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(54) **A granular fuel-fired boiler brazier**

(57) A granular fuel-fired boiler brazier (20) of the type having a brazier base (21) movable periodically from an operative position retaining fuel and ash F in the brazier to a discharge position, shown partially open to allow ash contents F to fall out of the brazier (20). Fragmentation means (35) operate on moving the base to break up the fuel and ash contents F.

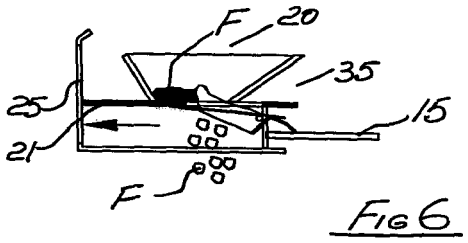


Fig 6

EP 2 187 122 A1

Description

Introduction

[0001] The present invention relates to a granular fuel-fired boiler brazier comprising a base and upstanding side walls, the base being movable from an operative position retaining fuel in the brazier to a discharge position to allow the ash contents to fall out of the brazier.

[0002] Such granular fuel-fired boilers are generally enclosed water heating boilers comprising walls forming a combustion chamber enclosure, hollow heat exchangers arranged for carrying water to be heated, usually provided by at least portion of the walls of the combustion chamber which are hollow water containing walls, and the assembly further comprises at least one granular fuel burner boiler assembly of the type comprising a brazier fed with a granular fuel and a burner to ignite the fuel.

[0003] In this specification, the term "granular fuel" is used to include not only granular fuel such as wood pellets formed from wood sawdust, but also other solid materials such as ground or semi-shredded husks of maize and similar products, together with particles of combustible waste material and other recognised fuels such as coal, peat and similar materials. In many such constructions, the granular fuel is on a brazier and an electric element is used to heat the granular fuel, very often wood pellets, until the wood or other granular fuel spontaneously ignites. There are problems with the granular fuel in that, very often, the granular fuel, as it burns, forms a relatively solid substance, essentially "a caked ash" which, instead of falling out the brazier when the base of the brazier is moved to empty the brazier, simply stays in position. The brazier then, over time, gradually fills up with ash, the combustion air is blocked and finally unburned fuel falls out of the brazier to burn at the base of the boiler leading to incomplete combustion and unwanted smoke. This problem is exacerbated with fuels that are not of a relatively cohesive construction. Indeed, the problem is exacerbated with some of the granular fuels hereinbefore described but is particularly exacerbated with wood pelleted fuel.

[0004] It is long appreciated that an open brazier which can be relatively deep is by far and away the best type of container for a combustion chamber. Because of the problems with an open brazier of the type hereinbefore described, it has been known to provide burner assemblies in which the combustion takes place in an elongate tube, usually double-jacketed, the inner jacket having holes for secondary air, with air and fuel intake at a proximal end and ash discharged at a distal end. Ignition in such burner assemblies is by glow plugs, electric elements or hot air. There are certain problems with these burner assemblies. Ash removal is either by blowing the products of combustion out the distal end or by some form of pusher blade assembly which is operated intermittently to push all the ash and other products of combustion out the distal end. Unfortunately, in such constructions, the fuel tends to be delivered out of the burner before full combustion takes place and often lies on the bottom of the boiler causing incomplete combustion and then further combustion resulting in more ash and smoke due to burning on the base of the boiler.

[0005] There is also the problem that such constructions are unable to handle fuels when such fuels are not uniform. For example, it is not unusual to find that the requirements for such a wood pelleted boiler require sawdust pellets to have a diameter of the order of 6mm to 8mm and not more than 30mm in length. Thus, to obtain relatively good combustion, a cohesive product is essential.

[0006] The present invention is directed towards overcoming the problems of the use of braziers of the type hereinbefore described while, at the same time, having the advantages of burning fuel within the brazier where the coherence and composition of the fuel is not of major importance.

Statements of Invention

[0007] According to the invention, there is provided a granular fuel-fired boiler brazier comprising a base and upstanding side walls, the base being movable from an operative position retaining fuel in the brazier to a discharge position to allow the ash contents to fall out of the brazier and fragmentation means whereby on moving the base to the discharge position, the fragmentation means move to break up the ash contents of the brazier. This is a particularly useful construction because there is now prevented any possibility of the caking of ash and it bridging across the brazier and not falling through as it should on discharge.

[0008] In one embodiment of the invention, the fragmentation means comprises a spring biased pivotal arm connected to the brazier whereby on moving the base into the discharge position, the arm pivots to project into any of the ash contents in the brazier (through the space previously closed off by the base). The advantage of a spring is that there is a relatively sharp projection of the fragmentation means into the ash so that the ash tends to be readily broken up. It is not, by any means, difficult to break, however, the sharp movement caused by the spring is advantageous in that the fragmentation means is more likely to project into the ash, than to simply push the ash upwards.

[0009] In another embodiment of the invention, the fragmentation means comprises an arm pivotally mounted intermediate its' ends carrying adjacent its proximal end a fragmentation device and adjacent its' distal end a counterweight, the fragmentation device being retained in a lowered position by a retention plate until the base moves to the discharge position when the fragmentation device is moved under the influence of the counterweight to project into any of the ash contents in the brazier. This again is a particularly advantageous construction.

[0010] In a still further embodiment of the invention,

the fragmentation means comprises an arm pivotally mounted intermediate its' ends carrying adjacent its proximal end a fragmentation device and adjacent its' distal end a counterweight, the counterweight being retained in a raised position by a stop member connected to the base until the base is moved to the discharge position. The counterweight is useful in the sense that it does not deteriorate and is not likely to damage, such as possibly a spring might, although to date there have been no problems in relation to the spring, in the sense that the spring is mounted below the brazier and is therefore not subject to the full heated combustion.

[0011] In one embodiment of the invention, the fragmentation means further comprises a plate terminating in an arcuate bull-nosed ash contents penetrating tip. Ideally, three side-by-side and spaced-apart plates are provided.

[0012] In this latter embodiment, the plates may comprise a central plate and two outer plates inclined outwardly away from the central plate.

[0013] In a still further embodiment of the invention, the fragmentation means comprises an ash engaging crushing tooth mounted on and projecting upwardly from the base whereby, on moving the base to the discharge position, the tooth pushes the ash contents across the brazier and crushes it. The advantage of a crushing tooth in this construction is that it moves easily with the base in operation.

[0014] In one embodiment of the invention, in the operative position, the crushing tooth lies along a side wall.

[0015] In another embodiment of the invention, the ash engaging crushing tooth projects into a through receiving slot in the side wall in the operative position.

[0016] In a modification of this latter embodiment, there is a further ash engaging crushing tooth spaced-apart from the other ash engaging arm and projecting into a through receiving slot in an opposite side wall.

[0017] Where crushing teeth are used, a clearance gap may be provided between the arm and its respective receiving slot to provide an air inlet. The advantage of this is that it allows for a good ventilation, it ensures that air holes will not get blocked and further, ensures the cooling of the crushing teeth.

[0018] In another embodiment, there may be a plurality of crushing teeth and receiving slots in the side wall.

Detailed Description of the Invention

[0019] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a side diagrammatic view of a wood pellet boiler incorporating a brazier assembly according to the invention,

Fig. 2 is a perspective view of the brazier assembly,

Fig. 3 is an end view of the brazier assembly in the direction of the arrows III-III of Fig. 1,

Fig. 4 is a side view of the part, enclosed by the interrupted lines in Fig. 1, of a conventional brazier assembly, similar to the brazier assembly according to the invention,

Fig. 5 is a side diagrammatic view of the enclosed portion of Fig. 1 showing the brazier of the invention in the position of use during combustion,

Fig. 6 shows the brazier of Fig. 5 partially opened,

Fig. 7 shows the brazier of Fig. 3 fully opened and emptied,

Fig. 8 is a view similar to Fig. 2 of an alternative construction of brazier according to the invention, and

Fig. 9 is a view similar to Figs. 2 and 8 of a still further construction of brazier according to the invention.

[0020] Referring to the drawings and initially to Figs. 1 to 7 inclusive, there is provided a granular fuel-fired boiler, indicated generally by the reference numeral 1 (see Fig. 1), comprising a base 2 and upstanding side walls 3. The boiler is divided into a combustion chamber 4 and a heat transfer and condensing unit 5, containing conventional boiler tubes and, for example, water filled walls. Mounted on the base 2 is an ash pan 6. All of this is conventional.

[0021] There is provided a wood pellet burner assembly, shown in Fig. 1, indicated generally by the reference numeral 10, details of which are not given, nor indeed is the actual burner itself. There is also illustrated a pelleted feed delivery tube 11, and an electromechanical motor 12, shown only in outline, housed in the wood pellet burner assembly 10 for operation of a granular fuel-fired boiler brazier according to the invention, which is identified by the reference numeral 20 and which brazier 20 is within the interrupted lines of Fig. 1. The electromechanical motor drives a connecting rod 15 fast on the brazier 20. The brazier 20 is illustrated in more detail in Fig. 2 and comprises a brazier base 21 and upstanding walls, namely, a front wall 22(a), two side walls 22(b) and a rear wall 22 (c) which are connected rigidly within the combustion chamber 4 by arms and supports (not shown). The brazier base 21 and upstanding side walls 22(a) to 22(d) have air holes 23. The base 21 which is not connected to the side walls 22 is connected to a support wall 25, at 26, the support wall 25 in turn projecting upwards on a base wall 26. The brazier base 21 is further mounted by support lugs 28 on the base wall 27. The base wall 27 has a discharge hole 29.

[0022] Mounted between the support arms 28, on a shaft 30, are three arms, namely a central pivotal arm 32 and outer pivotal arms 33 which form a fragmentation

means, indicated generally by the reference numeral 35. The two outer pivotal arms 32 are formed from the one sheet of material and are splayed outwardly. The central pivotal arm 33 is welded to the sheet intermediate the outer pivotal arms 32 and the sheet is bent to form a U-shaped rearwardly projecting arm support 36 which is further bent on itself to form a spring engaging ledge 37. A spring 39 is secured fast o the support wall 25, at 40, and bears down on the ledge 37 to bias the pivotal arms 32 and 33 upwards.

[0023] Referring now to Fig. 4, what happens conventionally, when the brazier according to the present invention is not used, the fuel builds up in the brazier assembly. The fuel is identified by the letter F. When the brazier base 21 is moved to allow ash to fall, instead of falling, the caked ash simply bridges across the gap and then gradually there is a build up of caked ash. When that build up of caked ash occurs, there is initially incomplete combustion as the air holes 23 in the base 21 become blocked. Then fuel being delivered into the brazier simply bounces out and eventually overflows onto the boiler base causing the difficulties, as explained above. However, in accordance with the present invention, as the server motor is operated, the shaft 15 simply pushes the plate 26 away from it causing the brazier base 21 to move and to expose the caked ash. Then the arms 32 and 33 are pivoted upwards under the action of the spring 39, as illustrated in Figs. 6 and 7.

[0024] Referring now to Fig. 8, there is illustrated a still further embodiment of the brazier according to the invention, indicated generally by the reference numeral 50, in which parts similar to those described with reference to the previous drawings are identified by the same reference numerals. In this embodiment, instead of the use of a spring 39 to bias the fragmentation means 35 upwards, there is provided a counterweight 51 mounted on the ledge 37. This brazier 50 operates in exactly the same way as the brazier 20.

[0025] Referring now to Fig. 9, there is illustrated a still further brazier according to the present invention, indicated generally by the reference numeral 60, in which in the rear side wall 22(c), there is provided three receiving slots 61 through which crushing teeth 62, mounted on the brazier base 21, project. Movement of the brazier base 21 causes the crushing teeth 62 to engage and crush the caked ash.

[0026] The slots 61 and crushing teeth 62 can be so constructed so that there is a clearance gap between the crushing tooth 62 and the receiving slot 22(c) so that the gap forms an air inlet. The advantage of this is that, by virtue of movement of the crushing tooth 62 within its respective receiving slot 61, will ensure that there cannot be a substantial build-up of ash in the air inlet so formed.

[0027] Further, it is envisaged that an additional crushing tooth may be provided in the opposite side wall 22(a) whereby, on movement of the base 21 outwardly, the crushing tooth in the side wall 22(a) will move rearwardly exposing a large gap in the side wall 22(a) through which ash may be pushed, if such should be necessary.

[0028] In this specification, the terms "comprise", "comprises", "comprised" and "comprising" and the terms "include", "includes", "included" and "including" are deemed totally interchangeable and should be afforded the widest possible interpretation.

[0029] The invention is in no way limited to the embodiment hereinbefore described but may be varied in both construction and detail within the scope of the claims.

Claims

1. A granular fuel-fired boiler brazier (20) comprising a base (21) and upstanding side walls (22(a), 22(b) 22 (c)), the base (21) being movable from an operative position retaining fuel in the brazier (20) to a discharge position to allow the ash contents to fall out of the brazier (20) and fragmentation means (35) whereby on moving the base (21) to the discharge position, the fragmentation means (35) move to break up the ash contents of the brazier (20).

2. A granular fuel-fired boiler brazier (20) as claimed in claim 1 in which the fragmentation means (35) comprises a spring biased pivotal arm (32, 33) connected to the brazier (20) whereby on moving the base (21) into the discharge position, the arm (32, 33) pivots to project into any of the ash contents in the brazier (20) (through the space previously closed off by the base (21)).

3. A granular fuel-fired boiler brazier (20) as claimed in claim 1 in which the fragmentation means (35) comprises an arm (32, 33) pivotally mounted intermediate its' ends carrying adjacent its proximal end a fragmentation device and adjacent its' distal end a counterweight (51), the fragmentation device (35) being retained in a lowered position by a retention plate (40) until the base (21) moves to the discharge position when the fragmentation device (35) is moved under the influence of the counterweight (51) to project into any of the ash contents in the brazier (20).

4. A granular fuel-fired boiler brazier (20) as claimed in claim 1, in which the fragmentation means (35) comprises an arm (32, 33) pivotally mounted intermediate its' ends carrying adjacent its proximal end a fragmentation device and adjacent its' distal end a counterweight (51), the counterweight (51) being retained in a raised position by a stop member (26) connected to the base (21) until the base (21) is moved to the discharge position.

5. A granular fuel-fired boiler brazier (20) as claimed in any preceding claim in which the fragmentation means (35) further comprises a plate (32, 33) terminating in an arcuate bull-nosed ash contents pene-

trating tip.

6. A granular fuel-fired boiler brazier (20) as claimed in claim 5, in which three side-by-side and spaced-apart plates (32,33) are provided.

7. A granular fuel-fired boiler brazier (20) as claimed in claim 6, in which the plates comprise a central plate (32) and two outer plates (33) inclined outwardly away from the central plate (32).

8. A granular fuel-fired boiler brazier (20) as claimed in claim 1 in which the fragmentation means (35) comprises an ash engaging crushing tooth (62) mounted on and projecting upwardly from the base (21) whereby, on moving the base (21) to the discharge position, the tooth (62) pushes the ash contents across the brazier and crushes it.

9. A granular fuel-fired boiler brazier (20) as claimed in claim 8, in which, in the operative position, the crushing tooth (62) lies along a side wall (22(c)).

10. A granular fuel-fired boiler brazier (20) as claimed in claim 8, in which the ash engaging crushing tooth (62) projects into a through receiving slot (61) in the side wall (22(c)) in the operative position.

11. A granular fuel-fired boiler brazier (20) as claimed in claim 10, in which there is a further ash engaging crushing tooth spaced-apart from the other ash engaging tooth (62) and projecting into a through receiving slot (61) in an opposite side wall.

12. A granular fuel-fired boiler brazier (20) as claimed in claim 10 or 11, in which a gap is provided between the tooth (62) and its respective receiving slot (61) to provide an air inlet.

13. A granular fuel-fired boiler brazier as claimed in any of claims 8 to 12, in which there is a plurality of crushing teeth (62) and receiving slots (61) in the side wall (22(c)).

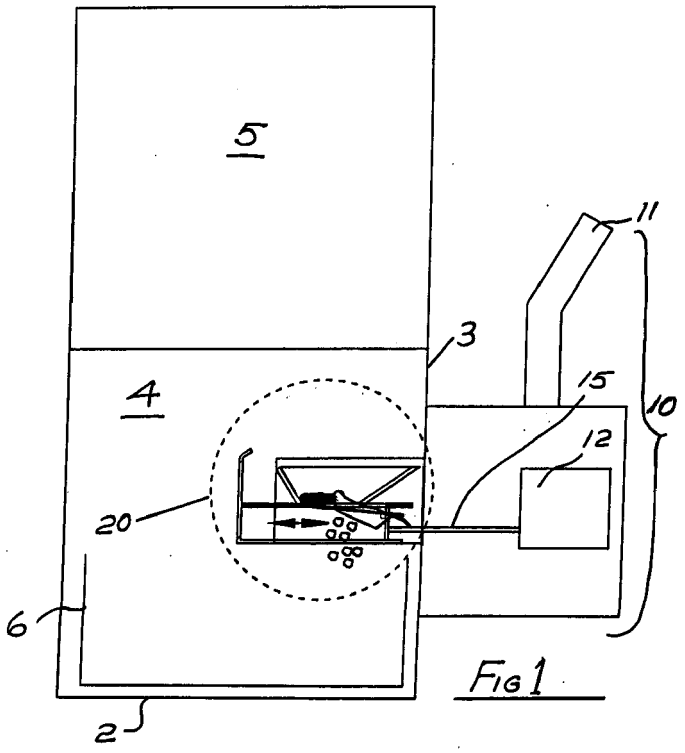
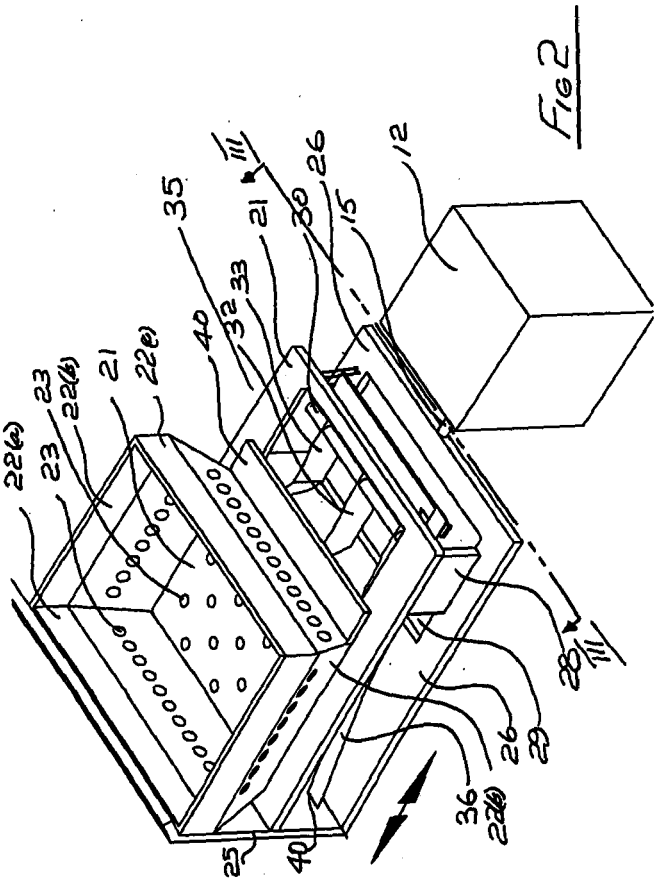


Fig 1


12
15
26
30
21
33
32
40
35
III
III
22(a)
23
22(b)
21
22(c)
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23
22(b)
28
26
29
36
22(c)
25
40

Fig 2

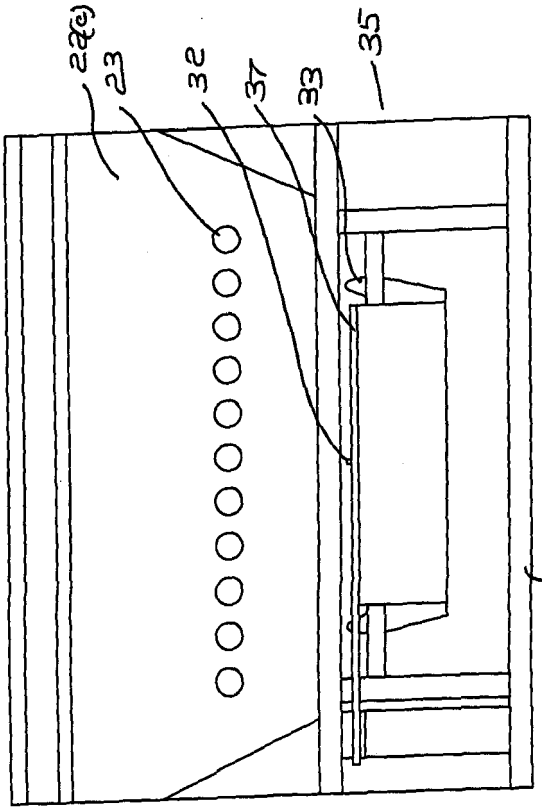

Fig 3

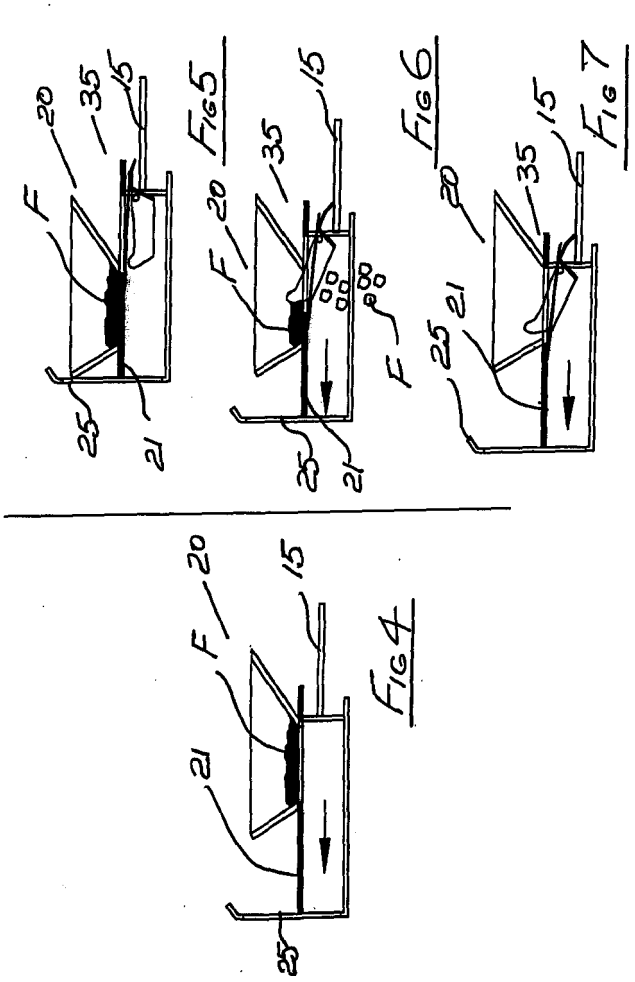

Fig 5

Fig 6

Fig 7

Fig 4

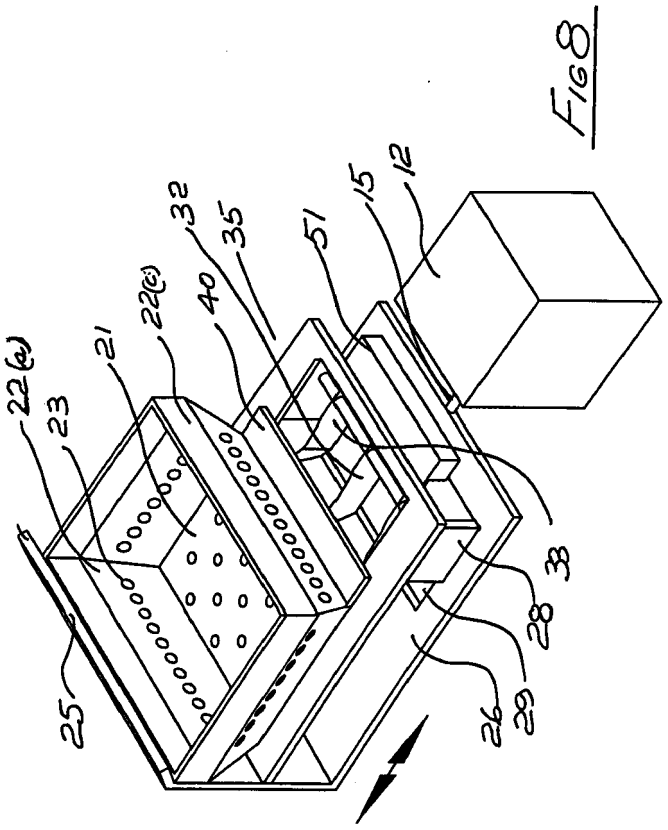

Fig 8

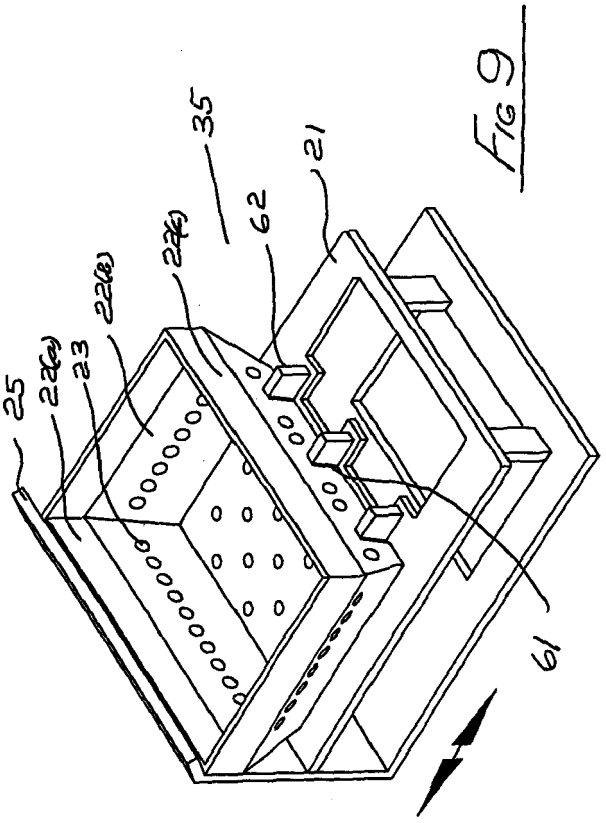

Fig 9

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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 9363

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	DE 20 2005 011610 U1 (LEDA WERK GMBH & CO KG BOEKHOF [DE]) 13 October 2005 (2005-10-13) * page 2, paragraphs 3,9 * * page 3, paragraph 21 - page 4, paragraph 28; figures 1-5 *	1,5,6,8	
X	FR 435 630 A (BEIER G. [DE]) 6 March 1912 (1912-03-06) * the whole document *	1,5,6,8	
A	GB 2 446 954 A (ALLEY ENTPR LTD [IE]) 27 August 2008 (2008-08-27) * abstract; figure 2 *	1	TECHNICAL FIELDS SEARCHED (IPC) F23B F23H F23J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 June 2009	Gavriliu, Costin

CATEGORY OF CITED DOCUMENTS

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