United States Patent

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[45] Patented Sept. 29, 1970

[54] **ANTIPOLLUTION APPARATUS**
9 Claims, 7 Drawing Figs.

[52] U.S. Cl. 110/8, 110/119
[51] Int. Cl. F23g 3/06
[50] Field of Search 110/8, 18, 119, 120; 261/17, 126, 127

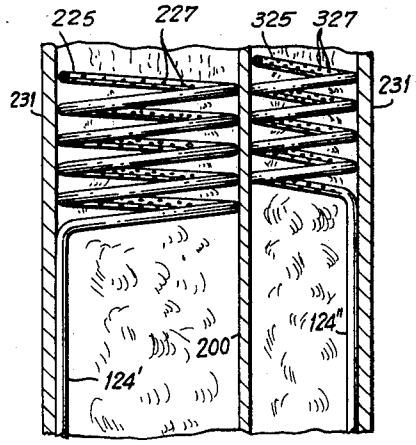
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ABSTRACT: An antipollution apparatus for removing the smoke particles from exhaust gases of an incinerator or fuel burning apparatus, having a plurality of spiral coils with steam jets mounted against the internal walls of the chimney adjacent to its opening and supplied with steam under pressure. As an incinerator, the apparatus also utilizes a gas burner for igniting the refuse articles, and an air blower having an air jet manifold for maintaining a high temperature of combustion within the incinerator. The apparatus also includes a control panel connected to a temperature dispensing device for operating the gas burner, and air blower to maintain a high temperature of combustion within its combustion chamber.



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Fig. 1

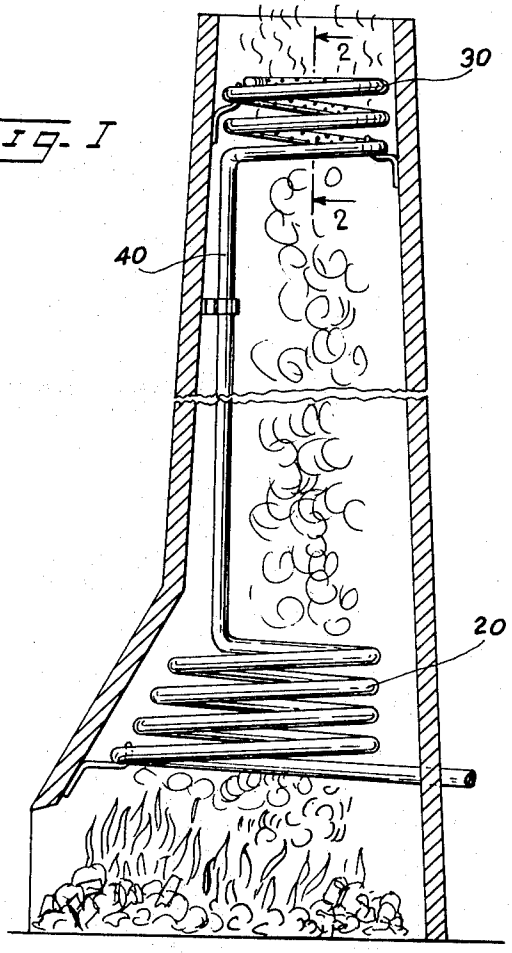
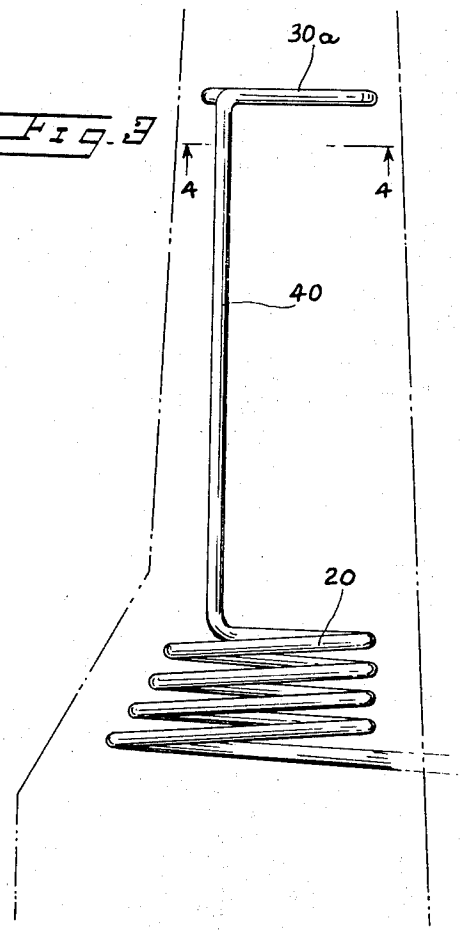


Fig. 3



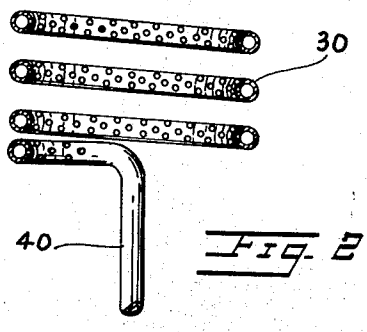


Fig. 2

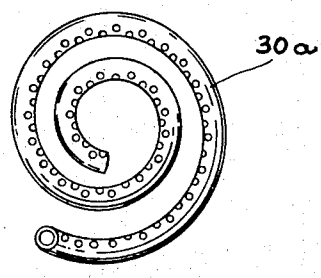


Fig. 4

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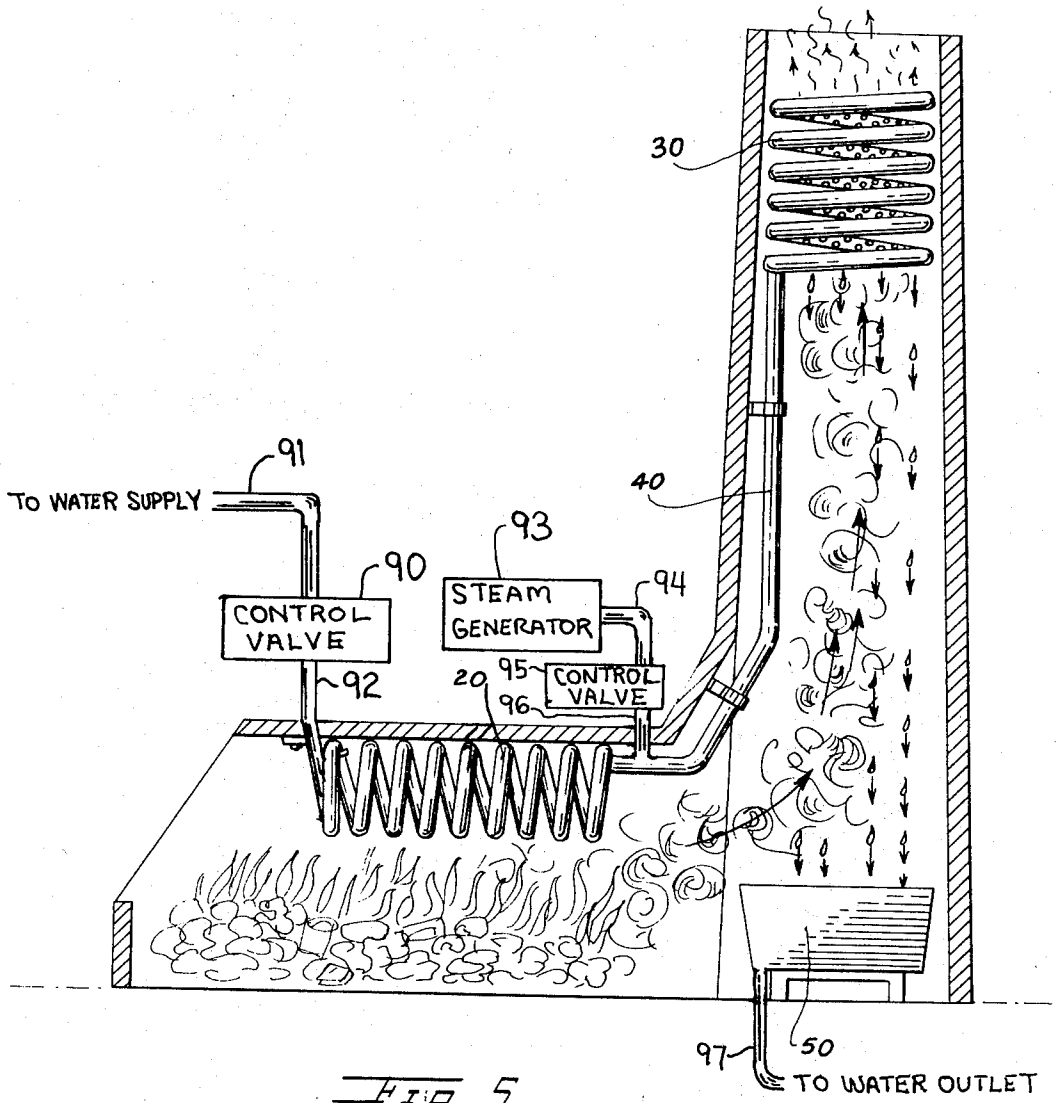


Fig. 5

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Fig. 6

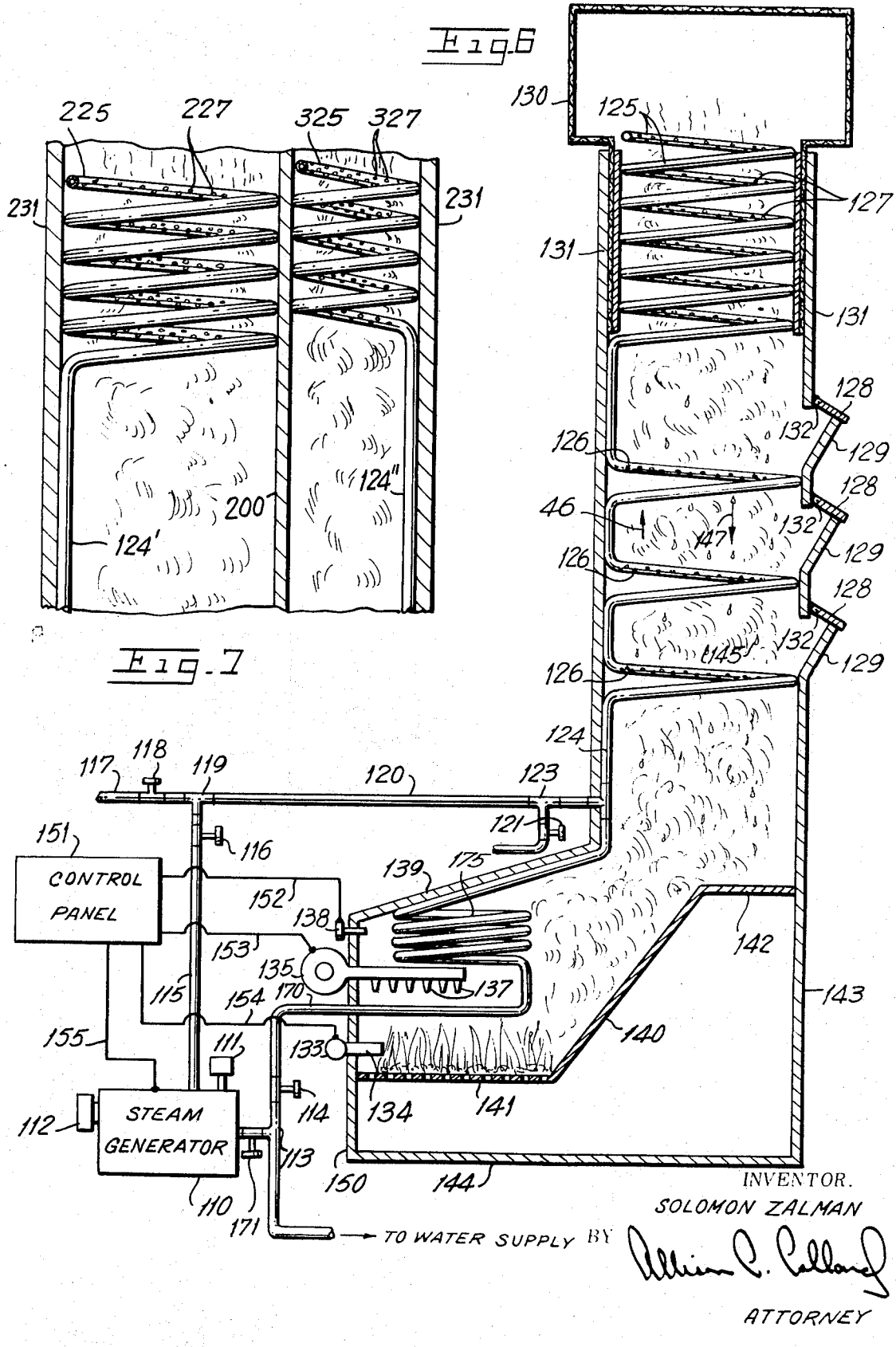


Fig. 7

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ANTIPOLLUTION APPARATUS

This is a continuation in part of application Ser. No. 698,221, filed on Jan. 16, 1968, entitled "Steam Scrubber," now abandoned.

The present invention relates to air pollution devices, and more specifically, to a steam scrubbing device which includes circular coils at the edge of the chimney for spraying a volume of steam upon the emerging smoke so as to precipitate the smoke particles to reduce air pollution.

In incinerators and oil fired furnaces, it is known to utilize smoke precipitation devices such as electrostatic fields and steam spraying apparatus in order to eliminate smoke particles from the emerging exhaust gases. Electrically operated smoke precipitating devices are costly to install and expensive to operate and are often unreliable, particularly if they are not cleaned and maintained.

Accordingly, the present invention provides a steam scrubbing apparatus for scrubbing the smoke particles from the exhaust gases of an oil fired furnace or incinerator. The invention includes a plurality of helical coils which are mounted against the internal walls at the outlet of the chimney and provided with a source of steam for saturating the exhaust gases prior to their entrance into the atmosphere. The invention may include further helical coils disposed at each floor level of the incinerator, and a steam generating source consisting of an additional helical coil disposed over the fire of the incinerator or furnace so that the apparatus of the invention provides its own source of steam from the fire generating the pollutant gases. In a preferred embodiment of the invention, the steam generating coils of the scrubber are also connected to a central steam generating source or supply or steam which is utilized to heat the building and maintain building facilities.

It is a particular advantage of the present invention that it functions and operates in direct proportion as to amount of exhaust and in direct relation to the time during which an exhaust is emitted. The exhaust is produced, for example, by the burning of rubbish in an incinerator. Since the head of steam is produced by the head of this very burning, the greater the burning the greater the head of steam produced. As the refuse is consumed and the fire extinguished, no head of steam is produced and the steam scrubber of the present invention remains dormant until the fire is restarted and its effluent re-emitted.

It is clear that great economics are effected by the present invention. In one embodiment, no outside source of energy is required other than that already existing and polluting. It may be made compactly to fit the smallest source of pollution and to fit the smallest pocketbooks. Conversely, it may be made as large as space will permit and thereby control and eliminate great amounts of pollution.

It is therefore an object according to the present invention to provide a steam scrubbing apparatus which will precipitate smoke particles from the emerging exhaust gases of an incinerator or oil fired furnace.

It is a further object according to the present invention to provide a steam scrubbing apparatus which is simple in design, easy to construct, and efficient in operation.

Other objects and features of the present invention will become apparent from the following detailed description considered in connection with the accompanying drawings which disclose several embodiments of the present invention. It is to be understood, however, that the drawings are designed for the purpose of illustration only and not as a definition of the limits of the invention, as to which reference should be made to the appended claims.

In the drawing, wherein similar reference characters denote similar elements throughout the several views:

FIG. 1 is a frontal partial cross-sectional view of an incinerator showing the steam generating coil and the steam spray coil of the present invention.

FIG. 2 is an enlarged cross-sectional view of a steam spray coil of the present invention.

FIG. 3 is a frontal view, partly in phantom, of the steam generating coils and steam spray head of the present invention.

FIG. 4 is a view of a steam spray head as seen across line 4–4 of FIG. 3.

FIG. 5 is a frontal partial cross-sectional view of the steam generating coil and steam spray head of the present invention shown installed in another incinerator.

FIG. 6 is a further embodiment of the steam scrubbing apparatus for use in multi-level buildings, and

FIG. 7 is a dual chimney embodiment of the steam scrubbing apparatus of the invention.

Referring to FIGS. 1—5, the steam scrubber of the present invention comprises a tubular coil **20** located closely above a source of heat for the generation of steam from water therein. The steam spray head comprises a tubular coil which may be either helical as at **30** or spiral at **30***a* and which communicates through tube **40** with steam generating coil **20**. The end of steam coil **20** is connected through pipe **92** to control valve **90**. The input of control valve **90** is connected through pipe **91** to the conventional water supply under pressure. Control valve **90** is a pressure control valve which permits water from the water supply to maintain a sufficient quantity of water within coil **20** at all times. Steam spray coil **30**, **30***a* is perforated around its inner periphery to provide orifices for directing the steam centrally to the column of rising exhaust in the chimney in which steam spray coil **30**, **30***a* is located.

In the operation of the present invention, water entering steam generating coil **20** is vaporized by the heat of the adjacent incinerator fire or other heat sources, the resulting steam being forced through tube **40** to steam spray head **30**, **30***a* and thence outwardly into the steam of rising exhaust. The steam collects around the pollutant particles in the exhaust stream and condenses thereon with each particle acting as a center or nucleus of condensation. The condensate with its trapped particles of pollution drops of its own weight where it is either consumed by the incinerator fire if that fire be directly beneath the chimney or collected for removal in an open-topped tank **50** if provided for the purpose beneath the chimney.

While the foregoing embodiments are illustrative of preferred forms of the present invention, it is clear that other forms and embodiments may be provided. For an example, it is basic of this invention that steam be sprayed at an outgoing pollution carrying stream. While methods may vary as to how the steam is actually sprayed, the foregoing has also provided a self-generating system which is preferred for its economy and effectiveness. The steam generator has been described as a tubular coil but it certainly is within contemplation to use any suitable heat exchanger which would vaporize the water. Further, the steam spray head has been described as a tubular coil but it is within contemplation to use any spray head which would effectively disperse the steam into and throughout the outgoing exhaust stream so as to be most effective in removing pollutants therefrom.

Referring to FIG. 6, there is shown another embodiment of the invention having a steam generator **110**, with a temperature control **111**, connected to its boiler, and a steam safety valve **112** for relieving excessively high pressures. Generator **110** also includes a water inlet **113** regulated by valve **171** for supplying the boiler of the generator with a supply of water. Water can also be supplied directly to heat exchanger coil **175**, through pipe **113** by opening valve **175**. Coil **175** is mounted within the combustion chamber of the apparatus so as to be disposed over the incinerator fire. Therefore, heat coil **175**, which is connected through tube **124** to coils **125** and **126**, can also provide a source of steam to openings **127**. It is therefore possible, under preferred operating conditions, to eliminate external sources of steam, and utilize the incinerator fire to generate the steam required for coils **125** and **126**.

Referring briefly to FIG. 5, there is also shown a steam generator **93** coupled to pipe **40**, in front of coil **20**, by means of pipe **96**. Between steam generator **93** and pipe **96**, is con-

nected a control valve **95**, which maintains a constant supply of steam from input pipe **94**, to pipe **40**. In FIG. **6**, the outlet **115** of generator **110** is connected through valve **116** to a T-connection **119**. T-connection **119** permits steam generated by the heating system of the building containing the apparatus of the invention to be supplied by line **117**, through valve **118**, into T-connection **119**. The outlet of T-connection **119** is connected through line **120** to T-connection **123**. The steam may be tapped off the bottom of T-connection **123** by opening valve **121** leading to line **122**. The output of T-connection **123** is connected to line **124** for conducting the steam to tubular spiral coils **125** and **125** secured against the internal walls of the chimney. Tubular coil **125** consists of several spiral turns of a hollow tube which is mounted adjacent to the chimney outlet. At least one single turn of additional tubes **126**, coupled to tube **125**, are disposed at each level of the chimney. Tubes **125** and **126** include a plurality of steam jet openings **127** communicatively mounted into pipes **125**, and directed toward the axial center of the chimney. With valves **118** and **121** maintained in a closed position, and with valve **116** open, steam produced by generator **110** and directed through pipes **115**, **120**, **124** and **125** will be directed out of jet openings **127** toward exhaust gases which emerge from a rectangularly-shaped screen cage **130** which collects the smoke emerging from chimney **131**. The smoke will spread throughout the area of the rectangular cage **130** before emerging through the screen and create a slight back pressure so that the steam emerging from openings **127** will have sufficient opportunity to saturate the smoke particles. The smoke particles **145** will precipitate upon contact with the condensed steam, and drop down chimney **131**, as shown in the direction of arrow **147**.

The incinerator is connected at the base of chimney **131**, and includes slanted wall **139** connected to vertical wall **150**, terminating at floor **144**. The back wall **143**, which rises from floor **144**, is interrupted by a plurality of chutes **129**, which are located at each floor of the building. Chutes **129** are provided with covers **128** which are hinged to the wall by means of hinges **132**. Refuse articles may then be inserted into the incinerator by opening covers **128**, and dropping them through chutes **129**, into the interior of the incinerator. The incinerator also includes a shelf consisting of a grate **141**, an inclined member **140** connected to the extending end of grate **141**, and a step **142** joining incline member **140** to wall **143**. Disposed above grate **141** is a gas burner **133** having a nozzle **134** directed through wall **150**, for incinerating the refuse articles which gather on top of grate **141**. As an alternate heating supply, the incinerator also includes an air pump **135** connected to a manifold **136** which is directed through wall **150**, and includes the plurality of air jets **137** directed over gas burner **133** toward grate **141**.

The air directed through jets **137** onto the burning refuse supported by grate **141** significantly increases the combustion temperature of the articles being incinerated. The increased temperature of combustion cuts down significantly on the amount of smoke which will be produced by the burning refuse in order to reduce the air pollution of the exhaust gases emerging from chimney **131**. The incinerator of the invention is also provided with a temperature regulator **138** which maintains the temperature at or below 1600°F. within the combustion chamber of the incinerator. A control panel **151** is also provided connected to temperature control **138** by means of conductor **152**. Control panel **151** is further connected to air pump **135** by means of connector **153**, and to gas burner **133** by means of conductor **154**. Temperature signals transmitted by temperature control **138** will cause control panel **151** to shut off air pump **135** and/or gas burner **133**, if the temperature of the incinerated articles increases above 1600°F. In a similar manner, control panel **151** will also maintain gas burner **133** and air pump **135** turned on in the event the temperature of the combustion chamber of the incinerator decreases to a pre-determined low temperature.

Control panel **151** is also connected through conductor **155** to steam generator **110**, and regulates the amount of steam supplied to steam jets **127** in accordance with the temperature of the combustion chamber.

Although the present invention has been described for use with incinerators, it is also obvious that it is equally adaptable for use with oil and coal burning equipment, commonly employed by heating and electrical generating plants. In this embodiment, the coal or oil burning equipment will be located in the combustion chamber of the incinerator together with the boiler so that the steam jet openings will be directed upon the smoke particles from the exhaust gases.

FIG. **7** shows a still further embodiment of the invention including a dual chimney **231** having a partition **200** so as to provide separate chambers within the chimney. Disposed in the larger of the chimney partition, adjacent to its outlet, is disposed a spiral steam coil **225** having a plurality of steam jet openings **227** which are directed toward the center of the chamber. Steam coil **225** is coupled to steam pipe **124'** which is connected to steam generating sources such as those shown in FIG. **6**. Likewise, the smaller chamber of the chimney includes a spiral steam coil **325** which is coupled through steam pipe **124''** which can also be connected to similar steam generating sources. The larger chamber of the chimney which includes steam coil **225** is connected to the incinerator portion of the building while the smaller chamber which includes steam coil **325** is connected to the heating plant for exhausting the fuel gases.

While only a few embodiments of the present invention have been shown and described, it will be understood that many changes and modifications may be made thereunto without departing from the spirit and scope of the invention.

I claim:

1. An apparatus for coupling to a chimney for removing smoke particles from the chimney exhaust gases comprising:

a first tubular helical coil for disposal in the chimney and surrounding its internal walls and secured adjacent to its outlet;

a plurality of steam jet openings disposed in said first coil, said jet openings being directed toward the axis of the chimney;

at least a second tubular coil disposed within said chimney, said further coil including a plurality of steam jet openings directed toward the axis of the chimney; and

steam generation means for producing a quantity of steam under pressure and having one end coupled to said first tubular helical coil and said second tubular coil, said steam generation means comprising a third helical coil disposed at the base of the chimney and having its other end adapted for receiving a supply of water.

2. The apparatus as recited in claim **1** additionally comprising a fuel burner disposed at the base of the chimney.

3. The apparatus as recited in claim **2** additionally comprising an air blower, and an air manifold connected to said air blower and secured at the base of the chimney, said air manifold having a plurality of air jets directed toward said fuel burner.

4. The apparatus as recited in claim **3** additionally comprising a temperature control mounted on said apparatus for detecting the temperature of the chimney base.

5. The apparatus as recited in claim **4** additionally comprising a control panel electrically connected to said temperature control, said air blower and said fuel burner, so that the temperature of the chimney base may be regulated at a predetermined temperature in response to said temperature control by selectively controlling said air blower and said fuel burner.

6. The apparatus as recited in claim **5** wherein said steam generation means additionally comprises a steam generator responsive to said control panel for generating an independent supply of steam for said steam jet openings.

7. The apparatus as recited in claim **6** wherein said steam generation means additionally comprises a second connection line coupled to said third helical coil and having its opposite end connected to a conventional steam heating supply source.

8. The apparatus as recited in claim 5 additionally comprising at least one chute communicative with the walls of said chimney and adjacent to said further coil for permitting the insertion of articles into the base of the chimney.

9. The apparatus as recited in claim 8, additionally comprising a screen secured over the outlet of the chimney, said screen having an enlarged cavity to collect the exhaust gases for contact with the steam spray emerging from said steam jet openings.