C. S. BRADLEY.

METHOD OF TREATING LIQUIDS WITH GASES.

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1,198,519. Patented Sept. 19, 1916.

Fig. 1.

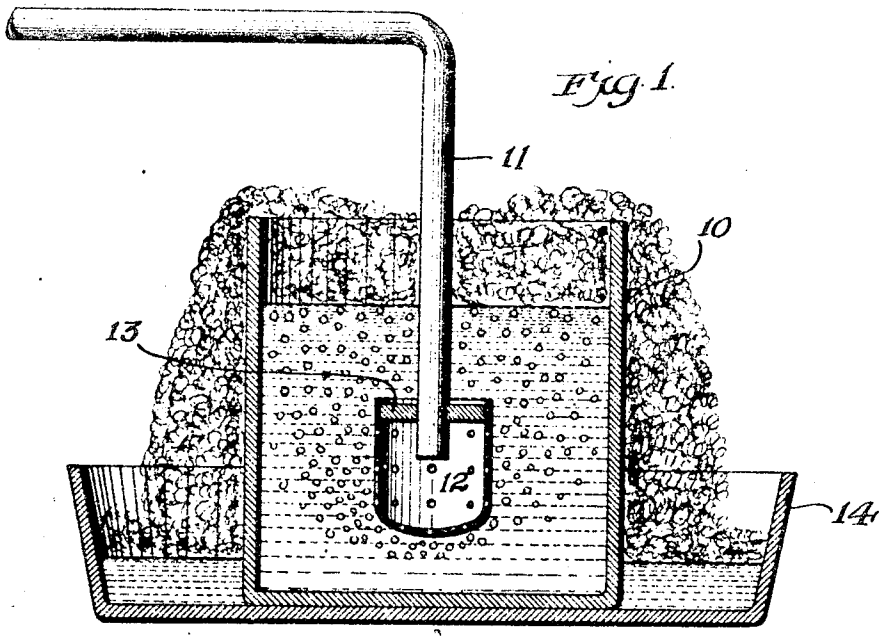
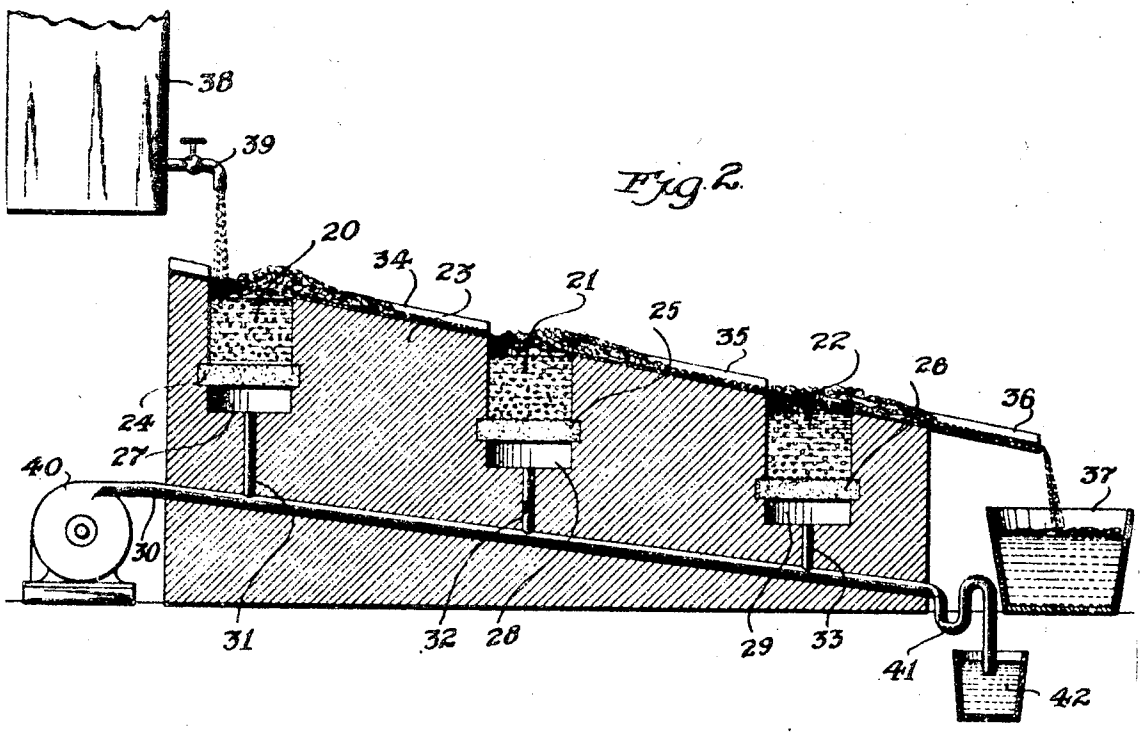


Fig. 2.



WITNESSES:

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METHOD OF TREATING LIQUIDS WITH GASES.

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To all whom it may concern:

Be it known that I, CHARLES S. BRADLEY, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Methods of Treating Liquids with Gases, of which the following is a full and clear specification.

My invention relates to the treatment of liquids with gases. Operations of this nature are employed for numerous purposes as, for example, for the purpose of oxidizing the liquid, in which case air or other oxygen supplying gas is supplied to the liquid. As an example of such a process I may refer to the oxidation of cuprous chlorid solution by means of air in which the following chemical action occurs:

$$3Cu_2Cl_2+3O+\text{aqua}=CuCl_2 3CuO,4H_2O+2CuCl_2+\text{aqua}.$$

In all such operations, it is desirable to effect as perfect a presentation of the liquid to the gas as possible, and the object of my present invention is to provide a method and apparatus in which the presentation or commingling of the gas in the liquid is practically complete, so that every particle of the liquid comes into contact with the gas. According to my invention the operations are conducted in such manner that the liquid is formed into a froth or a mass of bubbles containing the gas, so that substantially a film of liquid is produced at either side of which is a body of the gas. In order to insure that all of the liquid will be thus intimately presented to the gas before it is discharged, I permit only the froth to be discharged from the liquid in the tank or chamber. Where operations are to be performed which require more extensive contact, I perform the operations in a succession of steps, the froth from one chamber being allowed to resume liquid form and flow into the second chamber, where it is again converted into a froth, and so on through repeated treatments until the desired effect is obtained. In the case of treatments which involve the formation of precipitates, the precipitate may be collected after each operation or it may all be collected at the final step of the process.

The invention is illustrated by way of example in the accompanying drawings, in which,

Figure 1 is a diagrammatic elevation of a simple form of apparatus for carrying out the method, and Fig. 2 is a vertical section of a more complex form of apparatus in which a succession of treatments may be performed.

Referring to Fig. 1, 10 is the liquid container or frothing chamber, 11 the gas supply pipe and 12 is a perforated gas discharge head fitted on gas supply pipe 11, by the packing 13. The container 10 may, for example, be placed within an overflow receptacle 14. In operation the liquid is introduced into container 10, and gas is forced into the liquid by way of pipe 11 and perforated discharge head 12. The bubbles in the liquid within container 10 produce a froth or foam which bubbles over and is caught in the overflow receptacle 14, where it again returns to liquid form. By insuring that only foam is discharged from container 10 it will be obvious that only that portion of the liquid which has been intimately exposed to the gas will be found in receptacle 14.

In Fig. 2 the apparatus is shown as comprising a series of frothing chambers 20, 21 and 22, formed in, for example, a cement bed 23, and having porous bricks 24, 25, 26 at the bottom, under which are the gas chambers 27, 28, 29 which are supplied with gas through main 30 and branches 31, 32, 33. Inclined drain platforms 34 and 35 are arranged between successive frothing chambers and a drain platform 36 leads to a discharge receptacle 37. The liquid is supplied from a tank 38 under the control of a cock 39, which delivers the liquid into the first frothing chamber 20. Air or other gas is supplied by pump 40 to the main 30, from which it passes through the branches, gas chambers, and porous bricks into the liquid within the frothing chambers. The gas passing up through the liquid forms a froth or foam which overflows and moves slowly down the drain platforms from one frothing chamber to another, being repeatedly restored to liquid condition on its way to each successive frothing chamber. The supply of liquid to chamber 20 is so adjusted as to prevent the liquid body from overflowing and to provide that only the foam will escape. At the completion of the first operation, the oxidizing or other desired action may be still incomplete. The liquid is further oxidized any suitable number of

times, after which the thoroughly oxidized liquid is discharged into receptacle 37.

The main 30 terminates in a drain and seal 41 which discharges into receptacle 42.

In the embodiment of my invention herein shown, I have assumed a case in which a solution is subjected to the action of air for oxidizing, and hence have not shown any recovery of the excess gas. Where gas, such as SO_2, for example, is employed, it will be understood that the operation is carried on in a closed chamber or that the space over the frothing chambers and drain platforms is inclosed, from which the excess gas may be recovered.

I claim:

1. The method of producing chemical action between a gas and a liquid, which comprises introducing into the liquid a gas which is chemically active with respect thereto, to produce a foam, and discharging only the foam therefrom as the product.

2. The method of oxidizing liquids which comprises introducing an oxidizing gas into an oxidizable liquid to produce a foam, separating the foam from the remaining liquid, and recovering the foam as the oxidized product.

3. The method of producing chemical action between a liquid and a gas which comprises introducing a liquid into a frothing chamber, introducing into said liquid a gas chemically active with respect thereto to produce a foam, regulating the supply of liquid to said frothing chamber to cause only the foam to escape therefrom, and recovering the foam as a product.

4. The method of producing chemical action between a liquid and a gas which comprises introducing into the liquid a gas which is chemically active with respect thereto to produce a foam, discharging only the foam therefrom, re-liquefying the foam, subjecting the re-liquefied foam to a further frothing operation by means of the chemically active gas, and recovering the froth from the re-liquefied foam only as a product.

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