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Morine et al.

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[54] DISPENSING PUMP ASSEMBLY FOR BAKERY MATERIALS

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[52] **U.S. Cl.** **222/334**

[51] **Int. Cl.** **G01f 11/06**

[58] **Field of Search** 222/334, 383, 380, 504, 377, 222/385; 417/900; 137/565

[56] **References Cited**

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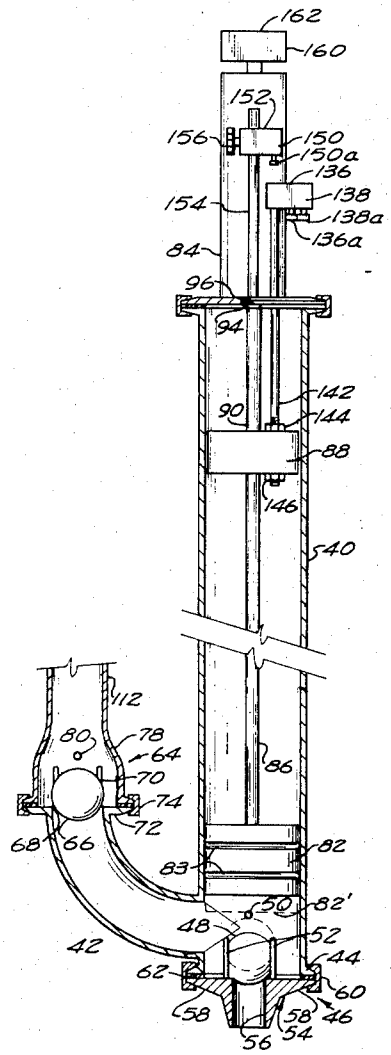
[57] **ABSTRACT**

The specification and drawings disclose a dispensing pump assembly which includes a first, vertically extending tubular cylinder for a piston mounted therein and adapted to reciprocate vertically. At the lower end of the cylinder, there is an inlet provided with a check valve which permits flow in only one direction into the cylinder. Immediately above the check valve is a discharge outlet having an outlet check valve. Preferably, the inlet and outlet check valves are relatively large diameter balls. Extending upwardly from the discharge check valve is a discharge pipe or tube which connects to a horizontally extending dispensing control assembly. The dispensing control assembly includes a pipe having an outlet and a reciprocal slide valve which controls flow through the outlet. Both the piston and the slide valve are controlled by separate double acting air cylinders. Additionally, control means are provided for controlling the operation of the air cylinders so that the valve is opened only when the piston is moving toward the inlet valve.

4 Claims, 6 Drawing Figures



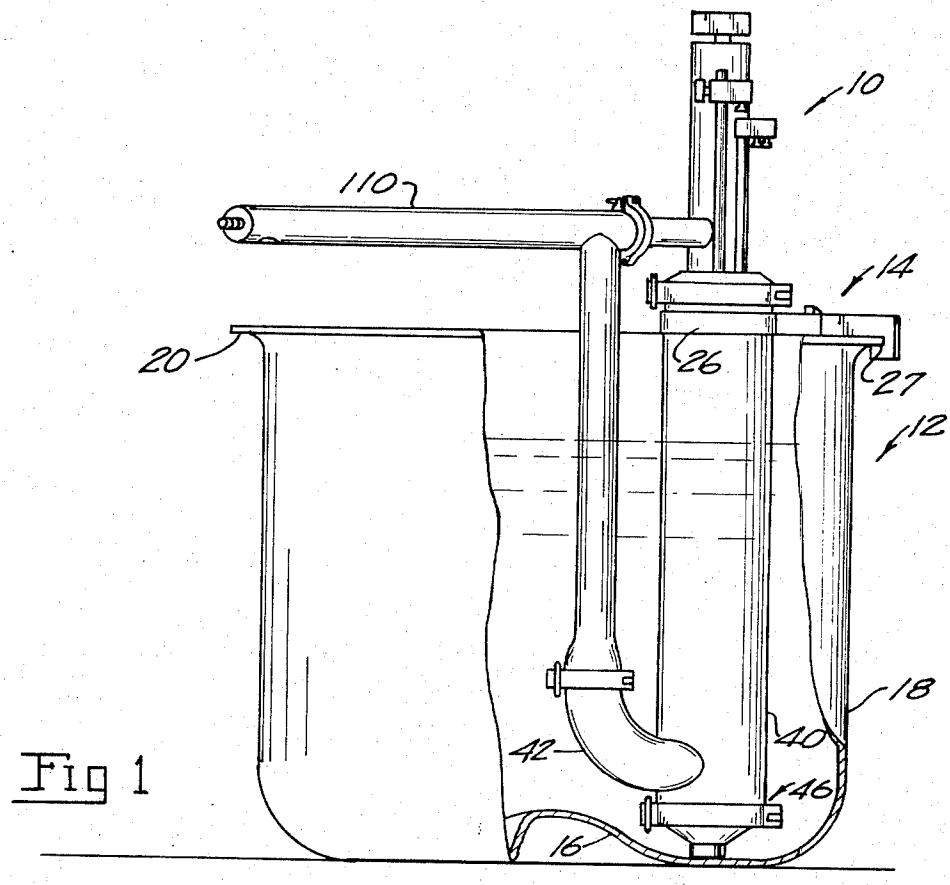


Fig 1

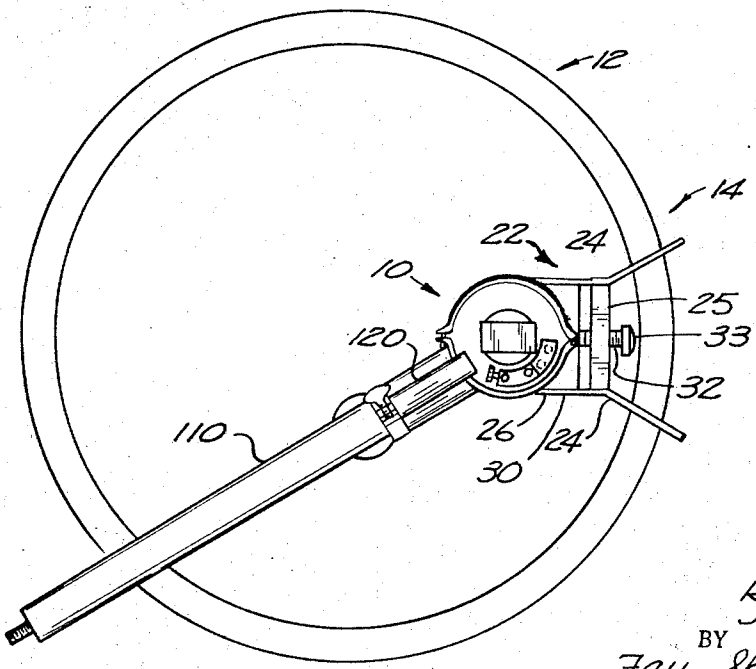


Fig 2

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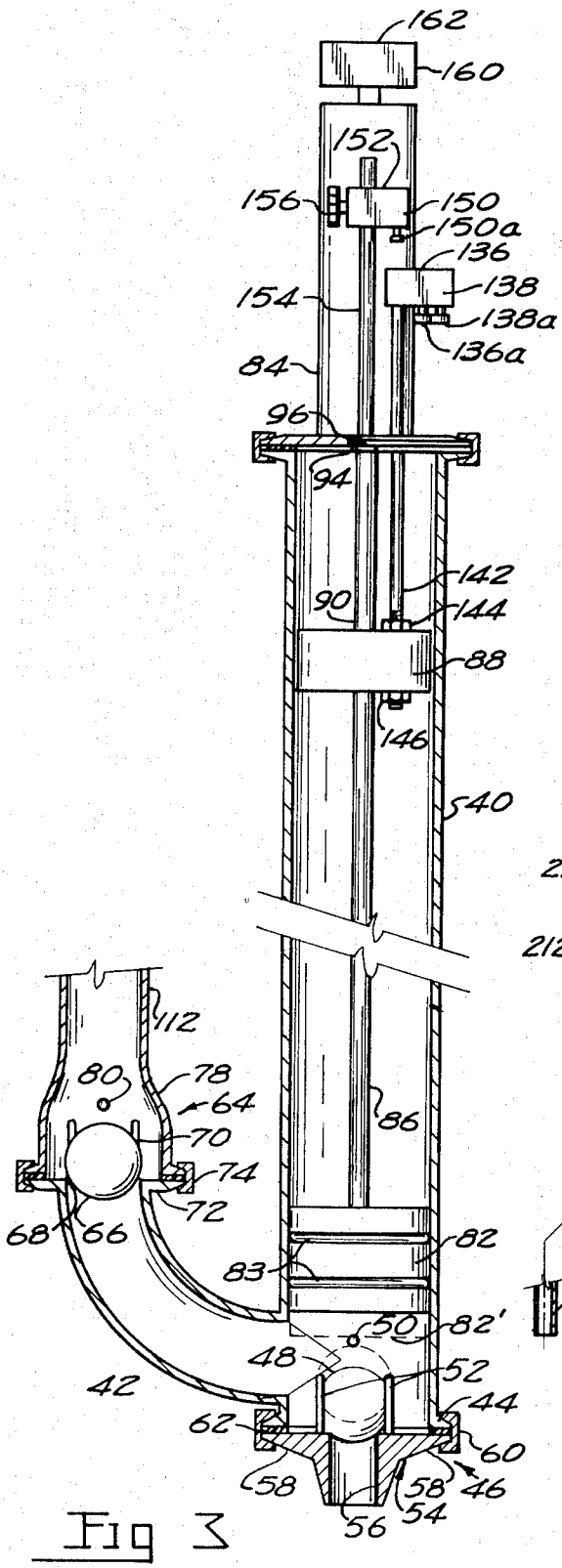

Fig 3

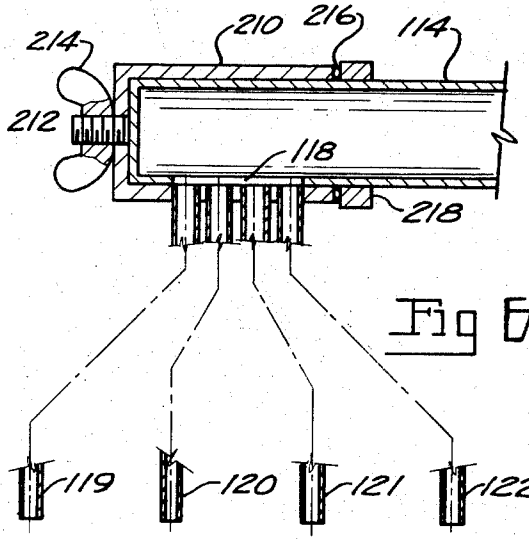

Fig 6

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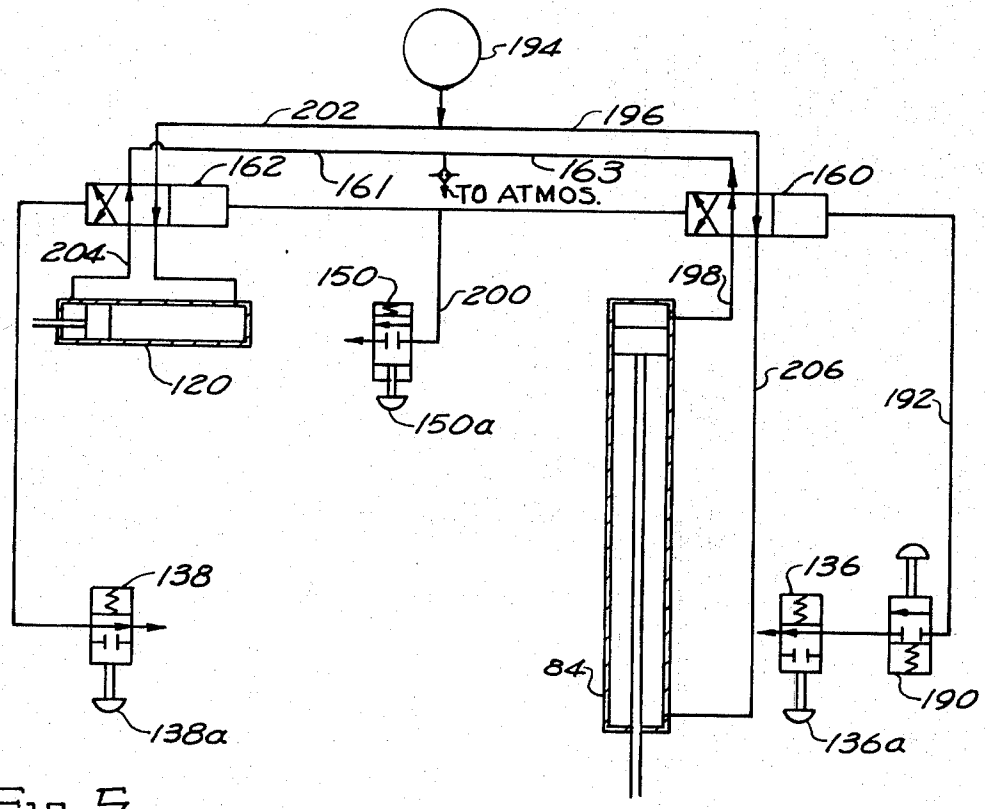

Fig 5

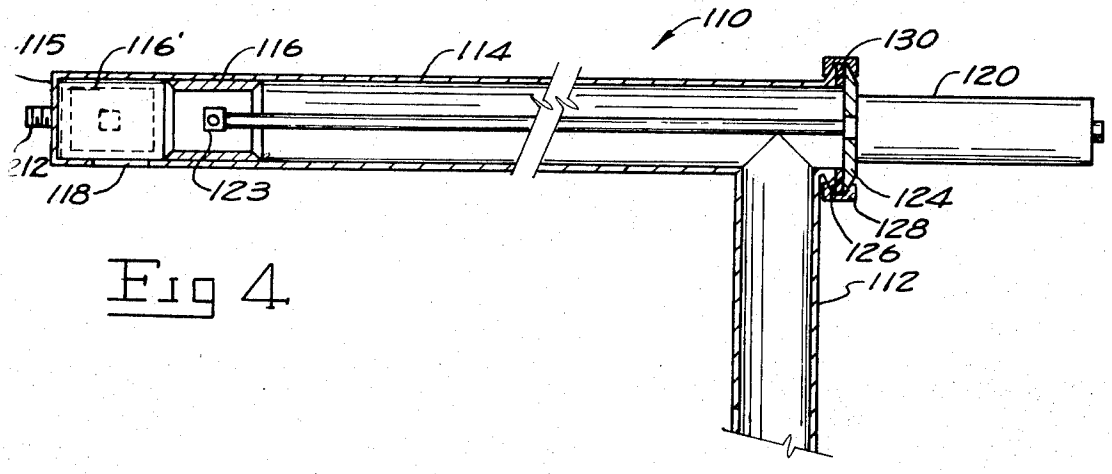

Fig 4

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DISPENSING PUMP ASSEMBLY FOR BAKERY MATERIALS

The subject invention is directed to the dispensing art and, more particularly, to a dispensing pump assembly capable of discharging closely controlled quantities of fluid materials.

The pump is particularly suited for use in dispensing cake batters and the like, and will be described with particular reference thereto; however, it should be appreciated that it can be used for dispensing many different types of food products, chemicals or other fluid materials.

In the baking industry, there is a distinct need for a small dispensing pump assembly which is capable of dispensing closely controlled quantities of cake batters and similar fluids. The need for such a unit is especially prevalent among the small job type bakeries in which only a limited quantity of any one product is made at a time. The use of the large, commercially available manifold dispensing assemblies which dispense a multiple number of quantities simultaneously cannot be economically justified in the small bakery. Accordingly, manual filling techniques are typically used.

Although certain prior art units are commercially available, these generally utilize an overhead hopper which feeds to a small manifold assembly. In use, the batter must be transferred from the mixing bowls to the overhead hopper. This is relatively difficult since the mixing bowls may weigh several hundred pounds, requiring the use of at least two men or hoisting equipment. Further, there can be substantial waste of batter because of the arrangements of the hoppers and manifolds. Additionally, the hopper and manifold arrangements are difficult to clean and relatively expensive.

Other types of dispensing pump units are available which use an oscillated valve to control both filling and discharging from a piston cylinder. Typically, the piston and cylinder are operated by air cylinders controlled by a single four-way valve. In operation, difficulties are encountered in assuring proper correlation in movement of the piston and valve. For example, variations in batter consistency can vary the valve opening and closing time.

In addition, the same hopper and cleaning problems are present as in the units discussed above.

The subject invention provides a highly simplified dispensing pump assembly which can be adjusted to dispense closely controlled quantities of many fluid materials. The assembly is arranged so that it can be used to pump directly from the mixing bowls to the pans. Further, if desired, the unit can be permanently mounted in a production line to draw from any type of hopper or container.

In accordance with one aspect, the invention comprises a dispensing pump assembly which includes a first, vertically extending tubular cylinder for a piston mounted therein and adapted to reciprocate vertically. At the lower end of the cylinder, there is an inlet provided with a check valve which permits flow in only one direction into the cylinder. Immediately above the check valve is a discharge outlet having an outlet check valve. Preferably, the inlet and outlet check valves are relatively large diameter balls. Extending upwardly from the discharge check valve is a discharge pipe or tube which connects to a horizontally extending dispensing control assembly. The dispensing control assembly includes a pipe having an outlet and a reciprocal slide valve which controls flow through the outlet. Both the piston and the slide valve are controlled by separate double acting air cylinders. Additionally, control means are provided for controlling the operation of the air cylinders so that the valve is opened only when the piston is moving toward the inlet valve.

In accordance with a more limited aspect, the assembly is provided with means which permit the total length of piston reciprocation to be varied so that the quantity of material discharged with each stroke of the piston can be adjusted.

The combination of the adjustable piston stroke and the slide valve outlet control allows closely controlled quantities to be dispensed. The air operated slide valve assures rapid cut-off following each cycle.

Accordingly, a primary object of the invention is the provision of a dispensing pump assembly which is simple in construction and operation.

Another object of the invention is the provision of a pump assembly of the type described which can handle a wide variety of fluid materials and which is easy to disassemble for cleaning and repairing.

Yet another object is the provision of an assembly which can dispense closely controlled quantities of materials in single or multiple cycles.

The above and other objects and advantages will become apparent from the following description when read in conjunction with the accompanying drawings wherein:

FIG. **1** is a side elevational view showing the improved dispensing pump assembly releasably mounted on a mixing bowl of the type often used in bakeries;

FIG. **2** is a plan view taken on line **2—2** of FIG. **1**;

FIG. **3** is a vertical cross-sectional view taken on line **3—3** of FIG. **2**;

FIG. **4** is a cross-sectional view taken on line **4—4** of FIG. **2**;

FIG. **5** is a schematic showing of the air control circuits; and,

FIG. **6** is cross-sectional view showing a modified form of outlet for the unit.

Referring more particularly to FIG. **1**, the preferred embodiment of the dispensing pump assembly **10** is shown releasably connected to a standard bakery mixing bowl **12** by a releasable mounting assembly **14**. Bowl **12** is a standard bowl formed from stainless steel or the like and having a raised bottom wall **16** and a circumferential side wall **18** which terminates at its upper end in an outwardly extending flange portion **20**. The pump assembly **10** is shown releasably connected to the upper flanged end by a support frame **22** comprising a pair of bracket portions **24** which extend laterally from a cross bar **25**. At their outer ends, the brackets have slots **27** adapted to receive the flange **20**. Extending from the opposite side of bar **25** is a band **26** which encircles the pump cylinder **40**. A clamp bar **30** is positioned between bar **25** and the pump cylinder. A threaded shaft **32** passes through bar **25** and has its inner end rotatably received in clamp bar **30**. A hand knob **33** allows shaft **32** to be tightened to clamp the pump against band **26**.

As best shown in FIG. 2, the pump assembly **10** is carried at a location such that its lower end is over the depressed side portion of the bottom wall of the mixing bowl **12**.

The arrangement thus far described is not of substantial importance to the invention and many other types of mounting and support arrangements could be used, if desired. Additionally, it should be understood that although the arrangement shown in the preferred embodiment is adapted for use in conjunction with a mixing bowl, the assembly could be permanently installed on a bakery line and used to pump from many types of containers or supply hoppers.

Of importance to the invention is the general construction of the pump assembly itself and its overall method of actuation and control. The construction of the pump assembly **10** can best be understood by reference to FIGS. **3** and **4**. The details could, of course, vary substantially from that shown in the drawings. However, as shown, the pump assembly comprises a main, vertically extending cylinder **40** having an outlet branch **42** connected thereto at its lower end. The main cylinder **40** and the branch member **42** are, in the preferred embodiment, formed from stainless steel and each have a cylindrical configuration. Extending outwardly about the lower end of the main cylinder **40** is a short flange **44** which provides means for releasable connection of the foot valve assembly **46**.

Foot valve assembly **46** is a one-way ball-type check valve including a plastic ball member **48**. The ball **48** is carried for free vertical movement in a cage-like arrangement comprising a first horizontally extending pin member **50** which is joined to the sides of the lower end of main cylinder **40**. The remaining portions of the cage are defined by three or more pins **52** which extend upwardly from the inlet defining flange member **54**. Flange member **54** includes a laterally extending flange portion **58** and a central opening **56** through which the batter or other material is drawn during a pumping operation. Member **54** is releasably connected to the lower end of cylinder **40** by a conventional split clamp ring **60** which engages the upper surface of flange **44** and the lower surface of flange **58** to releasably clamp the member **54** to the lower end of cylinder **40**. Preferably, a resilient seal or gasket member **62** is positioned between the opposing faces of flange **44** and flange **58**.

The discharge valve assembly for the pump unit is carried at the upper end of the laterally extending branch **42** and is indicated generally by the reference numeral **64**. The discharge check valve assembly **64** is a ball-type check valve similar to the inlet or foot valve assembly **46** and comprises a cylindrical plastic ball member **66** sized so as to seat closely with the shoulder **68** at the outlet end of branch **42**. Three or more pin members **70** extend upwardly from the flange **72** and provide guide for vertical movement of the ball **66**.

Connected to flange **72** by a split clamp ring **74** is a discharge tube **76** having an enlarged lower end portion **78** which is spaced outwardly from the ball **66**. A horizontally extending pin member **80** is positioned between the side walls of the discharge pipe **76** and limits the upper movement of the ball **66**. As can be appreciated, the arrangement thus far described allows flow in one direction inward through opening **56** and outwardly through the discharge pipe **76**.

The pumping action of the assembly is achieved by a piston **82** reciprocated within the vertically extending cylinder **40**. Piston **82** is preferably formed from plastic or other suitable material and is arranged to be closely received within the inner diameter of cylinder **40**. Preferably, O-rings or the like **84** are carried within suitable grooves formed in the outer surface of piston **82** and serve to seal between the piston and the wall of the cylinder.

The piston **82** is reciprocated by a double acting air cylinder **84** carried at the upper end of the cylinder **40**. It can be seen that a first rod **86** is releasably connected to the piston **82** in any convenient manner such as merely by threading it into the piston. The upper end of rod **86** is threadedly connected in a cylindrical guide block **88** which has its outer surface inwardly spaced from the inner surface of the tube **40**. The piston rod **90** of the double acting air cylinder **84** is threadedly connected in the opposite side of guide block **88**. Accordingly, actuation of the air cylinder **84** causes reciprocation of the piston **82**.

In the embodiment under consideration, the air cylinder **84** and piston **82** are arranged so that they can be rapidly removed from the cylinder **40** for cleaning or the like. This can be accomplished by many different arrangements; however, in the subject embodiment, the air cylinder **84** is threadedly connected in a top plate member **92** which has a threaded center bore **94** which receives the threaded end **96** of cylinder **84**. The top plate **92** is releasably connected to the laterally extending flange **98** by a split clamp ring **100** which engages the top surface of top plate **92** and the under surface of flange **98**. Additionally, a gasket or seal member **102** is positioned between the opposed faces of the flange **98** and the top plate **92**. As can be appreciated, merely by releasing the clamp ring **100**, the entire piston and air cylinder assembly can be removed from the cylinder **40**. Additionally, both the intake valve assembly **46** and the discharge assembly **64** can be removed in a similar manner to provide for easy cleaning of the entire unit.

Referring again to FIGS. **1** and **4**, it will be seen that a discharge control assembly **110** is connected to the upper end of discharge pipe **76**. In the embodiment under consideration, the discharge control assembly **110** is formed integrally with the pump unit **10**; however, for reasons which will hereafter be discussed, it is preferable at times that the assembly be releasably connected to the discharge pipe **76** such as through the use of a flexible hose.

Carried within the pipe **114** of the discharge assembly **110** is a cylindrical, slide valve member **116** which is preferably formed from a plastic such as polyethylene or the like. The valve member **116** is arranged to be reciprocated from the dotted line position **116'** to the solid line position **116**. In position **116'**, the valve closes off the discharge outlet port **118**. This arrangement assures sharp cut-off of the material being dispensed.

The means for reciprocating the valve member **116** in timed relationship with the actuation of the pump comprises a double acting air cylinder **120** which has its piston rod **122** connected with the valve **116**. It will be noted that the outer end of piston rod **122** is connected to a bar member **124** which extends across the interior of valve member **116**. The ends of the member **122** are

pinned or otherwise pivotally connected to valve member **116**. This allows the valve assembly to be self-aligning in the pipe **114** and makes it easier to withdraw for cleaning. Additionally, the pivotal connection assures the proper mating relationship between the valve and the interior wall of pipe **114**.

In order to permit the piston and cylinder assembly to be removed from **114**, the piston is connected to an end plate **124** which is releasably clamped to the end flange **126** by a split clamp ring member **128**. Additionally, a seal or gasket **130** is preferably positioned between the opposed faces of the end plate **124** and the flange **126** to provide a fluid tight seal.

As can be appreciated, the operation of the pump actuating cylinder **84** and the valve actuating cylinder **120** must be closely controlled so that the valve is preferably open during a power stroke of the piston **82**. Additionally, in order that closely metered amounts of material can be dispensed from the outlet port **118**, the stroke of the pump piston must be adjustable. For this reason, a control circuit, as best shown in FIG. **5**, is preferably used with the unit. Before describing the control circuit in detail, reference is made to FIG. **3** which shows the various control valves and their structural relationship with the unit. Note that a first pair of one-way air valves **136** and **138** is carried on an arcuate bracket **140**. Bracket **140** is carried on a vertically extending rod **142** which is adjustably connected to the guide block **88**. Note that the lower end of the rod **142** extends through a vertical opening formed in guide block **88** and is clamped therein by nuts **144** and **146**. This allows the guide block **140** to be adjusted slightly so that the actuating portions **136** *a* and **138***a* of valves **136** and **138** can be closely adjusted so that on the lower end of the pump stroke, the actuating portions will engage the top surface of plate **92** to cause the valves to operate at the proper time during a pump stroke.

The upper limit of the pump stroke is arranged to be controlled by an air valve **150** carried on a bracket **152**. Bracket **152** is mounted for vertical adjustment on a rod **154** which extends upwardly from the top plate **92**. Note that the rod **154** extends through an opening in bracket **152** and a nut and hand knob **156**. By releasing the hand knob **156**, the position of the bar **152** and valve **150** can be vertically adjusted. Note that upon an upward stroke of the pump, the valve actuator **150***a* of valve **150** is engaged by the top surface of block **140** to cause actuation of the valve **150**. By adjusting the position of valve **150**, the total length of the stroke of the piston can be varied. The total lower limit of the stroke is, of course, generally fixed and extends to the dotted line position **82'**.

Also carried with the air cylinder **84** is a pair of four-way valves **160** and **162** which are interconnected with the two air cylinders **120** and **84** in a manner subsequently to be described with reference to FIG. **5**.

CONTROL OPERATION

The overall operation and functioning of the dispensing pump system can best be understood by reference to FIG. **5** which is a diagrammatic or schematic showing of the air control circuitry for the assembly. FIG. **5** shows the components of the system at the end of a suction stroke. That is, the piston **82** is at its upper limit of movement and the valve **116** is in a closed position with the cylinder **120** fully extended. To initiate operation of a pump and discharge stroke, the pilot valve **190** is actuated permitting or causing the right side of the four-way valve **160** to be exhausted through line **192**. The pilot valve **190** can be associated with any type of foot or hand operator or the like. Further, it should be understood that it could be electrically operated in response to an impulse received from a pan sensing means such as a proximity switch, electric eye or the like.

Upon shifting of the four-way valve **160** to the right, air flow from the air supply **194** is conducted through lines **196** and **198** to the upper end of the cylinder **84** actuating the piston downwardly and causing the pumping piston **82** to expel the batter or the like through the discharge check valve **84**. As the air cylinder **84** moves downwardly, the bracket **140** (see FIG. **3**) disengages the actuator **150***a* of pilot valve **150**. This shifts the pilot valve to a position wherein line **200** is connected to atmosphere relieving the pressure in the right-hand end of the four-way valve **162**. This causes the four-way valve **162** to shift to the right and allows air to be conducted from air supply **194** to the left-hand end of cylinder **120** via lines **202** and **204**. The operation of valve **150** similarly exhaust the pressure on the left-hand end of valve **160**. However, this merely equalizes the pressures on both sides of pilot valve **160** and the valve does not move from the position it was in.

Movement of the piston in cylinder **120** to the right opens the discharge valve **116** to permit the material to be discharged through outlet opening **118**. In addition, as can be appreciated, the opening of valve **116** takes place substantially simultaneously with the pump stroke of piston **82**. At the lower end of the pump stroke, the actuators **136***a* and **138***a* of pilot valves **136** and **138**, respectively, are engaged with the cover plate **92** causing pilot valve **136** to move to a closed position and valve **138** to move to an opened position. Closure of valve **136** blocks discharge of air from the right side of pilot valve **160** thereby causing a pressure buildup and shifting of the pilot valve to the left to the solid line position shown. This reverses the flow of air to the cylinder **84** and air supplied from the source through line **196** and line **206** causing the piston **82** to be pulled upwardly for a suction stroke on the pump.

At the bottom of the pump stroke, the valve **138** is in an exhaust position. This has no effect upon the position of the pilot valve **162** since valve **150** is also in an exhaust position and both sides of the valve **162** are under the same pressure. The pressure in the left-hand side of valve **162** builds up against the valve but has no effect on its position since the pressure on the right side is still reduced or in the exhaust position. HOwever, at the end of the up-stroke of the pump piston, valve **150** is actuated to its closed position causing pressure buildup within the right side of the four-way pilot valve **162**. This shifts the pilot valve to the left to the position shown supplying air pressures to the right-hand end of cylinder **120** and moving the valve **116** to a closed position. Shortly prior to this time, the valve **190** will have been released and consequently, the pressure is balanced on both sides of each of the four-way valves and the elements are maintained in the solid line posi-

tion. However, if the pilot valve **190** is maintained in the down position, the pump will continually re-cycle until valve **190** is released.

Many different types of control arrangements could obviously be used. Additionally, mechanical interlocks or interconnections between the actuating piston and the discharge valve **116** could be provided, if desired. Additionally, it should be noted that the total upper length of stroke can be adjusted merely by adjusting the position of the pilot valve **150**. For this reason, the valve **150** is shown (see FIG. **3**) mounted on the adjustable arm **152** so that the point at which it is engaged and moved to a closed position can be varied as desired.

Also, it should be pointed out that the speed of piston movement can be controlled by limiting the rate of air bleed through valves **160** and **162**. Note that an orifice is placed in lines **161** and **163**. This allows adjustment for different fluids to control pump speed.

FIG. **6** shows how the dispensing control assembly can be modified to permit several separate streams to be dispensed simultaneously. This type of dispensing outlet arrangement is particularly useful when the assembly is being used for filling cupcake pans or the like. As shown, the modified assembly comprises a sleeve assembly **210** which is adapted to be closely received on the outer end of tube **114**. A threaded stud **212** extends outwardly from the end of pipe **114** and passes through an opening sleeve **210**. A wing nut **214** allows the sleeve **210** to be releasably held in position on pipe **114**. The end of the sleeve **210** is sealed by an O-ring **216** which is clamped by the end of the sleeve against a collar **218**. Collar **218** can be permanently connected to pipe **114** or releasably attached to a set screw or the like.

Extending downwardly from sleeve **210** area plurality of outlet tubes **119** through **122** having their lower ends located at any desired spacing. The upper ends of the tubes **119** through **122** pass through sleeve **210** at a spacing such that they are aligned with outlet **118**. This arrangement allows the unit to be rapidly converted from single to multiple outlet use.

The invention has been described in great detail sufficient to enable one of ordinary skill in the dispensing art to make and use the same. Obviously, modifications and alterations of the preferred embodiment will occur to others upon a reading and understanding of the specification and it is out intention to include all such modifications and alterations as part of our invention insofar as they come within the scope of the appended claims.

What is claimed is:

1. A dispensing pump assembly comprising:

a first, vertically extending tubular cylinder having a piston carried therein and adapted to reciprocate vertically;

an inlet opening carried on the lower end of said first cylinder with an inlet check valve mounted in said opening and arranged to permit flow only in a direction into said first cylinder;

an outlet opening in the side wall of said first cylinder at a location below said piston and immediately above said inlet opening, an outlet check valve associated with said outlet opening and arranged to permit flow only in a direction out of said first cylinder;

a discharge pipe connected to said outlet opening and extending upwardly therefrom;

a discharge outlet in said discharge pipe and a discharge valve adapted to control flow through said through said discharge outlet, said discharge valve comprising a hollow, cylindrical, open ended member positioned in said discharge pipe, said hollow member having an outer diameter adapted to be closely received in said discharge pipe;

a first double acting air cylinder for reciprocating said piston and a second double acting air cylinder for operating said discharge valve;

operating means extending from said second double acting air cylinder axially through said discharge pipe to said valve;

control means for controlling the operation of said first and second double acting air cylinders, said control means including means for causing said discharge valve to be opened only when said piston is moving toward said inlet valve and,

wherein said reciprocal valve comprises a hollow, cylindrical, open ended member positioned in said discharge pipe, said hollow member having an outer diameter adapted to be closely received in said discharge pipe; and,

said second air cylinder being connected to said discharge pipe.

2. The dispensing pump assembly of claim **1** including adjustable stroke limiting means provided to vary the total length of reciprocation of said piston.

3. The dispensing pump assembly as defined in claim **2** wherein said adjustable stroke limiting means include a valve means which controls flow of air to said first double acting air cylinder.

4. A dispensing pump assembly comprising:

a first, vertically extending tubular cylinder having a piston carried therein and adapted to reciprocate vertically;

an inlet opening carried on the lower end of said first cylinder with an inlet check valve mounted in said opening and arranged to permit flow only in a direction into said first cylinder;

an outlet opening in the side wall of said first cylinder at a location below said piston and immediately above said inlet opening, an outlet check valve associated with said outlet opening and arranged to permit flow only in a direction out of said first cylinder;

a discharge pipe connected to said outlet opening and extending upwardly therefrom;

a discharge outlet in said discharge pipe and a discharge valve adapted to control flow through said discharge outlet, said discharge valve comprising a hollow, cylindrical, open-ended member positioned in said discharge pipe, said hollow member having an outer diameter adapted to be closely received in said discharge pipe;

a first double action air cylinder for reciprocating said piston and a second double acting air cylinder for operating said discharge valve;

operating means extending from said second double acting air cylinder axially through said discharge pipe to said valve; and,

control means for controlling the operation of said first and second double acting air cylinders, said control means including means for causing said

discharge valve to be opened only when said piston is moving toward said inlet valve.

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