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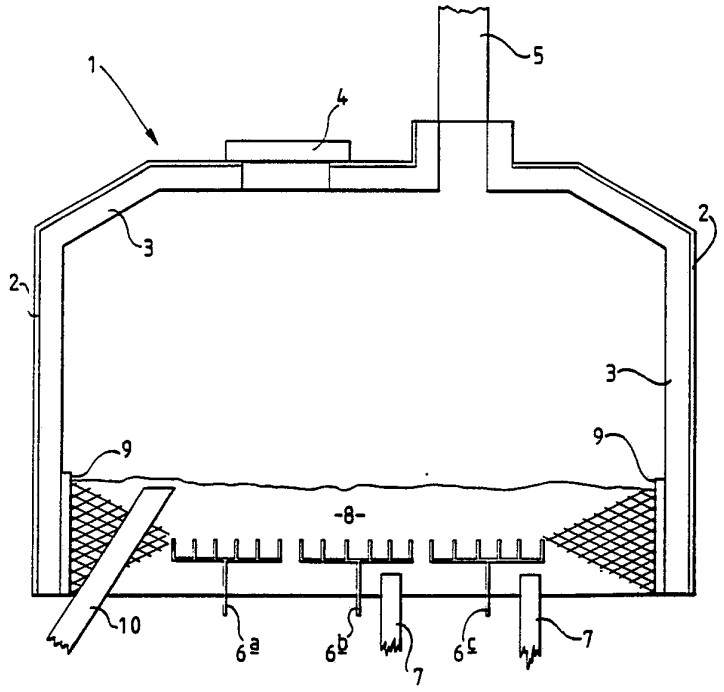
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(54) Title: INCINERATION APPARATUS



(57) Abstract

Incineration apparatus for incinerating a particulate material comprises a furnace housing (2), feeding means (7) for feeding the material to be incinerated into the housing (2), and gas supply means (6a-c) for introducing a gas into the material in the lower part of the housing (2) so as to form a fluidised bed (8). The gas supply means (6a-c) is spaced from the walls of the furnace housing (2) such that the walls are insulated from the fluidised bed (8) by particulate material not in a fluidised state.

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Title : Incineration Apparatus

This invention relates to apparatus for the incineration of granular or particulate material, in particular to apparatus for the thermal reclamation of a material such as foundry sand.

Used foundry sand may be subjected to reclamation so that it can be re-used in foundry processes. Such reclamation can take the form of mechanical attrition, whereby the sand is broken down into grain-size particles. However, used foundry sand contains a high proportion of chemical bonding agents, eg phenolic resins, and after a while these agents reach such a level that the properties of the sand deteriorate, even with mechanical reclamation. Consequently, there is a need for a thermal reclamation technique whereby the chemical agents are incinerated, leaving relatively clean sand. Such thermal reclamation is typically conducted in a furnace having a fluidised bed.

In a fluidised bed furnace, material to be treated is fed in and incinerated, the waste gases escaping through a flue stack at the top of the furnace. The reclaimed material is removed either periodically or continuously. The reaction may be substantially self-sustaining. That is to say, in theory at least, once the combustion process has reached a steady state from start-up (typically at around 800°C), there is no need to supply significant amounts of fuel gas since the combustion is supported by burning of the chemical agents.

Since furnaces of this type are subjected to considerable variations in temperature, yet must be completely air-tight in the fluidised zone, considerable problems are encountered with cracking or even collapse due to thermal expansion. Hitherto, attempts have been made to overcome these problems by constructing the walls of the furnace of specially shaped refractory concrete. Alternatively, the fluidised bed has

been enclosed in a stainless steel tank, which may be corrugated, having an external jacket of insulating material, such as ceramic fibre, with minimal thermal expansivity, the remainder of the furnace comprising a steel casing also lined with ceramic fibre.

Furnace designs of this kind suffer from a number of disadvantages. They are, for example, relatively complex and costly to manufacture. In addition, maintenance is difficult and costly to carry out.

There has now been devised an incineration furnace including a fluidised bed which overcomes or substantially mitigates the above-mentioned problems.

According to the invention, there is provided incineration apparatus for incinerating a particulate material, the apparatus comprising a furnace housing, feeding means for feeding the material to be incinerated into the housing, and gas supply means for introducing a gas into the material in the lower part of the housing so as to form a fluidised bed, the gas supply means being spaced from the walls of the furnace housing such that the walls are insulated from the fluidised bed by particulate material not in a fluidised state.

The apparatus according to the invention is advantageous primarily in that it is of relatively simple, and hence inexpensive construction. There is no requirement for the use of a stainless steel tank or refractory concrete to contain the fluidised bed. There are also relatively few components in the overall structure and very few components which are subject to any requirement for maintenance.

The apparatus according to the invention may be used for the incineration of a wide range of particulate materials, but is of particular utility in the thermal reclamation of a base

material from a mixture of that material with a combustible substance. One example of such a base material is foundry sand. Another material which may be incinerated using the apparatus according to the invention is dewatered sewage.

The gas supply means preferably comprises a suitable arrangement of pipes fitted with, for example, nozzles or bubble caps.

Generally, the spacing between the gas supply means (eg the nozzles) and the walls of the furnace housing should be sufficient to ensure adequate insulation of the walls from the fluidised bed. The required spacing will depend on, for example, the depth of the fluidised bed and the nature of the particulate material forming the insulating layer between the fluidised bed and the walls.

The fluidised bed may be formed wholly of the material being incinerated, or of a separate medium, eg sand. Similarly, the material forming the insulating layer may be material to be incinerated or some other particulate material.

The furnace housing is preferably of mild steel, and is preferably lined with a material of minimal thermal expansivity. One such suitable material is ceramic fibre which may be secured to the walls of the housing by conventional means. The insulating lining may include an impervious membrane, eg a stainless steel foil, to prevent combustion products condensing on the internal surface of the furnace housing.

In the lower part of the furnace housing, a barrier is preferably interposed between the ceramic fibre lining and the insulating layer of granular material to prevent penetration of that material into the ceramic fibre. The barrier may be, for example, a vacuum-formed ceramic fibre board.

The material to be incinerated may be fed directly into the lower part of the fluidised bed as described in our co-pending UK patent application no 2244939A, in which case the material may be fed into the fluidised bed from below the latter. Alternatively, the material may be fed onto the bed from above by conventional means.

Conveniently, the material is fed to a confined space beneath the fluidised bed by means of a mechanical conveyor. Alternatively, the material can be fed to the fluidised bed by a pneumatic conveyor, and is preferably injected into the bed at substantially the same level as the fluidising gas.

In cases where the material is fed to the fluidised bed in batches, a plurality of feeds is preferably provided which operate in sequence. For example, where two such feeds are provided, these can operate alternately.

Advantageously, the feeding means includes a plurality of pneumatic conveyors each of which feeds the material to the fluidised bed in batches, and means to operate the pneumatic conveyors in sequence.

The invention will now be described in more detail, by way of illustration only, with reference to the accompanying drawing, in which

Figure 1 shows a sectional side view of a thermal reclamation apparatus according to the invention.

Referring to Figure 1, a thermal reclamation apparatus (generally designated 1) according to the invention comprises a generally bell-shaped furnace housing 2 of mild steel. The furnace housing 2 is lined with a layer 3 of closely packed ceramic fibre which is secured to the housing 2 by hooks and skewers (not shown) in a conventional manner. At the top of the housing 2 there are provided an access door 4 for

maintenance and a stack 5 through which flue gases can escape.

Within the lower region of the housing 2, and inwardly spaced therefrom, there are provided three air/gas manifolds 6a-c of conventional form, comprising pipes fitted with bubble caps. Material to be reclaimed is introduced from below through pneumatic conveyer pipes 7 and forms a bed 8 at the base of the apparatus. A layer of vacuum-formed ceramic fibre board 9 is provided around the lower portion of the ceramic fibre lining 3 to prevent penetration of the material into the lining 3.

Air/gas introduced through the manifolds 6a-c fluidises the bed 8, except in the regions shown by cross-hatching. These latter regions act as an insulating layer between the fluidised bed 8 and the housing 2.

An exit chute 10 is located towards the left as shown in Figure 1 with its opening a short distance below the level of the bed 8.

In use, material to be reclaimed (such as a comminuted mixture of foundry sand and phenolic resin bonding agent) is fed from, for example, a silo or hopper (not shown), and introduced into the bed 8 via the conveyor tubes 7. The material thus enters the fluidised bed 8 from below, through the interstices between the bubble caps of the manifolds 6a-c. There is a net transport of material from right to left, material being introduced at the right and passing out of the furnace through the exit chute 10 at the left.

Claims

1. Incineration apparatus for incinerating a particulate material, the apparatus comprising a furnace housing (2), feeding means (7) for feeding the material to be incinerated into the housing (2), and gas supply means (6a-c) for introducing a gas into the material in the lower part of the housing (2) so as to form a fluidised bed (8), the gas supply means (6a-c) being spaced from the walls of the furnace housing (2) such that the walls are insulated from the fluidised bed (8) by particulate material not in a fluidised state.

2. Incineration apparatus as claimed in Claim 1, wherein the gas supply means (6a-c) comprises an arrangement of pipes fitted with nozzles or bubble caps.

3. Incineration apparatus as claimed in Claim 1 or Claim 2, wherein the spacing between the gas supply means (6a-c) and the walls of the furnace housing (2) is sufficient to ensure thermal insulation of the walls from the fluidised bed (8).

4. Incineration apparatus as claimed in any preceding claim, wherein the fluidised bed (8) is formed wholly of material being incinerated.

5. Incineration apparatus as claimed in any one of Claims 1 to 4, wherein the fluidised bed is formed of a separate medium such as sand.

6. Incineration apparatus as claimed in any one of Claims 1 to 4, wherein the material forming the insulating layer is material to be incinerated.

7. Incineration apparatus as claimed in any preceding claim, wherein the furnace housing (2) is of mild steel.

8. Incineration apparatus as claimed in any preceding claim, wherein the furnace housing (2) has a lining (3) of material of minimal thermal expansivity.

9. Incineration apparatus as claimed in Claim 8, wherein the lining (3) comprises ceramic fibre.

10. Incineration apparatus as claimed in Claim 8 or Claim 9, wherein the lining (3) includes an impervious membrane to prevent combustion products condensing on the internal surface of the furnace housing (2).

11. Incineration apparatus as claimed in Claim 10, wherein the membrane is a stainless steel foil.

12. Incineration apparatus as claimed in any one of Claims 8 to 11, wherein a barrier (9) is interposed between the lining (3) and the insulating layer of particulate material to prevent penetration of that material into the lining.

13. Incineration apparatus as claimed in Claim 12, wherein the barrier (9) is of vacuum-formed ceramic fibre board.

14. Incineration apparatus as claimed in any preceding claim, wherein material to be incinerated is fed directly into a lower part of the fluidised bed (8).

15. Incineration apparatus as claimed in Claim 14, wherein the material to be incinerated is fed to a confined space beneath the fluidised bed by means of a mechanical conveyor.

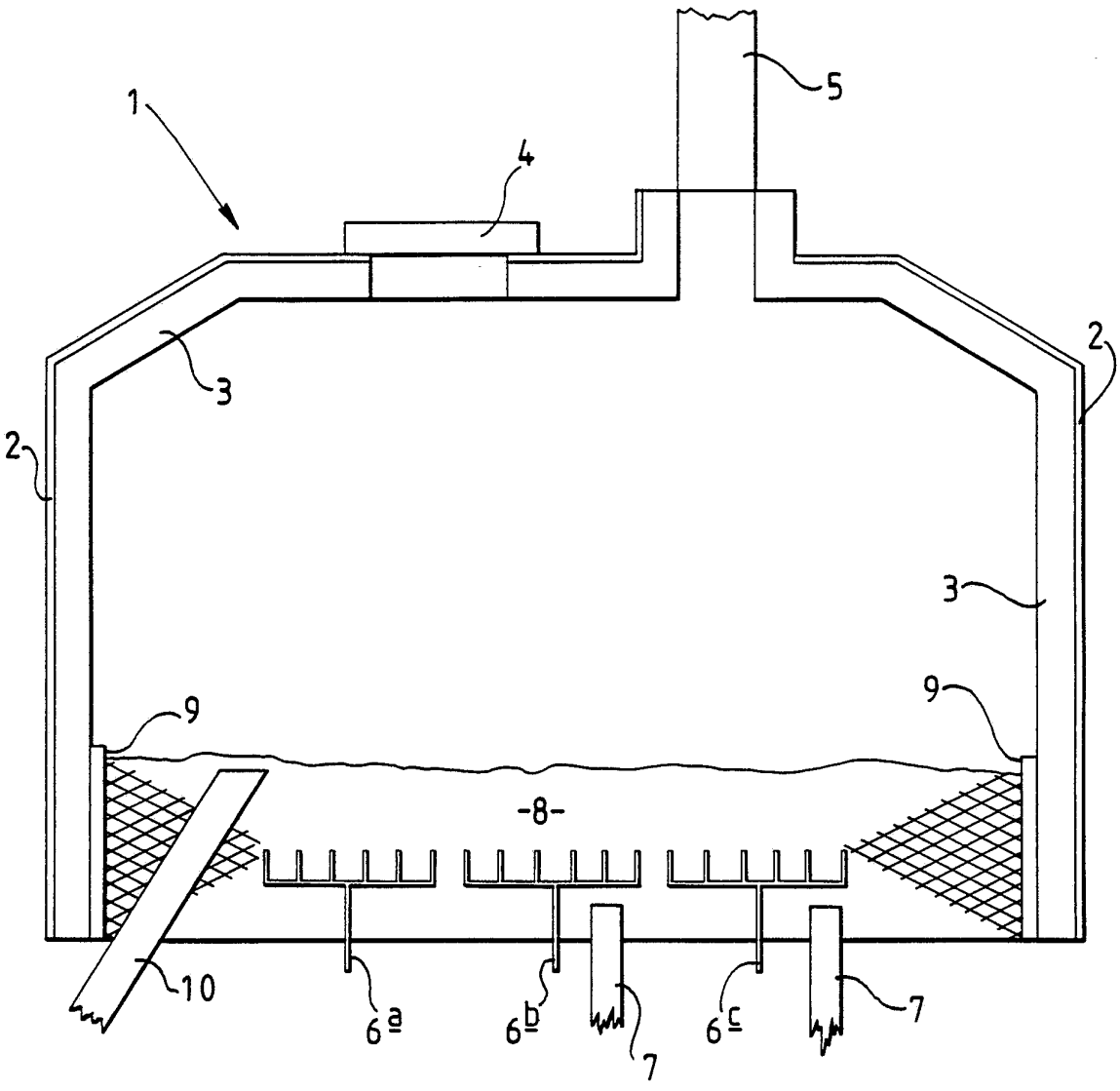
16. Incineration apparatus as claimed in Claim 14, wherein the material to be incinerated is fed to the fluidised bed (8) by means of a pneumatic conveyor, and is injected into the bed (8) at substantially the same level as the gas.

17. Incineration apparatus as claimed in any preceding

claim, wherein material to be incinerated is fed to the fluidised bed in batches, a plurality of feeds being provided which operate in sequence.

18. Incineration apparatus as claimed in any preceding claim, wherein the feeding means includes a plurality of pneumatic conveyors each of which feeds material to be incinerated to the fluidised bed in batches, and means to operate the pneumatic conveyors in sequence.

FIG 1



INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 92/02400

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B22C 5/18, F27B 15/06, F23G 5/30, F23C 11/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: B22C, F27B, F23G, F23C, C22B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG; WPI, CLAIMS, QUESTEL; EDOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4226830 (WILLIAM L. DAVIS), 7 October 1980 (07.10.80), column 8, line 28 - line 32; column 8, line 44 - line 48; column 10, line 16 - line 19, figures 1,2b, abstract	1-9
Y	--	10,11,14-18
Y	EP, A1, 0248674 (ENCOMECH ENGINEERING SERVICES LIMITED), 9 December 1987 (09.12.87), figure 2, abstract	10,11
Y	--	
Y	GB, A, 2244939 (RICHARDS ENGINEERING LTD), 18 December 1991 (18.12.91), figures 1,2,3, claims	14-18
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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16 March 1993	29. 04. 93
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Dialog Information Services, File 351, World Patent Index 81-93, Dialog accession no. 007106485, WPI accession no. 87-106482/15, ASEA STAL AB: "Power plant with fluidised bed has combustion chamber forming part of bed vessel, whose walls comprise panels of tubes and plates" SE 8601836, A, 861212, 8715 (Basic) --	1-3,5
X	Patent Abstracts of Japan, Vol 12,No 448, M-768, abstract of JP, A, 63-180340 (NIPPON KOKAN KEISHIYU K.K.), 25 July 1988 (25.07.88) --	1-4,6
X	US, A, 4645452 (JEAN-PIERRE HENIN ET AL), 24 February 1987 (24.02.87), column 2, line 59 - line 65, figure 2 --	1-4,6

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INTERNATIONAL SEARCH REPORT

Information on patent family members

26/02/93

International application No.
PCT/GB 92/02400

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4226830	07/10/80	NONE	
EP-A1- 0248674	09/12/87	NONE	
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