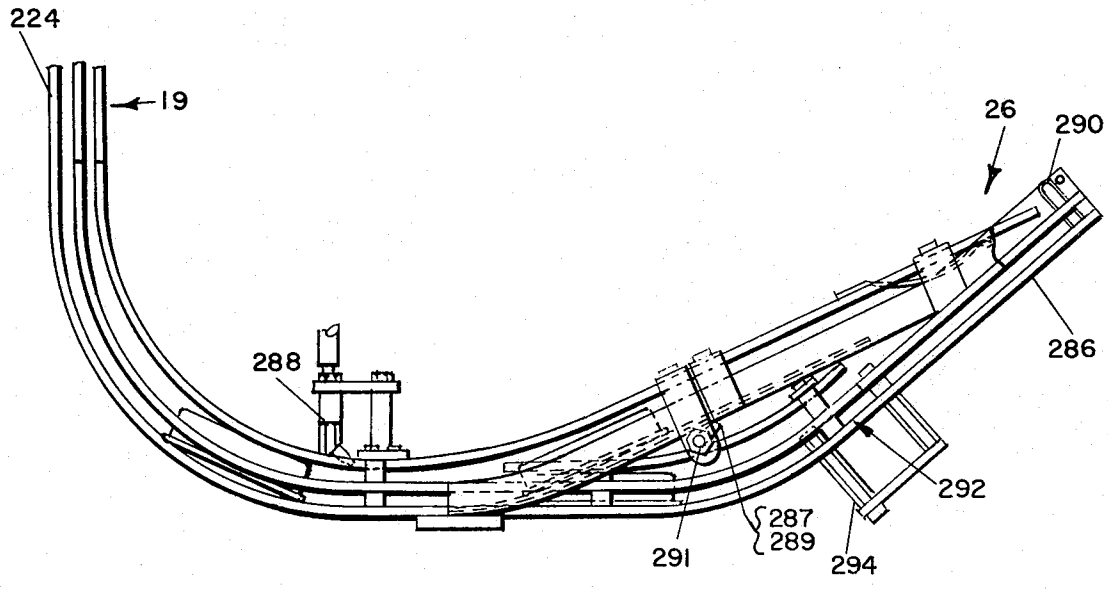


Fig. 17

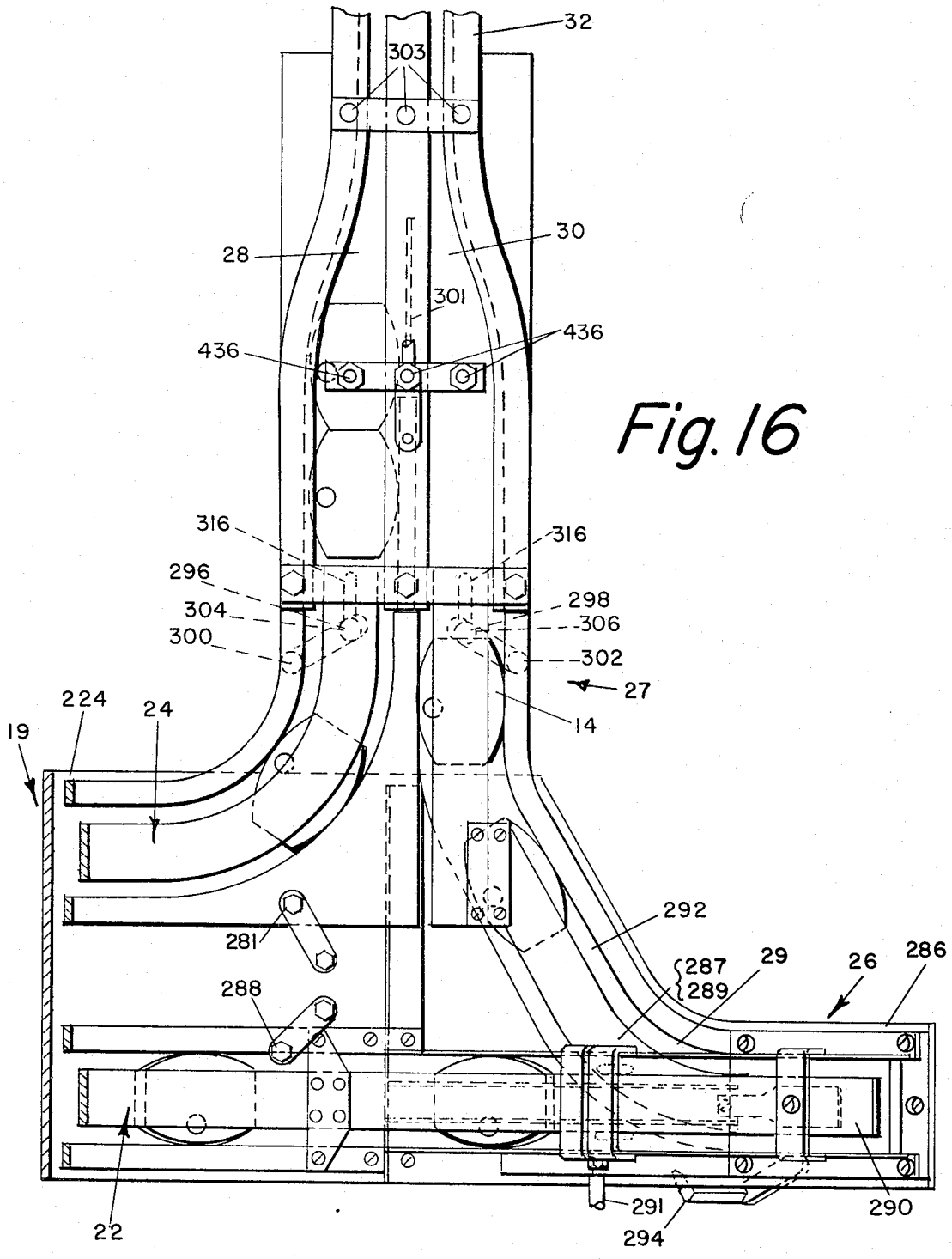

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Fig. 16

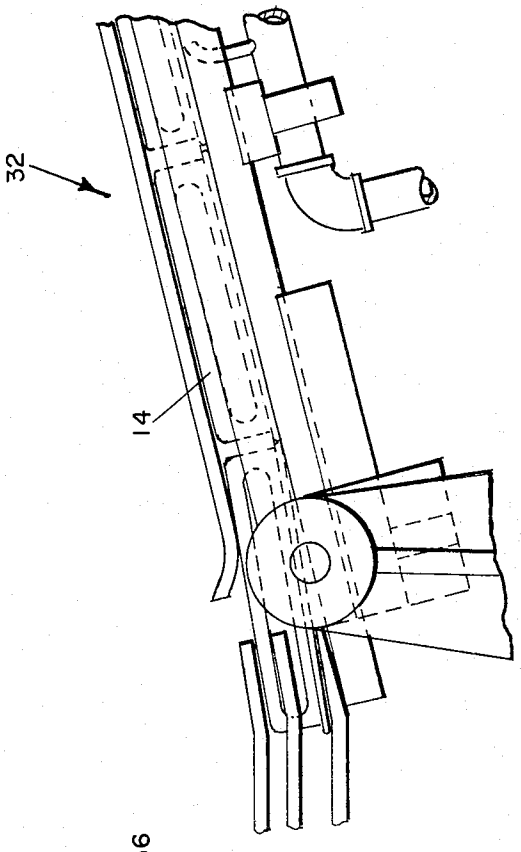


Fig. 18A

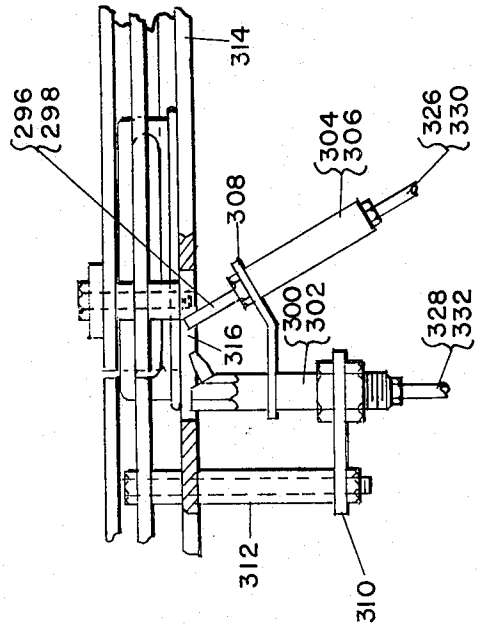
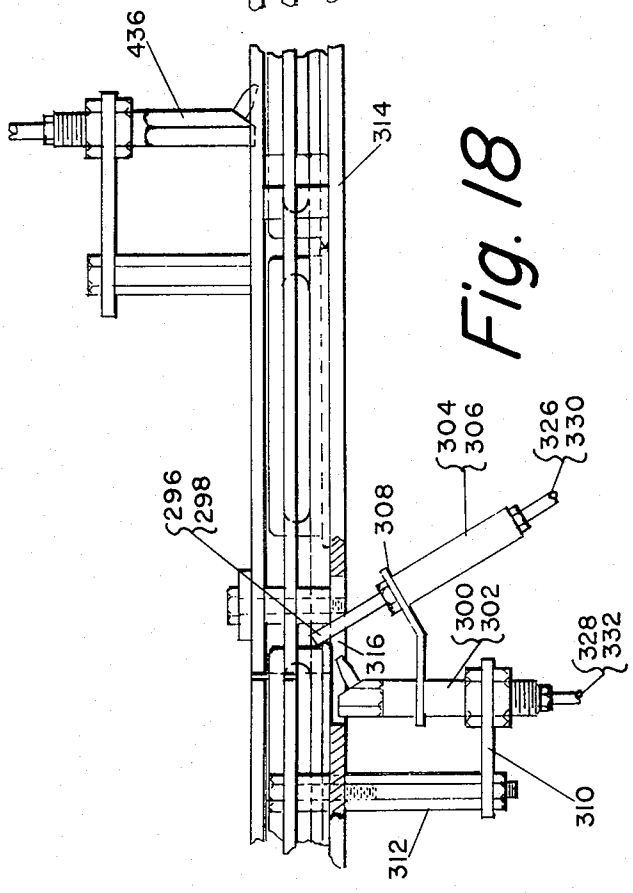


Fig. 18



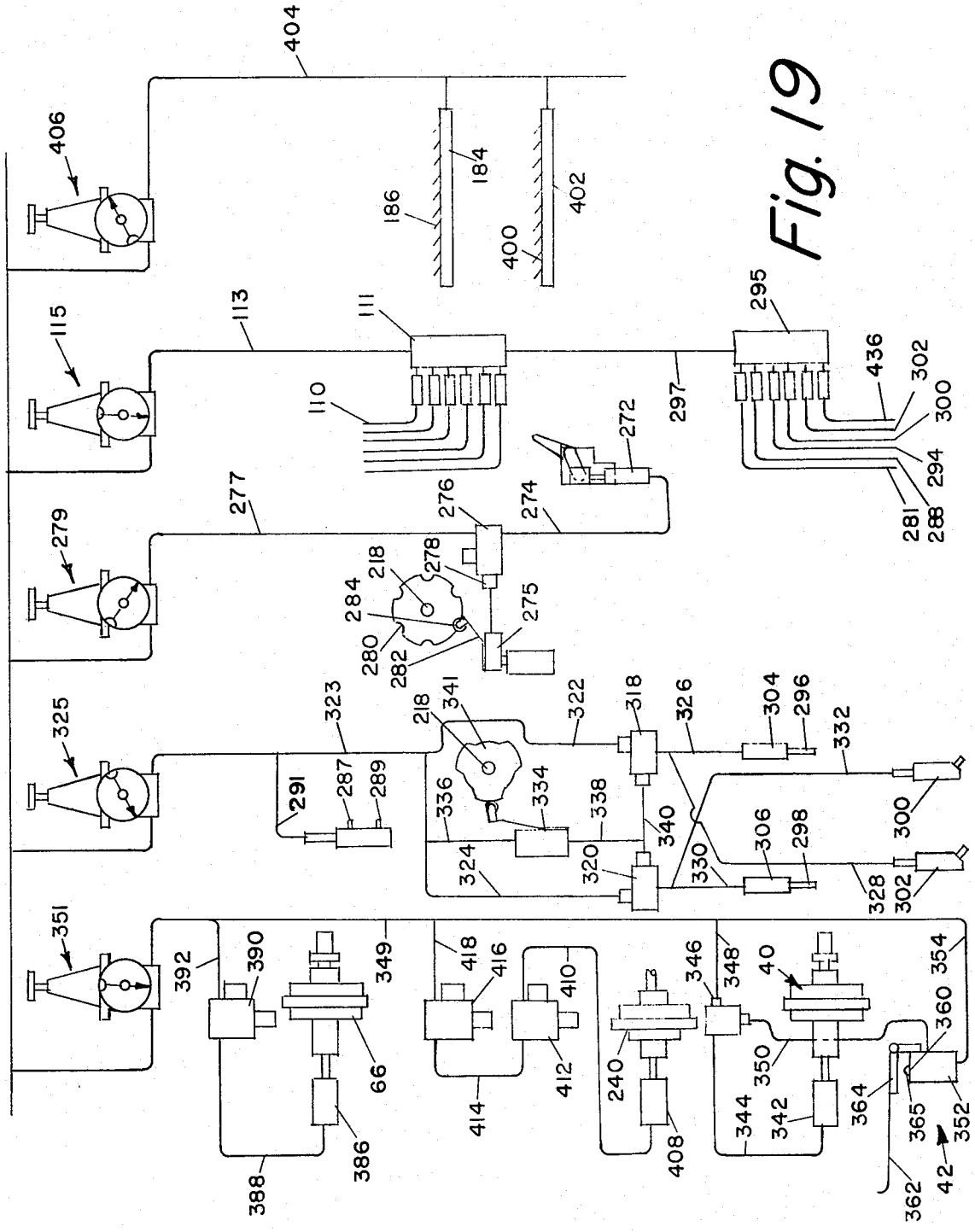

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Fig. 19

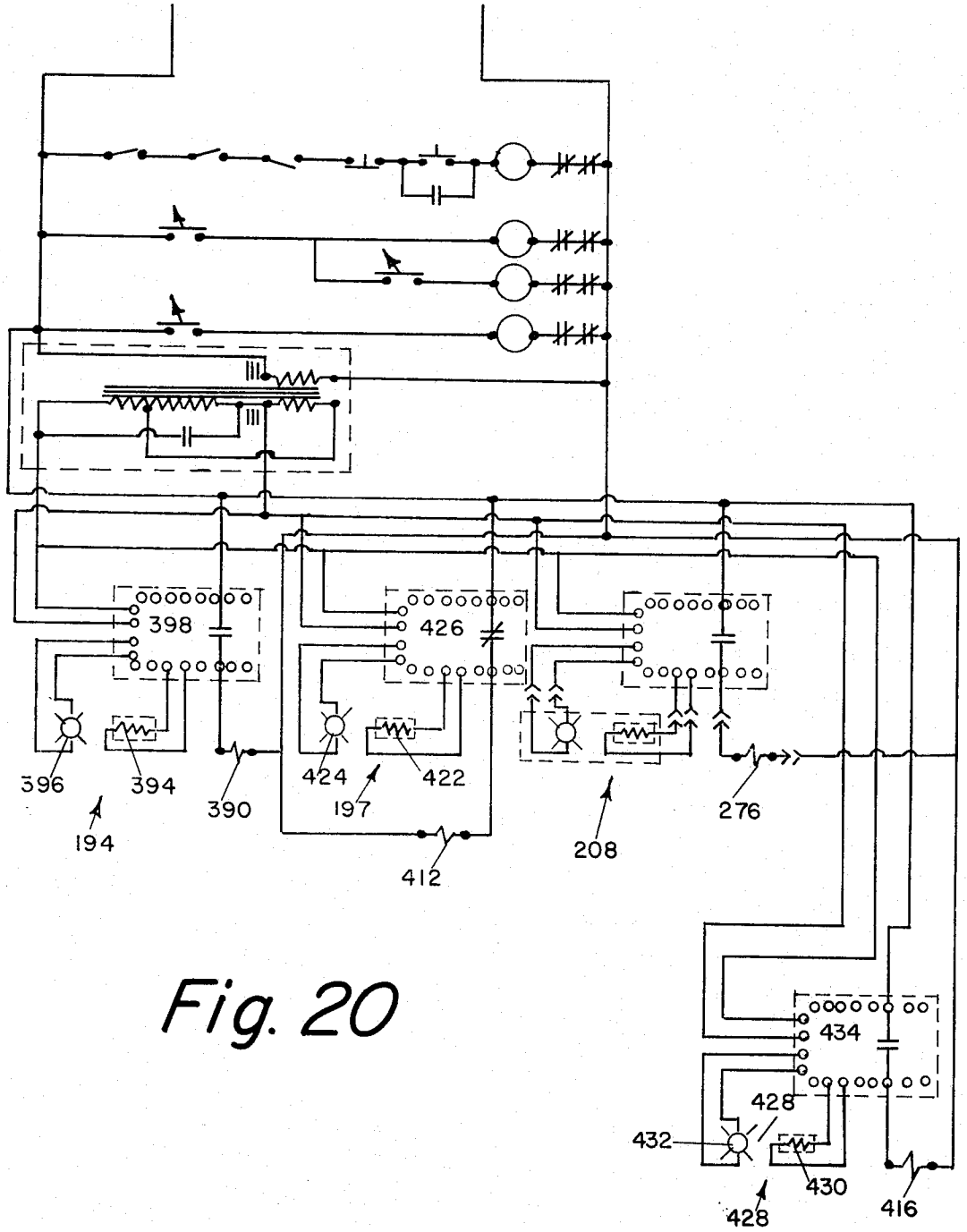

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Fig. 20

CLOSURE HANDLING AND ORIENTING APPARATUS

This application is a division of my copending application, Ser. No. **93,554** now U.S. Pat. No. **3,706,368,** filed Nov. **30, 1970** for Closure Handling and Orienting Apparatus.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The apparatus of the type herein illustrated is principally employed in the bottle industry wherein the filled bottles are provided with closures. The closure handling apparatus is adapted to sort and align randomly arranged closures which are deposited into a feed chute in an oriented condition, successive closures being withdrawn from the feed chute for application to the filled bottles.

2. Description of the Prior Art

Prior closure handling and orienting apparatus adapted to handle randomly arranged closures is illustrated and described in U.S. Pat. No. **2,715,978** assigned to the present assignee. Such prior apparatus is arranged to handle cylindrical closures wherein the randomly arranged closures are guided onto an orienting disk adapted to support those closures assuming a predetermined oriented position thereon, and to deposit such closures into a supply chute from which successive closures are withdrawn to be applied to bottles. Any closures assuming a position other than such predetermined oriented position are rejected from the orienting disk. Such prior closure handling apparatus is not adapted to handle elongated rectangular or oblong closures nor does it contemplate arrangement of the closures to permit reading in the same direction of any printed matter thereon.

SUMMARY OF THE INVENTION

In general, the present invention contemplates novel closure handling apparatus particularly adapted for handling elongated, substantially rectangular or oblong closures having printing or other characters thereon and in which provision is made for first aligning the closures longitudinally end to end and with their open ends up without regard for the direction of the printing and for thereafter sorting and realigning the closures to cause the printing on successive closures to read in the same direction.

The novel handling apparatus is adapted to first align and orient randomly arranged rectangular closures so that they all face with their open ends up, the closures being then deposited into a vertical chute. Successive closures then pass a sorting mechanism which is provided with means for detecting the direction of the printing thereon. Those with the printing reading in one direction are released onto one track and those reading in the opposite direction are released onto a second track. Provision is then made for changing the direction of the closures with the printing reading in the opposite direction so that all of the closures will read in the same direction. The closures which have been caused to change their direction are received on a track parallel to the first track, and provision is then made for realigning the oriented closures in both lines into a single line for delivery to the closure applying machine.

Provision is also made for controlling the operation of the apparatus whereby to maintain a supply of closures commensurate with the demand therefor, and to discontinue the supply of closures when a surplus thereof is detected.

Accordingly, the present invention has for an object to provide novel and improved closure handling apparatus adapted to align and orient randomly arranged elongated rectangular or oblong closures with their open ends all facing in the same direction in a superior and efficient manner.

The invention for another object to provide novel and improved closure handling apparatus of the character specified adapted to handle oblong closures having printing thereon and wherein provision is made for orienting and aligning the closures in a manner such as to have the printing thereon read in the same direction in a novel and superior manner.

A further object of the invention is to provide novel and improved closure handling apparatus of the character specified wherein novel provision is made for controlling the operation of the apparatus to discontinue the feed of closure when the supply thereof exceeds the demand therefor.

With these general objects in view and such others as may hereinafter appear, the invention consists in the closure handling 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.

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 side elevation thereof;

FIG. **3** is a perspective view of a closure adapted to be handled in the present apparatus;

FIG. **4** is a plan view of the driving mechanism to the rotary disk;

FIG. **5** is a side elevation thereof shown partly in cross section;

FIG. **6** is a detail view in cross section as taken on the line **6—6** of FIG. **1**;

FIG. **7** is a side elevation of means for controlling the feed of closures onto the rotary disk;

FIG. **8** is a cross sectional detail view of a portion of the control means shown in FIG. **7**;

FIG. **8A** is a plan view detail of the control means shown in FIG. **8**;

FIG. **9** is a cross sectional detail view of the transfer mechanism as seen from the line **9—9** of FIG. **1**;

FIG. **9A** is a plan view detail of the transfer mechanism shown in FIG. **9**;

FIG. **10** is a cross sectional view of the chute as seen from the line **10—10** of FIG. **1**;

FIG. **11** is a plan view of the driving mechanism to the cam shaft associated with the sorting and orienting mechanism;

FIG. **12** is a front elevation of the sorting and orienting mechanism showing portions of the drives;

FIG. **13** is a detail view in side elevation of the sorting and orienting mechanism showing the cam shaft and the cam operated valves associated therewith;

FIG. **13A** is a detail view of a curved portion of the chute leading to the switching mechanism;

FIG. **14** is a side elevation of the switching mechanism;

FIG. **15** is a rear view of the switching mechanism;

FIG. 16 is a plan view of the tracks forming a part of the orienting mechanism;

FIG. 17 is a side elevation of the tracks shown in FIG. 16, portions thereof being shown in cross section;

FIG. 18 is a detail view in side elevation and partly in cross section of the closure stop and release mechanism for releasing the closures alternately from two tracks to form one line thereof;

FIG. 18A is a detail view showing the parts in a different position of operation;

FIG. 19 is an elementary diagram of the electrical and pneumatic controls embodied in the present apparatus; and

FIG. 20 is an electrical diagram embodying the controls to be described.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and particularly to FIGS. 1 and 2, the container handling apparatus therein shown comprises in general: a guide chute 10 through which randomly arranged elongated rectangular or oblong closures 14 having printing thereon are delivered; a rotary carrier disk 12 which is mounted to rotate in a horizontal plane and which is arranged to receive and sort the randomly arranged closures 14; a transfer chute 16 through which successive closures released from the rotary disk pass to enter an clongated chute 18 having a horizontal portion 17 and a vertical portion 19, the closures entering the chute longitudinally end to end without regard for the direction in which the printing can be read; detecting, sorting and orienting means indicated generally at 20 wherein closures reading in different directions are deposited into different lines or tracks 22, 24; turn around or recoil mechanism 26 for redirecting and thus orienting the closures in one track to read in the same direction as the other track; and means indicated generally at 27 for releasing the closures alternately from two parallel lines or tracks 28, 30 into a single line or track 32, the latter comprising an upwardly inclined chute, only one end of which is shown for delivering the closures to a supply chute, not shown, and from which successive closures are withdrawn for application to containers.

In the illustrated embodiment of the invention, the randomly arranged printed oblong closures 14, FIG. 3, are delivered to the apparatus in controlled amounts by an upright conveyer 36 which is provided with a plurality of equally spaced flights 38. 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 38 as the outer run passes through the bulk supply hopper. In operation, when the closures are carried over the upper end of the conveyer, they fall off the flights 38 and are guided by the chute 10 onto the rotary carrier disk 12. The driving mechanism for the upright conveyer includes a normally engaged clutch 40 diagrammatically indicated in FIG. 19 which is arranged to be pneumatically disengaged by control mechanism, indicated generally at 42, to be hereinafter more fully described. The upright elevating conveyer 36 may comprise the conveyer illustrated and described in the U.S. patent to Sterling, U.S. Pat. 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 stationary post 44 suitably supported in the machine frame. The depending hub 48, FIG. 5, of the disk 12 is provided with a sleeve 50 secured to the hub by bolts 52. The sleeve is provided with ball bearings 54, 56, the lower bearing 56 resting on a shouldered portion of the central post 44. A lock washer 58 and nut 60 threadedly carried by the post 44 engage the upper ball bearings 54 as shown.

The carrier disk 12 is arranged to be rotated through connections from a motor 62 belted to one end of a drive shaft 64 having a normally engaged clutch 66 associated therewith. The shaft 64 is journaled in a bracket 68, and the other end of the clutch shaft is belted to the input shaft 70 of a speed reducing unit 72. The output shaft 74 of the speed reducing unit is provided with a pinion 76 which is in mesh with a gear 78 connected to the lower end of the sleeve 50 by the bolts 52. The motor 62, bracket 68 and speed reducing unit 72 are attached to the underside of a mounting plate 80 supported on the post 44 by a flanged hub 82. A casing 84 mounted on top of the plate 80 enclosed the gearing.

In operation, the disk 12 is arranged to be rotated in a counterclockwise direction at a relatively slow speed arranged to be varied as required. The mounting plate 80 is further provided with an extension comprising longitudinally extended side bars 86, 88 secured to two opposite sides of the plate, and a cross bar 90 connecting the outer ends of the side bars.

As herein shown, the carrier disk is surrounded by a circular guard or upright supporting wall 92. The wall 92 is supported from the mounting plate 80 by four equally spaced, radially extending struts 94 secured to upright spacing members 95 bolted to the plate 80. Each strut 94 carries an upright bar 96 at the outer end thereof to which the circular wall 92 is secured.

As illustrated in FIG. 3, the specific closure 14 being handled in the present apparatus comprises an oblong closure having curved side walls and straight end walls and is designed to be pressed onto a container. The open end of the closure is provided with a rolled edge 98 so that the width of the closure is greater across the rolled edges than the width of the body portion. This feature is taken advantage of to sort those closures assuming an oriented position, that is, with their open ends up, from those closures assuming a position with their open ends down. In practice, the randomly arranged closures are guided longitudinally end to end into a single line as they are carried around on the rotary disk, the closures being guided outwardly into engagement with an annular groove 100 in the marginal edge of the disk 12, FIGS. 1 and 6. The groove 100 is made of a width such as to accept in a fully seated position the width of the body portion of those closures having their open ends up while those closures having their open ends down are not able to seat themselves in the groove because of the increased width across the rolled edges 98. In practice, the randomly arranged elongated closures deposited on the disk 12 may fall with their open ends up or down, a majority of the closures falling naturally under the influence of gravity with their open ends up.

As illustrated in FIG. 1, the closures are guided into the groove to extend longitudinally end to end therein by a curved leaf spring 102 carried by a curved plate 104 attached to a clamp collar 105 secured to the upper end of the central supporting post 44. As best shown in FIG. 6, the annular groove 100 is defined on

one side by the peripheral edge of a circular sheet metal member **106** attached concentrically to the upper face of the rotary disk **12,** the other side of the groove being defined by a raised rim **108** integral with the disk **12.** In practice, the closures with their open ends up will seat themselves fully in the groove **100** while those closures guided toward the groove with their open ends down will not be permitted to seat themselves in the groove because of the rolled edge **98** and will assume an angular position therein. Provision is made for removing each non-oriented closures from the groove, and as herein shown, see FIG. **6,** a plurality of spaced air jets **110** are mounted to direct streams of air radially inwardly of the rotary disk against the angularly disposed closures to effect return of such closures toward the center of the disk. Such air jets are also arranged to remove any closures which are not fully seated in the groove, some of the closures thus removed being overturned to assume an open end up position so as to enter the groove the next time such closures are guided therein by the curved leaf spring **102.** As herein shown, see FIG. **6,** the air jets **110** are supported by brackets **112** secured to and depending from the lower edge of the circular wall **92.** The lower end of each bracket is horizontally extended and has an opening to receive the threaded end of its air jet, the latter being vertically adjustable in its bracket and held in its adjusted position by lock nuts **114.** The closures are also urged outwardly on the disk by centrifugal action to enter the annular groove. As diagrammatically shown in FIG. **19,** each of the air jets **110** is connected to a manifold **111** which in turn is connected by a pipe **113** to a regulated source of compressed air indicated at **115.**

Provision is made for preventing entrance into the annular groove **100** of nested closures or closures arranged one above the other. As herein illustrated FIG. **6,** a curved top rail **116** is disposed above the groove **100** concentric with the rotary disk. The rail **116** is supported from the circular wall **92** by spaced rods **120** extending radially inwardly therefrom and a short distance inwardly from the outer marginal edge of the groove **100.** A second rail **118,** FIG. 9A, which occurs for a short distance only at the exit portion of the guideway defined by the groove is supported from the inner rail **116** by spacing collars **122** and bolts **124** and is disposed immediately above the outer marginal edge of the groove **100.** The lower edge of each rail is spaced a short distance above the height of a closure fully seated in the groove, the rails being vertically adjustable by bolts **126** extending through clearance openings in the rail **116** and threadedly engaged with the rods **120.** Thus, the inner rail **116** serves as a shield to prevent entrance of more than one closure at a time into the groove so that nested or overlapping closures which cannot enter the groove assume a raised position to be returned onto the center of the disk by air jets **110.** Likewise, those closures with their open ends down which cannot be fully seated in the groove are removed therefrom by the air jets. It will be noted that once an oriented closure is fully seated in its groove, the top rail **116** serves to retain the closures therein so that they cannot be removed by the air jets.

From the description thus far it will be seen that the randomly arranged closures are guided into end-to-end alignment with their major axes arranged longitudinally in the annular groove **100** with their open ends up, and as herein shown, see FIG. **9,** successive closures in the line are removed from the groove by the transfer chute **16** which is arranged tangentially with respect to the groove. The transfer chute **16** is arranged to guide the closures with their open ends up into the horizontal leg **17** of the chute **18** and is supported above the disk **12.** The chute **16** extends through an opening **128,** FIG. **1,** in the circular supporting wall **92.**

As illustrated in FIGS. **2** and **9,** the closures with their open ends up are guided upwardly out of the groove **100** by a pivotally mounted ramp **130,** the lower end of which rests in the groove and up which successive closures are guided to an upper level on a base plate **132.** The ramp **130** is pivoted at **134** to the base plate **132** and is maintained in resilient contact with the bottom of the groove **100** by a coil spring **136** connected between the underside of the ramp and the base plate as shown.

The base plate **132** is supported by an upright bracket **138** fastened at its lower end to the side bar **88** which latter extends from the mounting plate **80.** The transfer chute **16** includes side rails **140, 142,** FIG. 9A, and a top rail **144.** The side rail **142** is bolted to the base plate **132,** and the side rail **140** is attached to angle brackets **141** which are mounted for lateral adjustment on the base plate. The top rail **144** is supported for vertical adjustment by angle brackets **145,** FIG. **9,** attached to the side rail **142.** In operation, the closures carried along in the groove **100** engage the ramp **130** and the back pressure of succeeding closures urges the leading closures up the ramp. The closures are assisted up the ramp by a stream of air from an air jet **146** supported in the circular wall **92,** the air stream being directed through an opening in the top rail **144.** Additional air jets **148** supported in brackets **150** fastened to the side rail **142** are likewise provided to advance the closures along the upper level of the transfer chute and into the horizontal leg **17** of the chute **18.** The area of the disk **12** over which the receiving end of the transfer chute is disposed is protected from interference by the closures on the disk by guard members including a member **152,** FIG. **1,** secured to the inner rail **116** and a second member **154** secured at one end to the circular wall **92** as shown in FIG. **1.** The member **154** is further supported by an angle piece **156** secured to the base plate **132.** The free end of the member **152** is arranged to overlap the free end of the member **154** as shown.

As herein illustrated, FIG. **2,** the chute **18** leading to the detecting and sorting means **20** is secured at one end to the bracket **138** in alignment with the transfer chute **16.** The chute **18** comprises a pair of spaced bottom rails **158, 160,** FIGS. 9A and **10,** which are bolted at the receiving end to the bracket **138.** Fastened to the bottom rails are a plurality of guide rail supporting units indicated generally at **162,** each supporting unit including a cross bar **164,** side rail holders **166, 168** secured to the cross bars and which carry the side rails **170, 172,** and a pivotally mounted top rail support **174** in which the stems **176** of the top rail **178** are supported for vertical adjustment. Each rail support **174** is pivotally carried by a bifurcated upright bar **180** attached to one end of its cross bar. It will be observed that each top rail support **174** is adjustably limited in its rocking movement by a set screw **171** carried by the support **174** and which cooperates with a stop member **173** secured to the upright bar **180.** The side rail holders **168**

are fixed in the cross bars **164** while the side rail holders **166** are mounted for adjustment laterally in the cross bar **164.** Each cross bar **164** also carries a U-shaped bracket **182** depending centrally therefrom which supports an air manifold **184** provided with a plurality of spaced air jets **186** for rapidly advancing the closures along the chute. The first cross bar **164,** comprising the bar nearest the end of the transfer chute **16,** is provided with a second upright bar **188** at the opposite side of the chute which supports an angle member **190.** A similar angle member **192** is carried by the upright bar **180.** Between the angle members **190, 192** is supported a photoelectric detecting unit indicated generally at **194,** FIG. **1,** and which forms a part of the control mechanism for discontinuing rotation of the carrier disk when a surplus of closures is detected as will be hereinafter more fully described. It will be understood that the closures are advanced along the horizontal leg **17** of the chute by the air jets **186** mounted in the manifold **184.** The outer end of the horizontal leg **17** of the chute **18** is connected to the vertical leg **19** thereof by a curved section **196,** FIG. **2,** which comprises a curved connecting plate **198** bolted at one end to the base plate **132** and at its other end to a cross bar **200** forming a part of the vertical leg **19.** The curved section **198** is provided with curved side rails **202** attached to the connecting plate **198** and a top rail **204** adjustably connected to the side rails **202** by angle brackets **206.** At a medial portion of the curved section **196** is disposed a photoelectric detecting unit indicated generally at **197** which is supported by brackets **199** attached to the section **196.** The detecting unit **197** forms part of a control mechanism for discontinuing operation of the orienting mechanism **20** when spacing between closures is detected as will be hereinafter more fully described.

From the description thus far, it will be seen that the closures are advanced along the horizontal portion **17** of the chute by air jets **186,** and when they enter the curved section **196,** they fall by gravity into the vertical section **19** of the chute. During their travel along the horizontal portion of the chute, the closed or printed ends of the closures face downwardly, and when they enter the vertical portion of the chute, the printed ends of the closures face forwardly where they pass the detecting and orienting means **20** to cause those closures with their printing reading in one direction to pass into the track **22,** and those reading in an opposite direction to pass into track **24.**

As herein shown, the detecting and orienting means **20** includes a retroreflective photoelectric unit **208,** FIGS. **2** and **13A,** arranged to scan successive closures passing through the vertical section **19** of the chute and a switching arm **210,** FIG. **12,** responsive to the photoelectric unit arranged to divert the closures into one track or the other. As illustrated in FIG. **3,** the printing on each cap extends parallel to the major axis thereof and is provided with a white reflective spot **212** intermediate the ends thereof and offset to one side of its longitudinal center line. Thus, a closure may pass the detecting point with its white spot on either the right or the left of the center line, depending on the position it assumed when it entered the groove **100.** The switching arm **210** is normally disposed in a position to guide the closures to the left to enter track **22** if the white spot is not detected. Conversely, if the white reflective spot **212** is detected, the switching arm **210** is rocked to the left to divert the closure to the right to enter track **24.** Those closures entering track **24** are disposed in an oriented position with the white spots on the right of the longitudinal center line while those entering track **22** pass through the turnaround or recoil mechanism **26** to redirect the closures to present the white spots on the same side as those in track **24** so that all of the closures are oriented to read in the same direction.

Referring now to FIGS. **12** and **13,** successive closures entering the vertical section **19** of the chute are engaged in and moved along with successive spaced radial pockets **214** of a rotary spiker **216** fast on a cam shaft **218.** The pockets **214,** which as herein shown are six in number, are arranged to engage and guide the closures passing through the chute into a position to be scanned by the photoreflective unit **208.** A scanning disk **222** having six spaced openings is also fast on the shaft **218** and is aligned with respect to the pockets **214** to have the light beam pass through the opening onto a reflective spot **212** of the closure. In order to urge the closures into uniform engagement with their pockets **214,** a coil spring **221** is provided which is longitudinally supported in the chute **19** in a position opposite the pockets as shown. The vertical portion **19** of the chute comprises a base plate **224,** side rails **226, 228** secured to the base plate, the plate **198** to which the curved section **196** is connected, and a front plate **230.** As illustrated, the cam shaft **218** is journaled in a bearing **232,** FIG. **13,** attached to the base plate **224** and is located so that the peripheral portion of the spider and the scanning disk overlie and extend within a portion of the chute **19** for cooperation with the closures.

As shown in FIG. **11,** and **13** the shaft **218** is driven from a motor **234** belted to a variable speed drive unit **236.** The variable drive unit is in turn belted to a clutch shaft **238** journaled in bearing brackets **237** and which has associated therewith a normally engaged clutch **240** and pulley **242** arranged to be automatically disengaged by control mechanism to be hereinafter more fully described. The pulley **242** is belted to the input shaft **246** of a speed reducing unit **248,** the output shaft **250** of which is connected by a belt and pulley drive **252** to the cam shaft **218.** The belt and pulley drive **252** is provided with a belt tightener **254.** The entire drive is mounted on a platen **256** supported from the floor by posts **258** and flanges **260.** A bracket **262** attached to the platen is connected to the vertical portion **19** of the chute and serves as a support therefor.

The tracks **22, 24,** FIG. **12,** extend angularly to the left and right, respectively, of the vertical portion **19** of the chute and the switching arm **210** is disposed below the portion **19** and between the tracks **22, 24.** The tracks then assume a vertical position as viewed in front elevation, and as shown in side elevation, the base plate **224** together with the tracks **22, 24** are curved forwardly at a point where the angular portions connect with the vertical portions of the tracks. At the lower end of the curved portion, the track **24** is curved to the right as viewed in front elevation to enter track **28,** FIG. **1.** The track **22** extends forwardly and angularly upwardly to the turnaround mechanism **26,** at which point the closure reverses direction and enters a curved track portion **29** which leads the closure into track **30** parallel to track **28.**

As illustrated in FIGS. **14** and **15,** the switching arm **210** is fast on a pin **264** journaled in a bearing member **266** secured to the base plate **224.** The other end of the

pin **264** is provided with an arm **268** fast thereon which is connected to the piston rod of an air cylinder **272** supported by a swivel stud **270** carried by an extension of the bearing member **266.** The switching arm **210** is normally rocked to the right as viewed in front elevation, and the air cylinder **272** is arranged to rock the arm **210** to the left. As herein shown, the air cylinder **272** is connected by a pipe **274** to a normally closed solenoid air valve **276,** FIG. **19,** which in turn is connected by a pipe **277** to a regulated source of compressed air indicated at **279.** The solenoid valve **276** is electrically connected to a relay associated with the photoreflective unit **208.** In operation, when the photoreflective unit is actuated by a reflective spot on a closure, the shifting arm **210** is rocked to the left as viewed in front elevation to guide the closure into track **24.** Since the photoreflective device operates to open the solenoid valve only momentarily after which the air cylinder would normally be exhausted through the solenoid air valve, provision is made for maintaining the air cylinder **272** energized to hold the arm **210** shifted for a short time longer than momentarily to assure sufficient time for the closure to get by and thereafter to permit return of the arm to its normal position before a succeeding closure arrives at the scanning position. This is accomplished by preventing exhaust of the cylinder **272** through the solenoid valve for a predetermined time. As herein shown, the exhaust end **278** of the valve **276** is connected to a normally open holding valve **275** arranged to be controlled by a six-point cam **280** fast on the cam shaft **218.** The holding valve **275** is provided with an arm **282** which carries a roller **284** for cooperation with the cam to close and open the exhaust port of the holding valve. The high points of the cam **280** are arranged to depress the arm **282** to close the exhaust port and the low points permit elevation of the arm to open the exhaust port to the atmosphere.

When the scanning beam falls on a non-reflective portion of the closure, indicating that it has to be turned around to orient the same, the solenoid valve **276** will not be actuated to rock the switching arm **210,** and since the air cylinder **272** was evacuated during a previous cycle, opening and closing of the exhaust port by the cam **280** will have no effect.

From the description thus far, it will be seen that those closures detected with the reflective spot **212** on the right will pass into track **24** and thence will be guided into track **28,** an air jet **281** advancing the closures along the track. On the other hand, those closures which are positioned so that a reflective spot is not detected will pass into track **22** to be guided to the turnaround mechanism **26.** As herein shown, the turnaround mechanism includes an upwardly curved extension **286,** FIG. **17,** of the track **22** up which the closure is advanced by an air jet **288** and a pair of high pressure air jets **287, 289** connected by a pipe **291,** FIG. **19,** to a main line **323** which leads to a regulated source of compressed air indicated at **325;** a leaf spring **290** supported at the end of the extension and against which the closure strikes; a return track **292** arranged to receive the closure which rebounds from the leaf spring, the return track **29** guiding the closure downwardly and angularly through a curved portion which joins the track **30** parallel to the track **28.** The air jets **288, 289** are supported from the extension **286** and advance the closures up the inclined portion of the track and against the spring, and an air jet **294** supported by the return track **292** advances the closures through the curved portion and into the track **30.** As shown in FIG. **19,** the various air jets for advancing the closure through the orienting mechanism and into chute **32** are connected to a manifold **295** which in turn is connected by a pipe **297** to the manifold **111.**

In operation, the closures in track **24** have the reflective spot **212** on the right when viewed in front elevation, and when they enter the track **28,** the reflective spot will be on the left when facing in the direction of travel of the closure. The closures in track **22** have the reflective spot on the left as viewed in front elevation, and when it enters the return track, the reflective spot **212** is still on the left. During the travel of the closure downwardly and around the curved portion of the track and into the track **30,** the reflective spot remains on the left when facing in the direction of travel of the closure which corresponds to the position of the closures in the track **28.** The oriented closures thus arranged in parallel lines in tracks **28, 30** are now manipulated to combine the two lines into one single line in track **32** by mechanism indicated generally at **27,** FIGS. **16, 18** and **18A,** and which includes two stop members **296, 298** one in each track **28, 30,** respectively, and two air jets **300, 302** arranged to cooperate with their respective stop members. The stop members **296, 298** are pneumatically operated to alternately stop and release succesive closures or group of closures in each line, and in operation, when one line is stopped, the other line is open to release one or more closures during one cycle, and during a succeeding cycle, the opposite line is stopped while the other line is open to release one or more closures, the air jets **300, 302** in each instance operating to rapidly advance a previously released closure through the double track area and into the single track **32.** The outer rails **34** of double tracks **28, 30** are curved inwardly, as shown, to form the single track **32.**

As best shown in FIG. **16,** in operation, the closures may be released alternately from their respective tracks either singly or in groups of two or three, and when a released closure or group of closures engage their respective inwardly curved portions of the tracks **28, 30,** a centrally disposed flexible guide rail **301** supported between the tracks is arranged to yield to permit passage of the closures into the single line. This expedient prevents displacement of one or more closures crosswise in the track during transfer from one of the lines **28** or **30** into the single line which would stop the flow of closures. As also shown in FIG. **16,** a plurality of additional air jets **303** are disposed at the beginning of the single track **32** to rapidly advance the closures along the track.

As herein illustrated, the stop members **296, 298** comprise piston rods extending from air cylinders **304,** 306. Each air cylinder is supported by an angle bracket **308** attached to its respective air jet **300, 302** and each air jet is threadedly and adjustably connected to the free end of an arm **310** supported at the lower end of a stud **312** depending from the base plate **314** of the tracks **28, 30.** The stop rods **296, 298** are arranged to extend through openings **316** in the base plate **314,** and the air jets **300, 302** are likewise directed to project a stream of air through said openings.

As illustrated in FIG. **19** the pneumatic control for effecting alternate operation of the stop rods **296, 298** and the air jets **300, 302** comprises a pair of piloted air valves **318, 320,** one of which is normally closed and

the other of which is normally open. Each valve **318,** 320 is connected directly to a regulated source of compressed air through pipes **322, 324** connected to a main pipe **323** which leads to a regulated source of compressed air indicated at **325.** As herein shown, the normally open valve **318** is connected by a pipe **326** to the air cylinder **304** in track **28** and is also connected by a branch pipe **328** to the air jet **302** in track **30.** Conversely, the normally closed valve **320** is connected by a pipe **330** to the air cylinder **306** in track **30** and also by a branch pipe **332** to the air jet **300** in track **28.** The valves **318, 320** are controlled by a normally closed cam operated valve **334** which is connected by an inlet pipe **336** to the regulated source of compressed air and by an outlet pipe **338** to a pipe **340** connected to the piloted valves **318, 320.** The normally closed valve **334** is provided with a spring pressed element arranged to be depressed by a three-point cam **341** fast on the cam shaft **218** to open the normally closed valve and permit air to pass through pipes **338, 340** which effects closing of the normally open piloted valve **318** and opening of the normally closed valve **320.** When the cam **341** presents its low spots to the control valve **334,** no air can pass through the latter, and the normally open valve **318** is free to permit air to pass to the air cylinder **304** in track **28** and to air jet **302** in track **30.**

With this arrangement it will be seen that in operation when the cam **341** presents its low spot to the control valve **334,** the stop rod **296** will be extended to stop the line of closures in track **28** and to release a blast of air in track **30** to rapidly advance the closures released during the previous cycle, and conversely, when the cam presents its high spot to depress the spring pressed element of control valve **334,** air is released to the pilots of the valves **318, 320** to open the normally closed valve **320** and to close the normally open valve **318** whereby to extend the stop rod **298** to stop the line of closures in track **30** and to release a blast of air in track **28** to rapidly advance the closures previously released. The released closures are thus advanced alternately from each track **28, 30,** either singly or in groups to form a single line of oriented closures in track **32.**

Provision is made for controlling the operation of the apparatus in a manner such as to provide a continuous supply of oriented closures on the rotary disk **12** sufficient to keep up with the demand therefor and to discontinue the supply when a surplus of closures is detected on the disk which might interfere with efficient operation of the aligning mechanism or which might cause excessive agitation of the cb sures carried by the disk. In practice, the upright conveyer **36** is continuously operated to maintain a substantially uniform amount of closures on the disk, preferably an amount slightly more than the demand therefor, such as to permit efficient operation of the sorting and aligning mechanism associated with the disk. In the event that a surplus of closures accumulates on the disk, provision is made for detecting such surplus and for discontinuing operation of the upright conveyer **36** in response to the detecting means until such time as a sufficient number of closures have been withdrawn from the disk to again permit normal operation of the sorting and aligning mechanism.

As diagrammatically indicated herein, see FIG. **19,** the elevating conveyer **36** which supplies the closures in controlled amounts is driven by means including a normally engaged clutch **40** arranged to be held in its engaged position by an air cylinder **342** which is connected by a pipe **344** to a normally closed piloted valve **346,** the latter being connected by a pipe **348** to a main pipe **349** which in turn is connected to a regulated source of compressed air indicated at **351.** The pilot end of the valve **346** is connected by a pipe **350** to an air block **352,** FIGS. **7** and **8,** forming a part of the control mechanism **42** and having an inlet pipe **354** connected to the regulated source of compressed air as shown. The air block **352** comprises a pneumatic control unit provided with an air chamber **356** whose inlet **358** has a restricted throat portion. The outlet from the chamber **356** comprises a nozzle or jet member **360** which is provided with a relatively small orifice **365.** As illustrated in FIGS. **1** and **7,** a feeler arm **362** of thin sheet metal and attached to a hinge plate **364** is pivotally mounted between trunnion bearings **366.** The hinge plate **364** is provided with a valve member **368** for cooperation with the jet member **360** to control the escape of air from the orifice **365.** The air block and feeler plate unit is adjustable to position the free end of the feeler plate at variable distances above the upper surface of the rotary disk **12** with the valve member **368** covering the orifice **365** to prevent the escape of air from the chamber **356.** As a result, the pressure in the chamber is increased to an extent such as to operate the normally closed piloted valve **346** to effect opening thereof, thereby operating the cylinder **342** to maintain the clutch **40** engaged. As shown in FIG. **7,** an adjusting screw **370** carried by an extension **372** from the air block **352** effects adjustment of the valve member **368** relative to the air jet **360.**

In operation, when a normal number of closures are maintained on the disk **12,** the feeler plate **362** will not be engaged and the pressure to the cylinder **342** will be continued to maintain engagement of the clutch **40.** However, when an excessive number of closures are accumulated on the disk **12,** the feeler arm **362** is engaged by a group of closures to rock the arm upwardly, thus permitting air to escape from the orifice **362.** As a result, the pressure in the chamber **356** is rapidly reduced, enabling the normally closed piloted valve **346** to close, whereby the cylinder **342** is evacuated to effect disengagement of the clutch **40.**

As illustrated in FIG. **7,** the trunnion bearings **366** are carried by opposed arms **374** attached to the air block **352,** and the latter is supported by an elongated stud **376,** FIG. **8A,** provided with threaded portions and extended through the block. The block is retained on the stud by a shouldered portion **378** engaged with one side and by a nut and washer **380** on the other side. The elongated stud **376** is attached to the upright supporting wall **92** by nuts **382** and is mounted for rotary adjustment therein. The outer end of the stud **376** is provided with a handle **384,** FIG. **2** by which the stud may be rotated to adjust the position of the feeler or detecting arm **362** relative to the upper surface of the disk whereby to permit more closures to be maintained on the disk in one instance before the detecting arm is engaged to discontinue the feeding operation, and whereby to permit fewer closures to be maintained on the disk in another instance before the detecting arm is engaged to discontinue the feeding operation. It will be apparent that as soon as the number of closures on the disk returns to a normal amount, the detecting arm will rock downwardly to again close the orifice **365** of

the air block **352** whereupon the clutch **40** will return to its normally engaged position.

Provision is also made for discontinuing rotation of the rotary disk **12** in the event that the chute becomes full beyond a predetermined point indicating that the closures are being supplied faster than they are being withdrawn. As herein shown, see FIGS. **4** and **19**, the control for the drive to the rotary disk **12** includes an air cylinder **386** arranged to maintain the clutch **66** normally engaged. The cylinder **386** is connected by a pipe **388** to the outlet of a normally open solenoid valve **390** which has an inlet connected by a pipe **392** to the main pipe **349** which leads to the regulated source of compressed air **351.** The control mechanism further comprises the photoelectric unit **194** which includes a photocell **394** supported on one side of the chute **18** and a light source **396** on the other side which are operatively connected to a relay **398** which in turn is connected to the normally open solenoid air valve **390.**

In operation, in the event that a surplus of closures is provided, the closures will build up in the chute **18** to a point beyond the photoelectric unit **194** so as to cut off the light beam to the photocell for a predetermined length of time. When this occurs, the air passing through the solenoid valve **390** is cut off, permitting the normally charged cylinder **386** to become evacuated so as to disengage the clutch **66,** thus bringing the rotary disk **12** to rest. It will be understood that only a slight delay in supplying closures to the chute **18** is sufficient to reduce the number of closures in the chute during continued withdrawals of closures therefrom, whereupon the solenoid valve **390** will return to its normally open position and the clutch **66** will be reengaged to resume normal running operation. It will be further understood that the photocell **394** connected in circuit with the relay **398,** as shown in FIG. **20,** may be adjusted through the relay so as to permit rapid passage of successive individual spaced closures through the chute without activating the relay. Under normal operating conditions, the closures transferred to the chute **18** are rapidly advanced by streams of air from jets **400** until they reach the trailing end of the line to form a continuous line arranged end to end up to the spider **216** where successive closures are received and advanced by the pockets **214** through the orienting mechanism **20.** The air jets **400** are carried by a manifold **402** connected by a pipe **404** to a regulated source of compressed air as indicated diagrammatically at **406** in FIG. **19.**

Provision is further made for controlling the operation of the cam shaft **218** under two different conditions. In one instance, when an absence of closures in the chute **18** is detected at a point immediately preceding the spider **216,** the normally engaged clutch **240** forming a part of the drive to the cam shaft is arranged to be disengaged. This is for the purpose of assuring a continuous line of closures arranged end to end so as to permit successive closures to enter successive pockets of the spider. In other words, if the closures were delivered to the spider in variably spaced relation, the individual closures might fail to be engaged by a pocket and instead might be engaged by a point of the spider and thus jammed in the chute. In another instance, when an excessive build-up of closures adjacent the entrance to the chute **32** is detected, indicating that closures are being supplied faster than they are being withdrawn, the normally engaged clutch **240** is likewise arranged to be disengaged whereby to prevent jamming of the closures in the chute.

As diagrammatically illustrated in FIG. **19,** the clutch **240** forming a part of the drive to the cam shaft **218** is held in its normally engaged position by an air cylinder **408** and the clutch is disengaged in one instance when closures are absent at a point in the chute preceding the spider **216,** and in another instance, the clutch is disengaged when a surplus of closures are present in the track **32.** The air cylinder **408** is connected by a pipe **410** to a normally closed solenoid air valve **412** which in turn is connected by a pipe **414** to a normally open solenoid air valve **416.** The solenoid valve **416** is connected by a pipe **418** to the pipe **349** leading to the regulated source of compressed air indicated at **351.**

The means for detecting the presence or absence of closures in the chute **18** at a point preceding the spider **216** comprises the photoelectric detecting unit **197** including a photocell **422** on one side of the chute and a light source **424** on the other side, the detecting unit being connected through a relay **426** to the normally closed solenoid air valve **412.** The detecting unit **197** is arranged to energize the solenoid air valve **412** when the chute is filled with closures so as to cut off the light source. Thus, in operation, when the chute **18** contains a continuous line of closures in end-to-end contact, the normally closed solenoid air valve **412** will be maintained in its open condition whereby to permit air to pass to the cylinder **408** to hold the clutch engaged. On the other hand, when the feed of closures through chute **18** is discontinued and the trailing end of the line of closures passes the detecting point **420,** the light beam signals deactivation of the solenoid valve **412** to effect closing of the same and evacuation of the cylinder **408** to effect disengagement of the clutch **240.**

The means for detecting a surplus of closures in the track or chute **32** includes a photoelectric detecting unit **428,** FIG. **1,** which comprises a photocell **430** and a light source **432,** the detecting unit being connected through a relay **434** to the normally open solenoid air valve **416.** In this instance, the detecting unit is activated when the light source is cut off by an accumulation of closures at the detecting point. In practice, successive closures released to enter the chute **32** are rapidly advanced by an air jet **436** past the detecting means to join the trailing end of the supply line from which successive closures are being withdrawn. Thus, in the event that the closures are being supplied faster than the demand therefor, the trailing end of the line will back up to a point where the closures will cut off the light beam and will thus cause the normally open valve to be closed to discontinue the feed of closures into the chute **32.** Conversely, upon withdrawal of closures from the chute to cause the trailing end to extend forwardly of the detecting unit, normal operation of the apparatus will be again resumed.

From the above description it will be seen that the present apparatus is capable of handling oblong closures having printing or other characters, marks or symbols thereon wherein provision is made for first sorting from a randomly arranged group thereof those closures which are disposed with their open ends up without regard for the direction of the printing, then depositing the closures end to end longitudinally into a chute and sorting successive closures with respect to the direction of the printing thereon into two different tracks or chutes, the closures in one track being redi-

rected to read in the same direction as the other track, and finally bringing together the closures in both tracks to form one line in which the closures are all oriented to read in the same direction. It will be observed that novel provision is made for controlling the operation of the apparatus in a novel manner such as to assure a continuous supply of closures in conformity with the demand therefor and in a manner such as to prevent jamming of the closures at selected points in the apparatus. It will be further observed that the number of closures per minute supplied by the present apparatus may be varied by adjustment of the variable speed drives.

While the specification and claims refer to closures having characters readable in one direction or another, herein illustrated by readable characters occurring right side up or upside down depending on how the closure is disposed, it will be understood that such reference is intended to include other characters disposed in selected areas on the closures and adapted to be oriented as described.

Having thus described the invention, what is claimed is:

1. Closure handling and orienting appratus adapted to handle oblong closures having a reflective spot disposed on one side or the other of a longitudinal center line of the closure, means through which the closures are advanced to form a continuous line of closures, wherein some of the closures have a reflective spot on one side and others on the other side of said longitudinal center line, means for advancing the line of closure at a uniform rate, means for detecting the position of the reflective spot on successive closures, means responsive to said detecting means for distributing the closures having the reflective spots on different sides of the center line into two different paths, means for releasing the closures alternately from each path to provide a single line, means for rapidly advancing each closure to join the trailing end of said single line, means for detecting an extension of said trailing end toward said releasing means, and means for rendering said first means inoperative.

2. Apparatus according to claim **1,** comprising means for repositioning the closures in one of the paths prior to recombining the lines of closures to provide said single line such that the reflective spots all occur on the same side of the center line of the closures.

3. Apparatus according to claim **1,** wherein said first means comprises a rotor containing a plurality of peripherally spaced pockets arranged to receive and advance the successive closures.

4. Apparatus according to claim **1,** wherein said first means comprises a rotor containing a plurality of peripherally spaced pockets arranged to receive the closures and a shaft for rotating the rotor to advance said closures at a uniform rate.

5. Apparatus according to claim **1,** wherein the means for releasing closures comprises a pair of movable stops one in each line and means for actuating said stops alternately.

6. Apparatus according to claim **5,** comprising an air jet associated with each stop and cam operated air valves associated with said stops and air jets, said air jets being adapted to rapidly advance successive closures as they are released.

7. Closure handling and orienting apparatus adapted to handle oblong closures, means through which the closures are advanced to form a continuous line of closures, each closure having a reflective spot disposed on one side or the other of a longitudinal center line, means for detecting the position of said reflective spot on successive closures, said detecting means including a retroreflective photoelectric device, a switch arm responsive to said detecting means for distributing the closures having reflective spots on different sides of the center line into two different paths, means for redirecting the closures in one path to conform to the closures in the other path and means for bringing together and realigning the closures from both paths into one line of closures with the reflective spots all occurring on the same side of the center line of the closures.

8. Closure handling and orienting apparatus adapted to handle oblong closures, a chute through which closures are advanced to form a continuous line thereof, said closures having a reflective spot disposed on one side or the other of the longitudinal center line of the closures, means for receiving and advancing the closures at a uniform rate along said line, means for detecting the position of the reflective spot on successive closures, means responsive to said detecting means for distributing the closures having reflective spots on different sides of the center line into two different paths, means for redirecting the closures from one path to conform to the closures in the other path, means for bringing together and realigning the closures from both paths into one oriented line of closures with their reflective spots all occurring on the same side of the closures, means for detecting the absence of closures in said chute at a point preceding said first named means and means responsive to said detecting means for rendering said first means inoperative when closures are absent at said point.

9. Closure handling and orienting apparatus adapted to handle oblong closures, a chute through which the closures are advanced to form a continuous line thereof, said closures having a reflective spot disposed on one side or the other of the longitudinal center line of the closure, means for receiving and advancing closures at a uniform rate along said line, means for detecting the position of the reflective spot of successive closures, means responsive to said detecting means for distributing the closures having reflective spots on different sides of the center line into two different paths, means for redirecting the closures in one path to conform to the closures in the other path, means for bringing together and realigning the closures from both paths into one oriented line thereof with reflective spots all occurring on the same side, means for driving said first named means, means for rapidly advancing successive closures along said oriented line to join the trailing end thereof, detecting means spaced from the trailing end of said line and means responsive thereto for discontinuing operation of said second means when the trailing end extends into the path of said detecting means.

10. Closure handling and orienting apparatus adapted to handle oblong closures, means through which the closures are advanced to form a continuous line thereof, said closures having a reflective spot disposed on one side or the other of a longitudinal center line of the closures, means for receiving and advancing closures at a uniform rate along said line, means for detecting the position of the reflective spot of successive closures, means responsive to said detecting means for distributing the closures having reflective spots on dif-

ferent sides of the center line into two different paths, means for redirecting the closures in one path to conform to the closures in the other path, means for bringing together and realigning the closures from both paths into one oriented line thereof with reflective spots all occurring on the same side, means for driving said first named means, means for rapidly advancing successive closures along said oriented line to join the trailing end of said line and means responsive thereto for discontinuing operation of said driving means when the trailing end extends back to said detecting means.

11. Closure handling and orienting appratus adapted to handle oblong closures, a chute through which the closures are advanced to form a continuous line thereof, said closures having a reflective spot disposed on one side or the other of the longitudinal center line of the closures, means for receiving and advancing closures at a uniform rate along said line, means for detecting the position of the reflective spot on successive closures, means responsive to said detecting means for distributing the closures having reflective spots on different sides of the center line into two different paths, means for redirecting the closures in one path to conform to the closures in the other path, and means for bringing together and realigning the closures from both paths into one oriented line thereof with the reflective spot, said distributing means including a switch arm, pneumatically operated means adapted to rock said switch arm, and a solenoid operated valve operatively connected to said detecting means to effect rocking of the arm when a reflective spot is detected.

12. Closure handling and orienting apparatus as defined in claim **11** wherein the solenoid valve is normally closed and opened momentarily by said detecting means, and cam operated means operatively connected to said solenoid valve adapted to increase the time the valve is opened.

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