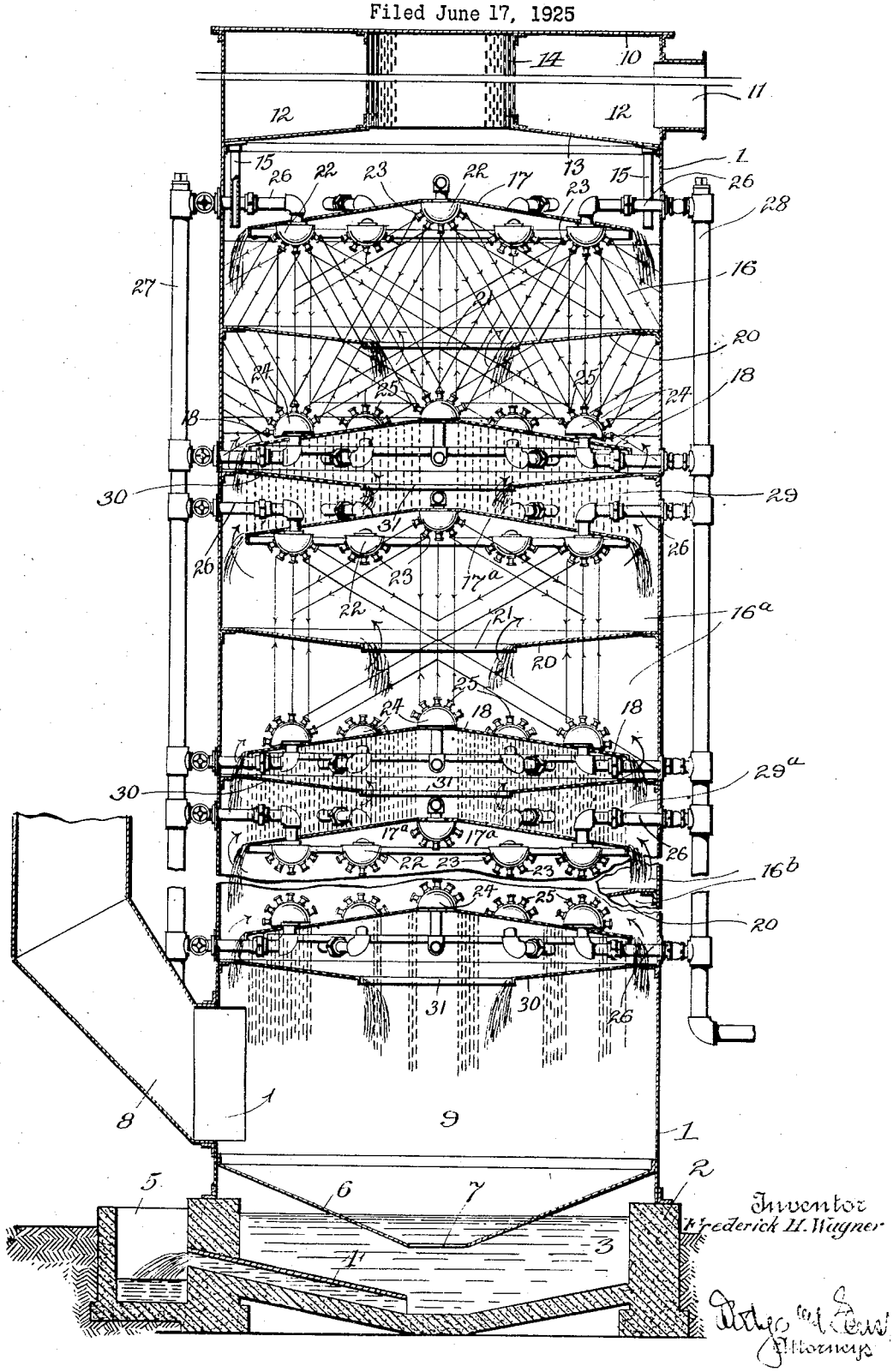
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F. H. WAGNER

LIQUID AND GAS CONTACT APPARATUS

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Inventor
Frederick H. Wagner

Attorneys

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FREDERICK H. WAGNER, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE BARTLETT HAYWARD COMPANY, OF BALTIMORE, MARYLAND, A CORPORATION OF MARYLAND.

LIQUID AND GAS CONTACT APPARATUS.

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This invention pertains to an improved liquid and gas contact apparatus and is of the type generally denominated as a "scrubber". The main object of the invention is to produce a scrubber characterized by the absence of any moving parts and wherein the gas and liquid in the form of rain and spray are brought into intimate contact as they pass through the apparatus in counterflow.

A further object of the invention resides in the positioning of the spray heads and nozzles so that the streams passing from the nozzles will intersect or cross each other, thus preventing the formation of any voids or pockets in the chambers into which the nozzles discharge, thereby precluding the passage of gas through such chambers without the same coming into intimate contact with the liquid in sprayed form.

A further object resides in the provision of a series of alternate intercommunicating spray and rain producing chambers, the liquid after having been sprayed passing in the form of rain from the spray chamber into what may be termed a rain chamber. The arrangement of the chambers is such that the gas is caused to travel in a circuitous path through the apparatus and to pass through the rain and spray at an angle.

With these and other objects and advantages in view, as will hereinafter appear, reference will be had to the annexed drawing, wherein a preferred embodiment of the invention is shown in vertical sectional elevation.

In said figure, 1 denotes the casing, preferably cylindrical in cross-section, mounted upon a suitable foundation 2 in which is formed a sump 3. Said sump is provided with a take-off 4 delivering into a well or conduit 5 from which the liquid may be withdrawn and returned to the spray nozzle or sent to waste.

The bottom 6 takes the form of an inverted cone provided with a central discharge opening 7, said opening being submerged in the liquid in the sump to prevent outflow of gas therethrough. A gas inlet 8, designed to receive the gas under pressure opens into the lower portion of the casing or into what may be denominated the lowest rain chamber designated by 9. The casing is closed at its upper end by any suitable means as a plate 10, and a lateral gas discharge port 11 is provided, the latter opening into a chamber 12. The lower wall 13 of said chamber inclines downwardly from a central opening formed therein, and suitable means, such for instance as a series of perforate plates 14, extend upwardly from the wall 13 to the cover plate 10, is provided for eliminating any entrained liquid which is carried by the gas as it passes to port 11. Suitable drain pipes 15 extend downwardly from chamber 12 to the chamber next below.

Arranged within the casing between the lowermost rain chamber 9 and the eliminator chamber 12 is a series of spray and rain chambers arranged in alternation. Any number of said chambers may be provided as is found necessary or desirable for the particular work or operation being undertaken.

In the embodiment illustrated the uppermost spray chamber is designated generally by 16 and may be said to be defined by an upper convex or inclined plate 17 and a lower similarly formed plate 18, the latter being perforated. As will be seen, these plates are spaced away from the casing 1 at their edges so that the gas being forced or drawn through the casing may pass around their edges. To prevent direct upward flow a diaphragm or deflector plate 20 is provided. Said plate is provided with a central opening 21 from which it extends outwardly and upwardly, the outer edge of the plate extending to the casing to which it is secured in any suitable manner.

A series of spray heads 22 each having a series of nozzles 23 extending therefrom are removably mounted beneath plate 17 and a similar series of heads 24 having nozzles 25 are located above the perforate plate 18. Pipes, as 26, extend from the heads to pressure lines 27 and 28. The heads and nozzles are of such number and are so arranged that the streams emanating therefrom intersect and disrupt each other and completely fill the chamber 16 both above and below the diaphragm 20; in fact the entire chamber becomes filled with a fog or mist.

As above noted, any number of chambers may be employed and two other spray cham-

bers 16^a and 16^b are illustrated. Located between chambers 16 and 16^a, and between chambers 16^a and 16^b are other chambers which, like chamber 9 which underlies 16^b, may be denominated rain chambers. The uppermost rain chamber is denoted generally by 29 and that immediately below 16^a by 29^a. Perforate plate or diaphragm 18 forms the top of chamber 29 and an imperforate plate 17^a, slightly convex, forms the bottom of the chamber. Plate 17^a like plate 18 terminates short of the wall of the casing and likewise forms the top of the spray chamber 16^a. A dished diaphragm 30 extends inwardly from the wall of the casing dividing chamber 29 into an upper and a lower portion. Said diaphragm is perforated throughout and preferably provided with a relatively large central discharge opening 31. Each of the other "rain" chambers is similarly formed except the lowermost one, 9, wherein the bottom plate 6 takes the place of the convex plate 17^a.

It will thus be seen that there is provided throughout the height of the casing a series of spray and rain chambers arranged in alternation and that by reason of the fact that the diaphragms or cross partitions as 20 and 30, extend to the wall of the casing while the top and bottom elements of said chamber are spaced inwardly therefrom, the gas takes a tortuous or circuitous path in passing through the apparatus.

In chamber 16 I have sought by the arrowed lines to depict the action of the nozzles and sprays and to show how said sprays counterflow and intersect and completely fill the entire chamber. A few of such lines are shown in 16^a and have been entirely omitted in 16^b for the sake of clearness.

The rain or rain of drops of the liquid is shown in chambers 29 and 29^a, and partially shown in chamber 9. The openings in the perforate plates and diaphragms must be made more numerous or larger in the lowermost portion of the apparatus to take care of the increasing volume of liquid which is present therein.

It is thought that the operation of the apparatus will be clear from the foregoing description but it may be briefly summarized as follows:

Assuming that a gas is to be washed with water, the gas is forced in through conduit 8 and the water passes under pressure from the supply mains 27 and 28 to the various spray heads and nozzles 23. The spray immediately fills the chambers 16, 16^a and 16^b and the water therefrom passes into the rain chambers 29, 29^a and 9, the water being broken up into drops or fine streams as it passes through the perforations in the top plates of such chambers (the bottom plates of the spray chambers) and the perforations in the diaphragms. The water from the rain chamber passes over the edge of the bottom plate, say 17^a, of the rain chamber and falls in a curtain or sheet into the upper portion of the spray chamber immediately below, striking the diaphragm 20 and running to the central discharge opening. Here it drops down through the central opening 21 onto the perforate plate 18 where it is again subdivided into rain.

The gas in entering at 8 comes into contact with the rain in chamber 9 thence into and through the spray chamber 16^b, thence upwardly through the apparatus through the alternate rain and spray chambers. Any entrained moisture will be removed from the gas by the eliminator located in chamber 12 and returned to the apparatus through pipes 15.

From the foregoing it will be seen that an intimate and prolonged contact is had between the gas and liquid and the liquid is presented to the gas in a dispersed condition. Moreover, the gas is caused in the main to pass through the liquid in a counter-current direction and at an angle to the flow of the latter.

The inclination of the various plates and diaphragms is such that any dust or foreign matter washed from the gas will be washed off the plates or diaphragms, thus keeping the same clear and the openings therein unobstructed.

What is claimed is:

1. In an apparatus of the character specified, the combination of a casing provided with ports for the inflow and outflow of gas; a series of intercommunicating chambers formed therein; means for producing a series of interspersed counter-flowing jets of liquid in at least one of said chambers; and means for causing the liquid thus sprayed to pass into the chamber next below in a subdivided condition.

2. In an apparatus of the character specified, the combination of a casing provided with ports for the inflow and outflow of gas; a spray chamber located therein, said chamber being defined by an upper plate and a lower perforate plate, said plates being spaced away from the casing at their edges; a series of nozzles projecting downwardly from the under face of the upper plate; and a second series of nozzles projecting upwardly from the upper side of the lower plate, the nozzles being so disposed and arranged as to produce numerous intersecting streams or sprays of liquid within the spray chamber.

3. In an apparatus of the character specified, the combination of a casing provided with ports for the inflow and outflow of gas; a spray chamber located therein, said chamber being defined by an upper convex plate and a lower perforate convex plate, said plates being spaced away from the casing at their

edges; a diaphragm located within the space between said plates, the diaphragm being provided with a central opening and extending to the walls of the casing; a series of nozzles projecting downwardly from the under face of the upper plate, and a second series of nozzles projecting upwardly from the upper side of the lower perforate plate, the nozzles being so disposed and arranged as to produce numerous intersecting streams or sprays of liquid within the spray chamber.

4. In an apparatus of the character specified, the combination of a casing provided with ports for the inflow and outflow of gas; a series of intercommunicating chambers formed therein; means for producing a series of interspersed jets of liquid in at least one of said chambers; means for causing the liquid thus sprayed to pass into the chamber next below in a subdivided condition; and a perforate diaphragm extending transversely of the last named chamber, said diaphragm being concave in outline and provided with a relatively large central discharge opening.

5. In an apparatus of the character specified, the combination of a casing provided at its lower end with a gas inlet port and with a gas exhaust port at its upper end; a series of intercommunicating chambers located within the casing, each succeeding pair of chambers being formed by an upper convex plate, the edges whereof are spaced from the wall of the casing, a diaphragm extending from the wall of the casing, said diaphragm being dished and provided with a central opening, a convex perforated plate, the edges whereof are spaced away from the wall, and a perforated concave diaphragm extending inwardly from the walls of the casing and provided with a relatively large central discharge opening; a series of spray producing nozzles extending downwardly from the under side of the first-mentioned plate; a second series of nozzles extending upwardly from the upper face of the convex perforated plate; and liquid pressure lines connected to said nozzles.

6. In an apparatus of the character specified, the combination of a casing provided with ports for the inflow and outflow of gas; a series of intercommunicating chambers located within the casing, said chambers being defined by upper and lower walls; at least one baffle located in each of said chambers to cause the gas to take a circuitous path therethrough; means located within certain of said chambers for producing a series of interspersed, counterflowing jets of liquids therein; and means for causing the liquid thus sprayed to pass into the next adjacent chamber in a subdivided condition.

In testimony whereof I have signed my name to this specification.

FREDERICK H. WAGNER.