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(54) Enclosed fireplace unit, particularly for heating buildings and sanitary water

(57) An enclosed fireplace unit, particularly for heating buildings and sanitary water, constituted by a hearth (3) on the perimeter whereof side walls (4,5a,5b,6a,6b) protrude upwardly so as to delimit a firebox; a hood (19) for connection to a flue is arranged above the firebox. At least one of the side walls of the enclosed fireplace unit is constituted by a first labyrinth-like element (9) which is suitable for the passage of water that arrives from one or more intake ducts (10a,10b) and is connected, in an upward region, to a plurality of hollow plates (15) which can be accommodated in the hood. The hollow plates have a refractory element at the rear and are connected, in an upward region, to a second labyrinth-like element (21) for connection to one or more discharge ducts (23a,23b).

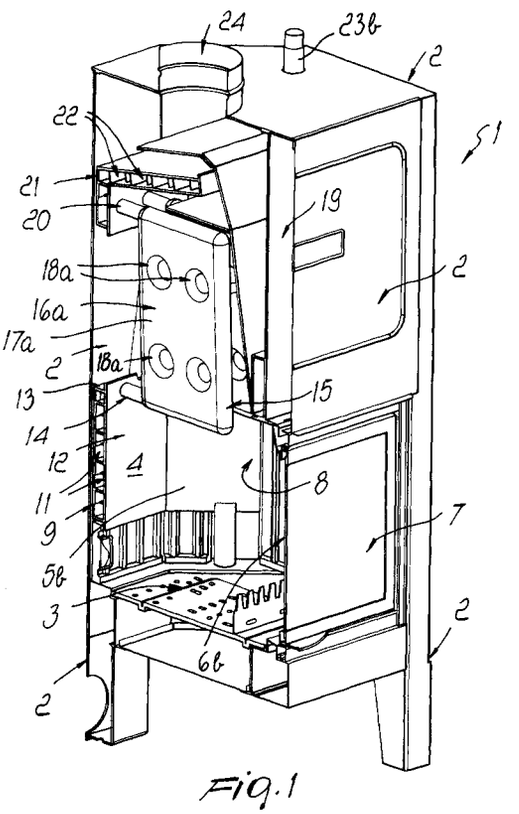

Fig.1

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Description

[0001] The present invention relates to an enclosed fireplace unit, particularly for heating buildings and sanitary water.

[0002] Generally, a fireplace comprises a masonry structure which is usually arranged against the wall in one of the rooms of the building.

[0003] This masonry structure is substantially constituted by a hearth, usually made of bricks, stone, cast iron or other suitable refractory material, which is more or less raised from the ground; a flame is fed on this hearth, for example by burning wood.

[0004] Above the hearth there is provided a hood being directly connected to a flue which leads out onto the roof of the building, so as to collect and expel outside the fumes generated by combustion.

[0005] These fireplaces are generally used to cook or heat food, helping to heat the room almost exclusively through heat exchange by radiation.

[0006] Enclosed fireplace units of a known type, which internally comprise one or more paths for cold water arriving from the water mains or from the heating system of the building, are currently becoming commercially widespread.

[0007] Along these paths, cold water circulates inside pipes or interspaces located proximate to the flame center or inside the hood, so that the water is heated by the heat generated by the flame center or by the hot fumes that flow through the hood.

[0008] The hot water thus produced is then conveniently used as sanitary water and optionally also sent to the heating system for circulation within radiators, radiating panels or other radiating elements of a known type which are adapted for exchanging heat with the rooms of the building.

[0009] In order to achieve effective water heating, it is convenient to provide, inside the hood, a path for the water inside the pipes and for the fumes outside the pipes which induce an intimate exchange of heat, by convection and conduction, between the water and the fumes.

[0010] In many conventional enclosed fireplace units, this is achieved by providing an intentionally convoluted path for the fumes and optionally also for the water.

[0011] This fact leads to a first important drawback of these conventional enclosed fireplace units: the fact that they have structurally complicated hoods internally constituted by complex paths which include spirals and recirculations of the fume streams leads to the drawback that cleaning said hood is difficult and is often necessarily an incomplete process.

[0012] Ash, soot and whatever is raised by the flow of hot air that surrounds the flame center and is not light enough to exit toward the flue are in fact deposited, during use, on the outer walls of the pipes and interspaces, which are an integral part of the path of the fumes.

[0013] These deposits cause the double damage of making the flow of fumes more difficult and most of all of decreasing the exchange of heat by conduction through the walls of the tubes and of the interspaces, forming a layer with low heat conduction on said walls.

[0014] Some conventional enclosed fireplace units only partially solve this drawback by having systems for disassembling parts of the hood which are highly elaborate in their structure and require a considerable labour and time to perform, further allowing to achieve only partial cleaning.

[0015] Another drawback of conventional units is that the rear wall of the enclosed fireplace unit, which is usually recessed into the building wall, dissipates considerable heat, thus remaining at a relatively low temperature and causing condensation.

[0016] This humid surface, in contact with the fumes, facilitates the deposition of ash and soot, considerably worsening the cleanliness of said fireplace.

[0017] The aim of the present invention is to solve the above-described problems, by providing an enclosed fireplace unit which allows to achieve accurate and simple cleaning of every part thereof, particularly of the hood.

[0018] Within the scope of this aim, an object of the invention is to provide an enclosed fireplace unit which minimizes the deposition of soot and ash on the internal surfaces and particularly reduces or eliminates the problem due to the condensation of water at the rear wall.

[0019] Another object of the invention is to provide an enclosed fireplace unit which allows optimum heating of the water along the paths inside interspaces and pipes without thereby having excessive load losses.

[0020] Another object is to provide an enclosed fireplace unit which is structurally simple and has low manufacturing costs.

[0021] This aim and these and other objects which will become better apparent hereinafter are achieved by an enclosed fireplace unit, particularly for heating buildings and sanitary water, which is constituted by a hearth on the perimeter whereof side walls protrude upwardly so as to delimit a firebox, a hood for connection to a flue being provided above said firebox, characterized in that at least one of said side walls is constituted by a first labyrinth-like element which is suitable for the passage of water that arrives from one or more intake ducts and is connected, in an upward region, to a plurality of hollow plates which can be accommodated in said hood, said hollow plates having a refractory element at the rear and being advantageously connected, in an upward region, to a second labyrinth-like element for connection to one or more discharge ducts.

[0022] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of an embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figures 1 and 2 are respectively a partially sectional

perspective view and a partially sectional front view of the present invention;

Figure 3 is a sectional plan view of the invention, taken along a transverse plane at the firebox;

Figure 4 is a front view of the components of the boiler in which the water flows;

Figures 5 and 6 are respectively a transverse top sectional view and a lateral longitudinal sectional view of the elements shown in Figure 4;

Figure 7 is a sectional side view of the invention;

Figure 8 is a sectional plan view, taken along a transverse plane, of the elements of Figure 4, in which said plates are visible;

Figure 9 is a sectional plan view, taken along a transverse plane, of the elements of Figure 4, in which the second labyrinth-like element is visible.

[0023] With reference to the figures, the reference numeral 1 designates an enclosed fireplace unit which is constituted by a supporting frame 2 for a hearth 3, on the perimeter whereof side walls protrude upwardly.

[0024] In particular, a first vertical wall 4 is arranged in a rear position and is laterally connected to a second vertical wall and a third vertical wall, designated by the reference numerals 5a and 5b respectively, which are conveniently oblique and are connected to a fourth vertical wall and to a fifth vertical wall, designated by the reference numerals 6a and 6b, which are advantageously parallel to each other and are arranged on planes which being perpendicular to said first vertical wall 4.

[0025] In a front position there is a door, designated by the reference numeral 7, which lies parallel to said first vertical wall 4 and can be opened so as to allow access to a firebox 8.

[0026] In this embodiment, the first, second and third vertical walls 4, 5a and 5b are constituted by a first labyrinth-like element, designated by the reference numeral 9, inside which there is provided a path for a stream of water that arrives from a pair of intake ducts 10a and 10b which are advantageously arranged below said hearth 3.

[0027] The first labyrinth-like element 9 is conveniently constituted by a plurality of first ducts, generally designated by the reference numeral 11, which are arranged horizontally, are vertically packed together and are mutually connected by a plurality of bends so as to allow flow through them in succession one after the other, so as to increase heat exchange by convection between the water and the internal surface, designated by the reference numeral 12, of said first, second and third walls 4, 5a and 5b.

[0028] Proximate to the upper edge, designated by the reference numeral 13, of the first labyrinth-like element 9, four second ducts, generally designated by the reference numeral 14, for connection to respective four hollow plates 15, protrude horizontally inward.

[0029] Each one of the hollow plates 15 is constituted by two rectangular elements, designated by the reference numerals 16a and 16b, which are conveniently symmetrical and have curved edges and chamfered corners; on the flat surfaces 17a and 17b of the elements there are advantageously four recesses, designated by the reference numerals 18a and 18b respectively, which are advantageously circular.

[0030] The recesses 18a and 18b, having a depth which is approximately equal to the thickness of said rectangular elements 16a and 16b, are adapted to allow their interconnection: each one of the four recesses 18a of the rectangular element 16a in fact makes contact, during the assembly of the hollow plate 15, with the respective recess 18b formed in the rectangular element 16b.

[0031] In this manner it is possible to rigidly couple to each other the respective recesses 18a and 18b, for example by way of conventional methods such as bolting or welding, thus assembling each one of the hollow plates 15, which advantageously can have a gasket at the regions of contact between said pair of rectangular elements 16a and 16b.

[0032] The recesses 18a and 18b form, inside said hollow plate 15, when assembled, regions of interference for the water stream that arrives from the respective second duct 14, thus increasing the turbulence of the water and thereby effectively increasing heat exchange.

[0033] The hollow plates 15 are advantageously accommodated inside a hood, designated by the reference numeral 19, which is arranged above said firebox 8 and is suitable to convey the fumes produced during combustion toward a flue, which is not shown in the figures.

[0034] The hollow plates 15 are connected in an upward region, by means of respective third ducts which are designated by the reference numeral 20 and protrude horizontally in a rearward direction, to a second labyrinth-like element 21, which is advantageously L-shaped so as to protrude above the hollow plates 15.

[0035] The second labyrinth-like element 21 is preferably constituted by a plurality of fourth ducts, generally designated by the reference numeral 22, which are also arranged horizontally, are packed together side by side and are mutually connected by a plurality of bends so as to allow flow through them in succession one after the other, thus further increasing heat exchange between the water and the second labyrinth-like element 21.

[0036] Since it is arranged above the firebox 8, said second labyrinth-like element 21 in fact receives from said firebox heat by radiation and by means of the flow of the fumes that exit through the hood 19.

[0037] The water that circulates in the second labyrinth-like element 21, having heated up in passing from said pair of intake ducts 10a and 10b to the top of the enclosed fireplace unit 1, can exit from said enclosed fireplace unit by means of two discharge ducts, desig-

nated by the reference numerals 23a and 23b, which protrude vertically from said enclosed fireplace unit 1, so as to be available for heating the building and/or as sanitary water.

[0038] An opening, designated by the reference numeral 24, can be advantageously provided between the discharge ducts 23 for the connection of the flue, and the fumes generated during combustion can be expelled through the opening 24.

[0039] To the rear of the hollow plates 15, between the first labyrinth-like element 9 and the second labyrinth-like element 21, a refractory element is provided, designated by the reference numeral 25, which is adapted to prevent or at least limit the flow of heat that leaves the enclosed fireplace unit 1 toward the masonry possibly provided behind it, thus acting as a condensation-dissipating element.

[0040] Operation is as follows: with reference to Figures 1 and 2, the cold water enters through the pair of intake ducts 10a and 10b and rises in the first ducts formed inside the first labyrinth-like element 9, where it undergoes a first heating mainly by means of the heat received directly from the center of the flame that is present in the firebox 8.

[0041] Once it has reached the top of the first labyrinth-like element 9, the water enters the hollow plates 15 through the respective second ducts 14.

[0042] By rising along said hollow plates 15 toward the third ducts 20, the water is heated further by heat exchange with said hollow plates, since said plates receive heat by radiation from the flame center and by convection from the fumes, which exit through the hood 19 and strike their outer surfaces.

[0043] The presence of the recesses 18a and 18b increases the exchange of heat between the water and the hollow plates 15, since it increases the turbulence of the water, avoiding or reducing laminar flow.

[0044] From the third ducts 20, the already-hot water undergoes a further temperature increase by passing through fourth ducts formed in a second labyrinth-like element 21 which protrudes above said hollow plates 15 and is also heated by radiation and convection.

[0045] At the outlet of the pair of discharge ducts 23a and 23b one obtains, in this manner, appropriately hot water, mostly by virtue of an optimum utilization of radiation and of the cooling of the fumes that exit through the hood 19.

[0046] Actually, two intake ducts 10a and 10b and two discharge ducts 23a and 23b are provided not so much to allow a possible simultaneous flow of two water streams as to facilitate the installation of the enclosed fireplace unit by providing an intake duct and a discharge duct on either side of the enclosed fireplace unit.

[0047] The simplicity and efficient arrangement of the elements that constitute the enclosed fireplace unit allow optimum cleaning of the firebox and of the hood, ensuring that performance is truly maintained over time.

[0048] Cleaning operations are further facilitated by the fact that the refractory element 25 avoids most of the problems due to the formation of condensation, thus avoiding the deposition of thick layers of soot and ash.

[0049] It has been observed that the invention has achieved the intended aim and objects, an enclosed fireplace unit having been provided which allows to achieve optimum heating of the water even a long time after installation, allowing to perform accurate and rapid cleaning of every part of the enclosed fireplace unit, especially of the hood.

[0050] The invention is of course susceptible of numerous modifications and variations, all of which are within the scope of the same inventive concept.

[0051] The materials employed, as well as the dimensions that constitute the individual components of the present invention, may of course be more pertinent according to specific requirements.

[0052] The disclosures in Italian Patent Application No. MI2000A000532 from which this application claims priority are incorporated herein by reference.

[0053] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An enclosed fireplace unit, particularly for heating buildings and sanitary water, constituted by a hearth on the perimeter whereof side walls protrude upwardly so as to delimit a firebox, a hood for connection to a flue being provided above said firebox, **characterized in that** at least one of said side walls is constituted by a first labyrinth-like element adapted for the passage of water that arrives from one or more intake ducts and is connected, in an upward region, to a plurality of hollow plates which can be accommodated in said hood, said hollow plates having a refractory element at the rear and being advantageously connected, in an upward region, to a second labyrinth-like element for connection to one or more discharge ducts.

2. The enclosed fireplace unit according to claim 1, wherein said side walls are constituted by a first vertical wall which is arranged in a rear position and is laterally connected to a second vertical wall and a third vertical wall which are conveniently oblique and are connected to a fourth vertical wall and a fifth vertical wall which are mutually parallel and are arranged on planes which are perpendicular to said first vertical wall, **characterized in that** said first labyrinth-like element comprises said first, second and third vertical walls, multiple first ducts being

present inside said labyrinth-like element, said ducts being arranged horizontally, being packed vertically together and being connected to each other by a plurality of bends so that water can flow through them in succession one after the other.

3. The enclosed fireplace unit according to claims 1 and 2, **characterized in that** second ducts for the connection of said first labyrinth-like element to each one of said hollow plates protrude horizontally inward proximate to the upper edge of said first labyrinth-like element.

4. The enclosed fireplace unit according to claims 1 and 3, **characterized in that** each one of said hollow plates is advantageously constituted by two rectangular elements which are appropriately symmetrical, each element having curved edges and chamfered corners, multiple circular recesses being formed on their flat surfaces.

5. The enclosed fireplace unit according to claims 1 and 4, **characterized in that** the depth of said recesses is approximately equal to the thickness of each one of said two rectangular elements, so as to allow their mutual connection performed at said recesses, said hollow plates being watertight at the regions of contact between said pair of rectangular elements.

6. The enclosed fireplace unit according to claims 1 and 5, **characterized in that** said recesses, by being arranged inside said hollow plate, are adapted to increase water turbulence, consequently increasing heat exchange, and to reinforce said hollow plates.

7. The enclosed fireplace unit according to claims 1 and 6, **characterized in that** said hollow plates are connected in an upward region to said second labyrinth-like element, which is L-shaped, so as to protrude above said hollow plates by means of respective third ducts which protrude horizontally toward the rear wall of said enclosed fireplace unit.

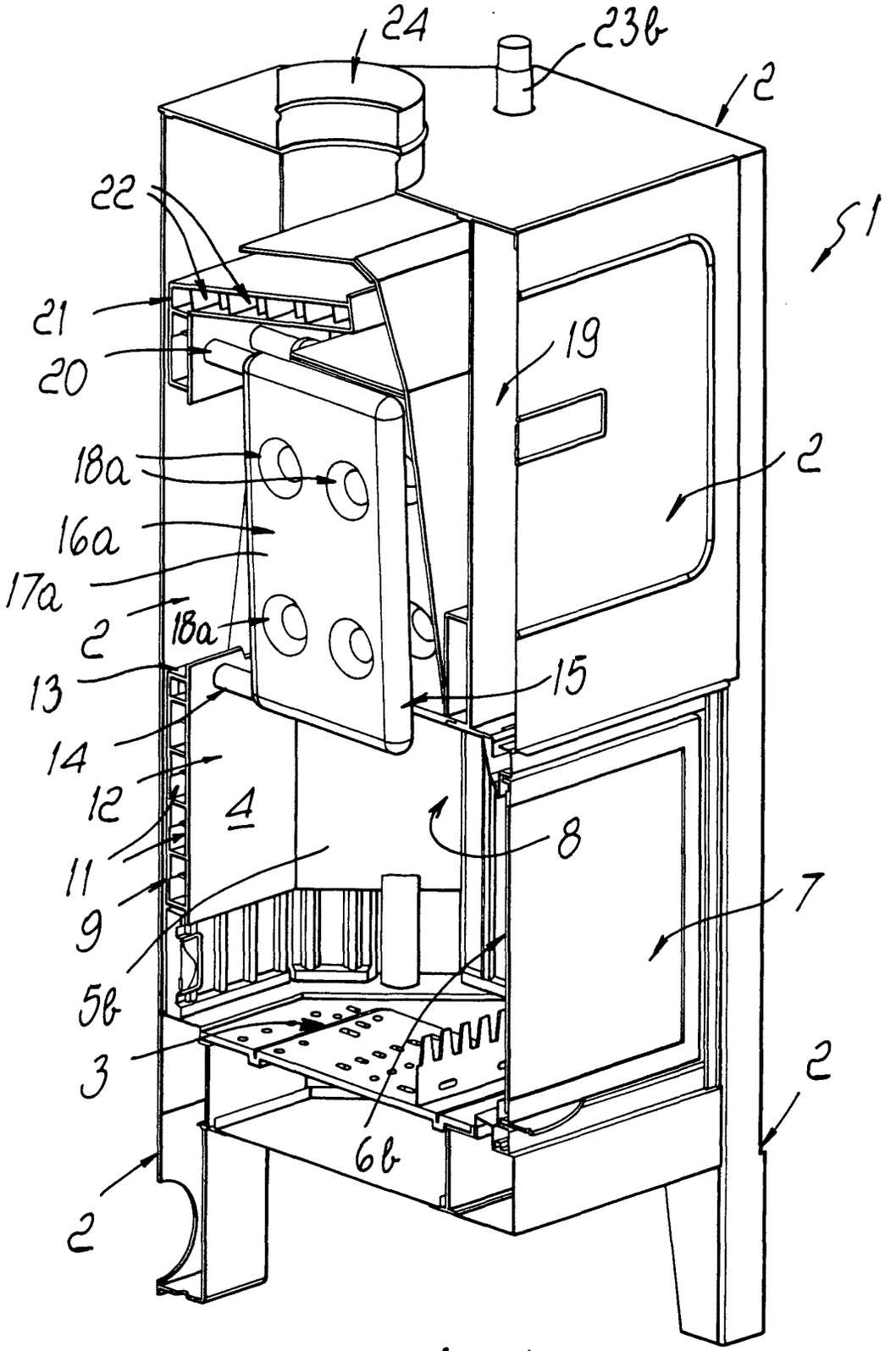
8. The enclosed fireplace unit according to claims 1 and 7, **characterized in that** said second labyrinth-like element is constituted by a plurality of fourth ducts which are arranged horizontally, are packed together side by side and are mutually connected by a plurality of bends so as to allow flow through them in succession one after the other, thus further increasing heat exchange between the water and said second labyrinth-like element.

9. The enclosed fireplace unit according to claims 1 and 8, **characterized in that** said refractory element, which is constituted by a plate of refractory material advantageously arranged between said first and second labyrinth-like elements, is suitable to reduce the flow of heat that exits from said enclosed fireplace unit through said rear wall, thus acting as condensation dissipator.

10. The enclosed fireplace unit according to claims 1 and 9, **characterized in that** said one or more intake ducts are constituted by two intake ducts which are arranged at the opposite ends of said enclosed fireplace unit.

11. The enclosed fireplace unit according to claims 1 and 10, **characterized in that** said one or more discharge ducts are constituted by two discharge ducts which are arranged at the opposite ends of said enclosed fireplace unit.

12. The enclosed fireplace unit according to claims 1 and 11, **characterized in that** said plurality of hollow plates comprises four hollow plates, each of which is connected to said first and second labyrinth-like elements respectively by means of said second and third ducts.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23b
2
22
51
21
19
20
18a
2
16a
17a
2
18a
13
15
14
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4
8
11
9
7
5b
3
2
6b
2

Fig.1

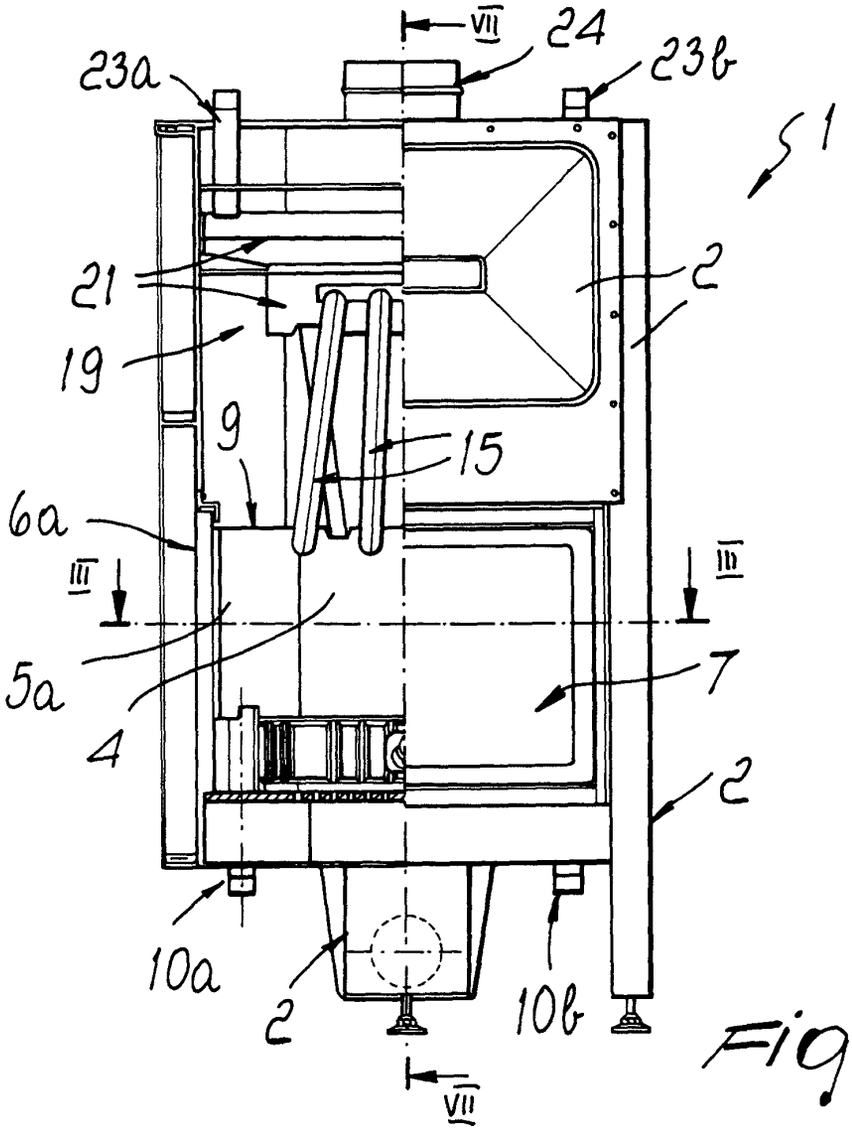
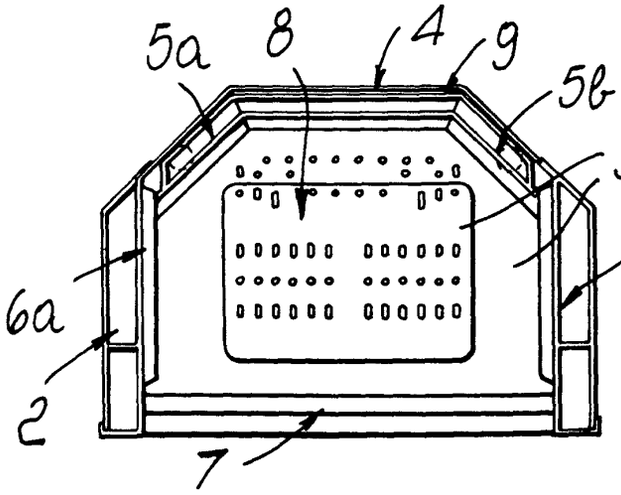

VII
24
23a
23b
1
21
2
19
9
15
6a
III
III
5a
4
7
2
10a
2
10b
VII

Fig. 2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4
9
5b
3
6b
6a
2
7

Fig. 3

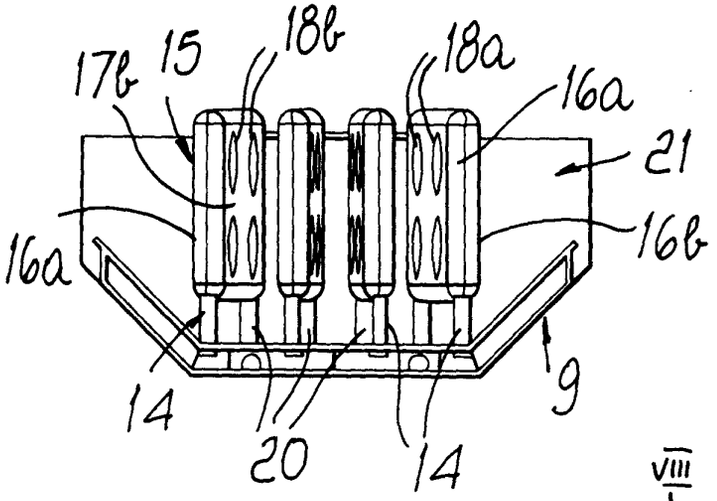

Fig. 5

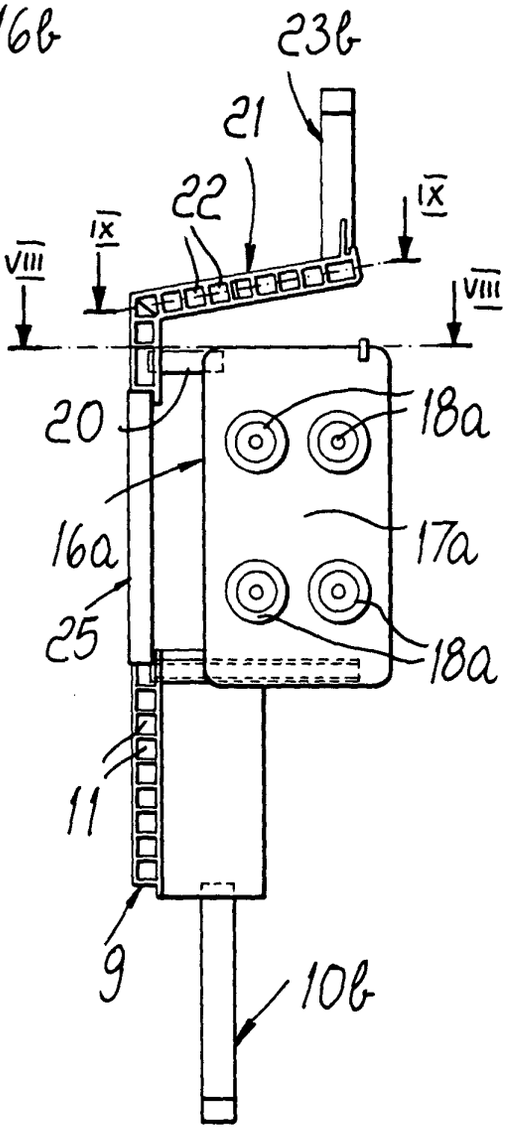

Fig. 6

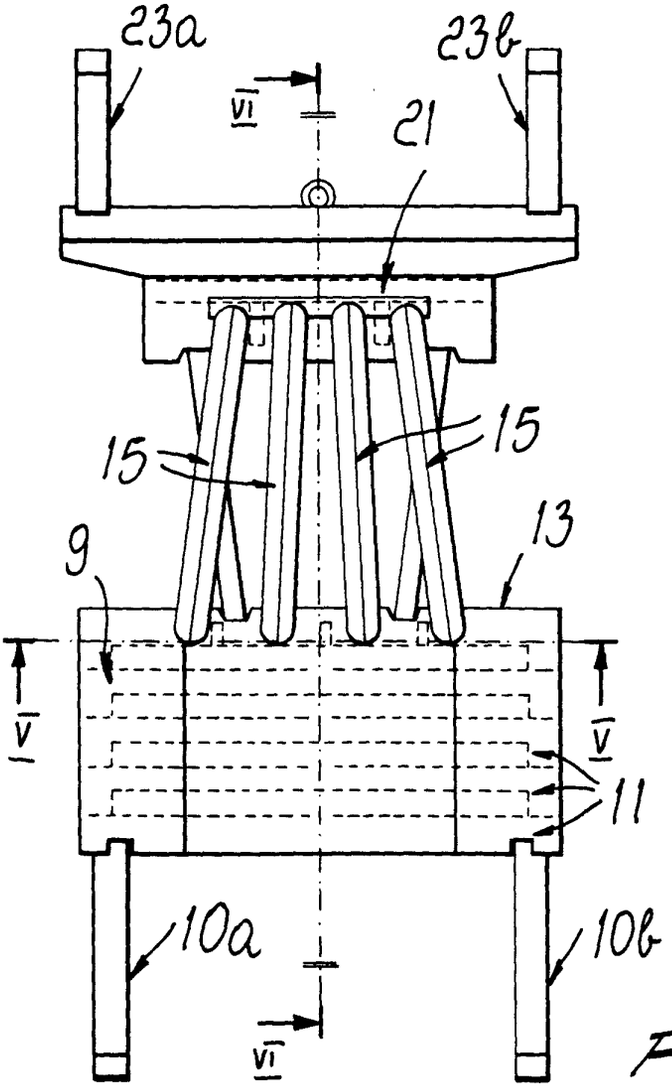

Fig. 4

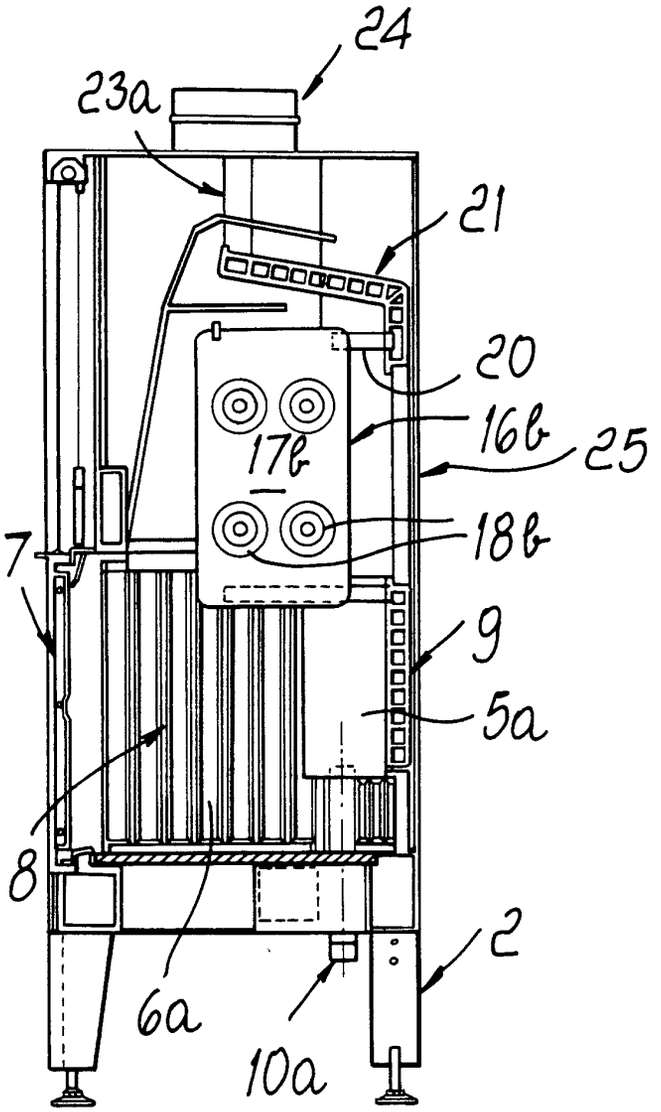

Fig. 7

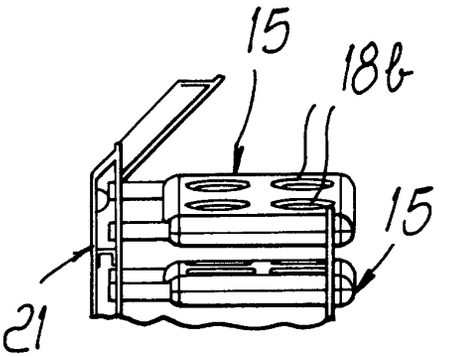

Fig. 8

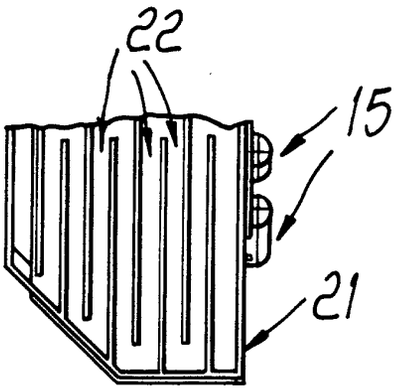

Fig. 9