United States Patent [19]

Lagen

[11] **3,862,608**

[45] **Jan. 28, 1975**

[54] **APPARATUS FOR INCINERATING SOLID FUELS CONTAINING CARBONIZABLE MATERIAL**

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[22] Filed: **Nov. 23, 1973**

[21] Appl. No.: **418,746**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 276,820, July 31, 1972, Pat. No. 3,777,676.

[52] **U.S. Cl.** ..... **110/8 C,** 110/15, 110/49 R, 110/165 R

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

[58] **Field of Search** ..... 110/8 R, 8 C, 11, 15, 49 R, 110/165

[56] **References Cited**

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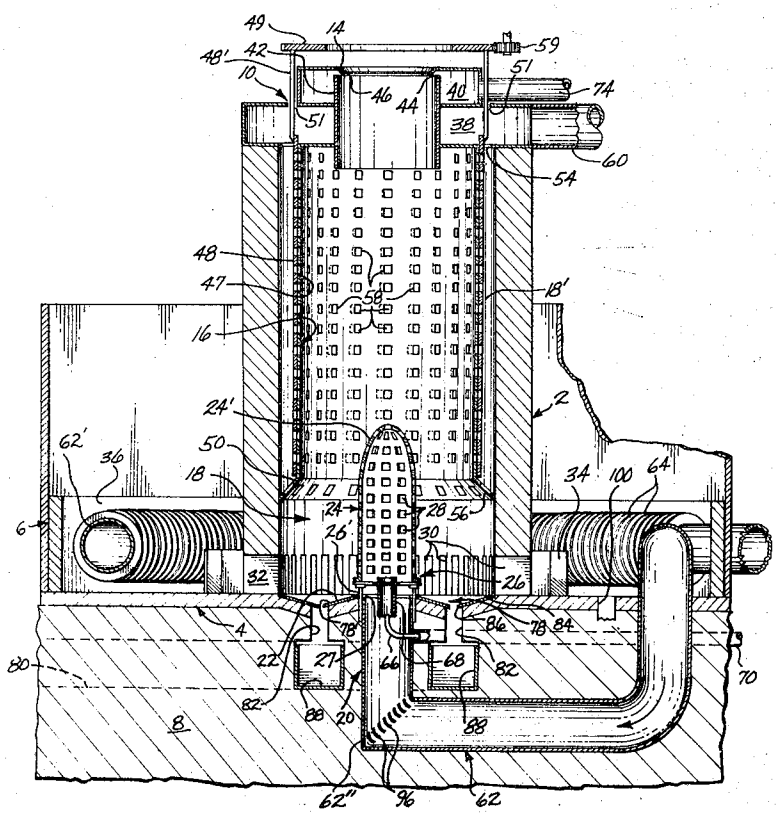
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[57] **ABSTRACT**

As in Applicant's patented apparatus U.S. Pat. No. 3,777,676, there are means for feeding the fuel onto the fuel retainer along an elongated path passing through the preliminary incineration chamber from the fuel intake. There are also fluid transfer means, including blower means, for pressurizing the atmosphere in the preliminary and post incineration chambers with an oxygen-containing gas, while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber. Now, the fluid transfer means also include means which are operative to form a plenum between the chambers and the blower means, on either or both of the intake and discharge sides of the blower means, which plenum or plenums extend lengthwise of the fuel flow path and communicate with the fuel flow path in directions crosswise thereof. Also, the post incineration chamber has a sump in the bottom thereof, and there are means movably associated with the sump to collect and discharge slag from the sump, relatively outside of the furnace. In addition, the intake side of the blower means is interconnected with the furnace on at least one side of the opening to the outside thereof, to collect and return fly ash to the post incineration chamber which has settled to the bottom of the furnace.

29 Claims, 5 Drawing Figures



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SHEET 1 OF 2

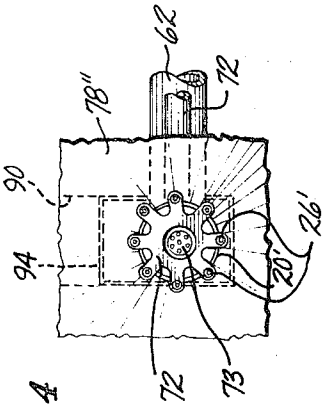


Fig. 4

Fig. 1

Fig. 3

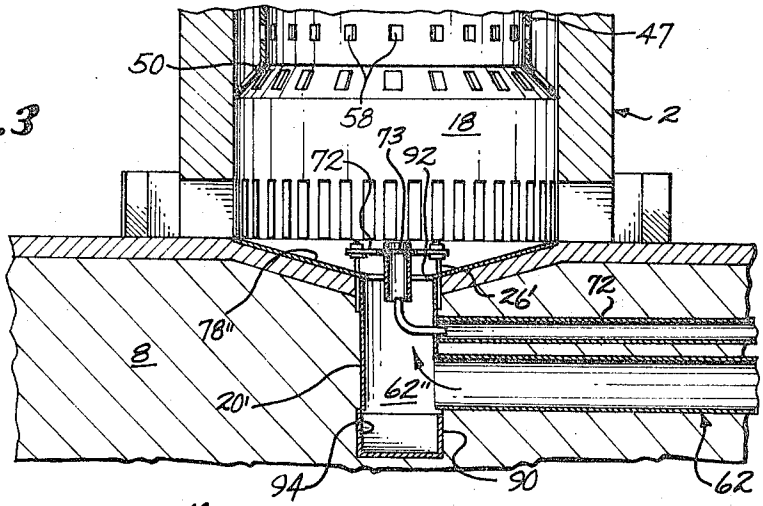


Fig. 2

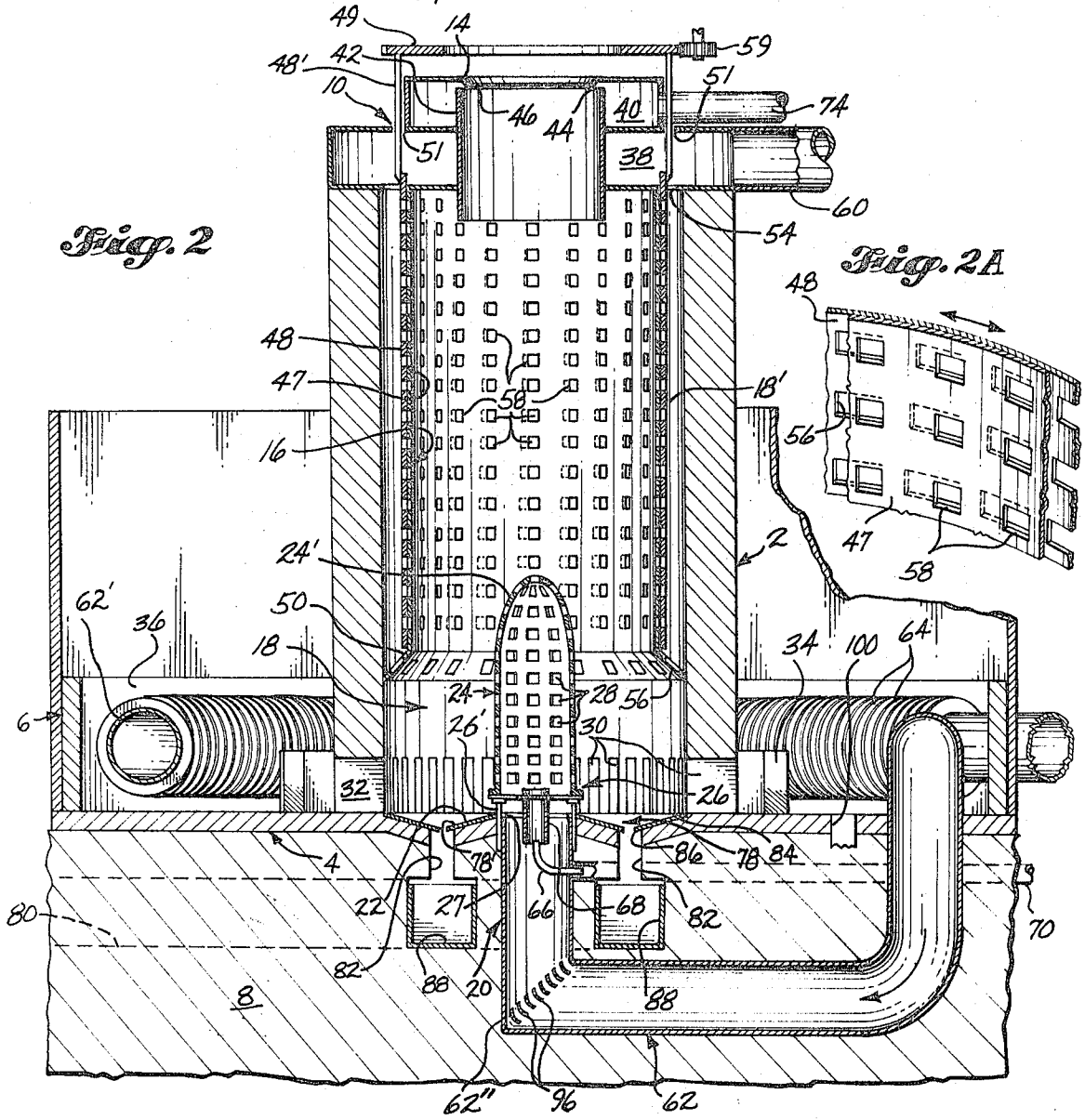


Fig. 2A

APPARATUS FOR INCINERATING SOLID FUELS CONTAINING CARBONIZABLE MATERIAL

RELATED APPLICATION

This application is a continuation-in-part of Applicant's earlier filed application Ser. No. 276,820, which was filed on July 31, 1972, and entitled "Apparatus and Technique for Incinerating Solid Fuels Containing Carbonizable Material." Application Ser. No. 276,820 is now U.S. Pat. No. 3,777,676 and is hereby incorporated into the present application in full.

THE INVENTION IN GENERAL

This invention also relates to an apparatus for incinerating solid fuels containing carbonizable material, and is an improvement on the apparatus described in Applicant's above-identified application.

In that application, the apparatus comprised a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein. In addition, there were means for feeding the fuel onto the fuel retainer along an elongated path passing through the preliminary incineration chamber from the fuel intake; as well as fluid transfer means, including blower means, for pressurizing the atmosphere in the two chambers with an oxygen-containing gas, while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber. While this apparatus was effective as an incinerator, it was fraught with the problem that dense or wet materials such as garbage effectively formed a dense "mat" over the fuel retainer and limited the rate at which the fluid medium, that is, the gases, fumes and vapors, could be passed through or purged from the preliminary incineration chamber. The apparatus was also fraught with the problem that highly viscous molten slag of silicate or other mineral material, tended to collect on the bottom of the furnace, and if the furnace was to be operated continuously, or substantially so, there was no effective means for removing the slag from the furnace. In addition, the apparatus had no means for collecting the fly ash which settled to the bottom of the furnace, both on the inside and the outside of the discharge opening therein.

According to the present invention, the purge rate problem has been met by the inclusion of means in the fluid transfer means, which are operative to form a plenum between the chambers and the blower means, on either the intake or the discharge side of the blower means, or on both sides thereof, which plenum or plenums extend lengthwise of the fuel flow path and communicate with the fuel flow path in directions crosswise thereof. The new plenum forming means make it possible to put the fluid medium through the fuel mass over a larger cross-sectional area, since the fluid medium is now discharged and/or exhausted at normals to the longitudinal axis of the fuel path. The new plenum forming means also make it possible to put the fluid medium through the fuel mass over a shorter distance of travel, so that between them, the two effects make it possible to achieve a higher purge rate in the furnace. This in turn makes it possible to maintain more favorable conditions for combustion and evaporation in the furnace, regardless of the fuel medium being incinerated.

Preferably, the fluid transfer means also include means whereby the purge rate can be varied, such as by

varying the degree of communication between the fuel flow path and the plenum or plenums.

In the presently preferred embodiments of the invention, the plenum forming means are operative to form an annular plenum between the preliminary incineration chamber and the intake side of the blower means. The annular plenum is disposed in the preliminary incineration chamber so that the fuel flow path passes through the same in leaving the fuel intake. Also, the plenum forming means are operative to form an elongated plenum between the post incineration chamber and the discharge side of the blower means. The elongated plenum is disposed in the post incineration chamber so that the fuel flow path passes about the same in approaching the fuel retainer. Preferably, the elongated plenum projects within the hollow of the annular plenum so that the fuel flow path passes between the two as it passes about the elongated plenum.

The annular plenum may be formed by a perforated chute which is suspended in the furnace about the fuel intake, and spaced apart from the wall of the furnace so as to form an annular clearance therebetween, which is in communication with the intake side of the blower means. The elongated plenum may be formed by a perforated cone which is erected upright in the furnace at the center of the fuel retainer, but inverted to the floor of the furnace so as to form an elongated nozzle thereon, which is in communication with the discharge side of the blower means. Preferably, the chute and the cone are coaxial with one another, on a line approaching a vertical.

The perforations in the chute or the cone, or in both, are adjustable in cross-sectional area, so that the rate of fluid flow through the same can be varied. For example, the chute may be formed by a pair of relatively rotatably interengaged sleeves having perforations therein which vary in overlap as the sleeves are rotated in relation to one another. Preferably, the area of overlap becomes progressively larger as the fuel passes through the sleeves.

The slag removal problem is met by providing the post incineration chamber with a sump in the bottom thereof, and providing the sump in turn with means which are movably associated therewith to collect and discharge the slag from the sump relatively outside of the furnace. Preferably, the sump has an opening in the bottom thereof, and the slag discharge means is movable below the opening to collect the slag as it drips through the opening. Moreover, the opening has an overhanging lip about the rim thereof, so that the slag drips through the opening without contacting the sidewalls thereof.

The slag discharge means may be mechanical or hydraulic in nature. At present, it takes the form of a tray which is reciprocable in relation to the furnace, to and from a point below the opening.

In some of the presently preferred embodiments of the invention, the atmosphere which is purged from the preliminary incineration chamber is discharged into the post incineration chamber through the opening in the bottom of the sump. In other embodiments, the atmosphere is discharged into the post incineration chamber through an opening therein which is spaced apart from the opening in the sump, such as by discharging it into the chamber through an opening at the center of an annular sump in the bottom thereof.

The presently preferred embodiments of the invention also include additional fluid transfer means which are operative to form an interconnection between the bottom of the furnace and the intake side of the blower means, on either the inside or outside of the opening in the furnace, or on both sides thereof. This interconnection is operative to collect the fly ash for return to the post incineration chamber with the oxygen-containing gas, and where the post incineration chamber has an apertured sump in the bottom thereof, the interconnection is preferably connected with the opening in the bottom of the sump. Also, where the interconnection is operative to collect the fly ash on the outside of the opening in the furnace, the furnace preferably has a trough formed about the opening thereof, and there are means in the trough for imparting a vortical motion to that portion of the fluid medium which is discharged through the opening in the furnace from the post incineration chamber.

DESCRIPTION OF THE DRAWINGS

These features will be better understood by reference to the accompanying drawings which illustrate two of the presently preferred embodiments of the invention.

In the drawings, FIG. 1 is a part cross-sectional view of one embodiment as it is seen from above;

FIG. 2 is a part vertical cross-sectional view of the same embodiment;

FIG. 2A is a part perspective view of the chute in this embodiment;

FIG. 3 is a part vertical cross-sectional view of the second embodiment; and

FIG. 4 is a part cross-sectional view of the second embodiment as it is seen from above.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, it will be seen that the apparatus in FIGS. 1 and 2 comprises an upright hollow cylindrical furnace 2 which rests on the floor 4 of a polygonal basin 6 that is supported in turn on a base or pedestal 8 therebelow. The furnace has an annular cap 10 at the top thereof, and fuel is introduced into the furnace through the cap by a conveyor (not shown) that discharges over the central opening 14 thereof. Inside of the furnace, the fuel settles progressively downward, passing firstly through an upright cylindrical chute 16 in which it is dried and preheated, and then into and downward toward the bottom of an incinerator 18 formed by the bottom portion of the furnace. After the fuel enters the incinerator, it undergoes burning in the presence of a stream of pressurized air which is discharged into the furnace through a vertical duct 20 which opens into the bottom 22 of the incinerator at the center thereof. The pressurized air contributes oxygen to the burning process, and in addition, operates to purge the atmosphere from the incinerator in a manner to be explained.

Erected upright over the mouth of the duct is a perforated, cone-like nozzle 24. The nozzle is elongated in the upward direction and has a parabolic tip 24' which projects within the passage of the chute. The base of the nozzle is formed by a trivet-like stand 26, the legs 26' of which are inserted upright in a set of symmetrically angularly spaced holes 27 in the bottom of the incinerator. The pressurized air in the duct discharges through the openings between the legs of the stand, as well as through the perforations 28 in the nozzle. Part of the air is discharged from the furnace through a series of ports 30 symmetrically disposed about the perimeter of the furnace at the bottom thereof. The balance of the air rises up through the interior of the furnace and is drawn into the interior of the cap in a manner to be explained. The ports 30 are formed between radial vanes 32 in the wall of the furnace, and at the outside of the furnace, the vanes are equipped with relatively angularly offset blades 34, so that the air discharging through the ports is deflected into a helical pattern as it enters the moat-like trough 36 of the basin 6. In this way, the air is induced to undergo a vortical or cyclone motion in the trough so that any particles which may have been carried from the furnace with the air, are trapped in the trough as the air escapes through the open top thereof.

As indicated, inside of the furnace, the balance of the air rises up through the interior of the furnace and is removed through the interior of the cap 10. The cap is fabricated so as to define a pair of relatively upper and lower annular chambers 40 and 38, the lower of which, 38, has the full outside diameter of the furnace. The upper chamber 40 is smaller in diameter, and is pressurized with air through a duct 74, so that an air lock can be developed across the opening 14 of the cap. The inner periphery of both chambers is defined by a collar-like feed tube 42 which is secured upright within the cap, so that the bottom end of the same depends into the top of the chute from the bottom of the cap, and the top end of the tube forms a narrow slot 44 around the opening 14 of the cap, at the inner periphery of the upper chamber 40. The pressurized air in the upper chamber 40, discharges through the slot and is deflected downward into the tube by an inward flare to the rim 46 of the opening 14. At the bottom of the tube, the pressurized air meets the upcoming air in the furnace, so that the latter is trapped in the furnace and can only be removed through the interior of the cap, as is to be explained.

The chute 16 comprises a pair of coaxially disposed perforated sleeves 47, 48, the inner 47 of which is fixedly suspended from the bottom of the cap, whereas the outer sleeve 48 is rotatably engaged about the inner sleeve and suspended on three symmetrically arrayed rods 48' depending from an annular spur gear 49 rotatably mounted above the cap. The diameter of the sleeves is substantially less than that of the inside diameter of the furnace, so that an annular plenum 18' is formed therebetween. However, the inner sleeve 47 has a perforated outturned flange 50 thereon, the outer diameter of which is sized to engage snugly within the wall of the furnace. The rods 48' pass through short part annular slots 51 in the top of the chamber 38, and longer such slots 54 in the bottom of the chamber. The slots 51 are flexibly sleeved to maintain an air-tight condition. The slots 54 are fully open for communication with the plenum 18'.

The nozzle 24 is fed through the duct 20 by a blower 52, the intake side of which applies suction to the lower chamber 38 of the cap through a duct 60 at the periphery thereof. The suction is applied to the plenum 18' through the slots 54, so that the blower operates to exhaust the atmosphere in the chute through the perforations 56 in the outer sleeve and the perforations 58 in the inner sleeve. As seen in FIGS. 2 and 2A, the respective perforations overlap, although the aggregate open

cross-sectional area of the same can be adjusted by rotating the outer sleeve **48**. A power driven spur gear **59** is engaged with the annular spur gear **49** for this purpose. The perforations **56** in the outer sleeve are the same size as those **58** in the inner sleeve at the top of the chute, but as the chute descends, the perforations **56** are progressively larger so that even when the perforations **56** are moved entirely out of registry with the perforations **58** at the top of the chute, the perforations **56** are nevertheless overlapping with the perforations **58** toward the bottom of the chute. Again, see FIGS. **2** and **2A**.

The exhausted atmosphere in the duct **60** is returned to the duct **20** in the bottom of the incinerator through an elongated, more serpentine duct **62** which circles through the trough **36** of the basin **6** before it enters the slab of the pedestal **8** and elbows up into connection with the duct **20**. In this way the return air is subjected to reheating by the hot air discharge from the ports **30**, and to aid in the effect, heat transfer fins **64** may be included on the section **62'** of the duct **62** which passes through the trough **36**.

The stand **26** of the nozzle is equipped with a liquid or gaseous fuel burner **66** which is operated to initiate the burning process, and may also be employed to augment the process where the fuel in the furnace is exceptionally wet. The stand has a pipe nozzle **68** suspended upright in the center thereof, and the burner **66** is installed in the duct **20** so as to insert in the bottom of the pipe nozzle. A line **70** feeds the burner through the slab of the pedestal.

In FIG. **3**, the nozzle is omitted, and instead, the stand has a spider-like lid **72** seated on the rim thereof, the fingers of which form a series of symmetrically angularly spaced openings about the perimeter of the stand. See FIG. **4**. Also, since the fuel in the furnace now rests on the stand, the pipe nozzle has a perforated cover **73** over the upper end thereof.

Preferably, the chute **16** is made of a stainless steel or ceramic material, and the perforations **56** and **58** in the same are quadrilateral in configuration, such as square or rectangular, and are arranged in vertical columns at symmetrically spaced angular intervals about the circumference of the sleeves.

The air fed to the airlock chamber **40** through duct **74**, may be fed by the main blower **52** or by a supplemental blower **76** seen in FIG. **1**.

During the incineration process, the molten slag from the fuel settles onto the bottom **22** of the furnace and is discharged from the pedestal **8** through a dished sump **78** formed in the bottom. In FIGS. **1** and **2**, the sump **78'** is annular in form and surrounds the nozzled end **24** of the duct **20**. In FIG. **3** the sump **78''** is conical and has its apex at the lidded end **72** of the duct.

Referring firstly to FIGS. **1** and **2**, it will be seen that the pedestal has four symmetrically arranged tunnels **80** therein, which approach the area below the furnace from different sides of the pedestal, and interconnect under the furnace. The tunnels open into the swale of the sump **78'** through a series of wells or bores **82** that are vertical to allow the slag to drip directly thereinto. Moreover, the bottom **22** of the furnace is lined with refractory metal plate **84**, the edges **86** of which overhang the bores so that the slag drips through the bores without contacting the sidewalls of the same. The slag is collected in the tunnels in trays **88** that are slidably engaged below the bores to be retracted from the tunnels when they are filled. Alternatively, the tunnels may be equipped with conveyor belts, or a liquid may be circulated through the tunnels to receive and chill the slag, and then remove it as entrained particle matter. Other means may also be employed for the purpose of removing the slag.

In FIG. **3**, a single tunnel **90** is formed at the bottom of the elbow **62''** in the duct **62**. Also, the duct **20'** has a lip **92** at the mouth thereof, from which the slag drips into a tray **94** in the tunnel, or alternatively into a liquid wash as mentioned in connection with the embodiment of FIGS. **1** and **2**. Thus, the duct **20'** also serves as drip chamber for the slag.

Where the duct **20** does not serve as a drip chamber, deflectors **96** are commonly included in the elbow **62''**.

In both embodiments, the suction side **60** of the blower **52** is connected to the tunnels **80** (or **90**) by a suction line **98** in the pedestal. See FIG. **1**. A damper (not shown) in the connection is opened periodically to enable the blower to intake fly ash from the tunnels, for reintroduction to the furnace.

A suction line **100** can also be employed in connection with the bottom of the trough **36**.

Also, as another feature, a pressure-sensitive paddle or other such mechanical sensor (not shown) can be employed in the furnace to regulate the speed of the blower **52** in accord with the accumulation of fuel in the furnace.

What is claimed is:

1. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along an elongated path passing through the preliminary incineration chamber from the fuel intake, means forming an airlock across the intake to assure that the atmosphere in the chambers is unable to escape therethrough, and fluid transfer means, including blower means, for pressurizing the atmosphere in the chambers with an oxygen-containing gas, while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, said fluid transfer means including means disposed in the furnace adjacent one of the fuel intake and the fuel retainer, so as to form a plenum between the chambers and the blower means, which plenum extends lengthwise of the fuel flow path and which plenum forming means has apertures in the body thereof through which the plenum communicates with the fuel flow path in directions crosswise thereof.

2. The apparatus according to claim **1** further comprising means for opening the post incineration chamber to the outside of the furnace at a point adjacent the fuel retainer while closing the atmosphere in the post and preliminary incineration chambers to the outside of the furnace between the fuel retainer and the fuel intake along the fuel flow path, so that a portion of the atmosphere in the post incineration chamber is discharged to the outside of the furnace from the region in which the fuel is collected on the retainer.

3. The apparatus according to claim **1** wherein the plenum forming means are disposed in the preliminary incineration chamber adjacent the fuel intake and are operative to form an annular plenum between the preliminary incineration chamber and the intake side of the blower means.

4. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along an elongated path passing through the preliminary incineration chamber from the fuel intake, and fluid transfer means, including blower means, for pressurizing the atmosphere in the chambers with an oxygen-containing gas, while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, said fluid transfer means including means which are operative to form a plenum between the chambers and the blower means, which plenum extends lengthwise of the fuel flow path and communicates with the fuel flow path in directions crosswise thereof, and means for varying the degree of communication between the fuel flow path and the plenum.

5. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along an elongated path passing through the preliminary incineration chamber from the fuel intake, and fluid transfer means, including blower means, for pressurizing the atmosphere in the chambers with an oxygen-containing gas, while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, said fluid transfer means including means which are operative to form an annular plenum between the preliminary incineration chamber and the intake side of the blower means, which annular plenum is disposed in the preliminary incineration chamber and extends lengthwise of the fuel flow path so that the fuel flow path passes through the same in leaving the fuel intake, and which annular plenum communicates with the fuel flow path in directions crosswise thereof.

6. The apparatus according to claim 5 wherein the annular plenum is formed by a perforated chute which is suspended in the furnace about the fuel intake, and spaced apart from the wall of the furnace so as to form an annular clearance therebetween, which is in communication with the intake side of the blower means.

7. The apparatus according to claim 1 wherein the plenum forming means are disposed in the post incineration chamber adjacent the fuel retainer and are operative to form an elongated plenum between the post incineration chamber and the discharge side of the blower means.

8. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along an elongated path passing through the preliminary incineration chamber from the fuel intake, and fluid transfer means, including blower means, for pressurizing the atmosphere in the chambers with an oxygen-containing gas, while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, said fluid transfer means including means which are operative to form an elongated plenum between the post incineration chamber and the discharge side of the blower means, which elongated plenum is disposed in the post incineration chamber and extends lengthwise of the fuel flow path so that the fuel flow path passes about the same in approaching the fuel retainer, and which elongated plenum communicates with the fuel flow path in directions crosswise thereof.

9. The apparatus according to claim 8 wherein the elongated plenum is formed by a perforated cone which is erected upright in the furnace at the center of the fuel retainer, but inverted to the floor of the furnace so as to form an elongated nozzle thereon, which is in communication with the discharge side of the blower means.

10. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along an elongated path passing through the preliminary incineration chamber from the fuel intake, and fluid transfer means, including blower means, for pressurizing the atmosphere in the chambers with an oxygen-containing gas, while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, said fluid transfer means including means which are operative to form an annular plenum between the preliminary incineration chamber and the intake side of the blower means, and an elongated plenum between the post incineration chamber and the discharge side of the blower means, each of which plenums extends lengthwise of the fuel flow path and communicates with the fuel flow path in directions crosswise thereof, and which elongated plenum projects within the hollow of the annular plenum.

11. The apparatus according to claim 10 wherein the annular plenum is formed by a perforated chute which is suspended in the furnace about the fuel intake, and spaced apart from the wall of the furnace so as to form an annular clearance therebetween, which is in communication with the intake side of the blower means, and the elongated plenum is formed by a perforated cone which is erected upright in the furnace in the center of the fuel retainer, but inverted to the floor of the furnace so as to form an elongated nozzle thereon, which is in communication with the discharge side of the blower means, and wherein the chute and the cone are coaxial with one another, on a line approaching the vertical.

12. The apparatus according to claim 11 wherein the perforations in one of the chute and the cone, are adjustable in cross-sectional area, so that the rate of fluid flow through the same can be varied.

13. The apparatus according to claim 12 wherein the chute is formed by a pair of relatively rotatably interengaged sleeves having perforations therein which vary in overlap as the sleeves are rotated in relation to one another.

14. The apparatus according to claim 13 wherein the area of overlap becomes progressively larger as the fuel passes through the sleeves.

15. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along a line passing through the preliminary in-

cineration chamber from the fuel intake, means forming an airlock across the intake to assure that the atmosphere in the chambers is unable to escape therethrough, means for pressurizing the atmosphere in the chambers with an oxygen-containing gas while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, means for opening the post incineration chamber to the outside of the furnace at a point adjacent the fuel retainer while closing the atmosphere in the post and preliminary incineration chambers to the outside of the furnace between the fuel retainer and the fuel intake along the line of feed, so that a portion of the atmosphere in the post incineration chamber is discharged to the outside of the furnace from the region in which the fuel is collected on the retainer, said post incineration chamber having a sump in the bottom thereof, and there being means movably associated with the sump, to collect and discharge slag from the sump, relatively outside of the furnace.

16. The apparatus according to claim **15** wherein the sump has an opening in the bottom thereof, and the slag discharge means is movable below the opening to collect the slag as it drips through the opening.

17. The apparatus according to claim **16** wherein the opening has an overhanging lip about the rim thereof.

18. The apparatus according to claim **16** wherein the slag discharge means takes the form of a tray which is reciprocable in relation to the furnace, to and from a point below the opening.

19. The apparatus according to claim **16** wherein the atmosphere purged from the preliminary incineration chamber, is discharged into the post incineration chamber through the opening in the bottom of the sump.

20. The apparatus according to claim **16** wherein the atmosphere purged from the preliminary incineration chamber, is discharged into the post incineration chamber through an opening therein which is spaced apart from the opening in the sump.

21. The apparatus according to claim **20** wherein the sump is annular, and the atmosphere purged from the preliminary incineration chamber, is discharged into the post incineration chamber through an opening at the center of the sump.

22. The apparatus according to claim **16** wherein there are dampered fluid transfer means interconnecting the opening in the bottom of the sump with the means for pressurizing the atmosphere in the chambers.

23. Apparatus for incinerating a solid fuel containing carbonizable material, comprising a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along a line passing through the preliminary incineration chamber from the fuel intake, means including blower means, for pressurizing the atmosphere in the chambers with an oxygen-containing gas while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, means for opening the post incineration chamber to the outside of the furnace at a point adjacent the fuel retainer while closing the atmosphere in the post and preliminary incineration chambers to the outside of the furnace between the fuel retainer and the fuel intake along the line of feed, so that a portion of the atmosphere in the post incineration chamber is discharged to the outside of the furnace from the region in which the fuel is collected on the retainer, and fluid transfer means forming an interconnection between the bottom of the furnace and the intake side of the blower means, to collect fly ash for return to the post incineration chamber with the oxygen-containing gas.

24. The apparatus according to claim **23** wherein the post incineration chamber has an apertured sump in the bottom thereof and the interconnection is connected with the opening in the sump.

25. The apparatus according to claim **23** wherein the furnace has a trough formed about the opening thereof and the interconnection is connected with the bottom of the trough.

26. The apparatus according to claim **25** wherein there are means in the trough for imparting a vortical motion to that portion of the atmosphere which is discharged through the opening in the furnace from the post incineration chamber.

27. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along a line passing through the preliminary incineration chamber from the fuel intake, and means for pressurizing the atmosphere in the chambers with an oxygen-containing gas while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, said post incineration chamber having a sump in the bottom thereof, and there being means movably associated with the sump, to collect and discharge slag from the sump, relatively outside of the furnace, said sump having an opening in the bottom thereof, said slag discharge means being movable below the opening to collect the slag as it drips through the opening, and said atmosphere purged from the preliminary incineration chamber, being discharged into the post incineration chamber through the opening in the bottom of the sump.

28. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along a line passing through the preliminary incineration chamber from the fuel intake, and means for pressurizing the atmosphere in the chambers with an oxygen-containing gas while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, said post incineration chamber having a sump in the bottom thereof, and there being means movably associated with the sump, to collect and discharge slag from the **23** sump, relatively outside of the furnace, said sump being annular and having an opening in the bottom thereof, said slag discharge means being movable below the opening to collect the slag as it drips through the opening, and said atmosphere purged from the preliminary incineration chamber, being discharged into the post incineration chamber through an opening therein which is disposed at the center of the sump and spaced apart from the opening in the sump.

29. In apparatus for incinerating a solid fuel containing carbonizable material, a furnace having a preliminary incineration chamber with a fuel intake therein, and a post incineration chamber with a fuel retainer therein, means for feeding the fuel onto the fuel retainer along a line passing through the preliminary incineration chamber from the fuel intake, and means for pressurizing the atmosphere in the chambers with an oxygen-containing gas while purging the whole of the atmosphere from the preliminary incineration chamber and discharging the same into the post incineration chamber, said post incineration chamber having a sump in the bottom thereof, and there being means movably associated with the sump, to collect and discharge slag from the sump, relatively outside of the furnace, said sump having an opening in the bottom thereof, said slag discharge means being movable below the opening to collect the slag as it drips through the opening, and there being dampered fluid transfer means interconnecting the opening in the bottom of the sump with the means for pressurizing the atmosphere in the chambers.

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