

[54] MOVING BOTTOM INCINERATOR

[75] Inventors: Shigeru Saitoh; Tetsuya Watanabe;
Noboru Suzuki, all of
Fukushima-ken, Japan

[73] Assignee: Kureha Kagaku Kogyo Kabushiki
Kaisha, Tokyo, Japan

[22] Filed: July 20, 1973

[21] Appl. No.: 381,356

[52] U.S. Cl. 110/8 R, 110/40 R
[51] Int. Cl. F23g 5/00
[58] Field of Search 110/8 R, 28 J, 40 R

[56] References Cited

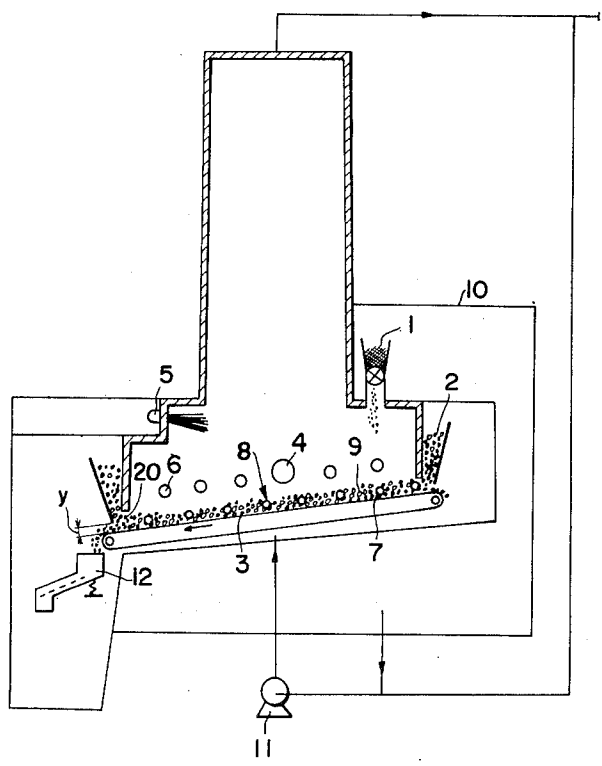
UNITED STATES PATENTS			
3,397,657	8/1968	Tada	110/28
3,473,493	10/1969	Simpson	110/40
3,577,939	5/1971	Muirhead	110/8
3,625,164	12/1971	Spector	110/28 J
3,702,595	11/1972	Muirhead et al.	110/28

Primary Examiner—Kenneth W. Sprague

[57] ABSTRACT

A moving bottom type incineration oven having: an inlet for supplying mineral pebbles or grains, the inlet being located in a first side wall of the oven; an outlet for removing the incinerated residue and the mineral pebbles or grains, the outlet being located in a second side wall of the oven, opposite the first side wall; and a conveying means forming the bottom of the oven and having an upper surface running from the inlet toward the outlet. Mineral pebbles are deposited on the upper surface of the conveying means to form a layer thereon. Rubbish deposited on the layer of mineral pebbles is incinerated. The conveying means may be a single conveyor or a combination or plurality of conveyors of relatively short length arranged as stairs. The combustion gas may be introduced into the oven through the layer of mineral pebbles or crushed rock, or alternatively, through port or ports in the side walls.

11 Claims, 5 Drawing Figures



PATENTED JAN 21 1975

3,861,331

SHEET 1 OF 3

FIG. 1

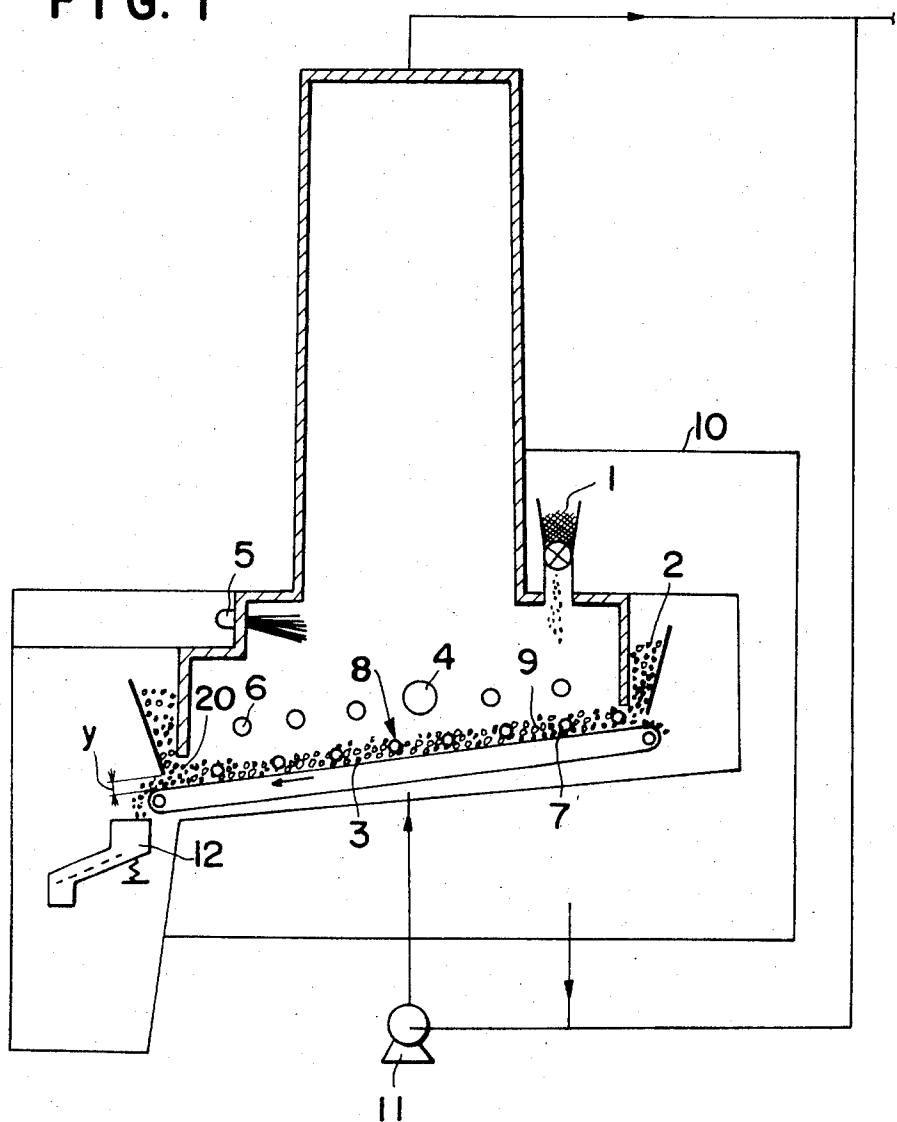


FIG. 2

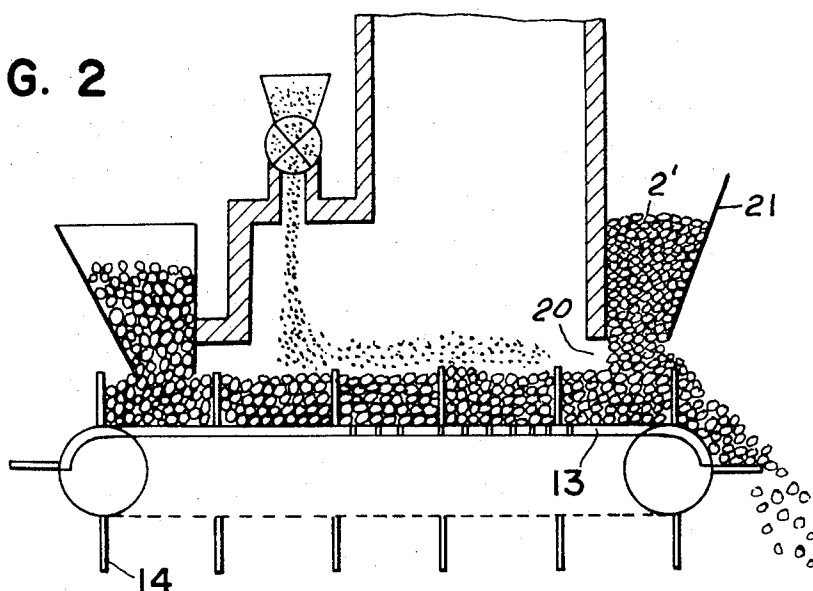


FIG. 3

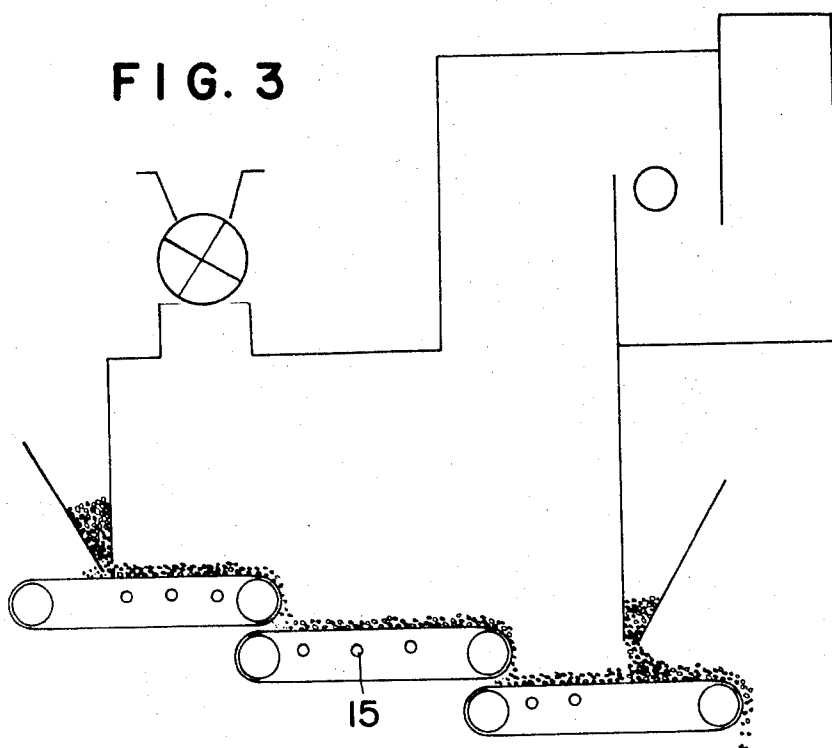


FIG. 4 (a)

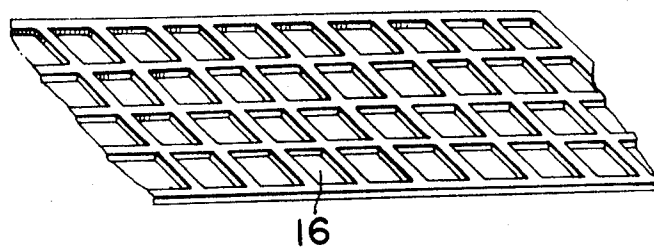
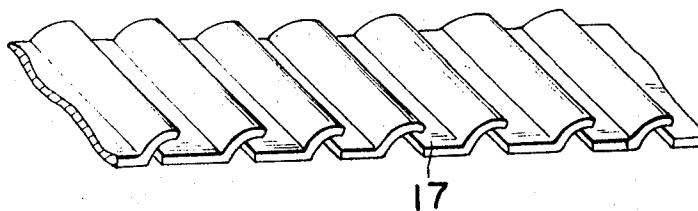


FIG. 4 (b)



MOVING BOTTOM INCINERATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a rubbish incineration oven 5 having a moving bottom, and more particularly to a rubbish incineration oven having a conveyor forming a bottom in the oven and extending from an inlet for introducing mineral pebbles or grains to an outlet through which the incinerated rubbish and the pebbles 10 are removed. The upper run of the conveyor is adapted to carry a layer of mineral pebbles.

2. Description of the Prior Art

The nature of municipal solid waste has changed with recent advances in container and packaging technology and a generally rising level of affluence. The recent tendency is that the type rubbish containing a high amount of moisture has decreased in quantity, while plastic waste has increased. The conventional incineration oven is designed for incinerating rubbish having a relatively low calorific value. Thus such a conventional oven will have a short service life when used to incinerate plastic wastes which have very high calorific values and which generated corrosive gases. For this reason, the conventional type incineration oven is suitable for 15 the incineration of plastic rubbish or waste. Thus, there exists a need in the art for an incineration oven adapted to incinerate plastic rubbish or rubbish containing large amounts of plastic waste.

The incineration of plastic waste or rubbish requires a great amount of air. The production of soot results from poor circulation of air flow within the incineration or from inadequate air, which conditions result in incomplete combustion. In addition, the metallic fire lattice which supports the rubbish during combustion is subject to corrosion due to HCl , SO_2 , SO_3 , HCN , NO_2 , etc. contained in the exhaust gas. Furthermore, tar matter from the rubbish tends to clog the openings of the fire lattice.

SUMMARY OF THE INVENTION

It has now been found that the foregoing and related disadvantages are overcome by a moving bottom type incineration oven having: an inlet for supplying mineral pebbles or grains, the inlet being located in a first side wall of the oven; an outlet for removing the incinerated residue and the mineral pebbles or grains, the outlet being located in a second side wall of the oven, opposite the first side wall; and a conveying means forming the bottom of the oven and having an upper surface running from the inlet toward the outlet. Mineral pebbles are deposited on the upper surface of the conveyor means to form a layer thereon. Rubbish deposited on the layer of pebbles is incinerated. The pebble layer protects the conveyor from corrosive combustion gases having high calorific value and allows continuous incinerator operation.

In one embodiment of the invention, there is provided a moving bottom type incineration oven which has a plurality of conveyors of relatively short length which are arranged so as to form stairs, thereby increasing the mixing of the rubbish by turnover at the junctions of the conveyors.

At least part of the combustion air may be introduced through the layer of the mineral pebbles or grains. Alternatively, the combustion air may be introduced through a port or ports in the side walls.

Accordingly, it is a principal object of the invention to provide an incineration oven which solves the metal lattice corrosion problem and which permits continuous operation.

Other objects and further scope of applicability of the present invention would become apparent from the detailed description to follow, taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional diagram of a moving bottom type incineration oven of the present invention;

FIG. 2 is a cross-sectional diagram of another embodiment of the moving bottom type incineration oven of the present invention;

FIG. 3 is a cross-sectional diagram of a yet another embodiment of the moving bottom type incineration oven of the present invention having stepped conveyor means; and

FIGS. 4 (a) and 4 (b) are perspective views of fire lattices suitable for use in the incineration oven of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows an incinerator of the present invention having an inlet 1 for the introduction of raw waste and an inlet 2 for supplying pebbles or crushed stones to form a layer on conveyor 3 which covers the bottom of the oven. Shown at 4 is a main burner, at 5 a subsidiary burner and at 7 an inlet through which the combustion air is supplied to the interior of the furnace. Sealing means 10 seals the lower portion of the oven. A blower 11 is provided for introducing combustion air. A screen 12 serves to separate the mineral pebbles or crushed rock from the ashy residue.

The conveyor 3 which forms a moving bottom for the oven may be a perforated endless strip capable of withstanding the elevated temperature, as shown in FIG. 1, or in the form of a plurality of scrapers 14 which move along a stationary perforated plate 13, as shown in FIG. 2.

The perforated endless strip may be the type shown in FIG. 4 (a), i.e., a metal lattice or the type shown in FIG. 4 (b), i.e., a run of a plurality of metal strips coupled to each other. In operation a support material, mineral pebbles or grains of a relatively large size, are continuously supplied to the endless perforated metal strip so as to form a layer 9 having a depth y within the range of from 5 to 100 cm, thus forming an oven bottom 8. The raw waste or rubbish is continuously fed through the inlet 1 onto the oven bottom 8 for the incineration by means of the main burner 4. The main burner is used only in the initial stage of the incineration, and thereafter the combustion is self-sustaining due to the heat of the burning rubbish, thus obviating the use of the main burner as a heat source. The combustion air may be supplied through the oven bottom 8, i.e., through the layer of the mineral pebbles or grains, or, alternatively, through port or ports 6 in the side wall of the combustion chamber.

The conveyor 3 is operated continuously or intermittently, as required. The speed of the conveyor is controlled to provide a dwell time for the rubbish within the oven that will give complete combustion. Thus, when the rubbish on the conveyor reaches the discharge end of the oven, the rubbish at that point will be

completely burned. The ash is discharged at 20 along with the mineral pebbles or grains. Thus, there is no possibility of non-combustible matter or combustion residue, i.e. ash, accumulating within the oven. As in FIG. 1, the combustion residue on the mineral pebbles or grains 2 exits from the oven at outlet 20. In order to close off the oven from the outside at that point, adjacent to outlet 20 is an inlet 21 through which mineral pebbles or grains 2' are continuously deposited on the combustion residue. This promotes an increase in the amount of air entering the oven through its bottom portion.

The mineral pebbles or grains 2' to be used at the outlet 20 may be the same as those (indicated at "2") employed at the inlet. The mineral pebbles or grains coming off of the end of the conveyor 3 are separated from the combustion residue by means of a screen 12, and recycled by returning a part thereof to the inlet for mineral pebbles or grains 2, and the remainder to the inlet 21.

The conveyor 3 may be an endless strip of a plurality of metal plates, bars or lattice elements coupled to each other. If required, a combination of such conveyors may be used. With a combination or plurality of conveyors, the conveyors are arranged so as to form stairs or steps, as shown in FIG. 3. Thus, when the rubbish is transferred from one conveyor to another, a mixing action or agitation results, thus improving the combustion efficiency. The lengths of the conveyors as used in such an embodiment are not necessarily the same, i.e., the length of the first conveyor may be longer than that of the following, depending on design requirements.

Each individual metallic conveyor may be provided with air ports 15 as shown in FIG. 3 to introduce air through the layer of mineral pebbles or grains from below; or stationary air injecting tubes may be provided adjacent the upper or lower flight of the conveyor for supplying the combustion air. Air injection nozzles are provided along the air supply tube 15. The air injection nozzles are directed upwardly where the supply tubes 15 are below the upper flight or run of the conveyor, and are directed downwardly where the air supply tubes 15 are above the upper run of the conveyor.

If the metallic conveyor has perforations such as 16 (FIG. 4a) or 17 (FIG. 4b), air will freely flow into the oven because of the negative pressure existing within the oven, and thus no air feeding device is necessary. However, in cases where a great amount of air is required as in the case of the combustion of the plastic waste, means for force feeding air into the oven is required. The flow rate of the air entering may be easily regulated. It should be noted, however, that the lower portion of the oven may be sealed airtight to force the air into the oven through the layer of the mineral pebbles or grains. However, the combustion air need not necessarily be supplied through the layer of mineral pebbles or crushed rock. Part or all of the combustion air may be supplied through other portions of the oven bottom and/or side walls, but at least part of the combustion air should preferably be supplied from beneath the layer of pebbles.

The layer of the pebbles or grains should be from about 5 to about 100 cm in depth. The surface portion of the pebble layer is heated by the combustion of the rubbish while the lower portion of the layer is at a lower temperature, cooled by the air supplied from beneath the layer. If required, the pebble layer may be made so

deep that the melt of the plastic waste will not reach the conveyor due to the melt becoming solidified within the pebble layer. The molten plastic generally remains on the surface of the pebble layer, and thus undergoes complete combustion. It should be apparent that the metallic surface of the conveyor will not encounter corrosive gas because of the air passing through the layer of the pebbles and because of the negative pressure prevailing inside the oven.

It is preferred that the mineral pebbles or fragments be of such a size which will provide ample void space within the layer so as to permit the free passage of air therethrough. The pebbles etc. may be any material of a nature which can withstand the elevated temperature. Quartz pebbles commonly found in alluvial deposits are suitable. Crushed granite, etc., is also satisfactory.

As is apparent from the foregoing description, the moving bottom incinerator of the present invention, formed of non-combustible materials, e.g. crushed rock or pebbles, is well suited for the incineration of plastic waste having a high calorific value and which generates corrosive gas. Another advantage is, by means of the moving bottom, the combustion residue is continuously removed, and the speed of the conveyor may be adjusted in accordance with the type of rubbish to be incinerated. The apparatus of the present invention is ideally suited for the incineration of municipal rubbish and like materials.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

We claim:

1. An incineration furnace comprising:

a housing;
means constituting a movable bottom portion of said housing;
means for depositing a support material selected from pebbles and crushed rock onto said movable bottom portion to form a layer thereon;
means for moving said bottom portion and said layer of support material transversely along said housing into a rubbish or waste combustion stage and through an outlet in said housing;
means for introducing rubbish or waste onto the top of said layer prior to said combustion stage;
means for burning said rubbish or waste within said housing to produce an incombustible residue; and
means for closing off space above said layer at said outlet so as to obstruct air from entering the housing through said outlet while permitting withdrawal of said support material together with said incombustible residue therefrom.

2. The furnace of claim 1 additionally comprising means for separating said support material from said residue.

3. The furnace of claim 1 wherein said means for moving said support material along the bottom of the furnace comprises at least one endless belt having an upper run and a lower run.

4. The furnace of claim 1 wherein said means for moving said support material along the bottom of the

5

furnace comprises a plurality of endless belts arranged in stepped fashion so that the waste or rubbish is sequentially transferred from an upper endless belt to the next adjacent lower endless belt.

5. The furnace of claim 3 wherein said endless belt 5 has a plurality of aperatures and wherein said furnace additionally comprises means for introducing combustion air through said aperatures.

6. The furnace of claim 5 wherein said endless belt 10 is in the form of a plurality of metal strips coupled to each other.

7. The furnace of claim 1 wheren the bottom of the furnace is a stationary metal support.

8. The furnace of claim 7 wherein said metal support 15 has a plurality of aperatures and wherein the furnace additionally comprises means to introduce combustion air upwardly through said aperatures.

6

9. A process for the incineration of rubbish or waste in a furnace comprising:

forming a layer of an incombustible support material selected from pebbles and crushed rock on a bottom portion of the furnace;

moving said layer through the furnace at a predetermined rate;

supplying the rubbish to be burned to the surface of said layer; and

burning said rubbish within the furnace.

10. The process of claim 9 additionally comprising introducing at least a portion of the combustion air into the furnace upwardly through said layer.

11. The process of claim 9 wherein said moving is intermittent.

* * * * *

20

25

30

35

40

45

50

55

60

65

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,861,331 Dated January 21, 1975

Inventor(s) Shigeru Saitoh et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 4 after "oven." the following was omitted:

--If necessary to achieve complete combustion, a second or third combustion chamber having subsidiary burners may be provided in series.--

Signed and sealed this 6th day of May 1975.

(SEAL)

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks