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Behunin et al.

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[54] **APPARATUS FOR DISPENSING FLOWABLE HIGH-DENSITY MATERIAL**

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[52] **U.S. Cl.** **222/387**, 222/389, 401/176, 401/187

[51] **Int. Cl.** **E04g 21/04**

[58] **Field of Search** 222/389, 399, 387; 401/176, 401/178, 187, 188

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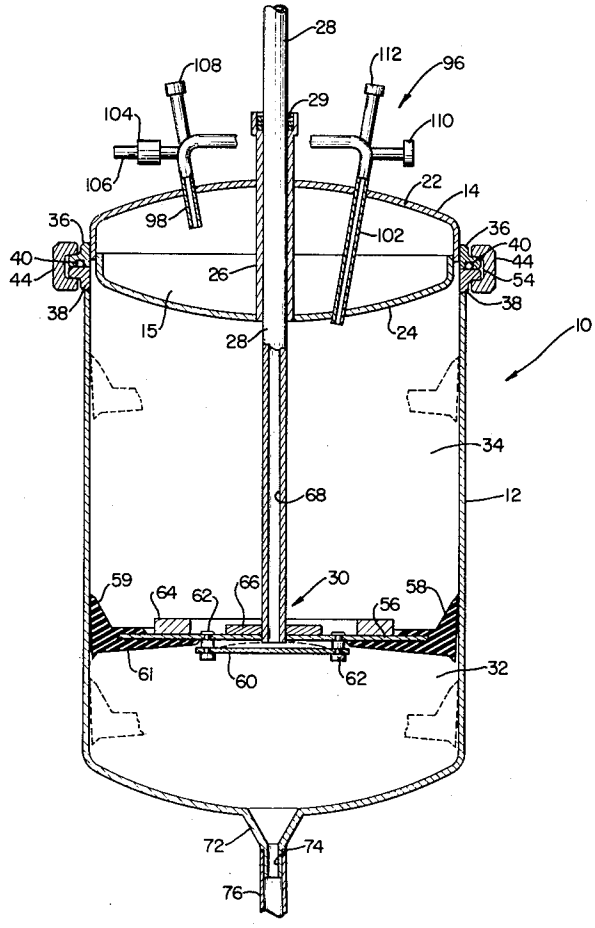
[57] **ABSTRACT**

A pressurized pot for dispensing mortar includes a cylindrical tank having a piston with a hollow piston rod mounted for reciprocal movement therein. The piston divides the tank into a compression chamber and a mortar supply chamber, the mortar supply chamber having an outlet connected to an adjustable trowel through which mortar may pass. A removable hermetically sealable cap for the tank has a compressed air reserve chamber and a pressure line connecting the reserve chamber to the compression chamber through a pressure regulator valve. The hollow piston rod fluidically connects the mortar supply chamber to the atmosphere and includes a rubber valve which seals or closes the opening in the piston rod when the piston engages the mortar so that mortar cannot pass therethrough but allows air entrapped in the mortar supply chamber to escape until the valve closes.

17 Claims, 9 Drawing Figures



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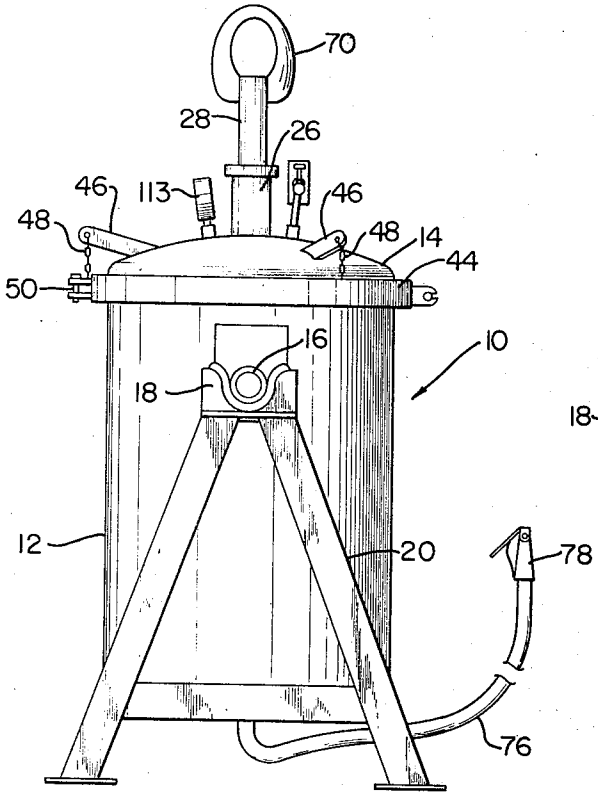

FIG. 2

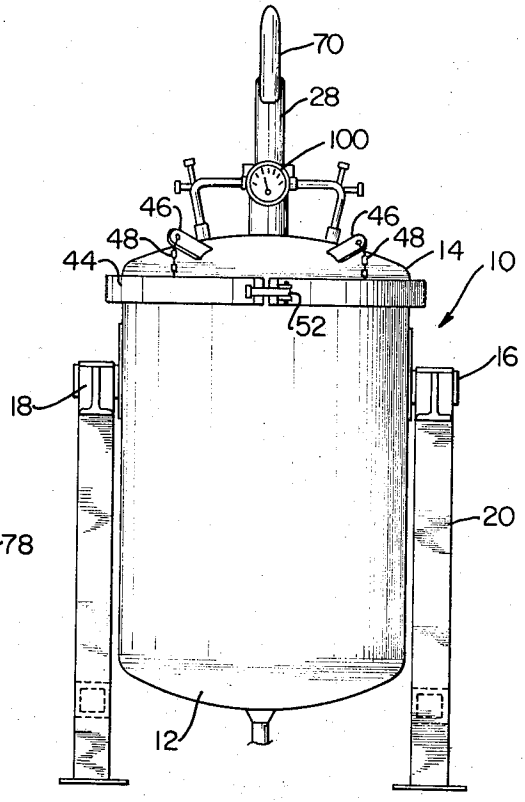

FIG. 1

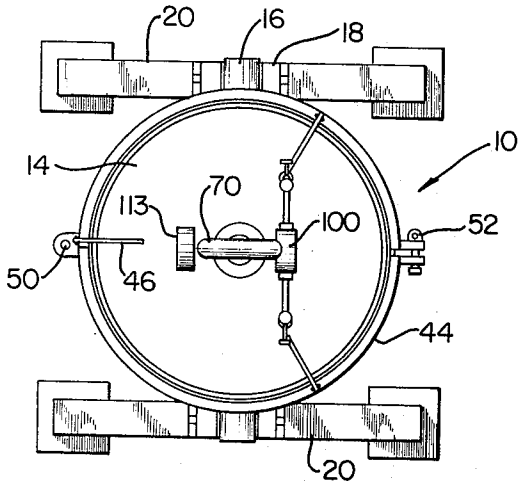

FIG. 3

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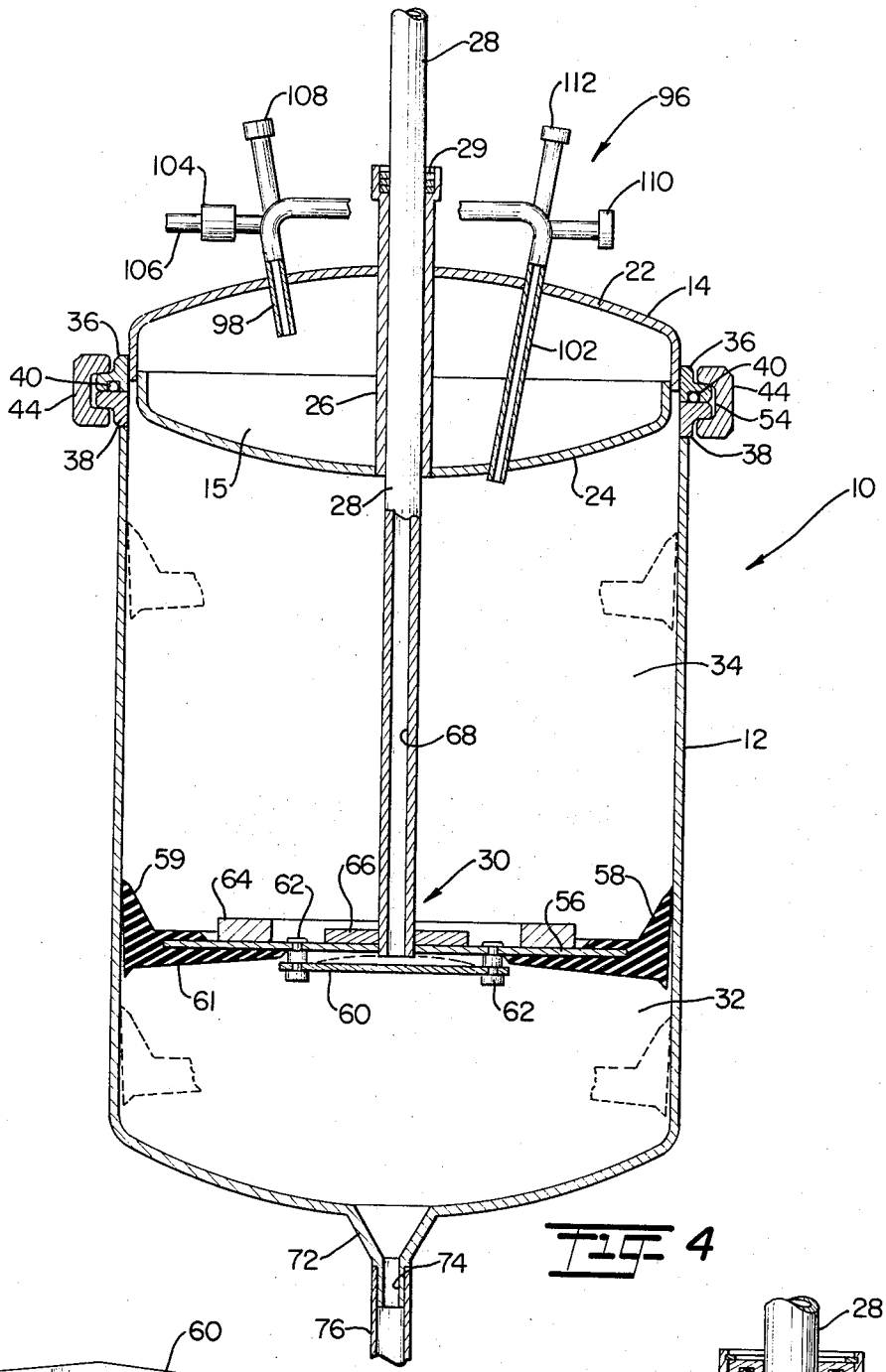

FIG. 4

FIG. 5

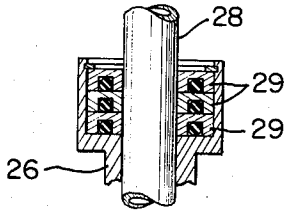

FIG. 6

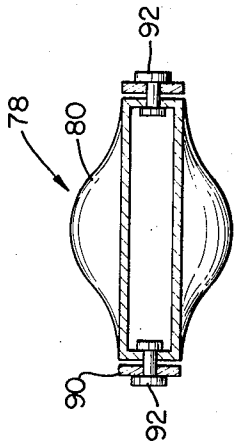

FIG. 9

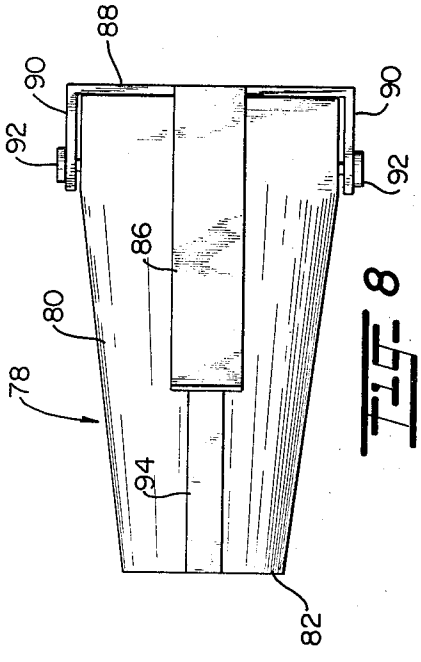

FIG. 8

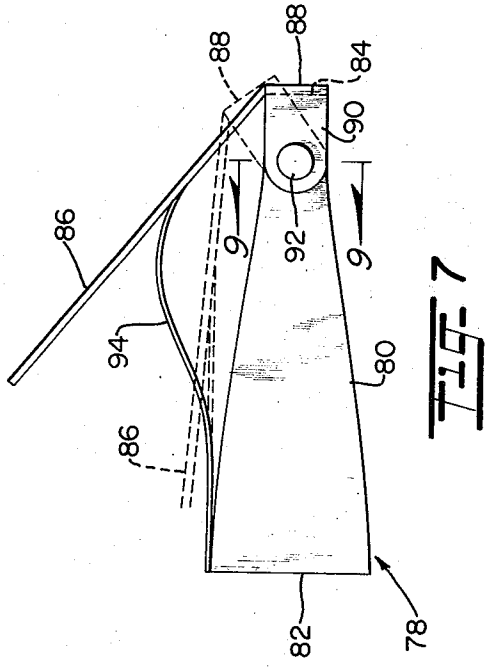

FIG. 7

APPARATUS FOR DISPENSING FLOWABLE HIGH-DENSITY MATERIAL

The present invention relates generally to novel and improved dispensing apparatus for flowable high-density material, and more particularly relates to a pressurized mortar dispensing pot adaptable for use in prefabricating brick panels in an assembly line operation.

The construction industry has been revolutionized by the advent of prefabricated parts and panels. Until recently, these parts and panels were limited to wooden or concrete forms; however, recent improvements in flexural and tensile strengths of mortar have increased interest in prefabricated brick panels and an acceptable prefabricated brick panel has been developed and produced by a process disclosed and specifically described in copending U.S. Pat. application Ser. No. 192,027 of Gage Behunin, which is of common ownership with the present application.

The process disclosed in the beforementioned patent application of Gage Behunin requires a dispenser that can dispense a uniform flow of high-density material at a selected continuous or interrupted rate and which is durable enough to withstand repeated rough handling and use as is commonplace in the construction industry. The dispenser of the present invention was developed to satisfy these needs.

Inasmuch as the liquid dispenser of the present invention finds a preferred use in the dispensing of mortar for masonry construction work, the description of the dispenser will be made in connection with this use.

In general, the dispenser comprises a self-contained pot which is divided into separate pressurized chambers in a manner such that a supply of mortar in the pot can be controllably dispensed by a bricklayer at a selected rate. The pot, being made of high-strength steel to withstand high pressures and repeated abuse, is necessarily very heavy and therefore must be transported by industrial equipment.

Even though the tank is provided with an elongated flexible hose and a connected adjustable trowel, whereby the tank can be statically placed at a work location and the bricklayer allowed to lay brick within an area defined by the length of the flexible hose, it is desirable that the pot be placed on a movable carriage providing the bricklayer with more flexibility and an expanded work area. A carriage of the type designed to support and transport the mortar pot is disclosed in the copending U.S. Pat. application Ser. No. 192,015 of Gage Behunin et al.

The mortar pot is provided with three internal chambers: (1) A compressed air reserve or supply chamber, (2) a compression chamber linked to the compressed air reserve chamber through a pressure line having an adjustable valve, and (3) a mortar supply chamber which is separated from the compression chamber by a reciprocating piston which inversely changes the volume of the adjacent chambers as it is moved within the pot. Before using the mortar dispensing pot, the pressure in the compressed air reserve chamber is raised to a predetermined pressure and the pressure regulator valve in the pressure line between the reserve chamber and the compression chamber adjusted in order to maintain a constant desired air pressure in the compression chamber. The pressure in the compression chamber advances the piston through the mortar supply chamber whereby mortar in the chamber is forced through the flexible hose and adjustable trowel which are fluidically connected to a discharge outlet from the mortar supply chamber. A unique rubber valve is provided to vent the entrapped air from the mortar supply chamber as the piston is driven through the chamber.

the adjustable trowel has a variable mouth opening which is regulated by a manually operable trigger. The opening can be completely closed to prevent the flow of mortar therefrom or opened any desirable amount to allow the mortar to flow out at a desired rate. The mouth opening in the trowel has a fixed width which is approximately equal to the width of the brick being laid so that a layer of mortar can be spread across a row of bricks with one pass. The trowel is removably attached to the hose, however, so that various trowels having different width mouth openings can be used depending on the width of the brick being laid.

Accordingly, it is an object of the present invention to provide a self-contained liquid dispenser capable of dispensing high-density liquids at a selected controllable rate.

It is another object of the present invention to provide a mortar dispenser which is durable enough to withstand repeated handling and abuse, is readily transportable and is so constructed and arranged as to enable rapid filling with the material to be dispensed.

It is another object of the present invention to provide a mortar dispenser having a pneumatically activated system for dispensing the mortar which is closely controllable and adjustable to regulate the rate and volume of material dispensed, and includes a fluid supply chamber which is readily removable for filling and can be securely locked in place for dispensing operations.

It is another object of the present invention to provide a pressurized mortar dispensing pot having a flexible mortar carrying hose with an adjustable trowel for controlled discharge of the mortar in metered amounts; further wherein a novel and improved piston is arranged for movement through a mortar supply chamber in discharging the mortar while permitting the escape of entrapped air in the chamber.

Other objects, advantages and features of the present invention will become more apparent as the description proceeds taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a front elevation with parts removed of the mortar dispenser of the present invention resting on a supporting saddle;

FIG. 2 is a side elevation of the dispenser of FIG. 1;

FIG. 3 is a top plan view of the dispenser of FIG. 1 with parts removed;

FIG. 4 is a vertical section through the dispenser of FIG. 1 with parts removed for clarity;

FIG. 5 is a plan view of a rubber valve used in the dispenser of FIG. 1;

FIG. 6 is an enlarged sectional view of the sealing means around the piston rod;

FIG. 7 is a side elevation of the adjustable trowel of the dispenser of the present invention;

FIG. 8 is a top plan view of the trowel of FIG. 7; and

FIG. 9 is a vertical section taken along line 9—9 of FIG. 7.

The mortar dispenser 10 of the present invention can be seen in FIGS. 1 through 4 to include a substantially cylindrical tank portion 12 and a removable cap 14. The tank portion 12 of the dispenser is provided with

integral diametrically opposed outer supporting arms **16** (FIGS. 1 through 3) which are adapted to be seated in a saddle **18** of a supporting standard **20.** The standard **20** is shown resting on the ground but with few modifications may be mounted on a movable carriage of the type disclosed in the beforementioned U.S. Pat. application Ser. No. 192,027.

Referring to FIG. **4,** the cap **14** of the mortar dispenser is seen to comprise an enclosed chamber **15** for retaining a volume of air under pressure. The cap is comprised of two cup-shaped members **22** and **24** which are hermetically sealed around their perimeter to define therebetween a compressed air reserve or retaining chamber **15.** A hermetically sealed sleeve **26** passes vertically through the center of the cap **14** and is adapted to slidably receive the piston rod **28** of a piston **30.** Three neoprene seals **29** are embedded in a counterbored recess in the upper end of the sleeve **26** to provide an airtight seal between the piston rod **28** and the sleeve. The piston **30** divides the tank portion **12** of the mortar dispenser **10** into a mortar supply or storage chamber **32** and a compression chamber **34.** The functions of the storage chamber **32** and compression chamber **34** will be described more clearly in the description that follows.

The cap **14** of the mortar dispenser can be seen in FIG. **4** to have an annular flange **36** welded thereto. The flange **36** is adapted to seat on an annular flange **38** welded to the upper edge of the tank portion **12** of the dispenser. An O-ring **40** is provided in an annular recess **42** in the flange **36** to hermetically seal the cap **14** to the tank **12** when the cap is properly positioned on the tank.

To lock the cap on the tank, a split lock ring **44** is annularly suspended from the cap by three supporting arms **46** and interconnecting chains **48.** The lock ring can be seen in FIGS. **2** and **3** to comprise two semicircular halves which are pivotally connected by a vertical pin **50** at one junction and can be secured together at the other junction by a swingable lock bolt **52.** In crossection (FIG. **4**) the lock ring can be seen to have an annular recessed portion defining a channel **54** which is adapted to fit over the flanges **36** and **38** when the cap **14** is in place on top of the tank **12.** With this arrangement, the cap is easily and securely hermetically sealed to the tank **12** by placing the cap on top of the tank so that the annular flanges **36** and **38** are in face-to-face abutting relationship and then closing the lock ring **44** around the flanges and locking it in place with the lock bolt **52.**

The piston **30** is movable between the upper and lower phantom line positions of FIG. **4** and can be seen to have a circular base plate **56** with an annular rubber sealing collar **58** attached to the perimeter thereof. The collar **58** is adapted to provide a sliding air-tight seal between the internal cylindrical wall of the tank **12** and the piston **30.** The collar is uniquely designed with a curved upper surface **59** so that the cempressed air in the compression chamber **34** will effect an even pressure seal. The lower surface **61** of the collar **58** is tapered upwardly and inwardly so that as the piston is moved downwardly, air in the storage chamber **32** will be forced toward the center of the tank for reasons that will become clear later. The plate **56** supports an underlying rubber valve **60** through two supporting pins **62.** The rubber valve **60** (FIGS. **4** and **5**) is seen to comprise a flexible bar which is larger in width at its center and has reduced ends which have apertures for receiving the supporting pins **62.** The reduced ends allow the valve to flex freely whereby the enlarged center portion can move into and out of sealing engagement with the lower end of the piston rod **28** for a purpose to be described more clearly later. A reinforcing ring **64** is mounted on top of the base plate **56** immediately adjacent an inner perimeter of the sealing collar **58.** The piston rod **28** is connected to the base plate **56** at the center thereof by an anchor plate **66.** The piston rod can be seen to have a longitudinal through bore **68** which serves as an air vent and which can be closed off or opened by the rubber valve **60.** A large oval handle **70** (FIGS. **1** through **3**) is secured to the upper end of the piston rod and is adapted to receive a crane hook (not shown) whereby the piston **30** and the cap **14** can be removed from the tank by an upward pull, or when the cap is locked on the tank portion, the entire dispenser can be moved by a crane.

The tank in the mortar storage chamber has a hopper bottom and a conical discharge outlet **72** with a cylindrical extension fitting **74.** The fitting **74** is adapted to receive the end of an elongated flexible hose **76** which removably carries on its unconnected end an adjustable trowel **78** (FIGS. **2** and **7–9**).

The adjustable trowel **78,** best seen in FIGS. **7-9,** can be seen to have an elongated body **80** which has a circular end **82** adapted to be removably attached to the end of the flexible hose **76.** The body **80** tapers down from the circular end **82** to a rectangularly shaped mouth opening **84** at its opposite end through which mortar can be emitted. The trowel has a trigger **86** that terminated at one end in a closure plate **88** which is substantially similar in size and shape to the mouth opening **84.** The closure plate has two rearwardly extending arms **90** that are pivotally connected to the sides of the body **80** by pins **92.** It can thus be seen that by moving the trigger **86** toward and away from the body, the closure plate can be moved between a closed position where it seals the mouth opening **84** and an open position wherein mortar is allowed to flow from the mouth opening. A leaf spring **94** is anchored to the body **80** of the trowel at the circular end thereof and engages the underside of the trigger **86** whereby the closure plate is urged into its closed position. It is accordingly a very simple matter to operate the trowel by merely placing one's hand around the trigger **86** and the body **80** of the trowel and then squeezing the trigger whenever it is desired that mortar flow from the mouth. It will be evident that the mouth can be opened any desirable amount whereby the flow rate of mortar from the trowel can be regulated. The trowel disclosed in FIGS. **6–8** has a mouth opening which has a width approximately equal to the width of a normal building brick, but trowels having any desired mouth width may be provided to suit various work applications.

A pneumatic pressure line system **96** (FIG. **4**) is operably affixed to the cap **14.** The pressure line system **96** includes an open-ended pressure line **98** in fluid communication with the compressed air chamber **15** in the cap **14,** and a pressure regulator valve **100** which connects the pressure line **98** to an open-ended pressure line **102.** The pressure line **102** fluidically communicates with the compression chamber **34** in the tank portion **12** when the cap is positioned on the tank. Air is compressed into the compressed air reserve or retaining chamber **15** through a one-way valve **104,** hav-

ing a fitting **106**, which is fluidically connected to the pressure line **98**. A bleed-off valve **108** is also fluidically connected to the pressure line **98** so that the pressure in the retaining chamber can be released when desired. The pressure in the compression chamber **34** can be released by an adjustable valve **110** which is fluidically connected to the pressure line **102**. The purpose of releasing the pressure in the compression chamber will become apparent later. A pop-off valve **112** is also fluidicially connected to the pressure line **102** as a safety factor in case the pressure in the compression chamber rises above a predetermined critical value. The pressure regulator valve **100** is a low pressure valve that indicates the pressure level in the compression chamber **34**. A conventional high pressure gauge **113** is also provided on the cap **14** to indicate the pressure in the compressed air chamber **15** so that the desired pressure in the chamber can be set when compressing air into the chamber and so that an operator will know when the pressure in the compressed air chamber is too low to maintain the regulated pressure in the compression chamber.

To fill the mortar dispenser with a supply of previously prepared mortar the lock ring **44** is first removed or loosened so that the cap **14** along with the piston **30** can be raised out of the tank **12** by a crane or other suitable industrial lifting equipment. With the cap and piston removed from the tank **12**, a predetermined quantity of mortar can be poured into the tank. To prevent the mortar from flowing through the outlet **72** and subsequently through the hose **76** and trowel **78**, the mouth of the trowel should be kept closed during the filling operation. After the predetermined quantity of mortar has beem poured into the tank the piston is lowered into the tank until the flange **36** on the cap abuts against the flange **38**. The lock ring **34** is then locked in place around the flanges **36** and **38** to hermetically seal the cap **14** to the tank **12**. Next, air is compressed into the retaining chamber in the cap **14** through the fitting **106**, the one-way valve **104**, and the pressure line **98** by a compressor or some other outside compressed air source. When the pressure in the retaining chamber is at the selected level, the pressure regulator valve **100** is adjusted to a predetermined pressure value so that the compressed air flows through the pressure line **98**, the pressure regulator valve **100**, and the pressure line **102** into the compression chamber **34**. With the pressure in the compression chamber **35** at the desired level, the piston **30** will be forced downwardly from the upper phantom line position in FIG. **4** thereby reducing the volume of the mortar storage chamber **32**. Air in the mortar storage chamber is urged toward the center of the tank by the tapered lower surface **61** of the collar **58** and escapes through the bore **68** in the piston rod as the piston is forced downwardly until the piston engages the mortar, whereupon the mortar forces the rubber valve **60** up into its dotted line position In FIG. **4** and thereby closes or seals the end of the bore **68**. Continued downward movement of the piston forces the mortar through the outlet **72**, the flexible hose **76**, and subsequently the adjustable trowel **78** when the mouth of the trowel is open. The lower phantom line position of the piston in FIG. **4** designates the lowermost position that the piston can reach.

To refill the tank with a new supply of mortar, it is first necessary to release the air in the compression chamber **34** so that the cap **14** can be easily removed. To release the air in the compression chamber, the adjustable valve **110** is opened until the air pressure has dropped to substantially atmospheric pressure. The valve **44** is then closed and the cap and pistOn removed as before described so that mortar can be poured into the tank portion **12**.

In use it can be seen that a mason is enabled to lay or spread an even layer of mortar at any desired rate as determined by the degree of mouth opening in the adjustable trowel **78**. The constant pressure maintained in the compression chamber of the tank **12** assures the bricklayer of a constant flow of mortar at a selected rate if he desires, or he can alternately open and close the mouth of the trowel if he wants an interrupted flow.

While the present invention has been described with reference to particular structure and preferred components, there is no intent to limit the spirit of the present invention to this structure except as defined by the appended claims.

What is claimed is:

1. Dispenser apparatus adaptable for use in dispensing under pressure a flowable high density material comprising in combination an enclosed tank, a fluid compression chamber within said tank, storage chamber means within said tank for storing a supply of flowable high density material including discharge means communicating with said storage chamber means through which said high density material is dispensed, plunger means activated by fluid in said compression chamber for driving said flowable high density material out of said storage chamber means whereby a flow of the high density material is created through said discharge means, and vent means communicating with said storage means including closure means and a passage through said plunger, wherein said closure means is engageable with the high density material to selectively close the passage whereby said Vent means is operable to selectively allow gas to escape from said storage chamber when said plunger is not engaged with material in said storage chamber and to prevent gas from escaping from the storage chamber when the plunger is engaged with the material in said storage chamber.

2. The dispenser apparatus of claim **1** further including a fluid supply means removably attached in sealed relation to one end of said tank, a pressure line for passing fluid under pressure from said fluid supply means to said compression chamber, and wherein said plunger means includes A piston separating said compression chamber from said storage chamber means whereby fluid under pressure in said compression chamber advances said piston through said storage chamber means to dispense the material therefrom.

3. The dispenser apparatus of claim **2** wherein said piston includes a hollow piston rod establishing fluid communication between said storage chamber means and the ambient environment.

4. The dispenser of claim **2** further including means for hermetically sealing said fluid supply means to said storage means.

5. A dispenser for a flowable high density material comprising in combination an enclosed container, a flowable high density material storage chamber and a fluid compression chamber within said container, removable cap means on said container, a movable piston disposed in said container between said storage chamber and said compression chamber, a discharge outlet to the ambient environment establishing fluid commu-

nication between said storage chamber and the ambient environment through which said high density material can flow, air vent means communicating with said storage chamber including a passage through said piston and a valve operable to selectively allow air to escape through said passage from the storage chamber when said piston is not engaged with material in the storage chamber and to prevent air from escaping through said passage from the storage chamber when the piston is engaged with the material in the storage chamber, and means for admitting fluid under pressure into said cOmpression chamber whereby said piston is moved to force the high density material out of the storage chamber through said discharge outlet.

6. The dispenser of claim **5** wherein said cap means includes an enclosed fluid supply chamber for fluid under pressure and wherein said means for admitting fluid under pressure includes a pressure line fluidically connecting said fluid supply chamber to said compression chamber.

7. A dispenser apparatus adaptable for use in dispensing mortar under pressure comprising in combination a cylindrical tank having a hopper bottom with a discharge outlet therein and an open top, a cap for the tank having an internal fluid supply chamber for retaining fluid under pressure, latch means for hermetically sealing the cap to the upper open end of the tank, a piston mounted in the tank for reciprocal movement therein, said piston having a piston rod, a sleeve passing through the cap which is adapted to slidably receive in an air-tight seal the piston rod, said piston having an annular collar extending radially from the loWer end of the piston rod which is adapted to provide a sliding air-tight seal against the internal cylindrical wall of the tank thereby dividing the tank into an upper compression chamber and a lower mortar storage chamber, said piston rod having a longitudinal bore therethrough to provide an air vent for said mortar supply chamber, a valve operably communicating with said air vent to allow air entrapped in the mortar supply chamber to escape but to prevent mortar from escaping therethrough, and a pressure line which has one end in fluid communication with said fluid supply chamber and the other end in fluid communication with said compression chamber and includes a regulator valve whereby fluid held under pressure in said fluid supply chamber can pass through said pressure line into said compression chamber and thereby cause said piston to move through said storage chamber to cause the mortar to be dispensed through said discharge outlet.

8. The dispenser apparatus of claim **7** wherein said tank has a flange with a flat annular face around its open upper end and the cap has a flange with a flat annular face adapted to abut against the flat face on the upper end of the tank and wherein said latch means comprises a ring split into two semi-circular halves which are pivotally joined at one juncture and have a lock bolt to secure them together at their other juncture, said rings having an annular groove adapted to fit over both the flange on the tank and the flange on the cap when the cap is positioned on the top of the tank so that when the ring is locked in place the cap will be sealed to the tank.

9. The dispenser of claim **7** further including a pair of diametrically extending shafts rigidly affixed to the external wall of the cylindrical tank thereby providing means by which the dispenser can be supported.

10. The dispenser of claim **7** wherein said valve comprises a flexible rubber bar mounted in spaced relation from the lower end of said piston rod in a position whereby when it is flexed upwardly it engages the lower end of said piston and seals the bore opening in the bottom thereof.

11. The dispenser of claim **10** wherein said piston further includes a base plate attached to the lower end of said piston rod and a pair of pins are provided depending from said base plate upon which the rubber bar is suspended in spaced relation from the lower end of said piston rod.

12. The dispenser of claim **11** wherein said rubber bar has an enlarged central portion and ends which are reduced in width and which have apertures for receiving said pins.

13. The dispenser apparatus of claim **7** wherein said pressure line includes an inlet line with a one-way valve whereby air can be compressed into said fluid supply chamber.

14. The dispenser apparatus of claim **13** further including a pressure gauge in communication with said fluid supply chamber to visually indicate the air pressure in the fluid supply chamber.

15. The dispenser apparatus of claim **13** further including a bleed-off Valve in communication with said pressure line whereby the air compressed in said fluid supply chamber can be released therefrom through the bleed-off valve.

16. The dispenser of claim **15** further including an adjustable valve in communication with said pressure line whereby the air compressed in said compression chamber can be released therefrom through the adjustable valve.

17. The dispenser of claim **16** further including a pop-off valve in communication with said pressure line whereby compressed air in the compression chamber will be automatically released therefrom when the air pressure in the compression chamber attains a predetermined value.

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