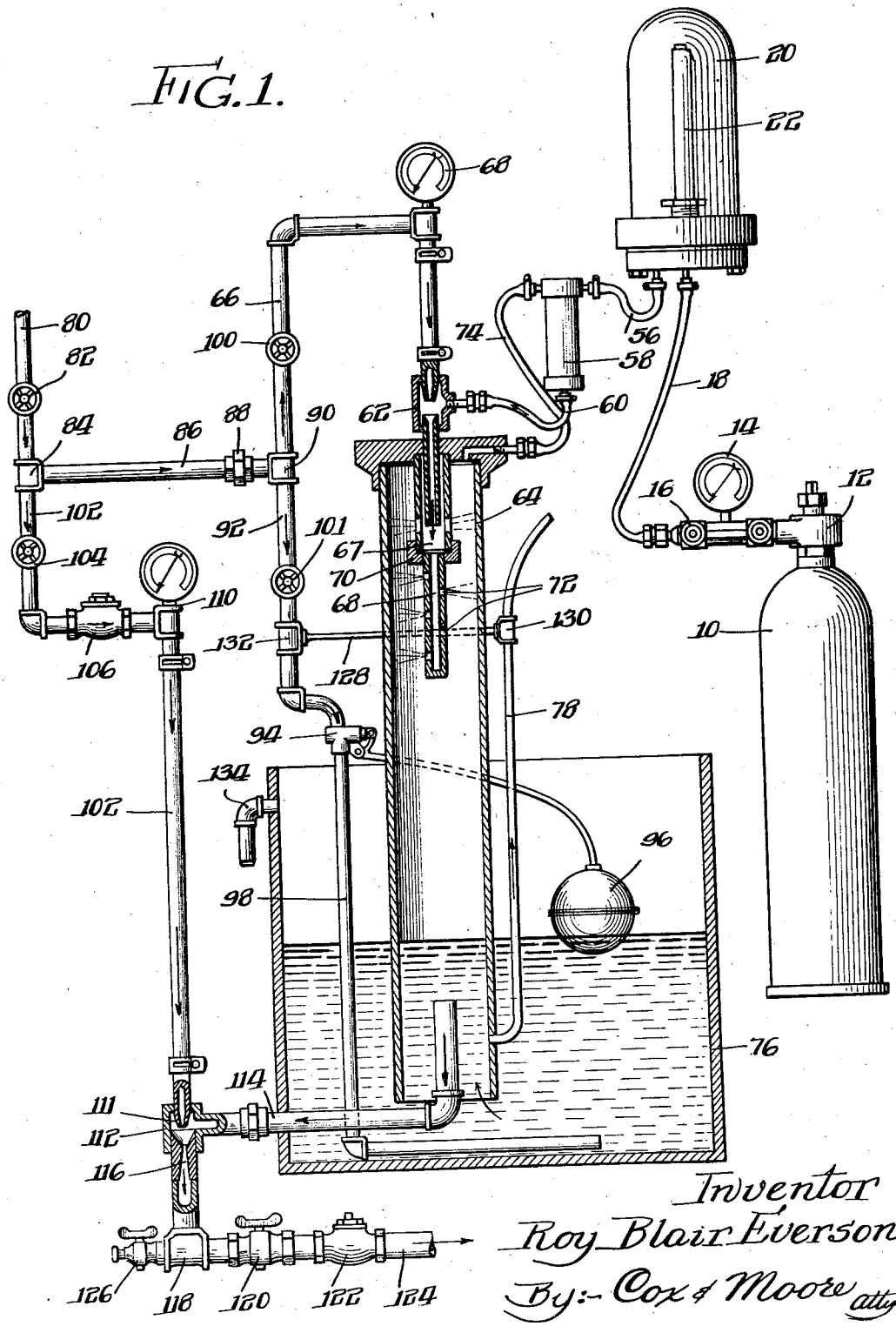
Oct. 28, 1941. R. B. EVERSON 2,260,936

GAS ABSORBING SYSTEM

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FIG. 1.



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FIG. 2.

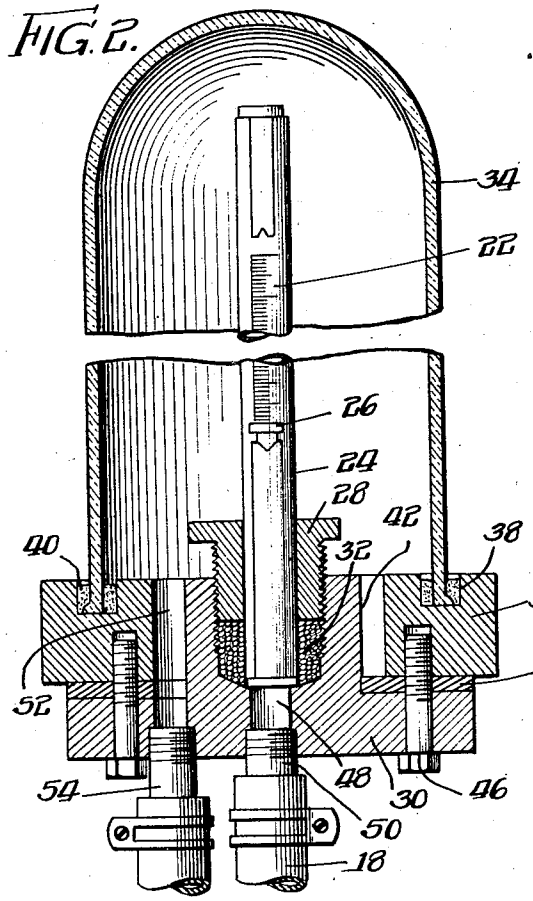


FIG. 3.

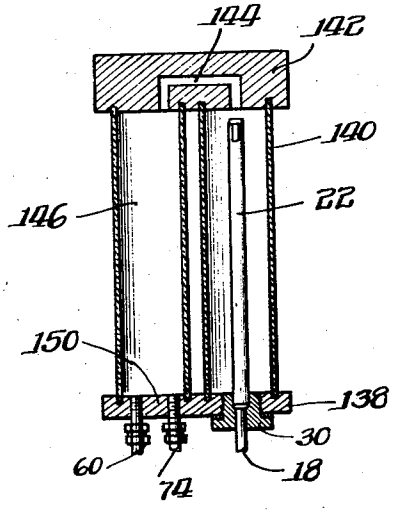


FIG. 4.

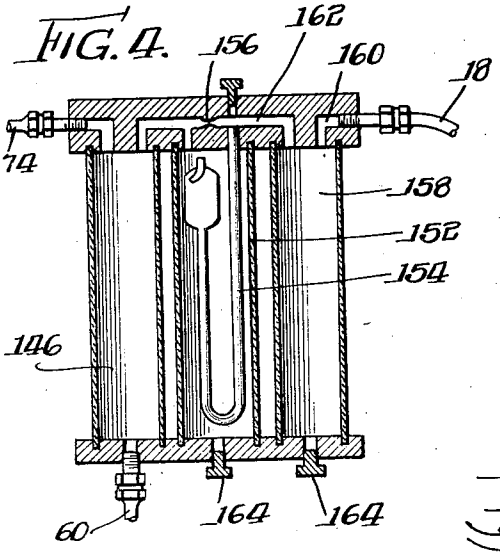
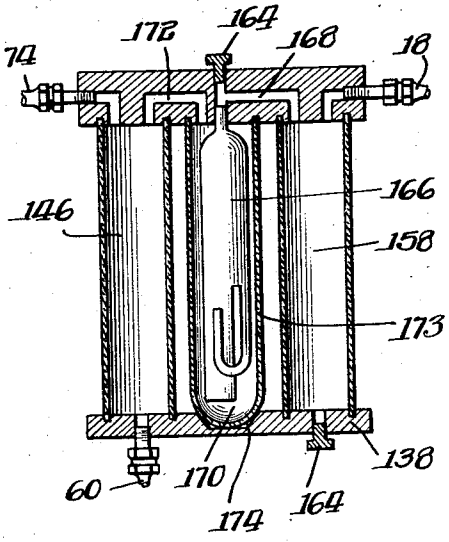


FIG. 5.



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UNITED STATES PATENT OFFICE

2,260,936

GAS ABSORBING SYSTEM

Roy Blair Everson, Chicago, Ill.

Application July 6, 1937, Serial No. 152,131

5 Claims. (Cl. 210—28)

This invention relates in general to a system for supplying water or other fluid to a device for utilization thereof and more specifically to a supply means having a gas treatment and absorbing system associated therewith.

Heretofore it has been conventional to feed hydraulic devices from municipal water mains under pressure. However, under certain conditions such as, for instance, when the mains are shut down or the source of pressure removed, a negative pressure or suction may be created in the main supply lines tending to withdraw or siphon back into the fresh water supply system the used liquids from the hydraulic device.

Considerable attention has recently been drawn to the necessity for preventing such pollution of municipal water supplies. The use of check valves in the supply conduits at once suggests itself but it will be obvious that such devices are by no means infallible nor do they generally, even in the best operative condition, provide a perfect seal. Inasmuch as only minute quantities of bacteria or polluting elements are sufficient to render unfit large quantities of supply water, it will be apparent that any means for the prevention of return siphoning must be positive at all times.

It is an object, therefore, of the present invention to provide a supply or feed system for a source of disposition of water or other fluid wherein regurgitation or backward siphoning of the fluid will be prevented.

An additional object of this invention is to provide a feed or supply means for supplying a liquid from a supply source to a swimming pool or other body of liquid, having a positive vacuum break operative at all times upon the incidence of a negative pressure in the supply source.

A yet further object of this invention is to provide a device for chemically treating fluid as it is supplied from a fluid source to a point of utilization thereof wherein re-siphoning of the fluid is prevented, not only from the point of utilization, but from the fluid treatment means.

Another object of this invention is to provide an absorbing system for gases wherein liberation of the gas is prevented by the utilization of a novel combination of liquid seals combined with an atmospheric venting conduit.

A still further object of this invention is to provide a gas absorbing system for the treatment of fluids having a novel and improved gas flow measuring device which may be readily disassembled and adjusted.

Numerous other objects and advantages will more fully appear during the course and progress of the following specification.

Figure 1 is a plan layout showing a gas absorbing device and fluid supply means in accordance with the present invention.

Figure 2 is a detailed sectional elevation taken through the gas flow measuring device shown in Figure 1.

Figure 3 is a sectional elevation of an alternative preferred form of measuring device and balance chamber.

Figure 4 is a sectional elevation of yet another alternative preferred form of measuring device and balance chamber.

Figure 5 is a sectional elevation of a further alternative preferred form of measuring device and balance chamber.

The embodiment selected for purposes of illustrating the present invention, comprises a gas tank or reservoir **10** forming a source of supply of any desired treatment gas. In the preferred embodiment, for purposes of illustration, the use of chlorine will be described. A valve fitting **12** is provided at the outlet of the tank **10** and this in turn connects directly with the gauge **14** indicating the pressure in the tank. The valve **16** serves to permit control of the gas whereby chlorine may be drawn off at constant flow and reduced pressure into the pipeline **18** and thence to the metering device **20**. This latter element comprises centrally a rotameter **22** (see Figure 2) conventionally known in the art and consisting of a glass tube **24** having a tapered bore with a float or pointer **26** residing therein and susceptible to upward displacement in accordance with the flow of gas upwardly in the tube. Inasmuch as the taper widens upwardly, as shown in Figure 2, when a flow of gas is induced upwardly, the float **26** will come to rest at a predetermined vertical position for any particular rate of flow of gas or fluid within its operative range. As is conventional in the art, the float is provided with specially shaped slots in its head (not shown) against which the fluid passing through the rotameter impinges, causing rapid rotation of the float in the center of the fluid stream away from the walls of the tube.

The tube is preferably of glass or other transparent material and maintained in the position shown by a collar **28** threaded into an enlarged bore in the base member **30** after the fashion of a packing gland and positioned above a suitable annular body **32** of impervious packing material. The meter is enclosed in a suitable transparent casing, illustrated in Figure 2 as a bell jar **34**,

supported at its open bottom by an annular collar 36, preferably formed of hard rubber or any other suitable substance inert to the reagents employed in the system. The lower edge of the casing 34 resides in an annular channel 38 formed in the upper face of the collar 36 and is sealed thereto by any suitable sealing compound 40. If desired, the sealing compound may comprise merely an oil or other viscous substance suitable to resist ingress of air and in some instances it will be found sufficient merely to fill the channel with water.

The meter base 30 has an upstanding cylindrical central portion 42 adapted to fit into the central aperture of the collar 36 and an outstanding annular flange extending over the bottom face thereof and separated therefrom by a suitable resilient gasket 44. The members are held in assembled relationship by a plurality of machine bolts 46 which tend to compress the gasket 44, providing a hermetic seal between the base and collar. An aperture 48, aligned with the bore of the rotameter, communicates directly therewith and has threaded into its lower end a nipple 50 to which is clamped the pipeline 18. The outlet hole 52 is drilled through the base and collar and communicates with the interior of the bell jar, exteriorly of the rotameter, and is threadedly associated at its lower end with nipple 54. It will be apparent that the metering device, though completely gas-tight, is readily visible and may be quickly removed for cleaning, inspection or repair simply by loosening of the machine bolts 46.

The flow of gas from the metering device passes through pipeline 56 to an auxiliary supply chamber or balance chamber 58, and from the bottom of the auxiliary supply chamber through a pipeline 60 to the ejector mechanism 62, where it mixes with a stream of water, and is subjected to further mixing in the tower 64. The ejector, as well as the balance chamber and tower, are described and claimed in detail in applicant's co-pending applications, Serial No. 747,817, filed October 11, 1934, and Serial No. 50,803, filed November 20, 1935. Briefly, however, water is fed to the ejector through a pipeline 66, having therein a gauge 68, as described in the previous applications. The ejector 62 pulls the gas from the pipeline 60 and mixes it with the incoming stream of water. Further mixing takes place in the auxiliary throat chamber 67 and its elongated extension 68, which threadedly passes through the cap 70 on the end of the throat chamber. Final mixing takes place as the water is sprayed through the apertures 72 and falls in particles through the atmosphere formed by residual chlorine gas.

The pipeline 74 effects communication between the upper portion of the auxiliary supply chamber and the upper part of the tower. Thus, the pressure on both sides of the ejector is continuously equalized, preventing refluxing or regurgitation of water in the event of a shut-down.

The bottom end of the tower 64 is open and resides relatively closely to the bottom of a solution tank 76 which is fed with fresh water by a means to be hereinafter described. A vent pipe 78 communicates with the interior of the tower at a point below the normal liquid level and is carried to some point in the exterior atmosphere. As described in the prior applications, if at any time during abnormal operation or shut-down of the process, the chlorine pressure should become great enough to force the liquid level interiorly of the tank below the inlet opening of the pipe 78, the excess gas will immediately be vented to the outside atmosphere and no chlorine will be permitted to enter the room in which the present machine is located.

The water is supplied for operation of the present device in the following manner: A pipe 80 leads to any suitable source of water under pressure, such as municipal water mains, the flow being controlled by the inlet valve 82. At the T-fitting 84 the flow divides, a part thereof passing through the pipe 86 and the union 88 to the T 90. At this point the flow is again divided, a portion thereof passing through the pipe 66, as aforesaid, to supply the ejector. The remainder of the flow through pipe 86 is diverted downwardly through the pipe 92 and the constant level valve 94 controlled by the float ball 96 in the solution tank 76. Thus it will be obvious that the water level in the solution tank will be always maintained at a predetermined level.

In order at any time to effectually resist the egress of chlorine into the room, the pipe 92 is continued downwardly as the pipe 98 and discharges under the liquid level and closely adjacent the bottom of the tank.

Valves 100 and 101 permit control of the liquid in accordance with the desire of the operator. The main water supply passing through T-fitting 84 passes downwardly, as shown in Figure 1, through the pipeline 102, controlled by the hand valve 104, and in seriatim order past the check valve 106 and the pressure gauge 110 to the ejector 112. The ejector comprises a restricted nozzle 111 and a restricted throat 116, although any equivalent form of device may be employed. At this point the chlorinated solution, from a point adjacent the bottom of the tower 64, passes into the feed pipe 114 and is pulled by the action of the ejector into the main stream of water passing therethrough to produce a thorough mixture in the throat 116. The thus treated supply of water is directed through the T-fitting 118, the control valve 120 and the final check valve 122 through the pipe 124 to its final place of disposal. The valve fitting 126 provides means for draining the system for cleaning, repair, and the like, and as a result is normally in a closed position. It has become the custom to daily sterilize all walks, locker rooms, shower rooms, etc., with a chlorine solution and to supply special foot baths with such solution for germicidal reasons and in order to destroy numerous fungus impurities causing foot infections. The petcock 126 provides a suitable means for withdrawing strong chlorine solutions for such sanitary requirements at any time. Though the present arrangement has been found to be particularly adaptable for use in supplying water to a swimming pool or the like, it will be obvious to anyone skilled in the art that any modification in a known manner may more effectively suit it to any particular type of feed use.

A cross vent pipe 128, associated through T-fitting 130 with the vent pipe 78, opens at its other end into the feed pipe 92 through the T-fitting 132. Preferably, the vent pipe 128 is of relatively small cross-section, being proportioned within a range such that it will readily admit sufficient air from the vent pipe 78 to the system in order to form a vacuum break but at the same time will carry only a relatively small proportion of the water flow during normal operation. Likewise, in accordance with the preferred embodiment, the pipe 78 is desirably of relatively

large diameter in comparison therewith, so that it will readily handle the flow of water normally passing through the vent pipe 128 and convey it to the body of water in the solution tank 76 without clogging or preventing free venting to the outside atmosphere. The function of the pipe 128 is, therefore, normally that of a bleeder pipe, permitting a small flow of water into the pipe 78 but capable of admitting sufficient air to readily break a suction.

In normal operation the valves are opened to the required degree to permit water to pass through the main pipe 102 and its associated elements, being conveyed ultimately through the pipe 124 to the swimming pool. The flow of water branching off in the pipe 86 is divided at the T 90, one portion passing through the pipe 66 and into the ejector 62 where it is mixed with the chlorine gas which it draws through the pipeline 60. Subsequent complete mixing takes place in the throat and the tower, the completely chlorinated water collecting within the solution tank 76. Additional water for the solution goes through the branch pipe 98, the level in the tank being maintained at the proper height in accordance with the position of the float 96. It will be obvious that under normal conditions the water pressure in the pipe 92 will cause a flow of the water through the vent pipe 128, which upon reaching the vent pipe 78 will pass downwardly therein into the body of water in the solution tank. The overflow pipe 134 preferably leads to a sewer and prevents flooding of the room in the event of an abnormal flow of water. The solution formed is thus conveyed through the pipe 116 and admixed with the main flow of water in the ejector 112. Proper flow in the several pipes is determined through the agency of the pressure gauges 68 and 110. Meanwhile, the correct proportioning of the gas is maintained through the control valve 16, as indicated by the meter 22.

When the present device is operated in one preferred manner, about half of the water flow is supplied through the pipe 86 and passed into the tower 64 through the ejector 62. The remainder of the water flow necessarily passes into the tank 76 through the pipe 98. All of the water pulled by the ejector 112 through the pipe 114 is derived from these two sources. As a consequence, during normal operation, there is a continuous flow of water from the tank 76 upwardly into the bottom of the tower 64, as indicated by the arrow in Figure 1. Thus the body of water in the tank 76 is normally substantially free of chlorine and incapable of liberating obnoxious vapors to the surrounding atmosphere. The highly concentrated solution in the bottom of the tower 64 is diluted by the flow from the tank 76 and continually drawn off in the pipe 114 to be mixed with the main flow of water.

In the event, at any time, that a negative suction occurs in the source of supply, such as would result from the breaking of a pipe, or for other known reasons, the usual system would be ineffective to prevent backward siphoning and polluted water. The present check valve alone would be insufficient in view of the well known impositiveness and fallibility thereof. If powerful suction was applied to the present machine, however, the suction would obviously be transmitted through the various pipes and would tend to draw water from the swimming pool or other relatively polluted source through the pipe 124. The check valve 122, if in operating condition, would normally tend to resist this rearward flow, as would the upper check valve 106. This effect would be in any event positively heightened by the constricted openings forming the jet 111 and the throat 116 of the ejector 112. It is obvious that these relatively constricted passages would, under any circumstances, greatly impede the flow.

However, by this time the suction will be transmitted to the pipes 86 and 92 and atmospheric air from the vent pipe 78 will travel through the cross vent pipe 128, completely breaking the vacuum in the pipe 86 as well as the pipe 102. Thus it is apparent that the pipe 128 will preferably be relatively short, although it will operate equally well in considerably longer lengths.

Should the water supply cease for some reason so that the water empties from the pipes 66, 92 and 98, and the chlorine inadvertently be permitted to run, the gas would accordingly have free passage through the pipes 66, 92 and 98. However, liberation to the air in the room would be prevented by the water seal formed in the part of the pipe 98 submerged below the solution in the tank 96 and any gas in these pipes would be liberated to the outside atmosphere, passing freely through the T connection 132 and the cross vent 128 to the vent pipe 78 leading outside the building. Liberation of obnoxious or poisonous fumes in the room is accordingly completely eliminated.

On the other hand, assuming that the pipeline 66 should be clogged or the valve 100, for instance, inadvertently shut off while the chlorine was continually delivered, the gas would be prevented from passing through the pipe 66 and out through the vent in the aforesaid manner. The gas pressure in the tower would accordingly increase, displacing the water level therein downwardly until it reached a point adjacent the bottom end of the vent 78 whereupon the gas would be continuously liberated to the outer atmosphere through the vent 78. The gas pressure necessary to liberate the excess gas in the above described manner need be only very small, preferably less than six ounces, and may be controlled by the positioning of the vent 78 with respect to the tower 64.

Should the present device be employed in connection with a re-circulating system of a swimming pool, for instance, and the re-circulating system at any time fail, if the operating pressure of the injector 112 is greater than the back pressure and re-circulating system, delivery of the solution would continue. On the other hand, should the main water supply fail at the same time as the re-circulating system, return flow, due to back pressure of the re-circulating system, would normally close the check valve 122. If the check valve should leak, the back flow of water would gradually fill the tank 76 up to the level of its overflow 134 and be continually conveyed off to the drain. Meanwhile any excess gas would be conveyed off, as hereinbefore mentioned.

It is preferred that the portions of the device carrying corrosive liquids or fluids be formed of hard rubber or other corrosive-resisting substance. This applies particularly to the tubes 18, 56, 60 and 74. When the gas used is chlorine, and particularly where a certain flexibility is necessary between the connected elements, soft rubber tubing is found desirable, although silver or silver-plated tubing, or any equivalent chlorine-resisting substance will serve the purpose. When other gases are used it will be obvious

that the type of pipe employed, dictated by the chemical properties thereof, will be indicated to anyone skilled in the art.

It is evident that the present invention provides a supply and treatment device which is simple and efficient, but utterly fool-proof and incapable of harmful operation. Most of all, a positive vacuum break is provided which will positively and beyond all reasonable possibility of failure, prevent the re-siphoning into the original water source of any of the used or polluted water.

The operation of the device has been described under certain hypothetical conditions likely or possible in service; namely, in the event a suction is applied at the source of fluid, or alternatively when the water supply fails, but the gas supply is continued. It will be obvious from the above disclosure that the protective aspects of the device are equally as effective in response to careless acts or mistakes made by the operator. Regardless of whether the valves are mis-operated, chlorine will not be liberated in the room, nor will equipment or surroundings be damaged.

When the vent pipe has been shown as connected to the pipe **92**, nevertheless it will be obvious that it could equally well be associated with the pipes **66**, **86**, **80** or any other portions of the water supply system. Likewise, the pipe **128** may, if desired, be of considerably larger diameter than that indicated and may carry a proportionately larger flow of water to the solution tank. According to another form of the invention, the pipe **98** and valve **94** might be entirely omitted and the entire flow of make-up water instead passed through the pipe **128**, suitably throttled or otherwise controlled.

Moreover, the entire portions of the device containing the treatment gas is maintained during operation at a pressure below atmospheric; that is, the vacuum created by the action of the ejector will serve to maintain a low pressure in the meter casing, the balance chamber, the supply lines and even the tower. Accordingly leakage cannot occur outwardly of the structure and, when using chlorine and other noxious gases, fumes are kept out of the surrounding atmosphere. The number of gases which may be used therewith is, therefore, extensive. The suction created by the ejector is, according to the preferred embodiment, very slight.

In Figure 3 is disclosed an alternative form of metering device comprising a rotameter **22** of the type shown in Figures 1 and 2, secured to a base member **30**, in substantially the same manner as described above, which is in turn secured to the base block **138** and surrounded by an open-ended glass cylinder **140**, suitably arranged between the block **138** and the upper block **142**. The passage **144** bored in the block **142** communicates with the auxiliary supply chamber **146**, which is likewise preferably a glass cylinder arranged between the upper and lower blocks. Gas is admitted from the inlet pipe **18** through an aligned nipple into the rotameter, passing into the auxiliary supply chamber **146** through the passage **144**, and is supplied to the outlet ejector through the outlet pipe **74** communicating with the passage **148**. The balance line **60** communicates to the interior of the chamber **146** through an aperture **150** in the bottom thereof.

The alternative type of metering device shown in Figure 4 comprises an auxiliary supply chamber **146**, as hereinbefore described. The central metering chamber **152**, formed of a glass cylinder assembled in the manner of the hereinbefore described embodiment, contains a manometer **154** arranged to register the differential of the pressure gauge across the orifice **156**. The inlet line **18** feeds the first supply chamber **158** through the upper passage **160**, the gas passing from the said chamber through the upper passage **162**, through the orifice **156** and into the auxiliary supply chamber **146**. The outlets are arranged in the manner of the previous embodiment. Screw plugs **164** permit access to the interior of the device for cleaning and the like.

A yet further embodiment comprises a bubble meter **166** of the type described in detail in the aforementioned co-pending applications. The supply chambers **158** and **146** are arranged as described in the aforementioned preferred embodiment, a bored passage **168** passing from the first chamber to the bubble device whereby gas passed therethrough and bubbled into the liquid **170** is conveyed through the passage **172** into the final auxiliary chamber **146**. The enclosing vessel **173** for the bubble chamber is formed from a cylinder preferably of glass or any other suitable material and having a closed bottom **174**. The bottom **174** resides in a suitable depression in the bottom block **138** and forms a leak-proof and efficient container for the body of liquid **170**. The members may be held in assembled relationship by any suitable means, but in the preferred embodiment the central chambers are clamped between the end blocks by tie-rods (not shown).

Any suitable liquid may be used in the bubble meter. If chlorine is being metered, water may be used. When using ammonia gas, on the other hand, kerosene has been found preferable. Liquid lost by evaporation may be readily replaced through the agency of the screw plug **164**.

Changes may be made in the form, construction and arrangement of the parts without departing from the spirit of the invention or sacrificing any of its advantages, and the right is hereby reserved to make all such changes as fairly fall within the scope of the following claims.

The invention is hereby claimed as follows:

1. A gas absorbing apparatus comprising a source of liquid, gas supply means, a branch conduit from the source of liquid, mixing means for mixing gas from the gas supply means with the liquid from the branch conduit to form a solution, a receptacle for holding the solution, a gas-tight conduit from the mixing means to the receptacle and having its lower end submerged in the solution in the receptacle, liquid-tight means for conducting liquid from the branch conduit to the receptacle, outlet means communicating with the receptacle for withdrawing solution therefrom, vent means to the atmosphere communicating with said gas tight conduit below the level of the liquid normally in the receptacle and communicating with said liquid tight means, whereby siphoning of said solution into the original source of liquid is prevented, and whereby gas from the mixing means will be vented to the atmosphere during abnormal operation.

2. A gas absorption apparatus comprising a water supply conduit having a plurality of branches, a supply of chlorine gas, a gas injector disposed in a first branch of said water supply conduit to produce a chlorine water solution, a receptacle for receiving said solution from the

njector, a gas-tight tower for conducting solution from the injector to the receptacle and having its lower end submerged in the solution in the receptacle, a second branch of the water supply conduit having its lower end submerged in the solution in the receptacle, a conduit from said receptacle for removing chlorine water solution from the receptacle, and a vent to the atmosphere tapped to the second branch of the water supply conduit above the normal liquid level of the receptacle and to the tower below the normal liquid level of the receptacle, whereby upon the development of suction in the water supply conduit the vent will establish atmospheric pressure in the chlorine gas injector and prevent backing up of the contents of the injector and the receptacle into the water supply conduit.

3. A chlorine gas absorption apparatus comprising a principal water supply conduit, a secondary water conduit having a branch conduit leading to a receptacle, said secondary conduit tapped to the principal water supply conduit for diverting a portion of the flow therefrom, a gas injector operated by said secondary water conduit, a source of chlorine gas communicating with the injector, an absorption tower for assisting in dissolving gas and water received from the injector, a receptacle for receiving water from the tower and having the lower end of the absorption tower submerged therein, an outlet from said absorption tower terminating in a second injector positioned in the principal water conduit at a point behind the connection to the secondary water conduit, a principal outlet conduit from the second injector for removing all of the liquid from the apparatus, and a vent to the atmosphere tapped to the aforesaid branch of the secondary water conduit, whereby upon the development of a suction in the principal water conduit, the vent will establish atmospheric pressure in both the principal water supply conduit and the secondary water conduit and prevent suction of the contents of the gas ejector into the principal water supply conduit.

4. A chlorine gas absorption apparatus comprising a principal water supply conduit, a source of chlorine gas, a vertically disposed absorption tower having an open bottom and disposed in a water tank at atmospheric pressure, a secondary water conduit connecting the principal water supply conduit to the absorption tower for diverting a portion of the flow thereto, means for introducing a gas to the absorption tower, a third water conduit tapped to the secondary water conduit for supplying water to the water tank, an injector in the principal water supply conduit at a point subsequent to the point where the secondary water conduit taps it, an outlet conduit from the water tank having its inlet inside the open end of the absorption tower and leading to the injector, whereby flow of water through the principal water supply conduit will cause a flow of water through the secondary and third water conduits so as to perform a gas mixing operation in the absorption tower and to redeliver the gas carrying water to the injector, and a vent to atmosphere in the third water conduit whereby upon the development of a suction in the principal water supply conduit the vent to atmosphere will establish atmospheric pressure in the absorption tower and in the principal water supply conduit.

5. The structure described in claim 4 with an additional vent tapped to the absorption tower at a point below the normal liquid level in the water tank.

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