United States Patent [19]

Schwartz, Jr. et al.

[11] **3,786,767**

[45] **Jan. 22, 1974**

[54] **INCINERATOR TYPE ENVIRONMENTAL CONTROL SYSTEM**

[76] Inventors: **William H. Schwartz, Jr.**, 7221 Ash Ave., Gary, Ind. 46403; **Billy D. Maxwell**, 3548 Delaware St., Gray, Ind. 46409

[22] Filed: **Apr. 5, 1972**

[21] Appl. No.: **241,225**

Related U.S. Application Data

[62] Division of Ser. No. 46,937, June 17, 1970.

[52] **U.S. Cl.** ..... **110/8 A**, 110/18 C

[51] **Int. Cl.** **F23g 5/12**

[58] **Field of Search**. 110/8 R, 8 A, 8 C, 18 N, 18 C

[56] **References Cited**

UNITED STATES PATENTS

3,031,981	5/1962	Smauder	110/8
3,453,976	7/1969	Burden, Jr. et al.	110/18
3,495,555	2/1970	Boyd et al.	110/8
3,043,249	7/1962	Hebert et al.	110/8 X
3,051,100	8/1962	Singleton	110/8
3,082,714	3/1963	Close	110/8
3,176,634	4/1965	Martin	110/8
3,403,645	10/1968	Flowers, Jr.	110/8 X
3,489,109	1/1970	Flowers, Jr.	110/18
3,665,871	5/1972	Swartz, Jr. et al.	110/8

Primary Examiner—Kenneth W. Sprague

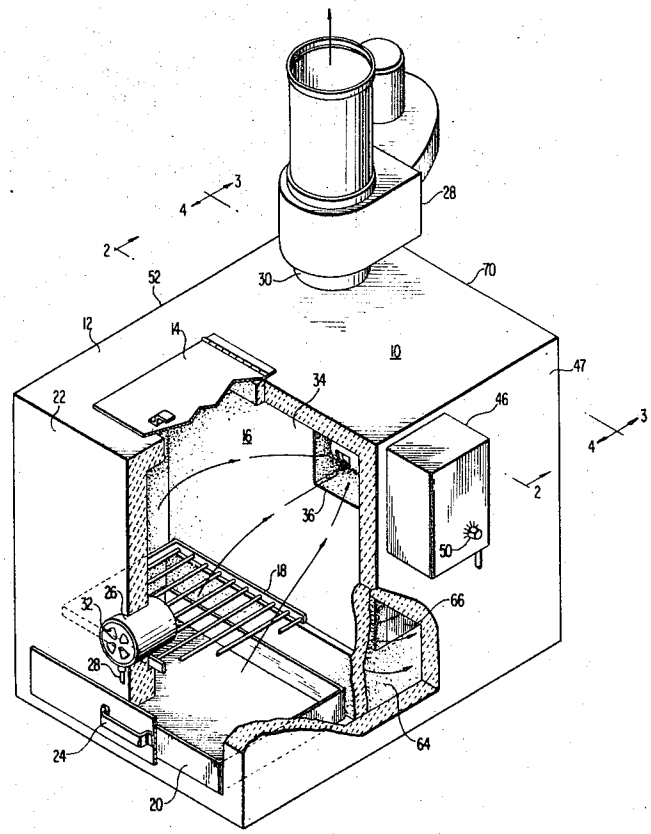
Attorney, Agent, or Firm—McDougall, Hersh & Scott

[57] **ABSTRACT**

A relatively small and compact system for cleaning and purifying products of combustion resulting from incineration of waste materials including smoke and particles suspended therein as well as gases produced thereby wherein all of the products of combustion are forced from a first burning chamber into a balanced flow system including a second burning chamber having a burner flame completely enveloping the input thereto for incinerating the smoke, etc. to a substantially clean, hot exhaust gas.

The extremely hot exhaust gases are fed into a temperature reduction labyrinth having several direction changes while maintaining the constant volumetric flow therethrough and finally through a scrubbing stage including a water bath, a series of water sprays and an output baffle while still maintaining the constant volumetric flow for completely removing any other products remaining in the exhaust gases thereby reducing air pollution to substantially a zero level.

7 Claims, 7 Drawing Figures



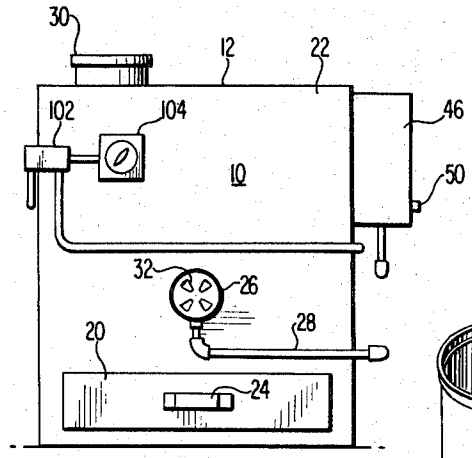


FIG. 5

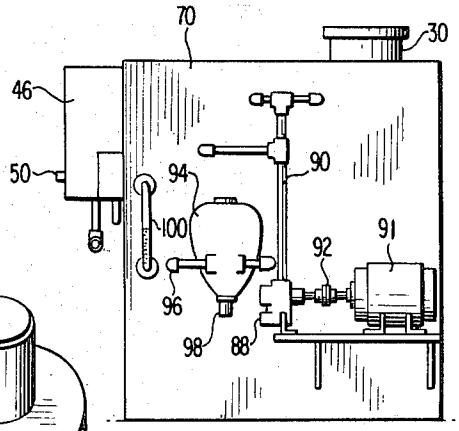


FIG. 6

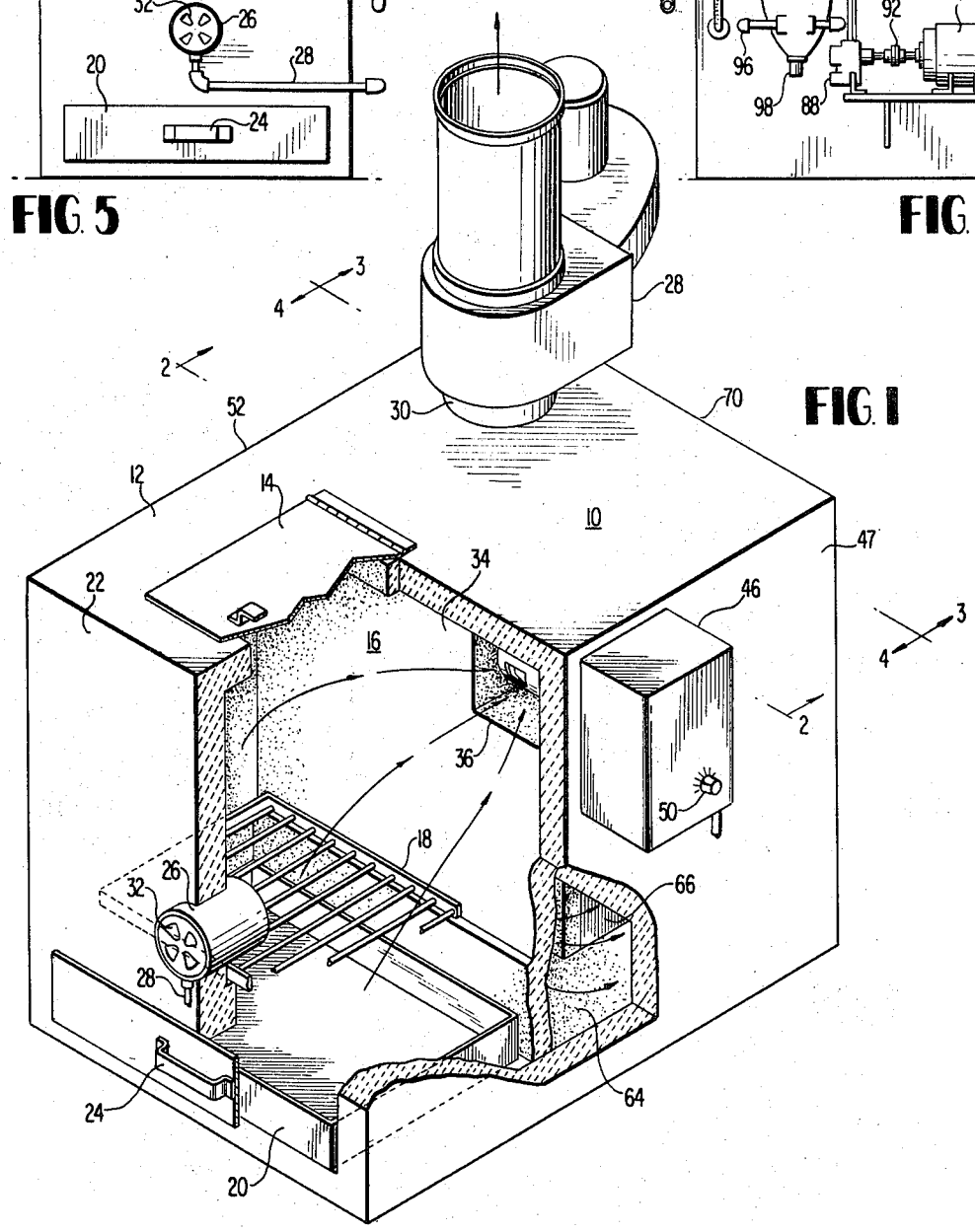


FIG. 1

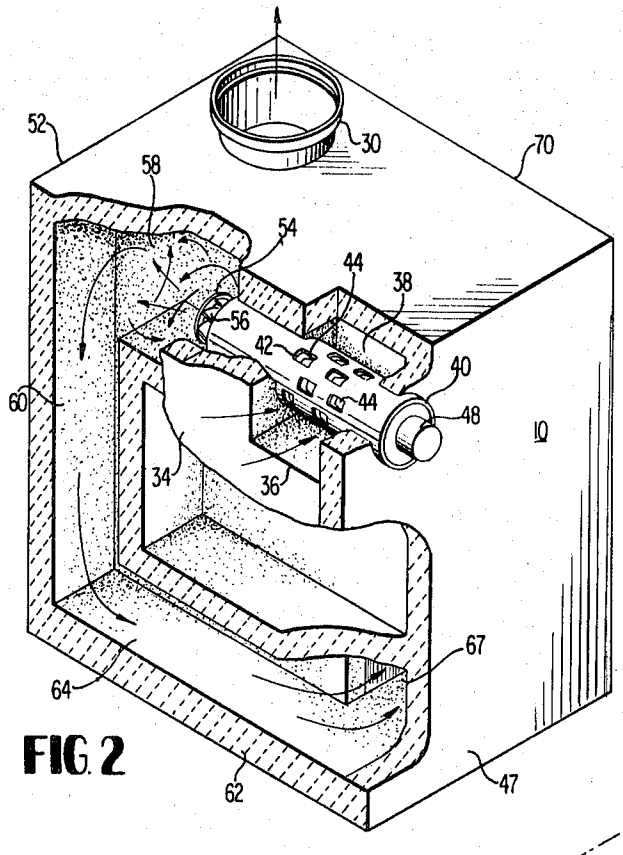


FIG. 2

FIG. 7

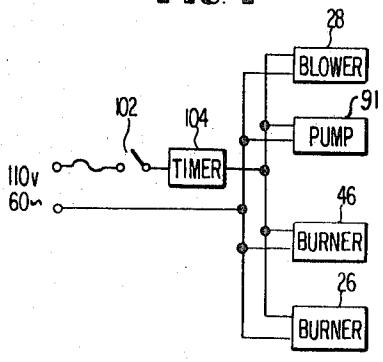


FIG. 4

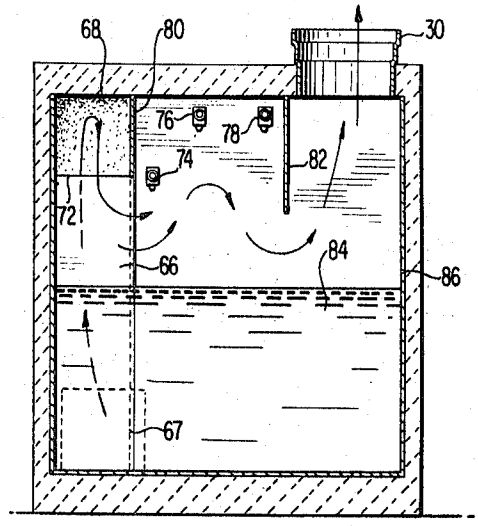
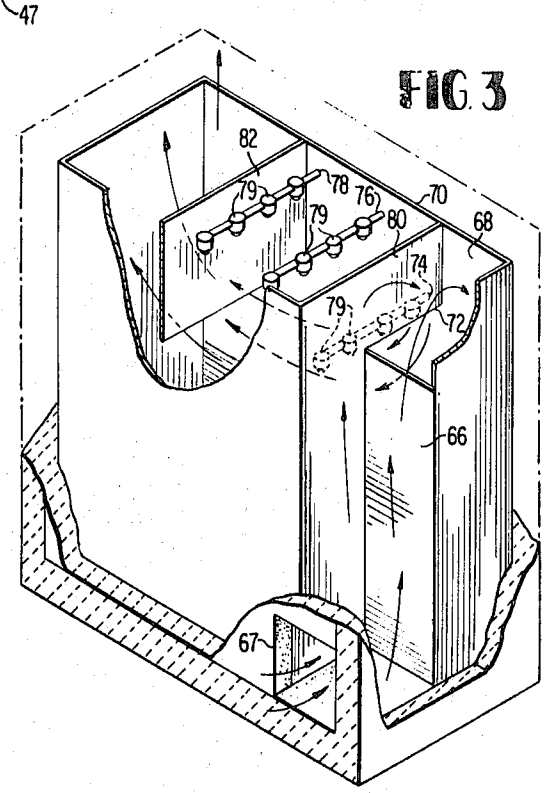


FIG. 3



INCINERATOR TYPE ENVIRONMENTAL CONTROL SYSTEM

This is a division of our copending application Ser. No. 46,937, filed June 17, 1970, and entitled "Incinerator Type Environmental Control System". This application is addressed to the after burner which may be employed in combination with an incinerator.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to incinerator apparatus for consuming all forms of combustible refuse, trash, and garbage or other organic rubble for either domestic or commercial applications where it is necessary to eliminate the smoke or gaseous oxidation products of the incinerator to a sightless and odorless state before exit into the surrounding environment.

2. Description of the Prior Art

The purification or cleaning of gaseous products of combustion to eliminate smoke and fly ash presents a serious air pollution problem which is a hazard of national scope and is receiving substantial attention not only from local and national health authorities but also from legislators. The problem, however, is not a new one since with the even increasing urban population, air pollution threatens the very lives of urban as well as suburban inhabitants. Combined with the problem of air pollution, is the disposal of waste materials in large cities or congested areas. These waste materials must be disposed of and the ordinary method of disposal is by incineration. The following patents are noted as being typical examples of incinerators which constitute the known prior art related to the subject invention:

U. S. Pat. No. 3,043,249, J. W. Herbert et al.
U. S. Pat. No. 3,051,100, C. N. Singleton
U. S. Pat. No. 3,082,714, S. Close
U. S. Pat. No. 3,176,634, L. S. Martin
U. S. Pat. No. 3,403,645, G. H. Flowers, Jr.
U. S. Pat. No. 3,489,109, G. H. Glowers, Jr.

While the above cited prior art discloses a second burning zone or an after burner which has for its purpose the incinerating of any gases or fly ash from the exhaust, these relatively small compact units which are particularly adapted for residential use, feed directly into a chimney or flue. While incinerators including gas scrubbing apparatus are also well known for ash removal and gas scrubbing, they are generally exclusively utilized in large complex systems since apparatus of the type referenced above has not been adapted to utilize such apparatus nor was it believed to have been necessary.

SUMMARY

The present invention is directed to an improved relatively small compact incinerator for both residential and commercial use which effectively removes all of the combustible products of the exhaust gases resulting from incineration so that it ultimately discharges exhaust gases into the atmosphere which is smokeless, odorless and free of fly ash. The system contemplated by the subject invention briefly comprises a first burning chamber of relatively large volume wherein waste products are incinerated. All of the products of combustion resulting from the incineration are forced into a second relatively smaller, elongated, cylindrical burning chamber located adjacent the first burning chamber which includes means for providing a flame axially therethrough such that all of the products of combustion must pass through the flame in the second burner. A mixing nozzle is affixed to the output end of the second burning chamber for providing a vortex or swirling output of exhaust gases therefrom which are then fed through a balanced flow temperature reduction means including a plurality of tortuous passages and then to a scrubbing means to an exit flue, whereby the dimensions of the power burner stage, the temperature reduction means and the scrubbing means are constrained to provide a constant volumetric flow therethrough and thereby provide a substantially pollution free exit gas into the atmosphere.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the subject invention partially cut away to disclose the first burning chamber and the exit port thereof;

FIG. 2 is a sectional view of the embodiment shown in FIG. 1 taken along the lines 2—2 thereof disclosing the second burning chamger including a cylindrical burner tube and a temperature reduction labyrinth;

FIG. 3 is a fragmentary sectional view of the embodiment shown in FIG. 1 taken along the lines 3—3 disclosing the scrubber apparatus following the temperature reduction labyrinth;

FIG. 4 is a cross-sectional view of the embodiment shown in FIG. 1 taken along the lines 4—4 further illustrating the scrubber apparatus shown in FIG. 3;

FIG. 5 is a front elevational view of the embodiment shown in FIG. 1;

FIG. 6 is a rear elevational view of the embodiment shown in FIG. 1; and

FIG. 7 is an electrical block diagram for operating the embodiment shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein the same reference numerals refer to the same parts of the various views of the invention, reference numeral **10** generally designates a substantially cubical housing of refractory material and can, when desirable, also include an outer metallic casing, not shown. In the forward portion of the upper wall **12** of the housing **10**, is located a charging door **14** forming an entrance into a first incinerating or burning chamber **16**, of relatively large volume and describing a configuration of flat walls intersecting orthogonally. The chamber **16** is often referred to as a fire box. A grate **18** is located in the lower portion of the chamber **16** and extends completely across the chamber and is adapted to receive rubbish or waste material for burning, not shown, when placed thereon by means of the door **14**. A pull-out drawer **20** is located at the bottom of the first chamber **16** below the grate **18** for the reception of ashes resulting from the burning of the material placed thereon. The pullout drawer **20** is adapted to be removed from the incinerator chamber **16** through the front wall **22** of the housing **10** by applying manual force to the handle **24** attached to the drawer **20**.

A first oil or gas burner **26** is mounted in the front wall **22** a short distance above the grate **18** for providing a means of igniting and incinerating the material placed on the grate **18** for disposal. The burner **26** is fed from a source, not shown, by means of the conduit

28. A forced draft for supporting combustion inside of the housing 10 is provided by an air blower 28 mounted on the exit or chimney flue 30 located at the rear portion of the top wall 12 causing an external air to be pulled into the housing 10 and through the system to be described by means of the ports 32 located on the pilot burner 26. The port openings may be fixed or variable depending upon the specific application.

In the upper right hand corner of the back wall 34 of the first burning chamber 16 is exit port 36 of substantially rectangular cross section wherein all of the smoke and gaseous products of combustion resulting from incineration of waste material placed in the burning chamber 16 is drawn thereto by means of the blower 28. The smoke, etc. drawn to the port 36 passes into a small antechamber 38 which is generally rectangular in cross section as shown in greaer detail in FIG. 2. A hollow cylindrical power burner tube 40 comprising a second burning chamber passes through the antechamber 38 in a substantially horizontal direction behind the wall 34 (FIG. 1). A plurality of intake openings 42 are fabricated in tube 40 only in that portion which extends into the region described by the antechamber 38. The plurality of openings 42 comprise substantially rectangular slots and inwardly directed tabs 44. A second gas or oil burner 46 shown in FIG. 1, called a power burner, is located on the side wall 47 and is attached to the power burner tube 40 through a transition member 48. A flame, when generated, is directed through the transition member 48 and into the power burner tube 40 along its central axis so that the flame substantially fills the burner tube 40 for a predetermined adjustable length. By selectively adjusting the amount of fuel fed to the power burner 46 by a control 50, for example, the flame through the power burner tube can be adjusted for any desired amount.

All of the products of combustion in the chamber 16 except the ash falling into the drawer 20 must pass through the intake openings 42 due to the suction created by the blower 28 and everything contained therein, e.g. smoke and unburned particles held in suspension is forced into the power burner flame. By selectively adjusting the flame in the power burner tube 40 substantially all of these unburned products are incinerated therein.

As noted above, the power burner tube 40 is shown mounted in a substantially horizontal position in the refractory material of the housing 10 behind the back wall 34 of the burning chamber 16. Additionally the tube 40 faces the inner surface of the left side wall 52 such as shown in FIG. 2. An output nozzle 54 including a plurality of radially extending vanes 56 is mounted on the other end of the power burner tube 40 so as to provide a swirling or vortex motion for the exhaust gases emanating from the power burner tube 40. Both the nozzle 54 and the power burner tube 40 are comprised of metallic material such as stainless steel or cast iron which can easily accommodate the high temperatures provided by the power burner flame which is adapted to extend even to the output of the nozzle 54.

Th swirling exhaust from the nozzle 54 is fed into a temperature reduction labyrinth of substantially constant cross section and being comprised, inter alia, of a relatively short passageway 58 extending to the wall 52. A second passageway 60 then extends vertically to the bottom wall 62 of the housing 10. A third passageway 64 extends horizontally along the bottom wall 62 and enters another vertical passageway 66 through a port 67 shown in FIGS. 2 and 3. Passageway 66 extends along the inner side of the right side wall 47 behind the burner tube 40. At the top of the passageway 66 a relatively short horizontal passageway 68 extends to the back wall 70 where an output port 72 is located as shown in FIG. 3.

The dimensions of the passageways 58 through 68 are maintained substantially constant throughout so that a balanced flow is provided, that is, a constant volumetric flow is maintained. The purpose of the labyrinth is to provide a temperature reduction means for the extremely hot exhaust coming from the power burner tube 40. This is provided by discrete direction changes for the exhaust gases emanating from the nozzle 54. The present invention therefore is able to provide a temperature change at each intersection of the passageways 58 through 68. In other words, four separate temperature reduction stages are provided by the subject invention as illustrated in FIGS. 2 and 3.

Following the exit of the exhaust gases substantially reduced in temperature at the exit port 72, they are fed into a gas scrubber stage prior to being directed to the output flue 30. The scrubbing apparatus is located at the rear portion of the housing 10 along the back wall 70 thereof. The scrubber comprises three water spray lines 74, 76 and 78 including four spray nozzles 79 connected to each line, mounted in the upper portion of the back wall 70 between the interior wall 80 forming a portion of the passageway 68 and an output baffle plate 82 extending downwardly adjacent an exit flue 30. Additionally a water bath 84 is maintained at a predetermined level in a trough 86 beneath the lower edge of the baffle 82 and the port 72 so that the exhaust gases coming from the labyrinth at the exit port 72 are forced to pass over the surface of the water 84 beneath the nozzles 79 attached to the lines 74, 76 and 78 and beneath the baffle 82. It should be noted that the water spray line 74 is positioned next to the wall 80 at a level of the exit port 72 while the other two lines 76 and 78 are located along a common plane at a relatively higher level. Thus the gases reduced in temperature by the labyrinth are subjected to a cleansing process for removing any other particles which may have escaped incineration in the burner tube 40 as well as further reducing the temperature of the exhaust gases to an acceptable level. It should also be pointed out that the height of the water 84 in the trough 86 is maintained at the aforesaid predetermined level in oreer to again maintain a balanced gas flow through the apparatus and thus matching the air flow in the labyrinth preceding the scrubbing apparatus so that the volumetric flow is constantly maintained throughout the entire system, i.e. from the port 36 of the first burner chamber 16 to the flue 30.

Referring now to FIG. 6, the scrubbing apparatus disclosed in FIG. 4 is operated as a closed system by means of the apparatus shown therein. Reference numeral 88 designates a water pump which is adapted to feed the lines 74, 76 and 78 shown in FIG. 4 by means of the plumbing 90 extending thereto through the rear wall 70. The water pump 88 is driven by means of an electric motor 91 connected thereby by means of a mechanical coupling 92. A water feeder tank 94 is coupled into a trough 86 by means of the plumbing 96 and 98 for maintaining the water level of the water 84 at a constant level as indicated by the level tube 100.

The apparatus thus described is comprised of four main elements: the initial burning chamber **16**, the cylindrical power burner tube **40** including the power burner **46**; the temperature reduction labyrinth including the rectangular cross-sectional passages **58, 60, 64, 66** and **68**; and the scrubbing apparatus including the water bath **84** maintained at a predetermined level in combination with the water spray lines **74, 76** and **78** as well as the vertical output baffle **82.**

It should be pointed out that the embodiment of the subject invention as disclosed is adapted for automatic operation by means of an electrical control of the pilot burner **26**, the power burner **46** and the electric motor **91** driving the water pump **88** and the blower **28.** This can be provided by means of an on-and-off switch **102** controlled by a manually set timer **104** controlling the application of **110** volt, single phase AC power to the apparatus as shown schematically in FIG. **7.**

What has been shown and described, therefore, is a new and improved incinerator type environmental control system which is of a small and compact nature for residential use as well as commercial applications wherein the exhaust gases ultimately discharged to the atmosphere are smokeless, odorless and free of any fly ash.

We claim:

1. An after burner for use in combination with an incinerator having an exit port through which the smoke and gases are exhausted from the incinerator in which the after burner comprises an antechamber adapted to receive substantially all of the smoke and exhaust gases from the exit port; burner means including a relatively small burner chamber coupled to said antechamber, means for generating a flame within said burner chamber, said burner chamber being dimensioned to pass through said antechamber, a plurality of intake openings through the burner chamber walls in the region defined by said antechamber for allowing all of said smoke and exhaust gases present in said antechamber to pass therethrough into said burner chamber, whereby said smoke and exhaust gases are forced into the flame by forced draft, temperature reduction means comprised of a plurality of passageways coupled to said burner chamber for receiving the exhaust from said burner chamber and reducing the temperature thereof as by a series of directional flow changes, an exit flue communicating with the output of said temperature reduction means, and means for maintaining a substantially constant volumetric gas flow from said first burner chamber to said exit flue.

2. An after burner as claimed in claim **1** wherein the burner chamber comprises an elongated hollow member adapted to channel said flame interiorally thereof, and wherein said plurality of openings additionally include an inwardly directed tab.

3. An after burner as claimed in claim **2** wherein the elongated member is of a tubular configuration.

4. An after burner as claimed in claim **3** wherein said plurality of openings are substantially rectangular openings and wherein said inwardly directed tabs are substantially rectangular.

5. An after burner as claimed in claim **4** where said tubular configuration is substantially circular in cross section and additionally including a nozzle attached to the output end of said member for producing a vortex flow of the exhaust gases therefrom.

6. An after burner as claimed in claim **1** wherein said plurality of passageways of said temperature reduction means are of substantially rectangular cross section.

7. An after burner as claimed in claim **1** in which the burner chamber comprises a generally horizontally disposed tubular member, and includes a nozzle connected to the end of the tubular member, said nozzle having a plurality of radially extending vanes for producing a vortex of the exhaust therefrom.

* * * * *