

July 29, 1969

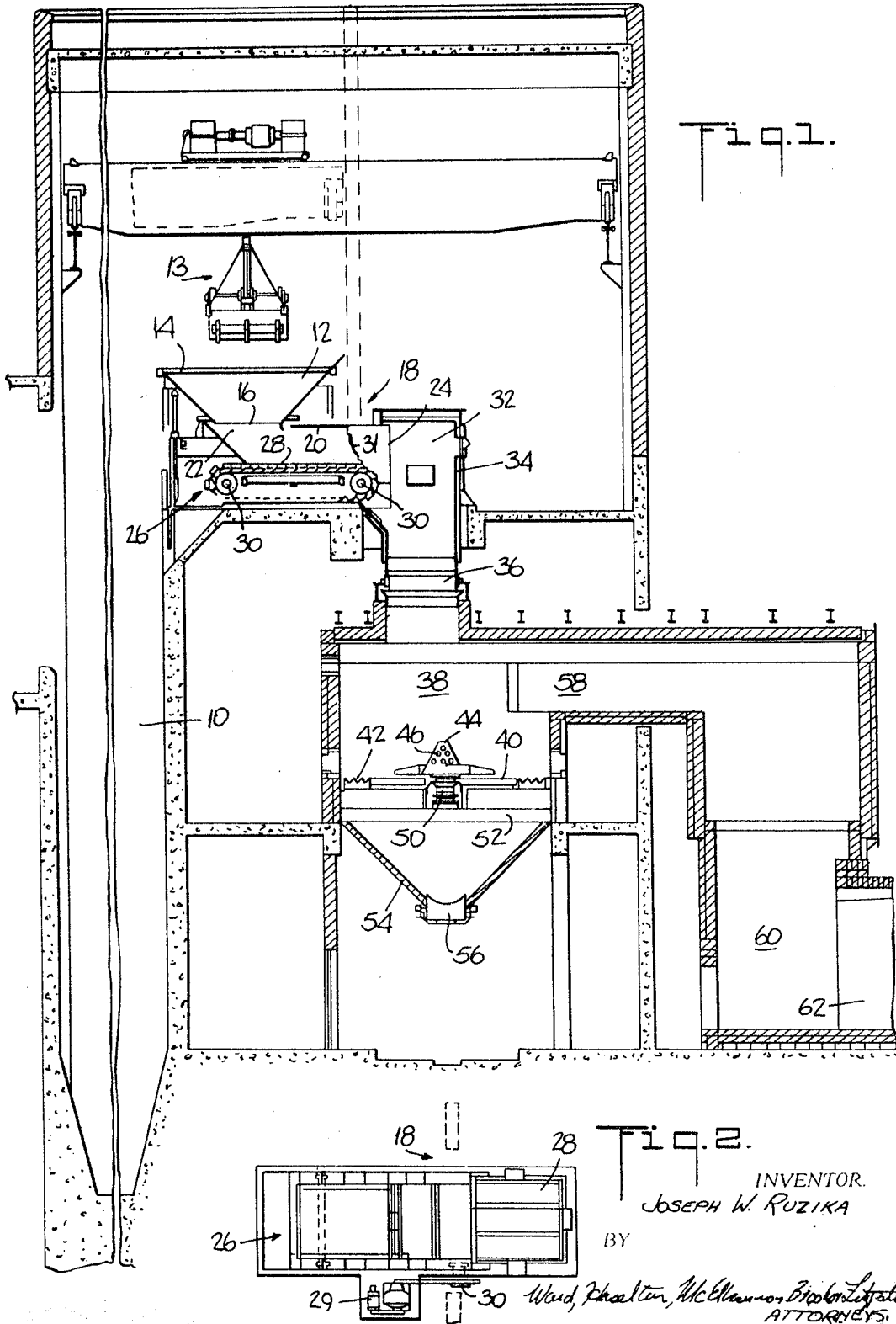
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METHOD AND APPARATUS FOR INCINERATING WASTE MATERIAL

Filed March 8, 1968

2 Sheets-Sheet 1



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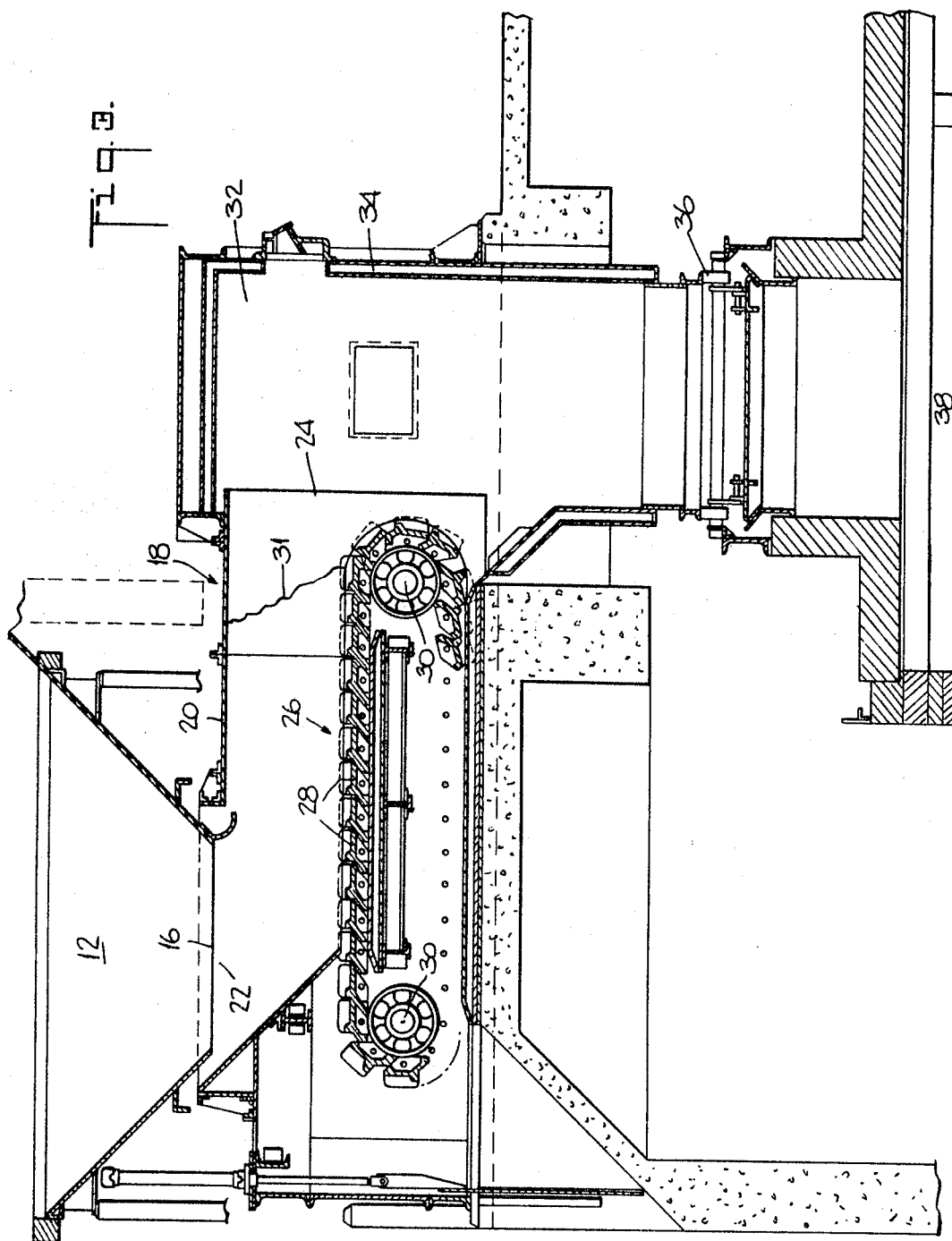
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3,457,882

METHOD AND APPARATUS FOR INCINERATING WASTE MATERIAL

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Filed Mar. 8, 1968, Ser. No. 711,565

Int. Cl. F23g 3/00; F23k 3/16

U.S. Cl. 110—8

13 Claims

ABSTRACT OF THE DISCLOSURE

Method for continuously incinerating waste material. A continuous conveyor is mounted within a duct, the duct being of dimensions and aperture such that during operation of the apparatus the material therein normally bridges across and plugs the duct to prevent the flow of undesired cold air through the duct into the combustion zone. A chute is positioned adjacent the outlet of the duct and a furnace chamber is positioned under the chute, grate means and hearth means are disposed in the furnace chamber, an ash hopper is mounted below the grate, and the chamber is provided with flue means for the discharge of combustion gases.

This invention relates to incinerators and more particularly to method apparatus for continuously incinerating waste material. The invention is particularly adapted, among other possible uses, for incineration of municipal, city or community garbage, trash or refuse.

Heretofore, incinerators utilized for this general type of service were of the so-called "batch" type. That is, the incinerator would be charged with one batch of refuse or other waste material to be burned, and then this batch of material was ignited and completely burned in the furnace chamber. Thereafter, another charge was admitted and the process repeated. These prior art devices were not entirely satisfactory because they were time-consuming, inefficient and cumbersome in operation, for example. Also, these devices permitted the inrush of excess cold air which materially deleteriously affected the combustion. Prior art attempts to overcome these problems included the development of continuous grate incinerators, but this type of apparatus encountered other problems, such as uneven burning across the grate due to the uneven burning rate characteristic of waste material. The time during which the waste material was retained in the incinerating zone was not flexible enough to accommodate the rapidly changing refuse characteristics as it travelled through the furnace. The variation of the character of the material across the grate resulted in the rapid combustion of the lighter or drier materials, thus forming "flow-holes" which allowed the combustion air to pass through the grates without contacting the refuse. This resulted in inefficient burning. Also, the mechanical parts of the grate had to be fabricated from material which parts of the grate had to be fabricated from material which could withstand high combustion temperatures. In addition, unburnt refuse tended to jam the moving parts and cause substantial damage.

The present invention involves a novel combination of features combined in such a way as to afford a very economical solution of the difficulties and problems above discussed. The invention has as one of its objects, a simplification of the apparatus and methods heretofore deemed necessary for incineration of waste material of the character aforesaid, whereby apparatus components and manipulated operations are eliminated as compared to practices of the prior art. That is, according to the present invention certain desirable aspects of the batch type of

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incinerators are retained as well as certain desirable aspects of the travelling grate type of incinerator. The time during which the refuse may be retained in the incinerating zone may be controlled as desired. This is important because of substantial changes in the character of the refuse material. Also, the waste material is generally evenly distributed over the entire incinerating zone and is fed at a preselected substantially continuous rate. In addition, the incinerating zone is continuously subjected to the hot combustion gases, thereby assisting in the burning of the waste material.

Briefly, this invention contemplates the provision of a new and improved construction wherein the apparatus comprises a continuous feeder which includes a duct, in which continuous conveyor means are mounted for moving material from the inlet to the outlet of the duct. This duct is of dimensions and aperture such that when the apparatus is operating the material in the duct bridges across and plugs the duct and prevents the flow of undesirable cold air therethrough. The apparatus further comprises chute means disposed adjacent the outlet of the duct for receiving material therefrom. The chute leads to a furnace chamber disposed therebelow. Grate means and hearth means are disposed in the furnace chamber and an ash hopper is mounted below the grate. Also, there is a flue in the furnace chamber for the discharge of combustion gases.

In one form of the invention, there is provided a storage bin for storing waste material. Crane means are employed for moving waste material from the storage bin to the inlet of a charging hopper which is mounted above the inlet of the continuous conveyor. This apparatus provides simple and efficient means for feeding material into the continuous conveyor. Also, according to the invention the continuous conveyor includes a pair of spaced shafts around which a continuous "apron-pan" type conveyor passes, one of said shafts being driven. The conveyor just described serves to continually supply waste material in a steady smooth flow without compacting the waste material to an extent harmful to the easy burning thereof, and yet with sufficient compaction to allow for the formation of the material bridge across the duct to prevent the entrance of undesirable cold air thereby allowing a single hearth furnace to operate with continuous feed.

In addition, according to the invention, the central floor area of the furnace chamber includes a stationary hearth, a grate area surrounding the hearth, and a rotatable up-standing hollow member of generally conical shape and having discharge apertures substantially throughout its surface. This member is rotatable about a generally vertical axis through the mid portion of the hearth and serves to break up the material to aid combustion and to gradually advance the waste material outwardly onto the grate area, and also to introduce air into the material, means being provided for supplying air to the inside of the member.

There has thus been outlined rather broadly the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which this disclosure is based may readily be utilized as the basis for the designing of other structures for carrying out the several purposes of the invention. It is important, therefore, that the claims be regarded as including such equivalent construction as do not depart from the spirit and scope of the invention.

One embodiment of the invention has been chosen for purposes of illustration and description, and is shown in

the accompanying drawings, forming a part of the specification, wherein:

FIG. 1 is a vertical medial sectional view of apparatus for continuously incinerating waste material constructed according to the concept of this invention.

FIG. 2 is a plan view of the continuous feeder portion of the apparatus; and

FIG. 3 is an enlarged vertical medial sectional view of the charging hopper, continuous feeder and chute means of the apparatus.

In the embodiment of the invention illustrated, the apparatus for continuously incinerating waste material includes a large storage hopper or bin 10, FIG. 1, and a generally conically shaped charging hopper 12. Overhead crane means located generally at 13, of well-known construction, serve to move the waste material which has accumulated in the storage bin 10 to the charging hopper 12. The charging hopper 12 has an upper inlet 14 for receiving material from the crane means and a lower dispensing outlet 16. As best seen in FIG. 3, a continuous feeder indicated generally at 18 comprises a substantially horizontally disposed duct 20 having an inlet 22 at one end for receiving waste material from the outlet 16 of the charging hopper 12 and an outlet 24 at the other end thereof. Continuous conveyor means indicated generally at 26 are mounted within the duct 20 for continuously moving the waste material from the inlet 22 of the duct to the outlet 24 thereof. In the illustrated embodiment of the invention, as best seen in FIGS. 2 and 3, the continuous conveyor is of the so-called "apron-pan" type wherein a plurality of interconnected apron-pans 28 are adapted to pass around a pair of spaced shafts 30, one being driven as by means of motor 29 (FIG. 2), provided for the purpose.

It will be particularly appreciated that the duct 20 is of dimension and aperture such that during operation of the apparatus the waste material in the duct bridges across, as along line 31 (FIG. 3), and plugs the duct to prevent the entry of undesirable cold air therethrough which would interfere with proper combustion of the refuse material on the furnace grate. That is, the diameter of the duct, the length of the duct and the rate of speed of the continuous conveyor are preselected to form a bridge or plug of material extending substantially along line 31 to provide a material barrier to prevent the entry of cold air into the charging hopper.

As best seen in FIGS. 1 and 3, a substantially vertically extending chute 32 is disposed adjacent the outlet 24 of the duct 20 for receiving waste material from the continuous feeder 18. Generally, the chute is watercooled as at 34, due to the high temperature of the combustion gases. A charging gate 36 is provided at the base of the chute to be closed during repairs or at other times when desired. A furnace chamber 38 is positioned below the chute 32 for receiving the waste material therefrom. The floor area of the furnace chamber comprises a central stationary hearth area 40 surrounded by a grate area 42. At the mid portion of the fixed hearth area 40, a rotatable upstanding hollow member of generally conical shape is provided, as shown at 44. The cone member 44 either at the upper portion thereof or preferably throughout its surface, is provided with air discharge apertures as at 46, the hollow interior of the cone communicating through a hollow supporting shaft 50 with an air supply furnished from a supply source connected, for example, to a conduit 52. The amount of the air thus supplied is adjusted as desired to assist in the combustion of the waste material. If desired, additional air may be supplied under the grates. The cone member 44 rotates about a generally vertical axis through the mid portion of the hearth for agitating the material on the hearth and for gradually advancing such material outwardly onto the grate area, as well as for introducing supplies of air into the waste material. The cone member is rotated by means, not shown, which

preferably are independent of the motor 29 used to drive the apron-pan conveyor 26.

Still referring to FIG. 1, a generally conically shaped ash hopper 54 is positioned in the furnace chamber below the grate, an ash gate 56 being disposed at the apex of the cone for the periodic removal of accumulated ashes.

As best seen in FIG. 1, towards the top of the furnace chamber 38 is a flue passage 58 through which the hot flue gases pass to the combustion chamber 60. That is, the solid material is burned in the furnace chamber 38 and the hot gases complete their burning process in the combustion chamber 60, after passing through the flue 58. Then the gas is passed through flue 62 to the spray chamber, not shown. It will be appreciated that since the combustion gases cannot pass through the material barrier along line 31, they are forced to pass through the flue 58, combustion chamber 60 and flue 62, thereby controlling the flow of the gases which may be treated by filtering means to remove odors or the like, if desired.

It will thus be seen that the present invention does indeed provide an improved apparatus for continuously incinerating waste material which is superior in simplicity, economy and efficiency as compared to prior art such devices.

Although a particular embodiment of the invention is herein disclosed for purposes of explanation, various modifications thereof, after study of this specification, will be apparent to those skilled in the art to which the invention pertains, and reference should accordingly be had to the appended claims in determining the scope of the invention.

What is claimed and desired:

1. Apparatus for continuously incinerating waste material comprising a continuous feeder including a duct having an inlet at one end and an outlet at the other end, continuous conveyor means mounted within said duct for continuously moving material from said inlet to said outlet, said duct being of dimensions and aperture such that during operation of said apparatus said material in the duct normally bridges across and plugs the duct to prevent the entry of outside air therethrough, chute means disposed adjacent said outlet for receiving material from said continuous feeder, furnace chamber means disposed under said chute means in material receiving attitude with respect thereto, grate means disposed in said furnace chamber means, an ash hopper disposed below said grate, and flue means disposed in said furnace chamber means for the discharge of combustion gases.

2. Apparatus for continuously incinerating waste material according to claim 1 wherein said duct is substantially horizontally disposed and wherein the inlet is positioned on the upper portion thereof, said apparatus further comprising a charging hopper having an upper inlet and a lower outlet, and means mounting said charging hopper so that its lower outlet is in material flow communications with respect to inlet of said horizontally disposed duct.

3. Apparatus for continuously incinerating waste material according to claim 2 further comprising a large storage bin, and crane means for moving waste material from said storage bin to the inlet of said charging hopper.

4. Apparatus for continuously incinerating waste material according to claim 1 wherein said duct is substantially horizontally disposed.

5. Apparatus for continuously incinerating waste material according to claim 4 wherein said continuous conveyor is of the continuous apron-pan type and is mounted adjacent the bottom of said duct.

6. Apparatus for continuously incinerating waste material according to claim 5 wherein said conveyor comprises a pair of spaced shafts around which the continuous buckets pass, one of said shafts being driven, the buckets being faced upwardly for carrying material from the inlet to the outlet of the duct.

7. Apparatus for continuously incinerating waste mate-

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rial according to claim 1 wherein said chute is substantially vertically disposed, and in vertical alignment directly above said furnace chamber means.

8. Apparatus for continuously incinerating waste material according to claim 1 wherein said furnace chamber means includes a center floor area comprising a stationary hearth, a grate area surrounding said hearth, means rotatable about a generally vertical axis through the middle portion of said hearth for agitating material on said hearth and for gradually advancing said material outwardly onto said grate area and for introducing supplies of air into said material.

9. Apparatus for continuously incinerating waste material according to claim 8 wherein said means rotatable about a generally vertical axis comprises a rotatable upstanding hollow member of generally conical shape, said member being provided with air discharge apertures substantially throughout its surface, and means for supplying air to the inside of said member.

10. Apparatus for continuously incinerating waste material comprising a storage hopper, a charging hopper having an upper inlet and a lower outlet, crane means for moving waste material from said storage hopper to said charging hopper, a continuous feeder including a substantially horizontally disposed duct having an inlet at one end for receiving waste material from the outlet of said charging hopper, said duct having an outlet at the other end thereof, continuous conveyor means mounted within said duct for continuously moving material from the inlet of said duct to the outlet of said duct, a pair of spaced shafts around which the continuous conveyor means passes, one of said shafts being driven, said duct being of dimensions and aperture such that during operation of said apparatus said material in said duct normally bridges across and plugs the duct and prevents the flow of undesirable outside air therethrough, a substantially vertically disposed chute disposed adjacent the outlet of said duct for receiving material from said continuous feeder, a furnace chamber disposed below said chute in material receiving attitude with respect thereto, the central floor area of said furnace chamber comprising a stationary hearth, a grate area surrounding said hearth, means rotatable about a generally vertical axis through the middle portion of said hearth for agitating material on said hearth and for gradually advancing such material outwardly onto said grate area and for introducing supplies of air into said material, said last named means in-

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cluding a rotatable upstanding hollow member of generally conical shape, said member being provided with air discharge apertures substantially throughout its surface, and means for supplying air to the inside of said member, an ash hopper disposed below said grate, and flue means disposed in said furnace chamber for the discharge of combustion gases.

11. A method of continuously incinerating waste material comprising continuously introducing said waste material into one end of an elongated duct having reduced passage area, passing said material through said duct on continuous conveyor means mounted within said duct at a rate of travel to cause said material in the duct to normally bridge across and plug the duct to prevent the flow of undesirable outside air therethrough, continuously passing said waste material from said duct into chute means, and thereafter passing said waste material from said chute means into a furnace chamber.

12. A method of continuously incinerating waste material comprising filling a charging hopper to a substantial height with said waste material, continuously introducing said waste material into one end of an elongated duct having reduced passage area, passing said material through said duct at a rate of travel to cause said material in the duct to normally bridge across and plug the duct to prevent the flow of undesirable outside air therethrough, continuously passing said waste material from said duct into a vertically disposed chute, and thereafter passing said waste material from said chute into a furnace chamber disposed directly below the outlet of said chute.

13. The method of claim 12 including generally uniform distributing said waste material over the incinerating zone of said furnace chamber as said material passes from said chute into said furnace chamber thereby facilitating incineration thereof.

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U.S. Cl. X.R.

110—108, 118