

[54] INCINERATOR

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[56] References Cited

UNITED STATES PATENTS

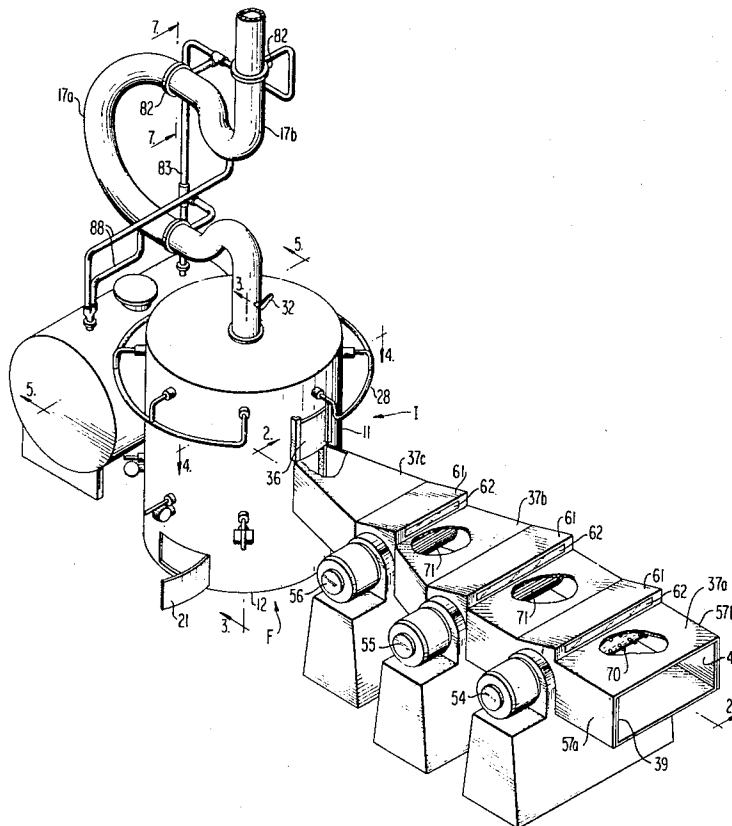
3,584,587	6/1971	Siracusa	110/8
3,448,702	6/1969	McLouth.....	110/8 X
3,495,555	2/1970	Boyd et al.....	110/8
3,159,353	12/1964	Atwater.....	110/8 X
3,357,380	12/1967	Siracusa.....	110/18 X
3,565,021	2/1971	Hill.....	110/7

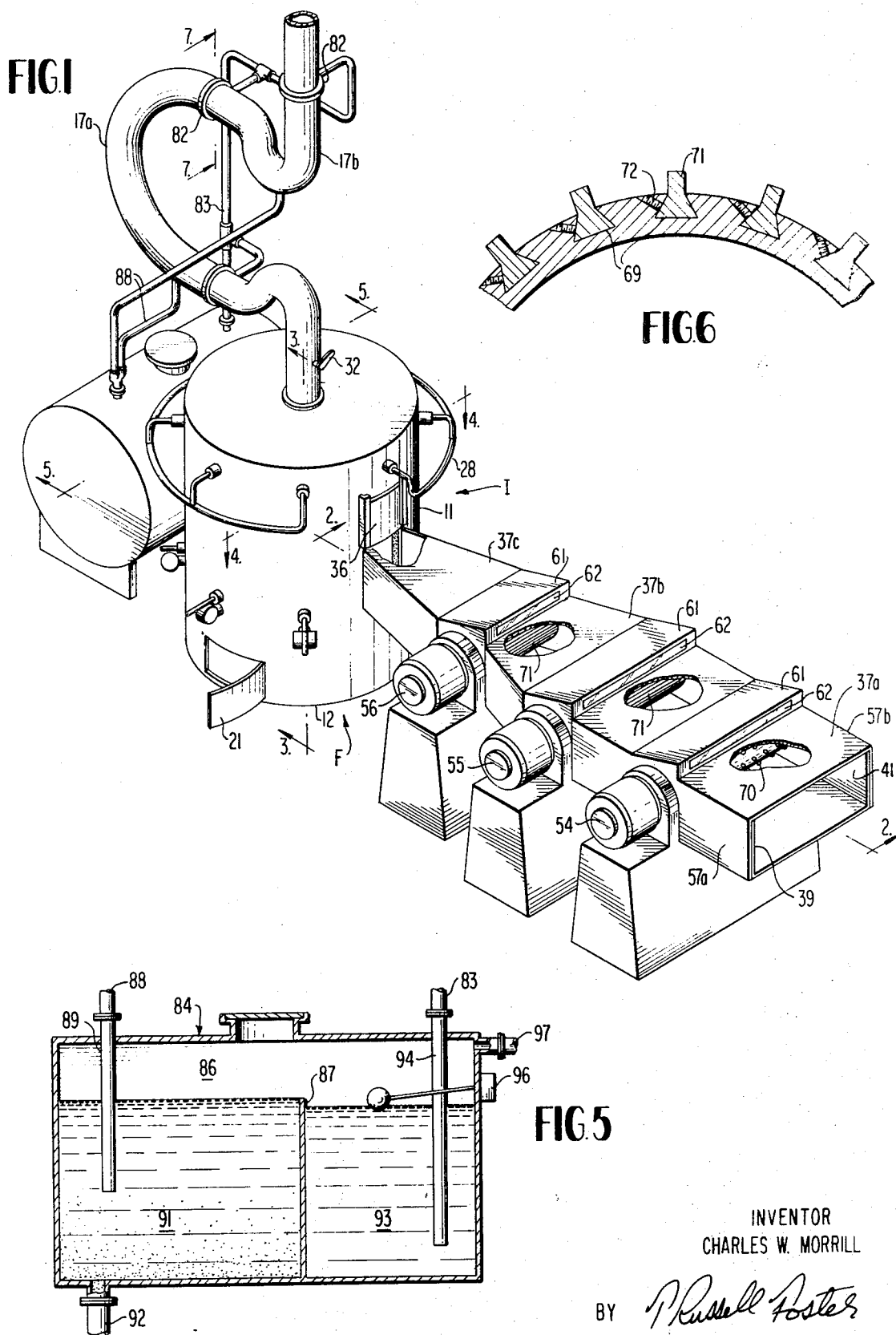
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[57] ABSTRACT

An incinerator for burning waste material such as garbage, trash and the like which includes a furnace having an interior and an inlet opening in the furnace side wall through which finely divided waste material is introduced from one end of an elongated trough provided with a plurality of comminuting rolls for grinding and cutting waste material introduced into the other end of the trough and for conveying the waste material through the trough and into the furnace. The furnace inlet opening is provided with a closure and an air spray device which in the open position of the closure distributes the comminuted waste material throughout the furnace interior while simultaneously providing a substitute closure for the inlet opening. The gaseous products of combustion are conducted from the furnace through a stack into which wash water is introduced for removal of the solids.

8 Claims, 7 Drawing Figures





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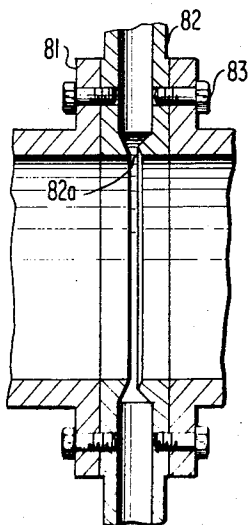
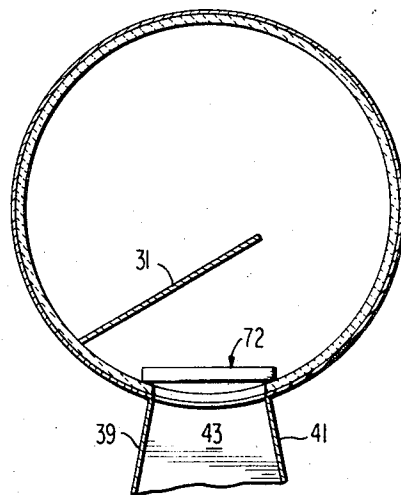
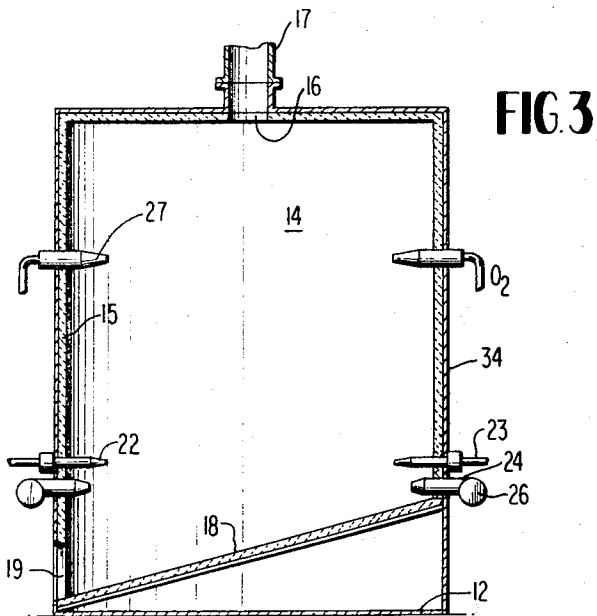
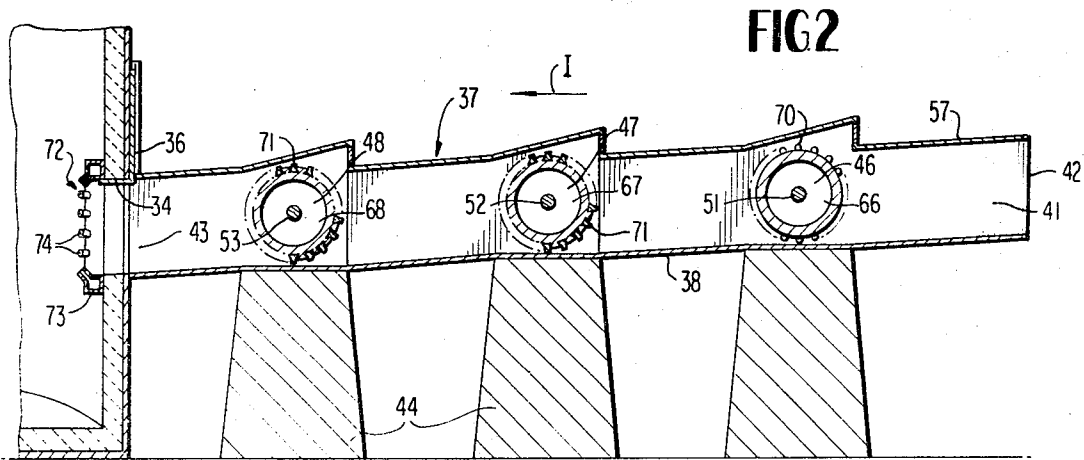


FIG4

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INCINERATOR

This invention relates to an incinerator and more particularly to an incinerator for burning waste material of the type produced in a populated area.

In communities today, in particular urban communities, the problem of disposing of trash, garbage and other waste material has become quite serious as a result of the rapidly increasing population and the relatively inefficient disposal operations in use today. Various types of present day refuse disposal techniques such as incinerators, ocean dumping, land fill operations, etc., are being strained to the utmost due to the exploding population and the costs of installing and enlarging these various facilities are becoming a severe burden on the already overburdened financial load in such communities today. Added to these economic problems is the serious pollution problem to which such facilities are already contributing to a large degree and, as additional facilities are added to accommodate such rapid population increases, there is a commensurate increase in pollution of the atmosphere and of the land which is rapidly approaching the intolerable stage. In addition, the variety of materials which are disposed of as waste by communities is also increasing due to the wide spread use of throw away containers, etc., so that not only is it typical to find both combustible and non-combustible material in a typical refuse collection but the waste material itself is characterized by variety of sizes and shapes seriously taxing the ability of present day waste disposal facilities to effectively perform their intended purpose.

Accordingly, a primary object of this invention is to provide a new and novel incinerator for burning waste material.

Another object of this invention is to provide a new and novel incinerator for burning waste material of the type commonly collected in an urban area in a highly efficient, low cost operation.

A further object of this invention is to provide a new and novel incinerator for burning waste material of virtually any type and size, which is of low initial cost and compact construction and which may be operated at a relatively low cost at a high production rate.

Still another object of this invention is to provide a new and novel incinerator for burning waste material which completely eliminates the introduction of pollutants into both the atmosphere and the land and which permits the ready recovery of the noncombustible portion of the waste material processed therein.

This invention further contemplates a provision of a new and novel incinerator for burning waste material which utilizes a minimum of parts, which is capable of prolonged use without breakdown and with a minimum of maintenance, which may be quickly and easily installed in a minimum of space in any selected location, which is capable of processing such waste material in large quantities and which is capable of serving a community of relatively large size either in a single unit or in multiple installations for serving communities of any size.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings.

The objects stated above and other related objects of this invention are accomplished by the provision of a furnace having an interior and means for introducing

fuel, oxygen and air into the interior for burning waste material under a slight pressure. The side wall of the furnace is provided with an inlet opening connected to the inlet end of an elongated trough having a removable cover and longitudinally spaced, comminuting rolls are provided in the trough for crushing, cutting and conveying waste material introduced into the other end of the trough for subsequent introduction into the furnace interior. A tubular stack having water sprays therein is connected in communication with the furnace interior for removing and washing the gaseous products of combustion so as to remove the solids from the waste gases and means are provided for separating and collecting such solids as well as the noncombustible products of combustion in the furnace so as to completely eliminate any pollution from an operation of the incinerator.

The novel features which are believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation may be best understood by reference to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of an incinerator constructed in accordance of the invention;

FIG. 2 is a sectional view taken substantially along line 2—2 of FIG. 1 in the direction of the arrows;

FIG. 3 is a sectional view taken substantially along line 3—3 of FIG. 1 in the direction of the arrows;

FIG. 4 is an enlarged sectional view taken substantially along line 4—4 of FIG. 1 in the direction of the arrows;

FIG. 5 is a sectional view taken substantially along line 5—5 of FIG. 1 in the direction of the arrows;

FIG. 6 is an enlarged sectional view of a peripheral portion of the crusher roll incorporated in the incinerator of FIG. 1; and

FIG. 7 is a sectional view taken substantially along line 7—7 of FIG. 1 in the direction of the arrows.

Referring now to the drawings and to FIG. 1 in particular there is shown an incinerator constructed in accordance with the invention and designated generally by the letter I. The incinerator I is arranged to be positioned on a suitable supporting surface in a selected location for access to refuse transport means such as garbage trucks, dump vehicles and the like.

Referring now specifically to FIG. 1, the incinerator I includes a furnace designated generally by the letter F preferably circular in cross-sectional shape and including a side wall 11, a bottom wall 12, and a top wall 13 defining an interior 14 as shown best in FIG. 3. The furnace F is provided with a lining 15 of a refractory material of any well known type. The top wall 13 of the furnace F is provided with an opening 16 to which is connected a stack 17 in communication with the interior 14 of the furnace F for removing the gaseous products of combustion during the burning operation. The stack 17 preferably includes arcuate portions 17a and 17b to facilitate the removal of the solid material in the gaseous products of combustion as will be explained hereinafter.

Referring now to FIG. 3, a grate 18 is supported in the furnace interior 14 adjacent the furnace bottom wall 12 for receiving the noncombustible products of

combustion or ash produced during the burning operation of the waste material. An access opening 19 is provided in the furnace side wall 11 adjacent the bottom wall 12 for access to the upper surface of the grate 18 for ash removal. A suitable closure 21, as shown best in FIG. 1, is preferably provided for the access opening 19.

In order to support the combustion of the waste material within the furnace interior 14, means such as fuel nozzles 22 are supported on the furnace side wall 11 for introducing fuel into the furnace interior. The nozzles 22 communicate with a source of fuel supply (not shown) by means such as conduits 23 connected thereto and preferably a plurality of such nozzles 22 are provided which are arranged in circumferentially spaced relationship on the side wall 11 as shown in FIG. 1. In addition, to support combustion, one or more air blowers 24 are supported on the furnace side wall 11 and preferably are of the type having fans 26 for blowing air into the furnace at a relatively high c.f.m. The blowers 24 are also arranged in circumferentially spaced relationship for introduction of combustion air into the furnace interior 14 adjacent the fuel nozzles 22.

Combustion of the waste material may be further supported and the combustion temperature increased by introducing oxygen into the furnace interior 14 from a suitable source (not shown) preferably utilizing a plurality of nozzles 27 also supported in circumferentially spaced relationship on the furnace side wall 11 and communicating with a common conduit 28 connected to a supply source such as bottles, etc.. It should be understood that any type of fuel may be utilized such as natural gas, oil or the like and preferably a slight gauge pressure is maintained within the furnace interior 14 for efficient combustion by means such as a damper 31 positioned in the stack 17 adjacent the outlet opening 16 as shown best in FIGS. 1, 4. Manual means such as an operating lever 32 may be provided for controlling the damper position and, by way of example, it has been found that a gauge pressure of approximately $3\frac{1}{2}$ ounces produces a highly efficient burning operation in the incinerator of the invention.

Referring now to FIGS. 1, 2, in order to introduce waste material into the furnace F, an inlet opening 34 is provided in the furnace side wall 11. A closure 36 is associated with the opening 34 preferably slidable between a closed position and an open position to permit introduction of the waste material into the furnace interior 14. In order to introduce waste material into the furnace interior through the inlet opening 34, an elongated trough, designated generally by the numeral 37, is provided having a bottom wall 38, a pair of side walls 39, 41, an inlet end 42, and an outlet end 43 connected in communication with the furnace inlet opening 34. The trough 37 is preferably somewhat tapered longitudinally from the inlet end 42 to the outlet end 43 and also is preferably positioned in an inclined manner on a plurality of support stands 44 as shown best in FIG. 2.

A plurality of transversely extending, longitudinally spaced, comminuting rolls are disposed in the trough 37 for converting the waste material introduced into the trough inlet end 42 into particulate form and for conducting the waste material from the trough inlet

end 42 into the interior 14 of the furnace F through the furnace inlet opening 34. In the illustrated embodiment, three of such comminuting rolls 46, 47, 48 are provided, roll 46 being a crusher roll and rolls 47, 48 cutting rolls. The rolls 46-48 are provided with shafts 51-53 respectively extending at each end through the trough side walls 39, 41 for rotatably supporting the rolls on suitable upwardly extending portions of the support stands 44.

The rolls 46-48 are driven by suitable individual drive means such as electric motors 54-56 respectively, motor 54 being arranged to drive crusher roll 46 at a relatively slow speed to initially break up the waste material introduced into the trough inlet end 42 and rolls 47, 48 being driven by motors 55, 56 respectively at a relatively high speed to grind or cut up the waste material moving past the roll 46 into very fine, particulate form with roll 48 moving the particulate waste material through the furnace opening 34 at a relatively high velocity. By way of example, it has been found that outstanding results have been accomplished with the invention by driving the crusher roll 46 at a speed of approximately 400 rpm, the cutting roll 47 at a speed of approximately 10,000 rpm and the cutting roll 48 at a speed of approximately 14,000 rpm.

The trough 37 is arranged to be closed by means of a removable top wall 57 having downwardly depending side portions 57a, 57b which overlap the trough side walls 39, 41 in the assembled position. The cover 37 is preferably divided into three portions 37a, 37b, 37c, each associated with one of the rolls 46-48 respectively, and each of the portions 37a-37c including inclined deflector portions 61 for forwardly deflecting the waste material processed in the associated roll. Openings 62 in each of the portions 37a-37c are also provided which permit the operator to view the waste material as it moves between the rolls.

Each of the rolls 46-48 include cylindrical body members 66-68 respectively. As shown best in FIG. 6, the peripheral surface of the body member 66 of roll 46 is provided with a plurality of circumferentially spaced, longitudinally extending dovetail slots 69 for slidably accommodating upstanding lugs 70 with suitable spaces therebetween. The lugs 70 are arranged in a plurality of circumferentially spaced rows, the lugs in each row being maintained in longitudinally spaced relationship by suitable spacers and fixed in position by means such as set screws 72. The peripheral surfaces of the body members 67, 68 of rolls 47, 48 respectively are similarly provided with longitudinally extending, dovetail slots for accommodating longitudinally extending cutter blades 71 arranged in circumferentially spaced relationship as shown in FIGS. 1, 2. Air spray means, designated generally by the numeral 72, are suitably positioned on the furnace side wall 11 and are preferably operatively associated with the movable closure 36. As shown best in FIG. 2, the air spray means, which may be a tubular member 73 of rectangular configuration provided with a plurality of ports 74, is preferably supported in underlying, planar relationship on the closure 36 and is connected to a suitable source of air pressure (not shown). Thus, the air spray means 72 is movable between an inoperative position in the closed position of the closure 36 and into an operative position when the closure 36 is moved into the open

position so as to direct a substantially circular, preferably conical, pattern of air into the interior of the furnace 14 through the inlet opening 34 distributing the comminuted waste material flowing therethrough throughout the furnace interior 14 and acting to at least partially seal the opening 34.

Means are provided for introducing a spray of water into the stack 17 for washing solids from the gaseous combustion products flowing in the stack. More specifically, as shown best in FIGS. 1, 7, the stack 17 is divided into a plurality of sections having ends provided with flanges 81 as shown best in FIG. 7. An annular water spray unit 82 is positioned between the adjacent ends of the stack sections and assembled thereto by means such as bolts 83. The water spray units 82 are provided with an annular slot 82a and water supplied to the interior of the spray units 82 by suitable conduit means 83 is introduced into the interior of the stack 17 in the form of a circular spray for washing the gaseous combustion products flowing within the stack 17.

Means are provided for conducting the wash water from the stack which, in the illustrated embodiment, include a separation tank 84 as shown best in FIG. 5 having an interior 86 in which is positioned an overflow partition 87. Suitable discharge conduits 88 are connected at one end to the stack 17 as shown in FIG. 1 and at the other end to a conduit 89 extending through the upper wall of tank 84 into the tank interior 86, one side of the partition 87 thereby providing a settling portion 91 for separation of solids from the clear water and subsequent removal through a suitable drain 92. The clear water in the settling portion 91 flows over the upper edge of the partition 87 into a clear water tank portion 93 for subsequent removal through a conduit 94 by a suitable pump preferably for use in the spray rings 82 through conduits 83. A suitable float control unit 96 is associated with the clear water tank portion 93 as shown in FIG. 5 and make-up water may be added to the tank clear water portion 93 through a suitable connection 97.

In the operation of the incinerator of the invention, waste material, which may be carried in transport means such as trucks or the like, is dumped into the open end 42 of the trough 37 and, as the trough is slightly inclined, the waste material moves into the crusher roll 46 for cutting or crushing of the waste material into relatively large particles. The rotation of crusher roll 46 moves the crushed material in the direction of the arrow I into the high speed cutting roll 47 where the waste material is cut into relatively fine pieces and advanced at considerable speed into the cutting roll 48. The cutting roll 48 completes the cutting operation on the waste material and, as it is rotating at an even higher speed than the cutting roll 47, the comminuted waste material is injected through the outlet end 43 of the trough 37 through the furnace inlet opening 34, the door 36 being positioned in the open position of FIG. 2. The air spray unit 72, which has been activated by the movement of the door 36 to the open position, distributes the finely divided waste material throughout the interior of the furnace wherein it is burned utilizing fuel from the nozzle 22. As explained above, combustion of the waste material is aided by the blowers 26 as well as by the injection of oxygen, where necessary, through the oxygen jets 27.

The gaseous products of combustion flow upwardly through the stack 17 to be washed by water conducted from the tank clear water portion 93 and sprayed into the stack through the water spray units 82. As previously explained, a slight gauge pressure is maintained within the furnace interior to aid combustion by selectively positioning the damper 31. The solids removed by the combustion gases flowing in the stack 17 are carried by the wash water through the discharge conduits 88 and into the tank settling portion 91 where the solids settle out of the wash water for subsequent removal through the drain 92.

While there has been described what at present is considered to be the preferred embodiment of the invention, it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the invention.

Having thus described the invention, what is claimed is:

1. An incinerator comprising, in combination, a furnace having a side wall, a top wall and a bottom wall defining an interior for accommodating waste material to be burned, means for introducing fuel into said furnace interior, a tubular stack connected to said furnace top wall in communication with said furnace interior for removing gaseous combustion products from said furnace interior, means for introducing a spray of water into said stack for washing solids from said gaseous combustion products flowing in said stack, means for conducting said wash water from said stack, an access opening in said furnace side wall adjacent said furnace bottom wall for removal of ashes from said furnace interior, an inlet opening in said furnace side wall intermediate said furnace top and bottom walls for introduction of said waste material to be burned into said furnace interior, an elongated trough having a top wall, a bottom wall, a pair of side walls, an inlet end and an outlet end connected in communication with said furnace inlet opening, a plurality of transversely extending, longitudinally spaced comminuting rolls disposed in said trough for converting said waste material introduced into said trough inlet end into particulate form and for conducting waste material from said trough inlet end into the interior of said furnace through said furnace inlet opening, means associated with each of said rolls for rotating the associated roll at a selected speed, a closure for said furnace inlet opening movable between a closed position and an open position to permit the introduction of said waste material into said furnace interior.

2. An incinerator in accordance with claim 1 including air spray means operatively associated with said closure movable between an inoperative position in the closed position of said closure and an operative position in the open position of said closure to direct a spray of air into said furnace interior throughout the marginal edges of said inlet opening for distribution of said particulate waste material throughout said furnace interior and to provide an air seal for said inlet opening in the open position of said closure.

3. An incinerator in accordance with claim 1 including a separation tank having an interior for separating the solids from the water in said wash water, a partition in said tank interior having an upper edge and defining with the walls of said tank a settling portion and a clear

water portion, means for communicating said wash water conducting means with the settling portion of said tank, means on said tank for removing the solids from said tank settling portion and means for removing the water from said tank clear water portion and means for controlling the level of said clear water in said clear water tank portion.

4. An incinerator in accordance with claim 1 wherein said comminuting rolls include a crusher roll disposed adjacent said trough inlet end, said crusher roll including a cylindrical body and a plurality of circumferentially spaced rows of radially projecting lugs on the peripheral surface of said cylindrical body, said lugs in each of said rows being positioned in longitudinally spaced relationship for performing a crushing operation on said waste material and for conveying said waste material to the adjacent comminuting roll in said trough.

5. An incinerator in accordance with claim 4 wherein said comminuting rolls including a pair of cutter rolls each having a cylindrical body and a plurality of circumferentially spaced, longitudinally extending, radially projecting blades on the peripheral surface of said

cylindrical body for performing a comminuting operation on the waste material conveyed by said crusher roll and for conveying said comminuted waste material through said inlet opening into the interior of said furnace at a high velocity.

6. An incinerator in accordance with claim 5 including means supported on said furnace side wall for introducing air at a high velocity into said furnace interior during combustion of said waste material and means supported on said furnace side wall for introducing oxygen into said furnace interior during combustion of said waste material.

7. An incinerator in accordance with claim 5 including damper means in said stack for limiting the flow of said gaseous combustion products in said stack to control the pressure in the interior of said furnace.

8. An incinerator in accordance with claim 5 wherein said top wall is removably positioned on said trough, said top wall being formed in a plurality of sections, each of said trough sections being operatively associated with one of said comminuting rolls.

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