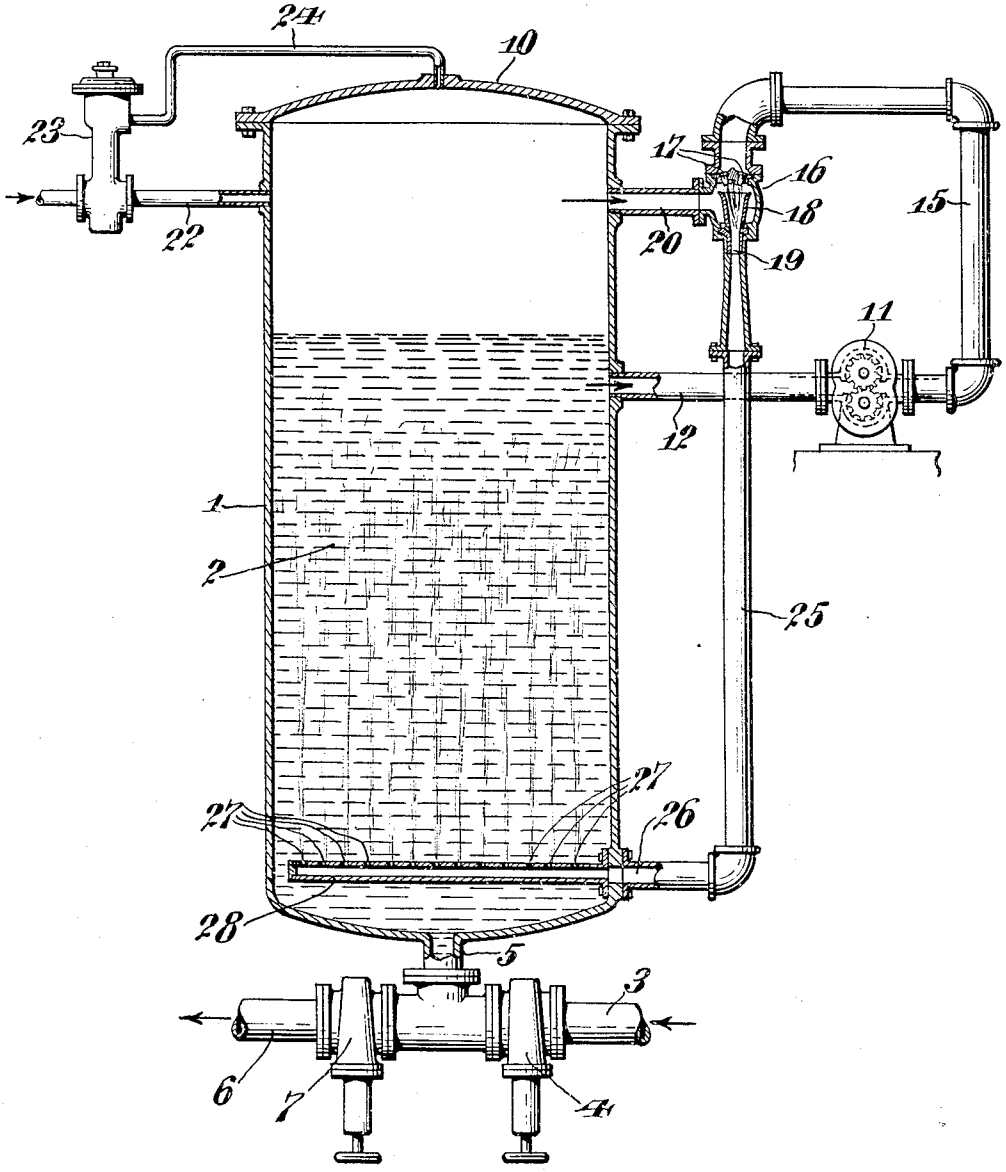
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APPARATUS FOR AND METHOD OF COMBINING LIQUIDS AND GASES

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APPARATUS FOR AND METHOD OF COMBINING LIQUIDS AND GASES

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My invention relates to apparatus for and methods of combining liquids and gases. It may be mentioned, for example, that the apparatus and the method may be employed in the hydrogenation of oils, the bleaching of liquids by chlorine and by sulphurous oxid (SO_2), the chlorination of liquids, and in fact for the treatment of liquids with gas for any purpose wherein it is desired to bring the two fluids into intimate relationship with respect to each other.

The general object of the invention is to provide a novel apparatus and method for the treatment of liquids with a gas which may be used with great efficiency and also with a high degree of economy.

It also is an object of the invention to provide an apparatus and method by the employment of which both the gases and the liquid may be conserved and by which the loss of gas is avoided because the same gas may be used over and over again until the treatment is concluded.

A further object of the invention is to provide a novel method wherein the gas and the liquid are caused to flow in an endless circuit in intimate contact and relationship with respect to each other whereby loss of gas is prevented and whereby the effect desired by the treatment of a liquid by a gas may be more speedily obtained.

Without undertaking at the present time to enumerate all of the objects and advantages of and incident to my invention I shall proceed with a detailed description thereof wherein reference will be made to a novel construction of apparatus in the form which at present is preferred by me, and in the description of the apparatus the method also will be described.

In the drawing a single figure is shown consisting of a view in vertical sectional elevation of an apparatus embodying the invention and which may be employed in the practising of the method constituting a part of the invention.

In the drawing I have shown at 1 a tank which is adapted to receive and to hold the liquid 2 which is to be treated with a gas. The liquid may consist of water, a water solution, oil or the like. The operation of the treatment is the same whether the liquid be of one kind or another. The liquid may be supplied at the bottom of the tank through a pipe 3 controlled by a valve at 4. The liquid passes from the pipe 3 into the bottom of the tank 1 through a short pipe 5. The liquid after treatment, or at any time, may be discharged through the pipe 5 and out through an outlet pipe 6 controlled by a valve 7. The top of the tank is hermatically sealed or closed by a cover 10. The top level of the liquid is located a distance below the top of the tank as indicated in the drawing. It is to be understood, however, that the plane of the level of the liquid may be higher or lower than is shown in the drawing.

For the purpose of causing a circulatory flow of the liquid I have provided a force pump, preferably of the gear type, at 11, to the casing of which the outer end of a pipe 12 is connected. The inner end of said pipe is in communication with the tank 1 a short distance below the top level of the liquid 2 in said tank. The liquid is drawn by the pump 11 from the tank 1 through the pipe 12 and is forced outwardly from the pump through a pipe 15 and is discharged from the latter into a liquid jet gas exhauster 16. In the construction as illustrated the water is discharged in solid streams through a plurality of convergent openings 17 into the upwardly flared portion 18 constituting the upper part of a Venturi pipe section 19. The interior of the casing of the exhauster 16 is connected by means of a pipe 20 with the upper portion of the tank 1 containing gas under pressure. The gas is supplied to the upper portion of the tank 1 through a pipe 22, the pressure of the gas entering the tank being controlled by a pressure valve indicated as a whole at 23. The pressure of the gas in the top portion of the tank 1 acting through a pipe 24 controls the operation of a valve in the pressure valve structure 23 and thereby controls and regulates the pressure of the gas in the tank 2. Any known construction of pressure regulating valve may be employed and as such structures are in common use no detailed showing or descrip-

tion of the said pressure valve is given. The action of the jets of water which are discharged into the upwardly flaring portion 18 in sucking the gas through the pipe 20 from the top portion of the tank is well understood but it will be stated that such liquid jet discharge creates a vacuum in the casing of the part 16 and causes the gas to flow through the Venturi section 19 and thence through the pipe 25 into the tank 1 near its bottom as indicated at 26. The combined or mixed liquid and gas are discharged into the body of the liquid 2 in the tank 1 through openings 27 provided in a pipe 28 which extends transversely of the tank near its bottom as shown.

During their passage through the venturi 19 and pipe 25 and into and from the pipe 28 into the liquid 2 the liquid and the gas are thoroughly intermingled and brought into most intimate contact relationship with each other. The uncombined and/or unabsorbed gas which enters the liquid 2 from the discharge pipe 28 bubbles upwardly through the liquid 2 and such portion thereof as may not be combined or absorbed in its upward passage through the said liquid enters the top portion of the tank above the level of the liquid and is again drawn by suction into the device 16 and again mixed with the liquid discharged from the openings at 17. By the method of my invention and as above described it will be seen that such gas as is not confined with or absorbed by the liquid in its passage therethrough is again subjected to the same operation and caused to re-flow through the liquid in intimate relationship therewith and that the cycles of operation may be repeated over and over again until the treatment of the liquid has been completed, or until the liquid has acquired the desired characteristics due to the action of the gas thereon.

As has been indicated already, the apparatus and the method may be employed for the treatment of liquids of various kinds by gases of various kinds. The apparatus and the method are adapted for use in any case where it is desired to bring together liquids and gases in intimate relationship to each other.

It will be understood that when the apparatus and the method are employed for the hydrogenation of liquid oils, such as vegetable oils, any known catalytic suitable for the purpose may be employed.

It will be apparent that my invention affords means and a method whereby the treatment of liquids with gases may be effected in a most efficient manner and at a minimum of cost due to the fact that no portion of either the liquid or the gas is or need be wasted.

Having thus described by invention what I claim and desire to secure by Letters Patent is:

1. The method of treating a liquid with a gas, which comprises the continuous withdrawal of liquid from a body thereof contained in a closed receptacle, causing movement of the said liquid as a stream, causing a flow of gas from the top portion of said receptacle into the said stream of liquid, conducting the mixed stream of gas and liquid to the bottom portion of the said body of of liquid and discharging the said mixed stream into the latter, permitting the unabsorbed or uncombined gas to bubble up through the said body of liquid, and thereafter causing a re-flow of the said portion of unabsorbed or uncombined gas into said stream of liquid and conducting the same with the said liquid back into the said body of liquid.

2. The method of treating a liquid with a gas, which comprises the placing of a body of liquid in a closed receptacle, supplying gas under pressure to an unfilled portion of the said receptacle above the top level of the said liquid, withdrawing liquid from a point near the top of the said body of liquid, causing the portion withdrawn to flow as a stream, causing gas to flow from the top portion of said receptacle into said stream, and returning the stream of mixed liquid and gas to the said body of liquid near the bottom thereof and permitting the unabsorbed or uncombined gas to bubble up through the said body of liquid from which it escapes into the top portion of the said receptacle.

3. In apparatus for the treatment of a liquid with a gas, the combination of a receptacle adapted to be partially filled with a liquid, a conduit having connection at one end with the said receptacle at a point below the top level of the liquid therein and at its opposite end at a point at or near the bottom thereof, means for causing withdrawal of liquid from the top portion of the liquid contained in the said receptacle and causing the same to flow through said conduit into the bottom portion of the said liquid, means for supplying a gas to the said receptacle above the top of the liquid therein, a conduit leading from the top portion of said receptacle to the first named conduit and opening into the latter, and means at the junction of the said conduits which causes the liquid as it flows therethrough to create suction to induce a flow of gas through the second named conduit into the stream of liquid flowing through the first named conduit.

4. In apparatus for treating a liquid with a gas, the combination of a receptacle adapted to be partially filled with the liquid to be treated, a conduit having communication at one end with the said receptacle at a point near the top level of the liquid therein and at its opposite end at a point at or near the bottom of said receptacle, means for the withdrawal of liquid through said conduit from

the top portion of the liquid in the said receptacle and for causing the same to flow through said conduit back into the said receptacle at or near the bottom thereof, means within the said conduit for causing a stream of liquid flowing therethrough to create a suction, a conduit in communication at one end with the top portion of said receptacle and at its opposite end with the first named conduit at a point in proximity to the last named means, and means for supplying the gas with which the said liquid is being treated to the portion of the said receptacle above the top of the liquid therein, the suction created in the first named conduit causing said gas to flow into the said conduit and to be carried by the stream of liquid into and through a portion of the first named conduit back into the said receptacle.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 14th day of June, 1930.

SIGMUND G. KETTERER.