March 24, 1970 A. F. PETERSON 3,501,893

BAG OPENING MACHINE

Filed Jan. 8, 1968 6 Sheets-Sheet 1

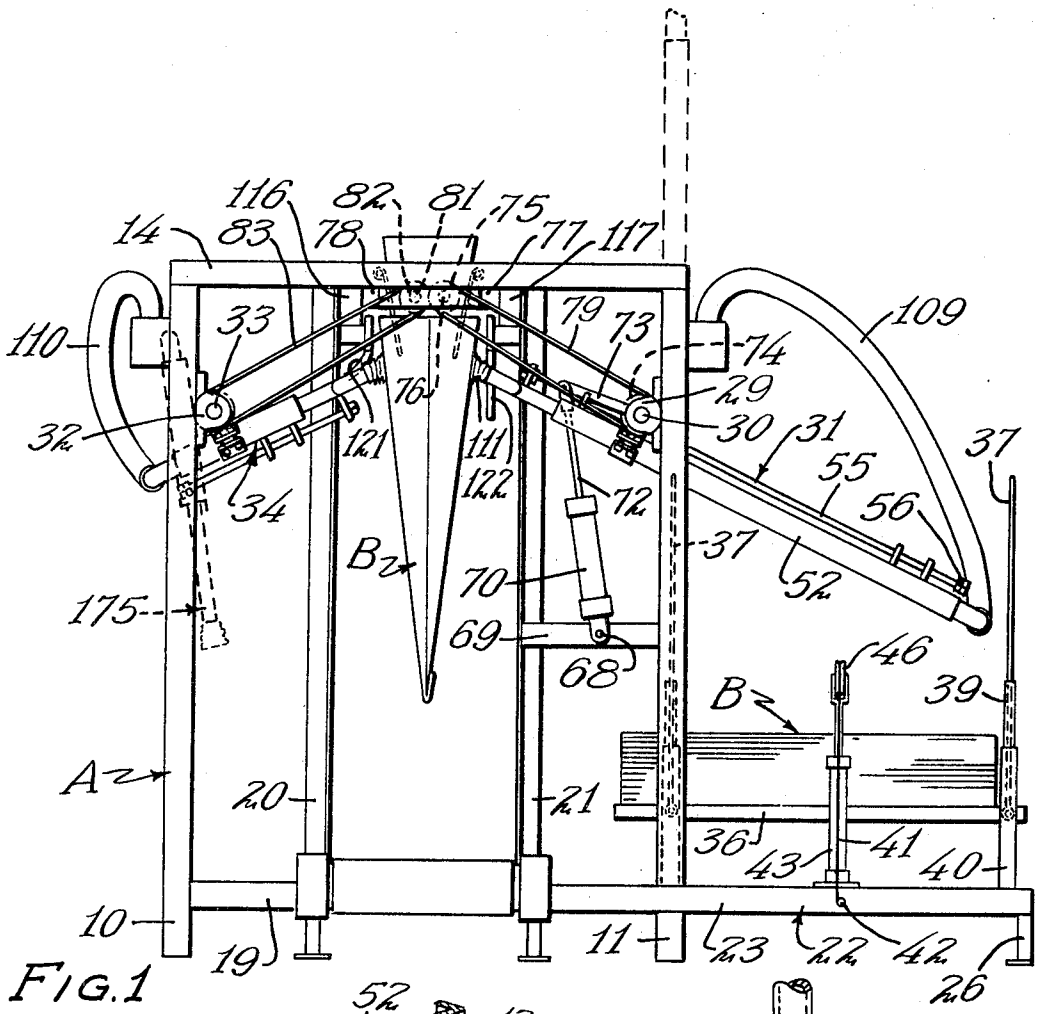


FIG. 1

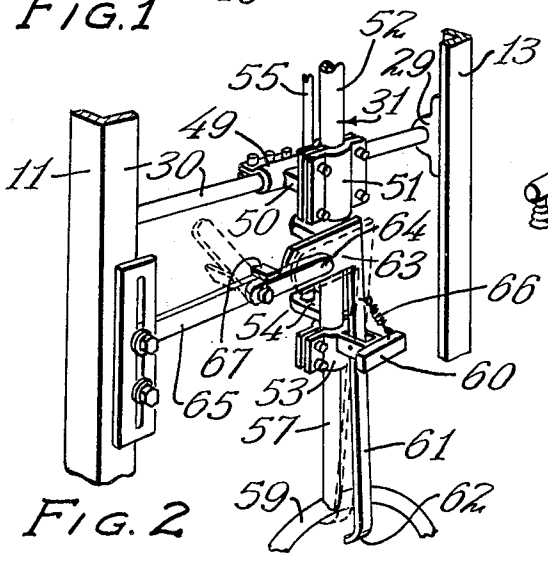


FIG. 2

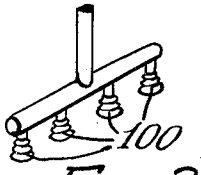


FIG. 3

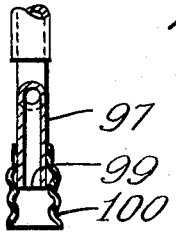


FIG. 4

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BAG OPENING MACHINE

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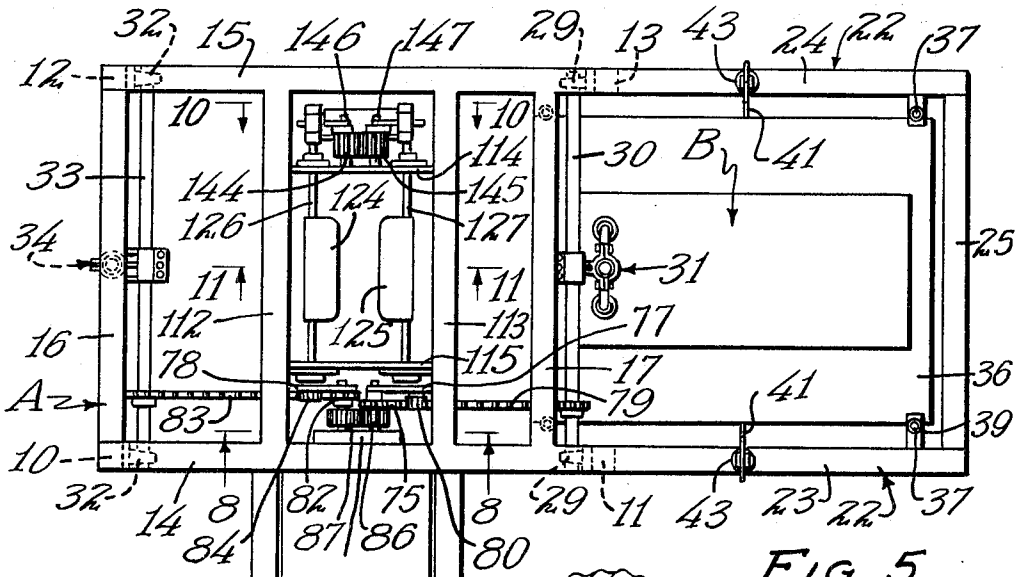
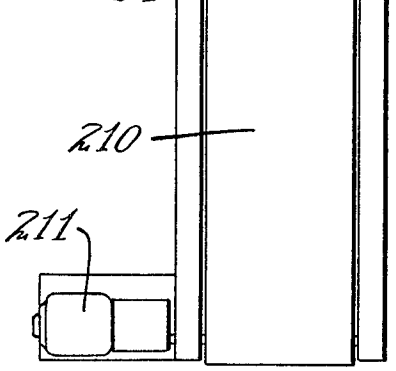


FIG. 5



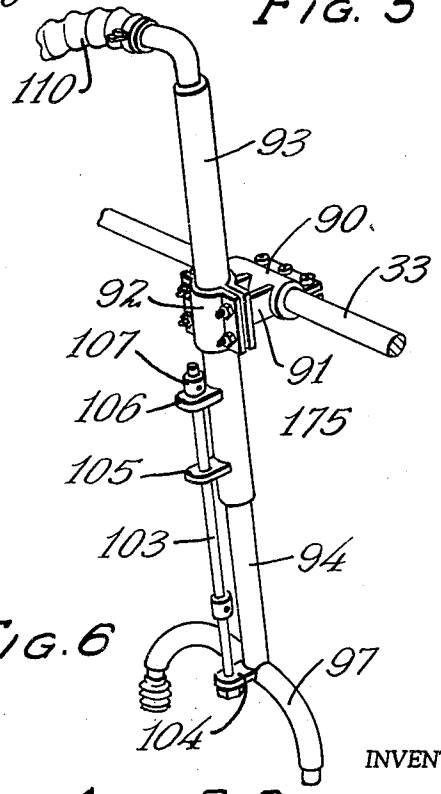


FIG. 6

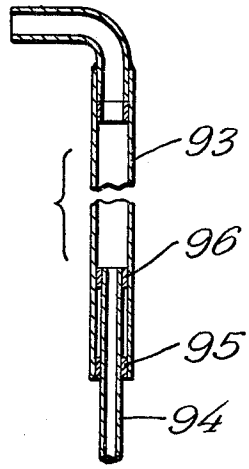


FIG. 7

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BAG OPENING MACHINE

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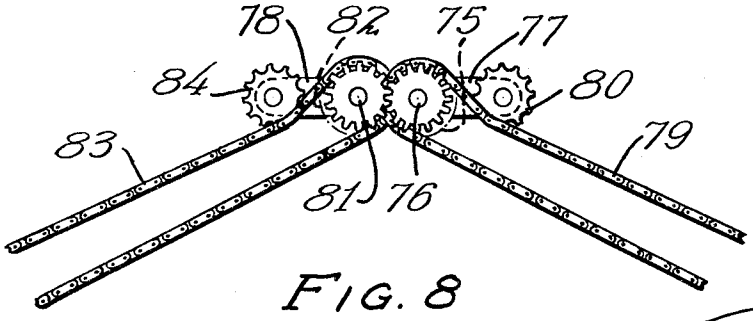


FIG. 8

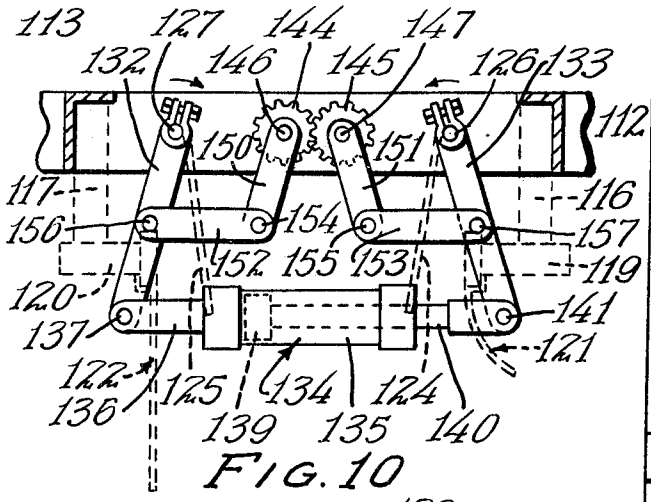


FIG. 10

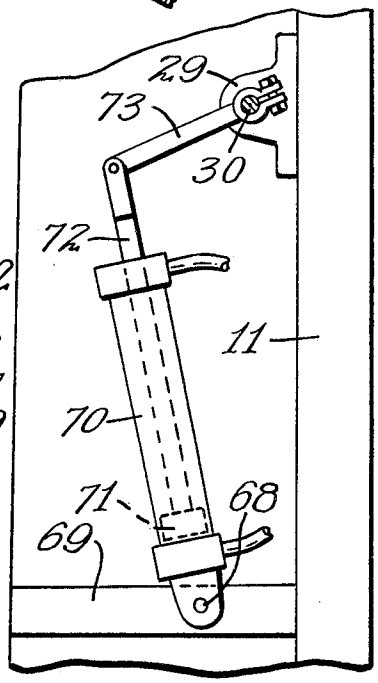


FIG. 9

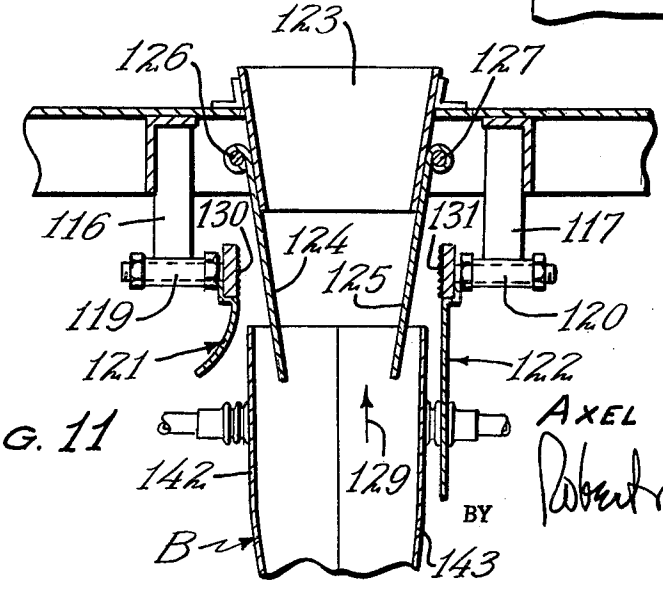


FIG. 11

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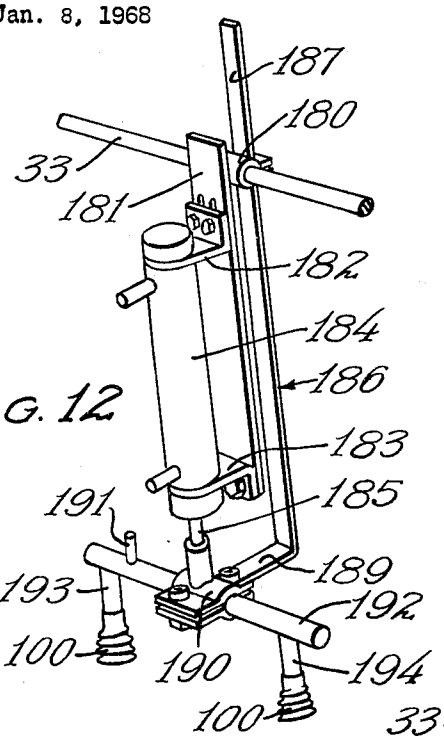


FIG. 12

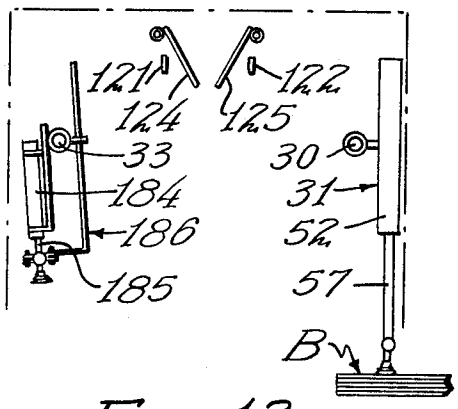


FIG. 13

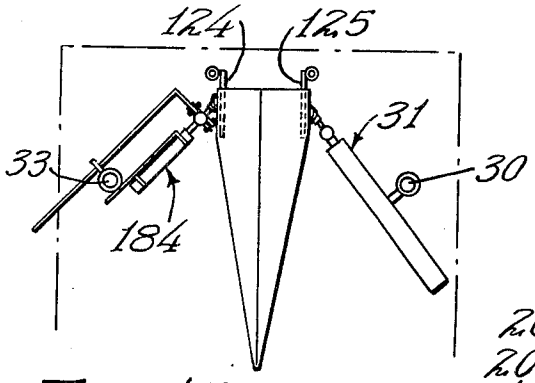


FIG. 15

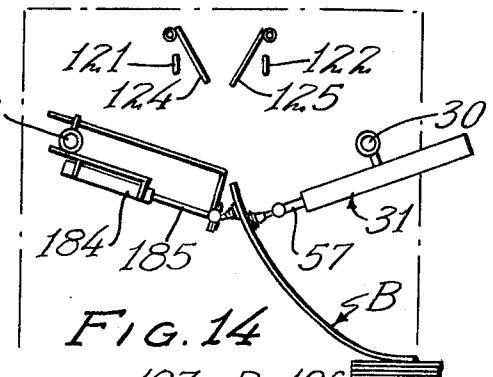


FIG. 14

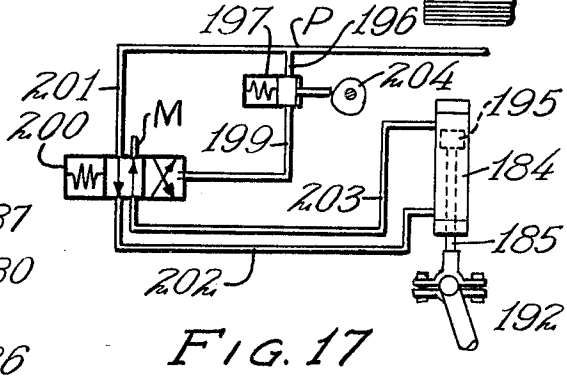


FIG. 17

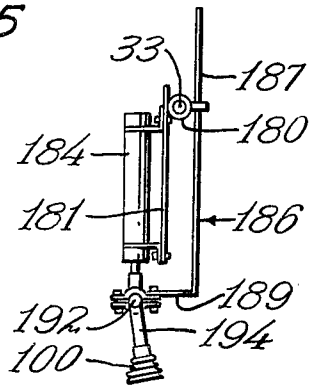


FIG. 16

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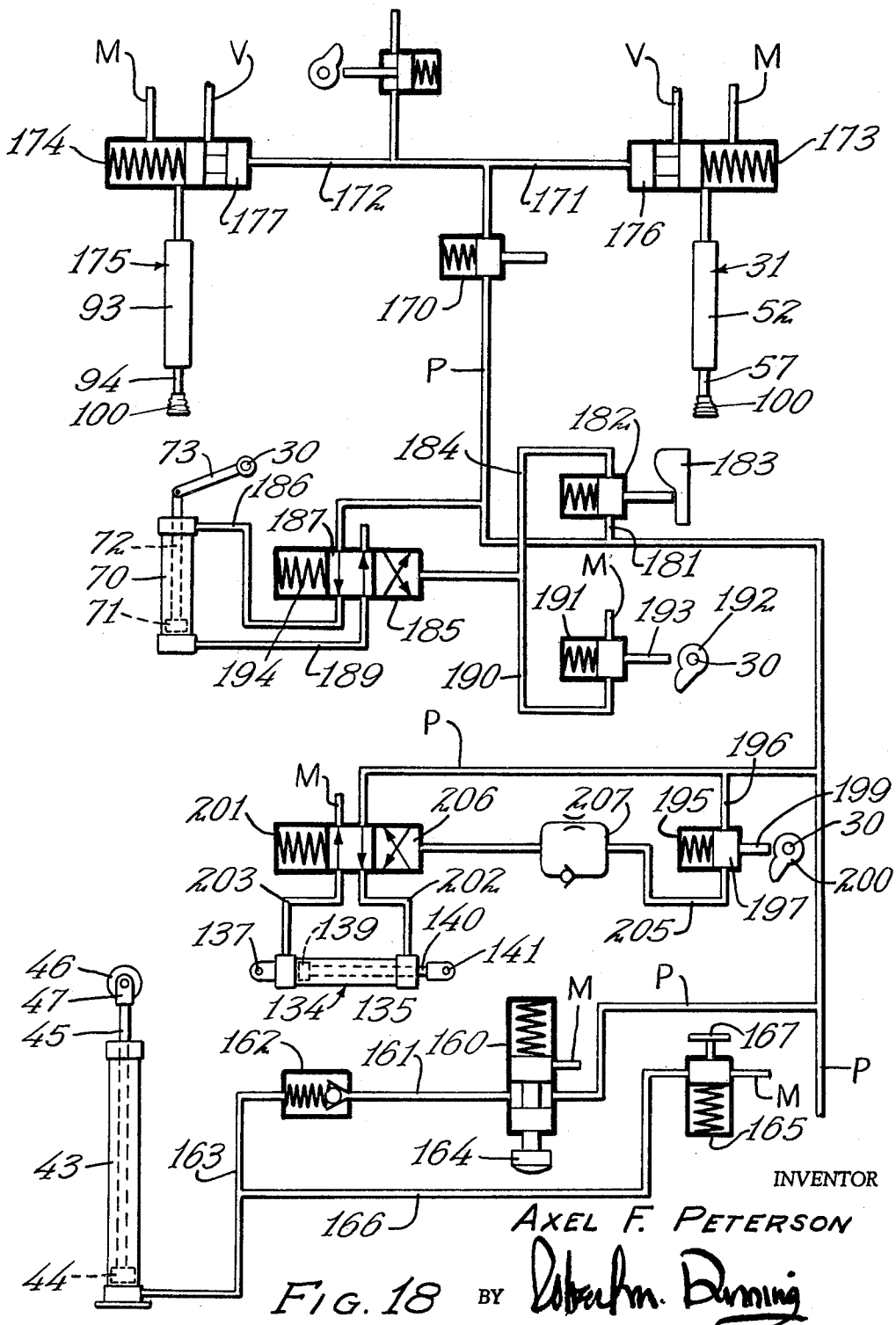
BY Robert M. Dunning

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March 24, 1970 A. F. PETERSON 3,501,893

BAG OPENING MACHINE

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FIG. 18 BY Robertson Dunning

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BAG OPENING MACHINE

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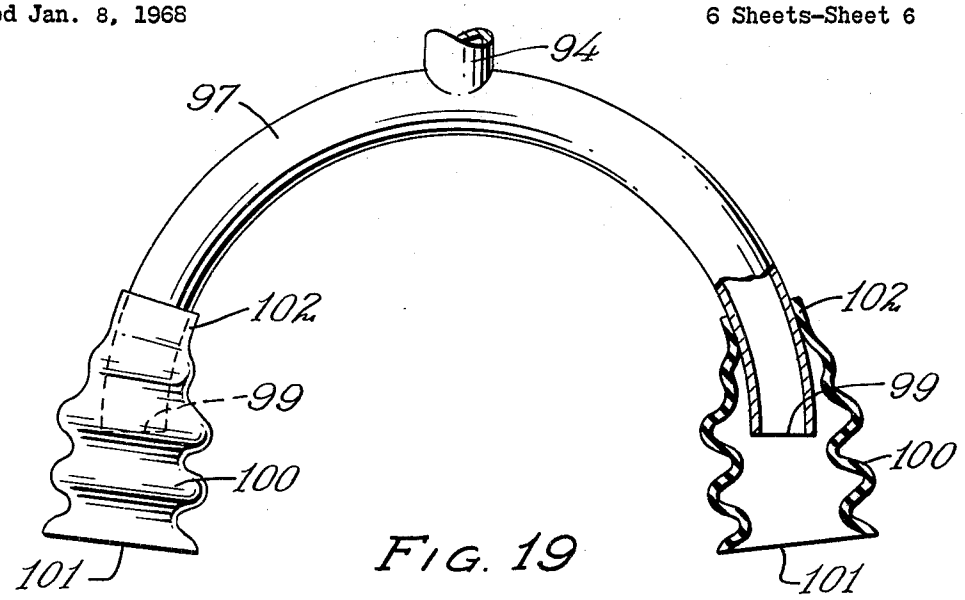


FIG. 19

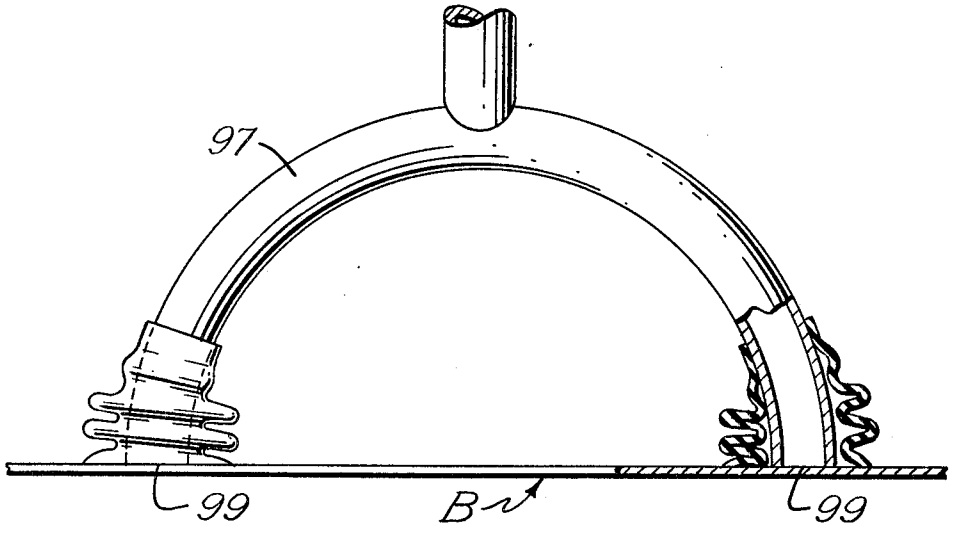


FIG. 20

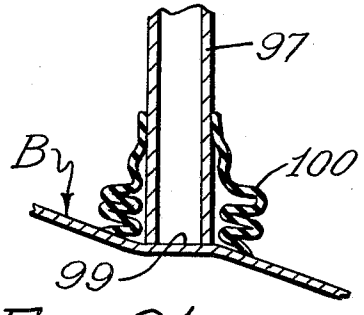


FIG. 21

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United States Patent Office 3,501,893 Patented Mar. 24, 1970

3,501,893

BAG OPENING MACHINE

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Filed Jan. 8, 1968, Ser. No. 700,667
Int. Cl. B65b 43/18, 43/30
U.S. Cl. 53—190 10 Claims

ABSTRACT OF THE DISCLOSURE

The invention discloses a bag opening apparatus for use with flat folded bags having pleated walls. The device includes a bag filling guide, and a pair of arms pivoted on parallel planes on opposite sides of said guide. The arms are provided with extensible and retractable end portions provided with bag engaging suction cups connectable to a source of partial vacuum. The arms are swingable from a substantially vertical position through somewhat more than ninety degrees to a position adjacent to the filling guide and on opposite sides thereof. When in vertical position the suction cups of one arm engage the uppermost bag of a series of superimposed bags. The extensible end of said one arm retracts, and the arms swing in unison until the bag is engaged by the suction cups of the other arm. The extensible end of the other arm retracts to open the big. When carried to position adjacent the filling guide the sides of the bag are clamped for filling.

This invention relates to an improvement in bag opening machine and deals particularly with an apparatus capable of picking up a bag from a supply stack, swinging it into upright position, opening the upper end of the bag, and holding the bag in opened position for a predetermined time period before releasing it.

Some years ago the filling of bags with flowable material of one type or the other was a manual operation. The operator picked up a bag from a supply pile, opened it up and placed it beneath a filling mechanism, operated the filling mechanism to fill the bag, and carried or otherwise moved the filled bag to a bag closing mechanism such as a sewing machine, a stapler, or the like. With the increase in cost of labor, such a manual operation became somewhat impractical, and as a result, machines of one type or the other were developed to accomplish the desired result. The present invention lies in the provision of an apparatus for packing up a bag made of paper or other suitable material from a vertical stack or pile of horizontal bags, swinging the bag into vertical position and simultaneously opening the bag by drawing the opposite walls of the bag apart, and holding the bag in an elevated position during the filling operation. As soon as the bag is released, the bag is moved out of filling position and the cycle of operation repeats.

A feature of the present invention resides in the provision of a device including suction arms swingable from a generally upright position in which suction cups on one of the arms engage the uppermost bag of a stack of bags through an angle of somewhat more than 90 degrees to a position adjoining a filling spout. As one suction arm carries the bag from one position to another, a second suction arm engages the opposite side of the bag, the two suction arms drawing the bag into open position as it moves into filling position. Means are provided for pivoting the arms on opposite sides of the bag in unision during the bag opening operation.

A feature of the present invention resides in a device of the type described including a pair of clamping members which enter the open upper end of the bag as it reaches filling position. As the upward movement of the bag stops, means are actuated to move the clamping

means against the bag to hold the bag securely during the filling operation. After a predetermined time period, the clamping means is released allowing the bag to drop unto a suitable conveyor and permitting the suction arms to return to starting position.

A further feature of the present invention resides in the provision of a suction arm including two tubular telescoping members one of which is provided at its end with one or more parallel suction cups. The other tubular member is connected to a source of partial vacuum. As the suction arms swing down toward vertical position, the portion of the suction arm bearing the suction cup slides partially out of the tubular member connected to the vacuum source to elongate the arm. As soon as the suction cups engage the surface of a bag, the suction acts to retract the slidable tubular member into the pivoted tubular member, raising the bag from the stack into position to be opened.

A further feature of the present invention resides in the provision of a particular type of suction cup which has been found particularly useful in the combination. The suction cup includes a relatively inflexible tube to which is secured a highly flexible skirt which is preferably corrugated so as to readily contract in length. The flexible skirt is brought into contact with the surface of the bag, and immediately conforms to the shape of the bag. When the skirt is engaged to the bag, the suction acts to contract the skirt until the surface of the bag is drawn against the end of the relatively inflexible inner tube. With this arrangement, the bags are readily picked up while at the same time the movement of the bag is controlled by engagement of the wall of the bag against the rigid inner tube once the bag has been picked up.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

FIGURE 1 is a front elevational view of the bag opening apparatus showing the general arrangement of parts therein.

FIGURE 2 is a perspective detail of the bag lifting arm showing the latch arrangement used to hold the arm in inoperable position when the device is not in use.

FIGURE 3 is a perspective detail of one arrangement of suction cups which may be used on the bag lifting arm.

FIGURE 4 is a vertical sectional view through one of the suction cups illustrated in FIGURE 3 of the drawings.

FIGURE 5 is a diagrammatic top plan view of the bag opening mechanism, showing the general arrangement of parts therein.

FIGURE 6 is a perspective view showing one of the bag lifting arms.

FIGURE 7 is a sectional view through a portion of the bag lifting arm.

FIGURE 8 is a fragmentary detail showing the manner in which the two bag engaging arms are moved in unison.

FIGURE 9 is a fragmentary view showing the cylinder employed for rotating the arms in unison.

FIGURE 10 is a fragmentary detail showing the means for operating the bag clamping means to hold the bag in open position during filling.

FIGURE 11 is a vertical sectional view through the means for clamping the bag in open position during the filling operation.

FIGURE 12 is a fragmentary detail illustrating the mounting of the bag opening arm.

FIGURE 13 is a diagrammatic view showing the general position of the bag lifting and opening arms at the beginning of a cycle of operation.

FIGURE 14 is a diagrammatic view of the position of the arms as the bag is lifted into position to be engaged by both of the opposed arms.

FIGURE 15 is a diagrammatic view showing the position of the arms when the bag is in fully elevated position.

FIGURE 16 is a side elevational view of the bag opening arm in operable position.

FIGURE 17 illustrates diagrammatically a portion of the pneumatic system.

FIGURE 18 is a diagrammatic view showing the air pressure and air suction lines and the valves used to operate the same.

FIGURE 19 is an enlarged detail of the end of the bag lifting arms showing the suction cups in elevated position.

FIGURE 20 is a view similar to FIGURE 19 but showing the suction cups after they have engaged the surface of a bag.

FIGURE 21 is an enlarged sectional detail showing the manner in which the bag may flex relative to the suction cup arrangement.

The bag opening apparatus is best shown in general in FIGURES 1 and 5 of the drawings. The device is indicated in general by the letter A, and includes a pair of front posts or standards **10** and **11**, and a pair of similarly spaced rear posts or standards **12** and **13**. The upper end of the standards **10** and **11** are connected by a horizontal connecting member **14**, and the upper ends of the posts **12** and **13** are connected by a parallel horizontal connecting member **15**. The connecting members **14** and **15** are connected by cross-members **16** and **17**. The standards **10** and **11** may also be connected by other supporting frame members, as may also be the standards **12** and **13**.

A horizontal connecting member **19** may connect the columns **12** and **13**, and vertical angle members **20** and **21** may extend upwardly from the lower frame member **19** to the upper frame member **15**. A generally rectangular frame **22** extends laterally to one side of the columns **11** and **13** as is best illustrated in FIGURE 5. The rectangular frame member **22** includes a front frame member **23**, a rear frame member **24**, and a side connecting frame member **25**. As indicated in FIGURE 1 of the drawings the frame **22** is supported by suitable supporting legs **26**.

The front and rear columns **11** and **13** are provided with bearings **29** which support a horizontal shaft **30** (see FIGURE 2). The shaft **30** pivotally supports the bag lifting arms **31** and function to swing the arm mechanism **31** through somewhat more than 90 degrees. A similar pair of bearings **32** (see FIGURE 1) are mounted upon the vertical standards or columns **10** and **12** to support a shaft **33** in opposed relation to the shaft **30**. The shaft **33** supports the arm mechanism which is indicated in general by the numeral **34** and which functions to open up the bag B which is lifted by the suction arm **31**.

A platform or table **36** is supported within the frame **22**. Vertical rods **37** are connected to the platform **36** near the corners thereof, and the rods **37** are slidable in sleeves **39** supported by vertical brackets **40** mounted upon the frame **22**. The platform **36** is supported by a pair of cables **41** which are secured to opposite sides of the plaform **36** and are secured in their opposite ends, as indicated at **42**, to the frame **22**. A pair of vertical cylinders **43** are mounted upon the frame members **23** and **24** on opposite sides of the platform **36** near the center thereof, and each cylinder contains a piston identified in FIGURE 18 by the numeral **44** and to which a piston rod **45** is attached. The pulley **46** ismounted in a clevis **47** at the upper end of each piston rod **45**. The cable **41** extends from the platform **36**, over the pulley **46** and is anchored to the frame at **42**. Accordingly, as the piston **44** is forced upwardly in each of the cylinders **43**, the elevations of the pulley **46** increases, and the platform **36** is raised. The purpose of this arrangement is to maintain the uppermost bag B on the platform **36** at a substantially equal level.

As indicated in FIGURE 2 of the drawings, a clamping bracket **49** is secured to the pivot rod **30**. A radially extending arm **50** is secured to the bracket **49** and supports a right angularly extending bracket **51**. A tubular member **52** forming the upper pivotal end of the bag lifting arm is clamped in the bracket **51**. A second clamping bracket **53** is secured to the tubular member **52** below the position of the bracket **51** when the bag lifting arm is in generally vertical position. The bracket **53** is provided with a laterally extending arm **54** supporting a rod **55** which extends through the arm **50**. The rod **55** is provided with adjustable stop means **56** for a purpose which will be later described.

A second tubular member **57** is slidably supported within the tubular member **52**, and supports a yoke **59** designed to support suction cups of a type which will be later described. The clamping bracket **53** supports a laterally extending bracket **60** which pivotally supports a locking arm **61**. The locking arm **61** is provided with an angularly turned lower end **62** which is engageable beneath the yoke **59** of the lower tubular member **57**. The arm **61** is provided with an enlarged upper end **63** which may be pivotally engaged by a locking lever **64** mounted upon a bracket **65** adjustably secured to the upright **11**.

The arrangement is such that when the latch member **64** is in one position shown in dotted outline in FIGURE 2, the hook end **62** of the arm **61** is out of the path of movement of the yoke **59** of the tubular member **57**, allowing the yoke to drop into contact with the surface of the bags B. When the latch **64** is in its outer extreme position, the arm **61** moves into the position shown in dotted outline in FIGURE 2 of the drawings, engaging the yoke **59** and preventing the tubular member from dropping. As indicated in FIGURE 2, the spring **66** normally draws the hook end **63** toward one extreme position. A lug **67** on the latch **64** holds the latch in either extreme position, the latch being manually operable.

The means for operating the bag lifting arm **31** is best illustrated in FIGURES 1 and 9 of the drawings. A cross-member **69** connects the rear column **13** with the upright **21**. A pneumatic cylinder **70** is pivotally connected at **68** to the cross-member **69**. A piston **71** (see FIGURES 9 and 18) is connected to a connecting rod **72** leading to a crank arm **73** mounted upon the shaft **30**. When the piston **71** is moved upwardly in the cylinder **70**, the crank arm **73** is rotated in clockwise direction rotation of the arm **30**. The cylinder **70** and its piston **71** are so proportioned that the bag lifting arm **31** is pivotal from a generally vertical position in which the suction cups engage the uppermost bag B, to the position illustrated in full lines in FIGURE 1 of the drawings. In other words, in the arrangement illustrated the shaft **30** is rotated through an angular distance of somewhat more than 90 degrees by the piston **71** and the cylinder **70**.

With reference to the FIGURES 1 and 8 of the drawings, means are provided for rotating the shafts **30** and **33** in unison. As indicated in FIGURE 1, a sprocket **74** is mounted upon the shaft **30**. A cooperable sprocket **75** is mounted upon a shaft **76**. The shaft **76** is supported by a bracket **77** in fixed relation to the frame. The sprockets **74** and **75** are connected by a chain **79**, the tension of which is adjusted by means of an idler sprocket **80**. A parallel shaft **81** supported by a bracket **78** supports a sprocket **82** connected to the shaft **33** by means of a chain **83**, the tension of which is adjusted by an idler sprocket **84**. As indicated in FIGURE 5 of the drawings the shafts **76** and **81** support intermeshing gears **86** and **87** which cause the shafts **76** and **81** to move in unison in opposite directions. As a result, the clockwise movement of the shaft **30** controlling the position of the bag pickup arm unit **31** causes a counter-clockwise pivotal movement of the shaft **33** supporting the bag opening arm unit **34**.

As is indicated in FIGURES 6 and 7 of the drawings, a bracket **90** is mounted upon the shaft **33** and includes a radially extending arm **91** supporting a clamping bracket **92** which is in right angular relation to the clamping bracket **90**. The bracket **92** includes a tubular arm member **93** which is clamped in fixed relation to the shaft **33**. A second tubular member **94** is slidable in the tubular member **93** for movement longitudinally thereof. As indicated in FIGURE 7 of the drawings, a seal **95** is interposed between the end of the tubular member **93** and the tubular member **94**. A second seal **96** is interposed between the upper end of the tubular member **94** and the pivotal tubular member **93**. Thus when the interior of the tubular member **93** is subjected to partial vacuum, the interior of the tubular member **94** is similarly subjected to partial vacuum.

A yoke **97** is secured to the lower end of the tubular member **94**. The yoke **97** is hollow and tubular, and the actual construction of this portion of the apparatus is best illustrated in FIGURES 19 and 21 of the drawings. It should be understood that the yoke **97** is identical to the yoke **59** mounted upon the tubular member **57** of the bag pickup unit **31**.

As indicated, the yoke **97** is substantially inverted U-shaped in form terminating in end portions **99** which are on a substantially common plane. Flexible resilient corrugated sleeves **100** are provided with a relatively large diameter open end **101**, and a relatively small diameter cylindrical attaching sleeve **102** which encircles the yoke **97**. The arrangement is such that when the corrugated suction cups **100** are in their normal relaxed position as indicated in FIGURE 19 of the drawings, the open ends **101** of the cups extend substantially beyond the ends **99** of the yoke **97**. The corrugated flexible nature of the cups or sleeves **100** permit the open end to readily adapt themselves to the surface of the bag B being engaged. On the other hand, when the open ends **101** of the collapsible sleeves **100** are subjected to partial vacuum and are closed by a surface of the bag B, the sleeves **100** will collapse until the end **99** of the yoke **97** are in contact with the surface of the bag B. As indicated in FIGURE 21 of the drawings, once the bag B has been engaged and drawn against the end **89** of the yoke **97**, the surface of the bag may bend to permit the bag B to assume a considerable angularity relative to the collapsible sleeve portion **100** of the suction cups.

The tubular members **52** and **57** operate in a manner similar to the telescoping tubes **93** and **94**. As long as the suction cups on the yoke **59** and the yoks **97** are open to atmosphere, and when the tubular members are in generally vertical position as indicated in dotted outline in FIGURE 1 of the drawings, the suction cup supporting yokes drop by gravity into extended position. The degree of extension of the tubular members **52**, **57** is limited by the rod **55** and the adjustable nut **56**. The degree of extension of the tubular members **93**, **94** is limited by the rod **103** which extends through a lug **104** on the tubular member **94**, and through aligned apertures in lugs **105** and **106** on the tubular members **93**, the limit of movement of the rod **103** being adjusted by an adjustment nut or collar **107**. As is indicated in FIGURE 1 and FIGURE 6 of the drawings, flexible suction hoses **109** and **110** are connected to the tubular members **52** and **93** respectively to withdraw air therefrom. Thus when the bag pickup arm unit **31** pivots into substantially vertical position, and the yoke **59** drops until the suction cups **111** mounted upon the yoke **59** engages the uppermost bag B, the tubular member **57** is automatically retracted into the tubular member **52** raising the uppermost bag as will be described.

As is indicated in FIGURE 5 of the drawings, a pair of forwardly and rearwardly extending supports **112** and **113** extend between the top frame members **14** and **15** and support the brackets **77** and **78** and a pair of parallel brackets **114** and **115**. Brackets **116** and **117** extend downwardly from the brackets **114** and **115**. The brackets **116** and **117**, as indicated in FIGURE 10 of the drawings, support opposed inwardly extending arms **119** and **120** which support fixed clamping members **121** and **122**. The fixed clamping members **121** and **122** provide abutment against which the opposite outer sides of the bag B are clamped during the filling operation.

The bag clamping apparatus is perhaps best illustrated in FIGURES 10 and 11 of the drawings. As indicated in FIGURE 11, a filling hopper **123** is supported above the bag B when the bag is in elevated position. A pair of clamping plates **124** and **125** are pivotally supported upon shaft **126** and **127** on opposite sides of the hopper **123**, the clamping plates being attached to the shafts **126** and **127** in order to move in conjunction therewith. FIGURE 11 of the drawings indicate the bag B in partially raised position, the bags being moved in the direction of the arrow **129**. When the bag is in fully elevated position, it engages between the friction surfaces **130** and **131** of the member **119** and **120** and is held in this position by the outward swing of the clamping plates **124** and **125**. In order to accomplish the desired result, the mechanism indicated in FIGURE 10 of the drawings is provided, the clamping blades **124** and **125** being indicated in dotted outline in this figure. A pair of crank arms **132** and **133** are mounted upon the parallel shafts **127** and **126** and rotate in unison therewith. A hydraulic piston cylinder unit **134** is mounted between the arms **132** and **133**. The piston-cylinder unit **134** includes a cylinder **135** having a fixed arm **136** on one end thereof pivotally connected at **137** to the arm **132**. A piston **139** in the cylinder **135** is connected to a piston rod **140** which is pivotally connected at **141** to the arm **133**. As is obvious, movement of the piston **139** to the right in the cylinder **135** will rotate the shaft **126** in a counter-clockwise direction, and rotate the shaft **127** in a clockwise position, acting to clamp the walls **142** and **143** of the bag B against the fixed abutments **121** and **122**.

In order to insure uniform movement of the arms **132** and **133**, a pair of gears **144** and **145** are mounted upon parallel pivots **146** and **147**. Crank arms **150** and **151** are mounted upon the pivots **146** and **147** to rotate in unison therewith. Links **152** and **153** are pivotally connected at **154** and **155** respectively to the ends of the crank arms **150** and **151**, and are pivotally connected at their other ends as indicated in **156** and **157** to the crank arms **132** and **133**. The crank arm **132** is parallel to the crank arm **150**, and the crank arm **133** is parallel to the crank **151**. As a result, upon actuation of the piston **139** in the cylinder **135**, the clamping plates **124** and **125** are pivoted uniformly against the abutments **130** and **131** in order to clamp the bag in an open position.

The pneumatic system for operating the apparatus is best illustrated in FIGURE 18 of the drawings. The letter P designates a pressure conduit leading from a source of air under pressure. The letter V indicates connections to a source of partial vacuum.

The pressure conduit P is connected to a limit switch **160** which is normally open. Air under pressure may flow through the conduit **161**, the check valve **162** and conduit **163** to the lower end of the cylinder **43** to raise the piston **44**. The limit switch **160** is provided with a plunger or feeler **164** which rests upon the surface of the uppermost bag B on the platform **36**. When the bags B are at the desired elevation, the plunger or feeler **164** is raised, closing the conduit to the cylinder **43** and preventing further raising of the platform **36** until the level of the bags B lowers to the point where further elevation is required.

An exhaust valve **165** is provided in an exhaust line **166** connected to the lower end of the cylinder **43**. When it is desired to lower the platform **36** in order to place additional bags on the platform, the manually operable plunger **167** may be lowered to connect the conduit **166**

to atmosphere, thereby allowing the piston 44 and its piston rod 45 to drop to the lowermost position.

The pressure line P also extends to an air switch 170 which is normally closed but which may be held by suitable means not illustrated in the drawings in an open position. From the air switch 170, the air may flow through conduits 171 and 172 to valves 173 and 174 controlling the flow of vacuum through the bag pickup arm unit 31 and to the bag opening unit which may be indicated in general by the numeral 175. When the manually operable valve 170 is in closed position, the bag pickup arm 31 and the bag opening arm unit 175 are inoperative. However, when the air switch 170 is open, the valve elements 176 and 177 are moved into position to subject the interiors of the cylinders 52 and 93 respectively to partial vacuum from the vacuum line V. The letter M indicates conduits or openings which extend to atmosphere.

The pressure conduit P is also connected by a conduit 181 to an air switch 182 controlled by a member 183 which is operated by the relative movement of the telescoping members 52 and 57. When the members 52 and 57 have elongated sufficiently to engage the uppermost bag B on the platform 36, the member 183 opens the valve 182 to direct the flow of air through the conduit 184 to a valve 185. The valve 185 normally directs air through a conduit 186 to the upper end of the cylinder 70, holding this cylinder in a retracted position. However, when air is introduced into the valve 185 through the conduit 184, the piston 187 is moved to the left as viewed in FIGURE 18, connecting the air conduit P with the conduit 189 leading to the lower end of the cylinder 70, and acting to raise the piston 170. This action acts to rotate the arms 31 and 175 through a pre-determined angular distance.

Most of the elements of the apparatus are controlled by rotation of the shafts from one extreme position to another. The conduit 184 is connected by a conduit 190 to a valve 191 which is normally closed. However, when the arm 31 is swung into the position shown in full lines in FIGURE 1 of the drawings, a cam means 192 act upon the valve plunger 193 opening the conduit 190 to atmosphere, and allowing the valve 185 to return to its original position due to the presence of the operating spring 194.

A valve 195 of the normally closed type is connected by a conduit 196 to the pressure line P. The valve 195 includes a piston 197 having a piston rod 199 controlled by a cam 200 on one of the operating shafts such as the shaft 30. Thus when the arms 31 and 34 are moved into their extreme upper positions, the cam 200 opens the valve 195 to perform a function which will be described.

The pressure line P is also connected to a valve 201 which normally directs air through a conduit 202 to the end of the cylinder 134 tending to retract the piston 139 in the cylinder. The conduit 203 is normally connected to atmosphere from the opposite end of the cylinder.

When the air switch or valve 195 is actuated to open the valve, a flow of fluid is provided from the conduit 196 through the conduit 205 to the end of the cylinder valve 201 forcing the valve element 206 to the left as viewed in FIGURE 18. When in this position, the air from the conduit P flows through the conduit 203 to the cylinder 135 forcing the piston 139 in the direction to extend the distance between the pivots 137 and 141. This action causes the clamping member 124 and 125 to clamp the bag B against the friction surfaces 130 and 131 of the abutments 121 and 122.

The conduit 205 which leads from the valve 195 to the air controlled valve 201 includes a time delay device 207 which retains the cylinder unit 134 in extended position for a predetermined period of time before releasing the air and permitting the clamping devices 124 and 125 to release the bag.

As is obvious from FIGURE 5 of the drawings, a conveyor 210 extends beneath the bag supported by the clamping arms 124 and 125, and the conveyor may act to convey the bag from beneath the clamps after the clamps have been released. The conveyor 210 is of the endless type and is operated by the drive motor 211.

FIGURES 12 through 17 of the drawings show a structure similar to that described in the previous description with the exception of the bag opening arm structure. The arrangement shown in these figures serves the same purpose as the structure previously described. However, this structure permits the apparatus to return to its original or starting position somewhat more quickly than the previous structure, and is illustrated for this purpose.

FIGURE 12 of the drawings discloses a bracket 180 secured to the shaft 33 and supporting an arm 181 secured to the bracket for rotation in connection therewith. The arm 181 supports a pair of spaced brackets 182 and 183, between which is supported a double acting pneumatic cylinder 184. The purpose of this arrangement will be described.

The cylinder 184 includes a piston which operates a piston rod 185. A right angular bracket 186 includes one arm 187 which is slidably supported by the bracket 180, and includes a right angular arm 189 supporting a bracket 190. These arms 193 and 194 are encircled by vacuum cups 100 of the type which is previously described.

FIGURES 13 through 16 of the drawings are designed to diagrammatically illustrate various positions of the cylinder 184 and the bag pickup mechanism 31 during the operating cycle. FIGURE 13 of the drawings shows the tubular member 57 of the bag pickup unit 31 in extended position and with the suction cups thereupon engaging the uppermost bag of a series of bags B. From the position illustrated in FIGURE 13, the suction within the tubular member 52 will retract the tubular member 57 into the cylinder 52, raising the uppermost bag from the stack.

FIGURE 14 of the drawings shows the bag pickup cylinder 31 swung through an angle of somewhat less than 90 degrees and the piston 185 of the cylinder 184 projected from the cylinder so that the suction cups 100 thereupon are in engagement with the side of the bag B opposite that engaged by the suction cups 100 of the pickup arm 31. When in approximately the position shown in FIGURE 14, the piston within the cylinder 184 is actuated to retract the piston arm 185 into the cylinder 184, thus spreading the sides of the bag B apart to open the bag.

FIGURE 15 of the drawings shows the bag pickup unit 31 and the cylinder 184 in their opposite extreme positions from those shown in FIGURE 13. In this position, the bag B has been spread open and positioned inwardly of the fixed clamping members 121 and 122. This view also illustrates movable clamping plates 124 and 125 clamping the bag in position.

FIGURE 17 shows a simple hydraulic circuit for operating the piston 195 on the piston rod 185 within the cylinder 184. The pressure line P is connected by a conduit 196 to a normally closed air switch 197 controlling the flow of air through the conduit 199 to pneumatic valve 200. The pressure line P is also connected by a conduit 201 to the valve, and the air under pressure normally flows through a conduit 202 to the cylinder 184 in the direction to retract the piston 195 and the piston arm 185. The opposite end of the cylinder 184 is connected by a conduit 203 to the valve 200 and the upper end of the cylinder is normally subjected to atmosphere. The air switch 197 is actuated by cam means 204 which first opens the air switch to the conduit 199 to move the position of the valve 200 and to direct air under pressure to the upper end of the cylinder 184 as viewed in FIGURE 17, and to connect the lower end of the cylinder to atmospheric pressure. Further movement of the air switch 197 by the cam 204 connects the pressure line 196 to atmosphere, reversing the position of the

valve **200** and quickly retracting the piston **195** and piston rod **185** in the cylinder **184**.

In accordance with the patent statutes, I have described the principles of construction and operation of my improvement in bag opening machines, and while I have endeavored to set forth the best embodiment thereof I desire to have it understood that changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. A bag opening device including:

a filling guide,

a pair of arms pivotally supported on parallel pivots on opposite sides of said filling guide,

means pivoting said arms in unison from a generally vertical position through a generally horizontal position,

means supporting a supply of bags in substantially horizontal position beneath one of said arms when in said vertical position,

each of said arms includes an extensible and retractable end portion including suction cups engageable with said bag,

the suction cups of said one arm being engageable with the uppermost bag of said supply when in said substantially vertical position, whereby pivotal movement of said arms will swing the bag engaged into the path of movement of the suction cups on the other of said arms,

means retracting the retractable end portion of said other arm to draw the opposite sides of said bag apart,

said arms moving said bag into position to receive material passing said filling guide.

2. The structure of claim **1** and including means for retracting said retractable end of said one arm upon engagement of said suction cups on said rectractable end with the uppermost bag of said supply.

3. The structure of claim **1** and including means actuated by pivotal movement of said arms into material receiving position for clamping said bag walls in open position.

4. The structure of claim **1** and including fixed clamping members on opposite sides of said bag between which said bag is moved by said arms,

movable clamping means inwardly of said fixed clamping members and extending into said bag when in material receiving position, and

means actuated by movement of said arms into position to move said bag into material receiving position to move said movable clamping means toward said fixed clamping members.

5. The structure described in claim **1** and in which said arms are tubular, and including a source of partial vacuum connected to the interior of said arms and through said arms to said suction cups.

6. The structure of claim **5** and in which said source of partial vacuum causes retraction of the retractable arm ends when said suction cups thereupon are closed by engagement with the bag.

7. The structure of claim **1** and in which said arms are tubular, and includes a source of partial vacuum connected thereto communicating with said suction cups thereon, and in which suction from said partial vacuum source retracts said retractable end of said one arm upon engagement with said uppermost bag.

8. The structure of claim **7** and including a pneumatic cylinder connecting the other said arm to its extensible end, and means for operating said pneumatic cylinder to extend and retract said extensible end.

9. The structure of claim **1** and in which said arms are tubular and including a source of partial vacuum connected to said arms and communicating with said suction cups and including means actuated by movement of said arms into material receiving position to disconnect said source of partial vacuum from said arms.

10. The structure of claim **9** and including clamping means engageable with opposite sides of said open bag in material receiving position, and means operable by movement of said arms to actuate said clamping means to clamp the bag.

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