

March 24, 1925.

1,531,112

F. E. LICHTENTHAELER

ABSORPTION APPARATUS

Filed May 28, 1921

Fig. 1.

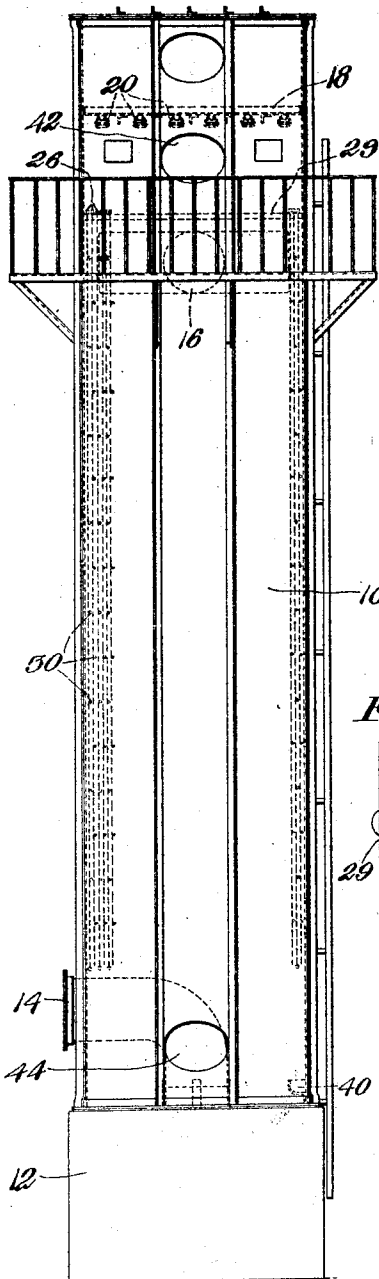


Fig. 2.

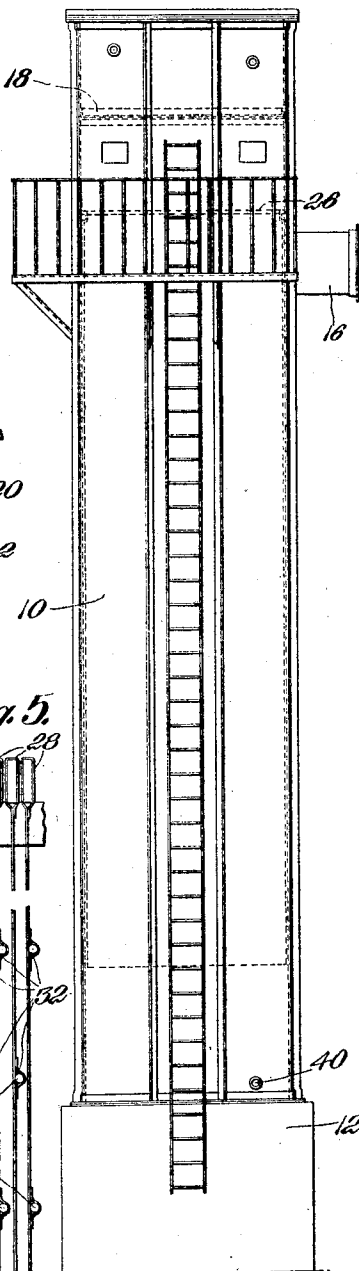


Fig. 3.

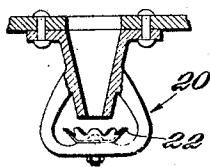


Fig. 4.

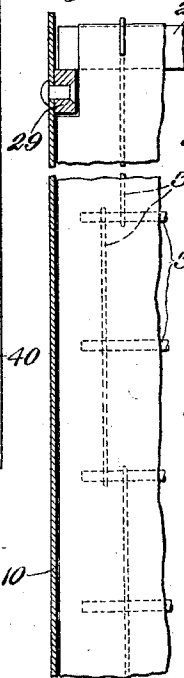
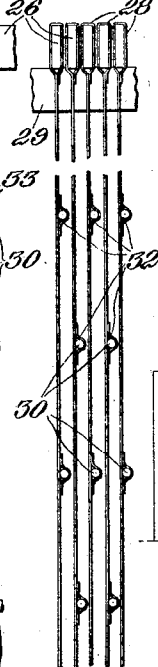


Fig. 5.



Witness:

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UNITED STATES PATENT OFFICE.

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ABSORPTION APPARATUS.

Application filed May 28, 1921. Serial No. 473,432.

To all whom it may concern:

Be it known that I, FRANK EDWARD LICHTENTHAELER, a citizen of the United States, residing at Newton Highlands, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Absorption Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an apparatus for affording contact between a liquid and a gas.

Apparatus for affording contact between liquids and gases are known by various names, such as scrubbers, absorbers or washers, depending upon the ultimate purpose sought to be attained by bringing gases and liquids into contact with one another. For example, it is oftentimes necessary to remove certain valuable products from gases; or to absorb a gas in a liquid; or to free the gas from an undesirable constituent which can be dissolved out by a liquid and the apparatus used for these purposes was successively designated as a scrubber, absorber or a washer.

Heretofore, various types of apparatus have been proposed for affording contact between liquids and gases. The most efficient of such prior apparatus comprises the cap and seal towers in which the gas is made to bubble through liquid entrapped on horizontal trays or decks. While apparatus of this type affords efficient contact between the gas and liquid, it has, however, the inherent disadvantage of back pressure opposing the flow of the gas. When large volumes of gas are to be treated, this type of apparatus is unsuitable for use because of the necessity of raising the pressure of the large volume of gas to a point such that it may overcome the opposing back pressure of the cap and seal tower. It is obvious that the power consumed and expense incurred in boosting the pressure of a large volume of gas in this manner is such as to render the apparatus uneconomical for use in such instances. Other types of prior contact apparatus have included "hurdle" towers in which wooden slats are piled in stacks within the towers. The liquid is supplied to the top of the tower and flows rapidly by gravity downwardly

over the wooden hurdles. Instead of the wooden hurdles other filling material has been used such as coke, broken quartz, clay balls or cylinders, and various other shapes specially prepared to increase the contact surface. The chief disadvantage of these prior constructions having the wooden hurdles or other filling material, resides in the tendency of the liquid to channel as it is passing downwardly through the tower. The tendency of a body of liquid in striking a wooden board is to converge into a single stream during its flow across the surface of the board thereby wetting the board only in a more or less funnel shaped path. Obviously this leaves a large portion of the surface of the board dry. This phenomenon is referred to as channeling. In practice it has been found that in order to overcome the channeling effect large quantities of liquid must be supplied to the top of the tower, and if supplied in sufficient volume will maintain the surfaces of the hurdles or other filling material fairly wet as it falls rapidly through the tower. The deluge of water or other liquid which must be continually supplied to the tower in order to secure efficient absorption or contact between the liquid and the gas detracts from the practicability of these towers for handling large volumes of gas. Furthermore, the filling material itself occupies a relatively large proportion of the space within the tower. For example, in the ordinary hurdle tower, the contact surface comprises only approximately eleven square feet per cubic foot of tower, while coke and other filled towers approximate only seven square feet per cubic foot of tower. It is therefore obvious that in order to afford the desired area of contact the towers themselves must be proportionately larger and correspondingly more expensive as the volume of gas to be treated increases. As the size of the tower is increased the difficulty of distributing the absorbing liquor also increases. In addition to the foregoing types of apparatus, there are the mechanically operated absorbers such as the horizontal Feld type having revolving brooms wet with the absorbing liquor, and other types depending upon centrifugal action to form liquid spray throughout the gas stream. The chief disadvantage with these mechanically operated absorbers resides in the continu-

ous power consumption required and in the difficulty of maintaining them in continuous operation.

The present invention has for an object to provide an apparatus for affording efficient contact between a liquid and a gas, which is of simple construction and in which all of the disadvantages inherent in existing types of such apparatus are eliminated.

The invention consists in the apparatus hereinafter described and particularly defined in the claims.

Referring to the drawing illustrating the preferred embodiment of the invention Figs. 1 and 2 represent side and end elevations respectively, of the improved apparatus; Fig. 3 is a sectional detail of one of the liquid spray nozzles; Figs. 4 and 5 are details showing a portion of the curtains of fibrous material within the tower and the manner of their suspension.

The improved apparatus comprises in general a contact chamber within which the liquid and gas are brought into contact. Provision is made for supplying liquid at the desired rate to one portion of the contact chamber and for supplying the gas to another portion thereof. Within the contact chamber a body of fibrous material, preferably in the form of curtain fabric, is positioned so that the liquid in passing through the contact chamber falls thereon. The flow of the liquid is retarded by the fibrous material and the latter is thoroughly wet because of its capillary action upon the liquid. The fabric is arranged to present a minimum restriction to the passage of the gas through the contact chamber and in a manner such that the gas is brought into contact with the liquid upon the surface of the fabric. Because of the effect of the fabric in retarding the flow of the liquid, the duration of contact between the liquid and gas is increased to an extent such that relatively small quantities of liquid supplied to the apparatus will serve to efficiently treat relatively large volumes of gas. Furthermore because of the character of the fabric an increased area of contact per cubic foot of space is secured, so that apparatus of relatively small proportions may be employed to treat relatively large volumes of gas.

The apparatus illustrated in the drawing is described as follows: An elongated casing 10 is suitably mounted upon a base 12 and is provided with an inlet 14 for the gas to be treated at near the bottom of the casing and also with an outlet 16 near the upper portion of the casing by which the treated gases may pass therefrom. The liquid to be supplied to the casing is pumped into a reservoir 18 mounted in the upper portion thereof, and is distributed uniformly in regulated amounts by a plurality of spray noz-

zles 20. Each spray nozzle 20 has a tapered opening as shown in Fig. 3 through which the liquid flows and the desired spray is secured by a baffle member 22.

In order to control the flow of the liquid downwardly through the apparatus a series of curtains of fabric such as common burlap, are suspended by cross members 26 extended through hems 28 in the upper ends of each curtain. The cross members 26 rest at their opposite ends upon brackets 29 secured to the walls of the casing, as shown in detail in Figs. 4 and 5. The curtains are preferably hung from one-half to three-eighths of an inch apart so that the gas passing upwardly between adjacent curtains is forced into intimate contact with the liquid retained by capillarity upon the curtain surfaces. The curtains may be stiffened laterally by means of rods 30 inserted in loops 32, as shown in Fig. 5, and the rods of adjacent curtains are preferably staggered with relation to one another so that the gas in passing around any particular rod may cause the next adjacent curtain to bulge or give way so that only very slight pressure of the gas is required to cause its passage upwardly between each curtain. The supporting rods 30 also operate as baffle members to cause the deflection of the gas onto the surface of the opposing curtain thereby increasing the contact between the gas and the liquid upon the curtain, and in some instances the gas may even be forced through the curtain depending upon the texture of the same. To assist in the suspension of the curtains, the rods 30 may be suspended by wires 33 from the cross members 26 as shown in Fig. 4.

The liquid as it is sprayed over the top of the curtains runs down between the supporting bars, spreading across the entire width of the curtains due to the capillary action of the fibrous material of the curtains upon the liquid. As the liquid on the curtains flows downwardly this capillary action causes a uniform flow across the entire width of the curtain, and serves to retard the rate of flow of the liquid and to increase the duration of contact between the gas and the same. The rate of flow of the liquid is in fact rendered nearly independent of gravity and depends almost entirely upon the quantity of liquid initially sprayed from the liquid reservoir. If an increased flow is desired the rate of flow thereof from the reservoir is increased and vice versa. In this respect therefore the relative proportion of the liquid to the gas may be nicely adjusted at the will of the operator which in itself constitutes a great advantage over the commonly used hurdle or filled tower in which a deluge of liquid is required to insure a more or less complete wetting of the surfaces of the filling material. The liquid flowing downwardly through and over the curtains

counter-current to the ascending gas becomes more and more concentrated in respect to the materials absorbed from the gas and finally collects in the bottom of the casing from which it is drawn through a suitable trap 40 of any desired construction.

Manholes 42, 44 are provided in the upper and lower portions of the casing 10 to afford access to the interior thereof so that the curtains may be conveniently suspended or replaced.

Having thus described the invention, what is claimed is:—

1. An apparatus for affording contact between a liquid and a gas, comprising a contact chamber, a plurality of curtains of fibrous material suspended vertically within the contact chamber, a plurality of reinforcing members for the curtains arranged to act as baffle members to deflect the gas in its

passage upwardly between the curtains, means for distributing a liquid above the curtains, and means for supplying a gas to a place beneath the curtains to permit it to pass upwardly between the same.

2. An apparatus for affording contact between a liquid and a gas, comprising a contact chamber, a plurality of curtains suspended in the chamber, each curtain consisting of a sheet of fibrous material supported from a cross-member and provided with transverse stiffener rods at intervals of its length to hold the curtains flat, suspension wires for connecting the stiffeners and cross-members, and spraying means at the top of the chamber for distributing the liquid on the curtains, said chamber being provided with openings at the bottom and top of the chamber for induction and eduction of gas.

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