

Feb. 3, 1931.

P. L. GEER

1,790,804

LIQUID ATOMIZING AND AERATING DEVICE

Filed July 31, 1929

2 Sheets-Sheet 1

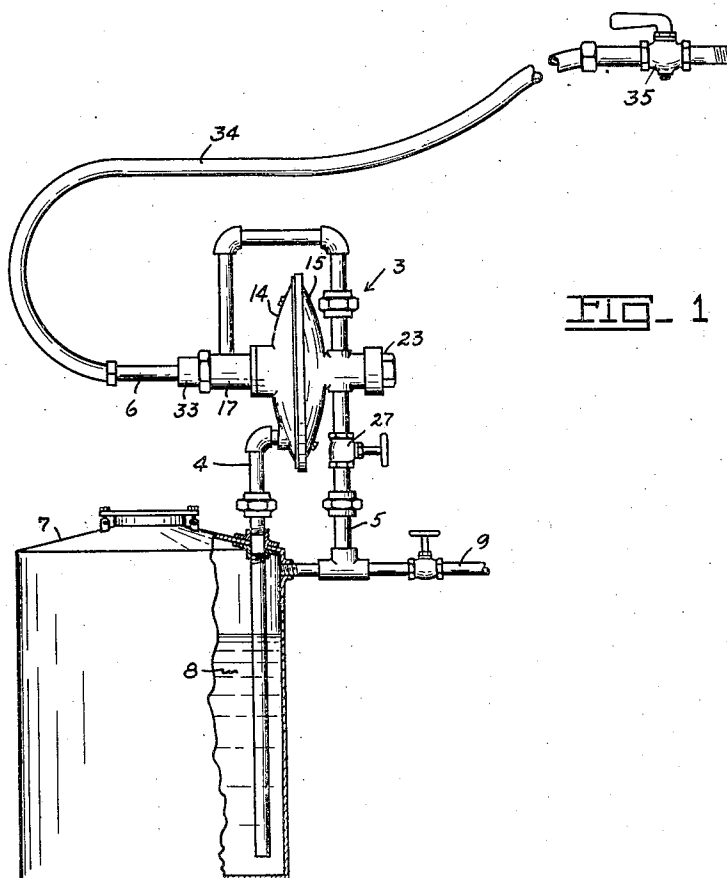


FIG. 1

INVENTOR.  
Paul L. Geer  
BY M. C. Frank  
ATTORNEY.

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**P. L. GEER**

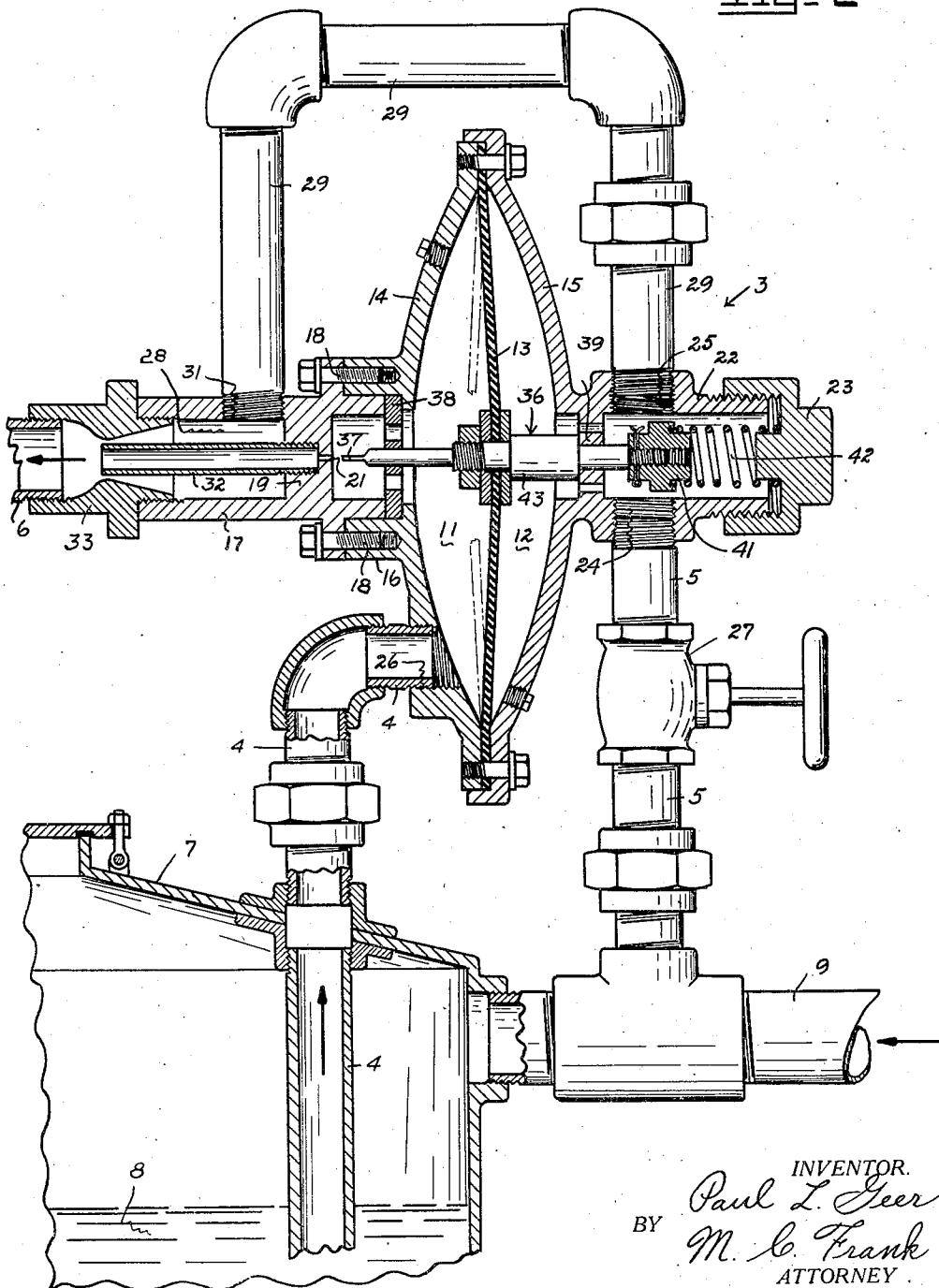
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# LIQUID ATOMIZING AND AERATING DEVICE

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2 Sheets-Sheet 2

FIG-2



INVENTOR.  
Paul L. Geer  
BY M. C. Frank  
ATTORNEY.

## UNITED STATES PATENT OFFICE

PAUL L. GEER, OF ALBANY, CALIFORNIA, ASSIGNOR OF THREE-TENTHS TO WESLEY M. WOOTEN, OF SAN FRANCISCO, CALIFORNIA, AND THREE-TENTHS TO M. C. FRANK, OF OAKLAND, CALIFORNIA

## LIQUID ATOMIZING AND AERATING DEVICE

Application filed July 31, 1929. Serial No. 382,408.

The invention relates to a device for atomizing and aerating liquids for subsequent conveyance thereof through pipes and the like.

An object of the invention is to provide a device of the class described wherein a preflow of the liquid constituent is prevented when the discharge of the aerating medium therefrom is initiated.

Another object of the invention is to provide a device of the class described in which clogging is automatically and positively prevented when viscous or sedimentary liquids are to be atomized and aerated.

A further object of the invention is to provide a device which may be disposed at a point remote from the point of discharge of the mixture and yet is arranged to be automatically controlled from said latter point.

Yet another object is to provide a device of the class described which is particularly adapted for preparing and discharging spray painting mixtures and the like for general application to surfaces.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth or be apparent in the following description of a preferred form of the invention which is illustrated in the accompanying drawings, in which:

Figure 1 is an elevation of a typical installation of the device, part being in section.

Figure 2 is an enlarged fragmentary and generally sectional view of the device as disclosed in Figure 1.

Essentially, the present mixing device 3 is designed for mixing a liquid from a pipe 4 with a gas or gases from a pipe 5 for discharge in spray form through a pipe 6. As particularly illustrated, the pipe 4 extends upwardly through and from a sealed pressure tank 7 containing a liquid 8 such as an asphaltic emulsion, and said tank and the pipe 5 are connected with a pipe 9 from any suitable source (not shown) of compressed air where-

by the impressed pressures in the tank 7 and pipe 5 are alike.

Referring to the disclosed structure of the mixing device 3, said device comprises a casing providing pressure compartments 11 and 12 separated by a flexible diaphragm 13, such as reinforced rubber, and respectively connected with the pipes 4 and 5 whereby said compartments are arranged to respectively receive and contain the liquid and air. Preferably and as shown, the diaphragm partition 13 is arranged for clamping between generally circular and axially separable casing portions 14 and 15; the opposed casing portions being appropriately cupped or otherwise formed to provide for a certain degree of axial displacement of the central diaphragm portion between certain limiting positions thereof. As particularly shown in full lines in Figure 2, the diaphragm 13 is in one of its limiting positions, and the other limiting position thereof is indicated in dash lines.

A tubular boss 16 extends axially from the casing portion 14 and a casing element 17 of cylindrical outline is fixed to said boss in coaxial relation thereto as by means of bolts 18. The element 17 is cylindrically recessed from both ends thereof whereby a partitioned bore is provided therein, and the partition 19 thus defined is provided with a relatively small axial orifice 21 of cylindrical bore, said orifice being so much smaller than the bore of the pipe 4 and the bores of the element 17 that pressure-impelled liquid passing there-through from the compartment 11 will be projected therefrom at a high velocity in a sharply defined stream of small diameter.

The casing portion 15 is provided with a tubular and axial boss 22 which is externally threaded at its free end for the mounting thereon of a cap member 23. As shown, the boss 22 is integrally related to the casing portion 15 and its cavity communicates with the compartment 12. Openings 24 and 25 extend radially through the boss 22 from the cavity

thereof and the pipe 5 is threadedly engaged in the opening 24 for supplying air to said cavity and the compartment 12. For supplying liquid to the compartment 11, the wall of the casing portion 14 is provided with an inlet opening 26 opposite the compartment 11 for the threaded reception of the discharge end of the liquid supply pipe 4. A suitable throttle valve 27 is interposed in the air pipe 5 for a purpose to be hereinafter brought out.

It will now be noted that air from the compartment 12 is arranged to be mixed with the liquid discharged from the orifice 21. Accordingly, and as shown, the opening 25 of the boss 22 is connected with the outer passage portion 28 of the element 17 by means of a pipe 29, said element being provided with a radial perforation 31 for the purpose and said passage portion providing a mixing chamber. In the present embodiment, the opening 25 and perforation 31 are threaded to receive the respective ends of the pipe 29. For insuring a proper and uniform mixing of the air and liquid therein, the outer end of the passage 28 is conically contracted in the general manner of a venturi orifice and a tube 32 is extended axially from about the orifice 21 to a termination at the contracted passage portion. The bore of the tube 32 appreciably exceeds that of the orifice 21 with which it registers and the outside diameter of said tube at its discharge end is but slightly smaller than the passage thereat whereby the air from the pipe 29 is arranged to be discharged into the stream of liquid emitted from the tube in a conical and forwardly directed sheet. As particularly shown, the tube 32 is threadedly mounted on the partition 19 of the element and the contracted portion of the passage 28 is provided in a removable end section 33' of the element 17, said section being threaded at its outer extremity for connection with the discharge pipe 6. It is noted that limitation to the disclosed device for aerating the stream of liquid discharged from the orifice 21 is not intended, the disclosure being presented as merely illustrative of a preferred structure for the purpose.

The disposition of the diaphragm 13 in the chamber jointly provided by the compartments 11 and 12 and partitioned thereby is determined by the relative pressures in the said compartments, and means are accordingly provided for controlling the orifice 21 in accordance with the disposition of said diaphragm. As particularly shown, the pipe 6 discharges into a hose 34 having a shut-off valve 35 at its discharge end and being arranged to carry a nozzle (not shown) or other discharge device beyond said valve, said hose constituting, and being considered for present purposes, an extension of the pipe 6. When, as shown, the valve 35 is open, a continuous mixing and discharge of the liquid and air is arranged to occur and the orifice 21

is fully open. If, however, the valve 35 be fully closed, or substantially so, a closure of the orifice 21 is arranged to be automatically effected, the diaphragm 13 being utilized as a control means.

It will be noted that when the valve 35 is open, the pressure in the air compartment 12 will be less than that in the liquid compartment 11 whereby the diaphragm 13 will assume the position illustrated wherein the capacity of the compartment 11 is a maximum and that of the compartment 12 a minimum. The pressure difference thus provided may be increased to any desired degree by throttling the air supply to the compartment 12 by use of the valve 27 in the air supply pipe 5. A member 36 is removably mounted on the diaphragm 13 to extend axially therethrough and therefrom, said member providing at the extremity thereof within the compartment 11 a reduced plunger portion 37 for longitudinal and fitted engagement in and through the orifice 21. Under fluid flow conditions, the plunger 37 is withdrawn from the orifice 21 as shown. The member 36 is generally cylindrical and is guided for axial movement by reason of its engagement in the bores of guide rings 38 and 39 provided in the casing portions 14 and 15; as shown, the ring 38 is held in fixed position by reason of its joint engagement by and between the casing portion 14 and element 17, while the ring 39 comprises an integral partition at the inner end of the boss 22 of the casing portion 15. Both of said guide rings are perforated at other points than their guide openings to permit a free fluid flow thereby.

A spring seat member 41 is mounted at the extremity of the member 36 within the boss 22 of the casing portion 15, and a compression spring 42 is operatively engaged between the seat member 41 and the cap 23, it being noted that the effective spring pressure may be adjusted by means of the cap. When the plunger 37 is fully engaged in the orifice 21, it preferably extends slightly therefrom, such being one limiting position thereof. The other limiting position of the plunger is that when it is fully withdrawn, and stop means are accordingly provided for limiting the plunger to movements between said positions. Preferably, and for a reason to be hereinafter brought out, the stop means are provided externally of the liquid compartment 11. As particularly disclosed, the guide ring 39 serves as a fixed stop against opposite sides of which the spring seat member 41 and a collar 43 provided on the member 36 are arranged to respectively engage when the plunger is engaged in and withdrawn from the orifice 21. In this manner, the axial displacement of the plunger is limited independently of the effective pressure difference between the opposite sides of the diaphragm.

With the device discharging the mixed fluid, the difference in fluid pressures in the compartments 11 and 12 is arranged to exceed the resistance of the spring 42 whereby the plunger 37 is held fully withdrawn from the orifice 21 for permitting a free liquid flow through the orifice. If the shut-off valve 35 is closed, the air pressure in the compartment 12 will build up whereby, as it approaches equality with that in the compartment 11, the spring 42 is arranged to function to dispose the plunger 37 in orifice closing position and so shut off any flow through the orifice. A reopening of the valve 35 will for the first instant cause a discharge of air which lacks a charge of the atomized liquid, after which the liquid will become mixed with the air in desired full strength. In this manner, the discharge of un-aerated liquid is positively prevented at all times, the plunger acting as a valve plug with respect to the orifice 21.

It will be particularly noted that the present apparatus is specifically designed for use in the spray coating art wherein more or less viscous liquids must be atomized and discharged as an air-borne spray against a wall or floor surface to be coated. With apparatus heretofore generally used, the necessarily small liquid passages in atomizers tend to become clogged through coating with the liquid to be discharged and so must be frequently cleaned with consequent loss in efficiency and cost of operation. With the present device, however, the forward end of the plunger 37 is cut off square or even concavely cupped whereby as it moves forwardly into the orifice 21 it actually cleans out the same to its full size and for its full length. In this manner, each flow stoppage is arranged to automatically effect a cleaning of the orifice 21 and the plunger 37 effects its plugging to prevent clogging thereof by the liquid while the device is out of use but still connected to the supply tank 7 and air pipe 9. Should the effect of clogging be apparent while the mixture is being discharged, an operator need only momentarily shut off the stream at his station, as by closing the valve 35 or a nozzle for the pipe 6, and the orifice 21 is automatically cleared in the manner described. It will thus be apparent that the atomizing and aerating of a suitable liquid is arranged to be accomplished with the present device in a particularly positive and efficient manner, and that the action of the device is at the same time controlled at and from the discharge end of the pipe 6.

Besides being useful in the application of viscous paint solutions, having asphaltic or chemical bases, the present device is also usable to discharge sedimentary fluids such as mixtures of water with kalsomines or hydraulic cement. Or aerated water may be produced thereby for mixing with a cement

at its point of discharge from the pipe 6, as in nozzles such as are disclosed by me in my copending application, Serial No. 213,483, filed August 17, 1927, it being noted that the water which would be used would seldom be entirely free of sediment or carbonates. It will thus be clear that the orifice cleaning function of the plunger 37 is a major feature of novelty of the present disclosure under all circumstances of use thereof and equals or even exceeds in importance the valve functioning thereof. Since deposits may occur on the surfaces within the liquid compartment 11, the use of such surfaces as stops for the plunger carrying member 36 is not dependable, hence the described use of the ring 39 in the compartment 12 has been resorted to. By provision of the stop means in the chamber 12, the member 36 need not extend through and from the casing; should the member 36 so extend, a stuffing box therefor would be required.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent of the United States the following:

1. In a device for atomizing and aerating a liquid for subsequent conveyance through a closed passage controlled by a shut-off valve, a casing providing a discharge orifice for the liquid and a mixing chamber connected with said passage and into which the liquid is arranged to be discharged from said orifice, a plunger member for closing engagement in said orifice, and means automatically operative to engage said plunger member in said orifice by and upon a closing of said shut-off valve, said plunger being arranged to engage the orifice bore during its insertion in the orifice for scraping any deposit from said bore.

2. In a device for atomizing and aerating a liquid for subsequent conveyance through a closed passage controlled by a shut-off valve, a casing providing a chamber into which streams of the liquid and air are arranged to be discharged for mixing, an orifice through which the liquid is arranged to be discharged into said chamber in atomized form, a plunger engageable in said orifice for closing the same, and means actuated in accordance with the fluid pressures in both said streams for controlling the positioning of said plunger

whereby the same is arranged to be automatically disposed and held in said orifice by and during a closing of said shut-off valve.

3. In a device for atomizing and aerating a liquid, a casing providing a pressure chamber and a mixing chamber, a transversely flexible diaphragm dividing said pressure chamber into separate compartments, said compartments being respectively arranged for connection with a source of liquid under pressure and source of air under pressure, a constantly open duct connecting the air compartment with the mixing chamber, a discharge orifice connecting the liquid compartment with said mixing chamber, a plunger for engagement in said orifice, means operable in accordance with the relative pressure conditions in said compartments to variably dispose said diaphragm in said pressure chamber, and means connecting said plunger with said diaphragm for operation thereby.

4. In a device for atomizing and aerating a liquid, a casing providing a pressure chamber and a mixing chamber, a diaphragm dividing said pressure chamber into separate compartments, said compartments being respectively arranged for connection with a source of liquid under pressure and a source of air under pressure, a duct connecting the air compartment with the mixing chamber, a discharge orifice connecting the liquid compartment with said mixing chamber, a plunger for engagement in said orifice, means operable in accordance with the relative pressure conditions in said compartments to variably dispose said diaphragm in said pressure chamber, and means connecting said plunger with said diaphragm for operation thereby whereby said plunger is arranged to be disengaged from said orifice solely during the discharge of material from said mixing chamber.

5. In a device for atomizing a liquid and mixing the same with a carrier gas for conveyance through a closed passage controlled by a shut-off valve, a casing providing a pressure chamber and a mixing chamber, a diaphragm partition dividing said pressure chamber into separate compartments at opposite sides thereof, said compartments being respectively connected with a source of gas under pressure and a source of liquid under pressure, passages connecting said compartments with said mixing chamber, means whereby the fluid pressure in said gas compartment is less than that in said liquid compartment when said shut-off valve is open, and valve means in the passage from the liquid compartment arranged to be operated by said diaphragm whereby said latter passage is normally open and is closed by and upon a closure of said shut-off valve.

6. In a device of atomizing and aerating a liquid for subsequent conveyance through a closed passage controlled by a shut-off valve,

a casing providing a mixing chamber discharging into said passage and into which streams of liquid and air are arranged to be discharged under pressure for mixing therein, a valve controlling the flow of the said liquid stream to said chamber, and means controlled jointly by the pressures in both said streams for closing said second valve by and upon a closing of said shut-off valve, and to thereafter open said second valve following an opening of the shut-off valve.

In testimony whereof, I affix my signature.  
PAUL L. GEER.

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