C. F. WALLACE & M. F. TIERNAN.

APPARATUS FOR PURIFYING WATER.

APPLICATION FILED MAR. 26, 1915.

1,285,491.

Patented Nov. 19, 1918.

2 SHEETS--SHEET 1.

Fig. 1.

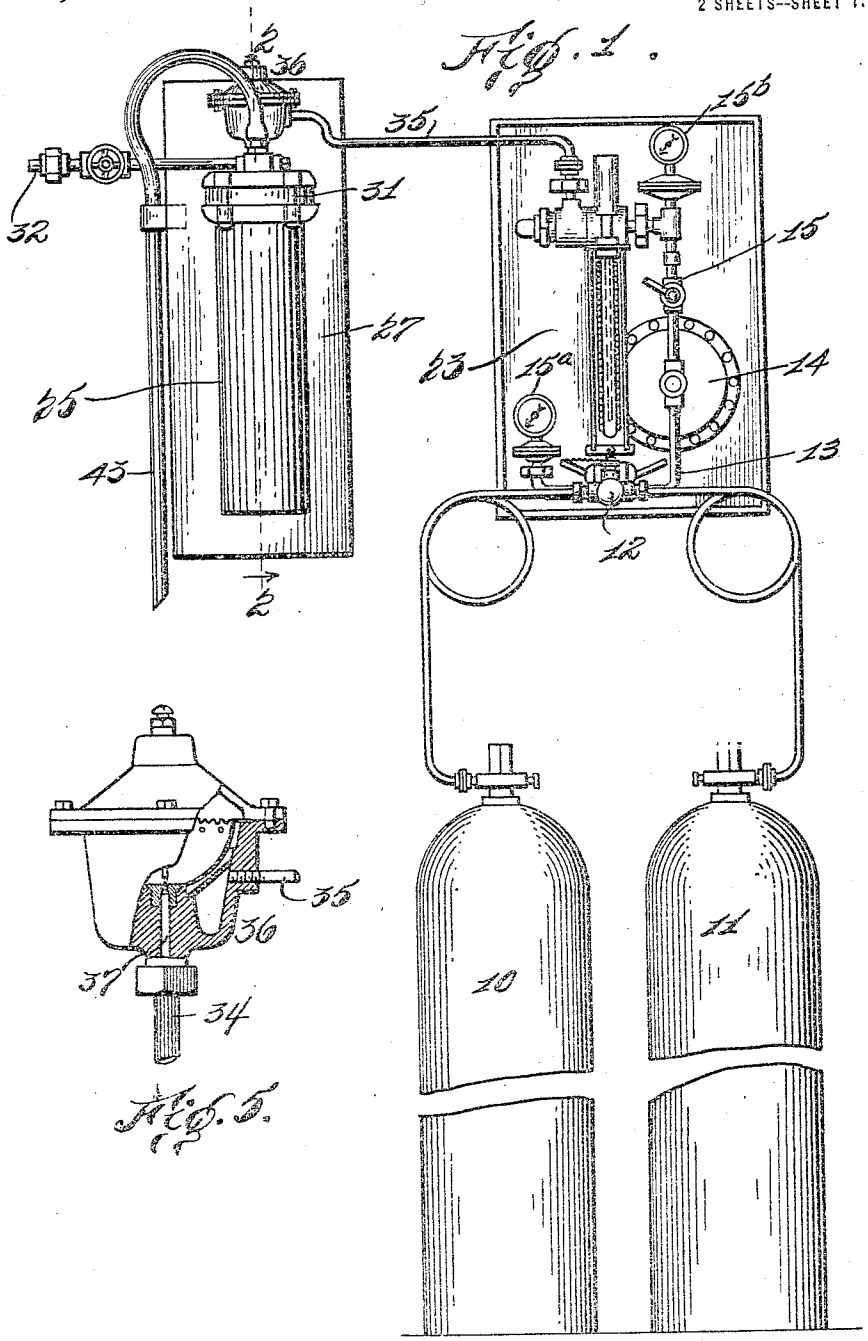


Fig. 5.

Witnesses:
C. A. Jarvis
F. Bluestein

Inventors:
Charles F. Wallace.
Martin F. Tiernan.
By Newell Neal
attorneys.

C. F. WALLACE & M. F. TIERNAN.

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2 SHEETS—SHEET 2.

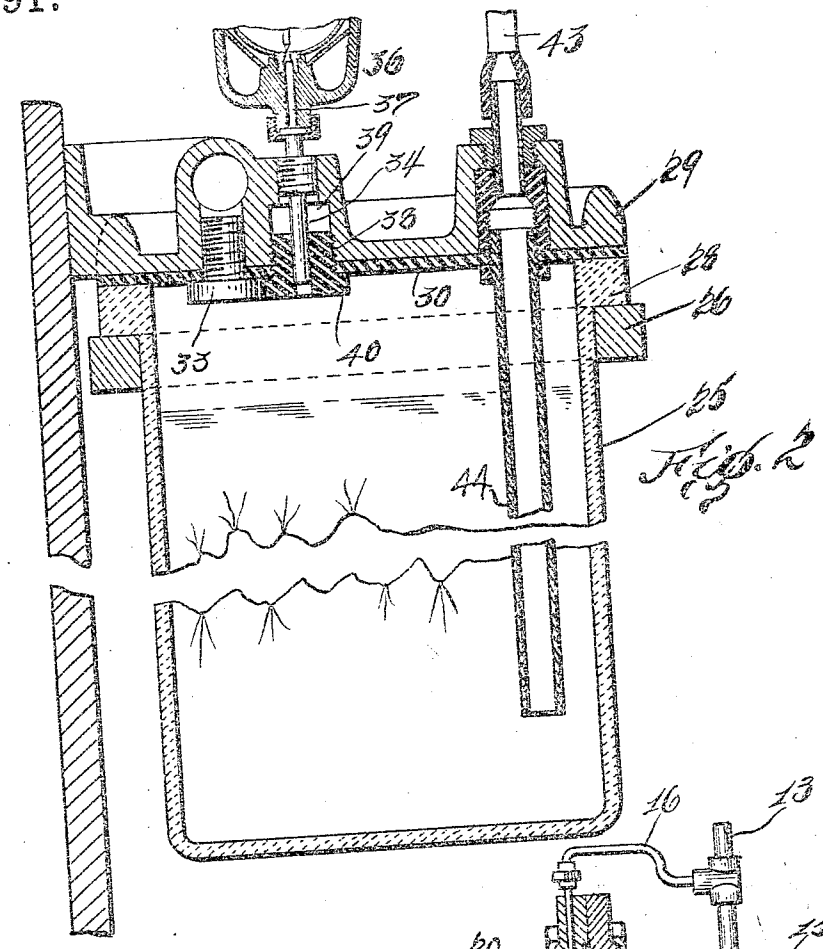


Fig. 2.

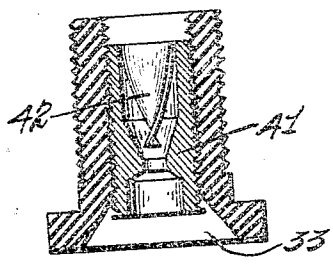


Fig. 3.

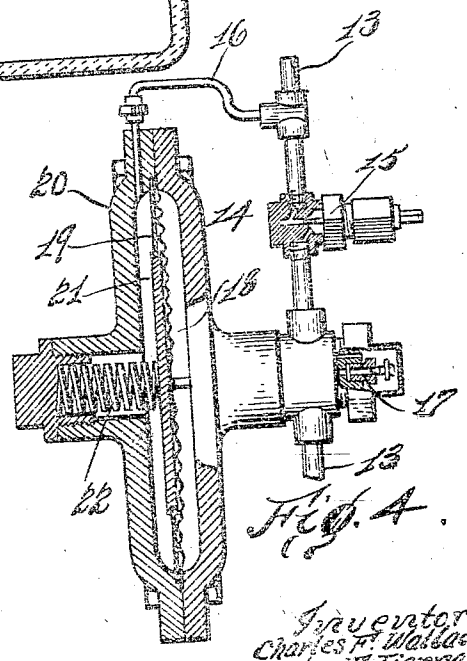


Fig. 4.

Witnesses
E. A. Jarvis
A. Mundstein

Inventors
Charles F. Wallace
Martin F. Tiernan
by Newell Neal
attorneys

UNITED STATES PATENT OFFICE.

CHARLES F. WALLACE AND MARTIN F. TIERNAN, OF NEW YORK, N. Y.

APPARATUS FOR PURIFYING WATER.

1,285,491. Specification of Letters Patent. Patented Nov. 19, 1918.

Application filed March 26, 1915. Serial No. 17,123.

To all whom it may concern:

Be it known that we, CHARLES F. WALLACE and MARTIN F. TIERNAN, citizens of the United States, residing at Tompkinsville, borough of Richmond, city and State of New York, and New York, borough of Manhattan, county and State of New York, respectively, have invented certain new and useful Improvements in Apparatus for Purifying Water, of which the following is a clear, full, and exact description.

This invention relates to an apparatus for and process of purifying water and dissolving chlorin in water, which is treated and fed to the point of application to the main supply of water and in such a manner that there can be no escape of chlorin to the atmosphere. One of the objects of the invention is to provide for an increased pressure of a purifying agent, such as chlorin gas, in a closed chamber so that there is a greater and more rapid solubility of the chlorin in water according to the well-known law of the solubility of gases and liquids under pressure. Another object is to render the process for making the solution visible. A further object is to so mingle the water jet as it enters the absorption chamber and the gas, that the water will have a strong impinging and emulsifying effect upon the gas, thus increasing the rate of solution. Other objects are to provide an apparatus of the class described, which is efficient and practical and in which the parts which constitute the absorption device may be easily interchanged for repair and inspection.

These being among the objects of the present invention, the same consists of the process and certain features of construction and combinations of parts for carrying out said process to be hereinafter described and then claimed with reference to the accompanying drawings illustrating an embodiment of the invention, and in which—

Figure 1 is a front elevation of the apparatus;

Fig. 2 is an enlarged section on the line 2—2 Fig. 1, parts being broken out, showing the absorption chamber and concomitant parts;

Fig. 3 is an enlarged detail of means for spreading the jet of water as it issues from the inlet into the absorption chamber;

Fig. 4 is an enlarged transverse section of the differential pressure-reducing valve, showing concomitant parts such as the control valve for obtaining a drop in pressure; and

Fig. 5 is an enlarged transverse section of a suitable back pressure valve.

The apparatus forming the subject matter of the present application is specifically different from the apparatus forming the subject matter of our contemporaneous application Serial No. 17,122, and particularly in the fact that there is no diffuser; this being dispensed with, as a solution is fed directly to a main body of water. In common with the latter case, the apparatus of the present application may include two tanks 10, 11, for liquefied chlorin, an automatically controlled three-way valve 12, which connects one of the tanks with the gas line 13 when the supply from the other tank is exhausted, a differential pressure-reducing device 14, which as shown is specifically different from the corresponding feature of aforesaid application, although the present invention is broad enough to embrace said corresponding feature, said device being connected in the line ahead of the control valve 15, used for obtaining a drop in pressure, together with a branch pipe 16 to said line 13 from behind the control valve 15, and a metering or measuring device 23, comprising a flow-meter. Suitable gages such as 15^a, 15^b, may also be employed as in aforesaid application. The differential pressure-reducing device of the present application is adapted to maintain a constant drop in pressure across the control valve 15, and the details are illustrated in Fig. 4.

Referring to Fig. 4, it will be seen that the valve proper 17 of the differential pressure-reducing device controls the passage of gas through the line 13, and that the control valve 15 is located between the aperture controlled by said valve 17 and the branch pipe 16. The valve chamber 18 is located to one side of a suitable flexible diaphragm 19 arranged in a casing 20 so as to provide a second chamber 21 at the opposite side of said diaphragm. This diaphragm is preferably reinforced. Branch pipe 16 connects with the chamber 21, and at the same side of the diaphragm 19 there is located a helical spring 22 which is placed under suitable tension. The complications of the pressure-reducing device of said other application are not here necessary, and the device is in very simple form, its object being to maintain through the medium thereof a constant drop

in pressure across the control valve 15 regardless of varying pressure at either side of diaphragm 19. The difference in pressure in the line between the points of connection at opposite sides of the control valve 15, operates upon the diaphragm against the force of spring 22 to close the valve 17 to a point when equilibrium is established between this difference in pressure and the force of the said spring. Any variation in pressure in the line, beyond the control valve, is transmitted equally to both sides of said valve and does not affect the rate of flow of the gas.

To render an understanding of the device illustrated in Fig. 4 clearer, it is stated that the known methods for regulating the flow of gases employ means for eliminating the effect of variation in pressure at the source of supply, but they do not provide means for eliminating the effect of variation in pressure at the point of application of said gas. It is obvious that the said known methods are not applicable in cases where the point of application of said gas is subject to a variable pressure, because such variations in pressure reduce the difference in pressure across the controlling valve, which varies the flow of said gas through said valve. Further, said variations in pressure cause a corresponding change in density of the gas as it flows through the meter indicator. Such change in density vitiates the accuracy of the calibration of said indicator. The device of Fig. 4 is therefore an improvement on the known methods, in that it is a means for controlling and measuring the flow of gas which shall be substantially unaffected by variations in the pressure at the source of supply and any variation in pressure at the point of application up to a predetermined maximum.

Referring more particularly to Fig. 2, the preferred absorption vessel and concomitant parts will now be described. This comprises a glass chamber 25 for containing the solution, and which may be supported upon a metal ring 26 which is carried by the support 27, said chamber 25 being provided with a shoulder 28 which rests upon said ring. The vessel including chamber 25 also includes a suitable cover 29, the joint between which and the upper edge of the glass chamber 25 is suitably packed as by a gasket 30 which may be composed of a layer of rubber or other suitable material. Bolts such as 31, see Fig. 1, pass through the cover 29 and the metal ring 26, and secure the glass chamber 25 in stationary position. Water under pressure is introduced into the absorption chamber 25 through an inlet 33 in the top or cover 29, while the chlorin gas is introduced through an inlet tube 34 which may be suitably mounted in the cover 29, and between said tube and the extension 35 of the gas line from the flow-meter 16, there is located a back pressure device 36 shown in detail in Fig. 5, and comprising a valve proper 37 for controlling the passage of the gas into the chamber 25. Said back pressure device although in this case preferably located above and directly mounted on the absorption device, need not be described in detail, inasmuch as the preferred form thereof corresponding substantially to the one here illustrated, is described fully in aforesaid application. As explained therein, this back pressure device maintains a constant back pressure on the measuring orifice and prevents moisture from coming back in the orifice, or at least enough to do any damage.

Preferably the inlet tube 34 is of silver and is surrounded by a bushing 38 which may be of vulcanite, and is screwed into a recess 39 in cover 29, which surrounds the tube 34, said bushing extending through the layer of rubber 30 and having a flange 40 upon which said layer is seated, so as to provide a proper joint. Preferably the water and the gas inlets are associated closely together, substantially as shown. Preferably also, the water inlet 33 is flared so that a conical sheet-like jet may be produced by a suitable water spreading device located in said inlet. This spreading device may comprise a tubular section 41 screwed into said inlet and having a suitable passage therethrough, in which is rigidly mounted a spiral blade or web 42 which terminates just back of the extreme end of the inlet. The solution of chlorin is piped off to any desired point of application by means of an outlet pipe 43 which is connected in suitable manner with the upper end of a tubular leg 44 which may be composed of vulcanite, and extends from the cover 29 down below the level of the water and to a point which is fairly close to the bottom of the absorption chamber 25, so as to make it impossible to draw off from the chamber any gas except that dissolved in the water, for the reason that the gas will remain at the top of said chamber.

It will be seen that as the described system or apparatus is an inclosed one, the gas cannot escape to the atmosphere, and an increased pressure of the gas in the absorption chamber 25 will produce a more rapid solubility of the same in the water in the chamber. It will be seen that in operation, the water jet issuing from the inlet 33 will be emitted from its point of generation, in a downward direction through the free gas space in which the surface of the body of water is located, and by reason of its being unimpeded said jet will exert its full force downwardly, so as to have a strong impinging and emulsifying effect upon the gas issuing from the adjacent inlet tube 34 and which is present in said free space in the

upper part of the chamber, thus increasing the rate of solution, and also submitting the gas to a continuous emulsifying effect until the solubility thereof is fully accomplished. The reason for locating the outlet end of the tubular discharge leg 44 at a lower level than the upper part of the body of the water in which the gas may not be fully dissolved is now more apparent. The water spreading inlet before described, produces a sheet-like jet of water of conical shape, which will thus cover a larger area as it strikes the surface of the body of water upon which it impinges, and effects a more perfect solubility of the gas. Said sheet-like jet of water as it impinges on the surface of the water increases the area covered thereby at said surface as the pressure of the gas tends to lower the water in the absorption vessel.

Obviously the invention is susceptible of modification, as parts may be omitted, added and substituted without departing from the scope of the invention as claimed.

What we claim as new is:—

1. In an apparatus for purifying water, the combination of a gas conducting line, means for controlling and regulating the rate of flow of gas through said line, a closed vessel having a free spacial upper part into which said line conducts said gas, means independent of the pressure of said gas for supplying water under pressure in an uninterrupted jet directed downwardly through said free upper space of said vessel so as to impinge directly onto the surface of the body of water in said free space, and solution discharge means having its inlet below the water level in said vessel.

2. In an apparatus for purifying water, the combination of a gas conducting line, means for controlling and regulating the rate of flow of gas through said line, a closed vessel to the free spacial upper part of which said line conducts said gas, means for supplying water under pressure in a downward jet into said upper part and to said vessel so as to impinge directly onto the surface of the body of water in said free space, pressure controlled valve means in said line at a point ahead of said vessel, and comprising a valve for controlling a valve orifice located between it and said vessel, said valve being biased to tend to close said orifice in the direction of flow of said gas, and solution discharge means having its inlet below the water level in said vessel.

3. In an apparatus for purifying water, the combination of a gas conducting line, means for controlling and regulating the rate of flow of gas through said line, a closed vessel having an inlet in its upper part through which said line conducts said gas, means for supplying water under pressure through a separate inlet into said upper part and to said vessel, a downwardly directed water spreading device located at said water inlet and across which said water is let into said vessel, and whereby the water is caused to plunge downwardly into the body of water in said vessel, and solution discharge means having its inlet below the water level in said vessel.

4. In an apparatus for purifying water, the combination of a gas conducting line, means for controlling and regulating the rate of flow of gas through said line, a closed vessel having its water level near the top thereof, and above which level said line admits said gas into said vessel, means for discharging water into said vessel at a point above said water level and in a downwardly directed jet, under pressure independent of the pressure of said gas, said vessel being free from obstructions to the downward plunge of said jet onto and into the body of water in said vessel, and solution discharge means having its inlet below the said water level.

5. In an apparatus for purifying water, the combination of a gas conducting line, means for controlling and regulating the rate of flow of gas through said line, a closed vessel having its water level near the top thereof, and above which level said line admits said gas into said vessel, means for discharging water into said vessel at a point above said water level and in a downwardly directed jet, under pressure independent of the pressure of said gas, said vessel being free from obstructions to the downward plunge of said jet onto and into the body of water in said vessel, back pressure valve means in said line for closing a valve orifice between said means and said vessel, and adapted to open under pressure of said gas in a direction reverse to the flow of said gas, and solution discharge means having its inlet below the said water level.

6. In an apparatus for purifying water, the combination of a gas conducting line, means for controlling and regulating the rate of flow of gas through said line, a closed absorption vessel to the upper part of which said line conducts said gas, means for supplying water in a downward jet into said upper part of said vessel so as to impinge directly onto the surface of the body of water in said vessel, a valve casing in said line, said casing having a gas outlet toward said vessel, an automatic valve in said casing normally closing said outlet, and adapted to be opened independently of the pressure in said vessel, by the pressure of said gas in a direction reverse to the flow of said gas, and solution discharge means having its inlet considerably below the water level in said chamber.

7. An absorption device for dissolving gas in water, comprising a closed vessel having a free and uninterrupted space at and above

the water level in said vessel, said vessel being provided at the top of said space with two inlets, laterally removed one from the other and respectively for separately admitting water and gas under pressure into said vessel, the water inlet being directed downwardly into said vessel to produce a plunging action of the jet of water onto the body of water in said vessel, and a solution discharge leg in said vessel extending down considerably below the water level.

8. An absorption device for dissolving gas in water, comprising a closed vessel having a free and uninterrupted space at and above the water level therein, said vessel being provided at the top of said space with two inlets, laterally removed the one from the other and respectively for separately admitting water and gas under pressure into said vessel, a downwardly directed water spreader at said water inlet and at the point of generation of a jet of water from said inlet, whereby the water is formed into a conical sheet caused to plunge downwardly into the body of water in said vessel, and a solution discharge leg in said vessel extending down considerably below the water level.

9. The process of purifying liquids, which consists in projecting gas into a free space of a closed absorption vessel and directly above a relatively large mobile body of liquid in said space, and at the same time projecting a jet of liquid directly down from a point above said space through the gas in said space, and causing said liquid jet to plunge directly into said body of liquid without impedance and with full force, and thereby churning up said body of liquid to facilitate the absorption of said gas and to form a solution.

10. The process of purifying liquids, which consists in continuously projecting a jet of gas into a free space of a closed absorption vessel and directly above a relatively large mobile body of liquid in said space, continuously projecting a jet of liquid directly down from a point above said space through the gas in said space and causing said liquid jet to plunge directly down into said body of liquid without impedance and with full force, thereby churning up said body of liquid to facilitate the absorption of said gas and to form a solution, and continuously discharging said solution from said vessel under the pressure of said gas, the surface-level of said body of liquid being variably controlled by said gas pressure.

11. The process of purifying liquids, which consists in projecting chlorin gas into a free space directly above a relatively large mobile body of water in a closed absorption chamber, and at the same time projecting a jet of water through the gas in said space directly down from its point of generation into said body of water, without impedance and with full force and thereby churning up said body of water to facilitate the absorption of said chlorin gas and to form a solution.

12. The process of purifying liquids, which consists in projecting a jet of gas under pressure into a free space directly above a relatively large mobile body of liquid in a closed absorption chamber, and at the same time projecting a conical sheet-like jet of liquid through the gas in said space directly down into said body of liquid, and thereby churning up said body of liquid to facilitate the absorption of said gas and to form a solution.

13. The process of purifying liquids, which consists in projecting chlorin gas into a free space directly above a relatively large mobile body of water in a closed absorption chamber, and at the same time projecting a jet of water through the gas in said space directly down from its point of generation into said body of water, and without impedance and with full force thereby churning up said body of water to facilitate the absorption of said chlorin gas and to form a solution, and discharging the said solution under pressure of said gas into a body of water to be purified, the surface-level of said body of liquid being variably controlled by said gas pressure.

14. The process of purifying liquids, which consists in projecting gas into a free space directly above a relatively large mobile body of liquid in a closed absorption chamber, and at the same time projecting a conical sheet-like jet of liquid through the gas in said space directly down into said body of liquid, and thereby churning up and agitating the upper portion of said body of liquid to facilitate the absorption of said gas and form a solution, discharging said solution under pressure, at a point where it is comparatively quiescent, and increasing the surface-area covered by the impinging conical jet at the liquid level as the liquid is pressed further down by the gas above it.

15. The process of purifying liquids, which consists in admitting a continuous inflow of water under pressure to a closed absorption chamber by directing thereinto a downward jet of said water, establishing a supply of chlorin gas under high pressure continuously in producing said chlorin gas into said chamber under reduced pressure during the direct impingement of said water jet at full force onto the water in said chamber from the point of generation of said jet, which is the point of inflow of said water into said chamber, in order to form a solution therein, maintaining by said jet of water such a body of water in said chamber as to substantially fill it while at the same time violently agitating the upper portion of said maintained

body of water by means of said downward jet of water direct from its point of generation, utilizing the continued pressure of said gas upon said body of water in said chamber by the impingement of said gas upon the so agitated portion of said body of water to tend to produce a continuous outflow of said solution, keeping up the supply of said gas at said reduced pressure irrespective of the pressure in said chamber, continuously discharging the so formed solution from said chamber by means of said gas pressure in said chamber, but at a point where said body of water is more quiescent, and applying the so discharged solution to water to be purified.

Signed at New York, N. Y., this 22" day of March, 1915.

CHARLES F. WALLACE.
MARTIN F. TIERNAN.

Witnesses:
GEO. L. WHEELOCK,
BEATRICE MIRVIS.