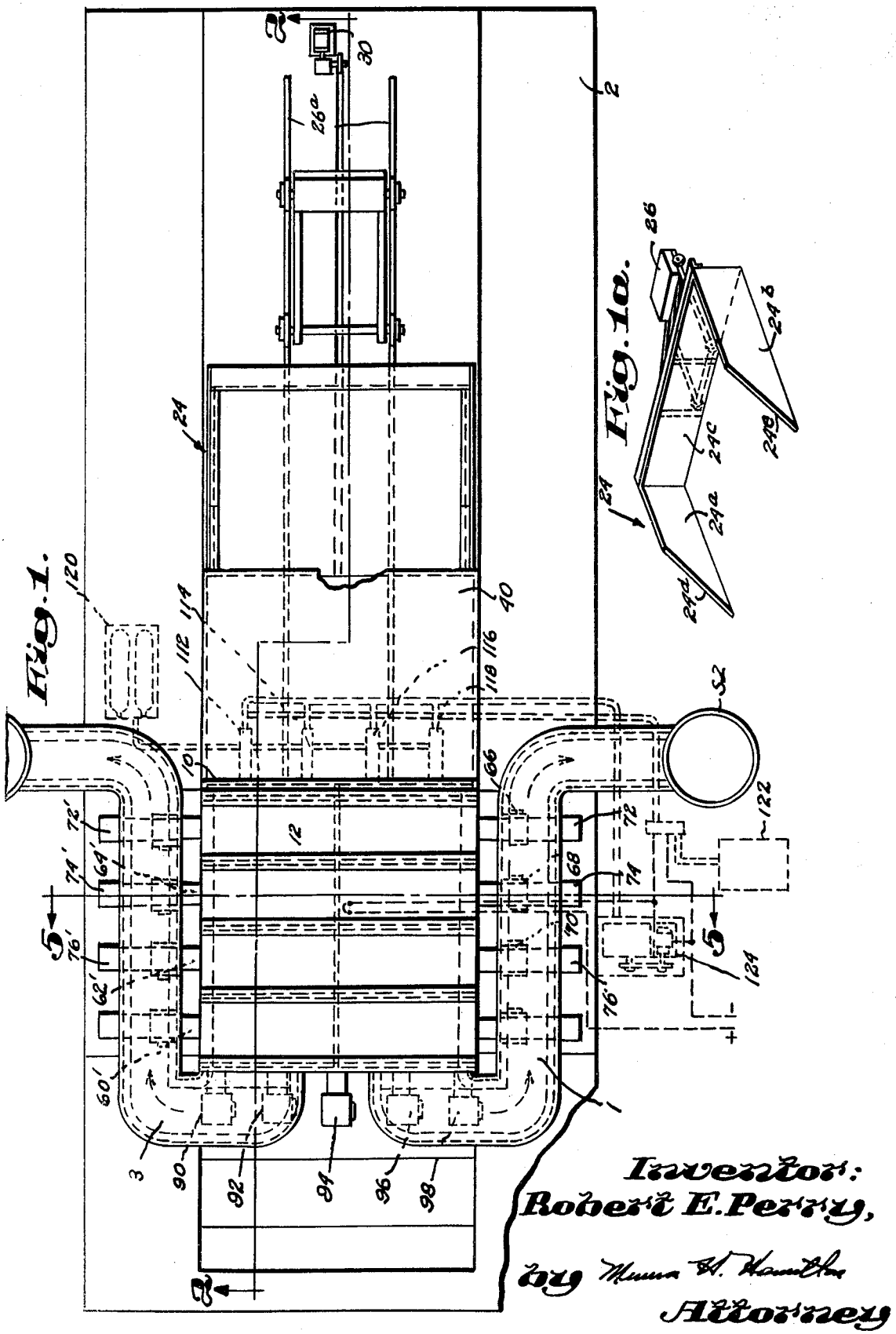
May 5, 1970 R. E. PERRY 3,509,836

METHOD AND APPARATUS FOR BURNING WASTE MATERIALS

Filed May 14, 1968 6 Sheets-Sheet 1



May 5, 1970 R. E. PERRY 3,509,836

METHOD AND APPARATUS FOR BURNING WASTE MATERIALS

Filed May 14, 1968 6 Sheets-Sheet 2

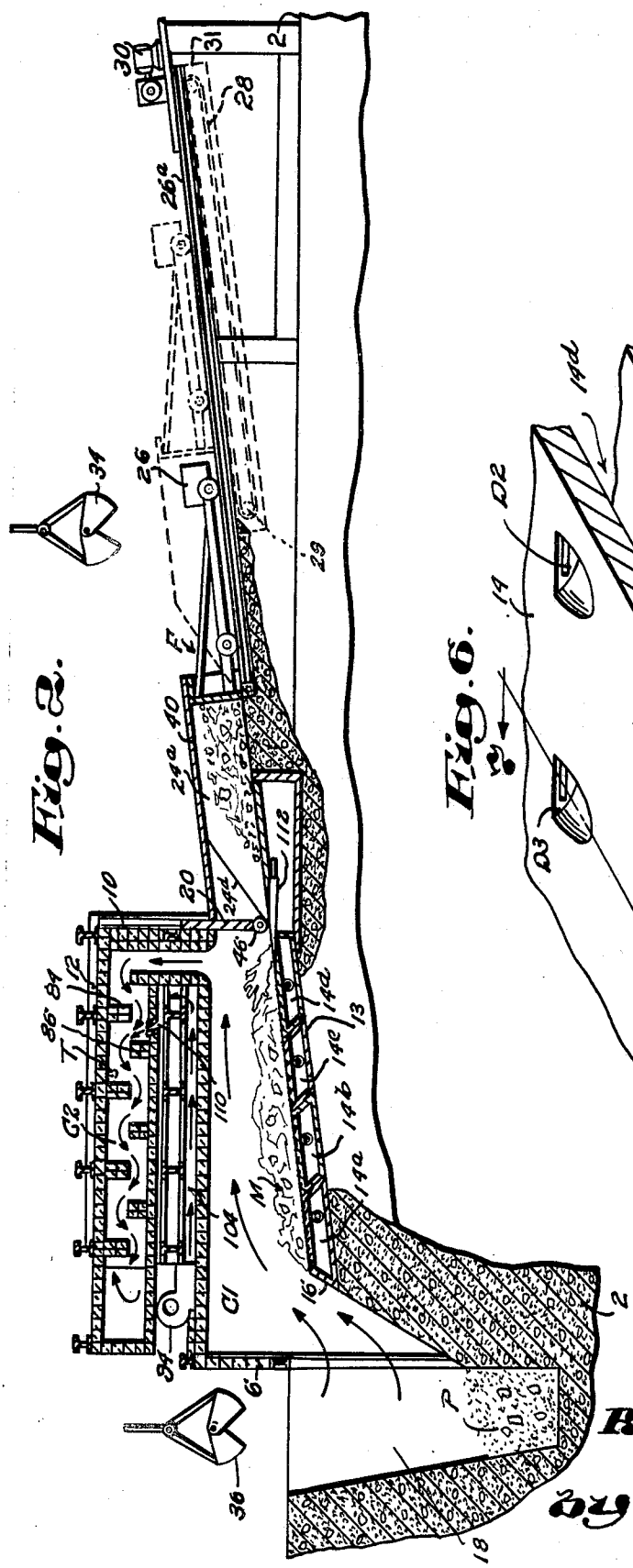


Fig. 2.

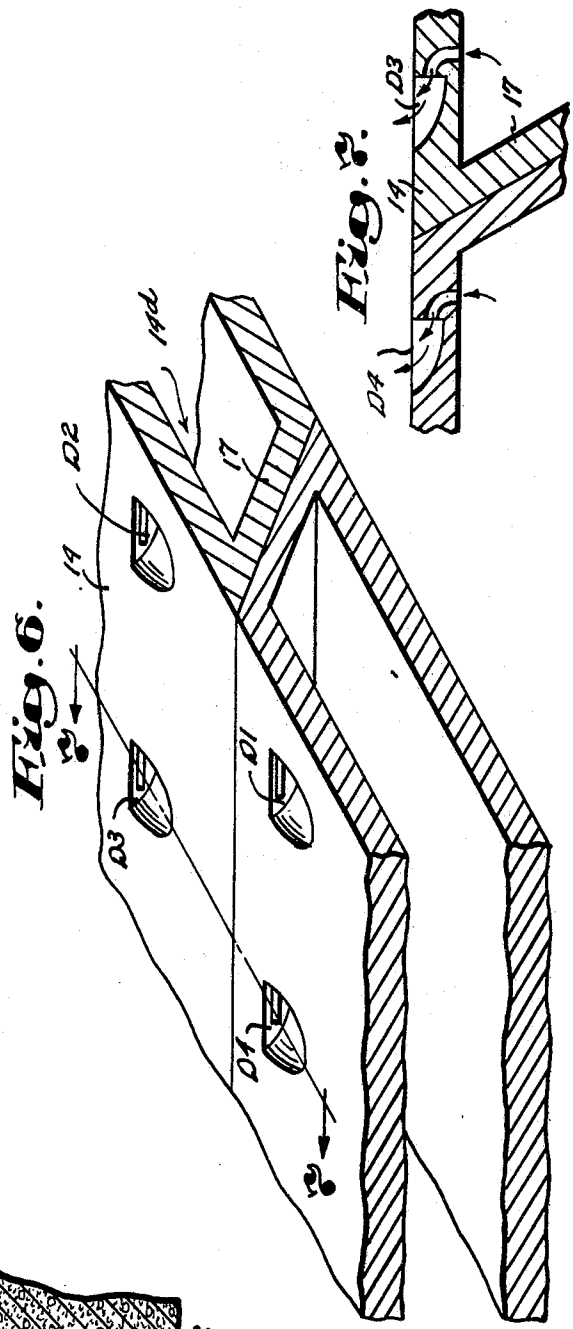


Fig. 6.

Fig. 5.

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May 5, 1970 R. E. PERRY 3,509,836

METHOD AND APPARATUS FOR BURNING WASTE MATERIALS

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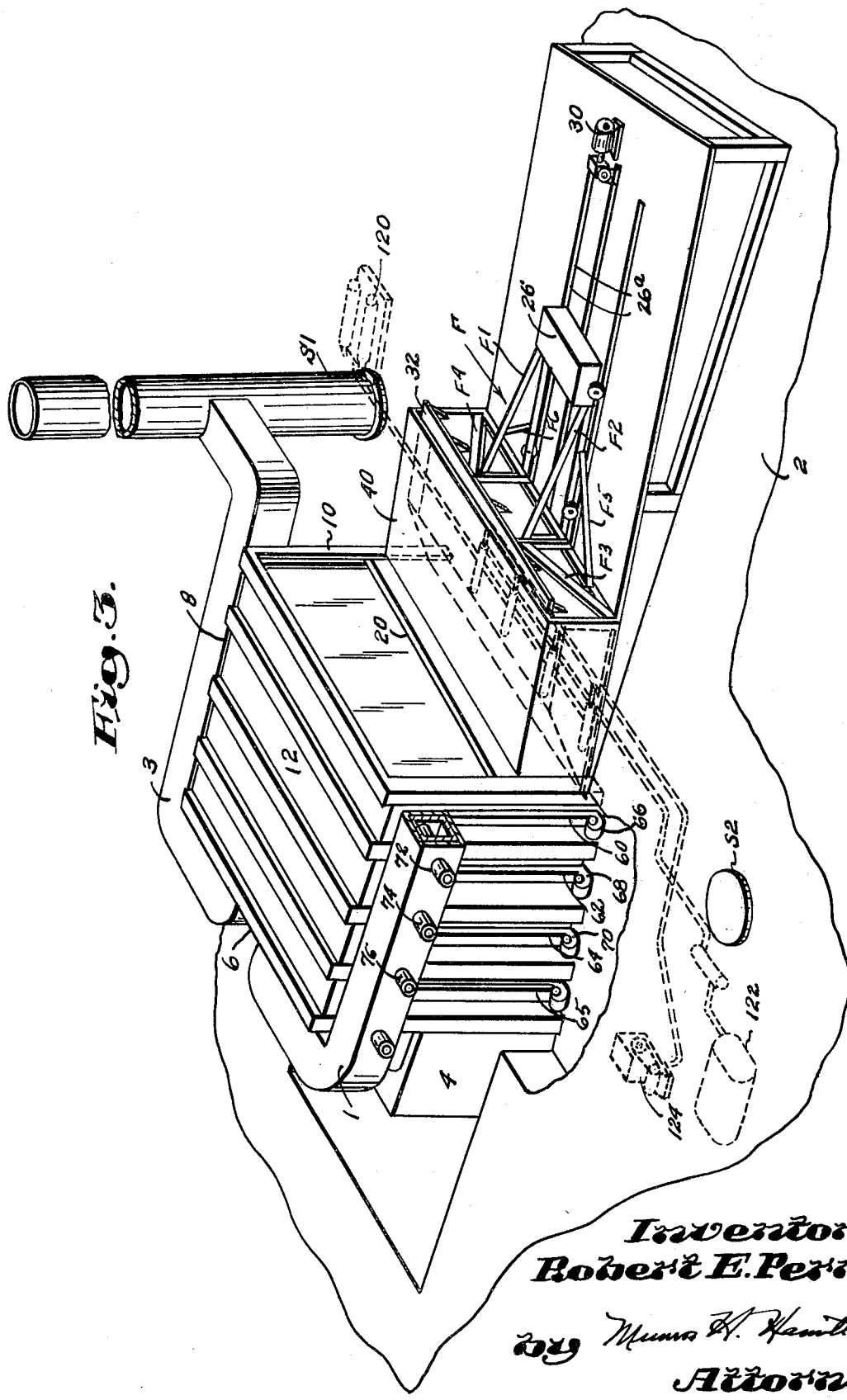


Fig. 5.

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METHOD AND APPARATUS FOR BURNING WASTE MATERIALS

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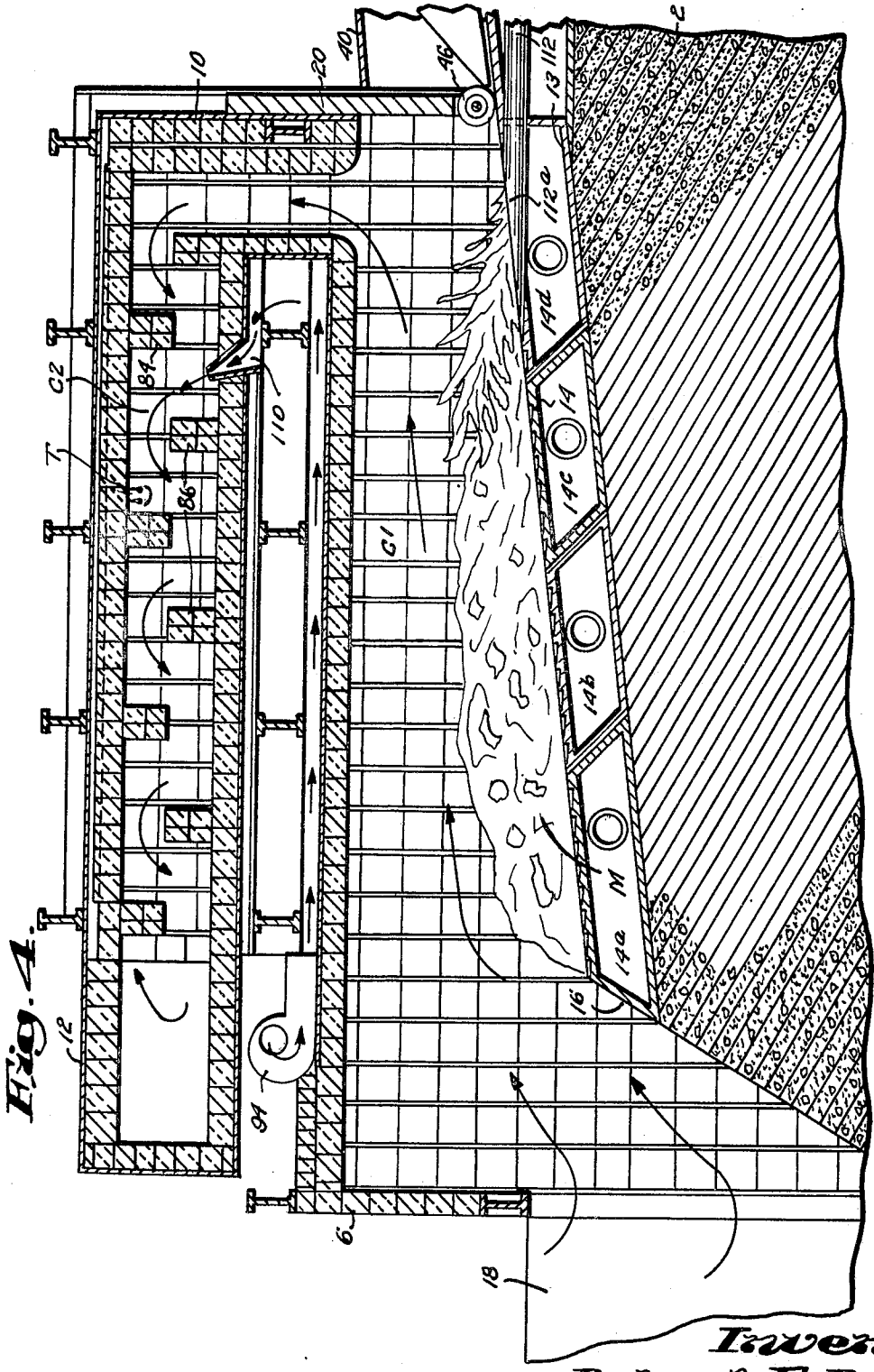


Fig. 4.

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METHOD AND APPARATUS FOR BURNING WASTE MATERIALS

Filed May 14, 1968 6 Sheets-Sheet 5

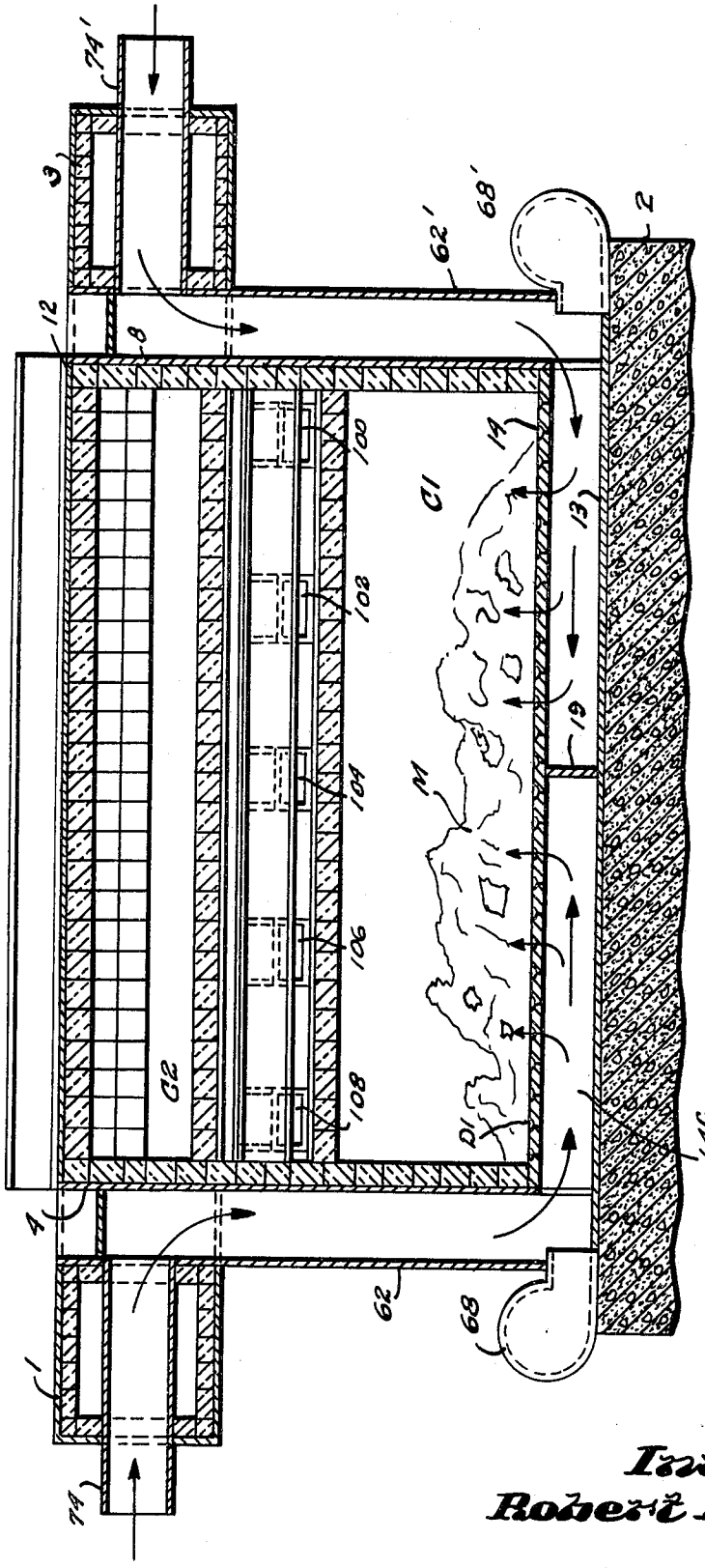


Fig. 5.

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METHOD AND APPARATUS FOR BURNING WASTE MATERIALS

Filed May 14, 1968 6 Sheets-Sheet 6

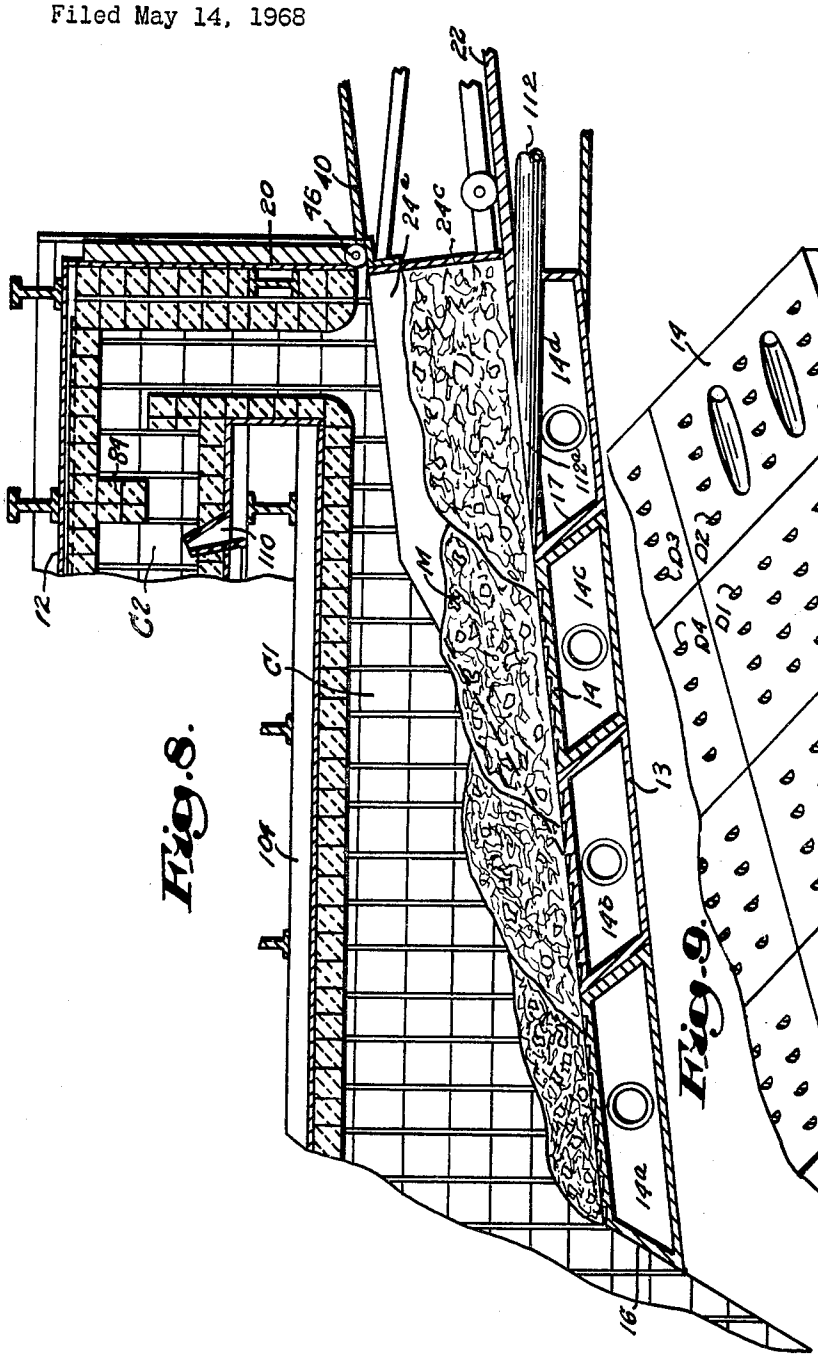


Fig. 8.

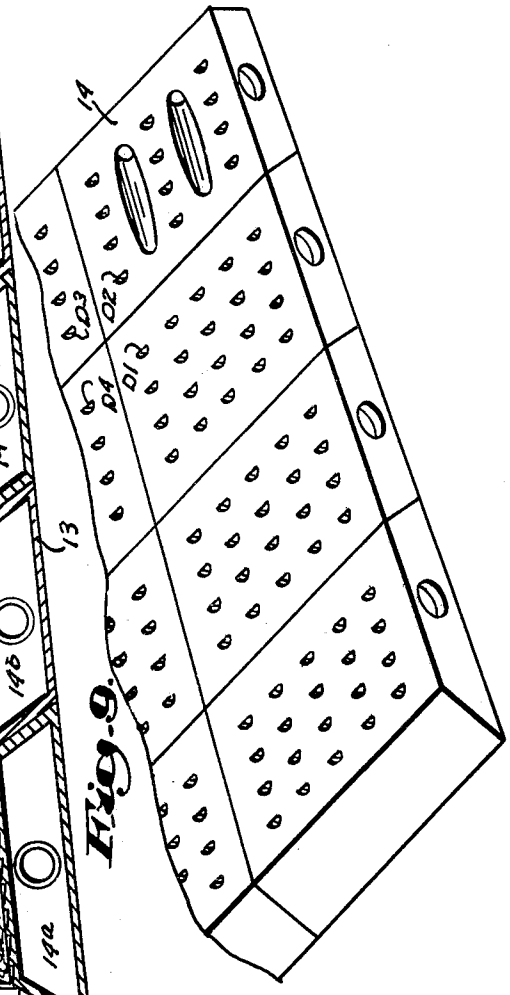


Fig. 9.

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3,509,836

METHOD AND APPARATUS FOR BURNING WASTE MATERIALS

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Int. Cl. F23g 5/04
U.S. Cl. 110—8 13 Claims

ABSTRACT OF THE DISCLOSURE

Rubbish and other waste materials of both combustible and non-combustible nature is loaded onto a charging apparatus and periodically advanced along an inclined loading platform into a preheating chamber. After being preheated, the charge is advanced into the burning chamber of an incinerator structure. Successively advanced loads of rubbish are forced one against another and travelled through the combustion chamber in a predetermined time interval. Combustion air is pumped through the base of the incinerator and auxiliary flame means maintain the temperature in the burning chamber at desired temperature levels.

This invention relates to a method and apparatus for burning rubbish, waste, demolition materials and the like and, more particularly, the invention is concerned with an improved incinerator apparatus in which relatively large quantities of both combustible and non-combustible waste materials may be continuously and efficiently processed.

It is a chief object of the invention to provide an improved method of burning waste materials and to devise an improved incinerator apparatus in which waste materials of varying sizes and classes may be contained and slidably moved along an inclined base into a combustion chamber in an efficient and rapid manner.

Another object of the invention is to provide an incinerator method and means for preheating waste materials and air surrounding the waste materials prior to the waste material being introduced into a combustion chamber to thereby prevent any drop in temperature in the combustion chamber as well as avoiding any cold air surge taking place at the time the materials are forced into the combustion chamber.

Still another object of the invention is to provide an inclined loading platform which is co-extensive with an inclined combustion chamber floor along which successive charges of waste materials may be slidably moved, one against another, into the combustion chamber and from time to time progressively forced out through a discharge opening in the incinerator body.

Still another object of the invention is to provide a novel arrangement for supplying combustion air which may be preheated in a unique heat exchanger assembly and which may be directed upwardly through a combustion chamber floor to provide maximum burning efficiency, and

Still another object is to provide means automatically operable to maintain the combustion chamber temperature at desired levels.

The nature of the invention and its other objects will be more fully disclosed in connection with a detailed description of the invention as illustrated in the accompanying drawings, in which:

FIG. 1 is a plan view of the apparatus of the invention;

FIG. 1*a* is a detail perspective view of a load carrier member;

FIG. 2 is a cross section taken approximately on the line 2—2 of FIG. 1;

FIG. 3 is a perspective view further illustrating details of the apparatus and particularly showing a main incinerator body and stack means associated therewith together with material handling mechanism;

FIG. 4 is longitudinal cross sectional view generally corresponding to FIG. 2 but shown on a somewhat larger scale and particularly illustrating jet flame burning equipment mounted therein;

FIG. 5 is a cross section taken on the line 5—5 of FIG. 1;

FIG. 6 is a fragmentary perspective view of a section of the combustion chamber floor;

FIG. 7 is a detail cross sectional view taken on the line 7—7 of FIG. 6;

FIG. 8 is a view generally similar to FIGS. 2 and 4 but further showing the load carrier delivering a charge of material into the bottom of the combustion chamber; and

FIG. 9 is a fragmentary perspective view of the combustion chamber floor.

In accordance with the invention, I have devised a method of processing rubbish and waste materials in an incinerator body of novel construction which includes a lower primary burning chamber and an upper secondary combustion chamber communicating therewith. In carrying out my invention method, a charge of waste material is supported on an inclined combustion chamber floor which extends through the base of the incinerator and outwardly to form an inclined loading platform. The charge of material is burned in the presence of currents of combustion air flowing over the mass of waste material and also upwardly through the inclined floor section.

Periodically successive charges of waste material are loaded into a power driven charging device movable on the inclined loading platform and the successive charges are slidably advanced one against another first into a preheating chamber and through into the lower primary burning chamber. One important feature of the invention consists in protectively enclosing the charge while in the preheating chamber so that the charge is raised to a predetermined temperature just before it passes into the burning chamber. At the same time, the temperature in the burning chamber is continuously sensed and maintained at a desired level by auxiliary flame jet burners.

Considering in further detail apparatus for carrying out the method of the invention, FIGS. 1, 2 and 3 illustrate an incinerator construction supported on a base 2 which may be any suitable ground level area or, if desired, may be comprised by a pad of concrete, asphalt or the like.

The incinerator generally comprises a rectangularly shaped structure having a steel frame lined with refractory brick to provide four sidewalls 4, 6, 8 and 10 and a flat top 12. A pair of stacks S1 and S2 are located at either side of the incinerator structure and connected by conduits 1 and 3 as best shown in FIG. 3. The top and sidewalls enclose a substantial burning space which includes a lower primary combustion chamber C1 and a secondary combustion chamber C2.

The bottom of the lower primary combustion chamber is defined by an inclined floor 14 which extends forwardly and downwardly from the front side wall 10 to meet with a discharge chute 16. A discharge pit 18 is arranged at the bottom of the discharge chute 16. Formed in the front side wall 10 is a charging doorway normally closed by a vertically movable door 20.

The incinerator structure may be of any desired size and, in one preferred embodiment may have a width of, for example, 25 feet, a height of 25 feet and a length of 32 feet. An over-all size such as this is intended to provide for processing both combustible and non-combustible demolition materials in various sizes and on a

twenty-four hour basis made up of three shifts utilizing two workmen for each shift.

An important feature of the incinerator structure above described is a method of burning waste materials while supported on the inclined floor **14**. Along this inclined floor **14** successive charges of waste material may be slidably moved one against another while subjected to burning for predetermined time intervals. For example, each charge of waste material moved into the lower combustion chamber C1 may undergo burning for a period of six or seven minutes although other intervals of time may be utilized and the invention is not intended to be limited to any particular period.

The angle of inclination of the floor for moving masses of material may, for example, range from 20 to 30 degrees and in this range of inclination I have found that desirable sliding characteristics of burning may be realized to most effectively displace burning masses along the combustion floor. The floor itself, in a preferred form, comprises a grate-slab floor made up of alloy cast iron and this floor is constructed to provide duct work for conveying preheated air to the underside of a burning mass as hereinafter described in detail.

In accordance with the method of the invention successive charges of waste material are advanced along a novel loading platform noted by the numeral **22**. This loading platform is also inclined and constitutes a continuation of the floor **14** as shown in FIGS. 1 and 2.

Mounted for sliding movement on the loading platfrom is a waste charging device **24** which is made up of a pair of vertical sides **24***a* and **24***b* and a rear wall **24***c*. As is more clearly shown in FIG. 1*a*, the forward ends of the sides **24***a* and **24***b* are shaped to provide angled slide surfaces **24***d* and **24***e*.

Secured to the rear wall **24***c* of the charging device **24** is a frame F which connects the charging device **24** to a power-driven apparatus consisting of a car **26** mounted on tracks **26***a*. Car **26** may be operated in any suitable manner as, for example, by means of sprocket chains **28** mounted around gears **29** and **31** better shown in FIG. 2.

The gear **31** is powered for rotative movement by a reversible driving motor **30** and is designed to be actuated by a workman through a suitable control switch of some conventional nature and which may be rotated at any desired point near the loading apparatus. As shown in FIG. 3 the frame F is made up of a pair of angled braces F1 and F2, side braces F3 and F4 and diagonal braces F5 and F6. The rear wall **24***c* of the car is also provided with a shelf portion **32** which overlies a portion of the frame F as indicated in FIG. 3.

Numeral **34** denotes a loading bucket which may be employed to pick up and load waste material onto the loading platform **22** in a position to be collected and charged into the combustion chamber by means of the charging device **24**. A similar loading bucket **36** is indicated at the left hand side of FIG. 2 for removing processed material P from the bottom of the pit **18**.

In accordance with a further important aspect of the invention, waste material is moved by the charging device **24** along the loading platform from a loading position such as is indicated in dotted lines in FIG. 2 into a preheating enclosure **40**. In the preheating enclosure **40**, the waste material undergoes a predetermined amount of preheating in a temperature range of from 400 to 500 degrees Fahrenheit.

The preheating enclosure **40** is joined to the front side of the incinerator around door **20** as indicated in FIGS. 2 and 3. This preheating enclosure is normally open at its opposite side to slidably receive the charging device **24** therethrough, so that when the charging device **24** is advanced into the position shown in FIG. 2 the real wall **24***c* sealably closes this open side of the preheating chamber.

The resulting sealed enclosure is normally adapted to receive heating and conduction from the lower combustion chamber through the inclined floor of the chamber and platform as well as the door **20** and also the adjacent side wall portion of the combustion chamber. The indicated range of preheating temperatures from 400 to 500 degrees Fahrenheit may, therefore, be realized very quickly and each charge is maintained at these temperatures in the preheating chamber for a period of from six to seven minutes before being advanced into the burning chamber.

Movement of the charging device **24** into the lower combustion chamber C1, with a preheated charge of waste material, results in two other operations taking place. First the angled edges **24***d* and **24***e* engage against roll means **46** located at the bottom of the door **20** as shown in FIG. 2. As the edges progress downwardly and into the chamber, the roll means actuated by the inclined edges force the door **20** upwardly into a position such as that shown in FIG. 8. Simultaneously with this action taking place, the preheated charge of waste material comes into contact with an earlier deposited charge of burning waste material in combustion chamber C1 and pushes against the burning mass to displace the mass downwardly along the inclined floor a short distance. This movement of one charge against another occurs all the way through the combustion chamber and results in material which has been in the lower combustion chamber C1 for a period, for example, of twenty to thirty minutes being discharged at chute **16** into the pit P. It will be understood that the time interval noted will vary with the volume of the charge.

Immediately upon the charging device **24** having transferred the charge into the position suggested in FIG. 8 the power driving means is actuated by a workman to reverse the travel of car **26** and to retract the charging device **24** out of the combustion chamber then through the preheating chamber, and then finally back to a normal starting position as shown in dotted lines in FIGS. 1 and 2.

The charging process above described is then repeated with another load of waste material being picked up and carried forwardly into the preheating chamber to undergo another preheating period and final burning. It will be understood that the door **20** is gravity operated to close whenever the charging device moves out of the combustion chamber C1.

In accordance with a further novel aspect of the method of the invention combustion of successive charges of waste material is carried out with the aid of combustion air supplied from both the upper and lower sides of waste materials supported on the combustion floor **14**. As shown in FIGURE 2 and indicated by the arrows at the left hand side of this figure, one supply of air is furnished to the combustion chamber C1 from the pit P and through the discharge chute entrance way and caused to pass upwardly over the mass of material M.

A second and more important supply of combustion air is furnished to the bottom of the burning mass M through a multiplicity of air ducts D1, D2, D3, D4, etc. formed in the floor **14** as is more clearly shown in FIGS. 6, 7 and 9. As noted in FIGS. 2, 4 and 8 the floor **14** is of hollow construction being made with a sub-base **13** by lying in spaced relation to the main floor section **14** and having a series of angled partitions **17** which define air passageways as **14***a* **14***b*, **14***c* and **14***d*. These air passageways occur along one side of the floor section **14** and on the opposite side of the floor section is another set of similar passageways. A main divider wall **19** shown in FIG. 5 separates the air duct structure into two main sections.

Communicating with the several passageways described is a plurality of vertical conduit members **60**, **62**, **64** and **65** etc. best shown in FIG. 3 and located at one side of the incinerator structure. Also located on the opposite side of the incinerator structure as shown in FIG. 1 is another set of similar vertical conduits **60'**, **62'**, **64'**, etc.

Mounted in the base of each of these vertical conduit members are air pump members as **66, 68, 70**, etc. and on the opposite side of the incinerator structure are similar air pump members **66', 64', 68'**, etc. connected to respective vertical conduits. At the upper ends of the vertical conduits are connected a plurality of horizontal conduit portions noted by the numerals **72, 74, 76**, etc. and similar but primed horizontal conduit portions are provided at the opposite side of the incinerator structure.

Two of the horizontal conduit portions **74** and **74'** are further illustrated in FIG. 5 and as shown therein extend through the conduit members **1** and **3** which function as heat exchangers. In the arrangement described combustion gases passing from the lower combustion chamber C1 pass upwardly and through the secondary combustion chamber C2 being drawn under and over a series of baffle members as **84, 86**, etc. (FIGS. 2 and 4). These flue gases pass out through the conduit members **1** and **3** to provide means for rapidly heating air drawn into the transverse conduit sections **72, 74, 76**, etc. This preheated air moves downwardly and is forced by the air pumps described into the passageways below the floor **14** and thence outwardly through the ducts **D1, D2, D3, D4**, etc. and then upwardly through the mass M.

By thus supplying combustion air at both the top and bottom of a mass of waste material in the burning chamber at all times relatively high temperatures can be maintained quite effectively and rapid and efficient burning can be carried out for a wide range of waste materials.

To further increase burning efficiency, as may be desirable in dealing with some more difficult combustibles, I may also supply combustion air directly into the second burning chamber C2. As illustrated in FIGS. 1 and 2 blower members **90, 92, 94, 96** and **98** are mounted on the upper rear side of the incinerator and are arranged to force combustion air through respective air ducts **100, 102, 104, 106** and **108** where the air is heated. These air ducts extend towards the front of the incinerator and communicate with the second combustion chamber C2 through openings as **110** (FIGS. 2 and 4), and provide increased amounts of oxygen in the form of preheated air to carry out more complete combustion of the flue gases passing through this secondary combustion chamber.

As a result of utilizing the several different air supply systems described, it is, I find, possible to maintain relatively high burning temperatures in a range of from 1600 degrees to 2000 degrees F. for most burning periods. However, in the event that temperature drop occurs for any reason, I further provide auxiliary temperature boosting means consisting of a plurality of flame jet members located preferably in the base of the combustion chamber C1.

FIG. 4 illustrates one of the flame jets denoted by numeral **112**. As will be observed from an inspection of FIG. 4 the flame jet burner **112** has a burner tip **112***a* located in the main floor **14** at a point slightly ahead of the door **20**. In this position the burner apparatus can be operated to direct a flame for a considerable distance along a generally horizontal direction so as to substantially encompass the entire top side of a mass of material M in the combustion chamber.

In FIG. 1, I have illustrated additional flame jets **114, 116** and **118** arranged in parallel spaced relation to the flame jets **112**. Also shown in FIG. 1 are oxygen supply tanks as **120**, fuel oil supply tanks **122** and compressed air supply means **124** together with suitable pipes for connecting these parts to respective burners. It will be appreciated that with flame jet burners of the type described, temperatures in the range of from 4000 to 5000 degrees F. can be induced in the burning chamber, and therefore, a rapid boosting of burning temperature can be realized by means of short periods of operation of these flame jet members when difficult combustibles are being processed. Temperature sensing means T shown in FIGS. 2 and 4 may be employed to detect drop in temperature and to control operation of the burners through an electrical control circuit.

From the foregoing description of the invention, it will be apparent that I have discovered a novel and efficient means of burning continuously relatively large batches or charges of waste material of various types and in this method combustion air is supplied at a plurality of points to insure complete combustion in all points in the apparatus, with the maintenance of high temperatures being realized at all times and complete burning of all combustion material being accomplished.

I claim:

1. In a method of processing rubbish and waste material in an incinerator member, said incinerator member including a burning chamber, an inclined combustion chamber floor which extends through the incinerator and outwardly and upwardly to form an inclined loading platform, and a preheating enclosure body located adjacent the burning chamber and overlying the loading platform, and a reciprocating stoker member movable into and out of the preheating enclosure along the loading platform, the steps which include supporting a charge of waste material on said inclined combustion chamber floor burning the charge of waste material in the presence of a flow of stack-induced combustion air over the charge and also in the presence of a flow of combustion air pumped upwardly through the inclined floor section and into the charge of waste material, and periodically advancing successive charges of waste material slidably along the inclined loading platform and into the primary combustion chamber, one charge against another, thereby to displace processed material from the burning chamber and to discharge processed material through a discharge chute in the burning chamber.

2. A method according to claim **1** in which each of the successive charges of material is moved into a preheating chamber and heated to a predetermined temperature.

3. A method according to claim **2** in which each of the preheated charges is protectively enclosed in a charging device as it is introduced into the burning chamber thereby to prevent temperature change and avoid flow of cold air into the chamber.

4. A method according to claim **3** in which the combustion chamber is provided with a movable door and movement of each charge in its protectively enclosed state into the lower primary burning chamber opens and closes the said door.

5. A method according to claim **1** in which the temperature within the upper secondary burning chamber is continuously sensed and burner means are operated periodically to maintain the temperature at a desired level in accordance with the sensing means.

6. Apparatus for burning rubbish, demolition materials and the like comprising an incinerator body having a lower primary combustion chamber and an upper secondary combustion chamber communicating therewith, said incinerator body being formed at one side with a charging opening and at an opposite side with a discharge outlet, a stationary loading platform for slidably supporting material to be introduced through the said charging opening, stack means for inducing flow of a current of combustion into the discharge outlet and through the said primary and secondary combustion chambers, the bottom section of the incinerator body including a rubbish supporting floor, said rubbish supporting floor being stationary and presenting an inclined upper surface which extends throughout the primary combustion chamber and outwardly of the incinerator body in a plane coextensive with the upper side of the loading platform, and reciprocating stoker means mounted for sliding movement forwardly and rearwardly along the said inclined upper surface of the floor and the loading platform to advance successive loads of rubbish from the loading platform onto the floor of the primary combustion chamber.

7. A structure according to claim 6 in which the incinerator body further includes a vertically movable door for opening and closing the said charging opening, and operable in response to travel of the said reciprocating stoker means, and a precharging enclosure member located externally of the door to provide a confined space for periodically containing and heating a charge of material prior to passage into the primary burning chamber.

8. A structure according to claim 7 in which the reciprocating stoker means includes said inclined loading platform, a load carrier slidably disposed on the inclined loading platform and formed with vertical material-retaining sides and an open bottom section, and power driven means attached to the load carrier for advancing the load carrier along the inclined loading platform into the precharging enclosure member for a predetermined heating interval and then through the charging opening into the primary combustion chamber.

9. A structure according to claim 8 in which the load carrier is formed with angularly shaped upper edges engageable with the said vertically movable door to raise and lower same when travelling into and out of the combustion chamber.

10. A structure according to claim 9 in which the load carrier and the precharged enclosure cooperate to form a closed space in one position of advancement of the carrier thereby to subject a load of material to preheating in the closed space prior to entry into the primary burning chamber.

11. A structure according to claim 6 in which the bottom of the primary combustion chamber further includes

means for delivering a high velocity jet flame at superatmospheric pressure upwardly and through the combustion chamber to provide for periodic increase in combustion chamber temperatures.

12. A structure according to claim 6 in which the said incinerator body is formed with heat exchanger members for conducting hot flue gases from the secondary burning chamber to the said stack means, said heat exchanger members consisting of tubular body portions extending along the sides of the incinerator body and said means for forcing preheated combustion air including conduit means extending through the said heat exchangers, and pump means for forcing air through the conduit means into the floor of the combustion chamber.

13. A structure according to claim 6 in which the floor of the primary combustion chamber is provided with air ducts open at the inclined upper surface, and pump means for forcing air through the ducts into said loads of rubbish as they are slidably advanced along the floor.

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U.S. Cl. X.R.

110—15