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(54) **Heat-accumulating module and a corresponding heat accumulator**

(57) A heat accumulator and a heat-accumulating module for use therein to be disposed e.g. in connection with a fireplace, in the flow channels for the combustion gases after the firebox. According to the invention, the heat-accumulating module (1,2,3) comprises a number of heat-accumulating elements (4) connected to each other side by side by means of at least one binding member (5) to form an elongated module.

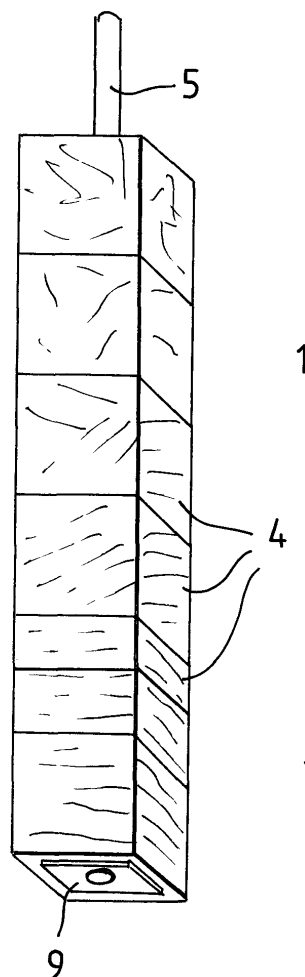


Fig 2

Description

FIELD OF THE INVENTION

[0001] The invention relates to a heat-accumulating module as defined in the preamble of claim 1 and to a heat accumulator as defined in the preamble of claim 13.

BACKGROUND OF THE INVENTION

[0002] The heat-accumulating properties of a fireplace may be improved by increasing the amount of the heat-accumulating stone mass in the fireplace. Traditionally, this has been done by making the fireplace jacket from a thicker material or by providing the fireplace with a number of jacket layers and circulating the hot combustion gases also between these jackets. A good example of that is a fireplace provided with side channels, wherein the firebox constitutes an inner jacket, and provided between the inner jacket and the outer casing are side channels through which the combustion gases flow down and out into the flue.

[0003] Further, to increase the heat-accumulating properties of a fireplace, it is known to place vertical tiles of soapstone at a distance from each other in the smoke channel or the upper combustion chamber above the firebox, so that the combustion gases are able to flow between these tiles and deliver heat into the tiles of stone. This is a functional and effective heat-accumulating arrangement. However, it has certain drawbacks. The large tiles of stone have high quality demands. In order to withstand extremely hot conditions, they have to be homogeneous and thus carefully selected, which is expensive. On the other hand, the large tiles of stone need good support in both lateral and vertical direction, and therefore often metallic parts have to be disposed in hot conditions in direct contact with fire.

[0004] It is also known to make load-bearing wall structures and fire covers of the fireboxes in fireplaces from factory-made opposite cleavage soapstone elements, patent FI102210 and utility model FIU3719. The objective in this technique has been to speed up the manufacture and mounting, to diminish the packaging and transportation costs, to reduce mounting errors and to assure quality mounting. In this connection, however, there has been no intention whatsoever to increase the heat-accumulating capacity of the fireplaces, but instead the elements have been presented as merely structural components for the load-bearing structures of the fireplaces.

OBJECTIVE OF THE INVENTION

[0005] The objective of the invention is to eliminate the drawbacks of the prior art referred to above. In particular, one objective of the invention is to disclose a new type of heat-accumulating module for use in fireplaces to increase the heat-accumulating capacity of the fireplace to a considerable degree without affecting in any way the

load-bearing structural components of the fireplace. Further, another objective of the invention is to disclose a new type of heat accumulator for use in fireplaces or separately, having excellent resistance even in hot conditions. Similarly, a further objective of the invention is to allow the use of structurally non-homogenous stone material as well as the heat-accumulating material even in hot conditions.

10 SUMMARY OF THE INVENTION

[0006] The heat accumulating module according to the invention is designated to be disposed in a fireplace, in the flow channels for the combustion gases after the firebox. It may be located right over the firebox in the upper combustion chamber, in the secondary combustion chamber, under the fire cover or in different sites of the side channels, depending on the fireplace construction. According to the invention, the heat-accumulating module is comprised of a number of relatively small heat-accumulating elements connected with each other side by side to form an elongated module by means of at least one binding member extending through the elements or on the surface of the elements. It is thus essential of the inventive heat-accumulating module that it does not constitute part of the load-bearing structure of the fireplace and does not actually form any flow channels for the combustion gases of the fireplace, but instead it or they are constructions which are substantially apart and separate from the flow channels and apart from the walls of the flow channels, supported only where necessary on the load-bearing fireplace structures which define the flow channels for the combustion gases.

[0007] Therefore, in one embodiment, all elements of the module comprise a hole through which an iron bar which serves as the binding member can be accommodated. In this manner, the iron binder does not remain visible, but is instead almost entirely, or entirely, depending on the construction, hidden inside the heat-accumulating elements in the final construction, and is therefore not brought into contact with fire. In another embodiment, the binding member or the binding members are strips, wires or the like disposed on the surface of the elements, for examples in grooves provided on the surface. Owing to the good heat-accumulating and heat transfer properties of the elements, the binding members are not overheated, in particular when soapstone elements are used as the heat-accumulating material.

[0008] Although the elements may be of a number of shapes, they are preferably rectangular parallelepipeds having straight and relatively smooth surfaces. One shape that has been found functional is the cube with an edge length of about 10cm. Modules of different lengths assembled from such elements are easily mountable in different flow channels of the fireplace, individually or in suitable groups, in each case according to the available space and the required heat-accumulating capacity.

[0009] Thus, in one embodiment of the invention using

identical elements, they form a module having a width and a length which are equal to the width and the length of an individual element, but a height which is equal to the height of an individual element multiplied by the number of the elements. The height of the module has no upper limit in terms of structure, but instead it is determined merely by the available space.

[0010] It is also possible that although the widths and the lengths of the elements are identical, their heights may vary freely. In this way, it is possible to have smooth and even modules. It is further possible that where winding, tortuous smoke channels between the modules are desirable, the widths and the lengths of the elements are arranged to be unequal suitably in the successive elements of the module. With this construction it is possible to slow down the flow of the combustion gases between the modules and to enhance heat transfer from the combustion gases and heat accumulation to the module.

[0011] Although the material used in the invention is most preferably soapstone, the elements may also be made from other materials which accumulate heat sufficiently and resist hot conditions, such as for example refractory cast mass.

[0012] In a first embodiment of the invention, one end, i.e. the upper end, of the heat-accumulating module comprises a suspension arrangement for suspending the module vertically at the upper end in a flow channel. In this manner, the heat-accumulating module suspends freely and stays disengaged from the rest of the fireplace structure for the entire length thereof, contacting the load-bearing structures only at the upper end. The employed suspension arrangement may comprise a suspension perch extending across a vertical flow channel, or a corresponding arrangement. It is also possible that the module is attached to the upper lid to suspend relatively freely.

[0013] The free suspension of the module in the flow channel for the combustion gases allows free heat expansion movements of the module. Further, it enables the placement of the lower part of the module as close to the upper part of the firebox, i.e. the hottest position in the fireplace, as possible.

[0014] Preferably, the lower end of the suspending heat-accumulating module comprises a base plate on which the lowest element is supported, the binding member, such as an iron bar, being arranged to lean against the base plate. However, it is also possible that a suitable cover element is used in the lowest position for covering the metallic base plate so that only the refractory material is in direct contact with the fire and the hottest gases.

[0015] In a second embodiment of the invention, the heat-accumulating module is also disposed vertically, but has at one end, i.e. at the lower end in this case, a support arrangement for supporting the module at the lower end in the vertical position in the flow channel. In this case, the support arrangement may be for example a bar, mounted vertically on the base of a side channel, so that, for example, elements comprising a hole may be threaded one upon the other around the bar in the side channel.

In this manner, no actual locking is needed in the module, but instead the elements stay in place by their own weight. Further, the uppermost element may comprise no bore hole through the stone. In this manner, it covers the end of the bar so that no metallic parts in the module remain visible.

[0016] In a third embodiment of the invention, the heat-accumulating module is arranged horizontally, i.e. transversely, in a vertical flow channel, whereby both of its ends are supported on the wall structures of the flow channel. In this case, the binding member preferably comprises tightening means, such as for example a threaded bolt and a nut, for clamping the elements to form a compact module. In this embodiment, too, both ends of the module are readily mounted to be hidden in the load-bearing wall structures of the fireplace so that no metallic parts, such as threaded bars, nuts, metal sheets etc. that extend out of the ends remain visible or in contact with the hot combustion gases.

[0017] Although the heat-accumulating modules according to the invention may be used perfectly well individually in different combustion gas channels of a fireplace, it is advantageous to dispose a number of them side by side and in parallel in the same flow channel at a distance from each other. When placed suitably at a distance from each other, suitable smoke ducts are formed between them, through which ducts the hot combustion gases are able to flow and release heat into the modules.

[0018] The invention also relates to a heat accumulator which may be an essential part of a fireplace, a separate construction operating in connection with a fireplace, or even a construction which is completely separate from a fireplace, operating in other contexts and accumulating heat from other hot gas flows. The heat accumulator comprises a jacket and, in the interior space defined by the jacket, one or more heat-accumulating components to cool down the hot gas flow passing through the space and to recover the heat. According to the invention, the heat accumulating component is a heat-accumulating module comprising a number of heat-accumulating elements connected to each other side by side by means of at least one binding member to form an elongated module.

[0019] The jacket employed in the heat accumulator may vary according to the intended use of the heat accumulator. Thus, it may be made from a heat-accumulating material as the modules, or it may be made from a heat-insulating material. In some constructions it may also be for example a metallic jacket which transmits the heat that has been accumulated in the modules into the surrounding space steadily and efficiently.

[0020] Preferably, the heat-accumulating module is supported on the jacket only from one end, and at the maximum only from both ends, the other parts of the module being disposed at a distance from the jacket. The heat-accumulating modules of different constructions, materials and shapes as described above and below in

this application may be used in the heat accumulator according to the invention, depending in each case on the intended use and the desired properties of the heat accumulator.

[0021] The heat-accumulating module and the heat accumulator according to the invention provide considerable advantages compared to the prior art. With the module according to the invention, it is possible to considerably and easily increase the heat-accumulating capacity in both new fireplaces and those which are already in use, because nearly all fireplaces comprise flow channels for the combustion gas flows with sufficient space for a heat-accumulating module of a suitable length. Owing to the small individual elements of the module, it is easy to select the most suitable stones for the module, for example in terms of cleavage when using soapstone, and thus to maximize the heat-accumulating capacity. On the other hand, owing specifically to the small size of the elements, also stone materials which vary in structure and thermal properties may be used. Thanks to the small size of the elements in particular, the module may be built in such a manner that the elements which are exposed to the highest thermal stress are selected from soapstones which have the best refractory properties. A further advantage is that the elements are clamped against each other in the module, so that particularly in the vertical modules cracking of one element does not necessarily affect the operation of the module, but even a cracked element stays in place between two solid elements.

LIST OF FIGURES

[0022] In the following section, the invention will be described in detail with reference to the accompanying drawings, in which

Fig. 1 shows one soapstone element used in the invention,

Fig. 2 shows a first embodiment of the invention,

Fig. 3 shows a second embodiment of the invention,

Fig. 4 shows a third embodiment of the invention and

Fig. 5 shows a heat accumulator according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] Fig. 1 presents a cube-shaped soapstone element 4 used in the invention. In the middle of one of the faces of the element there is a hole extending through the element to the middle of the opposite face. The element has been sawed from soapstone so as to have optimum cleavage 11 in terms of heat resistance and the heat-accumulating rate of the stone.

[0024] Fig. 2 presents one soapstone module 1 according to the invention comprising, one upon the other, both cube-shaped elements and lower elements wherein, however, the width and the length are equal to the

width and the length of the cube-shaped elements. Disposed through all of the elements there is an iron binder 5 supported at the lower end on a base plate 9 under the lowest soapstone element. In this manner, the entire module can be suspended on a desired site in the flow channels for the combustion gases of the fireplace by means of the iron binder 5 which extends into the space above the module. The soapstone elements 4 in the module are selected in such manner that, in the vertical direction, the elements having strongest orientation and being therefore the most resistant and the most efficient in heat-accumulating properties are positioned at the lower end of the module. There the elements have strong orientation and are fine-grained, whereas soapstone having weaker orientation and rougher grains may be used towards the top. In this manner, the soapstone which best resists heat is disposed in the hottest position of the fireplace. This applies, naturally, only when the module is positioned over the firebox where the combustion gases flow in an upwards direction.

[0025] Fig. 3 presents a second embodiment of the invention wherein the heat-accumulating module 2 comprises a vertical support arrangement 10, i.e. a straight metal bar, mounted on the load-bearing structure 17 of the fireplace. A set of soapstone elements 4 provided with a central hole are then stacked around the metal bar. In the last soapstone element 12 the hole only extends from the lower surface approximately halfway through the element so that in the final module the metal bar 10 stays completely hidden under the soapstone jacket and is protected from the hot combustion gases.

[0026] Fig. 4 presents a third embodiment of the invention wherein the heat-accumulating module 3 is disposed horizontally, i.e. transversely, in an upward combustion gas channel. The module comprises a number of elements 4 of equal sizes and is supported at the extreme elements 14 on the framing stones 13 of the fireplace. In this manner, the iron binder 5 including tightening means 6, i.e. the nuts, extending out from the ends of the module 3, are left outside of the combustion gas channel 15 defined by the framing stones 13.

[0027] Fig. 5 presents a more detailed view of an assembly which represents a separate heat accumulator according to the invention, as well as six heat-accumulating modules 1 according to the invention placed in a relatively compact disposition in the upper combustion chamber above the firebox of a fireplace. The heat-accumulating modules 1 are substantially suspending constructions according to the embodiment of Fig. 2. In this embodiment, each module comprises two iron binders 5, the soapstone elements 4 being arranged onto the binders. The iron binders may be placed in holes provided in the elements or in grooves provided on the surfaces of the elements. The suspension arrangement 7 for the soapstones is realized using transverse suspension perches 8 on which the iron binders 5 are mounted.

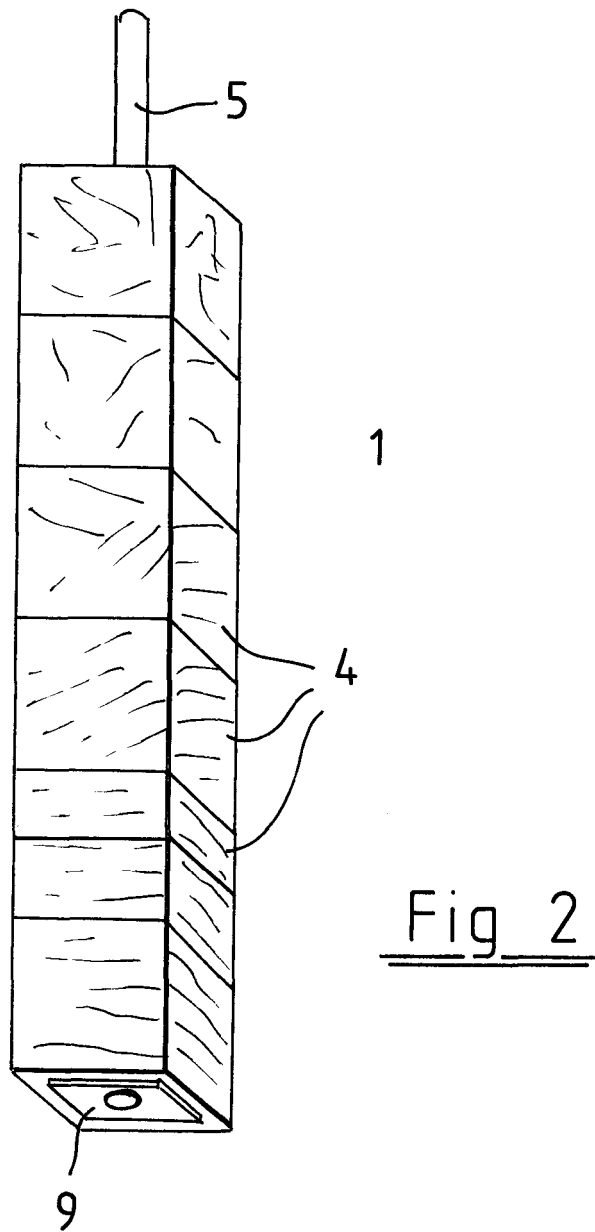
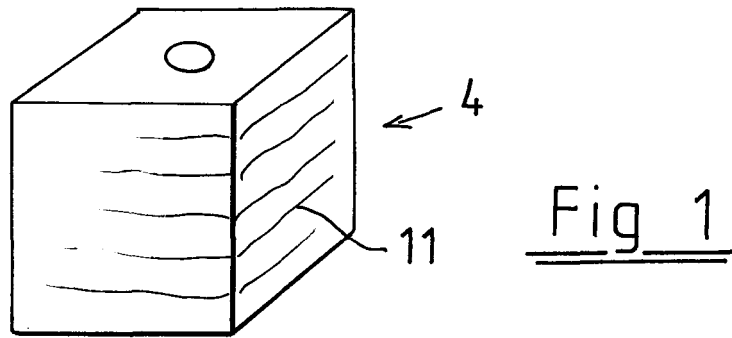
[0028] The modules 1 are positioned so as to be disengaged from each other and from the walls of the upper

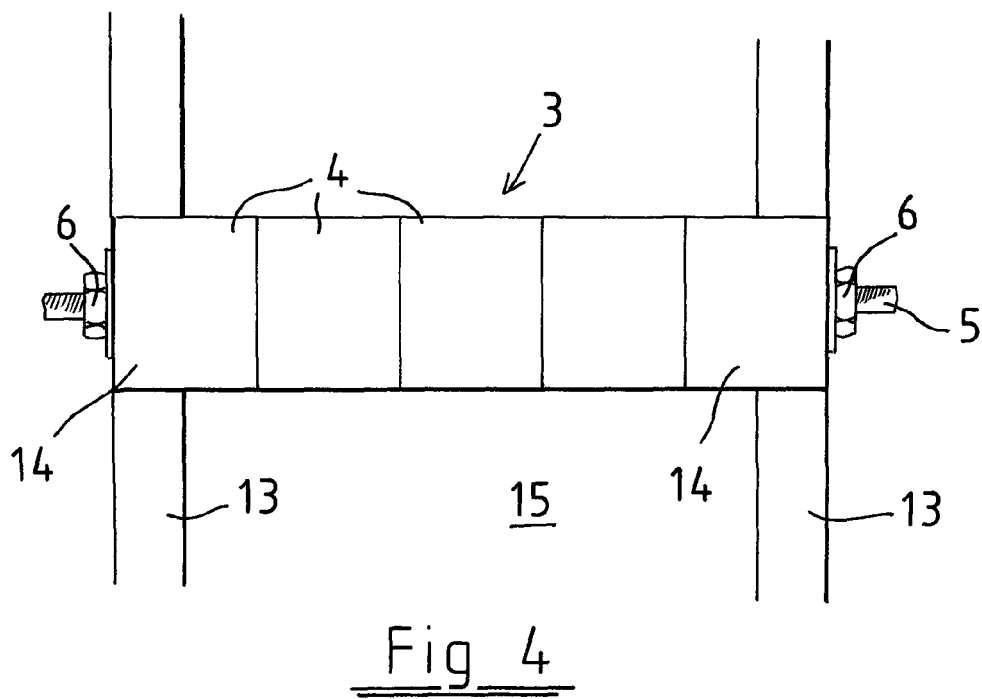
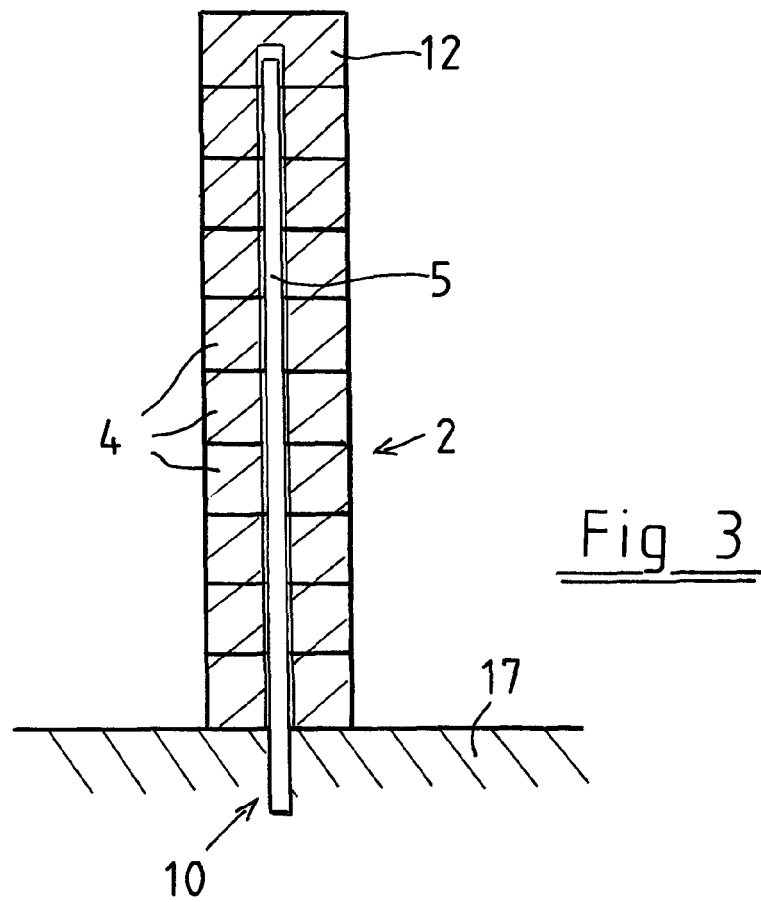
combustion chamber or the heat accumulator, i.e. at a suitable distance from each other, so that straight smoke ducts 16 with smooth surfaces are formed between them. In this manner, the rising hot combustion gases surround the heat-accumulating modules 1 from each side, so that the heat is able to accumulate efficiently and quickly in the elements.

[0029] The invention is not limited merely to the examples referred to above; instead, many variations are possible within the scope of the inventive idea defined by the claims.

Claims

1. A heat-accumulating module to be disposed in a fire-place, in the flow channels for the combustion gases after the firebox, **characterized in that** the heat-accumulating module (1,2,3) comprises a number of heat-accumulating elements (4) connected to each other side by side by means of at least one binding member (5) to form an elongated module. 5
2. The heat-accumulating module according to claim 1, **characterized in that** the heat-accumulating elements (4) are made from soapstone. 10
3. The heat-accumulating module according to claim 1, **characterized in that** the heat-accumulating elements (4) are shaped as rectangular parallelepi-peds. 15
4. The heat-accumulating module according to any one of claims 1 to 3, **characterized in that** the heat-accumulating elements (4) are identical with each other in one module. 20
5. The heat-accumulating module according to any one of claims 1 to 4, **characterized in that** the heat-accumulating elements form a module (1,2,3) wherein the width and the length are equal to the width and the length of an individual element, and wherein the height is the number of the elements multiplied by the height of an individual element. 25
6. The heat-accumulating module according to any one of claims 1 to 5, **characterized in that** the binding member (5) comprises tightening means (6) for clamping the elements to form a compact module. 30
7. The heat-accumulating module according to any one of claims 1 to 6, **characterized in that** one end of the heat-accumulating module comprises a suspen-sion arrangement (7) for suspending it vertically in a flow channel at the upper end. 35
8. The heat-accumulating module according to claim 7, **characterized in that** the suspension arrange-ment comprises a suspension perch (8) which ex-tends across a vertical flow channel. 40
9. The heat-accumulating module according to claim 7, **characterized in that** the lower end of the heat-accumulating module comprises a base plate (9), the binding member being arranged to be supported on the base plate. 45
10. The heat-accumulating module according to any one of claims 1 to 6, **characterized in that** one end of the heat-accumulating module comprises a support arrangement (10) for supporting it at the lower end in the vertical position in the flow channel. 50
11. The heat-accumulating module according to any one of claims 1 to 6, **characterized in that** the heat-accumulating module (3) is arranged horizontally, i.e. transversely, in a vertical flow channel, both of its ends being supported on the wall structures of the flow channel. 55
12. The heat-accumulating module according to any one of claims 1 to 11, **characterized in that** a number of heat-accumulating modules are disposed side by side and in parallel in the same flow channel at a distance from each other.
13. A heat accumulator formed by a jacket and, in the interior space defined by the jacket, one or more heat-accumulating components to cool down the hot gas flow which passes through the space and to re-cover the heat, **characterized in that** the heat-ac-cumulating component is a heat-accumulating mod-ule comprising a number of heat-accumulating ele-ments (4) connected to each other side by side by means of at least one binding member (5) to form an elongated module.
14. The heat accumulator according to claim 13, **characterized in that** the heat-accumulating module is supported on the heat-accumulating jacket only at one end, the other parts of the module being dis-posed at a distance from the jacket.
15. The heat accumulator according to claim 13, **characterized in that** the heat accumulator comprises the heat-accumulating module according to any one of claims 1 to 12.





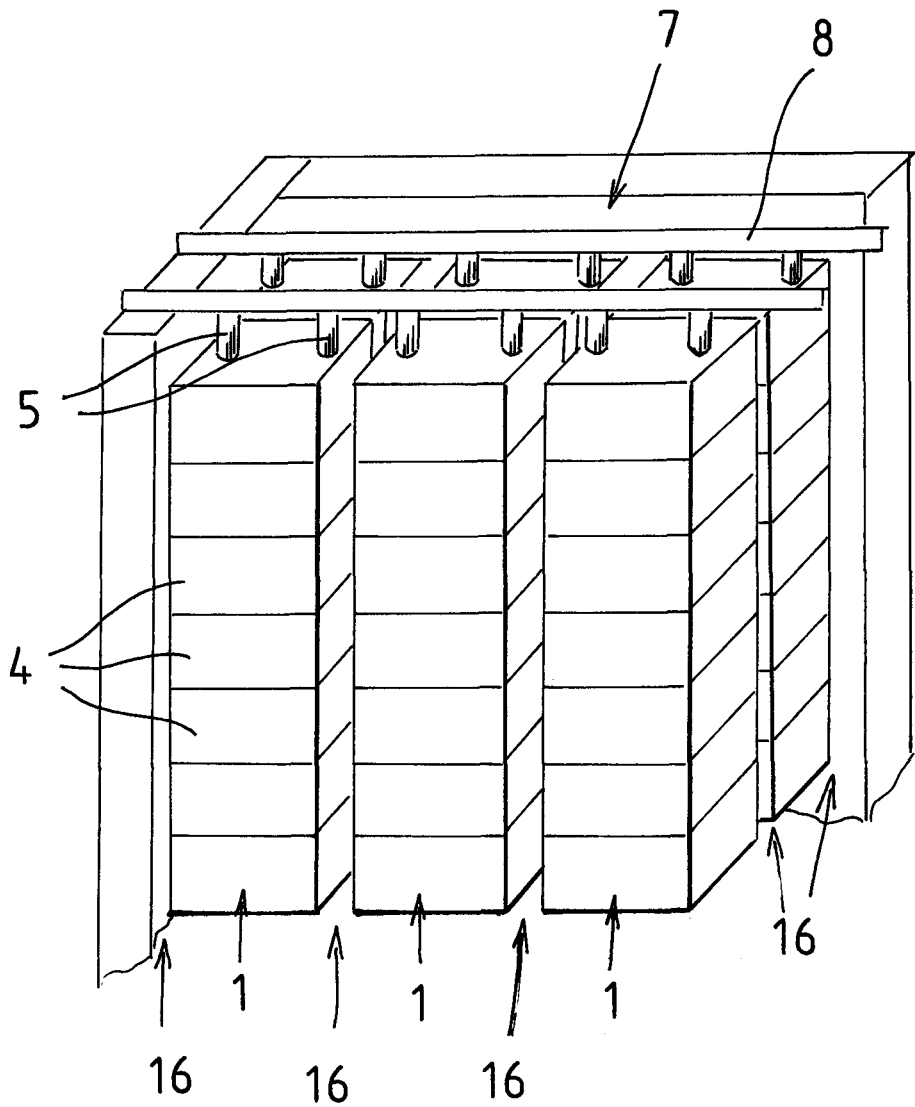


Fig 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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