

[54] REFUSE BURNER APPARATUS
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[22] Filed: May 30, 1973
[21] Appl. No.: 364,021

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 339,336, March 8, 1973, abandoned.
[52] U.S. Cl. 110/8 C, 110/18 C, 110/49 R
[51] Int. Cl. F23g 5/12
[58] Field of Search 110/7 R, 8 R, 8 A, 8 C, 110/18 R, 18 C, 49 R

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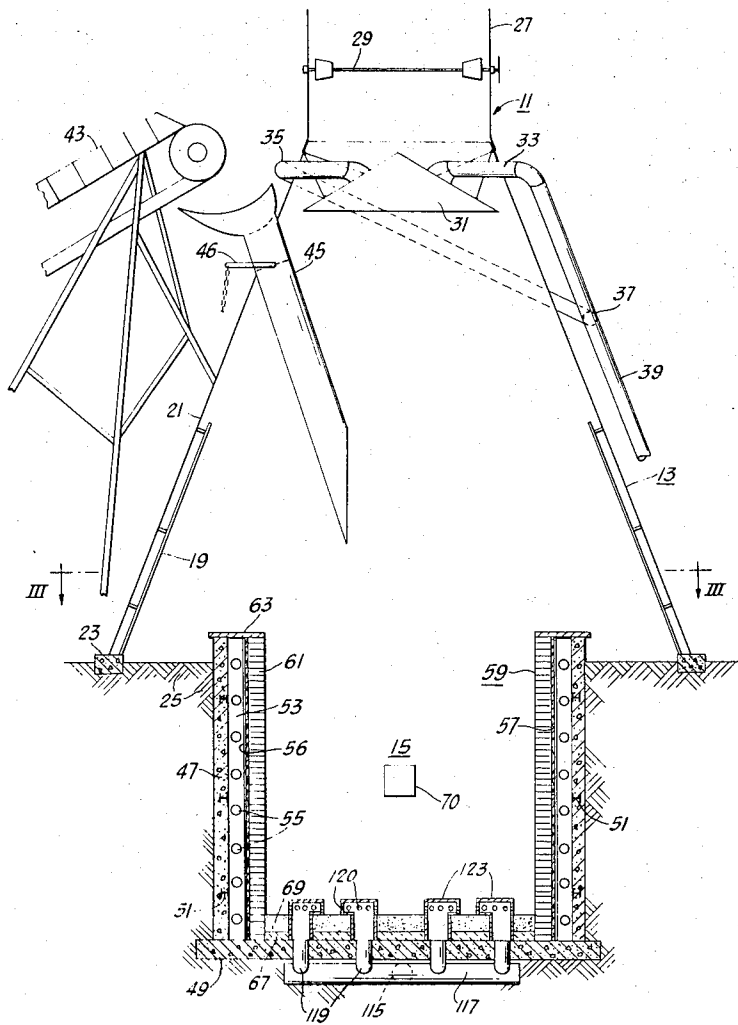
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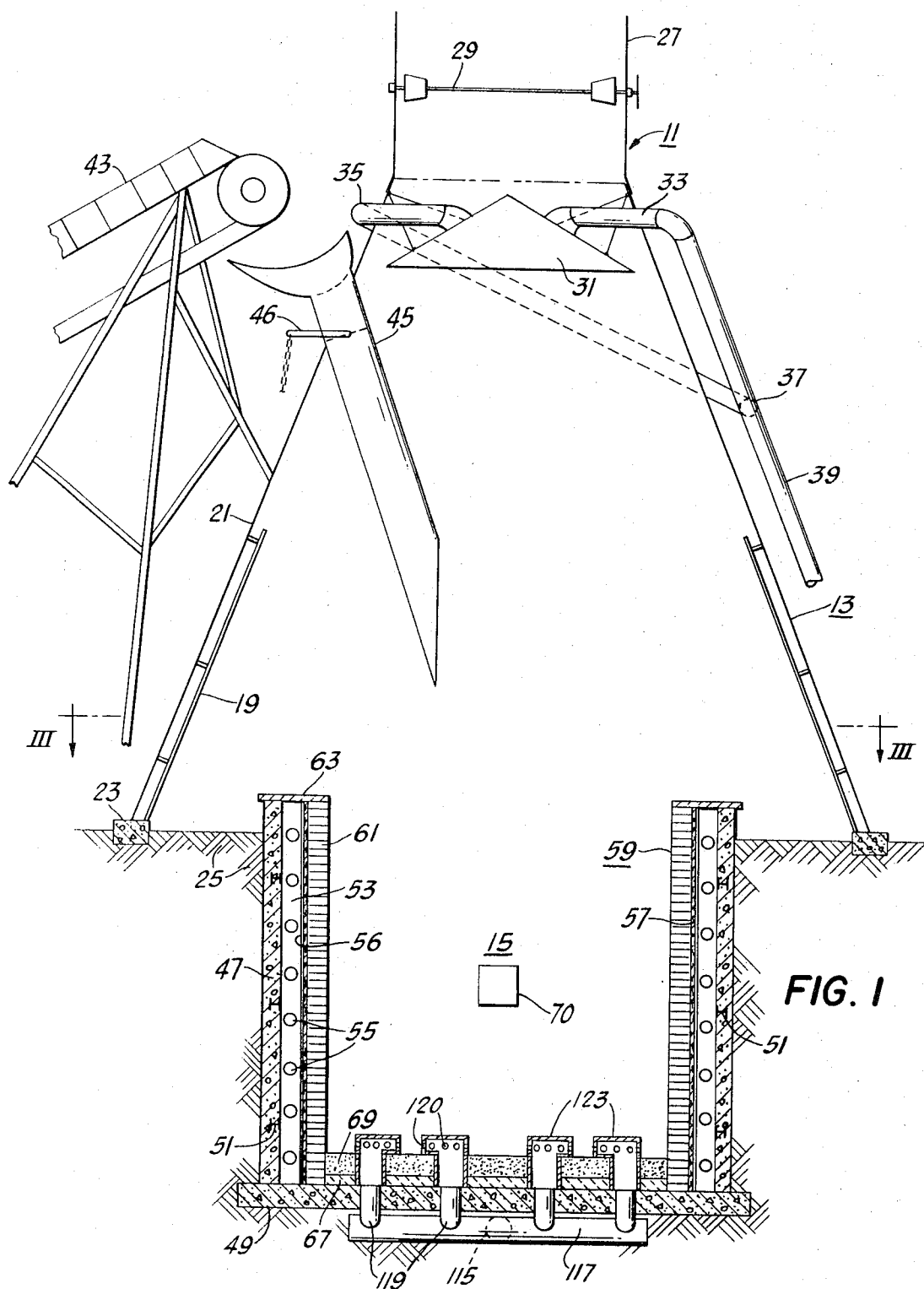
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ABSTRACT

A frusto-conical metal shell is disposed over a subterranean open-topped chamber having walls that are fluid cooled and that are lined with refractory. Means is provided for initial forced air burning and for forced recirculating effluent, recovered at the top of the metal shell, that is generated by material burning in the apparatus.

8 Claims, 5 Drawing Figures





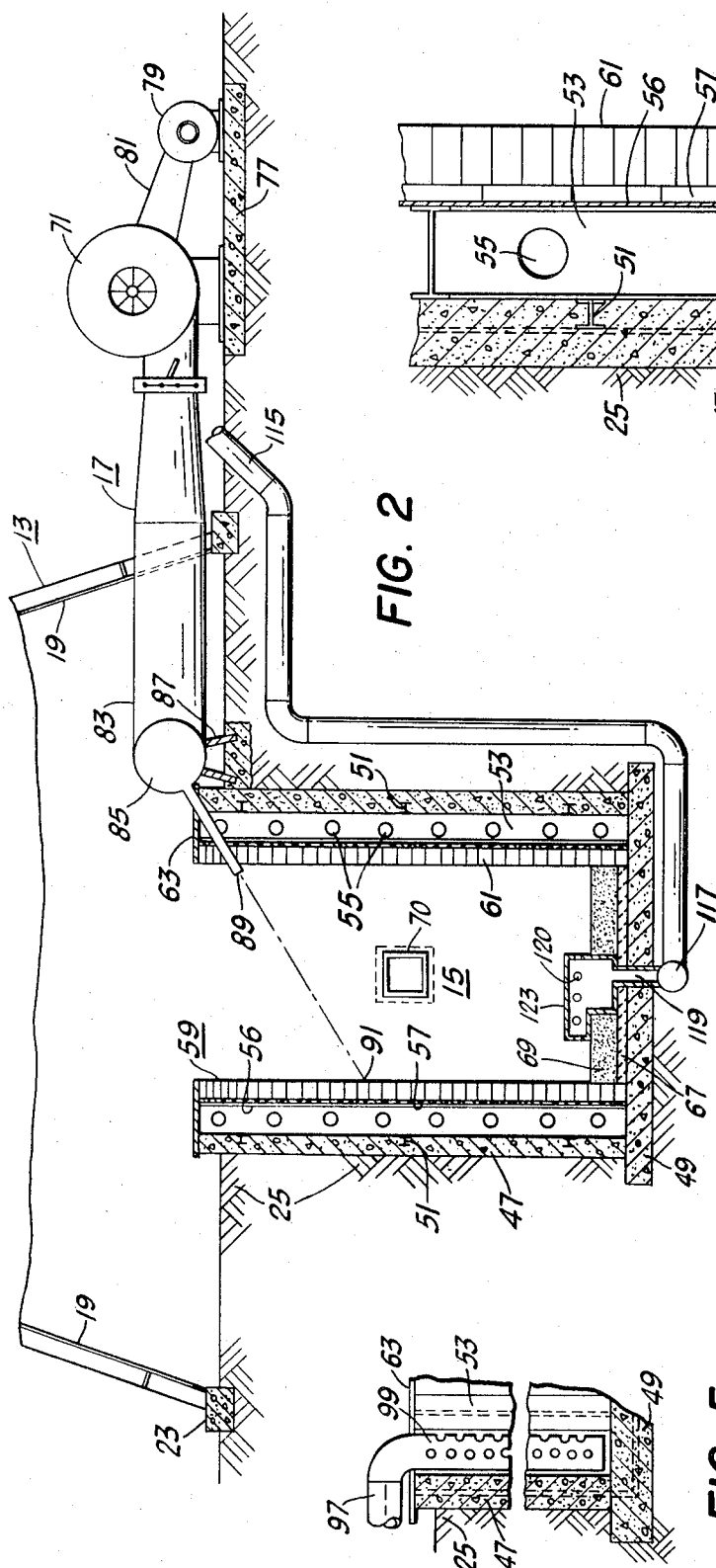


FIG. 2

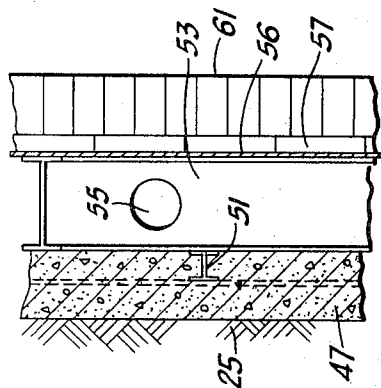


FIG. 4

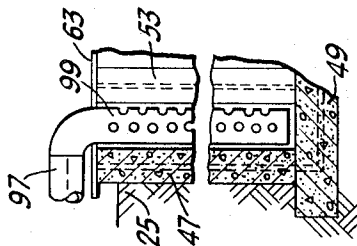
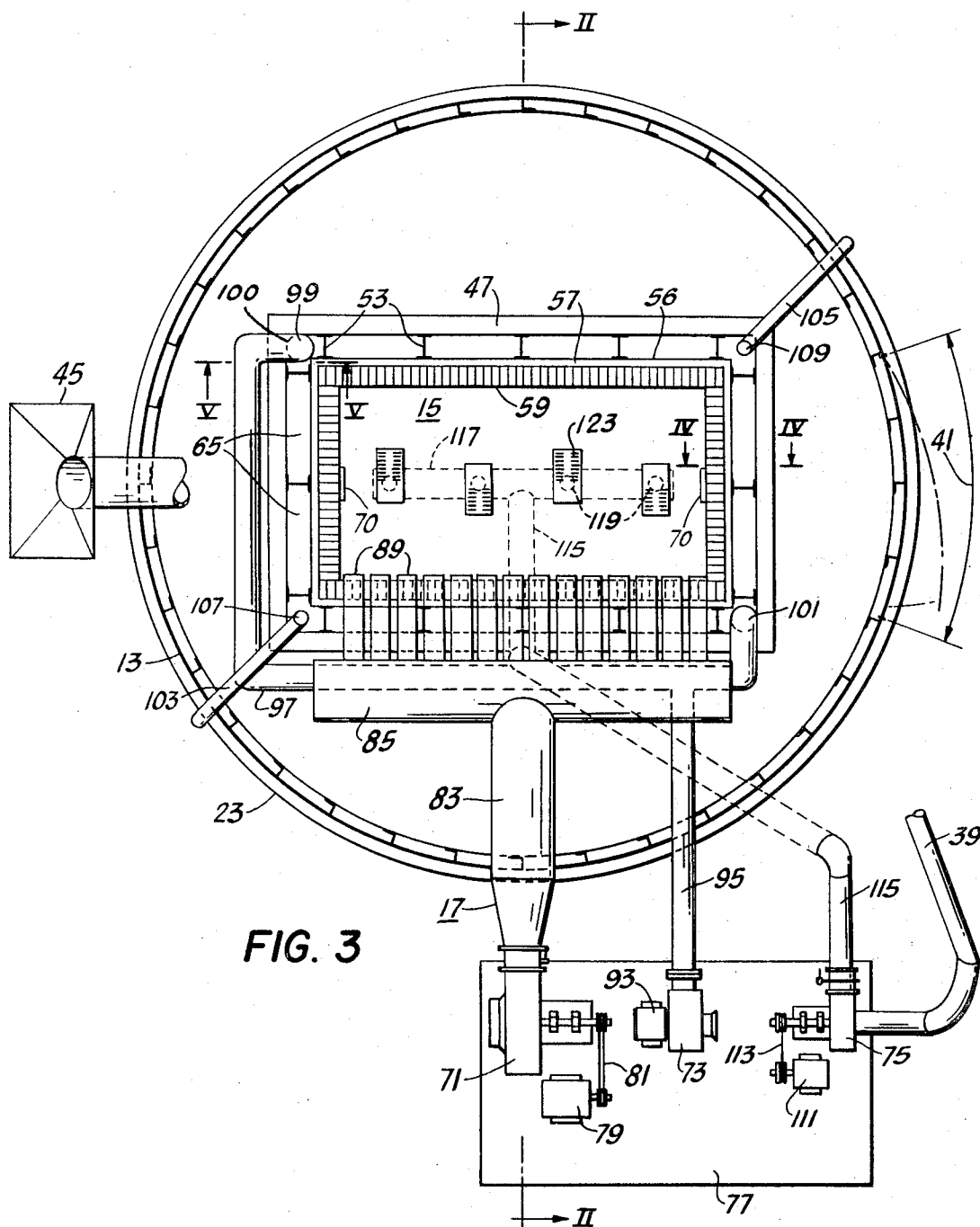


FIG. 5



REFUSE BURNER APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 339,336, filed Mar. 8, 1973 now abandoned.

BRIEF SUMMARY OF THE INVENTION

A refuse burner, in accordance with the invention, includes a subterranean, open-topped pit or chamber, having fluid-cooled walls, that is covered and surrounded by a frusto-conical shell. Initially, forced burning is provided and the effluent from burning material in the chamber is collected at the top of the shell and is reintroduced into the chamber through grates in the bottom of the chamber. Cooling of the walls of the chamber is accomplished by injecting fluid under pressure into a space between an outerwall portion, contiguous with the ground, and an inner wall lined with refractory material.

For a further understanding of the invention and for features and advantages thereof, reference may be made to the following description and the drawing which illustrates a preferred embodiment of equipment in accordance with the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a schematic sectional elevational view of one embodiment of a refuse burner in accordance with the invention;

FIG. 2 is a view along line II—II of FIG. 3;

FIG. 3 is a view along line III—III of FIG. 1;

FIG. 4 is a view along line IV—IV of FIG. 3; and

FIG. 5 is a view along line V—V of FIG. 3

DETAILED DESCRIPTION

Referring to FIG. 1, a refuse burner 11, in accordance with one embodiment of the invention, comprises a frusto-conical collection shell 13; a subterranean pit or burning chamber 15; and a combustion system 17.

The frusto-conical shell 13 includes an angle iron or structural steel skeleton frame 19, that is covered, preferably, with aluminized steel plating 21. The frame 19 may be made of any other structural members, if preferred, and both the frame 19 and the plating 21 are supported upon a circular concrete footing 23 disposed at ground level 25, as suggested in FIG. 1.

The top of the shell 13 is capped by a cylindrical-shaped tubular member 27 in which there is a conventional type of damper 29. The damper 29 may be of the vane or the shutter type, and it may be controlled by a conventional device (not shown) that acts responsively to the temperature of the effluent from the burning waste products in the chamber 15, or it may be operated manually, as preferred.

Adjacent the top opening in the shell 13 is a conical collector 31 which is supported in position just below the open top of the shell 13. The collector 31 is provided with two tubular conduits 33, 35 that pierce the shell 13 about as shown in FIG. 1, and that join at a point 37, located outside of the shell; they become thereafter a single downwardly directed conduit 39.

The shell 13 is provided with an access opening and door 41, located about where shown in FIG. 3, which affords entry to the interior of the shell 13 for a purpose that will be described hereinafter.

Outside of the shell 13 there is a conventional endless belt or other type of conveyor 43 that discharges waste wood products, or other consumable waste material, into a chute 45 disposed through the shell 13. The chute 45 is provided with a variable damper and actuator 46, and is so placed that the waste wood products and the like material gravitate into the pit or chamber 15.

The pit or burning chamber 15 is substantially entirely subterranean except for a small portion that is disposed above ground level 25 to prevent surface water from entering the pit. The pit or burning chamber 15 is generally rectangular in shape and is constructed preferably in the following manner. Contiguous with the ground 25 is a vertical, reinforced concrete wall 47 which is supported upon a reinforced concrete base or slab 49. The concrete wall 47 has imbedded therein a plurality of horizontally arranged structural I-beams or H-beams 51; though other structural shapes may be used if preferred.

Standing vertically on the concrete slab 49, and abutting the concrete wall 47, are a plurality of spaced apart I-beams 53, that also contact the horizontal I-beams 51. The vertical I-beams 53 have a plurality of holes 55 in their webs to provide fluid passageways therethrough.

The inner flanges of the vertical I-beams 53 are suitably fastened to vertical plating 56 which is connected and supports a layer of insulation 57, that may be mineral wool or any suitable type of insulation. The inside wall 59 of the pit or burning chamber 15 is formed of refractory bricks 61, and the wall 59 is capped at the top with a suitable steel plate 63, or in any other suitable manner. Thus, between the vertical I-beams and the concrete wall 47 and the insulation 57, there is an air or fluid flow space 65 around the entire pit or burning chamber 15.

At the bottom of the pit or burning chamber 15, there is a horizontal layer of castable refractory material 67, over which there is disposed loose, particulate, floor material, such as a layer of sand 69.

Associated with the apparatus 11 is the combustion system 17, which includes a pair of burners 70 in opposite end walls of the pit or burning chamber 15; an over-fire air fan 71; a cooling air fan 73; and a fly ash reinjection fan 75; most of which are mounted on a suitable slab or base 77 located just outside of the shell 13 and convenient to the pit or chamber 15, as shown in FIG. 3.

The burners 70 are inserted into the end walls about where shown in FIGS. 1, 2, and 3, and each burner 70 is operated by burning a suitable fuel such as oil or gas. In a preferred embodiment of the invention an eclipse 128NM burner as manufactured and marketed by Eclipse Fuel Engineering Co., Combustion Division, Rockford, Illinois 61101 is used for the purpose disclosed hereinafter.

The over-fire air fan 71 is of the centrifugal type that is driven conventionally by motor 79 and belts 81, and the fan discharge is connected to a conduit 83 that connects to a horizontal header 85 located along one side of the chamber 15. The header 85 is supported upon a suitable footing 87, such as that shown in FIG. 2. Pro-

jecting outwardly and downwardly from the header 85 are a plurality of rectangular injector tubes or nozzles 89. The nozzles 89 are so disposed that air jets from the nozzles impinge upon the opposite wall 59 of the pit 15 along a line 91, about where shown in FIG. 2.

The cooling air fan 73 is of the centrifugal type, being motor driven at 93, and the discharge of the fan 73 connects to a horizontal conduit 95. The conduit 95 joins a header 97 that connects to two vertical terminal pipes 99, that are perforated, as shown in FIG. 5. The two pipes 99 are located in the space 65 and at diagonally opposite corners 100, 101 of the chamber 15. The pipes 99 terminate near the bottom of the air space 65, as shown. The cooling air is under some pressure as it leaves the fan so that the cooling air is forced through the holes 55 in webs of the I-beams 53 and throughout the space 65. The air is conducted therefrom by two conduits 103, 105 that are located at the other two diagonally opposite corners 107, 109 of the chamber 15. The conduits 103, 105 receive the air near the top of the space 65 and discharge it to atmosphere near ground level outside of the shell 13, as shown in FIG. 3.

The fly ash reinjection fan 75 is also of the conventional centrifugal type, which is motor and belt driven, as at 111, 113. The fan inlet is connected to conduit 39 (FIG. 1) and the fan discharge connects to a conduit 115.

The conduit 115, as will be seen from FIG. 2, is mostly below ground level, connecting to a subterranean header 117 which has a plurality, four being shown, of vertical risers 119.

Each riser 119 connects to a grate box 121, having perforated side walls as at 120, in the portion thereof extending above the level of the sand floor 69, with a grate 123 on top of the grate box. The grate box 121 and grate itself 123 may be made of cast iron, malleable iron, or of any other suitable material, as preferred.

In operation, a quantity of wood and paper are placed on the sand floor of the pit or burning chamber and they are ignited in a conventional manner. It is desirable, especially during the initial start-up of the apparatus, to ignite the end wall burners 70. The heat from these burners quickly raises the temperature of the ambient within the chamber and burns the effluent created initially.

The damper at the top of the shell is closed initially and the fly ash reinjection system is activated to circulate the effluent within the burning chamber. The air and effluent that are recirculated exit through the grates and also through the perforation in the side walls of the grate boxes. The effluent does not escape to atmosphere during the initial warm-up period.

The apparatus is quickly brought up to a working temperature. Of course, additional waste wood products and other combustible material are introduced into the pit or burning chamber, from time to time, through the chute 45 or through the side wall opening in the shell.

When the chamber is at the working temperature and the walls have become heated, the cooling air fan is turned on to circulate cooling fluid in the space 65 between the inner and outer walls. The cooling fluid maintains the walls of the pit or chamber relatively cool, and during the burning process, waste wood and other combustible material are introduced, more or less continually, into the chamber through the chute. In

some instances a vehicle, carrying such combustible material, may be admitted to the shell, through the opening therein, in order to dump its load into the chamber.

From time to time, or whenever it is deemed necessary or desirable, mobile equipment, such as a backhoe or other similar apparatus, may be admitted to the shell through the opening for the purpose of removing ash residue from the chamber. Such apparatus can easily approach close enough to the edge of the chamber to quickly and effectively remove the ash residue.

Those skilled in the art will recognize that when the walls of the chamber have reached a desired temperature, the fan, which connects to the nozzles within the chamber, is operated. Air jetting from such nozzles creates a curtain over the burning material and, together with the fly ash recirculating system, develops very high temperatures within the chamber. The temperature, about 2000°F, is well above that generally regarded as desirable, which is around 800°F, to obtain complete and effective burning of waste material and the effluent produced.

From the foregoing description of one embodiment of the invention, those skilled in the art should recognize many important features and advantages of it, among which the following are particularly significant:

Very high combustion temperatures, as high as about 2000°F, are obtained in the combustion zone of the chamber of the apparatus of the invention. Since a temperature of only about 800°F will produce clean burning of waste wood products, it is readily apparent that, at the high temperature achieved in the apparatus of the invention, no smoke or effluent escapes to the atmosphere.

Initially the burners in the end walls are ignited to burn the effluent that is created before the working temperature of the apparatus is achieved;

Because the temperature in the subterranean chamber may be as high as 2000°F, the refractory-lined walls, with insulating space in which pressurized air circulates, can better withstand such a high temperature than the thin shell portion above ground;

Because the distance between the combustion zone in the chamber and the collection cone in the present apparatus is greater than that of burner apparatus known from the prior art, the fly ash cools down somewhat, and the upward, thermally-generated velocity of the fly ash in the present apparatus is much lower than that developed in prior art burner apparatus. These advantages result in less wearing of the conduits of the present fly ash reinjection system;

That batch feeding of waste wood products and other consumable material into the chamber is readily afforded, since there is a large access door and opening in the shell of the apparatus;

That ash removal from the chamber can also be readily accomplished, since mobile ash removal equipment is easily moved into and out of the shell through the access door and opening;

Since almost the entire burning chamber is below ground level, a uniform temperature profile down the walls of the chamber is effected, and no thermal shocks are set up from water or wind, and the like, or from any water seepage below ground level.

Flooding of the burning chamber is prevented, since it is protected by the above-ground shell;

The structural characteristics of the burning chamber, particularly the fluid-cooled walls and the sand floor, promote long life in service with very little maintenance time or expense; and

The sand floor in the chamber absorbs high-impact loads from batch feeding of large items such as pole cut-offs, stumps, scrap wood, and the like; the sand floor also is an effective insulating medium to prevent spalling of the concrete base.

Although the invention has been described herein with a certain degree of particularity, it is understood that the present disclosure has been made only as an example, and that the scope of the invention is defined by what is hereinafter claimed.

What is claimed is:

1. A burner comprising:

- a. a shell disposed above and surrounding;
- b. a subterranean chamber for burning material therein having an open top;
- c. means at the top of said shell for regulating the emission therefrom of effluent produced by said burning material;
- d. means adjacent the top of said shell for collecting said effluent, and conduit means for carrying it thence;
- e. said conduit means communicating with a fan that is motorized and discharges said effluent into
- f. a second conduit means in communication with said chamber whereby said effluent is reintroduced thereinto;
- g. said chamber having side walls that are fluid cooled and a bottom or floor of sand;
- h. means for introducing and for removing fluid from said side walls;
- i. means for introducing burnable material into said chamber;
- j. means for removing ash residue from said chamber; and
- k. burner means discharging heat into said chamber

for raising the ambient therein.

2. The invention of claim 1 wherein:

- a. said walls are insulated and have an air space in which air flows to cool said walls.

3. The invention of claim 1 wherein:

- a. said means for introducing and removing said fluid includes powered apparatus and conduit means for conducting said fluid under pressure and conduit means for removing fluid from said walls.

4. The invention of claim 1 wherein:

- a. said second conduit means includes grate means in the bottom or floor of said chamber.

5. The invention of claim 1 wherein:

- a. said walls of said chamber are lined with refractory material.

6. The invention of claim 1 including:

- a. a plurality of over-fire jets for directing air at an angle against one of said walls and above the burning material in said chamber.

7. The invention of claim 4 wherein:

- a. said grate means is supported by a grate box having perforated side walls in the portion thereof above the floor level in said chamber.

8. A burner comprising:

- a. a subterranean chamber having an open top and hollow-space side walls comprised of an inner refractory wall portion and an outer wall portion with structure connecting the inner and outer wall portions and with a layer of insulating material between said structure and said refractory wall portion;
- b. a sand floor within said chamber;
- c. means surrounding said chamber and extending above ground for receiving effluent emitted by material burning in said chamber;
- d. means for circulating cooling fluid in the space between said wall portions;
- e. a burner discharging heat within said chamber.

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