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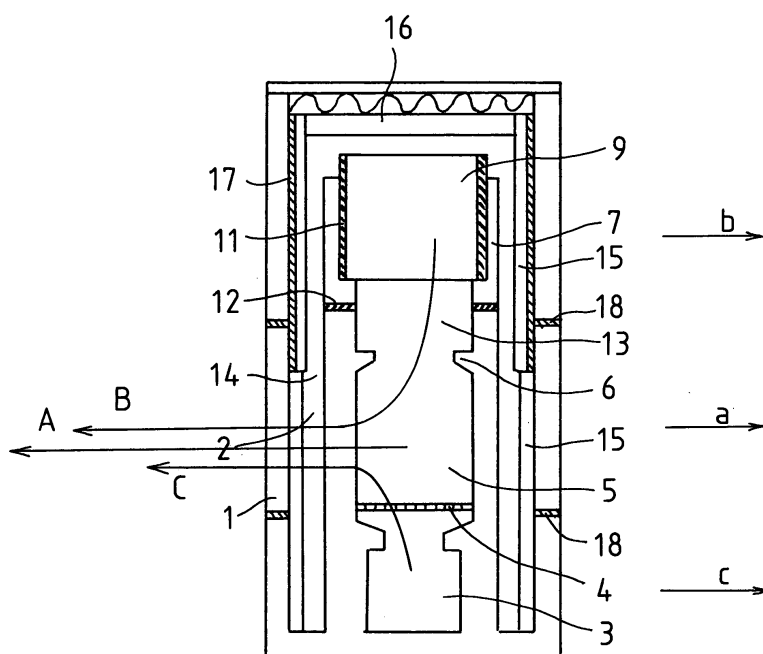
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(54) **Heat-storing fireplace**

(57) The invention relates to a heat-storing fireplace including an outer jacket (1) and an inner jacket (2) having a fire chamber (5) provided with a grate (4), as well as a smoke channel (7) consisting of a heat-storing material for recovering the heat contained in the hot flue gas flow from the fire chamber and for conveying the gases into

a flue. According to the invention, arranged within the smoke channel (7), along its given length, is a heat storage means (9), which substantially increases the heat storage capacity of the given length of the smoke channel. In addition, the heat storage means includes a limiter (11) of heat flows for delaying the heat flows from the heat storage means to the outer jacket.



**FIG 2**

## Description

### FIELD OF THE INVENTION

[0001] The present invention relates to a heat-storing fireplace as defined in the preamble of claim

1. In particular, the invention concerns heat-storing soapstone fireplaces, although in respect to the material, it is not limited to concern only these.

### BACKGROUND OF THE INVENTION

[0002] At present, nearly all detached houses and holiday houses, as well as many terraced houses are provided with heat-storing fireplaces irrespective of the actual heating system of the flat. These fireplaces are used, in ever increasing numbers, in continuous heating to restrain the high costs of oil or electric heating. Heating with wood is used especially when people obtain their firewood, for example, from their own woods.

[0003] The increase in fireplace usage in continuous heating is only restrained by the work load needed for the heating. If there is a wish to heat the whole flat using the present fireplaces that retain heat well, then the fireplace shall be heated at least every other day. In that case, big temperature changes create a problem. Thus, a uniformly convenient temperature requires heating on a daily basis, and heating more rarely leads to a room temperature that is sometimes too hot, sometimes too cool.

[0004] There has been an attempt to alleviate these problems by increasing the heat storage capacity of a fireplace; that is, by using thicker wall structures in the fireplace, or by placing heat-storing mass elsewhere into hot flue gas flows. Using these procedures, a hot heated fireplace will certainly release heat longer, but still, there is the problem with the fast temperature rise in the space to be heated, with the high peak temperatures, and after a narrow peak, a smooth decrease again; that is, non-uniform and continuously rising or falling heat-release properties.

[0005] In one prior-art solution, there has been an attempt to decrease the non-uniformity in the heat release by means of shutter blinds or roller shades placed between an inner jacket and an outer jacket, which blinds or shades, when pulled up, release the radiation heat from the inner jacket to the outer jacket, and when pulled down, reflect the heat back to the inner jacket, at least in theory. Adjusters can, to some extent, prevent heat transfer from the inner jacket to the outer jacket, but in practice, the functioning and output of such adjusters is questionable. In particular, when the adjusters would require adjustment measures, at some points of heating, which measures, however, no-one remembers to make on time, or there is nobody there to make the adjustment when needed.

## OBJECTIVE OF THE INVENTION

[0006] It is an objective of the invention to eliminate the disadvantages referred to above.

[0007] One specific objective of the invention is to disclose a new type of heat-storing fireplace that fully automatically and spontaneously, without any adjustment measures from outside, as well as without any spontaneous mechanical adjustment measures within the stove, releases heat as long and uniformly as possible.

[0008] One further objective of the invention is to disclose a heat-storing fireplace that fast and effectively absorbs the hot heats of flue gases at one relatively fast heating step, but still releases the heat gradually and periodically, uniformly over a long period of time.

## SUMMARY OF THE INVENTION

[0009] The heat-storing fireplace in accordance with the invention is characterized by what has been presented in claim 1.

[0010] The heat-storing fireplace in accordance with the invention includes an outer jacket and an inner jacket of a heat-storing material, the inner jacket having a fire chamber provided with a grate, as well as a smoke channel consisting of a heat-storing material for recovering the heat contained in the hot flue gas flow from the fire chamber and for conveying the gases into a flue. According to the invention, arranged within the heat-storing smoke channel, along its given length, is a heat storage means, which substantially increases the heat storage capacity of the given length of the smoke channel. In addition, the heat storage means is equipped at its circumference with a heat insulation layer for delaying the heat flows from the heat storage means to the outer jacket; that is, for limiting heat flows in a perpendicular direction with respect to the flow of flue gases. In this manner, according to the invention, the fireplace has a big heat storage capacity; it can fast and effectively absorb the heat contained in hot flue gases, but still, as a novel and surprising feature, because of the inventive structure, it releases heat to the outer jacket and via it into the space being heated uniformly, long, and the designed amount at a time. Thus, the invention is based on gradual or zoned heat release so that as the heat is absorbed simultaneously in the different heat-storing masses of the fireplace, these masses release the heat at different times and suitably arranged consecutively, so that the total heat release output of the entire fireplace remains substantially steady for as long a period as possible.

[0011] Preferably, in the fireplace in accordance with the invention, the heat storage means placed in the flue gas flow includes several adjacent heat-storing tiles at a suitable distance from one another, this distance, i.e. a suitable gap, forming flow paths for the flue gases. The tiles are preferably disposed in a vertical direction so that the flue gases flow from under upwards between the tiles. It is also possible to place the tiles in a horizontal direction,

or at an oblique angle, with respect to the flue gas flow, at a distance from one another. The tiles can also constitute one integral structure, or especially in some very hot conditions, the tile can consist of several sub-elements that together form one tile of the heat storage means.

**[0012]** Preferably, the heat-storing tiles have a thickness that is at least as big as the distance between them, i.e. the thickness of the smoke channel formed between them. In this manner, as great a heat storage capacity as possible is achieved for each available volume. This fact is, in addition, enhanced by equally thick soapstone tiles that conduct heat effectively and have a high heat storage capacity. However, it is also possible that the heat storage means consists either wholly or partly of some other material having suitable heat storage properties, such as of steel, cast iron or ceramic casting alloys. Similarly, it is also possible that in the same heat storage means, the tiles are of different thickness and/or the gaps between the tiles are of different width, depending on the desired heat storage properties, the flow amounts of the gas flows directed to the heat storage means, the flow directions, and the temperature, as well as on the structure of the entire fireplace.

**[0013]** The heat insulation layer, according to the invention, surrounding the heat storage means is used to limit and regulate the flow of heat out of the heat storage means. It can even surround the heat storage means from every side so that only the flue gases are left sufficient flow paths within the heat storage means and out of it. A suitable insulator is e.g. a hard mineral wool tile or a ceramic insulation tile. By choosing the material to be used in the heat insulation layer, its thickness and its placement so as to be suitable with respect to the heat-storing mass, it is possible to adjust the time constant of the release of the heat absorbed in the heat storage means so as to suit each fireplace specifically.

**[0014]** For example, when using a thin insulation tile between the jacket of the fire chamber and the outer jacket of the fireplace, it is preferable that the heat insulation layers on the outer surface of the heat storage means, or outer at its circumference, have a substantially higher insulation capacity than the insulation tile. In this manner, it is guaranteed that the heat accumulated in the heat-storing mass surrounding the fire chamber is emitted into the space to be heated substantially entirely before the heat contained in the heat storage means is conveyed to the outer jacket of the fireplace, through it, and into the space to be heated.

**[0015]** It is also possible that the structure of an insulated heat storage means takes advantage of the cleavage plane of soapstone. In that case, the soapstone tiles are placed into the heat storage means so that the heat storage means receives the heat contained in the flue gases as effectively as possible, but also releases heat towards the outer jacket of the fireplace as slowly as possible.

**[0016]** The heat transfer from the heat storage means

into the heat-storing structures of the fire chamber can be further regulated and delayed by isolating the heat-storing masses of the fire chamber and those of the heat storage means from a direct heat transfer contact with one another by means of horizontal, vertical and/or oblique heat limiters. A suitable insulation tile can act as the heat limiter, the thickness of which insulation tile is selected to be suitable for each case specifically. In this manner, the heat absorbed by the heat storage means can be made transfer practically entirely in a perpendicular direction with respect to the direction of flow of flue gases, generally in a horizontal direction, and with a delay determined by the heat insulator with respect to the heating process. When desired, the heat can be made radiate downwards from the heat storage means into the fire chamber and out via it, e.g. via the fire door, whereby the impression is similar to a situation where the fire is lit in an oven.

**[0017]** In most cases, in heat-storing fireplaces the fire chamber is reduced to form a throat before the smoke channel. If the heat storage means of the invention is placed into the smoke channel on top of the fire chamber, it is preferable that immediately after the throat, the smoke channel includes an open flow space before the heat storage means. This suitable distance between a fire and a heat storage means ensures that the heat radiation being emitted from a red-hot heat storage means does not have a harmful effect on the burning in the fire chamber.

**[0018]** The heat storage means that retains heat and releases it gradually, according to the invention, can be implemented in several different types of fireplaces. Thus, the fireplace can be a top-flue connection fireplace where the flue gases rise directly upwards from the fire chamber and escape into the flue from the top portion of the fireplace. Similarly, the fireplace can be a bottom-connection fireplace provided with side channels, wherein the flue gases circulate upwards from the fire chamber and further downwards along the side channels of the edges of the fireplace, escaping from the fireplace into the flue in the bottom portion of the fireplace. In both of these embodiments, the heat storage means of the invention is preferably disposed above the fire chamber and at a suitable distance from it. In particular, in a structure provided with side channels, it is, however, possible that the heat storage means is disposed farther in the flue gas flow, or that it extends farther into the flue gas flow, even downwards the side channels. Similarly, it is also possible that in the side channels, or even beneath the fire chamber, at the point of contact of the side channels, one uses a second heat storage means of the invention which recovers the heat contained in the flue gases, and which further, thanks to suitable insulation arrangements, releases the heat outside the fireplace later than before.

**[0019]** The heat-storing fireplace in which the invention is used can also be a baking oven. In a baking oven, the heat storage means can be disposed above the oven

space for enhancing the heat absorbance in the oven roof, keeping it longer in a baking temperature. In a baking oven, the heat storage means can also be placed underneath the oven space, where conventionally, there is just the ash bin, and thus space even for a big additional heat storage means and for a limiter of heat flow arranged about its circumference. In this manner, according to the invention, a conventional baking oven can be arranged so as to be a heat source that retains heat well and releases it long and uniformly, thereby also improving the baking properties of the oven.

**[0020]** In one embodiment of the invention, the heat-storing and heat-conducting outer jacket of the fireplace, such as a soapstone jacket, is divided into two or more zones using a suitable heat-insulating or weakly heat-conductive material. These zones of the outer jacket function as surfaces that release heat in different ways, depending on the heat flows within the outer jacket, because due to the effect of an insulating material, there are no significant heat flows between the zones. It is even possible that using the heat storage means and heat insulators in accordance with the invention, substantially all the heat accumulated in the fireplace can be made release via a given limited zone of the outer surface. This makes it possible to limit an instantaneous heat flow i.e. heating capacity, and the accumulated amount of heat can be made last longer than before.

**[0021]** The heat-storing fireplace of the invention has significant advantages over prior art. Using an additional heat storage means in accordance with the invention, the heat contained in the flue gases can be effectively recovered, and a heat amount bigger than conventionally can be made accumulate in the fireplace. In this manner, when heating a fireplace, it can be heated more effectively and longer more than one filling time without the flue gases escaping into the flue when too hot. Irrespective of the effective heating, the outer jacket of the fireplace does not get too hot, and, in practice, compared to a similar conventional fireplace, the outer jacket can remain even cooler. In this manner, the nominal heat output can be adjusted to suit also low-energy houses.

**[0022]** The structure of the invention is also very flexible in terms of its structural solution alternatives, enabling its placing in heat-storing fireplaces into nearly any suitable place in the flue gas flow, and thus substantially into all heat-storing fireplaces of a different model or shape.

**[0023]** As the fireplace releases the heat retained by it gradually, the outer jacket of the fireplace does not get unnecessarily hot in any stage; instead it remains substantially standard-warm over a very long period. In this manner, the fireplace of the invention that releases heat gradually keeps the surrounding space to be heated substantially standard-warm through the entire heating period, which depending on the size of the heat-storing masses of the entire fireplace, can be several days. In addition, a substantial feature in the invention is that during the long and uniform heat release period, there is no

need to make any adjustments in the fireplace. Similarly, the fireplace does not have any spontaneously moving adjustment structures, but the uniform and long heat release has been implemented using fixed and permanent structures.

## LIST OF FIGURES

**[0024]** In the following section, the invention will be described in detail with reference to the accompanying drawings, in which

Fig. 1 schematically represents a sectional view of a top-flue connection fireplace of the invention as seen from the front;

Fig. 2 schematically represents a sectional view of a bottom-flue connection fireplace of the invention as seen from the front;

Fig. 3 schematically represents one baking oven of the invention; and

Fig. 4 schematically represents another baking oven of the invention.

## DETAILED DESCRIPTION OF THE INVENTION

**[0025]** The fireplace as shown in Fig. 1 includes an outer jacket 1 and an inner jacket 2, both being of a material that retains heat well. The inner jacket forms an ash bin 3, on top of which there is a grate 4; as well as a fire chamber 5; a throat 6 disposed in the upper part of the fire chamber and an upwards directed smoke channel 7, which leads the flue gases into a flue connection 8. Except for the grate, the aforementioned parts are preferably of soapstone, but other materials can also be used. Arranged in the smoke channel 7, along its entire depth and width, is a heat storage means 9; that is, a number of soapstone tiles 10, which can be tiles consisting of one stone or of more than one element. There are, for example, 3 to 10 tiles side by side in a vertical direction at a distance from one another, so that vertical, equally thick gaps are formed between the tiles that form the smoke channels for the flue gas flow.

**[0026]** Outside the heat storage means 9 and the wall of the smoke channel 7 that supports the storage means, before the outer jacket 1, is a heat insulation layer 11 functioning as a limiter of heat flows. In addition, arranged in the lower edge of the smoke channel 7 and the heat storage means 9 is a heat limiter 12, so that the soapstone structures disposed above and underneath it are not in a good, direct heat conduction contact with one another.

**[0027]** Further, as the fire chamber is reduced to form a throat 6, there is a free flow space 13 after the throat before the tiles 10 of the heat storage means 9.

**[0028]** When heating a fireplace as shown in Fig. 1, heat is retained in the structures of the fire chamber 5, the throat 6, the walls of the free flow space 13, and the heat storage means 9 before the flue gases escape into the flue 8. During the heating, the heat entering the space

being heated consists mainly of radiation heat that enters through the fire door. As the heating ends, the heat retained in the structures of the fire chamber and the throat is conducted and radiates into the outer jacket 1 and further from it into the space to be heated. Thanks to the parts that limit the heat flows, such as the insulation layer 11 and the heat limiter 12, the heat storage means does not release the heat immediately into the outer jacket 1; instead it uses a suitable oven-specific time constant to be selected separately, the time constant being affected first of all by the properties of the heat-insulating materials to be used. In this manner, by suitable selections, the heat is made release from the heat storage means into the outer jacket 1 only when the main part of the heat retained up to the level of the fire chamber has already heated the surrounding room space.

**[0029]** In another embodiment of the invention, in Fig. 2, the same reference numerals are used to refer to the same parts for the sake of clarity. Fig. 2 shows a bottom-flue connection fireplace having an outer jacket 1 and inner jacket 2 of a heat-storing material, side channels 14 between them, as well as double stones 15 in the outer surfaces of the side channels for enhancing the heat storage capacity of the fireplace. The inner jacket 2 includes an ash bin 3, a grate 4, a fire chamber 5, a throat 6, a free flow space 13 above the throat, as well as an upwards directed smoke channel 7. Beneath the transversal upper lid 16 the smoke channel turns downwards into the side channels 14, the side channels being connected underneath and behind the smoke channel into a common flue connection in a manner known per se.

**[0030]** Arranged within the smoke channel, supported by the walls 7 of the smoke channels, is a heat storage means 9; that is, a whole consisting of several vertical e.g. soapstone tiles, wherein the flue gases are allowed to rise between the tiles and release heat to the stones. The heat storage means 9 is isolated from the structures of the smoke channel 7 by means of an insulation layer 11, and in addition, the structure of the smoke channel that retains and conducts heat is isolated by a horizontal heat limiter 12 in the area of the free flow space 13. Placed in the area of the heat storage means 9; that is, at its elevation, between the outer jacket 1 of the fireplace and the double stone 15, is an additional insulator 17, which together with the insulation layer 11 and the heat limiter 12 effectively limits heat flows from the upper part of the fireplace to the outer jacket.

**[0031]** It is also possible that placed in the outer jacket 1 of the fireplace are horizontal, weakly heat-conductive materials, e.g. ceramic decoration moldings 18, by means of which the outer jacket is divided in the elevation into zones that warm up in different ways.

**[0032]** When heating the fireplace shown in Fig. 2, the structures of the fire chamber 5, the smoke channel 7, the heat storage means 9 and the double stones of the side channels become very hot. As the heating ends, the retained heat is conducted and radiates first from the area of the fire chamber 5 into the outer jacket 1 and due

to the effect of the decorative moldings 18, mainly from the outer jacket middle area between them, into the room space. As the fireplace is well insulated at the upper part thereof, the heat retained in the heat storage means 9 is not allowed to emit into the outer jacket through the insulators. In this manner, the upper part of the fireplace does not heat the room space until the heat of the lower part has been consumed.

**[0033]** In the second embodiment shown in Fig. 2, the insulation thickness of the upper part can be increased so that most of the heat is not allowed to enter the upper part of the outer jacket, but its only flow path is downwards after the structures surrounding the fireplace have sufficiently cooled. With this solution, all the heat contained in the fireplace can be made release in the fireplace-high zone of the outer jacket into the room space in consecutive, long-lasting heat flows that are uniform in terms of temperature.

**[0034]** Depending on the thickness, locations and properties of the insulators limiting the heat flows of Fig. 2, the fireplace can be made release heat in steps a, b and c that are performed consecutively with respect of time and from different heights from the outer jacket, or in the second embodiment, in heat flows A, B and C that are consecutive both with respect to time and place from the height of the fire chamber.

**[0035]** Fig. 3 schematically shows a baking oven in which the heat storage means 20 is placed on top of the oven space 21, the tiles of the heat storage means being fixed to the oven roof 22. However, the heat storage means is provided with an effective insulation layer 23 on the top and sides thereof. In this manner, the heat storage means enhances the absorbance of heat in the oven roof, thus keeping it longer in a baking temperature.

**[0036]** Fig. 4 shows a second embodiment of a baking oven, according to the invention, wherein the flue gases escaping from the oven space 21 conventionally circulate on top of the oven roof 22 forwards and downwards from the sides. Arranged beneath the oven space is a heat storage means 25 provided with an insulation layer 24 on the sides and top, through which insulation layer the flue gases travel towards the flue connection.

**[0037]** It is even possible to design a baking oven in which the structures of Figs. 3 and 4 are so connected that in the same baking oven there are heat storage means both above and underneath the oven space. A substantial fact in the embodiments referred to is that the insulators disposed in conjunction with the heat storage means and limiting the heat flows are so fitted and dimensioned that they do not release their heat retained until the second step; that is, not until the oven part itself has cooled and its heat warmed up the surrounding room space through the outer jacket.

**[0038]** The invention is not limited merely to examples referred to above; instead many modifications are possible within the scope of the inventive idea defined by the claims.

## Claims

1. A heat-storing fireplace comprising an outer jacket (1) and an inner jacket (2) of a heat-storing material, the inner jacket having a fire chamber (5) provided with a grate (4), as well as a smoke channel (7) consisting of a heat-storing material for recovering the heat contained in the hot flue gas flow from the fire chamber and for conveying the gases into a flue, **characterized in that** arranged within the heat-storing smoke channel (7), along its given length in the flue gas flow, is a heat storage means (9), which substantially increases the heat storage capacity of the given length of the smoke channel, and that the heat storage means is equipped at its circumference with a heat insulation layer (11) for limiting the heat flows in a perpendicular direction with respect to the flow of flue gases and for delaying the heat flows from the heat storage means to the outer jacket.
2. The heat-storing fireplace as defined in claim 1, **characterized in that** the heat storage means (9) includes several adjacent heat-storing tiles at a distance from one another, this distance forming flow paths for the flue gases.
3. The heat-storing fireplace as defined in claim 1, **characterized in that** the thickness of the heat-storing tiles is at least as big as the distance between them.
4. The fireplace as defined in any one of claims 1 to 3, **characterized in that** the heat storage means (9) consists of equally thick soapstone tiles.
5. The fireplace as defined in any one of claims 1 to 4, wherein in the gap between the fire chamber and the outer jacket there is an insulation tile, **characterized in that** the insulation capacity of the heat insulation layer is substantially higher than that of the insulation tile.
6. The heat-storing fireplace as defined in any one of claims 1 to 5, **characterized in that** the heat-storing masses of the fire chamber and those of the heat storage means have been isolated from a direct heat transfer contact with one another using a horizontal heat limiter (12).
7. The heat-storing fireplace as defined in any one of claims 1 to 6, wherein the fire chamber is reduced to form a throat before the smoke channel, **characterized in that** immediately after the throat, the smoke channel includes an open flow space (13) before the heat storage means for eliminating the effects of the heat radiation of the hot heat storage means on the burning of the fireplace.
8. The heat-storing fireplace as defined in any one of claims 1 to 7, **characterized in that** the heat-storing fireplace is a top-flue connection fireplace.
9. The heat-storing fireplace as defined in any one of claims 1 to 7, **characterized in that** the heat-storing fireplace is a bottom-flue connection fireplace.
10. The heat-storing fireplace as defined in any one of claims 1 to 9, **characterized in that** the heat-storing fireplace is a corner fireplace or a straight-channel fireplace, wherein the heat storage means has been placed in the rear space substantially behind the fireplace.
11. The fireplace as defined in any one of claims 1 to 10, **characterized in that** the heat storage means has been placed beneath the grate level.
12. The heat-storing fireplace as defined in any one of claims 1 to 8, **characterized in that** the heat-storing fireplace is a baking oven, wherein the heat storage means has been placed above the oven space.
13. The heat-storing fireplace as defined in any one of claims 1 to 8 or 14, **characterized in that** the heat-storing fireplace is a baking oven, wherein the heat storage means has been placed beneath the oven space.
14. The fireplace as defined in any one of claims 1 to 13, **characterized in that** the heat-storing, heat-conducting outer jacket of the fireplace is divided into zones by means of a weakly heat-conductive material (18), so that the heat release of the fireplace into the surrounding space is performed via a given zone/ given zones.

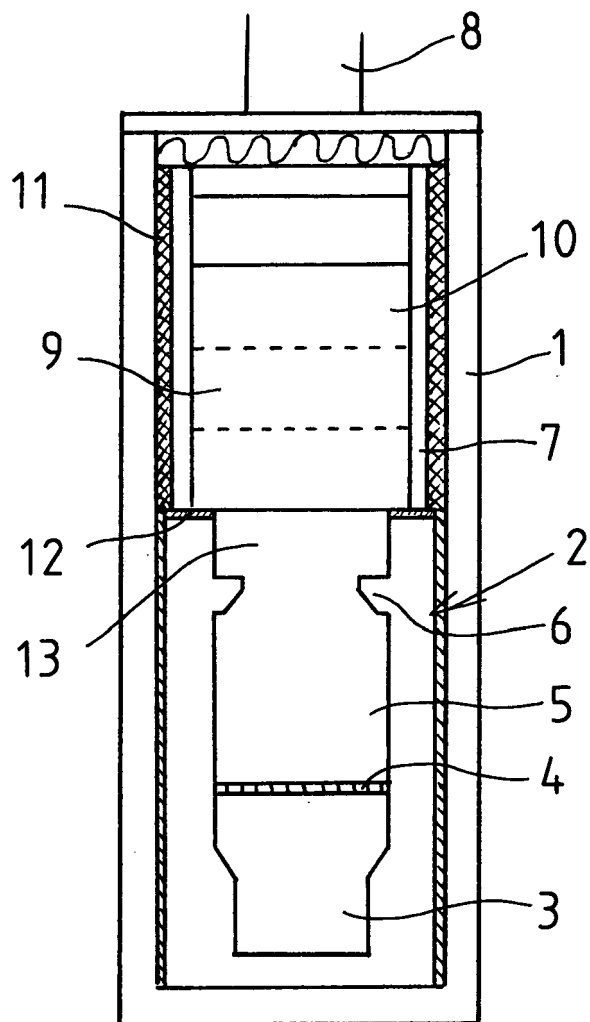


FIG 1

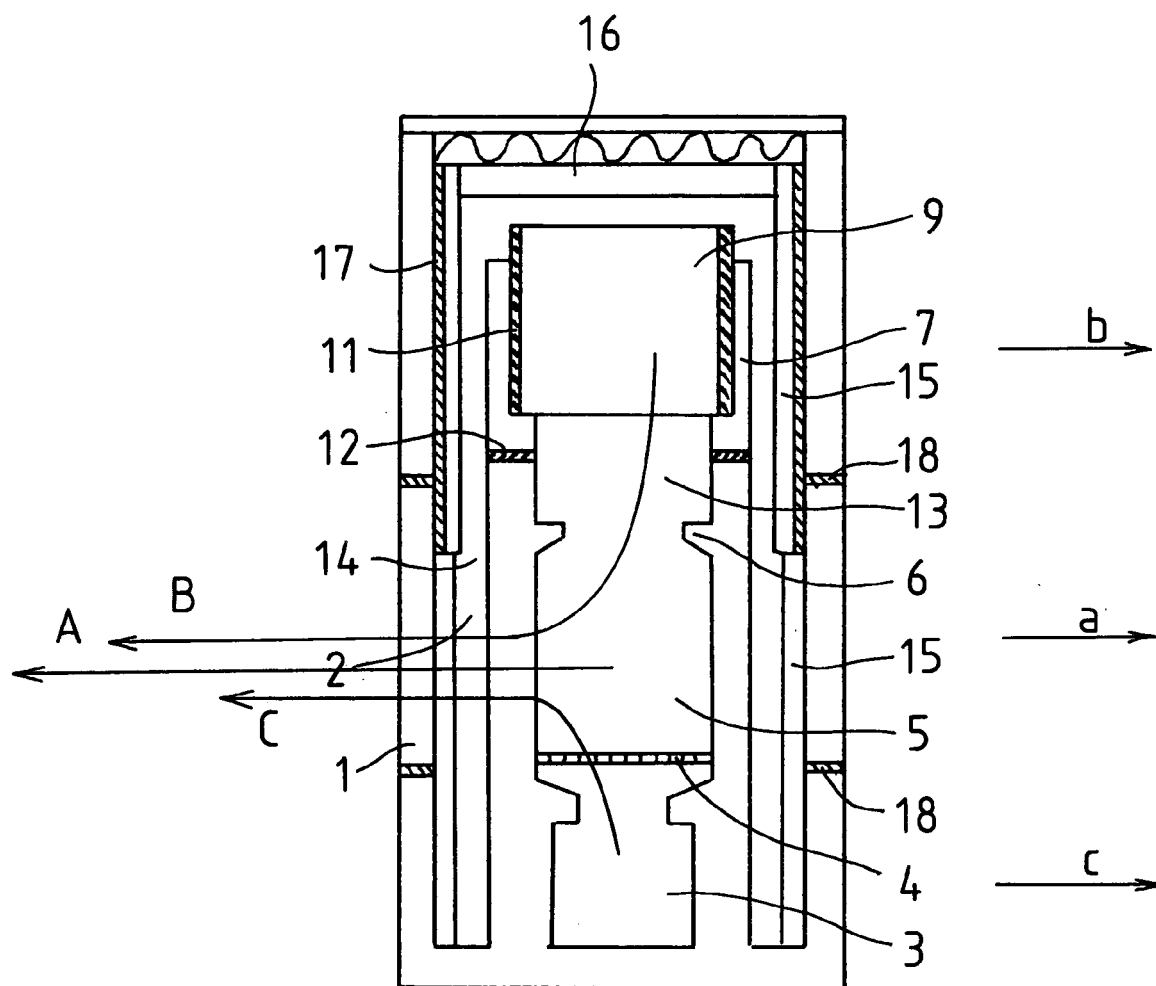


FIG 2

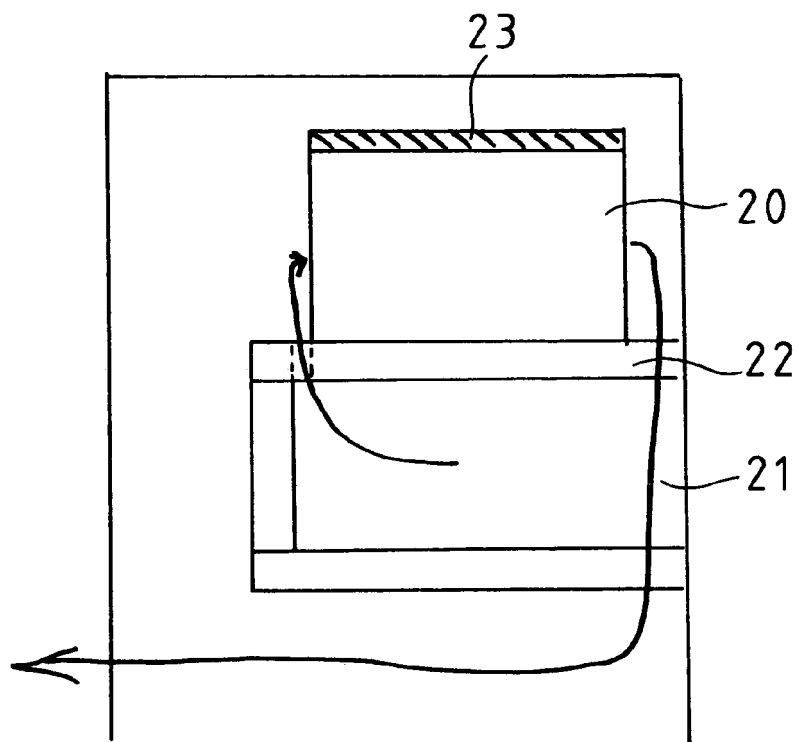


FIG 3

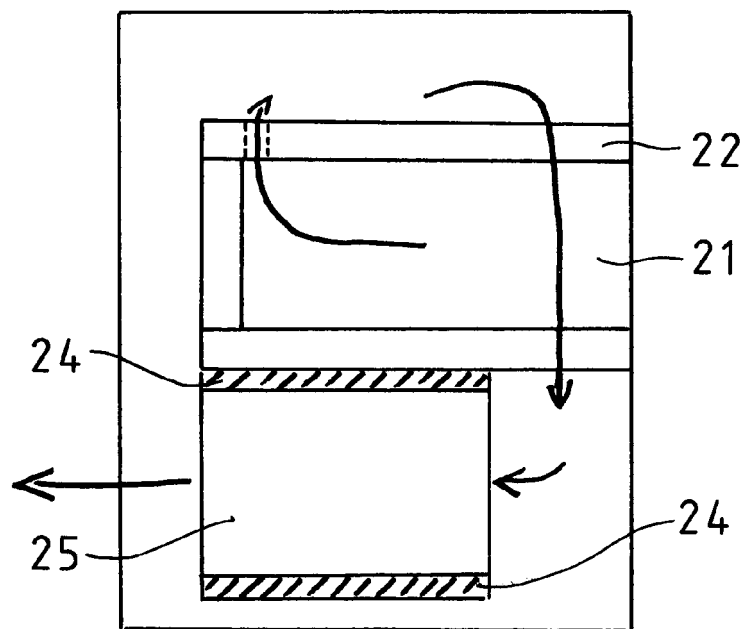


FIG 4