Jan. 28, 1969 W. P. VANCE 3,424,349

FLUENT MATERIAL MIXING AND DISPENSING APPARATUS

Filed April 3, 1967

FIG. 1.

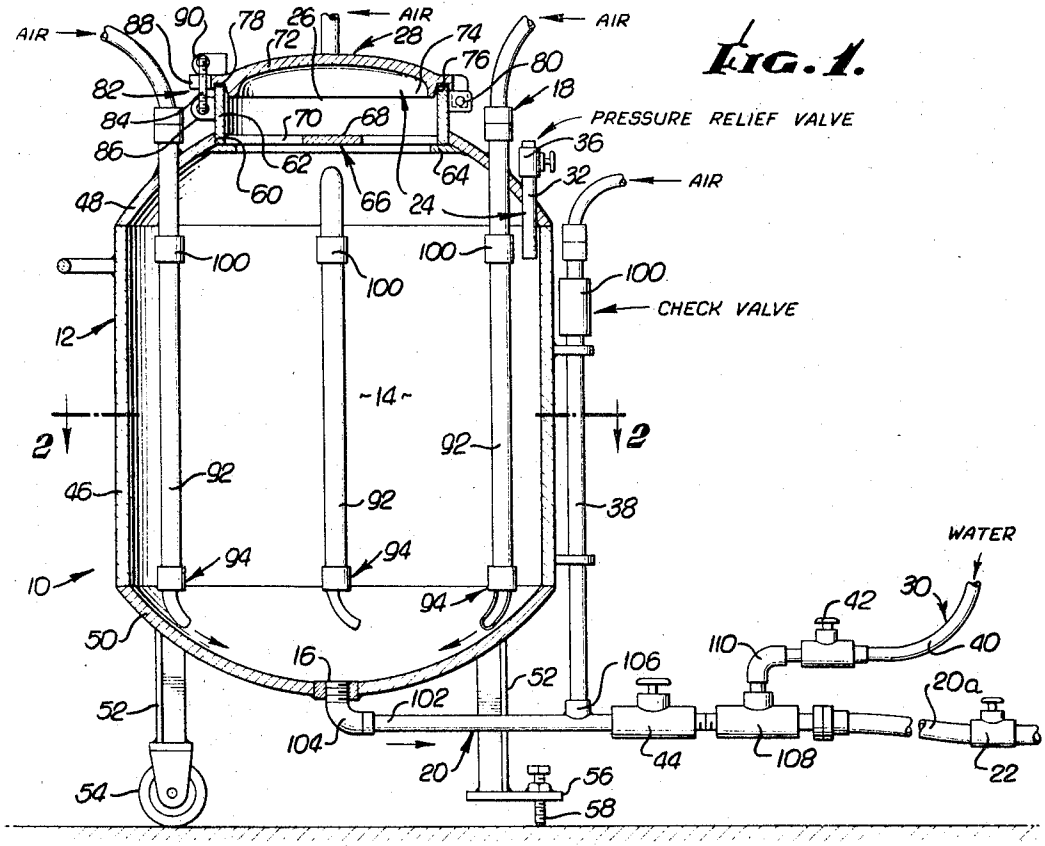


FIG. 2.

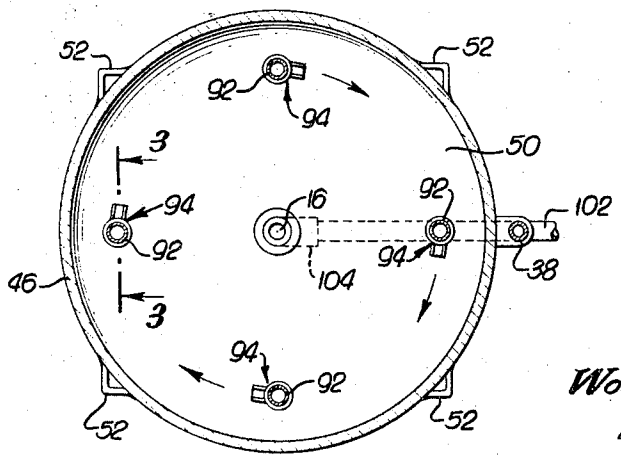
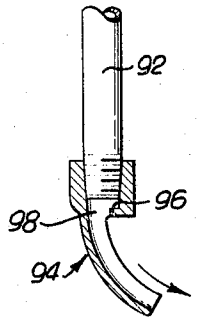


FIG. 3.



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FLUENT MATERIAL MIXING AND DISPENSING APPARATUS

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Int. Cl. B67d 5/60, 1/08; B65g 69/08

ABSTRACT OF THE DISCLOSURE

Fluid material mixing and dispensing apparatus having a hermetic tank with an upper opening through which a solid ingredient of the material may be introduced into the tank, a lower material discharge conduit for conveying the fluid material from the tank to a point of use, means for initially supplying a liquid ingredient of the material to the tank through and subsequently flushing out the discharge conduit, and means for supplying compressed gas, such as air, to nozzles within the tank and to the discharge conduit for initially agitating the fluid material within the tank while preventing blocking of the material outlet from the tank, and for then simultaneously agitating the material in and expelling the material from the tank.

This invention relates generally to fluid handling apparatus. More particularly, the invention relates to apparatus for mixing and dispensing to a point of use fluid materials, such as cementitious materials, paints, and the like.

As will appear from the ensuing description, the present mixing and dispensing apparatus may be utilized to mix and dispense various fluid materials, including fluid mixtures of liquid or semi-liquid ingredients only, as fluid mixtures of liquid and solid ingredients. Moreover, certain features of the invention may be utilized to advantage in apparatus for mixing and dispensing fluidic mixtures of dry ingredients only. For convenience, the expression "fluid material" is employed in this disclosure in its broadest sense to encompass any and all of these various materials or mixtures.

A great variety of devices have been devised for mixing and dispensing fluid materials of the character described. The existing devices of this kind, however, are deficient in that they utilize either mechanical means only or a combination of mechanical and pneumatic means for agitating and dispensing a fluid material. Purely mechanical mixing and dispensing devices, for example, commonly employ motor driven agitators for mixing and motor driven pumps for dispensing. Some of the existing mechanical and pneumatic mixing and dispensing devices, on the other hand, utilize motor driven agitators for mixing and a pressurized gas, such as air, for dispensing. Other devices utilize a pressurized gas for agitation and motor driven pumps for dispensing.

These existing mixing and dispensing devices, while satisfactory for some applications, possess certain deficiencies which the present invention seeks to overcome. Thus, the existing devices are characterized by undesirable complexity, high cost, large size, excessive weight, and other adverse structural and functional characteristics. Both types of existing devices referred to above, for example, require motors, shafts, gears, bearings, electrical cables, and numerous other stationary and movable mechanical elements. In addition, those devices which employ combined mechanical and pneumatic means for mixing and dispensing require two separate power sources, to wit, an electrical power source and a high pressure fluid source, as well as both electrical cables and air hoses.

It is a general object of this invention to provide an improved apparatus for mixing and dispensing fluid materials which avoids the above-noted and other deficiencies of the prior art devices.

A more specific object of the invention is to provide an improved mixing and dispensing apparatus for the purposes described wherein both the mixing and dispensing functons are accomplished pneumatically.

A further object of the invention is to provide an improved mixing and dispensing apparatus for the purpose described which is uniquely constructed and arranged to effect continued mixing of the fluid material during dispensing thereof, to prevent blocking of the material discharge from the mixing tank during mixing of the fluid material in the tank, to permit final flushing of the material discharge conduit, and to provide ease and reliability of operation, economy of manufacture, and convenience of transportation from one work site to another.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is an elevational view of an improved mixing and dispensing apparatus according to the invention, illustrating the mixing tank in vertical section;

FIG. 2 is a section taken on line 2—2 in FIG. 1; and

FIG. 3 is an enlarged fragmentary detail, partly in section, of one of the nozzles embodied in the pneumatic agitating portion of the apparatus.

According to its broader aspects, the invention provides a mixing and dispensing apparatus, represented in the drawings by the apparatus **10**, including a hermetic tank **12** having a chamber **14** for containing a fluent material to be mixed and dispensed and a lower port **16** opening to the chamber. Leading into the tank chamber **14**, and connected to a pressurized source (not shown) of a gas, such as air, are conduits **18** which discharge the pressurized gas into and thereby agitate the fluid material within the chamber. Leading from the lower port **16** of the tank **12** is a material discharge conduit **20** for conveying fluid material from the chamber **14** to a point of use. Discharge conduit **20** contains a discharge valve **22** for controlling material flow through the conduit. In a typical application of the present mixing and dispensing apparatus, the discharge conduit **20** may include a hose **20***a* and connect to a spray nozzle (not shown) from which the fluid or fluent material emerges in the form of a spray. In this case, the discharge valve **22** may be embodied directly in the nozzle. At the upper end of the tank **12** are vent means **24** for selectively communicating the tank chamber **14** to atmosphere. As will appear from the ensuing description, the present mixing and dispensing apparatus so so constructed and arranged that, initially, the vent means **24** may be opened, the discharge valve **22** closed, and the gas supply conduit means **18** supplied with gas under pressure to effect agitation of the fluid material within the tank chamber **14**. Thereafter, the vent means may be closed, the discharge valve opened, and the gas supply conduits continued to be supplied with gas under pressure to effect continued agitation of the fluid material within the chamber and simultaneous discharge and delivery of the material from the chamber **14** to a point of use through the discharge conduit **20** and its delivery hose **20***a*.

As noted earlier, the mixing and dispensing apparatus of the invention may be employed to mix and dispense various fluid materials, including fluid mixtures of liquid ingredients only, fluid mixtures of both liquid and solid ingredients, and fluidic mixtures of solid ingredients only. The particular apparatus illustrated in the drawings is intended primarily for mixing and dispensing fluid mixtures of both liquid and solid ingredients, such as cement and plaster slurries, and the like. In this case, the upper vent means **24** of the apparatus may comprise an opening **26** in the upper end of the tank **12**, sealed by a removable hatch cover **28**, through which the solid ingredient or ingredients of the fluid material may be introduced into the tank chamber **14**, and liquid supply means **30** for introducing the liquid ingredient or ingredients of the fluid material into the chamber. When the tank of the present mixing and dispensing apparatus is equipped with such a hatch cover, it may be desirable or necessary to vent the tank chamber **14** at certain times in the operation of the apparatus to facilitate or permit opening and closing of the cover with ease and safety. To this end, the vent means **24** of the illustrated apparatus also comprise a pressure relief vent tube **32** which extends through and is sealed to the wall of the tank **12**, so as to communicate the chamber **14** to atmosphere, and contains a manual pressure relief or shutoff valve **36**.

In those applications of the present apparatus in which the latter is employed to mix and dispense fluid mixtures of liquid and solid ingredients, it may be desirable or necessary to prevent blocking of the lower tank port **16** by the fluid material, particularly the solid ingredients of the material, during mixing. A feature of the invention in this regard resides in the fact that the gas supply conduit means **18** include an external gas supply conduit **38**, one end of which is connected to a source (not shown) of pressurized gas, such as air, and the other end of which is connected to the fluid material discharge conduit **20** between the tank **12** and the discharge valve **22**. During mixing operation of the apparatus, the discharge valve may be closed and gas under pressure may be supplied to the tank chamber **14** through the gas supply conduit **38** and the discharge conduit **20**. This gas thus enters the chamber **14** through the lower tank port **16** and thereby prevents this port from being blocked by the material in the tank. According to another feature of the invention, the liquid supply means **30** comprise a liquid supply conduit **40** which contains a liquid supply valve **42** and connects to the discharge conduit **20** between the tank **12** and the discharge valve **22**, and the discharge conduit contains a shutoff valve **44** between the tank and the liquid supply conduit. This arrangement of the present mixing and dispensing apparatus permits initial introduction of a liquid ingredient into the tank chamber **14** by closing the discharge valve **22** and opening the shutoff valves **42**, **44**, and final flushing of the discharge conduit by opening the discharge valve **22** and the liquid supply valve **42** and closing the shutoff valve **44**.

Referring now in greater detail to the embodiment of the invention which has been selected for illustration in the drawings, the hermetic tank **12** has a generally cylindrical side wall **46** and generally semi-spherical upper and lower end walls **48** and **50**, respectively. These end walls may be joined to the side wall **46** in any convenient way, as by welding. In order to facilitate movement of the tank **12** from one location to another, the tank is equipped with four depending legs **52** which are shown to comprise metal angles welded to the tank. Mounted on the lower ends of two of the tank legs **52** are rollers or casters **54**. The remaining two legs of the tank have transverse plates **56** welded to their lower ends. Threaded in these plates are adjustable ground supports or screws **58**. When the tank **12** is disposed in its normal stationary operative position, the casters **54** and the screws **58** rest on the ground. The screws are adjustable to level the tank. When it becomes necessary to move the tank from one location to another, the tank is rotated slightly about the casters **54** to elevate the screws **58** out of contact with the ground and the tank is then pulled or pushed to effect rolling movement of the casters along the ground.

The upper tank wall **48** has a central opening **60** in which is positioned and welded a cylindrical collar or rim **62**. This rim defines the opening **26** in the upper end of the tank **12**. Welded to the inner surfaces of the upper tank wall **48**, about the edge of the wall opening **60**, is a ring **64**. The inner edge of this ring projects radially inward a distance beyond the inner surface of the cylindrical rim **62** to define a shoulder for seating a grill **66**. Grill **66** has a central solid circular portion **68** surrounded by an outer annular perforate portion **70**. This perforate portion of the grill may comprise a number of parallel bars which are spaced to define therebetween relatively long and narrow slot-like openings. Grill **66** serves the dual function of a support on which a sack of dry ingredient may be rested when pouring the ingredient into the tank chamber **14** and a means for regulating the rate of entrance of the dry ingredient into the chamber and uniformly dispersing the entering ingredient about the interior of the chamber. The grill merely rests on the shoulder ring **64** and thus may be removed when its use is unnecessary.

The hatch cover **28** has a generally dome-shaped upper wall **72** and a depending rim **74** on the underside of the wall which is externally dimensioned to fit closely within the upper end of the cylindrical tank rim **62** when the cover is closed. Formed in the underside of the cover wall **72** about the rim **74** is an annular groove **76** for receiving the upper edge of the tank rim **62** in the closed position of the hatch cover. This groove contains a seal ring or gasket **78** for providing an airtight joint between the cover and tank rim. One side of the hatch cover **28** is attached to the outside of the tank rim **62** by a hinge **80** which permits the cover to be rotated between its open and closed positions. At the opposite side of the cover are locking means **82** for releasably locking the cover in its closed position. Various locking means may be provided for this purpose. The illustrated locking means, for example, comprise a screw shaft **84** which is pivotally attached at its lower end to a projecting lug **86** on the outside of the tank rim **62** and extends at its upper end through a slot formed in a projecting flange **88** on the hatch cover **28**. A cam **90** is pivotally secured to the upper end of the threaded shaft **84** in such a way that during its rotation to its position of FIG. 1, the cam exerts a downward camming force on the cover flange **88** for urging the hatch cover **28** to and retaining the hatch cover in its closed position. Rotation of the cam in a counterclockwise direction in FIG. 1 through approximately 180° provides sufficient clearance between the cam and the cover flange **88** to enable the threaded shaft **84** to be rotated out of the slot in the flange and thereby release the cover for opening.

It is evident at this point that the hatch cover **28** and its associated structure just described form part of the vent means **24** on the tank **12**. It will be recalled that this vent means further comprises a pressure relief vent tube **32**. This vent tube extends through and is welded to the upper end wall **48** of the tank at one side of the hatch cover. The pressure relief valve **36** on this tube is exposed above the tank wall **48** for manual opening and closing of the valve.

The gas supply conduit means **18** of the illustrated dispensing and mixing apparatus **10** comprise a number, shown to be four, of inner gas supply conduits **92** which extend vertically through the upper tank wall **48** and downwardly through the tank chamber **14** adjacent the cylindrical wall **46** to positions adjacent the lower tank wall **50**. The upper ends of these conduits are welded to the tank wall **48**. The lower ends of the conduits **92** are open. The upper external ends of the conduits **92** are connected to a source (not shown) of pressurized gas, such as air.

In a typical mixing and dispensing apparatus according to the invention, for example, the gas source to which are connected the internal gas supply conduits **92**, as well as the external gas supply conduit **38**, may comprise a motor driven air compressor which may be manually controlled to supply air under pressure to or discontinue the supply of air under pressure to the conduits and automatically controlled in response to the air pressure in the tank chamber **14** to maintain a relatively constant pressure in the chamber. In any case, it is evident at this point that air under pressure, which is supplied to the inner conduits **92**, issues from the open lower ends of these conduits.

Mounted on the lower ends of the inner air conduits **92** are deflectors **94**, one of which is shown in enlarged sectional detail in FIG. 3. These deflectors have a lower open arcuate trough-like extremity for diverting the air emerging from the lower ends of the conduits **92** in a generally downward and tangential direction relative to the tank **12**. In this regard, it will be observed that all of the deflectors **94** are arranged to direct the emerging air in the same tangential direction relative to the tank. As shown in FIG. 3, each deflector **94** has an inner shoulder **96** which defines, with the remaining wall portion of the deflector, a restricted orifice **98** through which the air emerging from the corresponding air conduit **92** flows to the lower curved extremity of the deflectors. This orifice serves to increase the velocity of the emerging air. At this point, it is evident that the deflectors **94** comprise, in effect, downwardly and tangentially directed nozzles on the air conduits **92** for discharging the air emerging from the conduits downwardly and tangentially of the circle on which the conduits **92** lie into the tank chamber **14**. It is significant to note that the lower extremities of the deflectors or nozzles **94** are located in close proximity to the lower tank wall **50**.

For reasons which will appear presently, it may be desirable or necessary to prevent backflow of fluid material through the air conduits **38**, **92**. To this end, each conduit is equipped with a check valve **100** which unseats to permit air flow through the conduits into the tank chamber **14** and seats to block reverse flow through the conduits.

The discharge conduit **20** comprises a pipe **102**, on one end of which is threaded an elbow **104** which is, in turn, threaded into the lower tank port **16**. The opposite end of te pipe **102** is secured to the shutoff valve **44**. Adjacent the valve **44**, the pipe **102** has a connection **106** connected to the lower end of the external air conduit **38**. Downstream of the shutoff valve **44**, the discharge conduit **20** contains a T-fitting **108** to which is secured an elbow **110** attached to the liquid conduit **40** through the valve **42**.

The operation of the mixing and dispensing apparatus **10** will now be described in connection with mixing and dispensing a fluent mixture of solid and liquid ingredients, such as a cementitious slurry containing cement, sand, and water. In this case, the liquid supply conduit **40** connects to a source of water under pressure. As already noted, the air conduits **38**, **92** connect to a source of air under pressure. The apparatus **10** is conditioned for mixing a slurry by releasing the cover locking means **82**, opening the cover **28**, and closing the discharge valve **22**. At this point, the water supply valve **42** and shutoff valve **44** are opened to admit water into the tank chamber **14**. When the water rises to the correct level in the chamber, valves **42** and **44** are reclosed. Air under pressure is now supplied to the air conduits **38**, **92**, and the required number of bags of cement and sand are introduced into the tank chamber **14** through the upper tank opening **26**. As noted earlier, the grill **66** in the opening serves as a support on which each bag may be rested during emptying of its contents into the chamber **14** and a means for regulating the dispersing the solid ingredients, i.e., cement and sand, as these ingredients are poured into the chamber. The compressed air constantly emerging from the inner air conduits **92** through the deflectors or nozzles **94** imparts a vortical or spinning motion and agitation to the water in the chamber **14**. This vortical motion and agitation of the water is beneficial for several reasons. Thus, it effects rapid wetting and mixing of the dry ingredients with the water as these ingredients are poured into the chamber **14**. Secondly, after all of the dry ingredients have been introduced into the chamber and mixed with the water to produce a slurry in the chamber, the tangential air jets emerging from the nozzles **94** serve to spin and agitate the slurry to a uniform mix or consistency. Finally, because of the downward inclination of the nozzles **94**, the air jets emerging therefrom tend to continuously sweep the bottom wall **50** of the tank and thereby prevent material from accumulating on this wall, particularly in the vicinity of the tank port **16**. As already noted, the compressed air arriving through the outer air conduit **38** and discharge conduit **20** enters the bottom of the tank chamber **14** through the tank port **16** and thereby prevents blocking of the port by the material or slurry in the tank, and particularly by any of the solid ingredients which may tend to settle to the bottom of the tank. Thus, the outer air conduit **38** and nozzles **94** cooperate to maintain the tank port **16** open.

After the fluid material or slurry in the tank chamber **14** has been thoroughly agitated and mixed, the manual pressure relief valve **36** is opened and the hatch cover **28** is closed and locked. In this regard, it is evident that venting of the tank chamber **14** through the pressure relief valve **36** is desirable to permit closing of the hatch cover without cutting off the air supply to the air conduits **38**, **92** which is essential to effect continuous agitating and mixing of the fluid material or slurry in the chamber. After the hatch cover **28** has been securely locked in its closed position, the relief valve **36** is closed and the shutoff valve **44** is opened. The increase in air pressure within the chamber **14**, occasioned by the air entering the chamber through the air conduits **38**, **92**, now becomes effective to build up pressure in the tank and expel the fluid material or slurry from the chamber through the discharge conduit **20**, as permitted by opening of the valve **22**. During this expulsion of the material, the air entering the chamber through the nozzles **94** continues to spin and thereby agitate and maintain the material in the chamber in its mixed state.

After the tank chamber **14** has been emptied, the shutoff valve **44** is closed and the water supply valve **42** opened to direct water from the water supply conduit **40** through the discharge conduit **20** for flushing the latter conduit downstream of the valve **44**. At this point, attention is directed to the fact that during initial filling of the tank chamber **14** with water, in the manner explained earlier, the downstream portion of the discharge conduit also fills with water which is thereafter expelled from the conduit when the discharge valve **22** is initially opened, thereby effecting initial flushing of the discharge conduit. If desired, the tank chamber **14** may be flushed, before or after flushing of the downstream portion of the discharge conduit, by closing the discharge valve **22** and opening the water supply valve **42** and shutoff valve **44** to admit water to the chamber. The water supply valve is then reclosed and the discharge valve **44** reopened to permit the water to drain from the chamber. During the flushing operation, particularly during flushing of the tank chamber **14**, compressed air may be supplied through the air conduits **38**, **92** to effect spinning of the water in and thereby thorough washing of the tank and total expulsion of the rinse water from the tank and the discharge conduit. The hatch cover **28** is reopened to permit recarging of the tank **12** with a new batch of dry ingredients after reopening the pressure relief valve **36**.

While the foregoing discussion has related to operation of the present apparatus for mixing and dispensing a fluid mixture of liquid and dry ingredients, the apparatus

may be used, as well, to mix and dispense the other fluid materials referred to earlier. In this regard, it will be understood that when mixing only dry ingredients, the liquid supply valve 42 will remain closed and the ingredients employed will be sufficiently fine to have the requisite fluidity necessary for flowing of such ingredients through the discharge conduit.

I claim:

1. Apparatus for agitating and dispensing a fluent material comprising a mixture of a solid ingredient and a liquid ingredient: comprising a hermetic tank having a chamber for containing the material and a port opening in the lower portion of said chamber, gas supply conduit means leading from said tank for connection to a source of gas under pressure and opening to said chamber for discharging said gas into said chamber and thereby agitating the material within said chamber, a material discharge conduit leading from said tank port for conveying the material from said chamber to a point of use, a discharge valve in said discharge conduit for controlling material flow therethrough, vent means for selectively communicating the upper portion of said chamber to atmosphere including an upper opening in said tank through which said dry ingredient may be introduced into said chamber, a removable hatch cover sealing said opening, means for releasably locking said cover in sealing relation to said opening, whereby initially said vent means may be opened, said discharge valve may be closed, and said gas supply conduit means may be supplied with gas under pressure to effect agitation of the material within said chamber, and thereafter said vent means may be closed, said discharge valve may be opened, and said gas supply conduit means may be supplied with gas under pressure to effect continued agitation of the material within said chamber and simultaneous expulsion of the material from said chamber through said discharge conduit by gas pressure in said chamber, and liquid supply means for introducing said liquid ingredient into said chamber comprising a liquid supply conduit for connection to a source of the liquid ingredient under pressure and connected to said discharge conduit between said tank and discharge valve, and a supply valve in said liquid supply conduit.

2. Apparatus according to claim 1; wherein said gas supply conduit means comprises a gas supply conduit connected to said discharge conduit between said tank and discharge valve, whereby during initial agitation of the material in said chamber, pressurized gas enters said chamber through a portion of said discharge conduit and said tank port to prevent blocking of said port by the material in said chamber.

3. Apparatus according to claim 2; including a check valve in said gas supply conduit adjacent said discharge conduit for preventing backflow through said gas supply conduit.

4. Apparatus for agitating and dispensing a fluent material comprising a mixture of a solid ingredient and a liquid ingredient: comprising a hermetic tank having a chamber for containing the material and a port opening in the lower portion of said chamber, gas supply conduit means leading from said tank for connection to a source of gas under pressure and opening to said chamber for discharging said gas into said chamber and thereby agitating the material within said chamber, a material discharge conduit leading from said tank port for conveying the material from said chamber to a point of use, a discharge valve in said discharge conduit for controlling material flow therethrough, vent means for selectively communicating the upper portion of said chamber to atmosphere, whereby initially said vent means may be opened, said discharge valve may be closed, and said gas supply conduit means may be supplied with gas under pressure to effect agitation of the material within said chamber, and thereafter said vent means may be closed, said discharge valve may be opened, and said gas supply conduit means may be supplied with gas under pressure to effect continued agitation of the material within said chamber and simultaneous expulsion of the material from said chamber through said discharge conduit by the gas pressure in said chamber, said gas supply conduit means comprising at least one inner gas supply conduit extending through and sealed to the wall of said tank and a nozzle on the inner end of said gas supply conduit opening generally tangentially into said chamber for discharging pressurized gas into the material within said chamber in a direction tangentially of said chamber and thereby inducing vortical motion of the material within said chamber, and an outer gas supply conduit connected to said discharge conduit between said tank and discharge valve, whereby during initial agitation of said material in said chamber, pressurized gas enters said chamber through a portion of said discharge conduit and said tank port to prevent blocking of said port by the material in said chamber.

5. Apparatus for agitating and dispensing a fluent material comprising a mixture of a solid ingredient and a liquid ingredient: comprising a hermetic tank having a chamber for containing the material and a port opening in the lower portion of said chamber, gas supply conduit means leading from said tank for connection to a source of gas under pressure and opening to said chamber for discharging said gas into said chamber and thereby agitating the material within said chamber, a material discharge conduit leading from said tank port for conveying the material from said chamber to a point of use, a discharge valve in said discharge conduit for controlling material flow therethrough, vent means for selectively communicating the upper portion of said chamber to atmosphere, whereby initially said vent means may be opened, said discharge valve may be closed, and said gas supply conduit means may be supplied with gas under pressure to effect agitation of the material within said chamber, and thereafter said vent means may be closed, said discharge valve may be opened, and said gas supply conduit means may be supplied with gas under pressure to effect continued agitation of the material within said chamber and simultaneous expulsion of the material from said chamber through said discharge conduit by the gas pressure in said chamber, said vent means comprising an upper opening in said tank through which the dry ingredient may be introduced into said chamber, a remmovable hatch cover sealing said opening, and means for releasably locking said cover in sealing relation to said opening, said apparatus further comprising a liquid supply conduit for connection to a source of the liquid ingredient under pressure and connected to said discharge conduit between said tank and discharge valve, a supply valve in said liquid supply conduit, and said gas supply conduit means comprise at least one inner gas supply conduit extending through and sealed to the wall of said tank and a nozzle on the inner end of said inner conduit opening tangentially into said chamber for discharging pressurized gas into the material within said chamber in a tangential direction of said chamber thereby inducing vortical motion of the material within said chamber, and an outer gas supply conduit connected to said discharge conduit between said tank and discharge valve, whereby during initial agitation of the material in said chamber, pressurized gas enters said chamber through a portion of said discharge conduit and said tank port to prevent blocking of said port by the material in said chamber.

6. Apparatus according to claim 5, wherein said outer gas supply conduit connects to said discharge conduit between said tank and said water supply conduit, and said discharge conduit includes a shutoff valve between said water and outer gas supply conduits.

7. Apparatus according to claim 6; wherein said vent means further comprise a separate pressure relief vent in the upper end of said tank and a pressure relief valve closing said latter vent, and said gas supply conduits comprise check valves for perventing backflow therethrough.

8. Apparatus for agitating and dispensing a fluent material comprising a mixture of a solid ingredient and a liquid: comprising a tank having a chamber provided with an inlet for the solid ingredient and a port opening in the lower portion of said chamber, a material discharge conduit leading from said tank port for conveying the material from said chamber to a point of use, a discharge valve in said discharge conduit, means for supplying fluid to said chamber for agitating the material in said chamber, and a fluid supply conduit connected to said discharge conduit between said tank and discharge valve for supplying a fluid under pressure to said tank through said port during agitation of the material in said tank to prevent blocking of said port by the material.

9. Apparatus for mixing and dispensing a fluid mixture of a dry ingredient and a liquid ingredient: comprising a tank having a chamber, a port opening to the lower portion of said chamber, and an opening to the upper portion of said chamber, a liquid supply conduit for connection to a source of the liquid ingredient under pressure and connected to said discharge conduit between said tank and discharge valve, a liquid supply valve in said liquid supply conduit, and a shutoff valve in said discharge conduit between said tank and liquid supply conduit, whereby initially said supply and shutoff valves may be opened and said discharge valve may be closed to introduce the liquid ingredient into said tank for mixing with the dry ingredient, and thereafter said supply and discharge valves may be opened and said shutoff valve may be closed to direct the liquid ingredient through said discharge conduit for flushing the latter conduit.

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U.S. Cl. X.R.

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