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Sigg

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[54] **APPARATUS FOR BURNING WASTE MATTER**

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Apr. 29, 1971 Switzerland 6300/71

[52] **U.S. Cl.** ..... **110/8 R**, 110/32

[51] **Int. Cl.** **F23g 5/00**

[58] **Field of Search** 110/7, 8, 15, 32, 33, 38, 74

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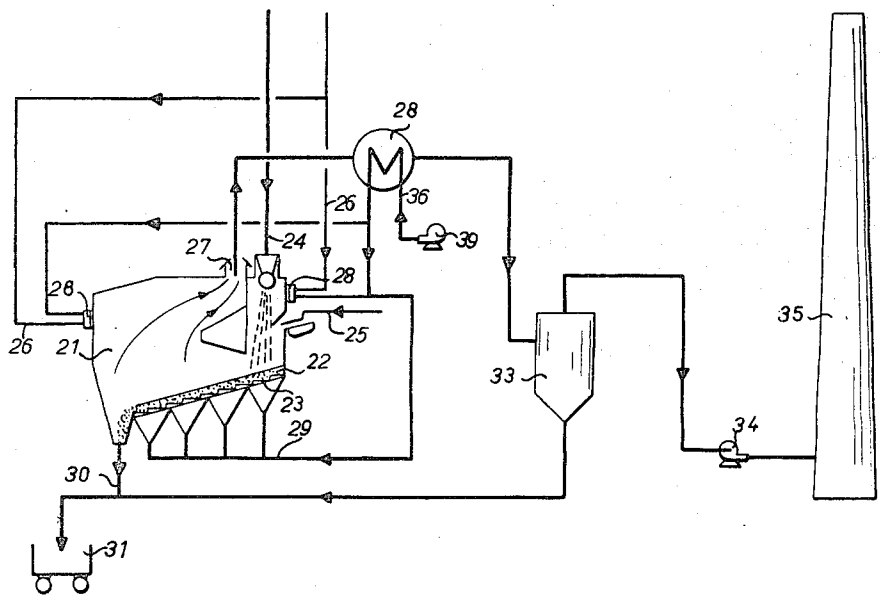
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[57] **ABSTRACT**

Apparatus for burning waste matter in a combustion chamber comprising a feed bed with a plurality of stepped sections. Combustion air is introduced in the region of the transition from one stepped section to the next. The upper sides of the stepped sections are closed and the sections lie on an inclined frame which is connected to a vibrator.

8 Claims, 8 Drawing Figures



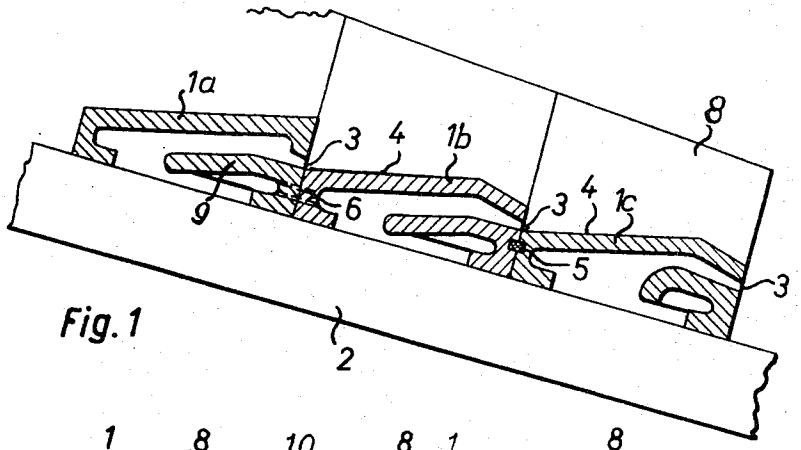


Fig. 1

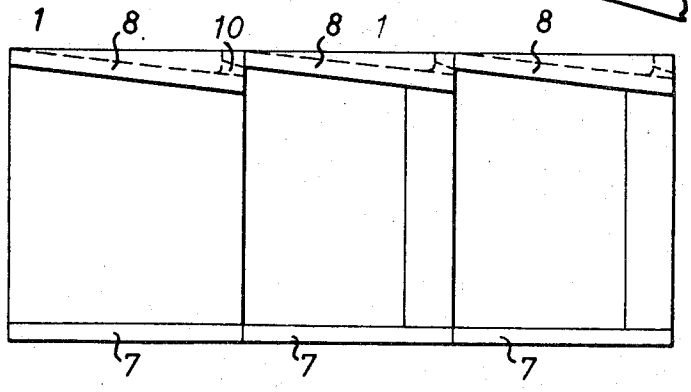


Fig. 2

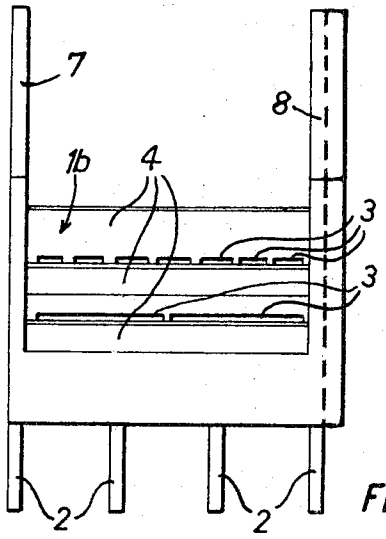


Fig. 3

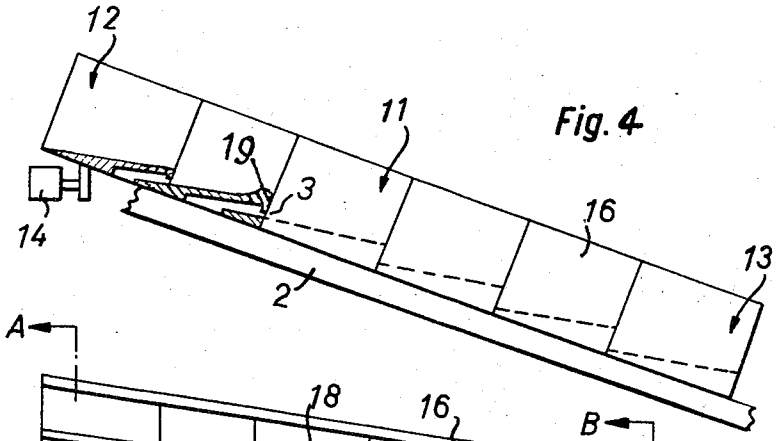


Fig. 4

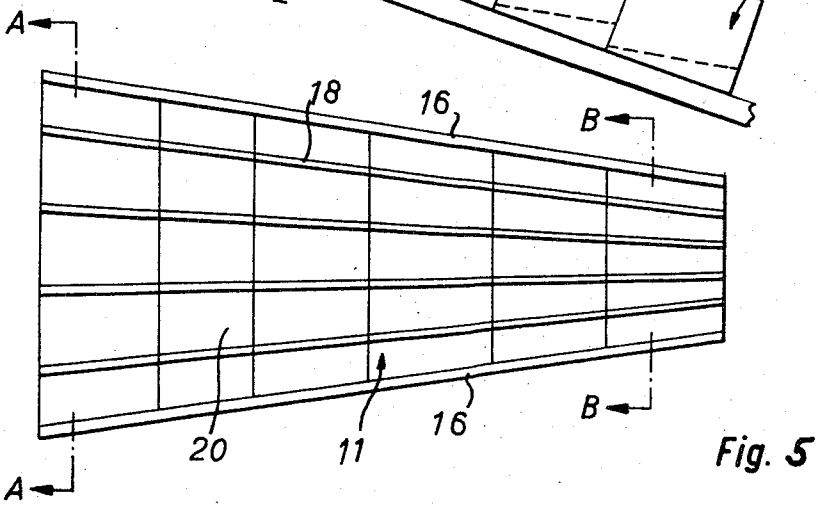


Fig. 5

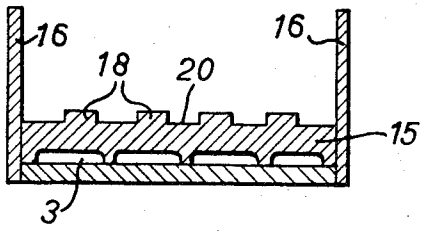


Fig. 6

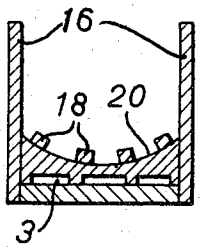


Fig. 7

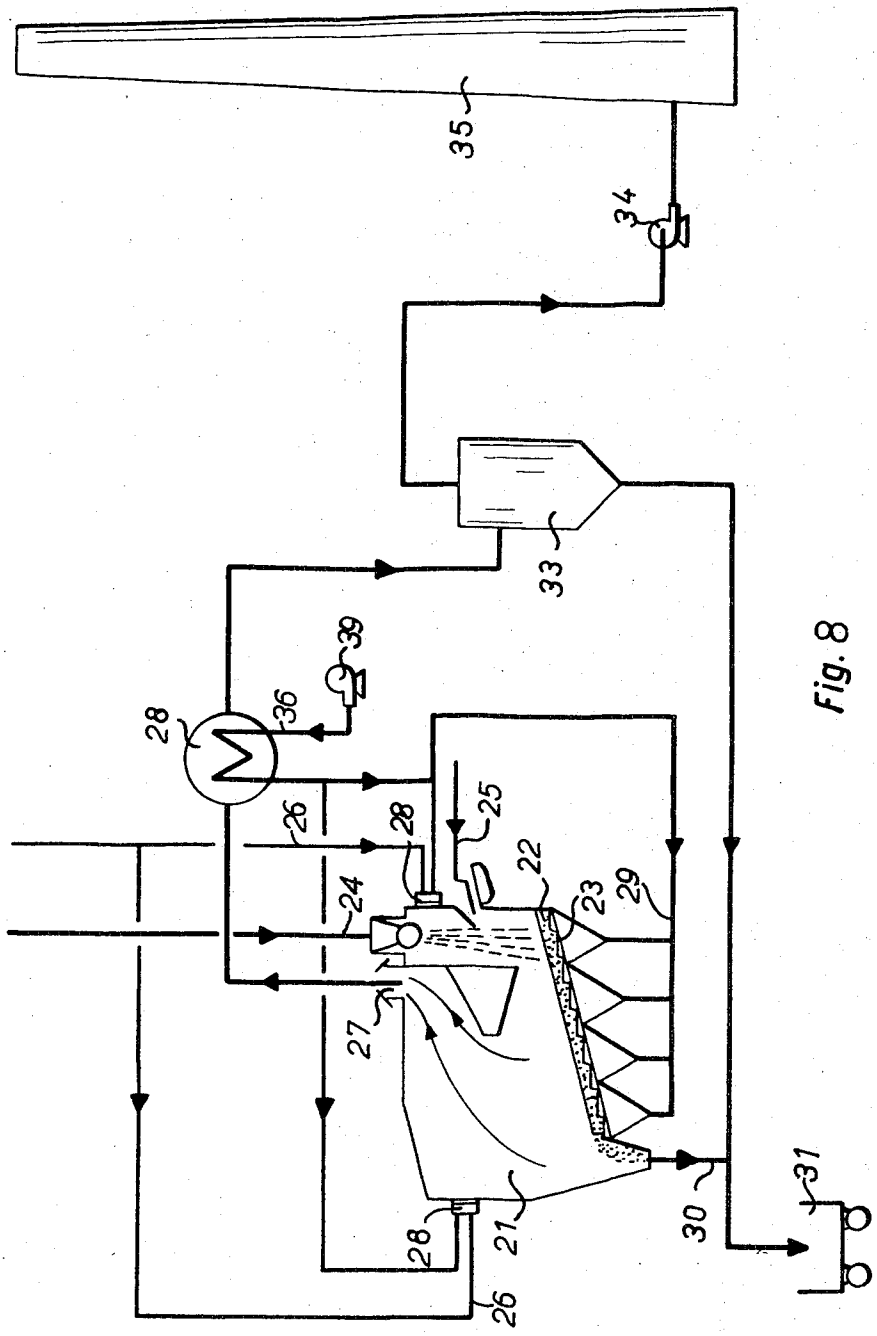


Fig. 8

APPARATUS FOR BURNING WASTE MATTER

The invention relates to an apparatus for burning waste matter, such as refuse, rubbish, sludge and the like.

PRIOR ART

In previously known systems for burning waste matter the burning material generally lies on a grate which has downwardly directed openings through which the air for combustion reaches the burning material. This grate usually consists of stationary parts and movable parts. Through a suitable reciprocating movement the burning material is moved along the grate from an entry point to a discharge point.

The disadvantages of these known systems consist firstly in that, at the parts which move relative to one another, the moving grates have gaps which enable material to fall through, while on the other hand they are subject to considerable mechanical and thermal stressing and wear. Moreover another disadvantage consists in that the feed mechanism for the burning material must be situated in the fire chamber and is consequently subject to thermal stressing.

It is accordingly a first object of the invention to provide an apparatus or equippment for burning solid waste matter, pulpy or pastelike substances and sludge, which hitherto entailed the risk that they might pass between the grate openings.

Another object of the present invention is the provision of an improved arrangement, which can be made mechanically very simple and can be produced at a relatively low cost.

A further object of the present invention is to provide an apparatus in which the speed for burning of waste matter can be substantially increased over that possible with prior art mechnism.

SUBJECT MATTER OF THE INVENTION

A more specific object of the present invention is to provide an apparatus for burning waste matter comprising a feed bed consisting of a plurality of hollow stepped sections, means for introducing combustion air in the region of the transition from one stepped section to the next, the upper sides of the stepped sections being closed, neighboring stepped sections lying against one another or overlapping at their end faces to prevent the waste matter or the residue thereof from falling therebetween.

The features of this invention together with further objects and advantages thereof, may be best understood by reference to the accompanying drawings, wherein:

FIG. 1 is a diagrammatic vertical section through a first embodiment of an apparatus for burning waste matter, with stepped sections of different constructions,

FIG. 2 is a diagrammatic plan view of the apparatus shown in FIG. 1,

FIG. 3 is a diagrammatic front view of the apparatus of FIGS. 1 and 2,

FIG. 4 is a side elevation, partly in section, of a modified embodiment of an apparatus for burning waste matter. FIG. 5 is a plan view of the apparatus shown in FIG. 4,

FIG. 6 is a section on the line A—A in FIG. 5 and

FIG. 7 is a section on the line B—B in FIG. 5,

FIG. 8 is a general view of a combustion installation.

The embodiment of the apparatus for burning waste material, such as refuse, rubbish, sludge, illustrated in FIGS. 1 to 3, is incorporated in a combustion plant which may be provided with a multi-purpose burner. A combustion plant of this kind may however also be used for burning plastics materials, or for the cremation of animal corpses. It has a feed bed with a plurality of hollow stepped section 1*a*, 1*b*, 1*c*, which are closed at the upper side 4 and are disposed like a staircase. These stepped sections are fastened rigidly on a vibrating frame 2. The waste material to be burned is poured onto the uppermost step 1*a* of the feed bed, and during burning passes downwards from step to step in the form of burning material or a fire bed. The required air for combustion is fed from below the stepped sections through passages and passes out through slots 3 on passing from one stepped section to the next. These slots 3, or outlet nozzles, are situated directly at the height of the upper side 4 of the next following lower stepped section.

In FIG. 1 three different kinds of stepped sections 1*a*, 1*b* and 1*c* are illustrated. As a rule, however, only a single kind of stepped section is used in one combustion apparatus. The inclination of at least a part of the upper side 4 of the individual steps is oppositely directed to the inclination of the frame 2 which is preferably about 15°. In order to prevent waste material or the products of combustion from falling through at the divisions between the end faces of neighboring step sections 1*a*, 1*b*, 1*c*, the stepped sections are joined tightly to one another either by a transverse bar 5 or by being pulled close to one another by means of screws 6 or other fixing elements.

The individual stepped sections are hollow and, as the air for combustion enters from the lower side, heat exchange takes place. A deflector 9 projects into the interior of the cavity of the stepped sections and deflects the current of air, while at the same time enabling the air to flow in substantially without turbulence and practically parallel to the upperside 4 of the stepped sections.

The steps 1*b* and 1*c* have an upper side 4 with ribs. In the case of the combustion of liquid or paste-like waste matter it is however convenient for a transverse bead 19 to be provided at the outer end of the stepped sections (FIG. 4). The deflector 9 is so shaped that over at least part of its length it is situated at a higher level than the upper surface 4 of the next lower stepped section, in order to prevent a return flow.

Upwardly projecting guide plates 7, which are provided on one side of the stepped sections, form a flat wall, while guide plates 8, which are provided on the other side, have a staircase-like stepped profile. Moreover, additional air for combustion may optionally pass out through gaps 10 between the guide plates.

In the alternative embodiment illustrated in FIGS. 4 to 7, the waste material passes gradually from an inlet 12 to an outlet 13, from which the residue, ashes or slag are removed. A feed bed 11 is provided with a vibrator 14, by which it is kept in continuous or intermittent movement, so that the burning material moves downwards through the action of the vibrations. The individual steps are slightly inclined towards the outlet 13.

Vertical side walls 16, which laterally bound the burning material, converge in the direction of move-

ment, the width of the feed bed decreasing in the direction of the outlet 13 in the embodiment illustrated in FIG. 5. Since the height of the layer of waste material decreases as the combustion process progresses, it is convenient for the width of the feed bed to decrease in the direction of the outlet 13.

When special circumstances exist, however, it is also possible for the width of the feed bed to increase in the direction of movement, that is to say in the downward direction.

In order to guide the burning material, which is moving downwards in the direction of movement through the action of the vibrations, towards the longitudinal centre, there are provided on the upper side 20 of stepped sections 15 ribs 18 which are likewise convergent in accordance with the varying width of the feed bed, as can be seen in FIG. 5.

From FIG. 6 and 7 it can be seen that not only the width but also the cross-sectional shape of the feed bed vary in the direction of movement. Near the inlet 12, the upper side of the stepped sections 15 extends substantially horizontally and straight, viewed in cross-section, whereas in the direction of the outlet 13 it gradually merges into a curved, concave shape.

It is preferable for the stepped sections to be made of a compacted refractory mineral material which sets chemically. Ceramic compositions which have good resistance to acids have been found satisfactory as compacted materials. It is also possible for the individual stepped sections to be formed by producing a skeleton of metal which is enclosed in or lagged with a compacted material.

The two side walls 16 and the stepped sections 15 are preferably in one piece.

The material to be burned is advanced continuously through the action of the vibrator. Brief interruptions, or the throttling of the vibrations, are also possible. Furthermore the vibrator may be operated with a variable amplitude or frequency in order to achieve slower or faster advance of the burning material. In addition it is also possible for the vibrator to be fastened pivotally, so that its vibrations act more in the direction of advance of the burning material or, for the purpsoe of throttling the advance, more in the vertical direction.

The stepped sections 1*a*, 1*b*, 1*c* and the side walls 16 are conveniently made of heat-resistant cast iron, steel, or cast alloy steel.

Instead of the gap between two neighboring step sections being disposed at the step riser, a construction would also be possible in which the deflector 9 is in one piece with the part 1*a* or 1*b* or 1*c* following in the direction of movement. Here again the highest point of this deflector 9 should be at a higher level than the following upper side 4 or of the cross-rib 19, where the latter is provided.

FIG. 8 shows a schematic illustration of a combustion installation with a combustion chamber 21. Solid waste is entered in the inside of the combustion chamber 21 by transporting means 25 and sludge or the like is entered by a pipe 24 at a predetermined rate. Fuel gas pipes 26 and air pipes 36 are discharging into burners 28 so that a high temperature is generated in the combustion chamber 21. The waste or sludge forms a burning fluidized bed 22 on the stepped sections 23, which corresponds to the step sections 1*a*, 1*b* or 1*c* of FIG. 1. To assist the burning process air is blown by a blow-er or fan 39 via a pipe 29 from the underside of the frame to the outlet nozzles or slots 3 of the stepped sections. The ash 30 is collected in a fly ash conveyor 31. The uncleaned exhaust gas leaving the combustion chamber 21 is collected by a flue or smoke gas cap 27 and passes then through a heat exchanger 28 and a multi-cyclone 33 and is then guided to an induced draught fan 34 into a chimney exhaust 35.

It will be readily apparent to those skilled in the art that a wide variety of such apparatuses might be provided without departing from the spirit of this invention.

I claim:

1. Apparatus for burning waste matter comprising;
a longitudinally inclined feed bed carrier provided with means for vibrating said carrier;
a plurality of hollow step-forming sections mounted in fixed positions transversely on said carrier so as to present a support surface for said waste matter that is substantially continuous except for openings in the risers of said stepped surface;
said step-forming sections being shaped so that, as disposed on said carrier, their forward edges are lower than their junctions with the bottom of the riser of the next higher step-forming section and shaped so that openings are formed in the risers communicating with the interior of said sections and so that the floor of said openings rises rearwardly so as to oppose flow of waste matter from the stepped surface rearwardly into the openings;
means for introducing combustion air into the space between said carrier and said stepped sections for supplying said air through said riser openings to the combustion of said waste matter, and
retaining side walls mounted in fixed positions on said carrier and extending above said stepped surface on either side to prevent sideways escape of said waste matter.

2. Apparatus according to claim 1, in which the width of the feed bed decreases in the direction of movement of the burning material, converging longitudinal ribs being provided on the upper side of the feed bed.

3. Apparatus according to claim 1, in which the cross-sectional shape of the feed bed varies in the direction of movement of the burning material, the support surface of the feed bed being transversely flat at the top and merging at the bottom into a concave shape.

4. Apparatus according to claim 1, in which the stepped sections are made at least partly of a compacted refractory mineral ceramic material.

5. Apparatus for burning waste matter as defined in claim 1, in which said step-forming sections have an interior shape such that said combustion air streams out of said openings in a direction substantially parallel to the top surface of the adjacent step.

6. Apparatus for burning waste matter as defined in claim 1, in which said step-forming sections have a lower portion shaped so as to meet tightly and to extend the surface of the next lower section and thereby to provide the rearwardly rising floor for said riser openings and further shaped so as to provide a deflector for causing the combustion air supplied to said openings to stream substantially parallel to the surface of said next lower step.

7. Apparatus for burning waste matter as defined in claim 1, in which said step-forming sections overlap, so that the overlapped portion of a lower section provides

the rearwardly rising floor for said riser openings and also a deflector for causing the combustion air supplied to said openings to stream substantially parallel to the top surface of said lower section.

8. Apparatus for burning waste matter as defined in claim 1, in which at least one of said side walls is of

stepped form providing shallow downstream-facing risers having additional combustion air orfices, and in which means are provided for supplying a flow of air through said additional orfices.

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