

[54] **DIRECTIONAL CONTROL OF HOT GASES FROM AN INCINERATOR OR THE LIKE**

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[52] **U.S. Cl.**..... 110/8 R, 110/8 A, 110/119, 122/20 B

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

[58] **Field of Search**..... 110/8 R, 8 C, 8 A, 18 R, 110/18 A, 18 C, 119; 122/20 B

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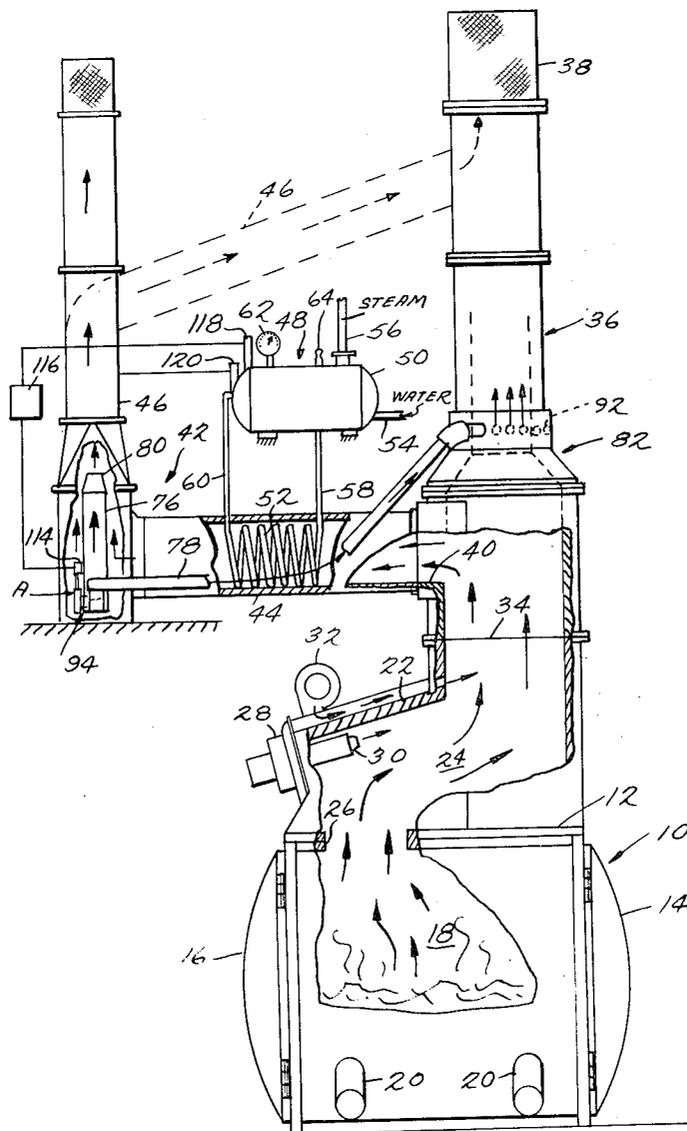
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[57] **ABSTRACT**

A directional control apparatus for directing hot flue gases received from a combustion zone, either directly to atmosphere through a main stack or through an auxiliary stack, where heat is recovered from the waste hot flue gases and further utilized as energy. While the directional control apparatus for flue gases is especially suitable in recovering waste heat from an incinerator, it may also be utilized for recovering waste heat from any type of combustion equipment, such as a furnace, gas heater, or the like. The direction of the flow of hot flue gases is controlled by aerodynamic valving rather than by mechanical means through either the main stack or the auxiliary stack provided with the heat exchanger of a heat recovery apparatus.

25 Claims, 6 Drawing Figures



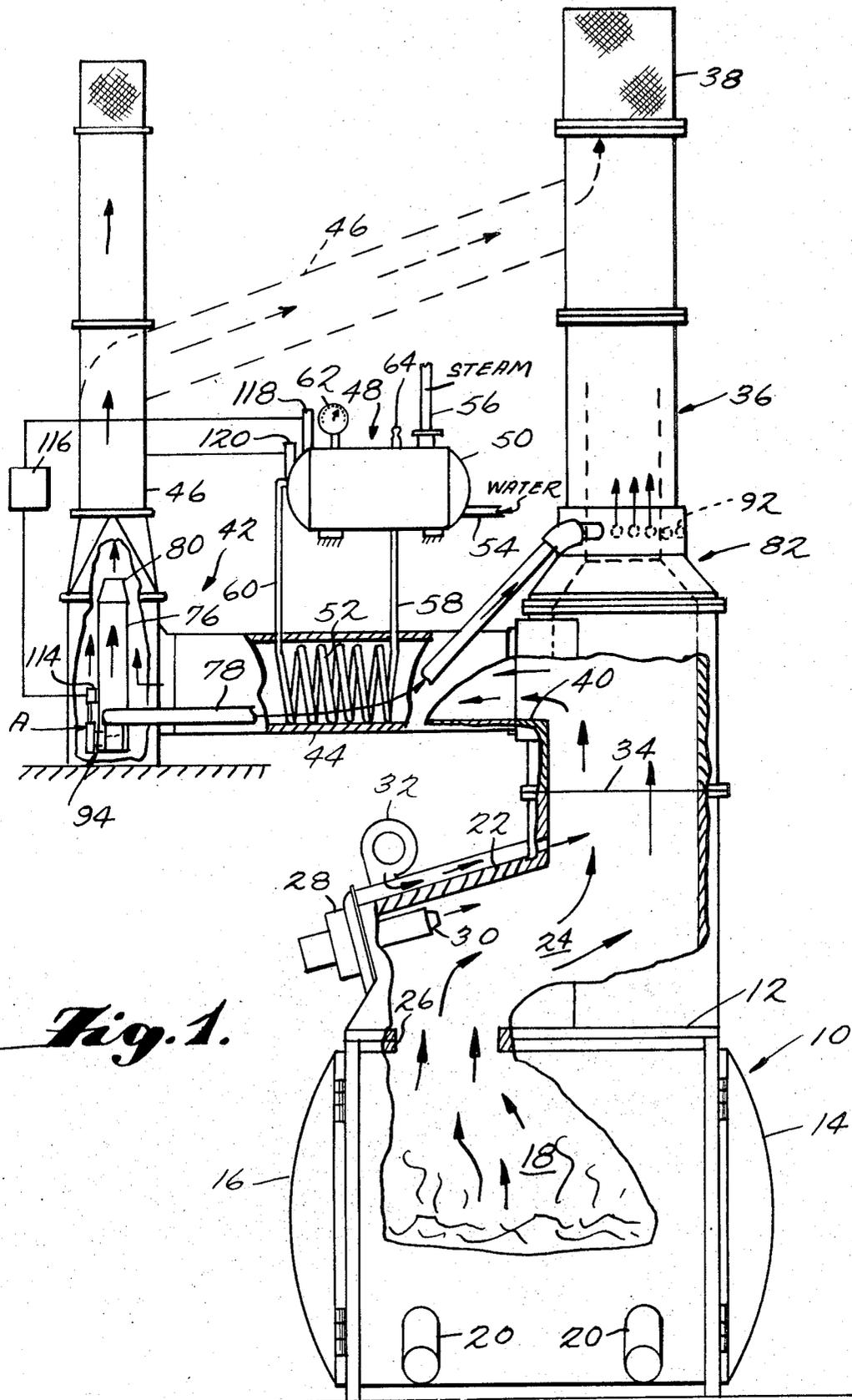


Fig. 1.

Fig. 3.

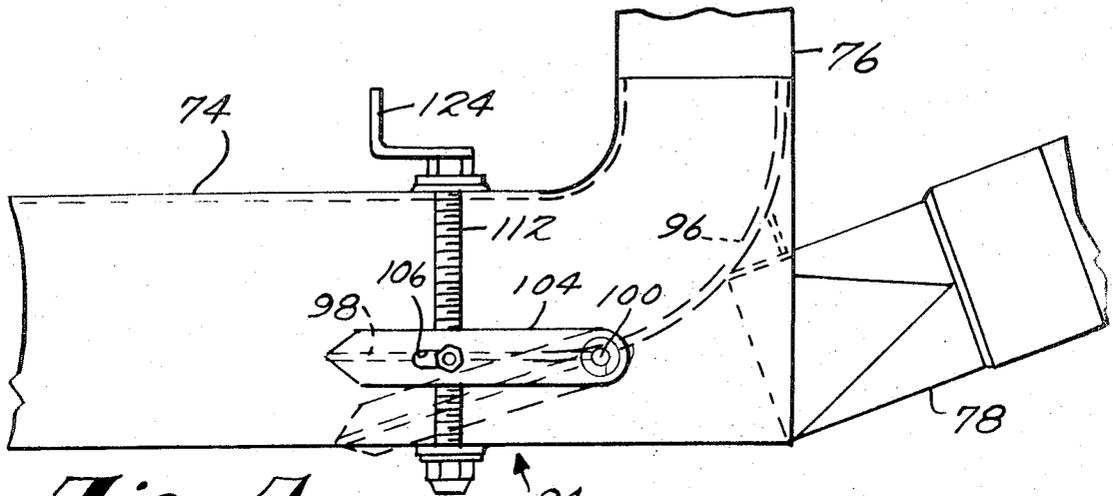


Fig. 4.

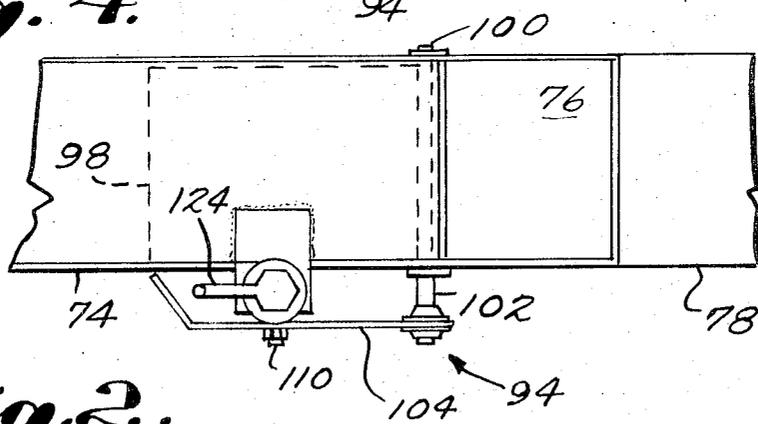


Fig. 2.

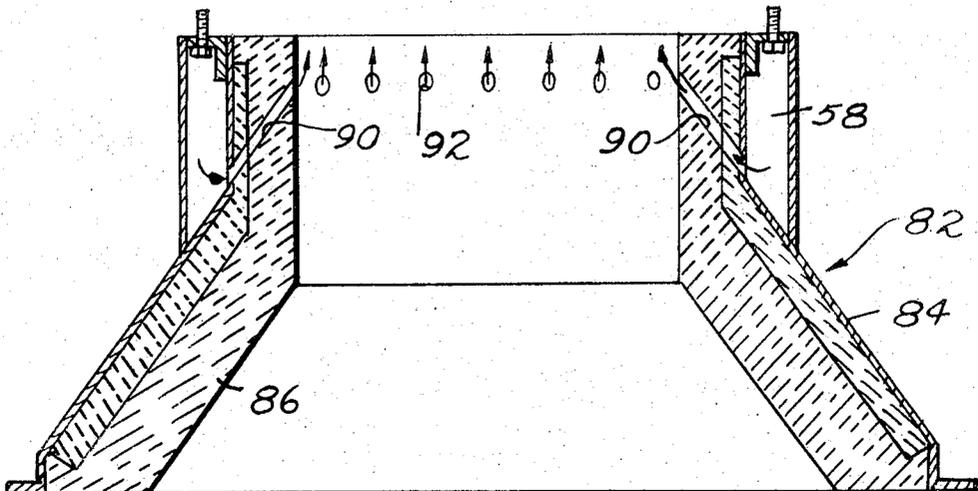


Fig. 5.

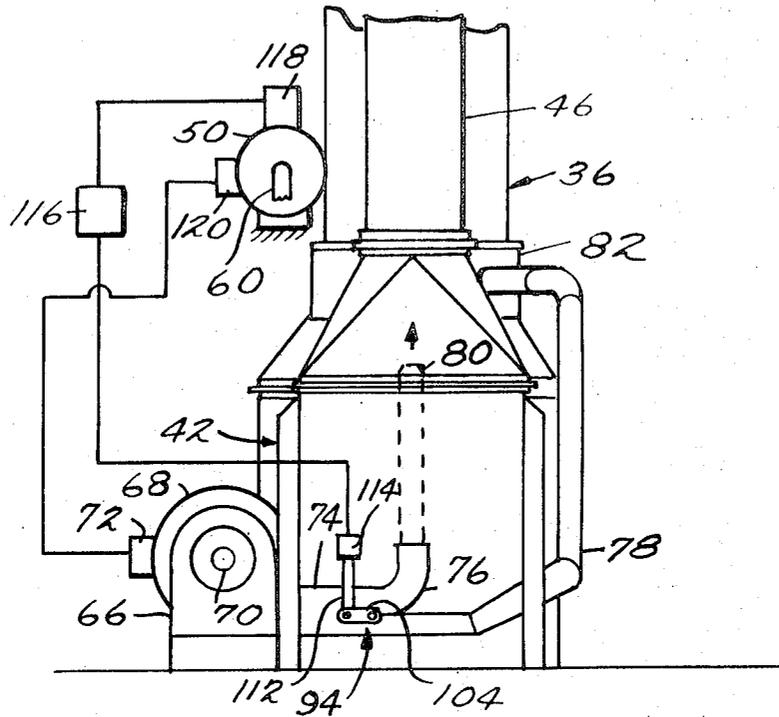
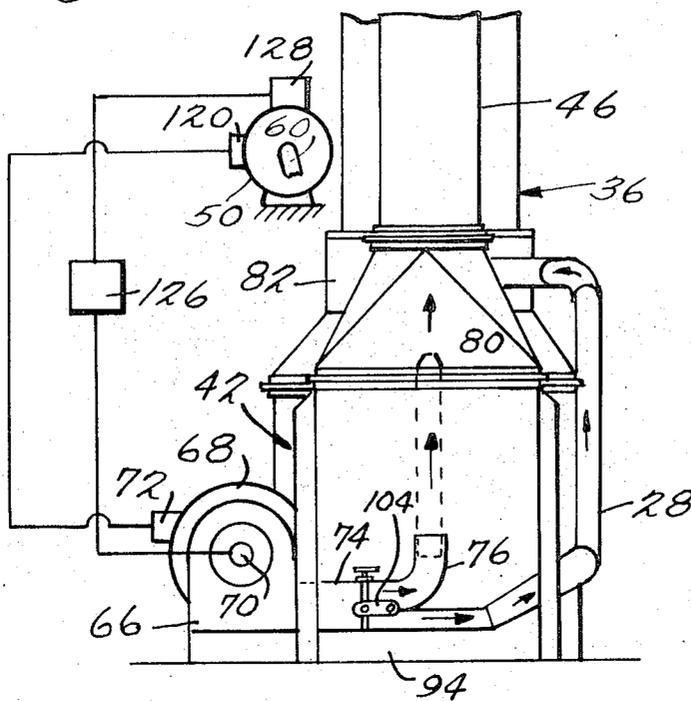


Fig. 6.



DIRECTIONAL CONTROL OF HOT GASES FROM AN INCINERATOR OR THE LIKE

The present invention relates to a new and improved system or apparatus for controlling the direction of flow of hot flue gases through either a main stack or an auxiliary stack having heat exchanger means therein for recovery of waste heat. More specifically, the invention is intended for use with an incinerator for burning waste material, either solid or liquid or a combination, although the apparatus may be used with other types of equipment producing flue gases such as a furnace, a gas heater, or the like.

BACKGROUND OF THE INVENTION

In recent years, there has been deep concern by the general public over the pollution of the environment from the discharge of pollution containing gases into the atmosphere by various means such as incinerators, furnaces, gas heaters, and the like. Another concern of environmentalists is the disposal of rubbish and waste material which are not biodegradable, as burying it creates other environmental problems with landfills and pollution of rivers, lakes, and other bodies of water. Consequently, in recent years, the technology of incinerators has increased so that incinerators are now made which discharge substantially pollution free flue gases, thus eliminating the necessity of disposing rubbish and waste material, such as solids, as well as some liquids, by burying the same. U.S. Pat. No. 3,403,645 issued Oct. 1, 1968 to George H. Flowers, Jr. and Pat. No. 3,489,109 issued Jan. 13, 1970 to George H. Flowers, Jr. disclose incinerators which utilize a two-stage combustion process for producing clean flue gases. In the first stage, burning of the bulk of the waste material is accomplished in a first combustion chamber. The hot exhaust gases discharged from this chamber, before they have had a chance to cool, enter a second combustion chamber where additional air is supplied to further support burning of any combustible products in the exhaust gases so as to produce a clean flue gas which is substantially pollution free. This type of incinerator is a controlled air flow type which produces a constant discharge of clean flue gases without adjustment of its controls. The subject matter of these patents is incorporated by reference herein.

More recently, there has been concern in this country over the energy crisis because of the shortage of petroleum products and natural gas. Consequently, many efforts are being made to conserve energy and one of these efforts is the recovery of heat from waste flue gases and the like, the heat being used to provide energy for generating steam or hot water or heating other fluids.

When steam is generated, it may be used in plants such as hospitals, textile mills, or the like, as an auxiliary system, or for that matter, the main system for supplying steam for various purposes. On the other hand, if the recovery system is used for hot water, it may be used in situations where hot water heat is desired; for example, in heating a building, providing hot water for hot water distribution systems in a building, and the like.

Efforts have been made in the past to incorporate heat recovery systems in incinerators, but such heat recovery systems have not proved satisfactory. In one prior effort arrangement, the incinerators were pro-

vided with coils or the like in the wall of the combustion chamber, the coils providing a heat exchanger for a heat recovery apparatus. These incinerator arrangements were sometimes called "water wall" incinerators. However, in this type of system, the recovery of heat from the combustion zone reduces the temperature of the exhaust gases to such an extent that there can be no further combustion of products in exhaust gases without adding sufficient energy back into the exhaust gases to raise the temperature of the same to a point for supporting combustion. In other words, this type of system would not be economical to operate because of the added cost for the heat energy necessary to produce pollution free flue gases and, further, the system is difficult to control and maintain a constant pollution control of the gases being discharged from the systems.

A further system proposed was the provision of a heat exchanger for a heat recovery system in the main exhaust stack, but such a system was also not practical as there were oftentimes periods when the heat recovery apparatus did not have to be used while the incinerator was in use and this in and of itself was undesirable since it could create a hazardous condition in the heat recovery apparatus. Additionally, the system was costly as the main stack had to have a continuously operating fan therein to overcome the pressure drop across the heat exchanger and maintain an adequate forced draft in the combustion chamber regardless of whether the heat recovery apparatus was operating.

A third system proposed involved the use of a main stack and a separate auxiliary stack, both connected to the combustion chamber. The main stack had a mechanically operated butterfly valve therein to close off flow when it was desired to utilize the auxiliary stack containing the heat exchanger of the heat recovery apparatus. In this type of system, the auxiliary stack also had a mechanically operated butterfly valve therein which was closed when the heat recovery system was not in use. The butterfly valve in the main stack was normally linked by a common control device to the butterfly valve in the auxiliary stack, but both of these valves had to be made of special refractory material as they were exposed to hot flue gases. This made such a system economically unsatisfactory.

Ancillary to the aforementioned described system, it was also proposed to utilize the auxiliary stack opening into the main stack rather than the combustion zone, the auxiliary stack having the heat exchanger therein. A mechanical interconnected butterfly valve system used with this arrangement directs the flow of flue gases to one stack or the other. The arrangement required a fan in the auxiliary stack in an effort to overcome pressure losses through the heat exchanger so as to try to maintain pressure in the flue gases discharging from the incinerator at a substantially constant valve.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

The present invention is an improvement over the above described prior efforts in that it provides an aerodynamic valving system for directing flue gases through either a main stack or an auxiliary stack opening to the main stack and having a heat exchanger therein of a heat recovery apparatus. By utilizing an aerodynamic valving system, movable valve parts or el-

ements are not provided in the flow path of the hot flue gases at anytime and a desired constant draft and flow condition can be maintained in the combustion chambers of the incinerators so that the flue gases are at all times substantially pollution free.

The directional control apparatus for the flue gases comprises providing a combustion zone delivering pollution free gases with a main stack so that such gases can normally flow to atmosphere and an auxiliary stack defined by a conduit having a first portion and a second portion. The first portion extends transversely to the axis of the main stack and opens to the same at a position downstream from the combustion zone, but in an area where the temperature of the flue gases is in the order of 1200 to 2400°F. The first portion of the conduit is provided with a heat exchanger of a heat recovery apparatus and is connected to the second portion which discharges flue gases after heat has been recovered therefrom. The aerodynamic valving system includes an air blower having its outlet connected to a manifold, the manifold being respectively connected to a first means for discharging an air jet downstream of the heat exchanger and in a downstream direction and a second means for discharging an air jet into the main stack above the point of connection of the first portion of the conduit to the main stack and also in a downstream direction of the main stack. By proportioning the two air jets when aspirating flue gases into the respective auxiliary and main stacks, the flow of flue gases normally being discharged out of the main stack can be totally or partially directed through the auxiliary stack and the heat exchanger therein so that heat can be recovered therefrom. Such an arrangement will overcome the pressure loss through the heat exchanger without upsetting the conditions of operation of the incinerator producing pollution free flue gases, but it is important to realize that the arrangement also provides for simple modulation or proportioning of the air jets to control the heat flow through the heat recovery apparatus. Additionally, the system provides a fail-safe means at times of dangerous or emergency conditions arising in the heat recovery apparatus because the blower can be turned off by a sensing unit for sensing an over capacity within the heat recovery apparatus. Once the blower is turned off, the pressure loss across the heat exchanger will cause the flue gases to take the path of at least resistance, namely, upwardly through the main stack so as to be discharged to atmosphere therefrom. The auxiliary stack and the heat exchanger will then cool down. The fail-safe feature is inherent in the operation of the blower and should the blower itself fail for any reason, the flue gases will immediately be diverted from the auxiliary stack and pass upwardly and harmlessly out of the main stack.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the directional control apparatus and incinerator of the present invention, the view being primarily diagrammatic and partly in section.

FIG. 2 is an enlarged vertical sectional view of the adapter member for the main stack and illustrates the manifold for supplying air jets to the main stack.

FIG. 3 is an enlarged view looking in the direction of the arrow A of FIG. 1, but illustrating a manually adjustable splitter valve for splitting and proportioning air

from the air blower and delivering it respectively to the main stack and auxiliary stack.

FIG. 4 is a fragmentary top plan view of FIG. 3.

FIG. 5 is a diagrammatic fragmentary end view of the main stack and auxiliary stack arrangement shown in FIG. 1 and looking generally from the left to the right of FIG. 1.

FIG. 6 is a diagrammatic end view similar to FIG. 5, but disclosing a modified form of the invention wherein inlet air to the blower is modulated in accordance with conditions in the heat recovery tank.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings wherein like characters or reference numerals represent like or similar parts, an incinerator for the present invention is generally designated by the reference numeral 10. The incinerator 10 includes an annular casing 12 provided with suitable refractory lining, the ends of the casing being provided with doors 14 and 16 or suitable mechanical means for loading and unloading the same. The casing 12 preferably has a horizontal axis, such as shown in the aforementioned Pat. No. 3,489,109, although it may have a vertical axis, such as shown in the incinerator of Pat. No. 3,403,645. Casing 12 provides a main combustion zone or chamber 18 for the burning of waste material and the casing includes the usual pressure burners 20 having nozzles within the chamber for starting the burning process of the waste material. The burners 20 normally are turned off once combustion has started and operating temperatures are reached. As will be appreciated by those skilled in the art, air is supplied in controlled amounts to the main combustion chamber 18 to assist in supporting combustion once the waste material is burning.

Incinerator 10 further includes a transition conduit 22 defining a second combustion chamber or zone 24, the transition conduit 22 being in communication with a passageway 26 in the upper portion of the casing 12. Hot exhaust gases from the main combustion zone chamber 18 pass through the passageway 26 into the second combustion zone 24 where a secondary stage of burning is accomplished. As described in the aforementioned patents, the exhaust gases leaving the main combustion zone carry with them burnable pollution particles or products which must be removed so that the resulting flue gases are substantially pollution free. In order to assist in burning of the waste particles or products in the exhaust gases, a pressure burner 28 having its nozzle 30 in the second combustion zone 24 is provided, as well as an air blower 32, which discharges air into this zone to assist in the supporting of the combustion process. Once burning begins in the secondary combustion zone 24 and the temperature herein has risen a sufficient amount, the pressure burner 28 may be cut off as the air supplied to the combustion zone or chamber 24, plus the heat of the exhaust gases is sufficient to support complete burning of waste products and the production of substantially pollution free flue gases.

The second combustion chamber 24 is provided with a discharge opening 34 to which is attached a main stack assembly 36. Under normal conditions of operation, the substantially pollution free flue gases will flow straight up the main stack 36 and be discharged from its upper end 38 to atmosphere. As best shown in FIG. 1, the main stack 36 is provided with a side opening 40 spaced upwardly from the combustion chamber 24, but

in an area where the flue gases haven't had a chance to cool and have a temperature normally in the range of 1200° to 2400°F. An auxiliary stack generally designated at 42 is connected to the opening. The auxiliary stack 42 is a conduit having a first portion 44 with a substantially horizontal axis transverse to the axis of the main stack 36, the first portion 44 being connected at one end to the opening 40. A second portion 46 of the auxiliary stack or conduit 42 is connected at its lower end to the outer end of the first portion 44 and it extends upwardly for discharging flue gases therefrom when such gases are flowing through the auxiliary stack 42, as will be described in more detail later in the specification.

A heat recovery apparatus generally designated at 48 includes a steam tank 50 and a heat exchanger 52 positioned in the first portion of the auxiliary stack or conduit 42. The steam tank 50 is provided with a water inlet 54 through which water is supplied when necessary and a steam outlet 56 from which steam is supplied upon demand to a source of use, such as a hospital steam system or a textile plant steam system. The heat exchanger 52 has been diagrammatically shown as a plurality of coils having a water inlet 58 from the steam tank 50 and a steam outlet 60 to the steam tank 50. The usual pressure gauge 62 and safety valve 64 are provided on the steam tank 50. While the heat recovery apparatus has been described as a steam system, it, of course, could be a hot water system for supplying hot water to a point of use or a system for heating other transfer fluids.

Even though there is an opening 40 in the main stack 36 which is connected to the auxiliary stack 42, flue gases will not flow through the auxiliary stack 42 under normal conditions of operation because of a pressure drop across the heat exchanger member 52. In other words, the heat exchanger member 52 provides a restriction to flow in the first portion 44 of the conduit 42 and thus pollution free flue gases will take the path of least resistance, which is directly up the main stack 36 from which the flue gases are discharged to atmosphere. When it is desired to change the direction of flow of flue gases so that instead of going up the main stack 36 they are diverted into and through the auxiliary stack 42, an air jet is provided in the auxiliary stack 42 downstream of the heat exchanger 52, the air jet discharging air in a downstream direction. The pumping energy of the air jet will overcome the pressure drop across the heat exchanger and all other turning and frictional losses in the auxiliary stack. In this respect, an air jet is also discharged into the main stack 36 above the opening 40 in a downstream direction merely to prevent air from being sucked down the main stack and cool the hot flue gases flowing through the auxiliary stack 42.

To discharge the air jets into the main stack 36 and the auxiliary stack 42 respectively, an air blower 66, having a source of power such as a five horsepower motor 68, is utilized. The air blower 66 had a suitable adjustable inlet valve 70 to control the amount of discharge from its air outlet and a motor control means 72 for starting and stopping the motor. The air outlet of the blower 66 is connected to a manifold 74 which, in turn, is connected to a first duct 76 and a second duct 78. The first duct 76 extends into the second portion 46 of the conduit or auxiliary stack 42 and centrally upwardly therein and terminates in an air jet nozzle 80.

The second duct 78 also extends from the manifold 74 at a position adjacent to the connection of duct 76 to an adapter member 82 (FIG. 2) positioned in and forming a part of the main stack 36 just above the opening 40. The adapter member 82 includes a metallic shell 84 having a refractory liner 86, the shell also having an annular manifold 88 at its upper end for receiving the air from the air duct 78. A plurality of holes 90 communicating at one end with the manifold 88 and extending upwardly through the refractory material 86 open to the interior of the adapter member 82, as indicated at 92. The openings 92 define small jet nozzles for discharging air upwardly in the main stack 36 to prevent cold air from being sucked down the main stack when the auxiliary stack 42 is being used.

It is necessary to proportion the air discharged into the auxiliary stack 42 and the main stack 36 so that a desired flow condition is obtained in the heat exchanger passage while simultaneously maintaining proper conditions in the combustion chambers 18 and 24 for complete burning of waste material and combustible products in the exhaust gases. In order to proportion the air, a splitter valve generally designated at 94 is provided at the junction of the ducts 76 and 78 with the manifold 74. Referring to FIGS. 3 and 4, a curved baffle or wall 96 extends between the openings of the ducts 76 and 78 to the manifold. The splitter valve 94 includes a flat plate 98 pivoted on a pivot axis 100 at the end of the baffle 96. The pivot axis includes a pivot rod 102 fixed to the plate 98, the rod extending outwardly of the manifold 74. A pointer arm 104 fixed to the rod 102 shows the position of the plate member 98. The pointer arm 104 has an elongated slot 106 therein through which a projection 110 of a threaded sleeve nut or collar (not shown) extends. The sleeve nut or collar is threadedly received on a screw 112 and rotation of the screw 112 causes the sleeve nut to move up or down, thus varying the pointer arm 104 and pivoting the pivot rod 102 which fixedly carries the plate member 98.

Referring to FIG. 5, it will be noted that the screw 112 is connected to a motor 114 for automatically rotating the same in one direction or the other. The motor in turn is provided with a motor controller unit 116, the motor controller being connected to sensor member 118 on the steam tank 50. The sensor member 118 may be of the type that detects the pressure in the steam tank or the temperature of the heated fluid and, thus, when it sends a signal to the controller 116, it will cause the splitter valve 94 to be operated in one direction or the other, depending upon the sensed condition so as to modulate the flow of flue gases through the heat exchanger 52. For example, if the sensor member 118 indicates that the steam tank 50 of the heat recovery apparatus 48 is low in steam pressure available for use, it will send a signal to the controller to move the splitter valve to a position wherein more air is discharged from the nozzle 80, thus drawing more hot flue gases across the coils of the heat exchanger 52 to develop more steam. If the steam pressure in the tank builds back up to a level greater than desired, the splitter valve 94 will be moved in an opposite direction so as to cause the pumping action of the nozzle 80 to decrease, thus permitting some of the flue gases to flow upwardly in the main stack 36 until such time as the demand for more steam requires more of the flue gases to flow through the auxiliary stack 42.

In the above described operation for modulating the pumping action of nozzle 80, the adjustable air inlet valve 70 is preset to give a constant output of air to the manifold 74 when the blower 66 is operating.

In order to make the system completely fail-safe, a fail-safe sensor member 120 is provided on the steam tank 50 for detecting emergency conditions within the tank, such as over pressure or low water level. The fail-safe sensor member 120 is connected to the motor controller 72 of the blower motor 68 and once it is activated, it immediately cuts off the blower motor and this stops all pumping action of the aspirating air jets in both the main stack 36 and the auxiliary stack 42. As described earlier, without the pumping action of the air jet nozzle 80, the hot flue gases discharged from the combustion chamber 24 will no longer be able to go through the heat exchanger 52 and they will taken the path of least resistance and go straight up the main stack 36 and be discharged to atmosphere. In fact, this action will actually draw some air into the main stack from the auxiliary stack, cooling the heat exchanger.

Referring now to FIG. 6, there is an alternate modification shown for modulating the aspirating action of the air jet nozzles 80 and 92. In this arrangement, the splitter valve 94 is manually adjusted by providing a crank handle 124 on the screw 112 (FIGS. 3 and 4). The pumping output energy of the blower 66 is varied by connecting the air inlet valve 70 to a controller 126, the controller in turn being connected to a sensor member 128 on the tank 50. The sensor member 128 may be similar to the sensor member 118 so that it senses the conditions within the tank as to whether or not more steam is needed. If more steam is needed, the air inlet valve 70 is opened more by the controller 126, thus providing a greater output of air from the blower 66 to the manifold 74.

As shown in FIG. 1 in broken lines, the second portion 46 of the auxiliary stack or conduit 42 may be folded back and coupled into the main stack to discharge flue gases therefrom when the flue gases are passing through the auxiliary stack system. Of course, the opening of the second portion 46 into the main stack 36 must be downstream of the adapter member 82 and its aspirating air jet nozzles 92.

In hospitals, there is a considerable waste disposal problem as hospitals have lately increased their use of disposable linens, garments, dishes, paper, and the like. Generally, hospitals have to dispose of from 20 to 25 pounds of waste per person per day since they have gone to these disposable materials, and this waste material has a relatively high heating value when burned. While in the past this waste has been buried in municipal land fills, suitable land fills are now becoming scarce and the cost of transporting the waste material to these areas is increasing. Lately, some hospitals have been disposing of it by incinerators, as incinerators are now being made which meet non-pollution requirements. While these hospitals have been burning up the waste material, they have not been utilizing the heat energy of the flue gases. This is also true in industrial plants where there is considerable waste material to dispose.

In a system such as described above where an incinerator has a capacity of disposing 1000 pounds per hour of all types of hospital waste, such an incinerator produces up to 5 or 6 million BTU's per hour in the flue gases. When the system has its heat recovery apparatus

connected into the normal steam system of the hospital, it can reduce the fuel for the normal system as this auxiliary system will produce as much as 2500 to 3000 pounds of steam per hour at 90 pounds per square inch gauge. When the flue gases pass through the heat exchanger 52, the inlet temperature of the flue gases into the heat exchanger is about 1800°F., whereas the outlet temperature from the heat exchanger is about 725°F., thus realizing over 60 percent recovery of heat energy from the flue gases. The static pressure in the upper burner chamber 24 is maintained constant to about -.15 inch water gauge.

If the situation occurs where there is not sufficient waste material to burn to meet the requirements of the steam generating system, then these requirements can be met at least partially by merely turning on the burner 28 in the upper chamber 24 of the incinerator 10. Heat from this burner alone is normally sufficient to provide flue gases in a range of 1200°F. to 1400°F.

The terminology used throughout this specification is for purposes of description and not for limitation, the scope of the invention being defined in the appended claims.

What is claimed is:

1. A directional control apparatus for flue gases received from a combustion zone comprising: an upwardly extending stack operatively communicating with the combustion zone and normally aspirating flue gases therefrom to atmosphere; a conduit having a first portion extending transversely to the axis of said stack and opening to said stack and a second portion for discharging flue gases diverted from said stack through said first portion; heat recovery means including heat exchanger means in said first portion of said conduit for recovery of heat from flue gases; and aerodynamic valving means to divert gases from aspirating upwardly and discharging from said stack to go through and discharge from said conduit whereby said heat exchanger means removes heat from said flue gases, said aerodynamic valving means including a first means for discharging an air jet into said conduit in a downstream direction of said conduit, said first means being positioned downstream of said heat exchanger means and a second means for discharging air in a downstream direction in said stack, said second means being positioned downstream of the opening of said first portion of said conduit to said stack.

2. A directional control apparatus for flue gases as claimed in claim 1 wherein said first means of said aerodynamic valving means injects a greater quantity of air into said conduit than the quantity of air injected into said stack by said second means of said aerodynamic valving means.

3. A directional control apparatus for flue gases as claimed in claim 1 wherein said aerodynamic valving means includes a blower for air and having a source of power and duct means for discharging an air jet in a downstream direction in said conduit downstream of said heat exchanger means and for discharging an air jet into said stack in a downstream direction and spaced downstream of the opening of said conduit into said stack.

4. A directional control apparatus for flue gases as claimed in claim 3 in which said duct means includes means to proportion the discharge of the air jet in said conduit to the discharge of the air jet in said stack.

5. A directional control apparatus for flue gases as claimed in claim 4 including means to modulate said proportioning means in accordance with conditions of said heat recovery means.

6. A directional control apparatus for flue gases as claimed in claim 3 including a valve means on said blower for controlling the amount of air discharged therefrom into said duct means.

7. A directional control apparatus for flue gases as claimed in claim 6 including means to modulate said control valve on said blower in accordance with conditions of said heat recovery means.

8. A directional control apparatus for flue gases as claimed in claim 3 in which said duct means includes means to proportion of the discharge of the air jet in said conduit to the discharge in the air jet in said stack and in which said blower includes a valve means to control the amount of air discharged therefrom to said duct means.

9. A directional control apparatus for flue gases as claimed in claim 8 including means to modulate said proportioning means and said blower control valve means in accordance with conditions of said heat recovery means.

10. A directional control apparatus for flue gases as claimed in claim 3 including a sensing means for said heat recovery means, said sensing means being operatively connected to said source of power and operable to cut off said source of power to stop said blower when emergency conditions are sensed in said heat recovery means.

11. A directional control apparatus for flue gases as claimed in claim 1 in which said second portion of said conduit includes an auxiliary stack discharging flue gases to atmosphere.

12. A directional control apparatus for flue gases as claimed in claim 1 in which said second portion of said conduit includes an auxiliary stack opening into said first-mentioned stack downstream of the opening of said first portion to said first-mentioned stack, said auxiliary stack discharging flue gases therefrom into said first-mentioned stack.

13. In combination: an incinerator having a main combustion chamber for burning of waste material and a secondary combustion chamber for receiving exhaust gases therefrom and burning waste products in the exhaust gases to produce substantially pollution free flue gases; a generally upwardly extending main stack operatively connected to said second combustion chamber for receiving the flue gases therefrom and normally discharging the flue gases to atmosphere; an auxiliary stack means connected to said main stack at a point downstream of its connection to said second combustion chamber, said auxiliary stack means including at least a first portion extending transversely to the axis of and opening to said stack and a second portion extending generally upwardly and connected to said first portion on an axis transverse to the axis of said portion; heat recovery means for recovering heat from said flue gases when flowing through said auxiliary stack means, said heat recovery means including a fluid tank and a heat exchanger connected to said fluid tank and positioned in said first portion of said conduit; aerodynamic valving means to divert flue gases from aspirating normally upwardly in said main stack to flow through and discharge from said auxiliary stack whereby said heat exchanger means removes heat from said flue gases,

said aerodynamic valving means including a first aspirating means for discharging an air jet downstream in said second portion of said conduit and a second aspirating means for discharging air in a downstream direction in said main stack at a position downstream of the opening of the first portion of said conduit to said main stack.

14. The combination as claimed in claim 13 wherein said aerodynamic valving means includes a blower for air having a source of power and control means therefor, a manifold extending from an outlet of the blower, said first aspirating means including a duct connected to said manifold and extending upwardly in said second portion of said conduit and having an air jet nozzle on the end thereof, and said second aspirating means including a second duct connected to said manifold and connected to said main stack.

15. The combination as claimed in claim 14 wherein said second conduit includes a manifold collar extending around said main stack and a plurality of upwardly extending holes in said main stack for directing air in a downstream direction therein.

16. The combination as claimed in claim 15 including an adjustable splitter valve positioned in said manifold for proportioning air discharged therefrom into said first and second ducts.

17. The combination as claimed in claim 16 including manually operable means for adjusting said splitter valve.

18. The combination as claimed in claim 16 including an air valve on said blower, sensor means on said fluid tank for sensing conditions within said tank, and a controller means operatively connected to said blower air inlet valve and to said sensor means for controlling output of air from said blower to said manifold dependent on conditions within said fluid tank.

19. The combination as claimed in claim 18 including a fail-safe sensor means on said tank for sensing emergency conditions within said tank, said fail-safe sensor means being connected to the control means for the source of power of said blower whereby said blower is stopped when emergency conditions exist.

20. The combination as claimed in claim 16 including control means for automatically adjusting said splitter valve to modulate the air in said first and second ducts and sensor means on said fluid tank for sensing conditions within said tank, said sensor means being operatively connected to said controller means.

21. The combination as claimed in claim 20 including a fail-safe sensor means on said tank for sensing emergency conditions within said tank, said fail-safe sensor means being connected to the control means for the source of power of said blower whereby said blower is stopped when emergency conditions exist.

22. The combination as claimed in claim 13 including a pressure burner having a burner nozzle positioned within said second combustion chamber, said pressure burner being utilized to assist in burning waste products in the exhaust gases when necessary to support combustion and further being utilized to assist in providing heat for flue gases when said incinerator is providing insufficient heat for use of said heat recovery means.

23. The combination as claimed in claim 13 wherein the second portion of said conduit of said auxiliary stack means discharges flue gases to atmosphere.

24. The combination as claimed in claim 13 wherein the second portion of said conduit of said auxiliary

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stack means opens into said main stack downstream of the opening of said first portion to said main stack and thereby discharges flue gases into said main stack.

25. The combination as claimed in claim **13** wherein

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said heat recovery means is for producing steam and wherein said fluid tank is a steam tank having an inlet for water and an outlet for steam.

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