

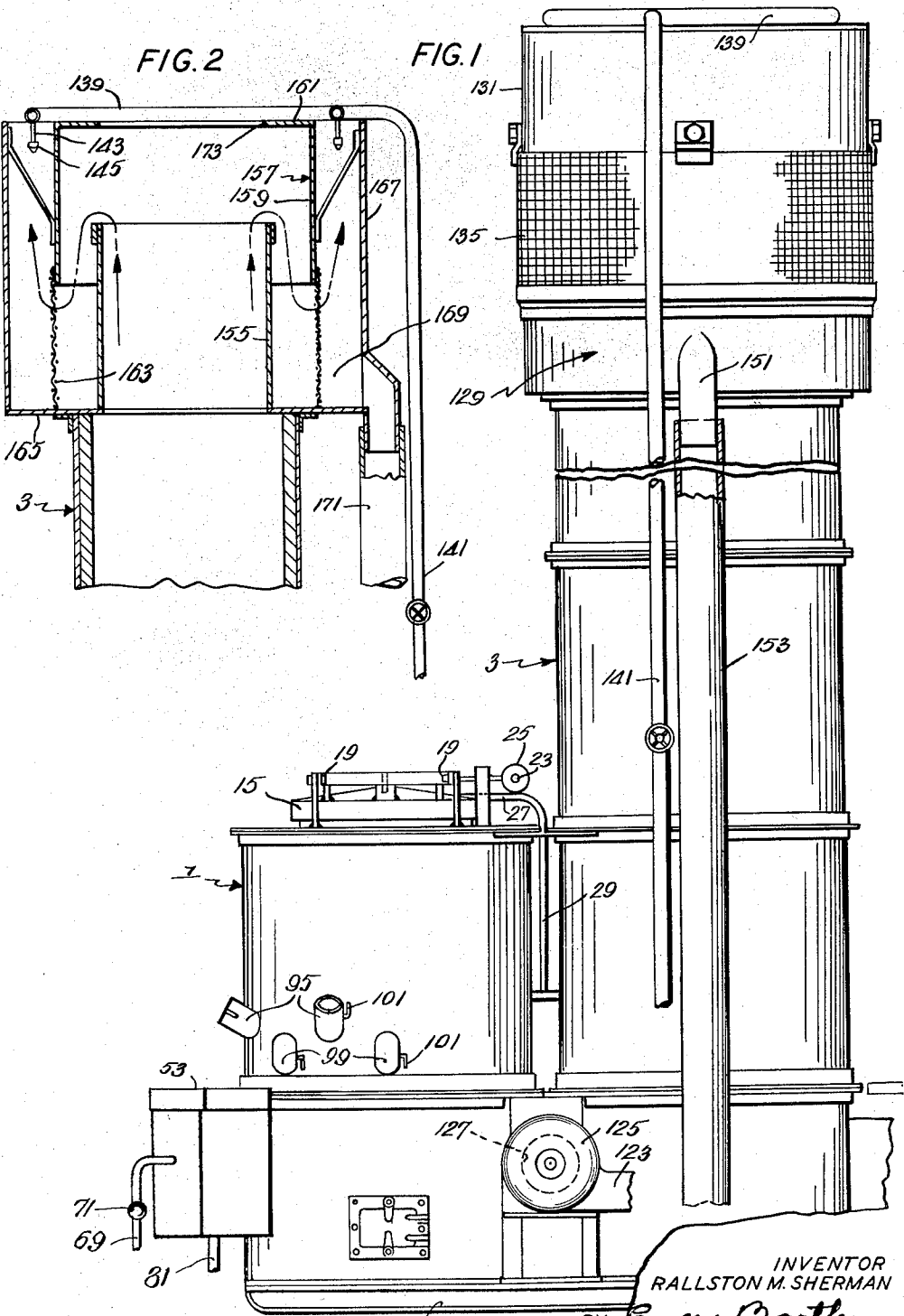
Jan. 20, 1959

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5 Sheets-Sheet 1



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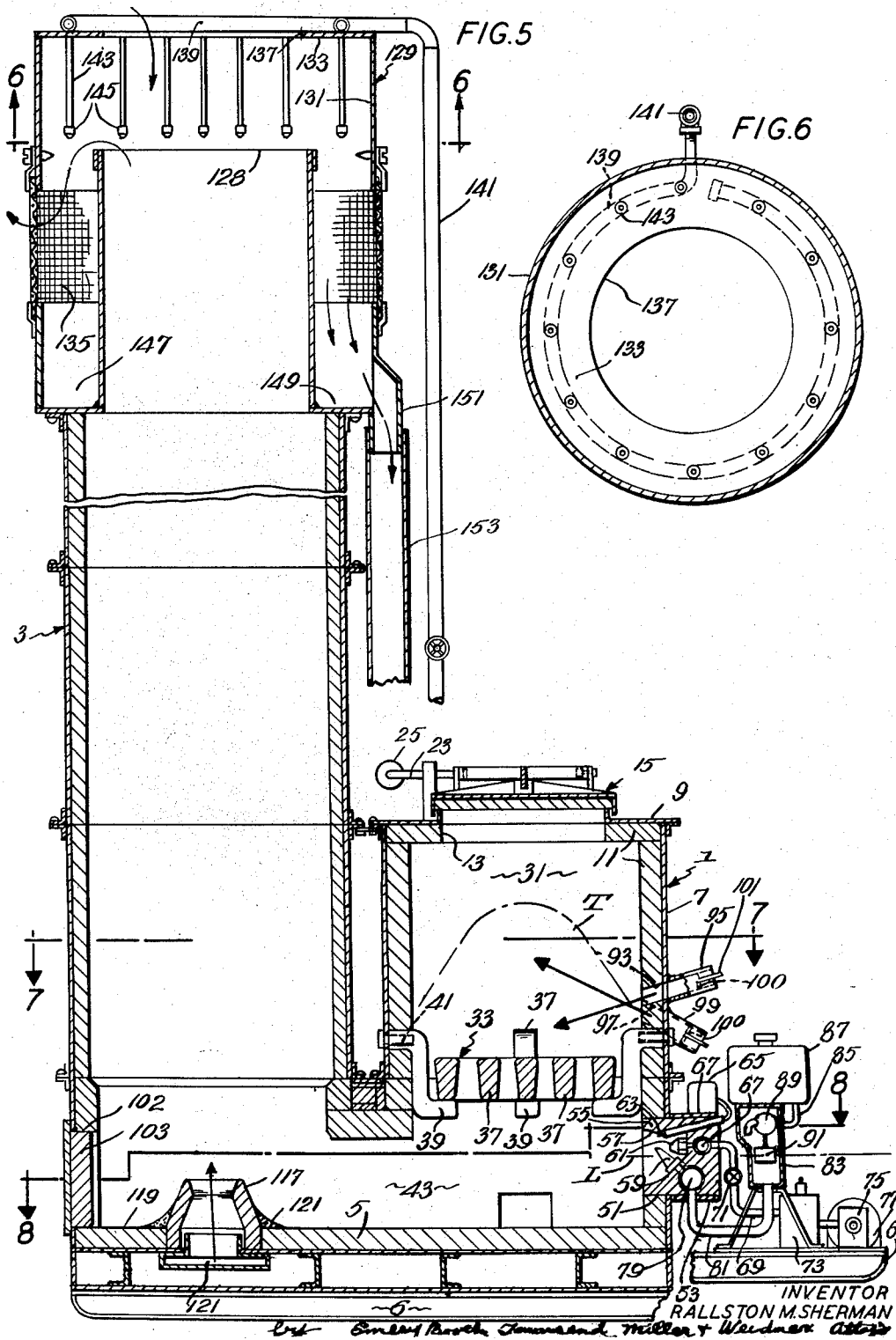
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FIG.7

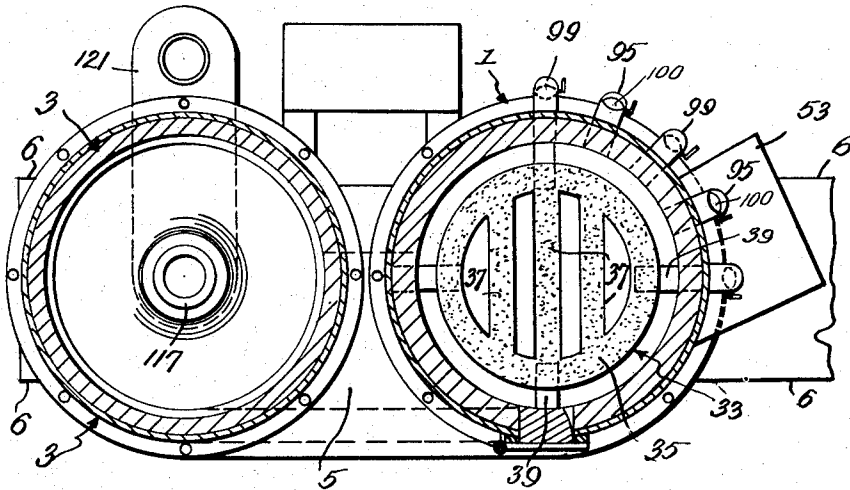
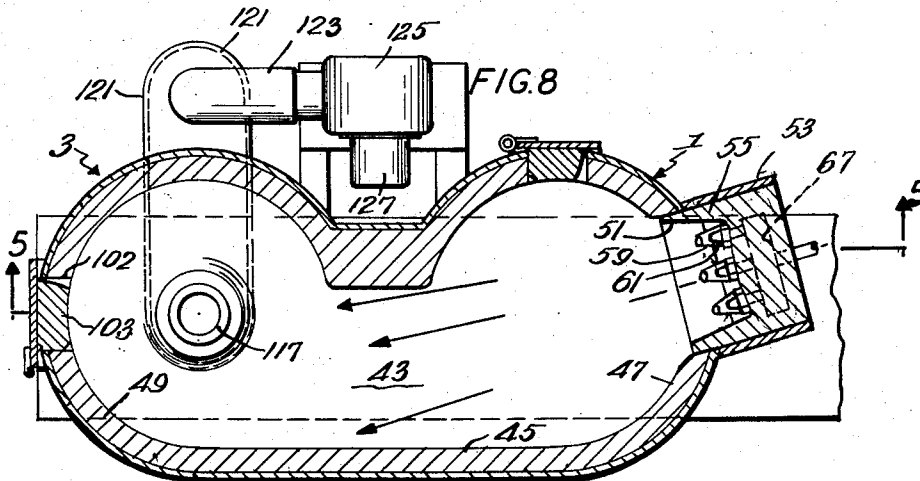


FIG. 8



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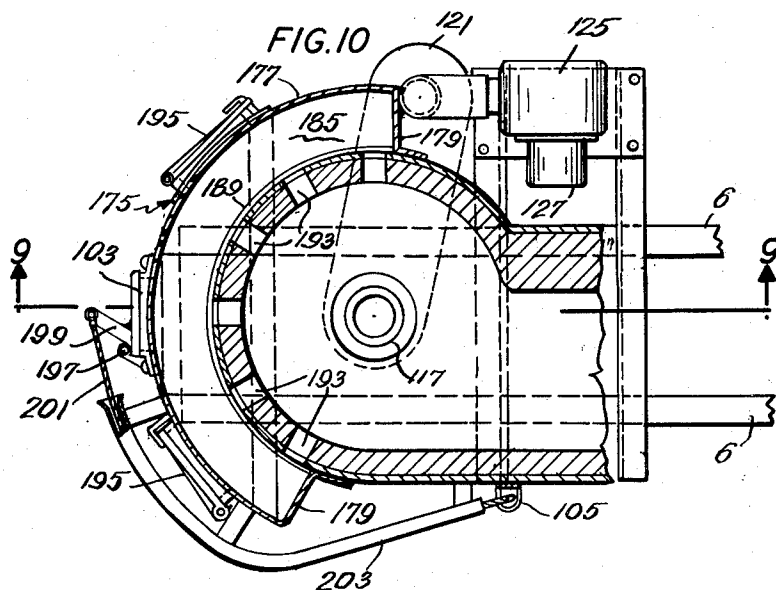
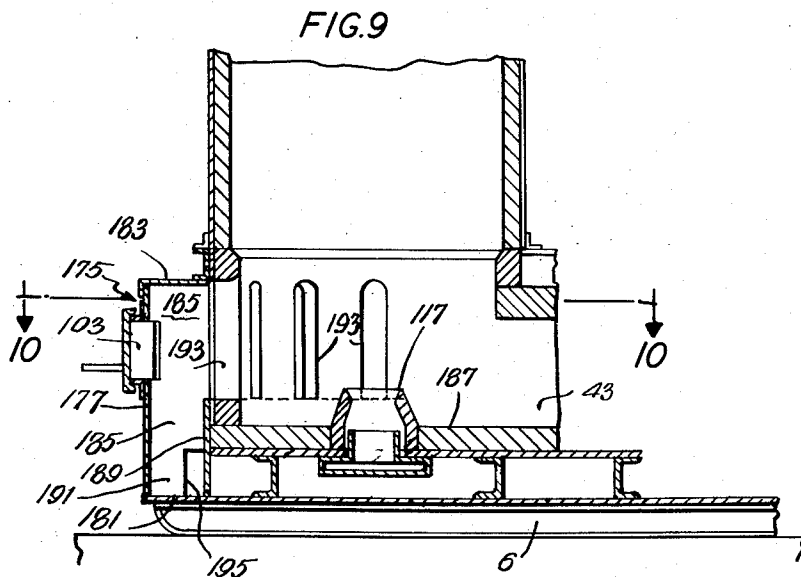
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5 Sheets-Sheet 5



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Application August 25, 1955, Serial No. 530,510

14 Claims. (Cl. 110—8)

My invention relates to incinerators.

The invention has among its objects the provision of a compact incinerator of relatively large capacity, and one having a stack of reduced height making the incinerator useful for installation in places where a high stack is objectionable, for example, installation at airports, in public parks, and the like.

Also, among the objects of the invention is the provision of an incinerator which is entirely smokeless and odorless and characterized by the absence of discharge of fly-ash.

Still further, among the objects of the invention is the provision of an incinerator that will rapidly consume trash containing a relatively large amount of wet material such as garbage.

The invention and its other objects however will be best understood from the following description when read in the light of the accompanying drawings of several examples of the invention selected for illustrative purposes, while the scope of the invention will be more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a side elevation of an incinerator according to the invention;

Fig. 2 is a medial vertical section of a modified form of the upper portion of the incinerator stack;

Fig. 3 is an elevation of the incinerator according to Fig. 1 as viewed from its side opposite that viewed in Fig. 1, with parts broken away and parts omitted;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a section on the line 5—5 of Fig. 8;

Fig. 6 is a section on the line 6—6 of Fig. 5;

Figs. 7 and 8 are sections on the lines 7—7 and 8—8, respectively, of Fig. 5 with parts broken away and parts omitted;

Fig. 9 is a section on the line 9—9 of Fig. 10, and shows a modified form of the base portion of the stack of the incinerator; and

Fig. 10 is a section on the line 10—10 of Fig. 9.

The incinerator illustrated by Figs. 1 to 8 comprises a cylindrical drum-like part 1 and a cylindrical stack 3 both supported on and opening into a tunnel-like part 5. The material to be incinerated is burned in each of these parts including the stack as is hereinafter more fully explained, such parts including the stack together forming a combustion chamber for such material. As shown, this structure is carried by a support comprising a pair of laterally spaced skids formed by the channel-irons 6.

The drum-like part 1, as shown, comprises an outer cylindrical metallic casing 7 provided with a top 9, the casing and its top having a heat refractory heat insulating lining 11. The top of the casing and its lining are provided with an opening 13 normally closed by a door 15. As shown, the door at one edge is provided with rearwardly extending lugs 17 (Fig. 4) hingedly connected, as indicated at 19, to the top wall 9 of said casing. The pivot pin 21 of the left hand hinge connection, as viewed in Fig. 4, is fixedly secured to the adjacent lug 17, and

is provided with an arm 23 carrying a counterweight 25 for approximately balancing the weight of the door. At its edge opposite the hinge connection the door is provided with a handle 27 having a downwardly extending portion 29 (Fig. 3) the lower end of which is so positioned as to be within convenient reach of the operator when he desires to open or close the door.

When the door 15 is opened the material to be incinerated may be charged through the top opening 13 into the chamber 31 constituting the interior of the drum-like part 1 to form a pile of trash or the like, schematically indicated at T (Fig. 5), which pile rests on a grate 33 at the lower portion of said chamber. The grate, as shown, comprises an outer ring-shaped portion 35 (Fig. 7) integrally formed with the spaced grate bars 37. As shown, the grate is supported by brackets 39 which, as indicated at 41 (Fig. 5), are bolted to the casing 7 of the drum-like part 1. This grate, because it is subjected, when the incinerator is operated, to flame both above and below it and flame passes through it, is raised to an extremely high temperature, so much so in fact that ordinary grate material is wholly unsuitable for its construction. Preferably, to withstand such temperature, it is formed of so-called "high alumina" fireclay such as fireclay having a high content of mullite or kyanite. The grate may be formed by ramming into a suitable mold such fireclay while moist and of dough-like consistency, and after the clay sets sufficiently to permit it to be removed from the mold may be fired to harden it.

The space beneath the grate 33 opens into the passage 43 formed by the tunnel 5. As best indicated by Fig. 8, this passage is positioned at one and the same side of the drum-like part 1 and stack 3 of the incinerator as viewed in a horizontal plane, the lower side wall 45 of the passage as viewed in Fig. 5 being tangent to the inner surfaces 47 and 49 of the part 1 and stack, respectively. As a result of this construction the products of combustion are discharged from the passage 43 tangentially into the base portion of the stack and consequently whirl as they ascend the stack. In ascending through the stack this whirling of the products thoroughly mixes them with combustion air so as to burn their residual combustible fractions. This whirling also causes such products to travel linearly through a much longer path than if they ascended the stack without whirling, and thus enables a much shorter stack to be employed.

As shown, that side of the space beneath the grate 33 which is remote from the opening of that space into the tunnel passage 43 is provided with a rectangular opening 51 (Figs. 5 and 8) from the edges of which projects a sleeve 53 of like cross-section, said opening and sleeve being filled with a body 55 of fireclay or the like, which body is formed to present a cavity 57 opening into said space. As shown, associated with this cavity is a fluid fuel burner, preferably an oil burner, for projecting a flame into said space. Preferably such oil burner is of the aspirator type, as the same produces a wide bushy flame which is effective to form a sheet of flame substantially coextensive with the under side of the grate.

The details of the above mentioned oil burner do not form part of the present invention, and hence are illustrated more or less diagrammatically in Fig. 5 and will be described only with such particularity as to indicate how they cooperate with the present invention. As shown (see Figs. 5 and 8), the burner comprises a row of three upwardly projecting oil aspirator nozzles 59 with each of which is associated an air blast nozzle 61 effective to blow a jet of air over the open end of the oil aspirator nozzle and draw oil from such nozzle and atomize it and mix with it, such mixture being ignited by an associated electrode or electrodes, indicated by the electrode 63 (Fig. 5), energized by the transformer 65.

As more or less diagrammatically illustrated, the air nozzles 61 are supplied with compressed air from a manifold 67 which is connected by a compressed air supply pipe 69, having a manually operated control valve 71, to a compressed air storage tank 73. The storage tank is supplied with compressed air by an air compressor, indicated at 75, driven by an electric motor 77. The oil aspirator nozzles 59 are shown as supplied with oil from a manifold 79, which latter is connected by an oil supply pipe 81 to a suitably supported chamber 83. This chamber is supplied with oil by a pipe 85 leading from an oil storage tank 87, there being within the chamber a valve 89 associated with said pipe and controlled by a float 91 for discharging oil from the pipe into the chamber so as to maintain oil within said chamber to a level L slightly below the upper discharge openings of the oil aspirator nozzles 59. Jets of air from the air nozzles 61 may be established, controlled and interrupted by the operator manipulating the valve 71 for establishing, controlling and interrupting the oil burner flame, the electrode or electrodes 63 preferably being continuously operated to insure the creation of the flame each time the valve 71 is opened. As shown, the oil burner nozzles are so positioned that the flame is projected from one side of the space beneath the grate diagonally, as viewed in Fig. 8, across said space in proximity to the under side of the grate into the tunnel passage 43 and toward the wall 45 of that passage, so as to promote when the burner is in operation whirling of the gases in the stack.

The oil burner flame may be employed for initially heating the incinerator from its cold condition, initially creating a draft up the stack, and igniting the charge on the grate. In incinerating dry trash the burner need be operated for these purposes but for a short period, say 30 seconds or so, such trash continuing to burn and maintaining the draft up the stack after the burner is placed out of operation. In burning wet trash, or trash mixed with wet material such as wet garbage, the burner may be kept in operation for a longer period so as to dry such wet material sufficiently to cause it to burn. Another important function of the burner is that, should the incinerator at any time discharge from the stack odorous gases, placing the burner in operation will immediately eliminate such odors, because the odorous constituents being of an organic nature the intense heat of the burner flame will consume them while in the space beneath the grate and while within the tunnel passage 43 and the base portion of the stack.

In the incinerator illustrated provision is made for admitting air to the drum-like part 1 to which the material to be incinerated is charged. As shown, such air admission means is in the form of tuyere-like passages comprising downwardly inclined openings 93 in the lateral wall of the part 1, and associated pipes 95, and comprising upwardly inclined openings 97 in said lateral wall, and associated pipes 99. Air is drawn through the tuyeres, when the door 15 of the part 1 is closed, by the draft through the stack. The upwardly inclined tuyeres act to project air against the upper portion of the charge on the grate. The downwardly inclined tuyeres project air toward the central portion of the grate for insuring continued burning of the charge when it is almost consumed. As shown, each tuyere pipe 95 and 99 is provided with a damper 100 having a handle 101 at the exterior of the pipe for its manual operation. By use of these dampers the amounts of air passing through the tuyeres may be accurately regulated and controlled.

As illustrated, the stack 3 at its base is provided with a side opening 102 normally closed by a hingedly supported door 103. It has been found that, should the stack begin to discharge smoke, opening of this door will cause auxiliary air to be drawn into the stack and ascend with the products of combustion and mix with them to

cause the smoke to be consumed. Opening of such door, it has been found, will totally eliminate discharge of smoke from the stack within about 5 seconds. For opening and closing the door there is conveniently provided, adjacent the downwardly extending portion 29 of the handle 27 for opening and closing the door 15 of the part 1, a hand operated lever 105 (Fig. 3) pivotally mounted at 107 for swinging in a vertical plane, to the lower end of which lever is hingedly connected one end of a curved link 109, the other end of which link is pivotally connected at 111 to an arm 113 projecting from and fixedly carried by the door 103. The door, which is hingedly supported at 115 (Fig. 4), will be held in closed position when the lever 105 is in its full line position shown by Fig. 3, and will be opened when said lever is swung to its dotted line position shown by that figure.

If desired, the base of the stack 3 may be provided with a nozzle 117 for discharging air upwardly and axially of the stack. The air so discharged will increase the draft through the stack without interfering with the whirling of the gases therein, and will materially increase the rate at which the incinerator will consume material. As shown, this nozzle, which preferably is formed of heat refractory fireclay, is carried by the bottom refractory wall 119 (Fig. 5) of the stack, and is supplied with air through a flat conduit 121 leading beneath said wall to one side of the stack, as indicated in Fig. 8, where it communicates with a pipe 123 leading from the outlet of an air supply blower 125 driven by an electric motor 127. The supply of air to the nozzle may be established and interrupted by use of a suitable manually operated switch (not shown) for energizing and deenergizing the motor.

As shown, the stack 3 at its upper end has an upwardly facing top opening 128 (Fig. 5). The upper portion of the stack, as shown, is surrounded by a cap 129 having a lateral wall 131 and a top wall 133, the lateral wall being in spaced relation to the adjacent lateral wall of the stack and the top wall being in upwardly spaced relation to the top opening of the stack. At a point below the top opening of the stack the lateral wall 131 of the cap is operatively apertured by providing it with an annular section 135 of screen which acts as a spark arrester, the products discharging through the top opening of the stack turning downward and discharging through such screen to the atmosphere.

It has been found that the whirling gases ascending the stack tend to create at the top opening of the stack a vortex, with a concomitant partial vacuum particularly toward the axial portion of the stack, that tend to interfere with the discharge of the downturned gases through the screen 135. However, it has been found that by providing the top wall of the cap 129 with an opening 137 atmospheric air will be drawn through such opening into the cap to destroy such vortex and partial vacuum and thereby promote discharge of the gases through the screen. The air so drawn into the stack also acts to reduce the temperature of the gases being discharged from the stack and thus contract their volume, which acts further to promote the draft up the stack and the discharge of gases through the screen. The opening 137 also acts to permit escape of gaseous products from the stack under untoward conditions that create an abnormal amount of such products.

As shown, resting on the top wall 133 of the cap 129 is a circular length of pipe 139 (Figs. 5 and 6) supplied with water under pressure through a valve controlled pipe connection 141. Leading downward from the pipe 139 into the cap are shown spaced short lengths of pipe 143 each of which at its lower end is provided with a water spray nozzle 145. The spray from these nozzles when water is supplied the pipe 139 will form a curtain of spray in the annular space 147 between the upper portion of the stack and lateral wall 131 of the cap, which curtain will wash fly-ash from the products leaving the top of the

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stack prior to their discharge through the screen 135. As shown, the lower edge portion of the lateral wall 131 of the cap is joined to the adjacent portion of the stack by an annular plate 149 so as to form a receptacle for the water from the spray nozzles. The water mixed with the fly-ash may discharge from this receptacle through an outlet 151 into a drain pipe 153 leading to any convenient place of water disposal.

If desired, and preferably, the upper portion of the stack and associated parts are constructed as shown in Fig. 2. As shown by Fig. 2, over the upper cylindrical portion 155 of the stack is placed a cap 157 having a cylindrical lateral wall 159 spaced from the stack and having a top wall 161 upwardly spaced from the top opening of the stack. Below the top opening of the stack the lateral wall of the cap is operatively apertured by forming it with an annular section 163 of screen. As shown, this screen extends downward to an annular horizontal plate 165 secured in a fluid tight manner at its opposite edges to the stack and lower edge of a cylindrical metal plate 167, respectively. The plate or wall 167 surrounds the lateral wall of the cap 157 and forms therewith an annular space 169 opening upwardly adjacent the level of the top wall of said cap. The products discharged from the stack pass downward and through the screen and then pass upward through the annular space 169. In this modification the circular pipe 139 having the spray nozzles 145 discharges the spray downward through the space 169 to wash fly-ash from the gaseous products after they discharge through the spark arresting screen 163 and before they discharge from the open upper end of said space. In such space the spray is not affected by the wind, as may at times be the case in the construction hereinbefore described with which the wind at times may blow through the screen at one side of the stack and blow objectionable amounts of spray from its opposite side. The water mixed with the fly-ash collects in the receptacle formed by the plate 165 and adjacent parts, and discharges from such receptacle through a pipe 171 to any convenient place of water disposal.

In view of that portion of the annular space 169 of Fig. 2 which is above the top opening of the stack acting as an upward prolongation of the stack there is not as great a need for admitting air through the top wall of the cap 157 for destroying the vortex and concomitant partial vacuum as in the construction heretofore described. However, in the construction shown by Fig. 2 the top wall of the cap 157 may advantageously, but not necessarily, be formed with an opening 173 similar to the opening 137 in the cap 129 heretofore described and serving for the same purposes.

Referring to the modification of the invention illustrated by Figs. 9 and 10, the base portion of the stack may be surrounded by an arcuate casing 175 having the outer wall 177, opposite end walls 179, bottom wall 181 and top wall 183, such casing forming a normally closed chamber 185. As shown, the bottom wall 181 of the casing is positioned below the bottom wall 187 of the stack, the chamber 185 having an arcuate wall 189 extending upward from the inner edge of the bottom wall 181 of the casing and overlapping, and welded at its upper edge to, the exterior surface of the stack to form a pit 191 at the bottom portion of the chamber 185. As shown, the wall of the stack is provided with a row of vertically extending slits 193 placing the base portion of the stack in communication with the upper portion of the chamber 185. The whirling gases in the base portion of the stack as they sweep over said slits will by centrifugal force throw fly-ash through said slits into said chamber, the fly-ash falling to the bottom of said chamber and collecting in the pit 191 from which it may be raked from time to time by opening one or more of the normally closed cleanout doors 195 to said pit. In this modification the door 103 for admitting air to the base of the stack is associated with the outer lateral wall 177 of the casing 175 forming the

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chamber 185. Such door is positioned above the top level of the wall 189 of the pit in which the fly-ash collects, so that when said door is opened to permit air to be drawn into the base portion of the stack through said chamber and the slits 193 it will not blow fly-ash from the pit back into the stack. In this modification the door 103 is shown as hingedly supported at 197 to the outer wall 177 of the casing 175, which door rigidly carries an arm 199 connected by a flexible yet relatively stiff cable 201 to the lower end of the manually operated lever 105 (Fig. 3) for said door, said cable passing loosely and slidably through a curved pipe support 203 fixedly carried by the stack and wall 177 of the casing 175.

It has been found that incinerators constructed as above described have for their size a large incinerating capacity. For example, one in which the charging chamber 31 is 3 feet in diameter and has a height of 3 feet above the grate, and in which the stack is 3 feet in diameter and about 13 feet in height from its base wall 119 to its top opening 128, will incinerate about 300 pounds of trash per hour even when containing as much as 50% by weight of wet garbage. By admitting air through the nozzle 117 to the base of the stack this amount of material incinerated per hour may be increased about 30%. It has been found that with incinerators hereinbefore proposed having the material to be incinerated resting on a grate such material can contain not more than about 20% of wet garbage for the reason that in such incinerators the combustion air passes upward from an ashpit or the like through the grate into the charge, whereas in the present incinerator it is admitted to the charging chamber 31 above the charge causing the flame to penetrate downward into the charge and pass downward through the grate to heat the latter to a high temperature. The highly heated grate in the present incinerator, in conjunction with the fluid fuel flame beneath the grate and substantially coextensive therewith, radiates heat upward to dry the wet fractions of the charge, thereby causing such fractions to be rapidly consumed. It has heretofore been proposed to spread wet material such as garbage, to be incinerated, on a hearth forming part of the incinerator and pass flame over the spread material for drying and burning it, with the result that the incinerator becomes large and expensive to construct, but all this is entirely avoided in the present incinerator. Furthermore, in incinerators heretofore proposed the gases discharged are commonly objectionably odorous, and this objection is eliminated in the present incinerator by reason of the provision of the fluid fuel flame which, as hereinbefore described, may be employed to consume the odorous constituents of the gases before they are discharged from the incinerator. Furthermore, incinerators heretofore proposed necessarily have tall stacks, while the present incinerator may employ a short stack by reason of the incinerator causing whirling of the gases in the stack to cause a short stack to have the same effect as a tall stack in respect to the length of the path of travel of the gases through it. Still further, in the present incinerator the whirling of the gases in the stack thoroughly mixes them with combustion air to cause consumption of the residual smoke producing particles in said gases, whereas with stacks in which the gases do not whirl the gases and combustion air tend to travel upward in separate straight paths without mixing and therefore do not effectively eliminate the production of smoke.

It will be understood that within the scope of the appended claims wide deviations may be made from the forms of the invention herein described without departing from the spirit of the invention.

I claim:

1. An incinerator having a charging chamber for the material to be incinerated, a grate at the lower portion of said chamber for supporting such material, means for admitting air to the portion of said chamber above said grate for supporting burning of said material and discharge of combustion products downward through said

grate to the space beneath said grate, a stack, a tunnel connecting such space to the lower portion of said stack constructed to discharge combustion products tangentially into said stack for causing them to whirl while ascending said stack for promoting combustion therein, said charging chamber, stack and tunnel together forming a combustion chamber in all of which enumerated portions thereof said material or combustible products evolved therefrom may be burned, and means for projecting a flame of burning mixture of fluid fuel and combustion air through said space beneath said grate in proximity to and across the under side of said grate into said tunnel.

2. An incinerator having a charging chamber for the material to be incinerated, a grate at the lower portion of said chamber for supporting such material, means for admitting air to the portion of said chamber above said grate for supporting burning of said material and discharge of combustion products downward through said grate to the space beneath said grate, a stack, a tunnel connecting such space to the lower portion of said stack constructed to discharge combustion products tangentially into said stack for causing them to whirl while ascending said stack for promoting combustion therein, said charging chamber, stack and tunnel together forming a combustion chamber in all of which enumerated portions thereof said material or combustible products evolved therefrom may be burned, and means comprising a plurality of horizontally spaced fuel atomizing nozzle devices for projecting a broad flame of burning mixture of fluid fuel and combustion air through said space beneath said grate in proximity to and across the under side of said grate into said tunnel.

3. A incinerator having a charging chamber for the material to be incinerated, a grate at the lower portion of said chamber for supporting such material, means for admitting air to the portion of said chamber above said grate for supporting burning of said material and discharge of combustion products downward through said grate to the space beneath said grate, a stack, a tunnel connecting such space to the lower portion of said stack constructed to discharge combustion products tangentially into said stack for causing them to whirl while ascending said stack for promoting combustion therein, said charging chamber, stack and tunnel together forming a combustion chamber in all of which enumerated portions thereof said material or combustible products evolved therefrom may be burned, means for projecting a flame of burning mixture of fluid fuel and combustion air through said space beneath said grate in proximity to and across the under side of said grate into said tunnel, and means for admitting auxiliary combustion air directly to the base of said stack.

4. An incinerator having a charging chamber for the material to be incinerated, a grate at the lower portion of said chamber for supporting such material, means for admitting air to the portion of said chamber above said grate for supporting burning of said material and discharge of combustion products downward through said grate to the space beneath said grate, a stack, a tunnel connecting such space to the lower portion of said stack constructed to discharge combustion products tangentially into said stack for causing them to whirl while ascending said stack for promoting combustion therein, said charging chamber, stack and tunnel together forming a combustion chamber in all of which enumerated portions thereof said material or combustible products evolved therefrom may be burned, means for projecting a flame of burning mixture of fluid fuel and combustion air through said space beneath said grate in proximity to and across the under side of said grate into said tunnel, and means for admitting auxiliary combustion air directly to the base of said stack axially thereof.

5. An incinerator having a charging chamber for the material to be incinerated, a grate at the lower portion of said chamber for supporting such material, means for ad-

mitting air to the portion of said chamber above said grate for supporting burning of said material and discharge of combustion products downward through said grate to the space beneath said grate, a stack, a tunnel connecting such space to the lower portion of said stack constructed to discharge combustion products tangentially into said stack for causing them to whirl while ascending said stack for promoting combustion therein, said charging chamber, stack and tunnel together forming a combustion chamber in all of which enumerated portions thereof said material or combustible products evolved therefrom may be burned, means comprising a plurality of horizontally spaced fuel atomizing nozzle devices for projecting a broad flame of burning mixture of fluid fuel and combustion air through said space beneath said grate in proximity to and across the under side of said grate into said tunnel, and means for admitting auxiliary combustion air directly to the base of said stack.

6. An incinerator having a charging chamber for the material to be incinerated, a grate at the lower portion of said chamber for supporting such material, means for admitting air to the portion of said chamber above said grate for supporting burning of said material and discharge of combustion products downward through said grate to the space beneath said grate, a stack, a tunnel connecting such space to the lower portion of said stack constructed to discharge combustion products tangentially into said stack for causing them to whirl while ascending said stack for promoting combustion therein, said charging chamber, stack and tunnel together forming a combustion chamber in all of which enumerated portions thereof said material or combustible products evolved therefrom may be burned, means comprising a plurality of horizontally spaced fuel atomizing nozzle devices for projecting a broad flame of burning mixture of fluid fuel and combustion air through said space beneath said grate in proximity to and across the under side of said grate into said tunnel, and means for admitting auxiliary combustion air directly to the base of said stack axially thereof.

7. An incinerator according to claim 1 in which the tunnel opens into the space beneath the grate and into the lower portion of the stack at one and the same side of the two as viewed in a horizontal plane, and the means for projecting the flame through the space beneath the grate projects it as viewed in such plane diagonally through said space toward said side and the opening of the tunnel into said stack, all for promoting whirling and consumption of the combustion products in said stack.

8. An incinerator according to claim 2 in which the tunnel opens into the space beneath the grate and into the lower portion of the stack at one and the same side of the two as viewed in a horizontal plane, and the means for projecting the flame through the space beneath the grate projects it as viewed in such plane diagonally through said space toward said side and the opening of the tunnel into said stack, all for promoting whirling and consumption of the combustion products in said stack.

9. An incinerator according to claim 1 in which the means for admitting air to the portion of the charging chamber above the grate comprises one or more tuyeres or the like for directing air downward from adjacent the side walls of said chamber at an inclination toward the central portion of the grate, and also comprises one or more tuyeres or the like for directing air from adjacent the side walls of said chamber upward at an inclination toward the axial portion of said chamber.

10. An incinerator according to claim 1 in which the means for admitting air to the portion of the charging chamber above the grate comprises one or more tuyeres or the like for directing air downward from adjacent the side walls of said chamber at an inclination toward the central portion of the grate, and also comprises one or more tuyeres or the like for directing air from adjacent the side walls of said chamber upward at an inclination toward the axial portion of said chamber, said tuyeres be-

ing provided with separate dampers for regulating the amounts of air so directed.

11. An incinerator according to claim 1 in which there is provided means forming at the exterior of the base portion of the stack a normally closed chamber communicating with said portion through one or more openings in the lateral walls of said portion, through which openings fly-ash is adapted to be thrown into said chamber by centrifugal force from the whirling products in said portion as they sweep over said openings.

12. An incinerator according to claim 1 in which there is provided means forming at the exterior of the base portion of the stack a normally closed chamber, the lateral walls of such portion of said stack having one or more openings communicating with said chamber above the bottom of said chamber to provide a space in said chamber for collection of fly-ash, through which openings fly-ash is adapted to be thrown into said chamber by centrifugal force from the whirling products in said portion as they sweep over said openings.

13. An incinerator according to claim 1 in which there is provided means forming at the exterior of the base portion of the stack a normally closed chamber, the lateral walls of said portion of said stack having a row of spaced vertically extending slits communicating with said chamber, through which slits fly-ash is adapted to be thrown by centrifugal force from the whirling products in said portion as they sweep over said slits, the lower ends of said slits being positioned above the bottom of

said chamber for affording a space therein for collection of such fly-ash.

14. An incinerator according to claim 1 in which there is provided means forming at the exterior of the base portion of the stack a normally closed chamber, the lateral walls of said portion of said stack having a row of spaced vertically extending slits communicating with said chamber, through which slits fly-ash is adapted to be thrown by centrifugal force from the whirling products in said portion as they sweep over said slits, the lower ends of said slits being positioned above the bottom of said chamber for affording a space therein for collection of such fly-ash, and means for at will admitting outside air into said chamber at a point above such fly-ash collecting space in said chamber for flow through said slits into said stack for promoting combustion in said stack.

References Cited in the file of this patent

UNITED STATES PATENTS

20	Re. 18,622	Jones	Oct. 18, 1932
	46,307	Prusman	Feb. 7, 1865
	490,582	McClave	Jan. 24, 1893
	830,974	Decarie	Sept. 11, 1906
	1,948,348	Gerhold	Feb. 20, 1934
25	2,160,481	Lockwood	May 30, 1939
	2,259,033	Fisher	Oct. 14, 1941
	2,274,050	Etwanik	Feb. 24, 1942
	2,291,790	Burton	Aug. 4, 1942
	2,515,869	Gregg et al.	July 18, 1950