

# United States Patent [19]

[ 19 ]

Martin et al.

[11] 3,783,803

[45] Jan. 8, 1974

[54] FURNACE CONSTRUCTION

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[22] Filed: June 8, 1972

[21] Appl. No.: 260,783

**[30] Foreign Application Priority Data**

June 11, 1971 Germany..... P 21 28 998.5

[52] U.S. Cl. .... 110/165 R, 110/171

[51] Int. Cl. .... F23j 1/02

[58] **Field of Search**..... 110/165 R, 171

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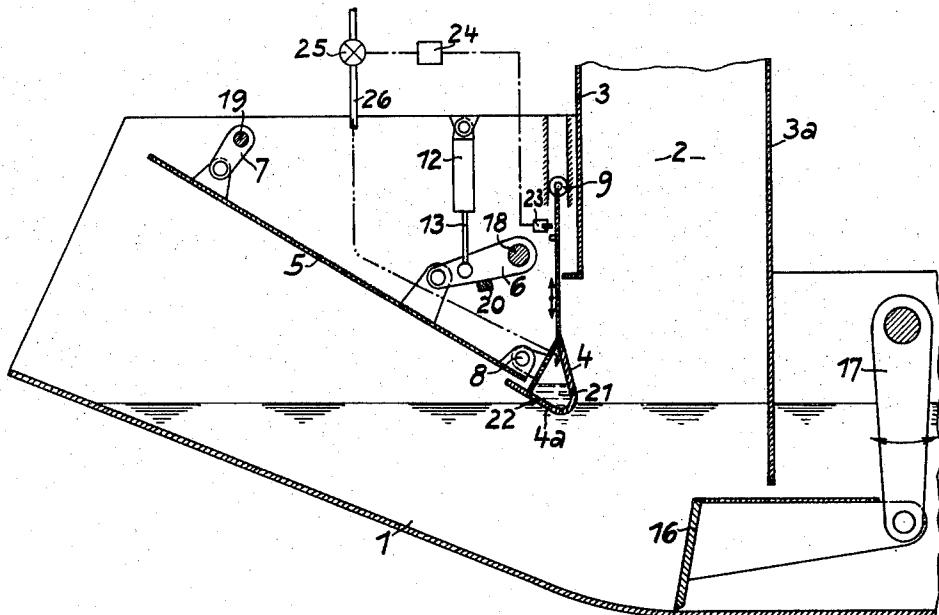
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[57] ABSTRACT

A horizontal trough accommodates a body of water and has two transversely spaced lateral sides one of which is provided with an edge. A substantially vertical discharge chute has an upper endportion into which slag and other combustion residue from a furnace is permitted to enter and a lower endportion with an outlet through which the residue enters into the trough. The lower endportion is bounded by two transversely spaced walls one of which is closer to the first edge and the other of which is closer to the second edge of the trough, with the other wall being vertically movable with reference to the stationary upper portion of the chute. A pusher pushes residue out of the trough, beneath the vertically movable wall and over the free edge of the trough.

## 10 Claims, 2 Drawing Figures



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SHEET 1 OF 2

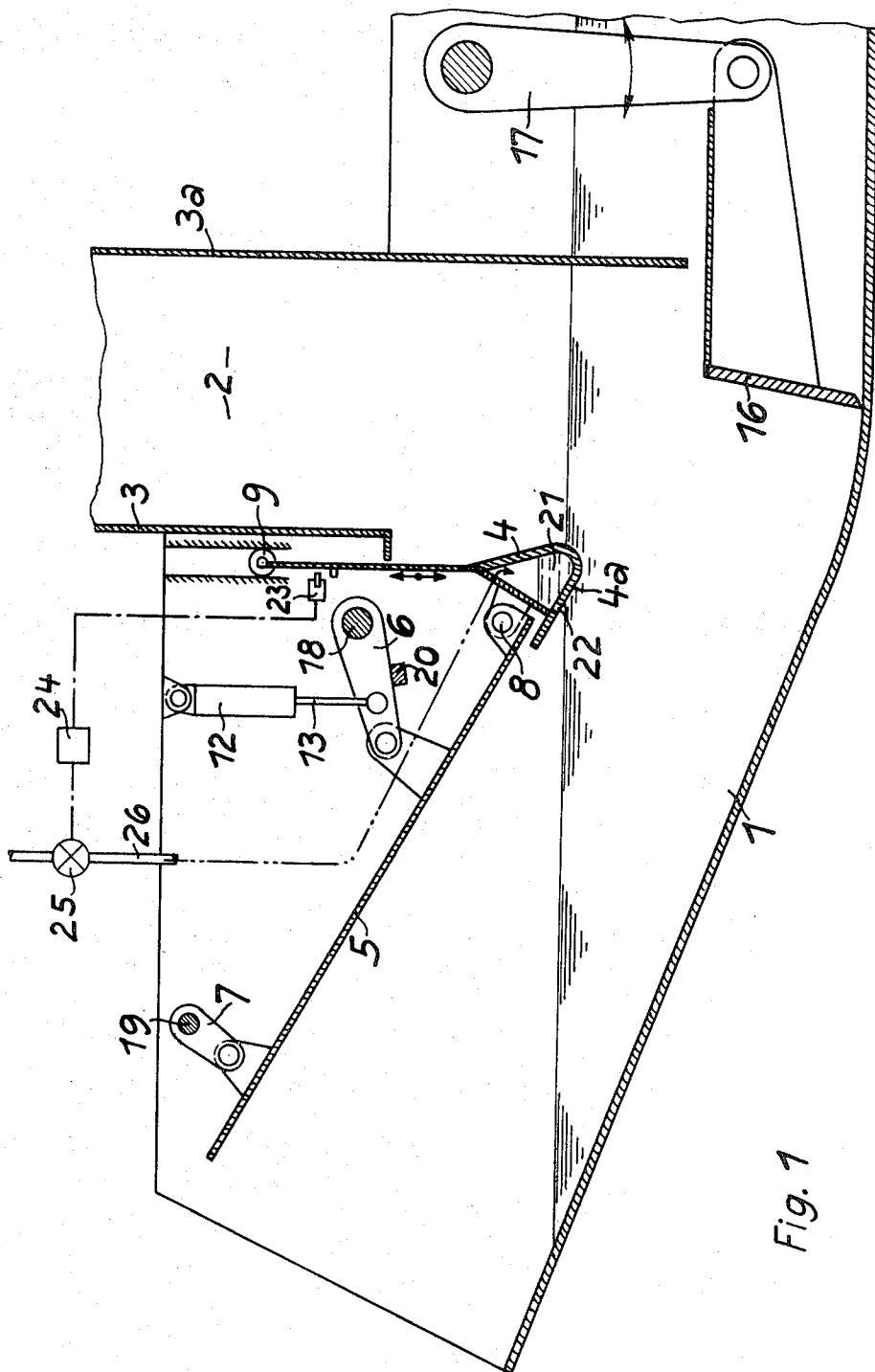


Fig. 7

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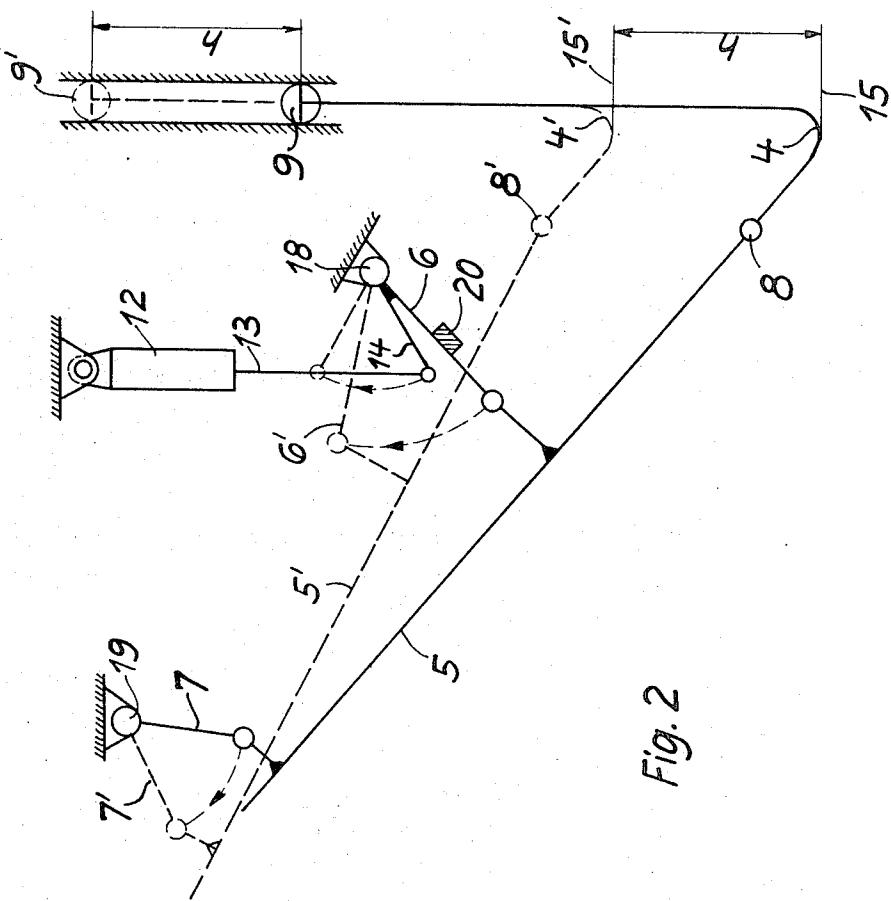


Fig. 2

## FURNACE CONSTRUCTION

## BACKGROUND OF THE INVENTION

The present invention relates generally to a furnace, and more particularly to an arrangement for discharging slag and other combustion residue originating in a furnace.

In large furnaces, for instance commercial or industrial types, much slag and other combustion residue is generated which must be removed. For this purpose it is necessary to provide downwardly of the combustion grate a horizontal water-filled trough, connected with the grate or with the region of the grate by an upright chute into which the combustion residue enters at the top and out of which it falls at the bottom to enter the trough. Once the residue has entered the trough and any remaining coal or fire has been extinguished, it is pushed out of the trough over one edge thereof by appropriate pushing devices.

Because the pushing devices must push the combustion residue out of the trough underneath the lower edge of the chute, which for various reasons must be relatively close to the level of water in the trough, it is known to make the wall of the chute in the region of the lower edge and at that side of the chute beyond which the slag or other combustion residue is to be pushed out of the trough, yieldable. For this purpose a portion of the lower end wall bounding the chute is mounted pivotally so that it can yield about a substantially horizontal axis, in some instances being opposed by spring action.

However, although to some extent this has been found to be satisfactory, difficulties are experienced, particularly if very large and bulky combustion residue pieces —e.g., slag— must be pushed underneath the lower end of the chute in which case the pivoted wall portion of the chute can usually not yield sufficiently to prevent interference.

## SUMMARY OF THE INVENTION

Accordingly it is a general object of the present invention to overcome the disadvantages of the prior art.

More particularly, it is an object of the invention to provide an improved construction, in a furnace, which avoids the disadvantages mentioned above.

Still more particularly it is an object of the present invention to provide such a construction in which no interference with any portions of the chute can take place with the discharge of combustion residue from the trough, irrespective of the size of any particular piece or pieces of the combustion residue.

In pursuance of these objects, and of others which will become apparent hereafter, one feature of the invention resides, in a furnace, in a combination comprising a substantially horizontal trough adapted to accommodate a body of water and having a first and a second lateral side with the latter having an edge. A substantially vertical chute is provided having an upper end portion adapted to receive combustion residue from a furnace, and a lower end portion provided with an outlet bonded in part at opposite sides by a first wall portion closer to the first side of the trough and a second wall portion closer to the second side of the trough. Mounting means mounts the second wall portion on the upper end portion for substantially vertical displacement, and pusher means is provided in the trough in the region of the first side and the first wall portion and is

operative for pushing combustion residue entering the trough from the outlet, to the second side and over the edge.

With this construction it is possible to obtain, when the movable wall portion yields, an outlet dimension in the chute —that is an opening bounded in part by the chute and in part by the trough— which can equal the dimension of the inlet of the chute at the upper end portion thereof.

Depending upon the size of the combustion residue, for instance lumps of slag or the like, the second wall portion will yield and increase or decrease this outlet cross section as a result of its vertical displacement, and this can be coupled with a cover wall overlying the trough to prevent splashing, which cover wall can be connected with the vertically displaceable second wall portion so as to move with the same and to become raised as the second wall portion moves upwardly. Thus, when the second wall portion is displaced upwardly to the maximum possible extent, the maximum space is provided for passage of a chunk of slag or other combustion residue, and at the same time the distance between the cover portion and the bottom wall of the trough is increased to the maximum possible extent, thus providing the preconditions for unhindered expulsion of the combustion residue over the free edge of the trough.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its constructions and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a somewhat diagrammatic vertical section through an embodiment of the present invention; and

FIG. 2 is a kinematic representation showing the operation of the embodiment in FIG. 1.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing the drawing in detail, it will be seen that the trough is identified with reference numeral 1 and will in operation be filled with a quenching liquid, usually water. It has two opposite lateral edges, the right-hand one (FIG. 1) and the left-hand one, with slag or other combustion residue to be pushed out of the trough over the left-hand edge in the illustrated embodiment. The trough is, of course, elongated in direction normal or substantially normal to the plane of FIG. 1.

Expulsion of combustion residue is effected via a pusher device 16 which is moved towards the left or towards the right by the pivoting arms 17 (one shown) which are driven in suitable manner and which perform the motion indicated by the double-headed arrow in FIG. 1.

It will be appreciated that the novel arrangement is used in the context of a furnace, and in order to conduct slag or other combustion residue into the trough 1 from the combustion grate of such a furnace (not illustrated) there is provided an upright (more or less vertical) chute 2 whose upper end (not shown) receives the slag so that the latter can fall in the chute 2 downwardly to

the outlet. The chute 2 has two transversely spaced side walls 3 and 3a, of which the side wall 3 is a part of the upper portion of the chute and is stationary. It will be appreciated that the chute 2 is elongated similarly as the trough 1. The lower endportion of the wall 3a extends into the body of water in the trough 1, but the lower endportion of the wall 3 is spaced upwardly from the level of the body of water.

In accordance with the present invention the wall 3 has a second wall portion or lower wall portion 4 which in accordance with the invention is mounted so that it can yield in upright direction, that is it can move up and down as indicated by the double-headed arrow associated with the wall portion 4. The guidance for this movement can be either of the sliding type and/or it can be by means of guide rollers 9. Hinge 8 connects the wall portion 4 with a cover wall 5 which extends longitudinally of the trough 1 and covers the same at the top, as illustrated, to prevent splashing or the like. The cover wall 5 is mounted on arms 6 and 7 which are pivoted about stationary journals 18 and 19.

A piston rod 13 of a piston guided in a pressurized cylinder 12, is connected either directly or, as shown in FIG. 2, via a lever arm 14, with the arm 6, and the latter and the arm 14 are rigidly connected with one another as is evident from the illustration of the kinematic chain in FIG. 2. It is the purpose of the cylinder 12 and the piston with piston rod 13 to permanently bias the wall 5 and the wall portion 4 in downward direction, that is to the normal end position. The cylinder 12 is a hydraulic cylinder, but it will be appreciated that a pneumatic cylinder could be utilized, or that springs could be employed instead.

The lower edge of the wall portion 4 is provided with a downwardly directed glide surface 4a which facilitates passage of the combustion residue beneath it, that is as the combustion residue passes beneath the wall portion 4 it will slide in contact with the surface 4a and will move more freely than if the wall portion 4 were simply bounded by an edge.

It will be appreciated that it is possible to omit the cover wall 5; in this case the cylinder 12 or whatever biasing means replaces it could be connected with the wall portion 4 at any desired location, for instance at the journal for the roller 9 or at the pivot 8. In this case a non-illustrated additional device would be utilized for guiding the wall portion 4 for vertical movement.

The operation of the novel arrangement will already be evident from what has been set forth above. Reference to FIG. 2 will make its operation still more clear. If excessively large and bulky combustion residue items (such as chunks of slag or the like) press against the wall portion 4, the latter is lifted upwardly against the biasing action of the cylinder 12 or other biasing means used in lieu of the same. The guide rollers 9 then move upwardly to the position 9' by the maximum distance  $h$ . At this time the wall portion 4 also moves from the position 15 to the upper position 15'. If the wall 5 is provided, the latter, as well as the hinge 8, are also provided upwardly at the same time as the wall portion 4 moves upwardly, until the wall 5 reaches the position 5' with its arms 6 and 7 reaching the upper end positions 6' and 7', and the hinge 8 reaches the position 8'.

When the wall portion 4 reaches its upper position 4' and the wall 5 its upper position 5', the opening for passage of combustion residue then approximately corresponds to the cross-section of the inlet opening of the

chute 2, that is if the chunk of slag was large enough to enter the chute 2 through the inlet thereof in the first place, there is now sufficient space for it to leave.

As soon as the particular chunk of combustion residue which has caused the upward displacement of the wall portion 4 and the wall 5 has moved out into the trough 1 due to operation of the pusher 16 in the sense displacing the latter towards the left in FIG. 1, the wall portion 4 and the wall 5 move from their upper positions 4' and 5', respectively, to their lower positions shown in FIG. 1. This is the result of the biasing action exerted by the cylinder 12 or other biasing means. An abutment 20 prevents displacement of the wall portion 4 and the wall 5 further downwardly beyond the end position shown in FIG. 1, it being apparent that the abutment 20 could be located elsewhere besides the position where it has been shown in the drawing.

In accordance with the invention it is also possible to displace the piston rod 13 not through its entire possible stroke inwardly or outwardly of the cylinder 12, but only through increments which may for instance correspond to one quarter of the maximum possible stroke. This can be achieved by permitting the escape out of the pressurized side of the cylinder of only so much pressure medium as corresponds to this incremental movement. If, after the piston rod has moved into the cylinder by an increment and has been arrested, no excessively high counterpressure developed during the next operation of the pusher 16, then the piston rod is again extended outwardly and the wall portion 4 is lowered. If, however, excessively high counterpressure acts during the next operations of the pusher 16, then the piston rod 13 is retracted by a further increment and the wall portion 4 is raised by another incremental distance. This particular operation is based upon the following considerations: If, in response to the occurrence of an excessively high pressure on the wall portion 4 the latter were to be raised immediately towards its highest possible upper position, despite the fact that the size of the chunk of combustion residue exerting the pressure does not necessitate such maximum raising, further chunks of combustion residue arriving out of the chute 2 might enter into the gap between the chunk which has caused the displacement in the first place and the lower end of the raised wall portion 4. This might cause their jamming in this space or, possibly even more disadvantageously, it might permit them to roll off the lower chunk (which has caused the raising of the wall portion 4) and over the edge of the trough 1 without first being quenched by contact with the water. The above-described operation makes this impossible.

FIG. 1 also shows that it is possible according to the present invention to secure a pressure container 21 on the wall portion 4, which container 21 is connected with a source of water and is provided in its lower portion with nozzles 22. Thus, as the wall portion 4 is raised, ejection of water through the nozzles 22 results in the establishment of a water curtain, that is the downward spraying of a plurality of jets of water under pressure out of the nozzles 22 of which many can be provided. Quenching of combustion residue which moves into or through this water curtain is thereby assured.

The supply of water under pressure into the container 21 can be controlled in dependence upon the vertical movement of the wall portion 4, for instance by having the wall portion 4 operate a switch 23 as it be-

gins to move upwardly, which in known manner opens a valve 25 via a relay 24, so that pressurized water can enter into the container 21 via flexible and/or rigid conduits which are diagrammatically shown at 26. The supply of water and thereby the creation of the water curtain is advantageously maintained until the wall portion 4 returns to its lower normal position, thereby triggering the switch 23 which closes the valve 25 via the relay 24 and shuts off the supply of pressure water to the container 21. Besides assuring quenching, the provision of such a water curtain prevents the escape of dust and hot gases out of the chute 2, or at least reduces them, as well as largely preventing the entry of infiltrated air into the chute 2.

It is of course possible to have the wall portion 4 as well as the wall 5 be composed of a plurality of sections which are respectively arrayed adjacent one another in longitudinal direction of the chute and the trough, respectively. Such a construction has the advantage that if a particularly high but not very wide (as seen in the direction of elongation of the chute and the trough) chunk of combustion residue is to be expelled, only one section of the wall portion 4 (and of the wall 5, if the same is present) need be raised at a time whereas the remainder can remain in place.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a furnace construction, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. In a furnace, a combination comprising a substantially horizontal tray adapted to accommodate a body of water and having a first and a second lateral side with the latter having an edge; a substantially vertical chute having an upper end portion adapted to receive combustion residue from a furnace, and a lower end portion provided with an outlet bounded in part at opposite sides by a first wall portion closer to said first side and a second wall portion closer to said second side; pusher means in said tray in the region of said first side and first wall portion and being operative for pushing combustion residue entering said tray from said outlet to said second side and over said edge; and mounting means mounting said second wall portion on said upper end portion for substantially vertical displacement in response to a force exerted on said second wall portion by combustion residue being pushed towards said second side by said pusher means.

2. In a furnace, a combination comprising a substan-

tially horizontal tray adapted to accommodate a body of water and having a first and a second lateral side with the latter having an edge; a substantially vertical chute having an upper end portion adapted to receive combustion residue from a furnace, and a lower end portion provided with an outlet bounded in part at opposite sides by a first wall portion closer to said first side and a second wall portion closer to said second side; mounting means mounting said second wall portion

10 on said upper end portion for substantially vertical displacement; a cover wall extending along and covering said tray; pivoting means pivotally mounting said cover wall on said second wall portion for movement therewith; and pusher means in said tray in the region of said first side and first wall portion and being operative for pushing combustion residue entering said tray from said outlet to said second side and over said edge.

3. A combination as defined in claim 2, said pivoting means comprising pivotable arms supporting said cover wall and connected with said second wall portion for movement with the latter.

4. A combination as defined in claim 1, said second wall portion having a lower edge region provided with a guide surface facing downwardly into said trays.

5. A combination as defined in claim 1, said second wall portion being movable to and from a normal lower end position; and further comprising biasing means biasing said second wall portion to said lower end position.

6. A combination as defined in claim 5, said biasing means comprising spring means.

7. A combination as defined in claim 5, said biasing means comprising hydraulic means.

8. A combination as defined in claim 5, said mounting means including a pivot arm connecting said second wall portion with said upper end portion; and wherein said biasing means is connected with and acts upon said pivot arm.

9. In a furnace, a combination comprising a substantially horizontal tray adapted to accommodate a body of water and having a first and second lateral side with the latter having an edge; a substantially vertical chute having an upper end portion adapted to receive combustion residue from a furnace, and a lower end portion provided with an outlet bounded in part at opposite sides by a first wall portion closer to said first side and a second wall portion closer to said second side; mounting means mounting said second wall portion on said upper end portion for substantially vertical displacement; dispenser means carried by said second wall portion and having outlet nozzles directed into said tray, said dispenser means being connected with a source of water and having its receipt of water from such source controlled in dependence upon the position of said second wall portion relative to said upper end portion; and pusher means in said tray in the region of said first side and first wall portion and being operative for pushing combustion residue entering said tray from said outlet to said second side and over said edge.

10. A combination as defined in claim 2, wherein said second wall portion and said cover wall are composed of a plurality of wall sections respectively arranged adjacent one another in longitudinal direction of said trays.

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