United States Patent [19]

Shields

[11] **3,757,707**

[45] **Sept. 11, 1973**

[54] **INCINERATOR**

[75] Inventor: **Robert Loren Shields**, Rushville, Ind.

[73] Assignee: **General Electric Company**, New York, N.Y.

[22] Filed: **Jan. 19, 1972**

[21] Appl. No.: **219,041**

[52] **U.S. Cl.** ..... **110/8 C**, 110/28 F

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

[58] **Field of Search** ..... 110/7 R, 8 R, 8 C, 110/28 R, 28 F

[56] **References Cited**

UNITED STATES PATENTS

3,536,049	10/1970	Agrest	110/28 X
3,456,603	7/1969	Studler	110/7
2,893,333	7/1959	Brunes	110/7 X
3,396,681	8/1968	Hubbard	110/8
3,500,775	3/1970	Hubbard	110/8

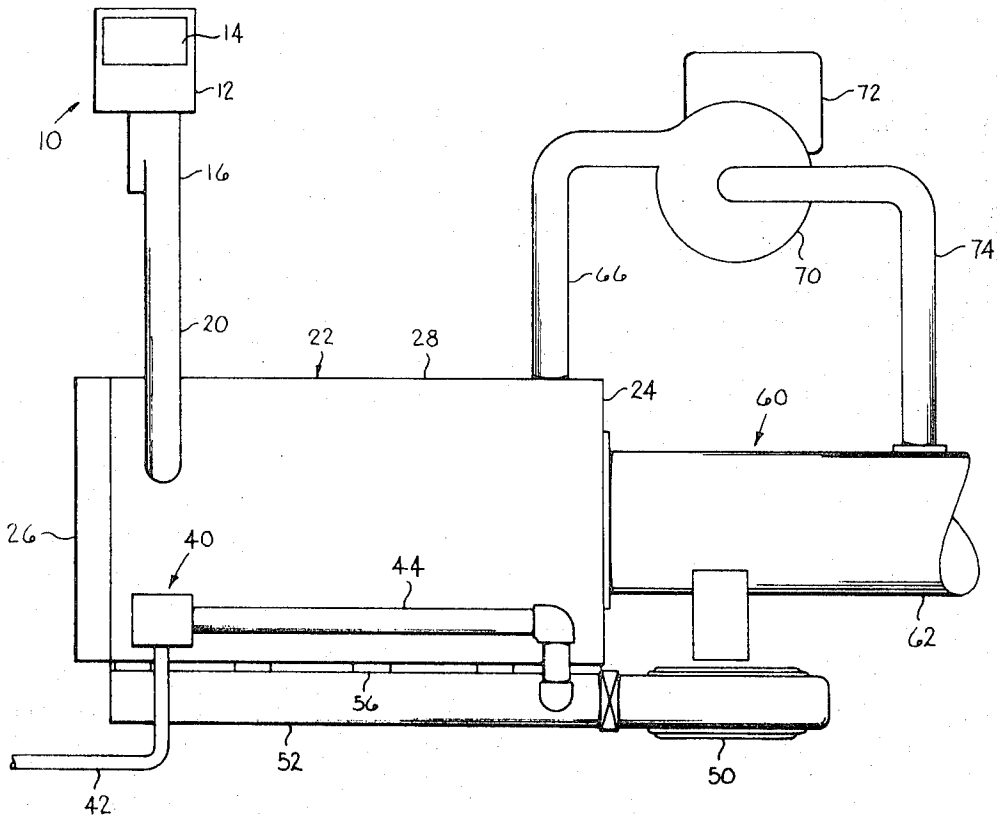
Primary Examiner—Kenneth W. Sprague

Attorney—Raymond G. Simkins et al.

[57] **ABSTRACT**

An incinerator for burning waste material including a horizontally extending combustion chamber having spaced end walls and a side wall through which a mixture of waste material and air is fed under pressure tangentially directed to said side wall for establishing a vertical movement of the waste material towards one of the end walls The waste material is ignited during its vertical movement by ignition means directing a flame into the direct path of the waste material and air as they enter the chamber. The chamber includes a discharge flue near the one end wall substantially concentric with the longitudinal axis of the chamber to exhaust combustion gases.

12 Claims, 3 Drawing Figures



2 Sheets-Sheet 1

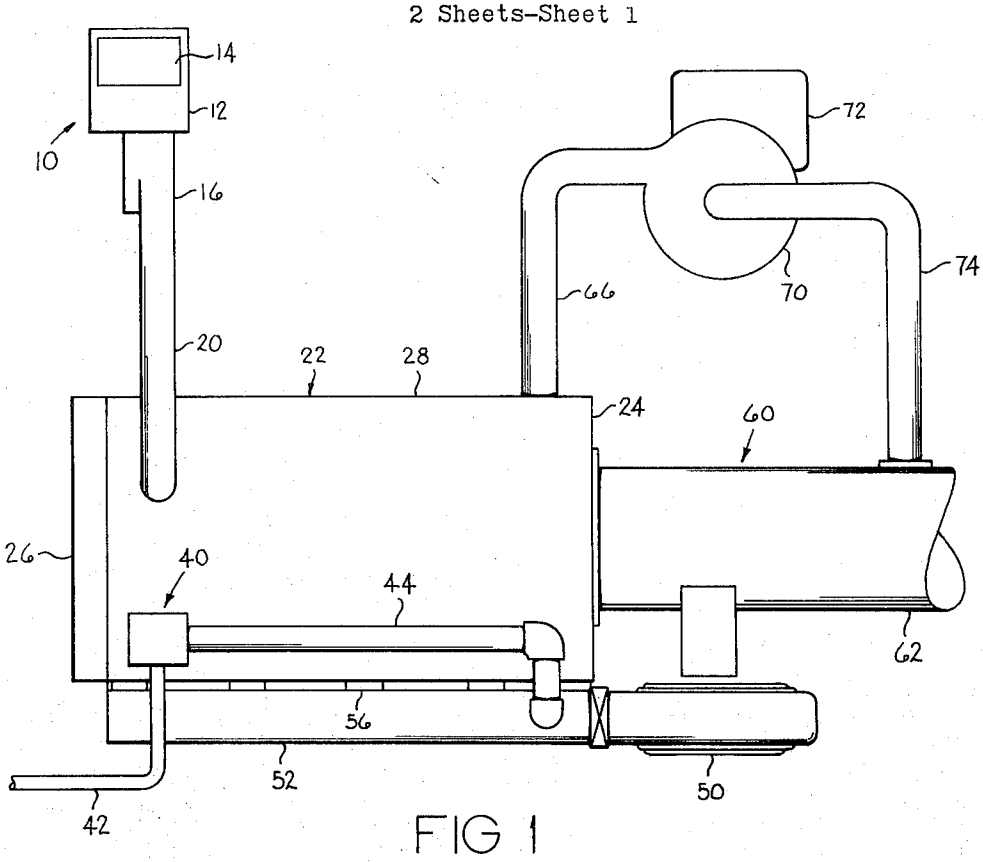


FIG 1

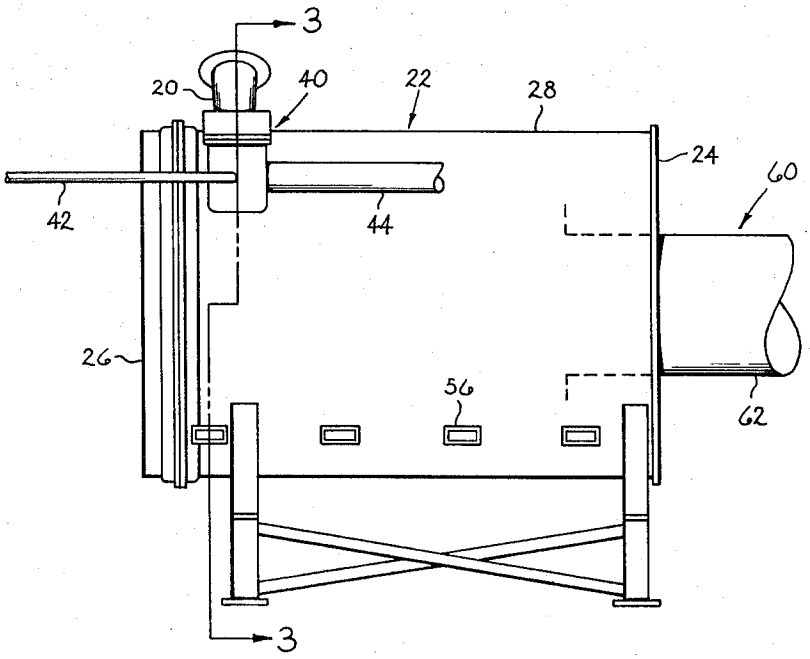


FIG 2

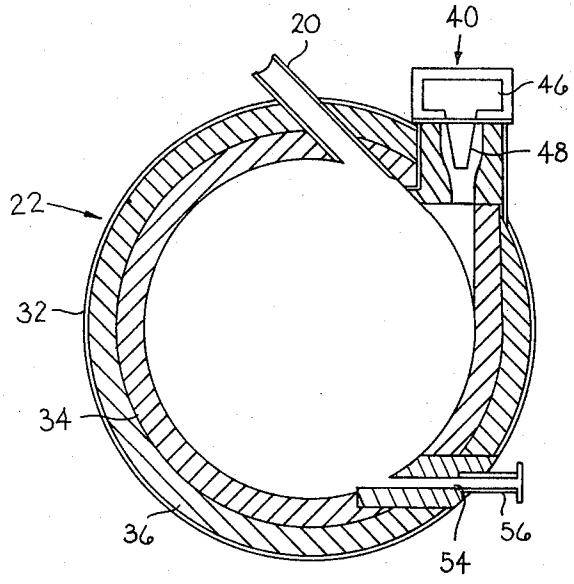


FIG 3

INCINERATOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This invention is disclosed in the prior filed co-pending U.S. Pat. application Ser. No. 159,251 filed on July 2, 1971 by Robert J. Hasselbring and Robert L. Shields and assigned to the assignee of this application. Also, certain features disclosed in this application are disclosed and claimed in U.S. Pat. No. 3,577,940 issued on May 11, 1971 to Robert J. Hasselbring and Robert L. Shields and U.S. Pat. application Ser. No. 103,536 filed on Jan. 4, 1971 by Norman R. Dibelius and William L. Zabriskie now U.S. Pat. No. 3,658,017, said patents each being assigned to the assignee of this application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to incinerators and has particular relation to municipal and industrial type incinerators for burning waste material.

2. Description of the Prior Art

Conventional municipal and industrial type incinerators ordinarily include one or more combustion chambers having drying grates with a flue for discharging to atmosphere the gaseous products of combustion of waste material in the chamber. Depending upon the efficiency of a particular incinerator design, varying amounts of noxious gases and ash are discharged through the flue to atmosphere. Prior incinerator designs in general have been incapable of effecting good combustion of waste material such that the products of the resulting incomplete combustion consist of a large quantity of noxious gases and ash which are discharged to the surrounding atmosphere in the form of dense acrid smoke.

In an effort to comply with regulator air pollution codes, more recent incinerator designs have provided for cleaning the gaseous products of combustion prior to the discharge to atmosphere. Such flue gas cleaning apparatus is usually of costly and bulky construction and in some cases has not operated to clean the flue gases sufficiently to comply with regulatory codes. One known flue gas cleaning apparatus includes means for conducting the gaseous products of combustion through water sprays so that the suspended ashes and other particulate matter are entrained in the water which is then collected and conveyed to a suitable clarification system. This type of flue gas cleaning apparatus is expensive and complex and contributes not only to the high cost and massive structure of prior art incinerators, but also to water pollution. Further, the very high temperatures within the chamber necessary to effect good combustion result in very hot flue gases which may result in inefficient operation of the flue gas cleaning apparatus and resulting undesirable pollution of the surrounding atmosphere. The provision of flue gas cleaning apparatus thus imposes a limitation upon the temperature within the combustion chamber which contributes to the poor combustion realized by certain prior art designs. Still further, some apparatus designs foster slagging conditions whereby the forming slag adversely affects burning efficiency of the apparatus and causes chamber cleaning problems.

OBJECTS OF THE INVENTION

It is therefore a primary object of the invention to provide a novel and improved incinerator capable of effecting substantially complete combustion of waste material and wherein essentially solid-free flue gases are discharged to the atmosphere to minimize air and water pollution.

It is another object of the invention to provide a novel and improved incinerator of such character which avoids the use of costly and complex flue gas cleaning apparatus.

It is also a further object of the invention to provide a novel and improved vortex incinerator of the foregoing character adopted for operating without fostering slagging conditions in the chamber.

It is a still further object of the invention to provide a novel and improved vortex incinerator which more rapidly raises the temperature of the combustible waste material to ignition and thereby extends the period for burning, and minimizes hot spots or pronounced temperature variations within the incinerator construction which contribute to irregular performance.

SUMMARY OF THE INVENTION

In carrying out the invention in one preferred form, an incinerator is provided which includes a combustion chamber having spaced end walls and a side wall with its central longitudinal axis extending between the end walls. The chamber is preferably generally cylindrical in configuration and is disposed in operative position with the central longitudinal axis extending horizontally or substantially horizontally. Means are provided for introducing waste material and primary air into the chamber for establishing a vortical movement of the waste material toward one of the end walls and provision is made for igniting the waste material during its vortical movement. The waste-ignition means is located in a region where it is in the direct path of air entering the chamber thereby enabling the air to reduce the temperature of the adjacent wall and thus avoid slagging conditions while sweeping the wall surface clear of any residual material. Moreover, greater uniformity of temperature throughout the chamber is attained. The waste-ignition means preferably is in the region where both the waste material and air are introduced to thereby provide quicker ignition of the waste material which prolongs the burning period for more complete combustion. Preferably, also, the waste inlet and ignition means are located in the upper section of the chamber away from the location of any residual matter which may be retained in the lower section of the chamber to prevent slagging and adhering accumulations thereof. Accordingly, the particular proximity of the combination and system of the improved incinerator of this invention overcomes localized overheating or "hot spots" and the slagging conditions resulting therefrom especially in the region of the chamber wall of the ignition flame impingement and in the lower section of the chamber wherein residual matter may accumulate. Further, the uninhibited vortical course of travel permitted by the absence of accumulated slag obstacles coupled with the quicker attained and more consistent temperature produced by the invention enhance the overall incinerating operation including extending the duration of the burning period for more complete combustion.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top-plan view of the incinerator;

FIG. 2 is a view in side elevation of the combustion chamber; and

FIG. 3 is a view in section taken along the line 3—3 of FIG. 2.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing, there is illustrated in FIGS. 1 to 3, an incinerator embodying the invention and comprising, in general: a size reduction unit for chopping up the waste material; means for feeding the waste material and primary air into a combustion chamber for establishing a vortical movement of the waste material, means for igniting the waste material during its vortical movement, means for adding secondary air to the chamber; exhaust means for venting gaseous products of combustion; and discharge means for discharging non-combustible material from the combustion chamber and a separator for separating the gases and solid materials discharged by the discharge means. The incinerator of the present invention is particularly suited for disposing of solid industrial and municipal waste material such as, for example, paper, peanut hulls, cardboard cartons, wood scrap, garbage, foliage, bottles, cans, and combustible floor sweepings. However, the incinerator is also capable of disposing of liquid waste material such as oils, paint sludges, and plating tank residue.

More specifically, the incinerator as shown in FIG. 1 includes a size-reduction unit **10** designed to shred and chop waste material into pieces small enough to be efficiently conveyed and burned in the combustion chamber. If the waste material to be disposed of is already of an acceptable size, such as sawdust, then the size-reduction unit is not required. The size-reduction unit **10** may be of any suitable construction and includes a hopper **12** having an open end **14** into which the waste material is fed for size-reduction by a shredding and chopping mechanism (not shown) operated by a motor (not shown). After being reduced in size, the waste material is drawn into a pneumatic conveying system including a blower **16** operated by a motor (not shown) which entrains the size-reduced material in a primary air stream and transports it through an inlet conduit **20** which opens into the combustion chamber **22.**

The combustion chamber **22** may be of any suitable configuration and is preferably cylindrical including a pair of spaced end walls **24** and **26** connected by an annular side wall **28.** The chamber **22** is preferably disposed when in operative position so that its central longitudinal axis which extends between the end walls **24** and **26** is horizontal or substantially horizontal as shown in FIG. **2.** If desired, the end wall **26** of the chamber **22** may include an access door to permit access to the interior of the chamber **22.** In the specific embodiment of the invention illustrated, the annular side wall **28** of the chamber comprises an outer casing **32** (FIG. 3) formed of a suitable material such as a low carbon steel and the casing **32** is lined with one or more inner layers **34** and **36** of suitable material such as fire brick. The innermost layer **34** is designed to exhibit good resistance to abrasion whereas the layer **36** may be designed to have good heat insulating properties or to transfer the heat to a remote location. The end walls **24** and **26** of combustion chamber **22** may be similarly formed of an outer layer of low carbon steel with inner layers of fire brick. In the embodiment illustrated, the inlet conduit **20** enters the combustion chamber **22** tangentially of the annular side wall **28** at a location near the top of the combustion chamber **22** and adjacent the end wall **26.**

Continuous feeding of a mixture of waste material and air under pressure into the combustion chamber **22** from the inlet conduit **20** tangentially to the annular side wall **28** of the chamber establishes a vortical movement of the waste material which travels from adjacent the end wall **26** toward the end wall **24** in a clockwise, swirling direction as viewed from the end wall **26** in FIG. **1.** It is understood, of course, that the inlet conduit **20** may be disposed to enter the combustion chamber **22** at the upper right hand side thereof instead of at the upper left hand, in which event the direction of the vortex would be reversed from the clockwise swirling direction illustrated to a counterclockwise swirling direction.

To ignite the waste material entering the combustion chamber **22,** a fluid fueled combustion burner **40,** such as one operated with gas or oil, is disposed near the end wall **26** of the combustion chamber **22,** directed to fire into the combustion chamber tangentially to its annular side wall. Combustion burner **40** may be of any suitable construction comprising a fuel supply pipe **42** from a source (not shown) and combustion air supply pipe **44** which may be supplied by fan **50** from manifold **52** as shown in FIG. **1.** Burner **40** is also composed of a mixing chamber **46** for fuel and air mixing and flame discharge outlet or nozzle **48** to direct the flame.

Under some operating conditions wherein a mixture of shredded waste material and primary air is continuously fed into the combustion chamber, but depending somewhat upon the nature and moisture content of the waste material, the burner can be turned off upon heating the combustion chamber to an effective ignition and burning temperature whereupon the continuously fed waste material and primary air thereafter sustain combustion. Apt operating temperatures for consuming common municipal waste material in the combustion chamber comprise typically between about 1,200° and 2,200° F. Thus, a typical operating procedure would be to fire the ignition burner **40** alone for a sufficient period to preheat the combustion chamber to its intended operating temperature of, for example, about 1,600° F., whereupon the feeding of the shredded waste material and primary air under pressure into the combustion chamber is initiated and combustion thereof incited by the high temperature. Thereafter the combustion may be self-sustaining without the need for added impetus provided by a separate source of fuel or flame, but again depending upon the nature of heat content of the waste "fuel" and its moisture content. However, if or when needed to maintain or regulate combustion because of the nature of the waste material, or for whatever reason, the burner can simply be continuously operated to maintain combustion or reactivated to return the incinerating operation to effective combustion temperatures. In some cases, such as burning sewage sludge, which normally has a relatively high moisture content, it may be feasible or even necessary to continuously fire the ignition burner.

The combustion burner can be a commercially available unit, such as a MAXON burner, for example an

EB–3, –4, or –5 depending upon the size and capacity desired.

To enhance combustion of the waste material and to maintain the energy of its vortical flow in a predetermined and controlled manner through the entire length of the combustion chamber, it is preferred to provide means for introducing controlled quantities of high-velocity secondary air into the combustion chamber **22** during the burning process, and at spaced regions throughout the length of the combustion chamber. To this end, a fan or blower **50** as shown in FIG. **1** can be provided to supply secondary air by means of elongated manifold **52** to be introduced at periodic regions along an axis substantially parallel to the longitudinal axis of the combustion chamber. This secondary air can be added substantially tangentially into the chamber through a plurality of substantially equally spaced openings **54** in the annular side wall **28** through ducts **56** connecting manifold **52** with openings **54.** In a preferred embodiment, several openings **54** are provided spaced along the entire length of the chamber, for example about four in number as shown in FIG. **1,** and can be individually controlled by means not shown.

To exhaust gaseous products of combustion from the combustion chamber **22** to the atmosphere, a flue **60** having an open end opening into the combustion chamber in the region of the end wall **24** and substantially concentric with the central longitudinal axis of combustion chamber **22** is provided. As best shown in FIG. **1,** the flue **60** comprises a hollow cylinder or flue pipe **62** of any suitable material extending through and suitably mounted in an opening in the end wall **24** of the combustion chamber.

Outlet means is provided for discharging non-combustible materials from the combustion chamber **22** during the burning process. For this purpose, the preferred embodiment includes an outlet conduit **66** opening into the combustion chamber **22** at a region downstream from the point of introduction of the waste material in the region adjacent the inner surface of end wall **24** for discharging from the chamber noncombustible material which is entrained in the outer region of the vortex. In the illustrated embodiment, the outlet conduit **66** comprises a pipe extending through the annular side wall **28** substantially tangentially thereto and substantially horizontally at the bottom of the chamber with its end opening into the combustion chamber. The outlet conduit **66** leads to a suitable separator and disposal means briefly described hereinafter. With the described arrangement, the opening of outlet conduit **66** is in the path of the non-combustible material which during operation of the incinerator is at the outer regions of the vortex and which has migrated to the region adjacent the end wall **24,** and the action of the vortex causes such material to enter the opening of outlet conduit **66** for discharge from the combustion chamber **22.**

A separator **70** is provided for separating the gases and the solid material discharged through the outlet conduit **66** and for dropping the solid material into a suitable container **72.** The separator **70** is preferably a commercially available cyclone or vortex separator wherein material discharge through the outlet conduit **66** is introduced tangentially into the separator **70** with the result that the solid material drops out of the open end of the separator into the container **72.** Such solid material constitutes ashes and other particulate matter formed in the combustion process and also other non-combustible material which can be disposed of in any suitable manner. The hot gases separated out of the separator **70** are conveyed away by pipe **74** and introduced into the flue **60,** or they may be returned and introduced into the combustion chamber. While most of the non-combustible material is delivered to the separator **70,** a small portion of such residual material tends to settle along the length of the bottom of the combustion chamber **22.** This settled material is minimized by the effects of the injection of secondary air at multiple regions spaced along the waste flow path. However, to the extent any such settlement of material occurs in the chamber, it can periodically be removed from the chamber by any suitable manner through an access door.

In accordance with this invention, in the incinerator system described, the combustion burner ignition means **40** is located in particular proximity to the inlet means **20** for feeding waste material and air into the combustion chamber. Specifically, the combustion burner ignition means is directed to fire substantially tangentially to the annular side wall of the combustion chamber within a region in the direct path of air being fed into the combustion chamber, and preferably the mixture of waste material and primary air fed through the inlet conduit in a direction which is also substantially tangentially to the annular side wall of the combustion chamber. Although the source of air would in most instances be most conveniently provided by the primary air combined with the waste material feed, the air can be supplied by the said secondary source or any other external means. More particularly, the relative positions of the tangentially directed combustion burner igniting means and the inlet means conduit for feeding waste material and air to the combustion chamber with respect to each other, are immediately adjacent within an arc of the annular combustion chamber side wall of not greater than about 120°, and preferably within about 90° from each whereby the cooling effect of the air in enhanced. Moreover, said combustion burner igniting means flame blast is preferably directed into the path of the waste material and air in an approximately common vertical plane, that is, in substantially the same transverse plane of the combustion chamber's horizontal central axis to achieve optimum cooling.

Referring to the drawing, and in particular the cross-section of FIG. **3** taken along the lines of 3—3 of FIG. **2** showing the preferred construction, inlet conduit **20** enters the annular side wall **28** of the combustion chamber **22** and directs its discharge of the waste material and air substantially tangentially to the inner surface of the annular side wall of the combustion chamber to effect a vortical movement of the material along the length of the cylindrical chamber. Combustion burner igniting means **40** is similarly positioned to fire in a direction with the flame blast entering the combustion chamber substantially tangentially to the inner surface of the annular wall **28** and in a region in the direct path of the waste material and air emanating from the inlet feed conduit. In the preferred embodiment, as illustrated in FIG. **3,** the combustion burner igniting means **40** is arranged substantially vertical, firing in a generally downward direction in the same transverse plane of the cylindrical combustion chamber as the inlet conduit, and is also positioned at least within approximately the same quadrant of the annular side wall

of the cylindrical combustion chamber as the inlet conduit **20**. The locating of the combustion burner igniting means **40** in the upper portion of the combustion chamber and firing in a direction generally downward as shown in the preferred embodiment of FIG. **3** substantially eliminates any slagging or fusing of residual particles retained in the bottom portion of the combustion chamber, a deleterious effect which disrupts the vortical path of flow and combustion efficiency, and ultimately requires interrupting the incinerating operation for cleaning of the chamber.

This arrangement or combination of these components of particular proximity in relation to the overall vortical incinerator system of the construction described obviates many disadvantageous conditions in the operation of such incinerators, including the elimination of hot spots or markedly uneven heating therein, a condition which fosters the formation of slag. And the arrangement of the invention accelerates the heating rate of the incoming feed material whereby the burning period for the waste is prolonged giving a more complete and uniform combustion.

By means of this invention, a very efficient incinerator is provided characterized by the exhaust of gases to the atmosphere which are substantially free of particulate matter so as to minimize air and water pollution. In addition, the combustible material is discharged from the combustion chamber during the burning process by the action of the vortex so as to avoid the provision of costly and complex material-handling apparatus for conveying such materials away from the combustion chamber. Further, the provision of costly and complex flue gas cleaning apparatus is avoided by the invention which allows operation of the incinerator at temperatures which are higher than that which would be allowable in the event flue gas cleaning apparatus were utilized. Moreover, the incinerator effects substantially complete combustion of combustible waste material resulting in an extremely high percentage reduction in the original volume of waste material.

A typical design of the incinerator of the present invention includes a combustion chamber having an internal length of 8 feet and an inner diameter D of 4½ feet. The flue **60** has an inner diameter of 2 feet and extends into the combustion chamber a distance of about 16 inches from the inner surface of the end wall **24**. Also, the outlet conduit **66** has an inner diameter of 4 inches. An incinerator of such design presently appears capable of disposing of solid waste having up to a 20% moisture content and normally 10% ash content with a heat value of 5,000 BTU's per pound at a rate of 3,000 pounds per hour to effect close to 98% destruction of combustible material. It presently appears that such an incinerator design emits particulate matter to the atmosphere of not more than 0.2 grains per standard dry cubic foot of flue gas. The foregoing results seem to be obtainable with chamber temperatures between 1,200° and 2,200° F.

Although the invention has been described with reference to certain specific embodiments thereof, numerous modifications are possible and it is desirable to cover all modifications falling within the spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An incinerator for burning waste material, comprising in combination:

a. a combustion chamber having spaced end walls and a side wall with its central longitudinal axis extending between said end walls, said chamber being disposed such that its central axis extends substantially horizontally;

b. means for introducing waste material and air into said chamber in a manner effective for providing a vortical movement of said waste material toward one of said end walls;

c. means for igniting said waste material during its vortical movement and located in a region in the direct path of air entering said chamber; and,

d. an exhaust flue having an open end opening in said chamber near said one end wall.

2. An incinerator as defined in claim **1**, wherein the means for igniting said waste material is located in a region in the direct path of both said waste material and air entering said chamber.

3. An incinerator as defined in claim **1**, wherein the means for introducing waste material and air comprises a single input means directing said material and air into said chamber, and said means for igniting said waste material is located in said chamber in the path of said material and air immediately adjacent the region of entering thereof.

4. An incinerator as defined in claim **1**, wherein the means for igniting said waste material comprises a burner adapted for directing a flame toward the inside wall of said chamber in a region immediately adjacent the entrance of said waste material and air and toward which said waste material and air are also directed.

5. An incinerator for burning waste material, comprising in combination:

a. a generally cylindrical combustion chamber having spaced end walls and an annular side wall with its central longitudinal axis extending between said end walls, said chamber being disposed such that its central axis extends substantially horizontally;

b. means for introducing a mixture of waste material and air under pressure into said chamber tangentially to said side wall in a manner effective for establishing a vortical movement of said waste material toward one of said end walls;

c. ignition means for directing a flame into said chamber tangentially to said side wall and toward a region directly in the path of waste material and air entering said chamber for quickly igniting said waste material during its vortical movement and avoiding slagging conditions in said region; and,

d. a discharge flue port having an open end opening in said chamber near said one end wall and substantially concentric with said central axis.

6. An incinerator for burning waste material, comprising in combination:

a. a generally cylindrical combustion chamber having spaced end walls and an annular side wall with its central longitudinal axis extending between said end walls, said combustion chamber being disposed such that its central axis extends substantially horizontally;

b. inlet means for feeding waste material and air into said combustion chamber directed substantially tangentially to said side wall of the combustion chamber for establishing a vortical movement of said waste material and air toward one of said end walls;

c. means for igniting said waste material during its vortical movement comprising a combustion burner directed to fire substantially tangentially to said side wall of the combustion chamber and into a region in the direct path of the waste material and air entering said chamber;

d. an exhaust flue having an open end opening into said combustion chamber near one end wall; and

e. said substantially tangentially directed inlet means for feeding waste material and air and said combustion burner igniting means each being positioned in relation to the other about the annular side wall of the cylindrical combustion chamber within an arc not greater than about 120°.

7. The incinerator as defined in claim **6**, wherein said substantially tangentially directed inlet means for feeding waste material and air and said combustion burner ignition means are both located in substantially the same plane extending transverse of the said longitudinal axis of the combustion chamber.

8. An incinerator for burning waste material, comprising in combination:

a. a generally cylindrical combustion chamber having spaced end walls and an annular side wall with its central longitudinal axis extending between said end walls, said combustion chamber being disposed such that its central axis extends substantially horizontally;

b. inlet means for feeding waste material and air into said combustion chamber directed substantially tangentially to said annular side wall of the combustion chamber for establishing a vortical movement of said waste material and air toward one of said end walls;

c. means for igniting said waste material during its vortical movement comprising a combustion burner directed to fire substantially tangentially to said annular side wall of the combustion chamber;

d. an exhaust flue having an open end opening into said combustion chamber near one end wall; and,

e. said substantially tangentially directed inlet means for feeding waste material and air and said combustion burner igniting means being positioned relative to each other in approximately the same quadrant of the combustion chamber annular side wall, and in substantially the same transverse plane of the combustion chamber's substantially horizontal central longitudinal axis.

9. An incinerator for burning waste material, comprising in combination:

a. a generally cylindrical combustion chamber having spaced end walls and an annular side wall with its central longitudinal axis extending between said end walls, said chamber being disposed such that its central axis extends substantially horizontally;

b. means for introducing a mixture of waste material and air under pressure into said chamber tangentially to said side wall in a manner effective for establishing a vortical movement of said waste material toward one of said end walls, said waste material and air entering said chamber through a pipe directing said material and air tangentially through the top of said chamber;

c. ignition means for directing a flame into said chamber vertically through the chamber top and tangentially to said side wall, toward a region directly in the path of waste material and air entering said chamber for quickly igniting said waste material during its vortical movement and avoiding slagging conditions in said region; and

d. a discharge flue port having an open end opening in said chamber near said one end wall and substantially concentric with said central axis.

10. An incinerator as defined in claim **9**, wherein said pipe and ignition means are located in a common vertical plane to provide for intersection of the paths of said waste material, air and flame.

11. An incinerator for burning waste material, comprising in combination:

a. a generally cylindrical combustion chamber having spaced end walls and an annular side wall with its central longitudinal axis extending between said end walls, said combustion chamber being disposed such that its central axis extends substantially horizontally;

b. inlet means for feeding waste material and air into said combustion chamber directed substantially tangentially to said side wall of the combustion chamber for establishing a vortical movement of said waste material and air toward one of said end walls;

c. means for igniting said waste material during its vortical movement comprising a combustion burner in a substantially vertical position to fire in a direction approximately downwardly and substantially tangentially to the annular side wall of the combustion chamber for establishing a vortical movement of said waste material and air toward one of said end walls;

d. an exhaust flue having an open end opening into said combustion chamber near one end wall; and

e. said substantially tangentially directed inlet means for feeding waste material and air and said combustion burner igniting means each being positioned in relation to each other about the annular side wall of the cylindrical combustion chamber within an arc not greater than about 120° and in substantially the same plane extending transverse of the said longitudinal axis of the combustion chamber.

12. An incinerator for burning waste material, comprising in combination:

a. a generally cylindrical combustion chamber having spaced end walls and an annular side wall with its central longitudinal axis extending between said end walls, said combustion chamber being disposed such that its central axis extends substantially horizontally;

b. inlet means for feeding waste material and air into said combustion chamber directed substantially tangentially to said annular side wall of the combustion chamber for establishing a vortical movement of said waste material and air toward one of said end walls;

c. means for igniting said waste material during its vortical movement comprising a combustion burner in a substantially vertical position to fire in a direction approximately downwardly into the combustion chamber substantially tangentially to said annular side wall of the combustion chamber for establishing a vortical movement of said waste material and air toward one of said end walls;

d. an exhaust flue having an open end opening into said combustion chamber near one end wall; and

e. said substantially tangentially directed inlet means for feeding waste material and air, and said combustion burner igniting means being positioned relative to each other in approximately the same quadrant of the combustion chamber's annular side wall, and in substantially the same transverse plane of the combustion chamber's substantially horizontally central longitudinal axis.

* * * * *