United States Patent

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[54] SMOKE POLLUTION ELIMINATOR

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[51] **Int. Cl.**.....**B01d 47/10**

[58] **Field of Search**.....55/228, 227, 229, 257, 430, 55/431, 421; 261/3, 116 V, 116 S, 116 F, 116 G, 25, 77

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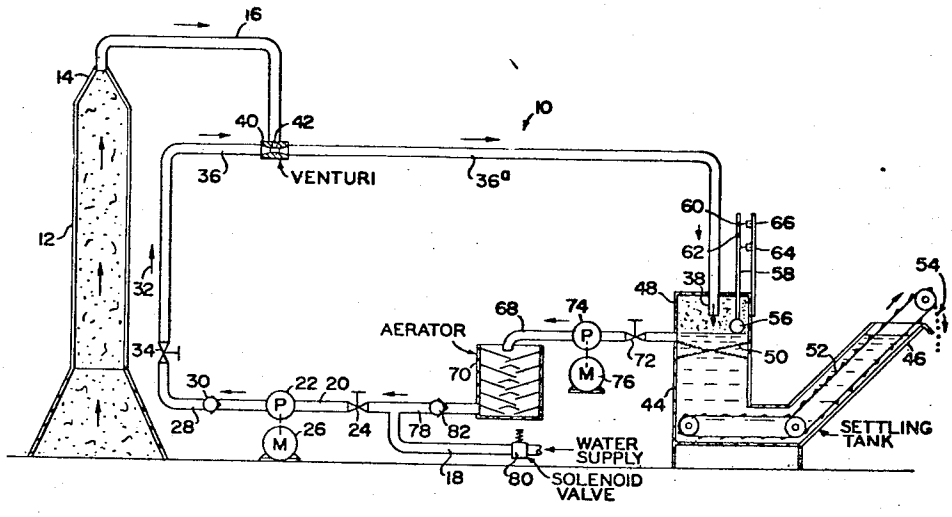
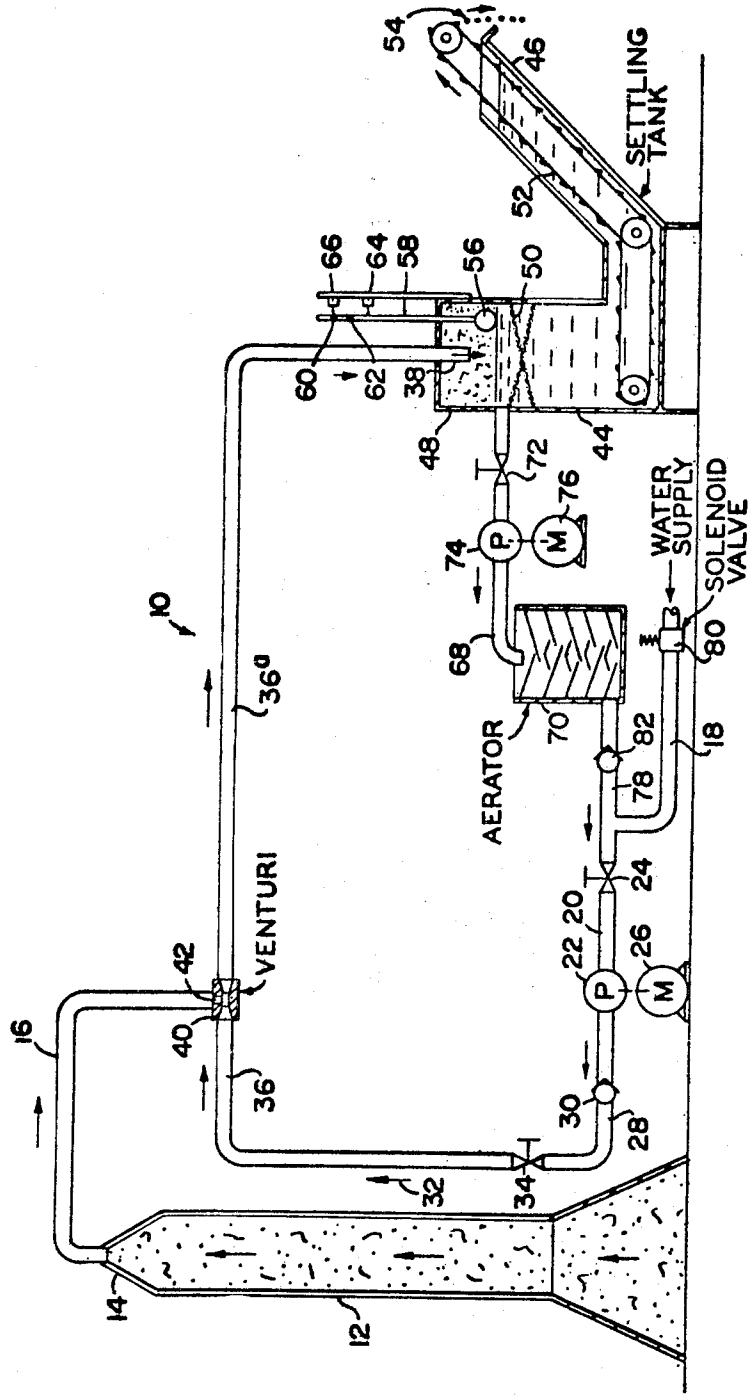
[57] **ABSTRACT**

The pollution eliminator is adapted for connection to the outlet of a chimney and includes a pump having a water supply connected thereto and an outlet pipe receiving a substantially full line pressure flow of water from the pump. Smoke means connect to the outlet pipe for introduction of smoke into the water filled line, a settling tank is connected to the outlet pipe to receive a smoke-water mixture therefrom, and an aerator receives water from the upper portion of the settling tank for ultimate return of water to the pump for closed system water circulation purposes.

6 Claims, 1 Drawing Figure

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WATER SUPPLY
SOLENOID VALVE
AERATOR
VENTURI
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SMOKE POLLUTION ELIMINATOR

The present invention relates to smoke pollution eliminators and especially to a substantially closed system wherein water is forced through a pipe under pressure and substantially fills the pipe at all times, and smoke is introduced into this water filled pipe for flow through a length thereof with the water and discharge into a settling tank. The system particularly contemplates an intimate and thorough mixture of smoke and associated particles with water in a line having pressure flow of water therein.

Heretofore there have been various types of smoke pollution eliminators proposed, and many of them have involved some type of passage of smoke and associated particles through a water tower wherein water is sprayed into the smoke for attempting to eliminate and participate dust particles in the smoke. Typical prior art structures include those shown in U.S. Pat. Nos. 1,103,304 and 2,653,674.

Heretofore it has been very difficult, if not impossible, to provide any relative inexpensive smoke elimination device that truly is operative for completely cleansing the smoke of dust and dirt particles initially contained therein. Also, it is desirable that these systems function automatically and at relatively low cost.

The general object of the present invention is to provide a novel and improved smoke pollution eliminator system characterized by the provision of a filled line having high pressure water flow therein and into which the smoke from a chimney exhaust means is deposited for intimate, turbulent, mixing action therewith.

Another object of the invention is to provide a substantially closed system wherein water can be recirculated in a smoke elimination system or apparatus and where additional water, as required, can be automatically supplied thereto.

Other objects of the invention are to provide a smoke eliminating or pollution eliminating system wherein water and smoke are brought into an intimate thorough mixture with each other, a volume of the water is permitted to settle and clarified water only is drawn from a settling tank for further flow through the smoke eliminator system; wherein the water having smoke and dirt particles therein is ultimately aerated and returned to the system for further flow therethrough; wherein any collection of dirt or solids in the settling tank can be eliminated as required; wherein any suitable pressures and flow rates can be used in the water system forming the main component of the smoke elimination system of the invention; and wherein check valve means and the like can be provided in a water circulating system of a substantially closed line type so that flow occurs therethrough in only one direction.

The foregoing and other objects and advantages of the invention will be made more apparent as the specification proceeds.

Attention now is particularly directed to the accompanying drawings, wherein the one FIGURE shown in a diagrammatic showing of the apparatus, partially broken away and shown in section, embodying the principles of the invention.

When referring to corresponding members shown in the drawing and referred to in the specification, corresponding numerals are used to facilitate comparison therebetween.

The present invention, as one embodiment thereof, relates to a smoke pollution eliminator system wherein a supply means is provided for connecting a chimney outlet to the system or apparatus which comprises a pump having a water supply connected thereto, an outlet pipe connected to the pump to receive a substantially full line flow of water therefrom, and where the smoke supply means connects to the outlet pipe spaced from the pump. A settling tank is present to receive the smoke-water mixture from the outlet pipe after a turbulent mixing action therein and an aerator is present to receive water from an upper portion of the settling tank to process the water to aid in oxygenating it again after which the water can be returned to the pump for recirculation through the system.

Reference now is had to the details of the apparatus shown in the drawing, and wherein a smoke pollution eliminator or

system is indicated as a whole by the numeral **10**. This smoke pollution eliminator **10** is adapted to be used in association with any conventional chimney **12**. The chimney **12** has an outlet end **14**, which may be of reduced diameter in relation to the remainder of the chimney and this outlet **14** connects to the system **10** by any suitable supply means or connector member **16**. The chimney **12** is of any known type and would be provided in association with any known combustion unit. In many instances, the chimney **12** is provided with a forced draft system and air and smoke are caused to flow by external power up into and through the chimney **12**, or it may be a straight gravity flow type in some instances, although the use of a pressure flow of gases into and through the chimney **12** is preferred.

The smoke pollution eliminator **10**, diagrammatically shown in the drawings, particularly includes a water supply line or pipe **18** that connects to any conventional water supply source (not shown) and with the water supply line connecting to an inlet line **20** for a water pump **22**. Preferably some type of a control gate valve **24** is present in the inlet line **20** for regulating water flow therethrough, as desired. The pump **24** has a conventional drive motor **26** connected thereto, and this motor **26** could be, for example, of approximately 40 horsepower and adapted to drive the pump **22** at such a speed as to provide a discharge therefrom of approximately 1,200 or more gallons per minute. An outlet pipe **28** connects to the pump **22** for receiving water therefrom and with such outlet pipe having a substantially full or completely full flow of water therethrough at all times. The pipe **28** can be of some appreciable size, such as from about, for example, approximately **12** inches or more, but will vary with the volume of smoke to be processed, pump size, capacity, etc.

Usually a check valve **30** or other equivalent means is present in this outlet pipe **28** to permit water flow therethrough only in the direction as indicated by the arrows **32**. If necessary, an additional control gate valve **34** of any desired type is provided in the outlet pipe **28** to regulate flow from one section **28** of the outlet pipe into a section **36** of the pipe more remote from the pump **22** than the outlet pipe section **28**. As diagrammatically illustrated in the invention, the outlet pipe section **36** is of some appreciable length and the supply means **16** from the chimney **12** connects to this pipe section **36** spaced appreciably from a discharge end **38** of such outlet pipe section.

Preferably the supply means **16** connects to the pipe section **36** by means such as a venturi **40** provided in the outlet pipe section **36** whereby the rapid flow of water from the outlet pipe or section **36** into and through the venturi **40** will aid in drawing smoke and gases from the supply means **16** into the outlet pipe section **36** through the side opening or inlet **42** in the venturi **40**. Then by the continued flow under appreciable pressure and at some appreciable line flow speed, the smoke and water present in the outlet pipe section **36** will have a turbulent mixing action therein and all dirt and dust particles and the like initially in the smoke flowing out of the chimney outlet **14** will be thoroughly wetted by the water in the outlet pipe section **36*a*** which is downstream from the venturi **40**.

Ultimately, the water and smoke, in thoroughly mixed conditions, will exhaust from the outlet pipe section **36*a*** through the discharge **38** and will flow into a settling tank **44**. Also some of the chimney gases may be absorbed by the processing water. The settling tank **44** has an outlet section **46** provided therefor and an equivalent vertically upwardly extending storage section **48** provided therein. However, the entire bottom portion of the settling tank **44** functions as a storage tank, but the height of the water received therein is measured in the vertically upwardly extending storage section **46**, which comprises just one portion of the upper margin of the settling tank **44** as indicated in the drawings. Hence, smoke-air-water mixtures discharged into the settling tank **44** will be accumulated therein, and any large particles in such mixture would be picked up upon or deposited upon screens **50** provided in an upper portion of the storage section **48**. Other portions of the

water, and particularly any heavy dirt or other particles therein will settle to the bottom of such tank. An intermittently driven conveyor **52** is operatively positioned in the lower portion of the settling tank **44** and has an upwardly directed section extending from the outlet section **46** for discharge of the solids **54** from the conveyor and collection in any desired associated means (not shown).

While it is desired to recirculate water in the smoke pollution eliminator system **10** of the invention, in some instances, it is necessary to continuously or intermittently replenish some of the water in the water volume being circulated so that a float **56** is provided in the closed upper end storage section **48** and the float has a control arm **58** extending upwardly therefrom. This control arm **58** normally extends vertically and has any suitable guide means provided therefor and a pair of contacts **60** and **62** are carried on an upper portion of this control arm **58** whereby when the water level lowers to a point at which the lower contact **62** engages a limit switch **64** secured to and above an upper portion of the storage section **48**, the switch **64** would be actuated, and usually closed and water can be introduced into the system, as hereinafter described. As more water is received in the system, and the level of liquid in the settling tank **44** increases, then the float **56** will move up and have the contact **60** contact an upper switch **66** at which time the addition of water into the system would be terminated and the system would remain in desired balance on the quantity of water being processed until the water level in the storage section portion of the settling tank **44** again lowers appreciably, usually, to open the switch **66** and ultimately to close the switch **64**.

In all events, clear water and air from the top portion of the settling tank **44** flows through an exhaust line **68** extending from an upper portion of the storage section **48** to a conventional aerator **70**. If desired, a control valve **72** is provided in this exhaust line **68** and, if needed, a suitably driven pump **74** is connected in the exhaust line **68** and driven by a motor **76** to increase the pressure on the water flow if the aerator **76** is spaced any appreciable distance from the settling tank **44**, or if a lifting or forcing action is required. Thus, the purified or clarified water having the dirt and solid materials removed therefrom in the settling tank will flow to the aerator **76** at a desired rate for dropping or flowing downwardly therethrough to aerate the water and prepare it for reuse, as well as to release the purified chimney gases. A further exhaust or return line **78** connects the bottom of the aerator **70** to the input line **20** to return water to the system for further flow therethrough.

The drawing also brings out the fact that a solenoid operated control valve **80** or the like is provided in this water supply line **18** for flow to the inlet line **20** so that, when the switch **64** is closed, energized or closed by the float, the solenoid valve **80** will be opened and additional amounts of water will be introduced into the system, so as to maintain a desired volume therein. The connections between the switches **64** and **66** and the valve **80** are conventional.

Another conventional check valve **82** can be provided between the connection of the water supply line **18** and the connection of the return line **78** to the lower portion of the aerator **70**.

It should be understood that any suitable type of a settling tank and aerator may be used in practice of the invention. However, it is quite important that a sufficient water input or supply is provided for the pump **22** at all times to maintain the outlet pipe **28** and associated pipes full of water. Such water is flowing under good velocity and high pressure through the outlet pipe system for blending with and thoroughly wetting any and all dirt and dust particles in the smoke being processed.

In practice or trial of test units of the invention, the apparatus has been found to be very satisfactory so that the objects of the invention have been achieved.

While one complete embodiment of the invention has been disclosed herein, it will be appreciated that modification of this particular embodiment of the invention may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In a smoke pollution eliminator system having supply means for connecting a chimney outlet to apparatus comprising

a pump having a water supply connected thereto,

an outlet pipe connected to said pump for receiving a substantially full line flow of water therefrom,

said supply means connecting to said outlet pipe spaced from the discharge end thereof for flow of smoke thereto, said outlet pipe having turbulent pressure flow of water therethrough,

a settling tank connecting to said outlet pipe for receiving a smoke-water mixture therefrom,

an aerator for receiving and processing a water-gas mixture from the upper portion of said settling tank,

float type water supply and control means operatively associated with said settling tank to provide additional water supply to said pump upon predetermined lowering of the water level in said settling tank,

said pump being adapted to maintain said outlet pipe full of water where connected to said pump,

check valve means in said outlet pipe to permit only unidirectional flow of water therein,

a venturi means at the connection of said supply means to said outlet pipe,

means connecting the water outlet of said aerator to said pump as the inlet thereof,

said settling tank having a closed upper end storage section and an open upper end disposal section, and

means are provided for collecting solids in said settling tank and removing them through said disposal section.

2. In a smoke pollution eliminator system having supply means for connecting a chimney outlet to apparatus comprising

a driven pump having a water supply connected thereto,

an outlet pipe connected to said pump for receiving a substantially full line flow of water under high pressure therefrom,

said supply means connecting to said outlet pipe for flow of smoke thereto, said outlet pipe having turbulent pressure flow of water therethrough downstream of the connection of said supply means thereto,

a settling tank connecting to said outlet pipe for receiving a smoke-water mixture therefrom,

an aerator receiving water from the upper portion of said settling tank, and

means returning the aerated water back to said pump.

3. In a smoke pollution eliminator system as in claim **2** and comprising said pump and said outlet pipe being correlated so as to have at least approximately 1,200 gallons per minute flow through said outlet pipe.

4. In a smoke pollution eliminator system as in claim **2** and comprising

said settling tank having a closed upper end storage section and a remote open upper end disposal section,

said outlet pipe discharging into said storage section, and

pipe and pump means connecting a portion of said storage section to said aerator.

5. In a smoke pollution eliminator system as in claim **2** where

said pump maintains said outlet pipe full of water where connected to said pump,

check valve means are present in said outlet pipe to permit only unidirectional flow of water therein, and

a venturi means is provided at the connection of said supply means to said outlet pipe.

6. In a smoke pollution eliminator system as in claim **2** where a venturi means is provided at the connection of said supply means to said outlet pipe.

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