

[54] **INCINERATOR WITH STACK TRANSITION CHAMBER**

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[58] Field of Search **110/173, 176, 8 C, 110/8 A, 8 R, 18 R, 18 C**

[56] **References Cited**

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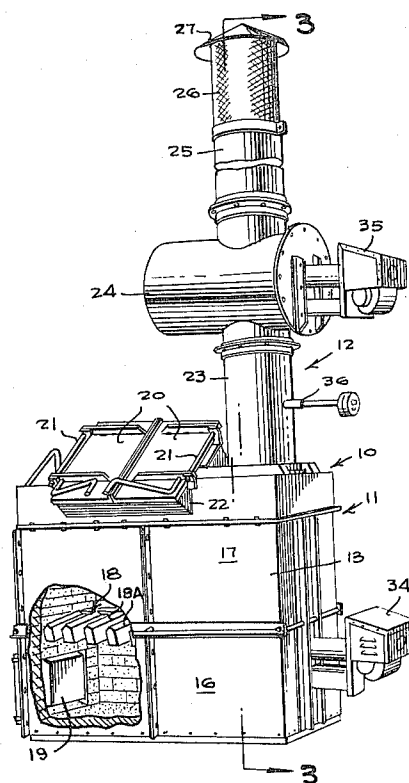
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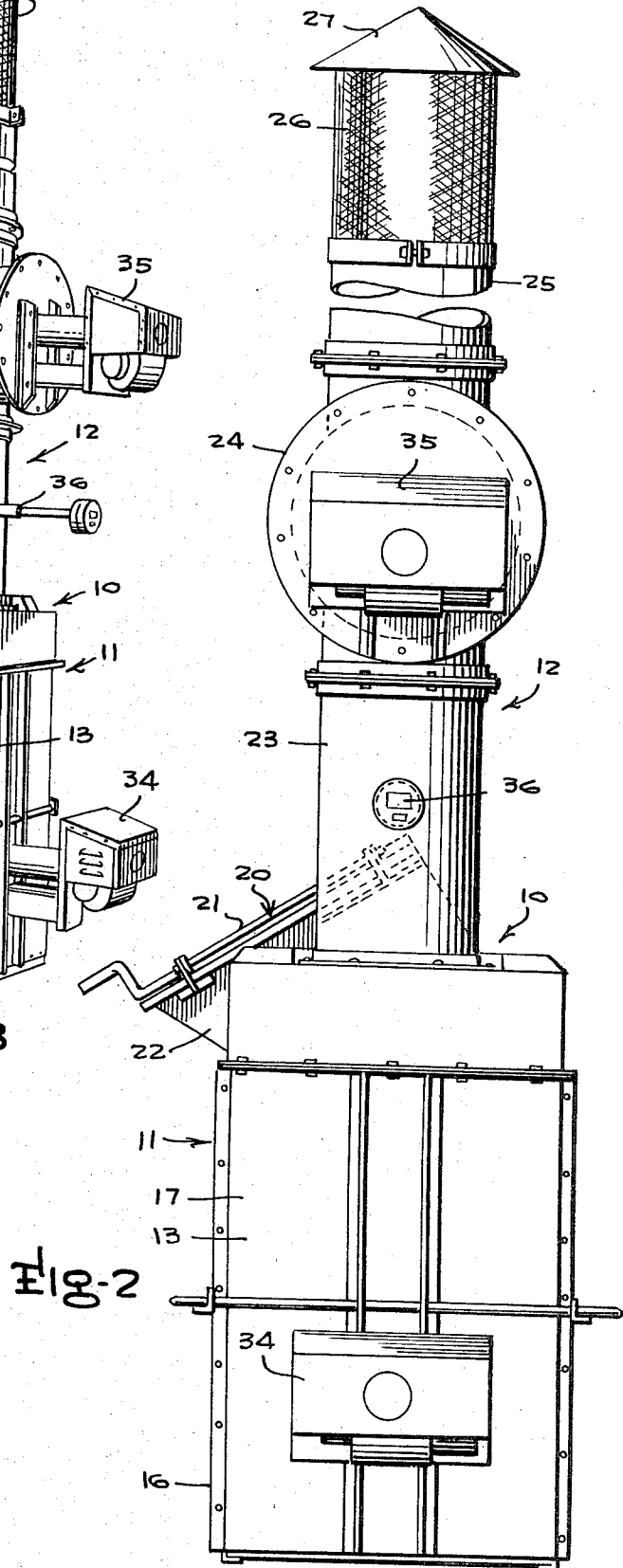
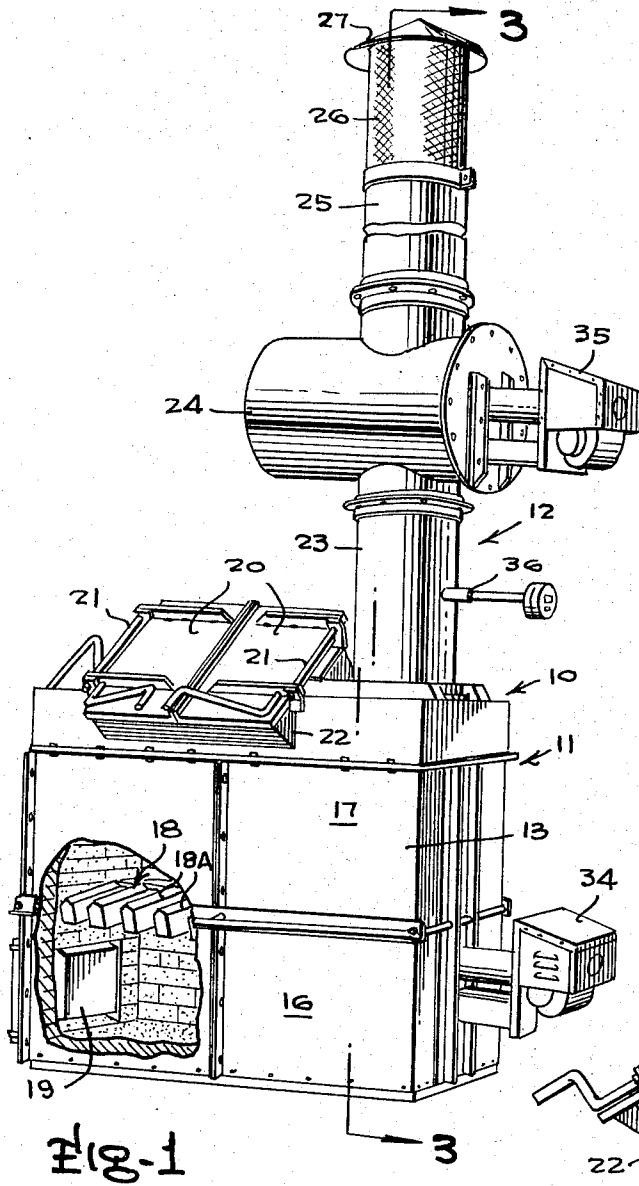
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[57] **ABSTRACT**

An incinerator for disposing of biological or pathological wastes and other materials, including a refractory lined lower primary combustion chamber having an upper fill opening and a grate sub-dividing the primary combustion chamber into an upper chamber portion and a lower chamber portion, a first burner for producing combustion in the lower chamber portion, an exhaust gas outlet stack extending upwardly from the primary combustion chamber having a transition chamber interposed therein at a location spaced above the primary combustion chamber, the transition chamber and the outlet stack between the transition chamber and the primary combustion chamber being refractory lined, a secondary burner communicating with the transition chamber defining a secondary combustion chamber therein. The transition chamber defines a horizontal cylindrical chamber wherein the blower flame extends along its center axis and includes an interrupted cylindrical metallic baffle member spanning part of the axial length of the secondary combustion chamber and having a downwardly facing open segment.

8 Claims, 8 Drawing Figures

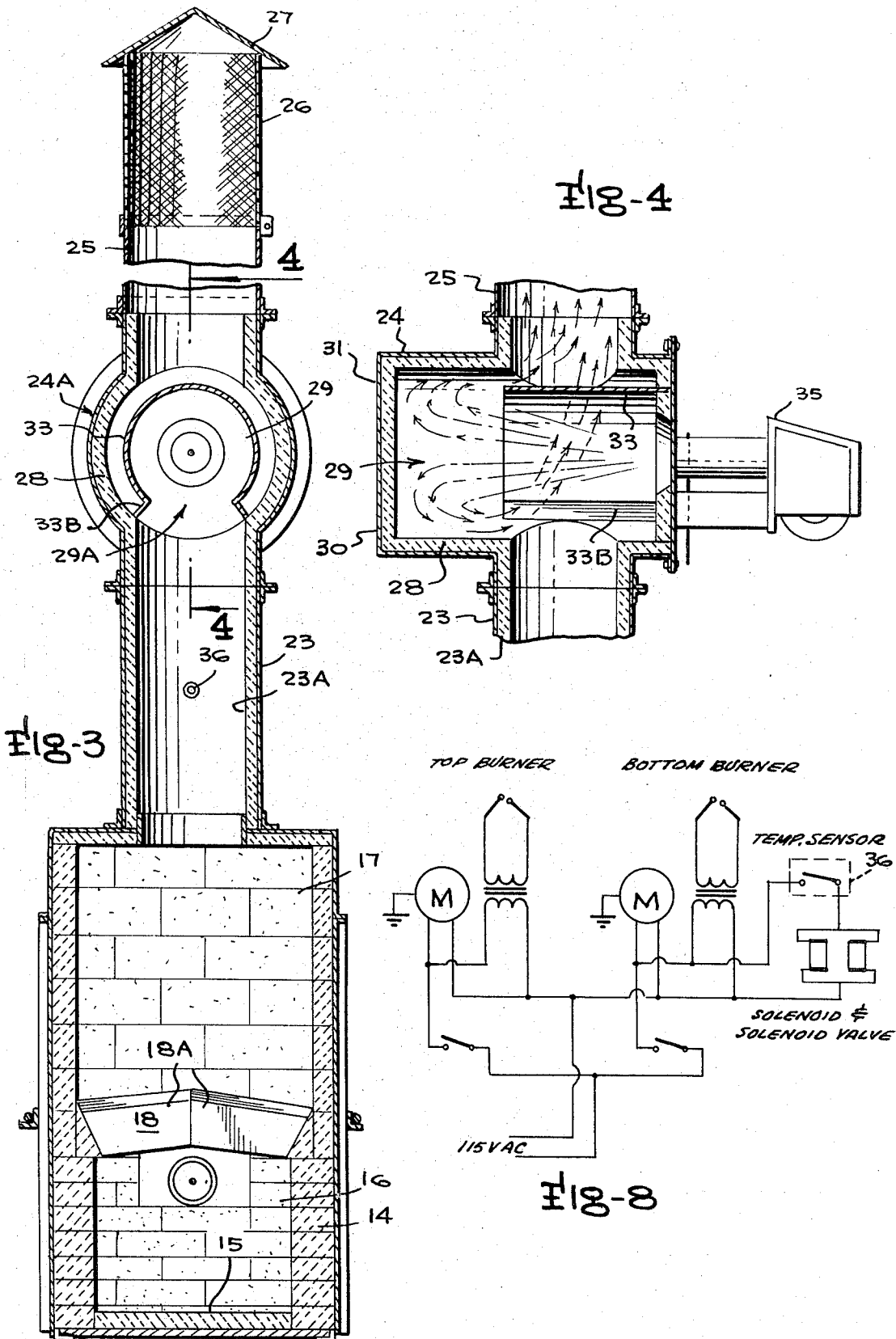


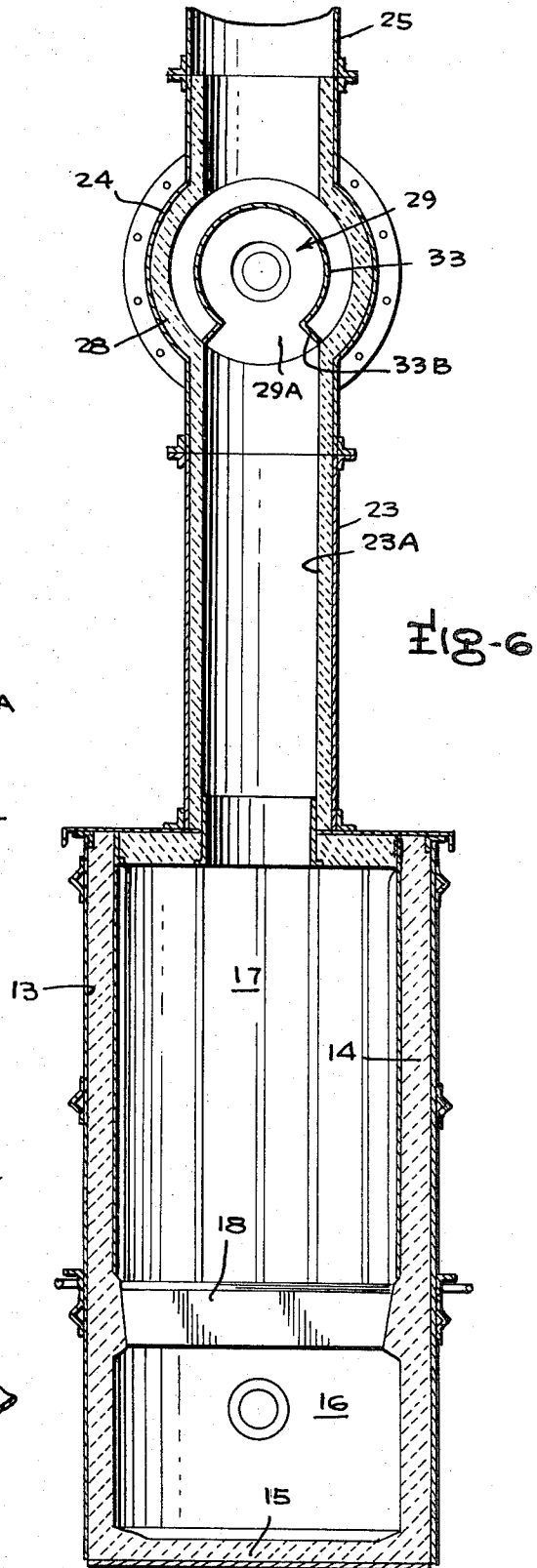
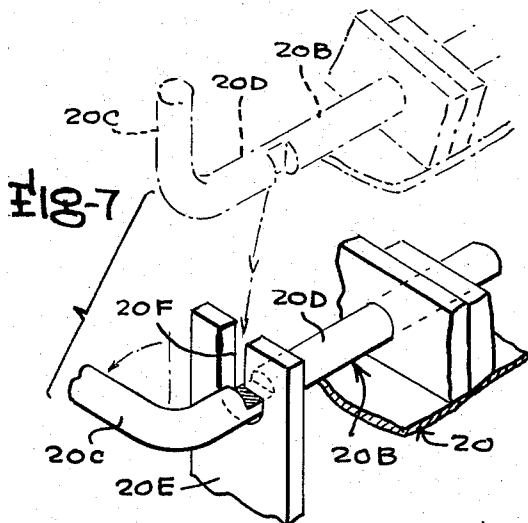
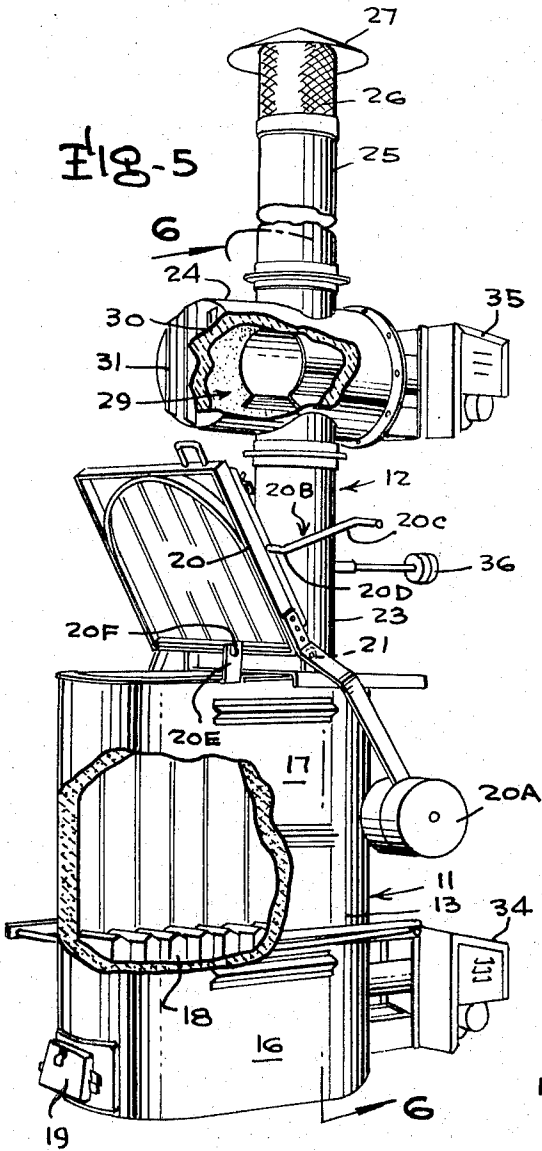


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INCINERATOR WITH STACK TRANSITION CHAMBER

BACKGROUND AND OBJECTS OF THE INVENTION

The present invention relates in general to incinerators, and particularly to oil or gas fired incinerator structures designed especially for agricultural use, and for use by veterinarians, hospitals, laboratories, research stations, and similar institutions where biological or pathological waste accumulates and must be disposed of in a manner meeting strict requirements regarding production of odors, smoke and pollution and elimination of pathological organisms.

Heretofore, various types of insulator structures have been devices for burning of pathological waste, such as animal tissue and animal waste, and the like. For example, professional veterinarians face a growing problem of solid waste disposal. Animal carcasses, wet papers and cage waste present a disposal problem because of their nature and volume. Many communities require the veterinarian to provide disposal facilities for incinerating such waste materials at their own premises within rather stringent code requirements as to smoke and odor control. There is a significant requirement for improved incinerators for agricultural use, primarily for disposal of poultry and farm animal carcasses, and for disposal of infertile egg yolks and shells in hatchery operations. For general farm applications, incinerators are desirable to dispose of poultry carcasses, lambs and pigs as typical farm waste. Numerous problems, however, have been encountered in disposal of animal or pathological waste containing fats.

An object of the present invention is the provision of an incinerator for disposal of pathological wastes and the like, which may be produced in the form of a relatively small outdoor incinerator at a competitive price, which operates efficiently and maintains reliable operation over a long period of time when exposed to the weather, and which employs a stack or chimney construction having a second combustion chamber or transition chamber to achieve more complete combustion in a refractory lined portion of the discharge stack to effect destruction of smoke and odors and pathological organisms. The incinerator construction of the present invention avoids certain disadvantages of single burner incinerators or incinerators wherein all of the burning zones are in the main combustion chamber, as such prior art arrangements produce temporary odors, especially in early firing stages, and do not achieve such complete smoke and odor control, and elimination of pathological organisms, as is necessary to meet the code requirements in many residential areas or localities. The incinerator construction of the present invention achieves such complete elimination of offensive smoke and odor by after-burning of the combustion products being discharged from the main combustion chamber.

Other objects, advantages and capabilities of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings illustrating preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a perspective view of an incinerator constructed in accordance with the present invention, suitable

for use particularly as a hatchery waste incinerator as well as an incinerator for various pathological waste, animal waste and the like;

FIG. 2 is an end elevation view thereof, viewed from the right hand side of FIG. 1;

FIG. 3 is a vertical section view taken along the line 3—3 of FIG. 1;

FIG. 4 is a vertical section view taken through the transition chamber portion, along the line 4—4 of FIG. 3;

FIG. 5 is a perspective view, to reduced scale, of a smaller incinerator structure of the oval type, constructed in accordance with the present invention, usable particularly for disposing of human or animal waste of the class 4 type;

FIG. 6 is a vertical section view taken along the line 6—6 of FIG. 5;

FIG. 7 is a fragmentary perspective view illustrating details of the handle and latch mechanism employed in the incinerator illustrated in FIG. 5; and

FIG. 8 is a schematic wiring diagram of a control circuit for regulating the burners.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings, wherein like reference characters designate corresponding parts throughout the several figures, and particularly to the first embodiment illustrated in FIGS. 1 through 4, the incinerator, generally indicated by the reference character 10, comprises a primary combustion chamber portion 11 and a stack portion 12 rising vertically from the top of the primary combustion chamber portion 11. In the embodiment illustrated in FIGS. 1 to 4, the portion 11 is of rectangular horizontal cross-section and is formed of an aluminized steel jacket 13 enclosing fire brick side walls 14 and a refractory lined bottom 15. The fire brick side walls 14 include 4 1/2 inch fire brick in the lower region spanning a height of about 15 1/2 inches, defining a lower chamber portion 16, and 2 1/2 inch fire brick in the region of the side wall above the 4 1/2 inch brick defining an upper chamber portion 17 forming the primary combustion chamber. In this manner, a ledge is formed about the sides and ends of the primary combustion chamber for supporting a grate 18 of refractory material formed in the usual manner. The grate 18, for example, may be formed of casted elongated refractory members 18A having tapered upper edge portions and being spaced apart, as shown in the portion of FIG. 1 where the jacket is broken away. An ash door or doors 19 is provided in the lower front wall to permit ash removal from the lower chamber portion 16, and a pair of fill doors 20 hinged on pivot rods 21 at their outer lateral edges normally cover the fill opening at the top of a laterally and upwardly inclined skirt portion 22 defining the fill opening to the primary combustion chamber.

The stack portion 12 includes a lower insulated connector stack 23 which may be about 15 inches tall, connected at its lower end to an exhaust gas discharge opening at the rear top portion of the primary combustion chamber 17 and connected at its top to a similar short stack portion of a transition chamber unit 24 defining a cylindrical secondary combustion chamber of cylindrical external configuration concentric with a horizontal axis. An upper outlet stack 25 extends aligned with the same vertical axis as the connector stack 23

from the top of the short stack portion at the top of the transition chamber unit 24. At the top of the outlet stack 25 is a stack spark arrestor 26, formed for example of expanded metal, over which is supported a conical stack cap 27.

The connector stack 23 includes a sheet metal outer jacket, for example of aluminized steel, protected with a castable refractory lining 23A which, in a preferred embodiment, is 1 1/4 inch thick. Similarly, the transition chamber 24 is formed of an aluminized steel outer jacket protected with a 1 1/2 inch refractory lining 28 defining the cylindrical inner combustion chamber 29 concentric with a horizontal axis. The combustion chamber 29 is forwardly closed by a circular front wall 30 likewise formed of sheet metal protected with a refractory lining and having forwardly projecting sheet metal cooling vanes 31 projecting in parallel perpendicular planes spaced laterally across the front wall 30. A generally cylindrical baffle 33 extends from the rear end of the secondary combustion chamber 29 in concentric relation with the horizontal axis of the transition chamber to a location just forwardly of the forwardmost extent of the inner surface of the refractory lining 23A in the connector stack 23, and has a downwardly opening segment indicated at 29A bounded by downwardly and outwardly flaring flanges 33B which extend to the inner surface of the refractory lining 28. In one illustrative embodiment, the inner diameter of the connector stack 23 and of the short vertical stack portions immediately adjoining the secondary combustion chamber 29 and forming part of the transition chamber unit 24 are 11 inches in diameter while the unlined outlet stack portion 25 may have a diameter of 14 inches. The front to rear length of the transition chamber in the example may be 30 inches, and the inner diameter of the transition chamber may be about 17 inches.

In the embodiment illustrated in FIGS. 1 through 4, a first oil burner unit 34 of conventional construction is mounted on the rear wall of the primary combustion chamber portion 11 in the region of the lower chamber portion 16 below the grate 18, to form a flame pattern in the chamber portion 16 for effective incineration of the load introduced through the fill opening and deposited on the grate 18. A similar oil burner 35 is mounted on the rear wall of the transition chamber unit 24 to direct its flame pattern substantially along the horizontal center axis of the secondary combustion chamber 29 in the zone within and surrounded by the baffle 33. In one example, the burners 34 and 35 may be commercial oil burners designed to burn number 1 and 2 fuel oil and having a B. T. U. rating of about 284,000. The burners are each of the type having a blower associated with the burner for supplying the air supporting combustion, and preferably include an adjustable air band or air inlet for varying the quantity of air supplied to the burner and thereby adjusting the burner for the desired burning conditions. For example, if the incinerator is to be used as a hatchery waste disposal unit, designed to incinerate infertile egg yolks and shells, the burners should be adjusted to provide temperatures up to about 2,100°F in the primary combustion chamber to break down the calcium in the shells.

In an incinerator made in accordance with the present invention and designed as a veterinary waste incinerating unit, it is desirable to also provide in the connector stack section 23 near its lower inlet end, a tem-

perature sensor 36, similar to the type used in furnace bonnets, electrically connected to a supply transformer and to a solenoid valve regulating fuel supply to the burner, but not regulating the burner blower, to prevent the temperature from getting so high that animal fat will melt and burn, and flow between the grate members down into the bottom of the incinerator. When this occurs, the bottom, being concave, serves as a "hearth," producing undesirable operating characteristics. The amount of drip is controlled by the temperature sensor 36 regulating the bottom burner 34 fuel supply.

FIGS. 5 and 6 illustrate a modified form of incinerator designed particularly for class 4 use, for incinerating human or animal waste, wherein the portions of the incinerator corresponding generally to those of the embodiment shown in FIGS. 1 to 4 are indicated by the same reference characters. In the embodiment shown in FIGS. 5 and 6, the lower primary combustion chamber portion 11 is of oval horizontal cross-section, rather than rectangular horizontal cross-section, and the walls are formed of casted refractory rather than of fire brick. In the embodiment shown in FIGS. 5 and 6, the inner diameter of the refractory lined connector stack section 23 is 8 inches, rather than 11 inches, and the refractory lining is 1 inch thick. The transition chamber unit 24 has a transition chamber portion which is 15 3/16th's inches in outer diameter, and is lined with a refractory lining of 1 inch thickness. The baffle 33 is of the same configuration as that described in the first embodiment.

The fill door 20 of the embodiment illustrated in FIGS. 5 and 6 is a single door hinged along its rear edge at the rear of the fill opening, and is provided with counterweights 20A at the opposite lateral sides thereof on extension arms fixed to the sides of the door, as well as having a handle 20B provided with a crank portion 20C and a horizontal rod portion 20D. The horizontal rod portion 20D is of semi-circular cross-section at two transversely spaced portions thereof serving as a latch rod cooperating with catch brackets 20E fixed to the upper portion of the jacket housing the primary combustion chamber portion 11. The brackets 20E have upwardly opening slots 20F therein of a width corresponding to the radius of the latch rod portion 20D to receive the semi-circular portions of the latch rod when the handle 20B is in the vertical position illustrated in FIG. 5. The bottom portion of the slot 20F has an enlargement for accommodating the full diameter of the latch rod when the handle 20B has been rotated through 90° from the position illustrated in FIG. 5, thereby bringing the flat diametric surface bounding the semi-circular latch portion in underlying relation to the downwardly facing transition surface between the smaller slot portion 20F and the enlarged portion of the slot at the lower part thereof to maintain the door in latched closed position when the handle is in forwardly extending horizontal position.

It will be appreciated that instead of using oil burners of the type previously described, gas burners of the type illustrated in earlier U.S. Pat. No. 3,920,613 granted to Reuben L. Christophel, one of the inventors of the present invention, may be used instead of the oil burners to provide a gas fired incinerator in accordance with the present invention.

By means of the incinerator construction described above, an after-burner or secondary combustion cham-

ber is provided in the exhaust stack from the primary combustion chamber to significantly reduce emission into the atmosphere of air pollutants, including smoke and odors, and to insure destruction of all pathological organisms which may be infesting a burning animal carcass or animal waste material in the incinerator. The provision of an insulated connector stack, such as the refractory lined connector stack section 23, between the exhaust gas outlet from the primary combustion chamber and the transition chamber maintains the temperature achieved in the primary chamber with very low heat loss, thus enabling combustion to continue while the exhaust gases are passing from the primary combustion chamber 17 to the secondary combustion chamber 29. The refractory lining of the secondary combustion chamber 29 enables a high temperature to be reached in this region for complete combustion and destruction of pathological organisms, and reduces heat loss from the secondary combustion chamber and therefore provides economical utilization of heat input. By reason of the design of the secondary combustion chamber and of the baffle provided therein, the exhaust gas entering the secondary combustion chamber from the connector stack 23 must pass directly through the auxiliary burner flame, subjecting all the smoke to a second burn. The combustion gases travel from the primary combustion chamber through the connector stack into the center region of the secondary combustion chamber defined by the baffle 33, when the combustion gas is contacted by the burner flame and excess air. The baffle in the secondary combustion chamber 29 directs the burner flame, the combustion gases and the excess air into the plenum portion forwardly of the front end of the baffle 33, where mixing and complete combustion occurs due to turbulence and the very high temperatures present. The longer retention time made possible because of the baffle 33 and the turbulence created insures the destruction of all pathological organisms in the exhaust gases. Thus the incinerator construction herein described provides an effective incinerator either of the oil fired or gas fired type, which has wide versatility as it may be used in a wide variety of agricultural applications, such as for disposal of poultry and farm animal carcasses, as well as being particularly applicable for veterinarian use and for destruction of various medical wastes and general pathological materials accumulated by hospitals, laboratories, research stations, and other enterprises. By this incinerator construction, all smoke is subjected to a second burn, and the provision of the refractory lined connector stack and transition chamber ensures such effective control of odor and smoke and destruction of pathological organisms as to meet the requirements imposed for such incinerator applications.

What is claimed is:

1. An incinerator assembly for incineration of human and animal wastes and the like, comprising a primary combustion chamber portion including a refractory lined jacket defining an enclosure about a primary combustion chamber having an upper fill opening for introducing waste material into the chamber, grate means subdividing the primary combustion chamber into an upper chamber portion above the grate means and a lower chamber portion below said grate means, a first burner assembly communicating with said lower chamber portion for projecting a flame into the latter, and exhaust gas outlet stack extending upwardly from

said primary combustion chamber portion in communication with said chamber, a transition chamber interposed in said stack at a location spaced a distance substantially corresponding to the height of said primary combustion chamber above said jacket enclosing said primary combustion chamber, said transition chamber including an outer wall and a second burner assembly communicating therewith defining a secondary combustion chamber for subjecting exhaust gases and combustion products discharged from the primary combustion chamber into said stack to after-burning to destroy odors and pathological organisms therein, and said stack having a refractory lined portion spanning the distance between said primary and secondary combustion chambers, said transition chamber comprising a cylindrical refractory lined wall concentric with a horizontal center axis and a circular refractory lined end wall collectively defining said secondary combustion chamber of cylindrical configuration, said second burner assembly projecting a flame from adjacent one end of the chamber generally along said horizontal axis, the refractory lined stack portion having an upper outlet opening into said secondary combustion chamber closely adjacent said one end to direct the exhaust gases into said flame, and a baffle member in said secondary combustion chamber for prolonging the retention time of the exhaust gases therein.

2. An incinerator assembly as defined in claim 1 wherein said baffle member is an interrupted cylindrical metallic sheet of smaller diameter than the inner diameter of the secondary combustion chamber concentric with said horizontal center axis spanning only part of the axial length of the secondary combustion chamber and having a downwardly facing open segment aligned with the upper outlet of said stack portion.

3. An incinerator assembly as defined in claim 1 wherein said baffle member is an interrupted cylindrical metallic sheet of smaller diameter than the inner diameter of the secondary combustion chamber concentric with said horizontal center axis spanning only part of the axial length of the secondary combustion chamber and having a downwardly facing open segment aligned with the upper outlet of said stack portion flanked by outwardly radiating flanges extending to the inner surfaces of the refractory lined cylindrical wall.

4. An incinerator assembly as defined in claim 3, including a temperature sensor in said stack below said transition chamber, and electrically controlled fuel regulating valve means for said burner assemblies to terminate fuel supply to the latter while the temperature adjacent said sensor is above a selected level.

5. An incinerator assembly as defined in claim 1, including a temperature sensor in said stack below said transition chamber, and electrically controlled fuel regulating valve means for said burner assemblies to terminate fuel supply to the latter while the temperature adjacent said sensor is above a selected level.

6. An incinerator assembly as defined in claim 1, including a hinged closure for said fill opening, said closure comprising a door having a refractory surface facing inwardly toward the combustion chamber, a counterweight member fastened to said door, a handle including an axially elongated cylindrical rod portion journaled in bracket members fixed to the door for rotation about a horizontal axis and a handle portion extending radially from the cylindrical rod portion, the rod portion having a rod latch formation along the cy-

lindrical rod portion of semi-circular cross-section interrupting the normal circular cross-section of the rod portion, and a stationary latch bracket on the enclosure having a slot sized to accommodate entry and exit of the rod latch formation when the handle occupies a selected angular position and having an enlarged slot portion defining a shoulder formation for receiving and latching the rod portion in door closing position at another angular position of the handle.

7. An incinerator assembly as defined in claim 3, including a hinged closure for said fill opening, said closure comprising a door having a refractory surface facing inwardly toward the combustion chamber, a counterweight member fastened to said door, a handle including an axially elongated cylindrical rod portion journaled in bracket members fixed to the door for rotation about a horizontal axis and a handle portion extending radially from the cylindrical rod portion, the rod portion having a rod latch formation along the cylindrical rod portion of semi-circular cross-section interrupting the normal circular cross-section of the rod portion, and a stationary latch bracket on the enclosure having a slot sized to accommodate entry and exit of the rod latch formation when the handle occupies a selected angular position and having an enlarged slot portion defining a shoulder formation for receiving and latching the rod portion in door closing position at another angular position of the handle.

8. An incinerator assembly for incineration of human and animal wastes and the like, comprising a primary combustion chamber portion including a refractory lined jacket defining an enclosure about a primary combustion chamber having an upper fill opening for introducing waste material into the chamber, grate means sub-dividing the primary combustion chamber into an upper chamber portion above the grate means

and a lower chamber portion below said grate means, a first burner assembly communicating with said lower chamber portion for projecting a flame into the latter, and exhaust gas outlet stack extending upwardly from said primary combustion chamber portion in communication with said chamber, a transition chamber interposed in said stack at a location spaced above said primary combustion chamber, said transition chamber including an outer wall and a second burner assembly communicating therewith defining a secondary combustion chamber for subjecting exhaust gases and combustion products discharged from the primary combustion chamber into said stack to after-burning to destroy odors and pathological organisms therein, and said stack having a refractory lined portion spanning the distance between said primary and secondary combustion chambers, including a hinged closure for said fill opening, said closure comprising a door having a refractory surface facing inwardly toward the combustion chamber, a counterweight member fastened to said door, a handle including an axially elongated cylindrical rod portion journaled in bracket members fixed to the door for rotation about a horizontal axis and a handle portion extending radially from the cylindrical rod portion, the rod portion having a rod latch formation along the cylindrical rod portion of semi-circular cross-section interrupting the normal circular cross-section of the rod portion, and a stationary latch bracket on the enclosure having a slot sized to accommodate entry and exit of the rod latch formation when the handle occupies a selected angular position and having an enlarged slot portion defining a shoulder formation for receiving and latching the rod portion in door closing position at another angular position of the handle.

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