



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 376 014 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

02.01.2004 Bulletin 2004/01

(51) Int Cl.7: **F24B 1/24, F24B 1/18**

(21) Application number: **03396058.4**

(22) Date of filing: **16.06.2003**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**

Designated Extension States:

AL LT LV MK

(30) Priority: **20.06.2002 FI 20021205**

(71) Applicant: **Nunnanlahden Uuni Oy
83940 Nunnanlahti (FI)**

(72) Inventor: **Lehikoinen, Juhani,
c/o Nunnanlahden Uuni Oy
83940 Nunnanlahti (FI)**

(74) Representative: **Helino, Timo et al
Papula Oy,
P.O. Box 981
00101 Helsinki (FI)**

(54) **Heating stove type fireplace**

(57) A heating stove type fireplace, comprised of a metal outer shell (1,2); a furnace (4) with an openable hatch and a grate (3); a heat storage unit (5) located in the area of the essentially hottest burn gas flow; a smoke gases afterglow heat transfer unit (6) to effect direct heat transfer from smoke gases coming from the heat storage unit into the surrounding airspace (7); as well as a chimney connection (8) for smoke gases.

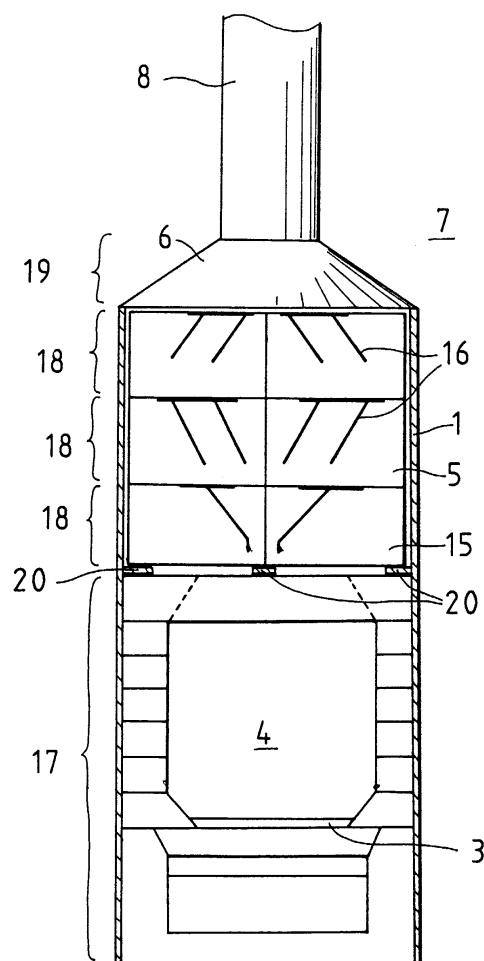


Fig 1

EP 1 376 014 A2

Description

[0001] The invention relates to a heating stove type fireplace according to the introduction of claim 1.

[0002] Heating stoves are traditionally fireplaces intended for quick heating. The heating stove contains a metal shell surrounding the furnace that extends upward to form a channel for rising smoke and a chimney connection, through which smoke gases are guided into the smoke chimney. Because the heating stove releases the heat it creates for all practical purposes immediately through its metal shell to the surrounding airspace, it is quick-heating if wood is burned in it efficiently and cleanly.

[0003] Due to the quick transfer of heat, when heating the heating stove wood must be added frequently, a little at a time, so that heat is created evenly and the heating stove does not heat up too much. However, such a burning process creates, especially during the beginning and end phases, relatively great unclean, polluting burn gases. The other disadvantage is that the burn event requires continuous monitoring, i.e. when wood must be added a little at a time, wood must then essentially be added constantly during the entire heating time. It is also a disadvantage that for all practical purposes, immediately after the fire goes out the heating stove ceases to produce heat.

[0004] To remove the above-mentioned disadvantages, wood must be burned quickly in large amounts with the correct amounts of air. In this way the heating stove would produce such an amount of heat per time unit that the metal heating stove would glow red. This would be quite hazardous for the safety and fire safety of the use environment. At the same time, heat would be created momentarily in such large amounts that the heating method in question would not be acceptable under any conditions.

[0005] The object of the invention is to remove the above-mentioned disadvantages. Particularly, the object of the invention is to provide a novel heating stove type fireplace that would further make possible traditional quick heating, but would also make possible the effective use of the energy contained in wood and clean burning without unclean burn gases.

[0006] The characteristics of the invention are described with reference to the accompanying claims.

[0007] A heating stove fireplace for heating a living space according to the invention contains a metal shell surrounding a furnace with an openable hatch and a grate. In the flow direction of burn gases from the furnace, for example above the furnace in the area of the essentially hottest burning and/or burn gas flows, is located a heat storage unit of a material that can well withstand the stress of high temperatures and that quickly stores heat. After the heat storage unit in the flow direction of burn gases is located a burn gases afterglow heat transfer unit to effect direct transfer of heat from burn gases that come from the heat storage unit and still con-

tain heat energy to the airspace surrounding the fireplace. In addition, the fireplace has a chimney connection for smoke gases after the afterglow heat transfer unit.

[0008] Therefore the basis of this invention is that effective and clean burning requires a relatively fast and high-temperature burn process. In order that this burn process can usefully be joined with a heating stove type fireplace, the heat energy of the hottest burn gases must be stored immediately, before the heat of the heating stove is transferred to the outer shell. From this was born the basic idea of the invention, i.e. the locating of a heat storage unit within a traditional heating stove in-between the furnace and the metal shell of the heating stove that releases heat outward into the area of the room.

[0009] In this way the fireplace releases the heat of partially cooled burn gases through the metal shell in the manner of a traditional heating stove while at the same time, during the heating phase, storing the greater part of the heat in a heat storage unit. When burning in the furnace is finished, the heat storage unit begins to release heat through the metal shell and the other structures of the fireplace. The heating stove according to the invention works thus not only in the manner of a traditional heating stove as a quick heater, but also as a long-term source of heat that releases heat slowly while also making possible very low emission and clean smoke gases that have largely released their heat.

[0010] Preferably, the heat transfer unit for burn gases afterglow consists of a part of the metal shell whose inner surface is in direct contact with the smoke gases coming from the heat storage unit.

[0011] Preferably, the outer shell of the fireplace is tight-fitting and without openings in the area of the afterglow heat transfer unit as well as after it in the flow direction of smoke gases. Preferably, there is in the metal outer shell only a furnace hatch and below this an ash hatch from which burn air also flows inward to the furnace, or the ash hatch is tight-fitting and air is guided under the grate from elsewhere, for example from outside the space to be heated. In this way the compact and tight-fitting outer shell guarantees that harmful smoke gases do not escape to the area of the room to be heated.

[0012] Preferably, the furnace is made of heat-storing materials such as soapstone that form the rear wall, side walls and also the cover structure of the throat leading towards the heat storage unit. These heat-storing structures work, in addition to the main heat unit located after the furnace, as structures that rapidly store heat energy. This makes possible a burning event in the furnace with cleaner smoke gases that occurs at a higher temperature and is more effective than previously possible without having the temperature of the outer shell of the heating stove rise to dangerous levels.

[0013] When using the efficient heat storage structures in the heating stove, located both in the fireplace and the heat storage unit located after the fireplace, it

is possible to preferably use as a grate a so-called "power grate", making possible effective burning. With a such grate known per se the pre-burn air flowing through it into the furnace under the burning load is regulated by flow amount as well as by location such that excessive gas creation from the burning material is prevented and all burn material changed to gaseous form is burned completely within the furnace.

[0014] Preferably, the chimney connection of the heating stove is above the afterglow heat transfer unit. This makes it possible for the heating stove to be relatively small in both depth and width. However, it is possible, that in the heating stove according to the invention the furnace, heat storage unit, afterglow heat transfer unit and chimney connection are partially or completely located in relationship to each other adjacent, stacked on top of one another, or fit in some other way as will be apparent later in this description.

[0015] In one embodiment of this invention there is outside the metal outer shell for example a surface shell of heat-storing material. In this way the metal shell can be covered completely, for example with tiles or soapstone or some other type of stone tile that possesses a desired colour and appearance. In this case the afterglow heat transfer unit, performing preferably direct and fast heat transfer of the smoke gases, is located inside the surface shell so that one can use flow openings in the surface shell to create airflow from the heat transfer unit to the airspace surrounding the fireplace.

[0016] It is also possible to use a heat-insulating material as the surface shell or a part it, wherein from a practical standpoint all the heat stored in the heat storage unit transfers to the airspace surrounding the fireplace only through the smoke gases afterglow heat transfer unit located after the heat transfer unit. The heat release of the heating stove is thus more long lasting and even than it would otherwise be.

[0017] Preferably, the heat storage unit located after the furnace consists of a huge heat-storing mass, such as a soapstone structure, through which are arrayed a plurality of rising and/or transverse smoke channels to increase heat transfer surface area between the hot smoke gases and the mass. The heat-storing mass can also be of sealing compound or of many parts composing one mass. The mass must essentially have a relatively large heat transfer surface area, i.e. the sum of the surface areas of the gas channels travelling through and around the mass. This enables effective and fast heat transfer to the heat-storing material from very hot, perhaps partially still burning smoke gases.

[0018] In one preferred structural solution of the heat-storing mass it consists of many one-directional and preferably vertical plates slightly distant from one another and of a heat-storing material. The distances between the plates form smoke channels. The plates can be for example soapstone plates of uniform thickness where plate thickness is about double the width of the distance between individual plates. In this way 5-10 plates can

be fit into the heating stove creating a large, effectively heat-absorbing surface.

[0019] To increase even heat transfer in the straight and diagonal rising or transverse smoke channels in-between the plates can be used flow distributors, for example plate-like guides of metal or soapstone. With these the flowing hot smoke gases are forced to spread in an essentially even way over the entire surface area of the plates and simultaneously over the entire volume of the heat storage unit. In consequence, the entire volume of the heat storage unit functions at essentially the same temperature and at maximum power to store an integral part of the heat energy of the hot smoke gases and to release out to the metal shell of the heating stove a flow of warm, i.e. not too hot, gases.

[0020] Using the heat-storing mass and the channels in the mass, i.e. the forms and arrangement of smoke channels, both the heat storage and heat release features of the heat storage unit can be adjusted. For example the soapstone plates of the mass can be attached on all sides to the surrounding metal shell, wherein the smoke channels traverse only within the heat-storing mass. Heat is thus effectively stored into the heat storage unit, while the outer surface of the fireplace in the area of the heat storage unit stays relatively cool during heating. This way heat flow in the surrounding area during heating occurs through the smoke gases afterglow heat transfer unit. On the other hand, there can also be flow channels between the soapstone plates and the metal shell, wherein heat transfer to the metal shell and onward to the surrounding airspace is more effective and faster in the area of heat storage unit as well.

[0021] In one embodiment of this invention the metal shell extends in a vertical direction up the fireplace from the bottom part level of the furnace up to the chimney connection. This way the metal shell can function as the load-bearing structure of the fireplace and as its outer shell. It is also possible that the metal shell is vertical only in the area of the heat storage unit and from there outward forming the afterglow heat transfer unit. It is even possible that the metal shell rests on and seals only in the upper part of the heat storage unit and continues from there upward, wherein the outer surface of the furnace area and the greater part of the outer surface of the heat storage unit area can be for example the same soapstone structure that forms the furnace and heat storage unit.

[0022] In one embodiment of this invention there are suitable brackets, props, or other supports in the metal shell from the lower edge of the fireplace upwards over essentially its entire height. These can be used to provide support for the entire massive heat-storing inner part of the fireplace. This way the weight of the heat storage unit does not lie on the structures of the fireplace, making possible the tearing out and rebuilding, i.e. the exchanging, if needed, of the heat-storing wall structures of the furnace without disturbing the upper structures of the fireplace.

[0023] Preferably, a heating stove type fireplace according to the invention is of modular structure, i.e. it is composed of three suitably measured modules separately distinguished by measurement of their desired heating characteristics and located on top of one another and/or adjacent, the furnace module, the heat storage module, the heat transfer module. The modules are separately attachable to one another, making possible modules of different size and shape. The number of modules is also variable, because multiple heat storage heat storage modules as well as possibly multiple heat transfer modules can be arranged one after the other and/or one on top of the other.

[0024] In the furnace modules the thickness of the heat-storing mass of the furnace walls, i.e. their heating capacity, the height of the furnace as well as the form of the hatch or the size of its opening can all vary. In the heat storage module the shape and number of the smoke channels, the amount of heat-storing mass and the amount of usable heat-storing mass can all vary, as well as height/width/depth of the entire heat storage unit. The adjustment of height/width/depth is preferably achieved by having the heat storage unit be composed of two or more stacked or adjacent cheaply identical heat storage modules.

[0025] Depending on the heat storage module used and its heat storage characteristics, a suitable heat transfer unit can be chosen to follow it. It may be relatively low and have a conical reduction of the furnace towards the chimney connection, or it may have more height and therefore more also a greater heat transfer surface area. It can also be larger and wider than the heat storage module located before it. The inner surface of the heat transfer module, which is in contact with the smoke gases, can also have heat transfer fins used to increase heat absorption. In the same way its outer surface can have convex shape that for example form decorations, but also increase exterior surface area for heat release.

[0026] In one embodiment of this invention a control is arranged in the fireplace that enables bypass of the heat storage unit for a short time, for example when it is desired to quickly get heat into a room area. In this way the control is used to guide hot burn gases directly to the afterglow heat transfer unit. The fireplace can even have, in conjunction with the control, a separate express heater, i.e. a heat-conducting shell before the afterglow heat transfer unit such that direct heat transfer surface area into the area of the room is noticeably greater than during normal heating.

[0027] A heating stove type fireplace according to the invention has significant advantages compared to known prior art. Since there is often a need to get quick heat, the heating stove has its own application area. In addition, its small size and relative lightness are often are often critical factors when purchasing a heating device. A fireplace according to the invention has managed to retain all the aforementioned positive attributes

of the traditional heating stove. In addition, an attempt has been made to add new heating technologies and effective heat storage capacity such as to create a wholeness where, with less amount of fuel and cleaner smoke gases, better heating characteristics are achieved for both quick heat production and long-term and even heat release.

[0028] This invention makes possible the burning of wood and briquettes at a temperature of 800°C or more, preferably at a temperature of approximately 1000°C. Using these structures and methods the energy use relationship of the fireplace is increased 10-30%, even 50%, compared to traditional heating stoves.

[0029] In the following, the invention is described in detail with reference to the accompanying drawings, in which

Fig. 1 shows a partial section view of a fireplace according to the invention,

Fig. 2 shows in more detail the structure of the heat-storing mass of inner part of the fireplace in figure 1,

Fig. 3 shows a section view of another fireplace according to the invention,

Fig. 4 is a schematic illustration of a fireplace according to the invention,

Fig. 5 is a schematic illustration of another fireplace according to the invention,

Fig. 6 is a schematic illustration of a third fireplace according to the invention,

Fig. 7 is a graphic representation of a fourth fireplace according to the invention.

[0030] The heating stove type fireplace in figure 1 contains a metal outer shell 1, which extends from the very bottom edge of the fireplace upward for the entire height of the fireplace. The fireplace has a furnace 4 with a hatch (not illustrated) and a grate 3 and that opens upward through the throat to the heat storage unit 5.

[0031] After and immediately above the heat storage unit 5 the metal outer shell 1 narrows greatly forming a tapering surface towards the upward-pointing chimney connection, which forms the smoke gases afterglow heat transfer unit 6. The inside of the metal shell of the heat transfer unit 6 is in direct contact with the still relatively warm smoke gases rising from the heat storage unit and on the outside it is in direct contact with the airspace 7 to be heated. Therefore, heat energy is allowed to rapidly and effectively move through the metal shell 6 and a relatively well-cooled flow of smoke gases rises to the chimney connection 8.

[0032] The fireplace in figure 1 can be of modular structure such that the modules are separate from one another and thus combinative and stackable one on top of the other in a suitable combination. In the embodiment of figure 1 the furnace module 17 is of course at the bottom. On top of this are stacked three identical heat storage modules 18, on top of which is located the heat transfer module 19.

[0033] The embodiment of figure 1 also shows supports 20 attached to the outer shell 1, on which the heat storage modules 18, i.e. the upper massive parts of the fireplace above the furnace, rests so that the furnace wall structures can be changed or maintained without dismantling the entire heating stove.

[0034] In figure 2 is better seen how the furnace 4 consists of a rear wall 9 and side walls 10 of heat-storing soapstone, as well as cover structure 11 of the furnace, also of soapstone, load-bearing blocks, which form the throat towards the heat storage unit 5.

[0035] In heat storage unit 5 are six upright, adjacent plates 15, each of which is composed of six soapstone plates. The plates 15 are one-directional and suitably distant from one another such, that the area between the plates forms vertically-leading smoke channels 14. Between the smoke channels 14 in the plates 15 as in figure 1 is used preferably metal flow distributors 16, i.e. guides for the upward-rising flow of smoke gases. Through these the hot, rising smoke gases are guided as evenly as possible across the entire surface area of the plates 15, such that the storage of heat into the soapstone plates is effective.

[0036] Figure 3 shows another embodiment of this invention, in which the furnace 4 and the heat storage unit 5 located above it are like those in the embodiment of figure 1. However, in this embodiment the metal outer shell 2 begins only above the furnace, i.e. from the lower edge of the heat storage unit 5. It is also possible that it begins only from near the upper edge of the heat storage unit.

[0037] After and immediately above the heat storage unit 5 the metal outer shell 2 narrows greatly, forming the tapering surface towards the upward-pointing chimney connection, which forms the smoke gases afterglow heat transfer unit 6. The fireplace in the embodiment of this figure is further surrounded by a surface shell 12 of preferably soapstone. The surface shell forms preferably a front wall, rear wall, side walls and cover for the fireplace.

[0038] In upper part of the surface shell 12, at the height of the upper edge of the heat transfer unit 6, are arranged outflow openings 13 for airflow. The intake openings 21 are located in the surface shell 12 lower near the lower edge of the outer shell 2. In this way the heat transfer unit 6, which enables quick heating, works here in essentially the same way as in the embodiment of figure 1.

[0039] Figures 4-7 show by way of example different structural alternatives of how the different parts of a fireplace according to the invention can be located in relationship to one another. There are of course even more possible alternatives.

[0040] In figure 4 air intake A, burning B, heat storage H and heat release E are located on top of one another in the flow direction of smoke gases corresponding the embodiments shown in figures 1-3.

[0041] In figure 5 air intake A and burning B are on

top of one another and next to them is located heat storage H. Heat release E is located above both, i.e. on top of burning B and heat storage H.

[0042] In figure 6 air intake A, burning B and heat storage H are located on top of one another and located next to these three, and of equal height as the sum height of all three previously-mentioned parts is heat release E.

[0043] In the alternative of figure 7 air intake A, burning B, heat storage H and heat release E are located on top of one another as in figure 4, but in addition a express heat releaser Q has been provided next to the heat storage unit. In consequence, the flow of burn gases after burning travels through the control R, which guides hot burn gases alternatively, or possibly even simultaneously, through heat storage H or express heat releaser Q to heat release E. This structure enables fast preheating of the area of a cold room.

[0044] The invention is described by way of example with reference to the accompanying drawing, wherein the different embodiments of this invention are possible within the limitations of the claims.

Claims

1. A heating stove type fireplace used for heating living spaces, **characterized in that** the fireplace contains
 - a metal outer shell (1,2),
 - a furnace (4) provided with an openable hatch and grate (3),
 - a heat storage unit (5) located after the furnace in the flow direction of essentially hottest burn gases,
 - a smoke gases afterglow heat transfer unit (6) located after the heat storage unit in the flow direction of burn gases to effect direct heat transfer to the surrounding airspace from smoke gases coming from the heat storage unit (7) as well as
 - a smoke gases chimney connection (8) located after the afterglow heat transfer unit.
2. A fireplace according to claim 1, **characterized in that** the smoke gases afterglow heat transfer unit (6) is comprised of a part of the metal outer shell (1,2), whose inner surface is in direct contact with smoke gases coming from the heat storage unit (5).
3. A fireplace according to claim 1 or 2, **characterized in that** the furnace (4) is comprised of a rear wall (9), side walls (10), as well as a cover structure (11) forming a throat towards the heat storage unit (5) of heat-storing material, preferably of soapstone.
4. A fireplace according to any of claims 1 to 3, **char-**

acterized in that the grate (3) has a pre-burn control, which enables effective burning, for guiding burn air adjustably and optionally from the different areas of the grate through it to the burning load.

5. A fireplace according to any of claims 1 to 4, **characterized in that** the fireplace has a tight-fitting outer shell having no openings in the area of the afterglow heat transfer unit and after it in the flow direction of smoke gases. 5
6. A fireplace according to any of claims 1 to 5, **characterized in that** outside the metal outer shell (2) is a surface shell (12). 10
7. A fireplace according to claim 6, **characterized in that** the heat transfer unit (6) is inside the surface shell (12), wherein the surface shell contains flow openings (13) to effect airflow from the heat transfer unit to the airspace (7) surrounding the fireplace. 15
8. A fireplace according to any of claims 1 to 7, **characterized in that** the heat storage unit (5) consists of a massive heat-storing mass, such as of soapstone, through which are arrayed a plurality of smoke channels (14) to increase surface area for heat transfer between the smoke gases and the mass. 20
9. A fireplace according to claim 8, **characterized in that** the heat-storing mass consists of a plurality of one-directional plates (15) slightly distant from one another, where the distances between plates form the smoke channels (14). 25
10. A fireplace according to claim 9, **characterized in that** the smoke channels (14) between the plates (15) have flow distributors (16) that spread the hot smoke gases essentially evenly over the entire surface area of the plates. 30
11. A fireplace according to any of claims 1 to 10, **characterized in that** the metal shell (1) extends in the flow direction of burn gases from below the furnace (4) to the chimney connection. 35
12. A fireplace according to any of claims 1 to 10, **characterized in that** the metal shell (2) extends in the flow direction of burn gases from the area of the heat storage unit (5) to the chimney connection (8). 40
13. A fireplace according to any of claims 1 to 11, **characterized in that** the metal shell (1) has supports for support of the heat-storing inner area of the fireplace above the furnace (4). 45
14. A fireplace according to any of claims 1 to 13, **characterized in that** the fireplace is composed of three 50

stacked and/or adjacent modules separately distinguished by measurement of their desired heating characteristics, the furnace module (17), heat storage module (18) and the heat transfer module (19).

15. A fireplace according claim 14, **characterized in that** the heat storage unit is comprised of two or more stacked and/or adjacent, preferably identical, heat storage modules.
16. A fireplace according to any of claims 1 to 15, **characterized in that** the fireplace has a control (R) to guide hot burn gases optionally through the heat storage unit (5) or past the heat storage unit to the afterglow heat transfer unit (6).
17. A fireplace according to any of claims 1 to 15, **characterized in that** the fireplace has a express heat releaser (Q) to guide hot burn gases essentially directly to the airspace surrounding the fireplace.

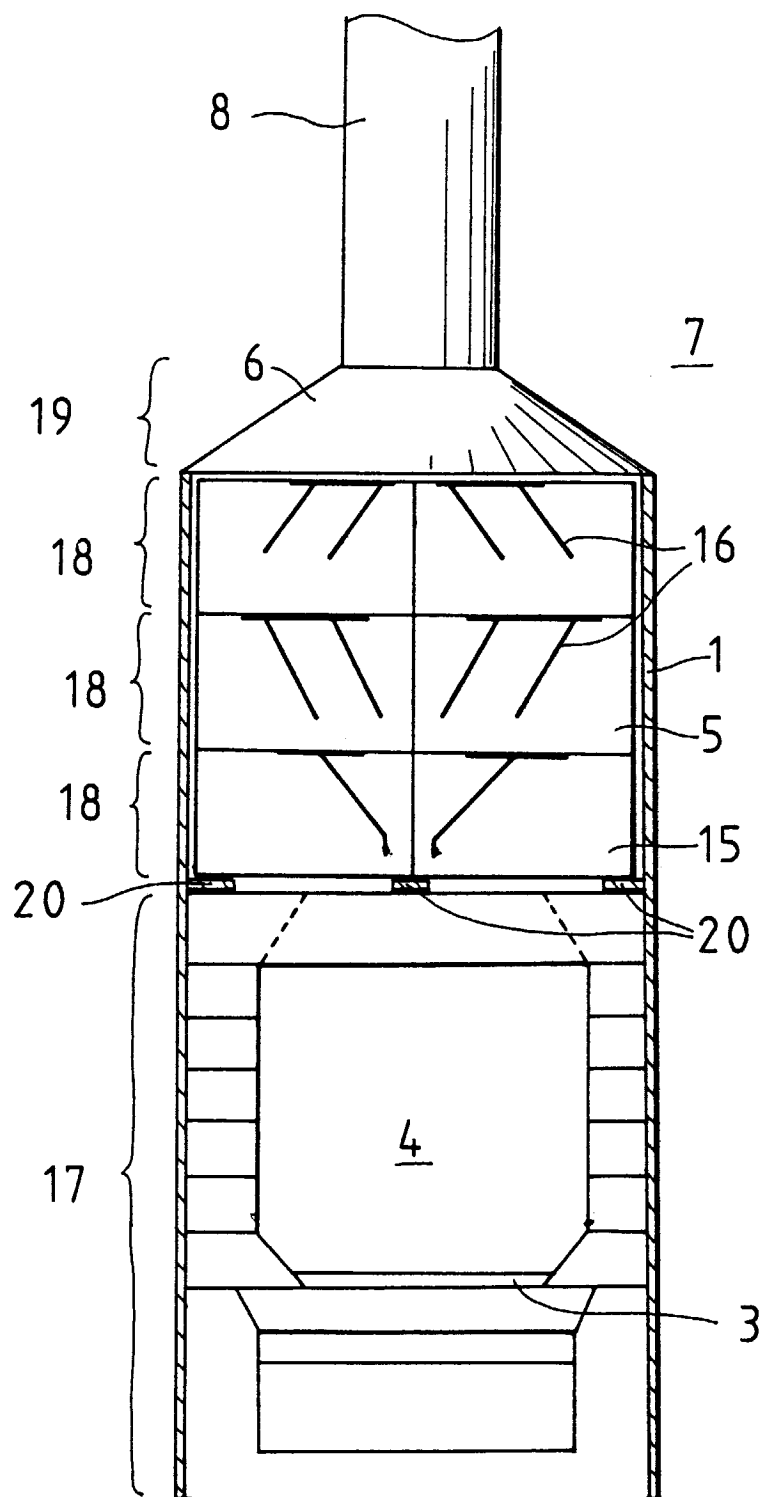


Fig 1

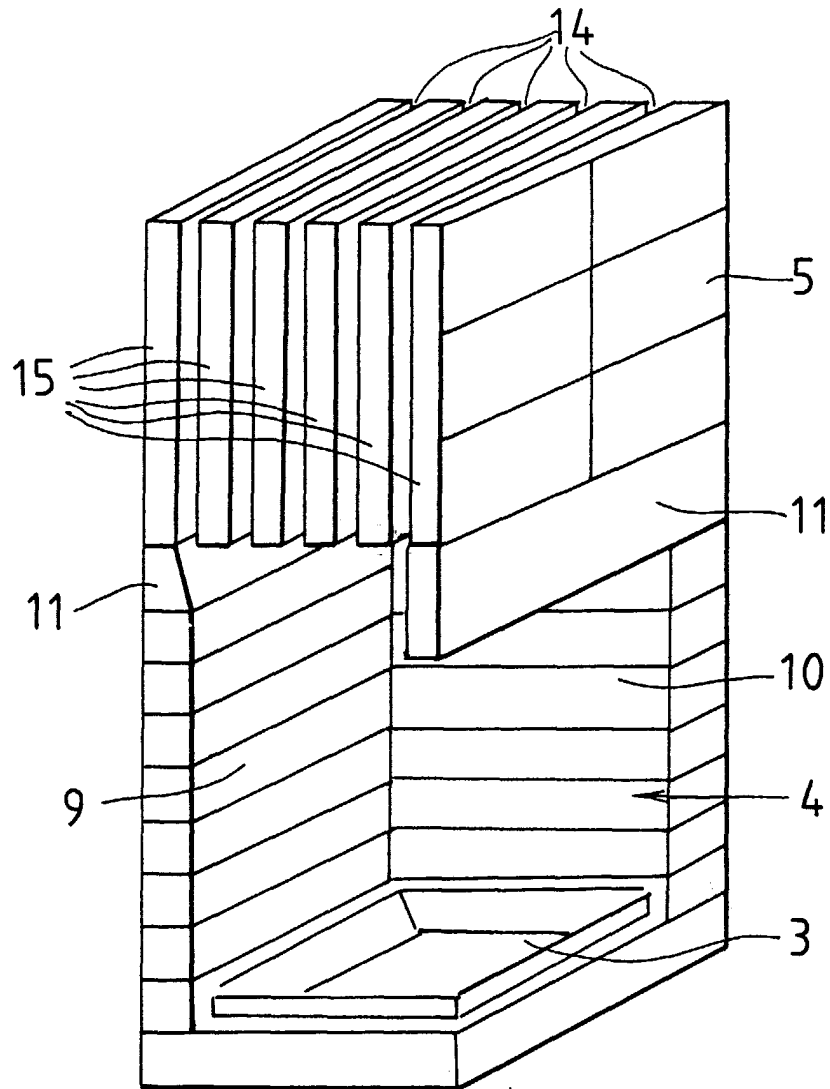


Fig 2

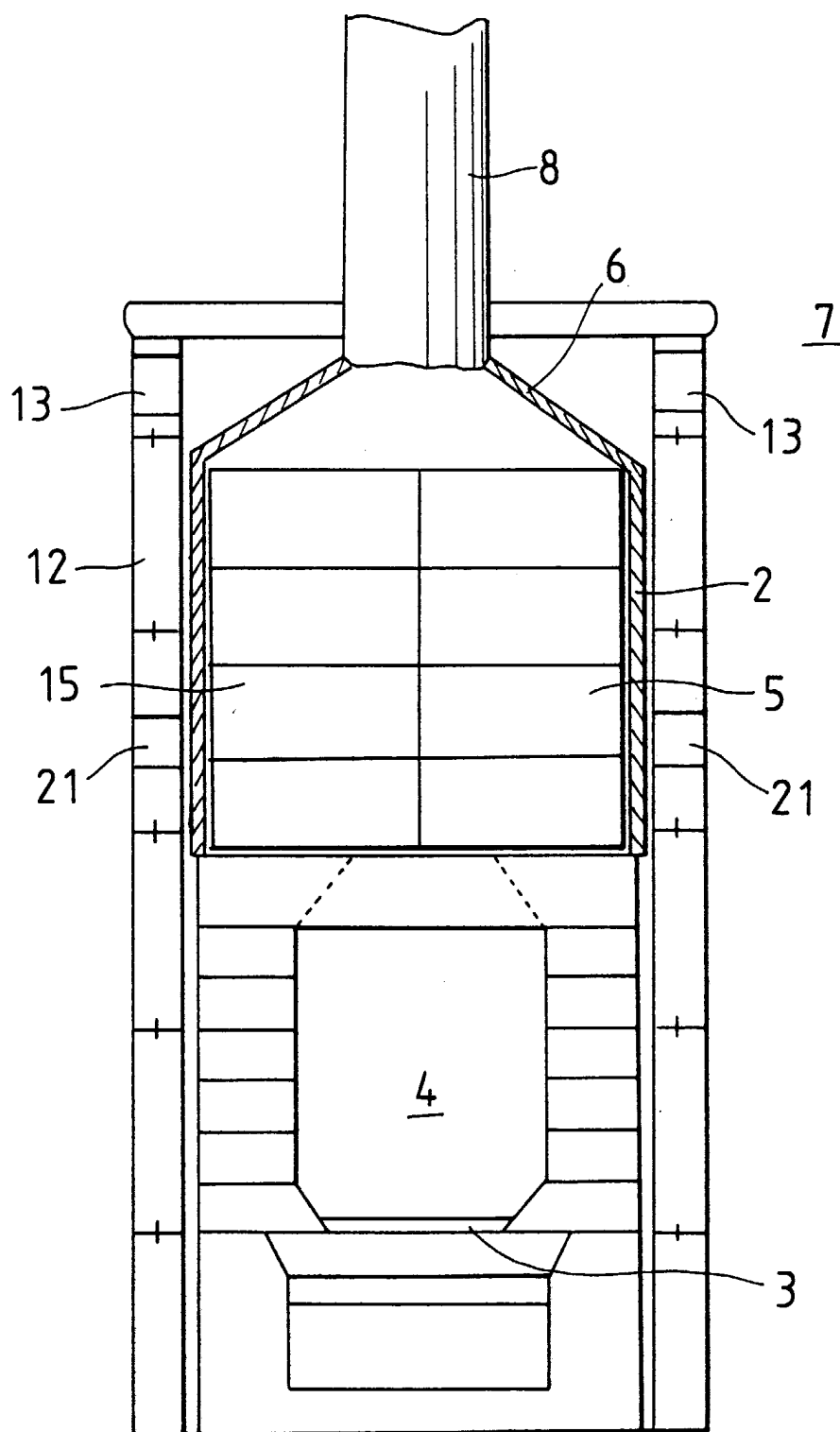


Fig 3

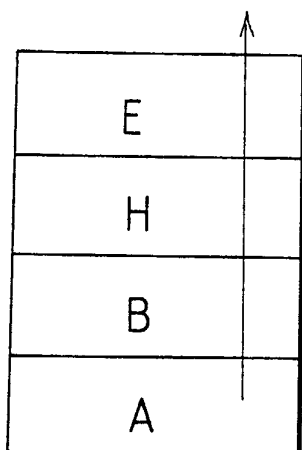


Fig 4

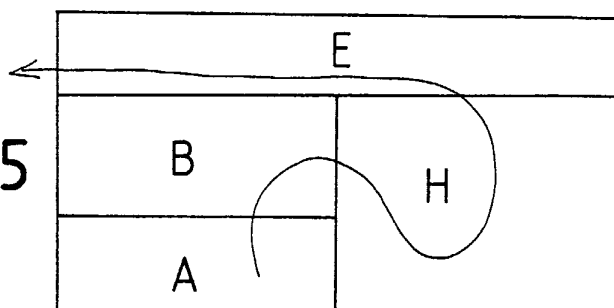


Fig 5

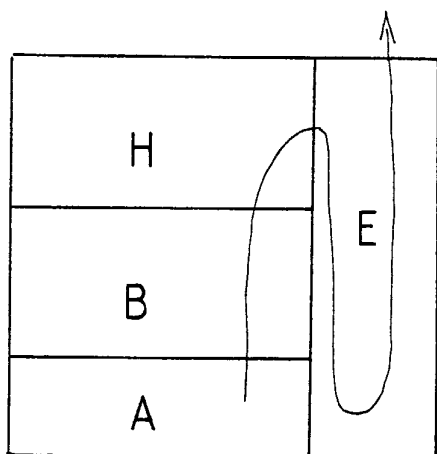


Fig 6

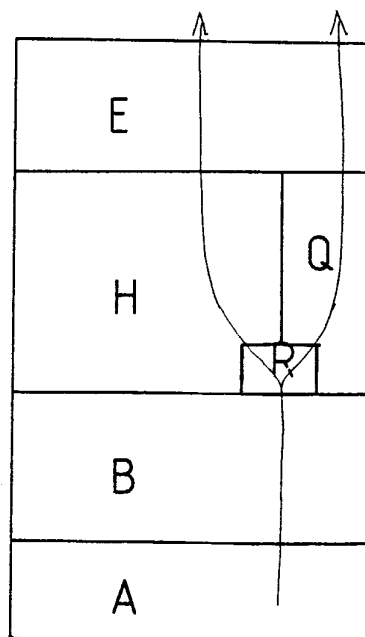


Fig 7