June 24, 1941. F. P. BINGMAN 2,247,285

GAS CLEANER

Filed Nov. 2, 1938 2 Sheets-Sheet 1

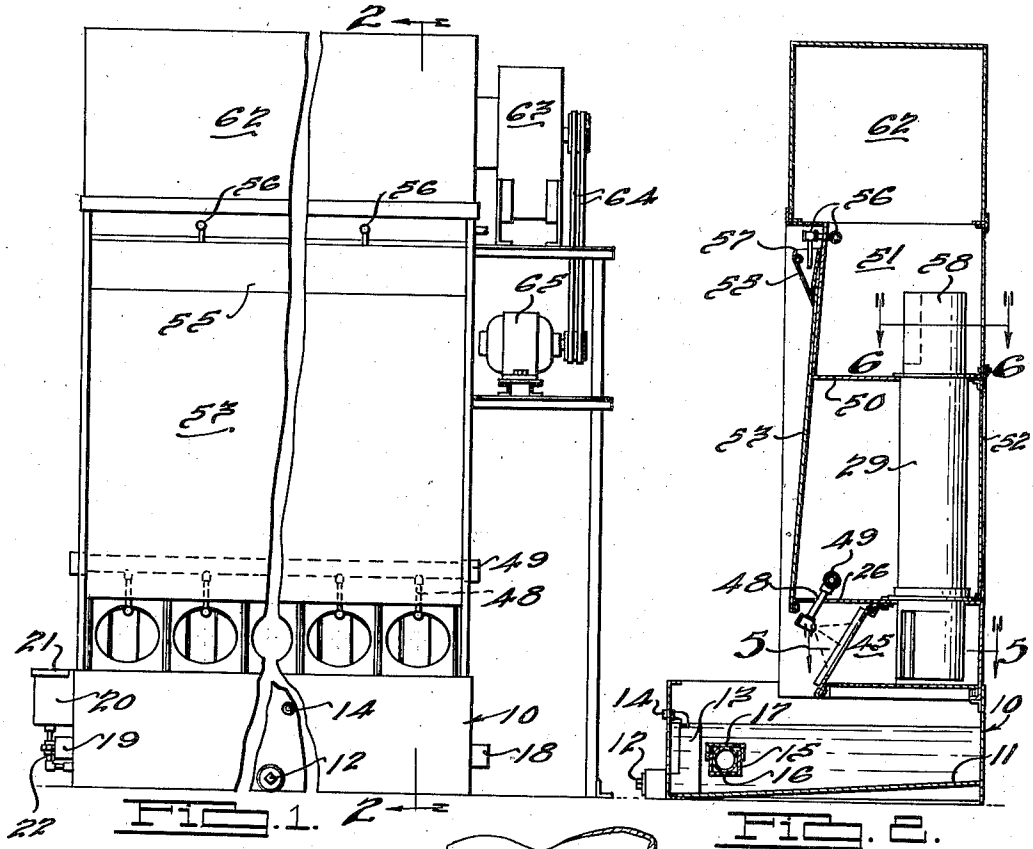

Fig. 1.

Fig. 2.

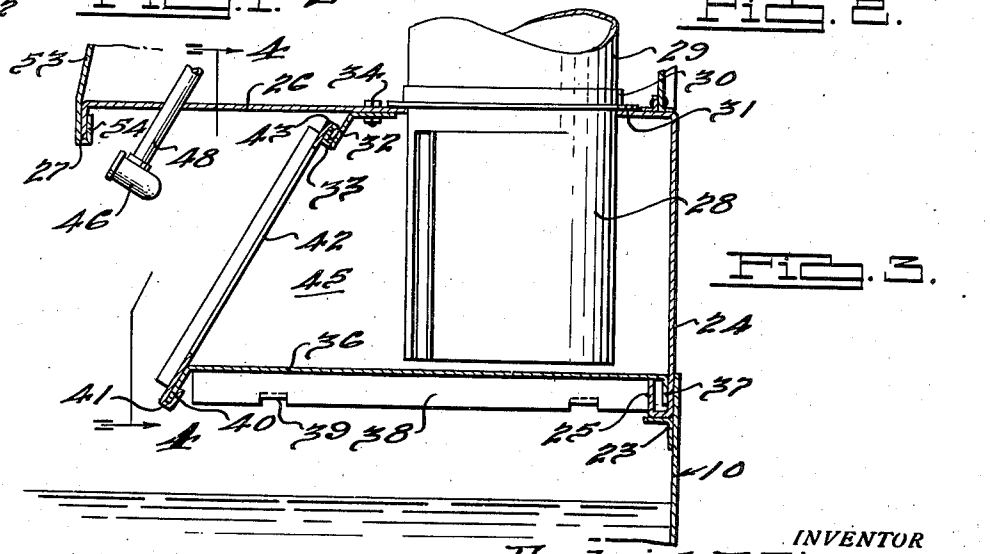

Fig. 3.

INVENTOR
Frederick P. Bingman
BY
Harness, Dickey & Pierce.
ATTORNEYS.

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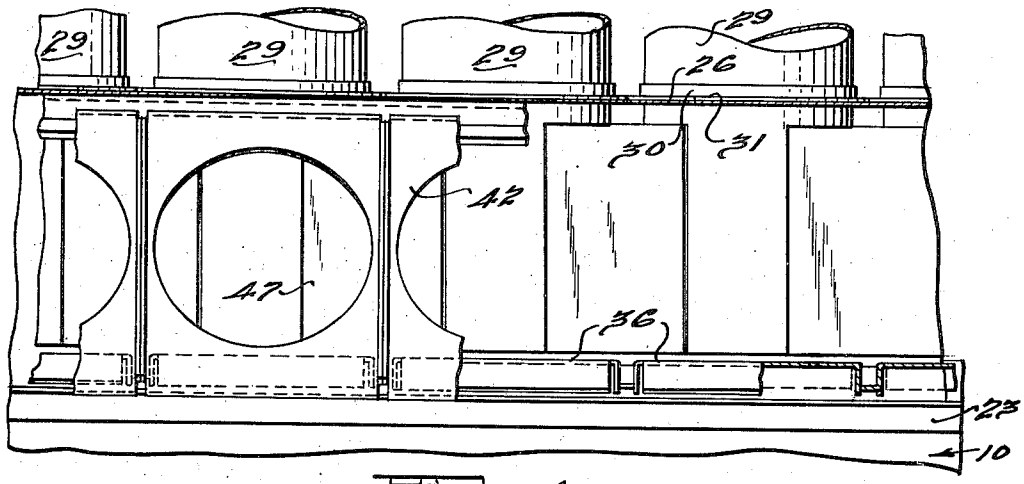

Fig. 4.

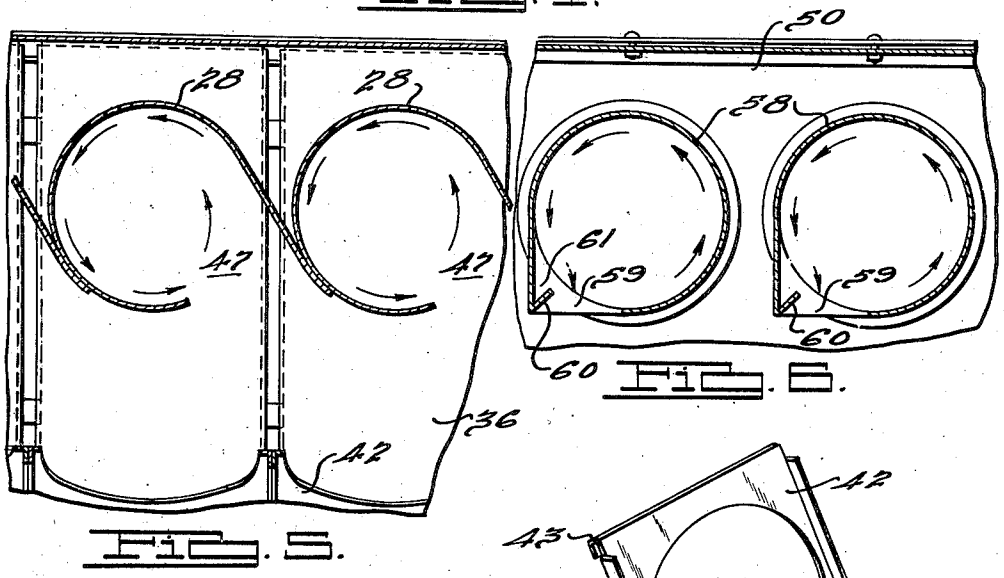

Fig. 5.

Fig. 6.

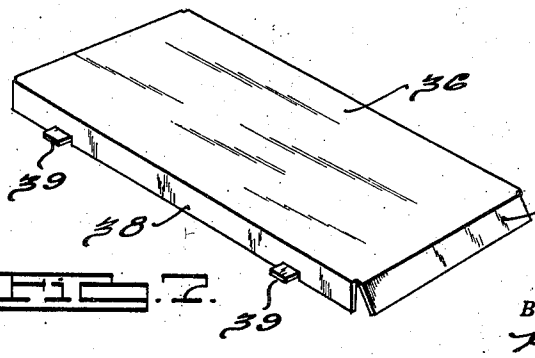

Fig. 7.

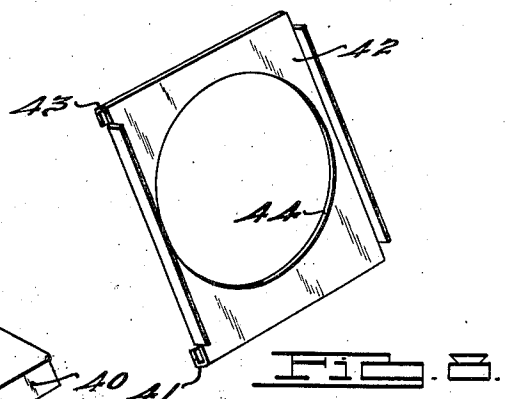

Fig. 8.

INVENTOR
Frederick P. Bingman.
BY
Harness, Dickey & Pierce.
ATTORNEYS.

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UNITED STATES PATENT OFFICE

2,247,285

GAS CLEANER

Frederick P. Bingman, Birmingham, Mich., assignor to R. C. Mahon Company, Detroit, Mich., a corporation of Michigan

Application November 2, 1938, Serial No. 238,447

2 Claims. (Cl. 183—22)

This invention relates to gas cleaners of the type in which a liquid is mixed with the gas to be cleaned so as to wash the impurities from the gas, and then the liquid is eliminated with the impurities therein.

The main objects of this invention are to provide an improved gas cleaner in which a liquid is introduced into the gas to be cleaned, and thereafter the liquid and impurities separated from the gas by centrifugal force; to provide a gas cleaner of this character in which the action of the liquid eliminator is entirely independent of the height of liquid level in the drain tank; to provide a gas cleaner in which various parts thereof are detachably attached so as to be readily disassembled for cleaning and inspection, and to provide a gas cleaner of simple construction with large capacity and having exceptionally good efficiency.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which:

Fig. 1 is a broken view in front elevation of a complete unit.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1, looking in the direction indicated by the arrows.

Fig. 3 is an enlarged, fragmentary, transverse, sectional view showing the lower end of one eliminator tube, its relation to its drain plate, and the surrounding walls.

Fig. 4 is a fragmentary view partly in elevation and partly in section taken along the line 4—4 of Fig. 3 looking in the direction indicated by the arrows.

Fig. 5 is an enlarged, fragmentary, sectional view taken along the line 5—5 of Fig. 2, looking in the direction indicated by the arrows.

Fig. 6 is an enlarged, fragmentary, sectional view taken along the line 6—6 of Fig. 2, looking in the direction indicated by the arrows.

Fig. 7 is a view in perspective of one of the drain plates, and showing the spacing lugs which maintain the plate in spaced relation to an adjacent drain plate.

Fig. 8 is a view in perspective of a front side wall plate showing the inlet orifice therethrough, and the arrangement of the marginal edge flanges.

The present invention is of the same general character as that shown in applicant's copending application, Serial Number 177,960, filed December 3, 1937, which has matured into Patent No. 2,191,187, Feb. 20, 1940, and assigned to the assignee of this application.

In the construction illustrated in applicant's above referred to copending application, it has been found that under certain conditions paint and the like floating on the top of the water, is drawn into the bottom of the eliminator tubes, and the high velocity of the air or gas being cleaned tends to draw this accumulated material and the liquid in the tank, up into the eliminator tube due to the submergence of the lower end of the tube in the tank liquid. Where the conditions of volume and velocity will cause such a difficulty, it is found that the condition could, to some extent, be remedied by lowering the liquid level so as to be in closely spaced relation to the open lower end of the eliminating tube.

It is difficult, however, and well nigh impossible to maintain the liquid level at exactly the height desired, and even when this is done, under some conditions the liquid from the tank has a tendency to be drawn upwardly into the eliminator tubes.

In the present invention this difficulty has been entirely overcome, and the apparatus will function satisfactorily under all conditions regardless of volume, velocity, or the nature of the gas or liquid being operated upon.

In the construction shown in the drawings, a liquid sludge tank, generally designated 10, of shallow depth and generally rectangular in shape, is shown provided with a forwardly sloping bottom 11, and a drain connection 12 located at the front of the tank at its lowermost point. The drain connection 12, on the inner side, comprises an adjustable elbow 13, which can be swung to various positions for draining the liquid from the top of the tank and thus prevent the sludge in the bottom from going into the sewer lines. A telltale coupling 14 is welded into the front wall of the tank above the normal water line so that if the liquid level within the tank becomes too high, the liquid will drip or run from the telltale coupling and thereby indicate that necessary adjustments be made to maintain a proper liquid level within the sludge tank.

The tank is also provided with a pump suction box 15 extending the entire length thereof and built integrally therewith. A slotted opening 16 is provided along the entire length of the bottom, and a removable cover 17 is provided for giving access to the inlet slot 16. The ends of the box terminate in liquid circulating pump couplings 18 and 19 which protrude from opposite ends of the tank so that the liquid circulating pump may be connected at either point.

A float box 20, having a removable cover 21, is provided on one end of the tank and is connected to a source of liquid, such as fresh water.

for making up that which is needed to maintain the proper liquid level within the sludge tank. A fresh supply of water or other liquid enters the sludge tank 10 from the float box 20 through suitable pipe connections 22 which also serve to equalize the liquid levels in both the float box and sludge tank. The float box 20 may be bolted to the side of the sludge tank at any convenient place.

The rear wall of the sludge tank 10, adjacent the upper edge thereof, is provided with an angle bar 23, one flange of which is welded or otherwise suitably secured to the vertical wall of the tank, and the other flange thereof extends horizontally in a position to support the lower edge of a vertically disposed rear side wall 24 of sheet metal. The lower edge of the wall 24 is formed in U-shape, as shown at 25, and the bottom of the U rests upon the horizontal flange of the angle 23.

The upper edge of the rear wall 24 is bent at right angles to form a substantially horizontally disposed wall 26 extending forwardly from the rear wall 24, and the front marginal edge of which is turned down at right angles to provide a flange 27. The horizontal wall 26 is provided with an opening therethrough for receiving the lower end 28 of a vertically disposed eliminator tube 29 of circular cross section, the tube 29 being provided with a collar 30 having a radially extending flange 31 which rests upon the top surface of the horizontal wall 26 around the marginal edge of the opening therethrough. The collar 30 is welded, riveted, or otherwise suitably secured to the eliminator tube 29 so as to be rigid therewith.

The underside of the horizontal wall 26, forwardly of the eliminator tube 29, is provided with a depending angle bar 32 having a downwardly and forwardly extending flange which is reversely bent, as shown at 33. The other flange of the angle bar 32 is secured to the wall 36 by bolts 34, or the like.

The free upstanding leg of the U-shaped portion 25 of rear wall 24 supports one end of a plurality of substantially horizontally disposed, rectangular drain plates 36 by receiving a downwardly turned flange 37 formed at the rear edge of each of the drain plates. The drain plates 36 are in closely spaced relation to the open lower end 28 of the eliminator tubes and the spacing is such that liquid eliminated within the tubes may drain out over the top surface of the plates while at the same time the plates are sufficiently close to prevent any substantial volume of air from entering the tubes through the lower ends thereof. The side edges of the drain plates 36 are provided with downwardly extending flanges 38 for stiffening the plates, and one of these flanges is slit at two different points to provide spacing tabs 39 which are bent out at right angles to the flange in position to abut against the depending side flange of the next adjacent drain plate. The tabs 39 maintain the plates in definitely spaced relation to each other for permitting liquid draining onto the plates to pass down around the sides thereof into the tank 10.

The front end of each of the drain plates is provided with a downwardly and forwardly extending flange 40 which is adapted to be embraced by a U-shaped flange 41 formed on the bottom edge of upwardly and rearwardly inclined front wall plates 42. The upper edges of the plates 42 are also provided with inverted U-shaped flanges 43 which embrace the free edge flange of the U-shaped portion 33 of angle bar 32. The arrangement is such that the front plates, being hooked over the upstanding flange of angle bar 32, will thereby support the front ends of the drain plates 36 when the front flange 40 thereof is engaged with the U-shaped flange 41, and these plates may be readily disassembled and removed for inspection or cleaning purposes.

Each of the front plates 42 is provided with an orifice 44 through which the gas to be cleaned enters a compartment 45 which is formed by the front wall 42, the rear wall 24, the top wall 26, and the drain plates 36. A spray nozzle 46 is located in front of each of the orifices 44 for spraying a liquid into the gas or air as it passes through the orifices into the chamber 45.

The lower ends 28 of each of the eliminator tubes which is embraced within the chamber 45 are provided with tangential inlet openings 47, as shown most clearly in Fig. 5 of the drawings, and which cause gas and liquid entering therein to be swirled about within the eliminator tube so that as it travels upwardly it will travel in a helical path with sufficient rotation to cause the liquid to be eliminated from the gas by centrifugal force, the eliminated liquid then traveling downwardly in a thin film on the inner walls of the eliminator tubes and draining from the open lower ends thereof onto the drain plates 36.

The spray nozzles 46 are each connected through branch pipes 48 to a header 49 to which liquid under pressure is supplied. The header 49 may be located above the horizontal wall 26 with the branch pipes 48 extending downwardly and forwardly through suitable apertures formed therein.

The eliminator tubes 29 extend upwardly a suitable distance, and the upper ends thereof pass through openings formed in and are supported by a horizontally disposed wall 50 which forms the bottom wall of an outlet chamber 51. A back wall 52 extends upwardly from the rear wall 24, and is removably secured so that access may be had readily to the tubes 29.

An inclined front wall 53, in the form of a flood sheet extends from the front edge of the horizontal wall 26 to which it is detachably attached by a U-shaped flange 54 which embraces the flange 27, and this wall also extends upwardly beyond the wall 50 to overlap the front wall of the outlet chamber 51.

A gutter or trough 55 is provided along the upper edge of the flood sheet 53, and liquid is supplied thereto through suitable pipe connections 56, the liquid in the trough overflowing the rounded front edge 57 of the trough, and flowing down the face of the flood sheet in a relatively thin film.

The upper ends of the eliminator tubes 29, which communicate with the outlet chamber 51, may be provided with closed end caps 58, positioned in continuation and forming a part of the tubes 29, and which have tangential outlet openings 59, as shown most clearly in Fig. 6 of the drawings. The outer edges of the openings 59 are preferably provided with reversely bent flanges 60 which function to prevent any particles of liquid which may be traveling around the inner surface of the eliminator tubes from passing out through the discharge openings. When such liquid is caught by the flanges 60, it will drain downwardly and inwardly over the surface 61, and thence downwardly in the eliminator tubes.

The top of the chamber 51 is preferably open and communicates directly with an exhaust

chamber generally designated 62 to one end of which is connected an exhaust fan 63 driven through belts 64 by an electric motor 65 in the usual manner. Operation of the fan 63 causes flow of the gases through the apparatus in the customary way.

In the operation of this cleaner, liquid is introduced into the sludge tank 10 through the float chamber 20 and pipe connections 22. The liquid circulating pump, not shown, which is attached to the pump suction box at either 18 or 19 thereof is then started, and this pump supplies liquid to the pipe connections 56, 48 and 49, thus causing the trough 55 to fill up and overflow over the flood curtain 53, and at the same time create a spray of liquid at each of the inlet orifices 44. The motor 65 may also be started which will drive the exhaust fan 63 and thereby draw the air or gas to be cleaned into the orifices 44 at which point water or other liquid is introduced thereinto and thence into the eliminator tubes 29 through the tangential openings 47 from the intake chamber 45.

As the gas and liquid are drawn into the eliminator tubes through tangential openings, the flow is given a circular, swirling motion, and as it travels upwardly within the eliminator tubes will describe a helical path. The rotation or swirling of the gas and liquid within the tubes will cause the liquid to be separated from the gas by centrifugal force, the gas continuing upwardly and being discharged from the openings 59 in the caps 58 into the outlet chamber 51, while the liquid will travel downwardly in a thin film on the inner walls of the eliminator tubes 29.

The caps 58 with their discharge openings are not essential however to the successful operation of this apparatus, and in some instances a satisfactory operation of the apparatus has been secured without the use of these cap members.

From the discharge chamber 51 the separated air or gas passes into the exhaust chamber 62 and thence to the exhaust fan 63.

A unit of this character may be built of any desired length and have any desired number of eliminator tubes 29, the principle and the operation of the unit being the same regardless of the number of tubes, or the length or disposition of the unit.

The drain plates 36 are maintained in definitely spaced relation to each other by reason of the spacer tabs 39, and the liquid draining from the open lower ends of the eliminator tubes is allowed to readily drain off of the plates over the sides thereof and down into the sludge tank 10. In some instances, however, the sludge tank 10 is located remotely with respect to the remainder of the unit, and the drain plates 36 do not drain directly into the sludge tank.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit and substance of the invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. In a gas cleaner, a liquid tank, a substantially horizontally disposed drain plate supported by said tank in spaced relation above the liquid level thereof, a substantially vertically disposed eliminator tube having an open lower end in closely spaced relation above said drain plate, said tube having a tangential inlet opening adjacent the lower end thereof, walls forming a chamber surrounding said inlet opening, one of said walls having an orifice therethrough for entry of the gas to be cleaned, means for introducing a liquid into the gas to be cleaned, and means for moving the gas and liquid into the lower end of said tube mainly through said tangential opening, and upwardly in said tube, tangential walls adjacent said tangential opening for directing the gas and liquid in a helical path within said tube, whereby the liquid is eliminated from the gas by centrifugal force, and the eliminated liquid will drain from the lower end of said tube onto said drain plate and thence into said tank.

2. In a gas cleaner, a liquid tank, a substantially horizontally disposed drain plate supported by said tank in spaced relation above the liquid level thereof, a substantially vertically disposed eliminator tube having an open lower end in closely spaced relation above said drain plate, said tube having a tangential inlet opening adjacent the lower end thereof, walls forming a chamber surrounding said inlet opening, one of said walls having an orifice therethrough for entry of the gas to be cleaned, means for introducing a liquid into the gas to be cleaned as it passes through said wall orifice, and means for moving the gas and liquid into the lower end of said tube mainly through said tangential opening, and upwardly through said tube, tangential walls adjacent said tangential opening for directing the gas and liquid in a helical path within said tube, whereby the liquid is eliminated from the gas by centrifugal force, and the eliminated liquid will drain from the lower end of said tube onto said drain plate and thence into said tank.

FREDERICK P. BINGMAN.