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(71) Applicant: **Tulikivi Oyj
83900 Juuka (FI)**

(72) Inventors:
• **Hirvonen, Tarmo
81100 Kontiolahti (FI)**

• **Hiltunen, Jouni
83940 Nunnanlahti (FI)**
• **Horttanainen, Pekka
81100, Kontiolahti (FI)**
• **Olenius, Heikki
83940 Nunnanlahti (FI)**

(74) Representative: **Roitto, Klaus
Kolster Oy Ab,
P.O. Box 148,
Iso Roobertinkatu 23
00121 Helsinki (FI)**

(54) **Fireplace**

(57) The invention relates to a fireplace comprising a core (2) with a firebox (3), and a shell (1) arranged at a distance from the core in such a manner that there is a space (5) between the core and shell. So that in conventional batch-type burning, the fireplace was be able to emit heat to its surroundings more uniformly and heat

emission continued longer than in the prior art fireplaces, heat regulation means (4) are arranged in the space (5) between the core (2) and shell (1) to control the amount of radiation heat transmitted from the surface of the core towards the inner surface of the shell.

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Description

BACKGROUND OF THE INVENTION

[0001] The invention relates to a fireplace comprising a core with a firebox and a shell arranged at a distance from the core in such a manner that there is a space between the core and the shell. The shell is at a distance from the core among other things to enable, without damaging the structure of the fireplace, displacements caused by differences in the thermal expansion of the shell and core.

[0002] Fireplaces having this structure are very common. They often are heat-retaining fireplaces.

[0003] An essential feature of a fireplace is the ability to emit heat into its surroundings (typically a room). The thermal effect that a fireplace emits to its surroundings depends on the size (surface area) of the shell of the fireplace and the temperature of its surface. The thermal effect of a batch-heated fireplace varies as a function of time during the heating cycle and after the heating cycle. When heating is started, the temperature of the shell surface rises approximately in direct proportion to the time used for heating. After the heating ends, the temperature of the shell continues to rise, because heat is still transmitted from the hot core of the fireplace to the relatively cold surrounding shell. After the core has increased the surface temperature of the shell to its maximum, the surface temperature of the shell begins slowly to decrease with time.

[0004] A unit used for heating is generally expected to provide an as uniform heat emission as possible. A fireplace is a heating unit in which said property is, in practice, difficult to implement, because it requires that the fireplace be heated at short intervals, which is arduous. One desired property of a fireplace is that it emits heat at high power and as long as possible per one heating. In this respect, a large fireplace is better than a small one. A drawback of a small fireplace in particular is that it needs to be heated to such a high temperature that it raises the temperature in a room at least momentarily to uncomfortably hot so as to achieve a long-term heat emission per one heating.

BRIEF DESCRIPTION OF THE INVENTION

[0005] It is an object of the present invention to provide a fireplace whose ability to emit heat into its surroundings is significantly more uniform than in the prior art fireplaces and which also makes it possible to maintain a more efficient and longer heat emission per one heating than the prior art fireplaces.

[0006] This object is achieved by a fireplace of the invention, which is characterized in that, in the space between the core and the shell, heat regulation means are arranged for controlling the amount of radiation heat transmitted from the surface of the core towards the inner surface of the shell.

[0007] The heat regulation means preferably comprise plate-like elements and a turning mechanism for placing the plate-like elements into the space between the core and shell alternatively in a first position, in which the planes defined by the plate-like elements are mainly parallel to the plane defined by the core, thus preventing radiation heat from transmitting from the surface of the core towards the inner surface of the shell, and in a second position, in which the planes defined by the plate-like elements are at an angle to the plane defined by the core, in which second position the planes defined by the plate-like elements do not prevent the transmission of radiation heat. The use of several plate-like elements makes it possible to locate the heat regulation means in a small space inside the fireplace, in which case the distance between the core and shell can be short. A relatively short distance, such as 20 to 50 mm, between the core and shell is important, because otherwise radiation heat cannot be made to transmit efficiently from the core to the shell when this is required, i.e. typically when the fireplace has cooled below a given temperature. Heat transmission may also be needed at the initial stage of heating, when it is necessary for the fireplace to obtain its maximum temperature as quickly as possible.

[0008] The heat regulation means of the fireplace preferably consist of a jalousie, wherein the slats of the jalousie form said plate-like elements. The structure of the jalousie may correspond to that of a conventional jalousie used in dwellings, in which the slats of the jalousie are horizontal. An advantage of the jalousie is also that it is easy to raise and lower to the desired height, which makes it possible to influence the heat emission properties of the fireplace.

[0009] The heat regulation means can alternatively consist of a vertical lamella jalousie, the lamellas of which form said plate-like elements. The structure of the vertical lamella jalousie can be similar to that of the vertical jalousies used in offices. One advantage of the vertical lamella jalousie is that its structure can be made such (vertical pivots) that the power needed to adjust the angle of the lamellas is very low and turning the jalousie into the desired position can be done with a small actuator and even automatically.

[0010] Said plate-like elements are preferably made of a material that reflects (well) thermal radiation and is heat insulating, such as hollow aluminium or steel pieces.

[0011] According to an embodiment of the invention, the material of the heat regulation means can be selected to poorly transmit thermal radiation when the temperature is high, but to transmit thermal radiation well when the temperature is lower. Such a structure provides automatic regulation of radiation heat, in which the shell is prevented from becoming unnecessarily hot, but the transmission of thermal radiation is possible from the core of the fireplace to the shell when the shell temperature is low.

[0012] A very simple implementation of the heat reg-

ulation means is obtainable by a solution, in which the heat regulation means comprise 1 to 4 plate-like elements turnable towards the main surface of the fireplace from a first position to a second position, the face surfaces of the plate-like elements being, in the first position, arranged to prevent radiation heat from being transmitted from the surface of the core towards the inner surface of the shell, and the face surfaces of the plate-like elements being, in the second position, at a location where they are prevented from causing the prevention of the transmission of radiation heat. The shell of the fireplace can then have an opening or openings for removing the plate-like elements at least partly from the space between the core and shell of the fireplace. The more elements the heat regulation means has, the more exactly the amount of transmitted heat radiation can be regulated.

[0013] According to one quite simple embodiment, the heat regulation means comprise a first plate-like element and a second plate-like element movable from a first position to a second position with respect to the first plate-like element. The first and second plate-like elements then have a set of holes in such a manner that the second plate-like element is arranged to cover the holes in the first plate-like element when the second plate-like element is in its first position, and the holes of the second plate-like element are aligned with the holes of the first plate-like element when the second plate-like element is in its second position so as to enable the transmission of radiation heat.

[0014] Preferred embodiments of the fireplace of the invention are described in the attached claims 2 to 16.

[0015] The biggest advantages of the fireplace of the invention are that, in conventional batch-type burning, it has an ability to emit heat to its surroundings in a more uniform and longer manner than the prior-art fireplaces having the same mass, and in such a manner that the thermal emission power remains high. This makes possible a better utilization of the heat stored into the stone material of the fireplace.

BRIEF DESCRIPTION OF THE FIGURES

[0016] The invention will now be described in greater detail by means of preferred embodiments and with reference to the attached drawing, in which

Figure 1 illustrates heat emission in a fireplace of the invention and in a conventional fireplace,
Figure 2 illustrates the structure of a fireplace of the invention,
Figure 3 shows the shell of the fireplace of Figure 2,
Figure 4 is a top view of the fireplace of the invention,
Figure 5 illustrates in more detail the heat regulation means of the fireplace of Figures 2 and 3,
Figures 6 and 7 show an alternative embodiment of the heat regulation means shown in Figures 2 and

5,

Figure 8 shows a similar structure as Figure 6,
Figure 9 shows an enlarged detail of Figure 8, and
Figure 10 illustrates the structure of Figure 8 from the top.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Curves A and B of Figure 1 illustrate how thermal effect P changes as a function of time t in a fireplace of the invention equipped with heat regulation means. The fireplace is made of stone and comprises a core and a shell surrounding it. Both curve A, marked with a dashed line, and curve B, marked with a continuous line, illustrate how the thermal effect changes as a function of time when the fireplace has been heated in batches with the same method and the same amount of wood.

[0018] Thermal effect P changes according to curve A when the heat regulation means (the structure of which is described later) are set to the open position, in which they do not much prevent the transmission of heat from the core of the fireplace to the shell of the fireplace. Curve A corresponds to the changing of the thermal effect of a conventional fireplace without heat regulation means as a function of time. Curve B shows the changing of the thermal effect P_B of the fireplace according to the invention as a function of time t when the heat regulation means in it are controlled as a function of time. In curve B, the heat regulation means are initially open (or alternatively closed) for a short time, after which they are closed and kept at least partly closed for a specific time, after which the heat regulation means are opened so that, in the end, they are fully open.

[0019] The shapes of curves A and B differ essentially from each other. Curve A shows the rapid heating of the fireplace to maximum power P_{Amax} , in which the temperature of the shell is for instance 80°C , after which the shell begins to cool so that the cooling is quite rapid during a longish period. Curve B shows a situation, in which the heat regulation means of the fireplace are kept closed at least during time period t_1 to t_2 so that the thermal effect of the fireplace cannot increase to value P_{Amax} , but only increases rapidly to maximum power P_{Bmax} , which is considerably lower than P_{Amax} . The thermal effect P_B of the fireplace remains approximately constant during time period t_1 to t_3 , after which the thermal effect begins to decrease, but only gently due to the fact that the heat regulation means are kept open after time instant t_3 , whereby the core of the fireplace emits heat to the shell of the fireplace as efficiently as possible. After the heating is stopped and after time instant t_2 , curve B is higher than curve A, which means that the thermal effect emitted by the fireplace after the time instant t_2 is significantly higher than in the case of curve A and heat emission also continues longer. Because curve B decreases more gently than curve A, heat emission to the surroundings is also more uniform. In the case of both curve A and curve B, the amount of

heat emitted to the surroundings is the same. However, the essential difference is that, in the case of curve B, the thermal energy corresponding to the area A_A , marked with diagonal lines, is not taken into use during time period t_0 to t_2 , but, in the case of curve B, it is only taken into use after time instant t_2 , which is illustrated by the area A_B , marked with diagonal lines. To make the fireplace of the invention emit heat to the surroundings as uniformly as possible, the heat regulation means are kept in the open position at the initial stage of heating during time period t_0 to t_1 , they are kept closed during time period t_1 to t_3 , and open again after time instant t_3 . The following describes the heat regulation means that make said control possible.

[0020] Figures 2 and 3 illustrate the structure of the fireplace of the invention. In Figure 2, the fireplace is shown opened in such a manner that most of the shell 1 of the fireplace is removed. The figure thus shows the core 2 of the fireplace having a firebox 3, and the bottom end of the shell 1.

[0021] Reference number 4 indicates a jalousie serving as the heat regulation means and mounted on the side of the fireplace, the jalousie enabling the control of the amount of radiation heat transmitting from the core 2 of the fireplace towards the shell 1. The jalousie 4 is fastened to the top edge of the core 2 at the height of the fire lid of the fireplace. There are several jalousies, as shown in Figure 4 which shows that there are jalousies on all sides (back, both sides, and front) of the fireplace. For the sake of simplicity, Figure 2 only shows one jalousie 4. The jalousies 4 extend down until the low limit of the firebox 3, even though, in some applications, it is enough that their low edge is at a distance of 0 to 300 mm from the low limit of the firebox. On the front wall of the fireplace, the low edge of the jalousie can also extend until the low limit of the firebox 3, because the jalousie can easily be lifted out of the way at the fire door.

[0022] The jalousies 4 are in the space between the shell 1 and core 2, which space is illustrated by reference number 5. The distance S between the core 2 and shell 1 (see Figure 5) is preferably 5 to 30 mm, but may be within the range of 5 to 90 mm. If the distance is too long, the core 2 of the fireplace cannot efficiently emit radiation heat to the shell 1, which heat emission is required in some operating situations. Due to this, the distance S is, in practice, at most approximately 300 mm.

[0023] When the jalousie 4 is closed, the planar slats 13 cover each other as they are substantially parallel and in the vertical direction, thus preventing radiation heat from transmitting from the core 2 to the shell 1. When the jalousie 4 is open, the planes of the slats 13 are substantially horizontal and have large openings between them to enable radiation heat to transmit from the core 2 to the inner surface of the shell 1. The position of the slats 13 of the jalousie 4, i.e. angle α , can be adjusted as required by means of a turnable control rod 6 on the outer surface of the fireplace shell, see Figure 3.

[0024] Reference number 7 in Figure 3 indicates the control rod of the jalousies on the front surface of the fireplace.

[0025] When the jalousies 4 of the fireplace are kept closed, the surface temperature of the fireplace shell 1 follows curve B during time period t_1 to t_3 . If the jalousies 4 are kept open, the temperature of the fireplace surface follows curve A of Figure 1.

[0026] Figure 5 shows in more detail the structure of the jalousies 4 mounted on the sides of the fireplace of Figure 2. The jalousies 4 are conventional jalousies used in rooms. Therefore, they comprise not only a control rod 7, but also two strings 8, by means of which the bottom edge 9 of the jalousies (see Figure 2) can be set at the desired height. The structure need not be described in more detail in this context, since it is generally known. Naturally, the materials of the jalousie need to be selected so that their temperature endurance is sufficient. By turning the knob 10 of the control rod 6, the slats 13 can be turned into the desired position. Holes for the control rod 6 and strings 8 have been made in the shell 1.

[0027] In Figure 5, the slats 13 of the jalousie 4 are installed at such an angle α with respect to the vertical plane defined by the core 2 that the slats reflect the radiation coming from the core 2 obliquely downward back towards the core, which is illustrated by the arrows drawn in the figure. Because the top of the core 2 is hotter than its bottom, said position of the slats is suitable to even the temperature difference between the top and bottom of the core 2. This is an advantage, because it, for its part, helps the fireplace to emit heat as uniformly as possible.

[0028] Figure 5 further shows that the jalousie 4 is arranged closer to the shell 1 than the core 2. The vertical centre point of the jalousie 4 is at a distance L from the inner surface of the shell 1, which means that the centre point remains at a distance S - L from the surface of the core 2. Distance L is 5 to 20 mm.

[0029] In some cases, there may be a need to direct heat from the space 5 between the core 2 and shell 1 to the room. For this, the bottom and top of the shell 1 have openings closable with covers 11 and 12; see Figure 3. The position of at least one 11 of the covers 11, 12 is adjustable to control the amount of air flowing through a cover opening, whereby the cover operates as a valve enabling the control of the amount of heat transmitted through the cover to the room. In Figure 5, the opening of cover 12 is drawn with a dashed line, and it is marked by reference number 14.

[0030] Figures 6 and 7 show an alternative fireplace to the embodiment of Figures 2 and 5. The reference numbering used in Figures 2 and 5 is also used in Figures 6 and 7. As in Figure 2, the shell 1' of the fireplace of Figure 6 only shows its bottom so as to reveal the structure of the core of the fireplace and the heat regulation means 4'. In the solution of Figure 6, the heat regulation means consist of a vertical lamella jalousie 4'.

For the sake of simplicity, only one vertical lamella jalousie 4' is drawn in the figure, even though they could preferably be installed on all main walls of the fireplace (as is the case in the solution of Figure 2). The structure of the vertical lamella jalousie 4' can be similar to conventional vertical lamella jalousies used in buildings, such as business premises. Temperature endurance need naturally be sufficient, which is taken care of through correct materials selection. The planar lamellas 13' of the vertical lamella jalousies 4' can be set to overlap so that heat cannot transmit through radiation from the core 2' to the shell 1'. The plane formed by the lamellas 13' then follows the direction of the surface of the fireplace. The lamellas 13' can be turned into a position in which they are substantially perpendicular to the direction of the fireplace surface. In this position, the core 2' of the fireplace is capable of radiating towards the shell 1' through openings between adjacent lamellas to heat the shell by radiation heat.

[0031] In the embodiment of Figure 6, the lamellas 13' are fitted with bearings in the vertical direction, whereby the force needed to turn the lamellas is very small. Reference number 15' indicates an actuator with which the lamellas 13' are turned to the required angle. The actuator 15' can be one based on wax expansion, bimetal temperature transformation, electric temperature measurement and electric control. For control, the temperature can be measured from the fireplace or room or outside the building. In Figure 7, reference number 16' indicates a temperature sensor fastened to the shell 1' of the fireplace. The actuator 15' can be controlled manually or by a thermostat.

[0032] Figures 8 to 10 illustrate what kind of vertical jalousie may be arranged in the fireplace. The figures use the same reference numbers for the same parts as in Figures 2 to 7. Figures 8 to 10 show that each lamella 13" of the vertical lamella jalousie 4" is fitted with a double bearing 17". Reference number 18" indicates a push rod with which the size of the openings between the lamellas 13" is adjusted. In Figure 10, the push rod 18" is in a position in which the lamellas 13" are partially open. By moving the push rod 18" to the right (in which case the push rod also moves slightly downward in the figure), the openings between the lamellas 13" can be made larger; and by moving the push rod 18" to the left (in which case the push rod also moves slightly upward in the figure), the openings between the lamellas 13" can be made smaller and even completely closed.

[0033] In the solutions described above, the plate-like elements serving as the heat regulation means are made of a heat-insulating material that reflects thermal radiation. An example of this type of material is a hollow aluminium slat with air or a solid insulation material inside it. Instead of aluminium, steel or another metal can be used.

[0034] Above, the invention is described by means of examples and, therefore, it should be noted that the invention may in many ways differ in detail within the

scope of the attached claims. Thus, the number and exact location of the heat regulation means may vary in the fireplace. It is thus possible that one of the main surfaces, such as the front surface, of the fireplace does not have the heat regulation means. The structure of the heat regulation means may also vary. They can be made up of perforated plates set to overlap, one of which can be moved with respect to the other so that the holes are in line or covered. In the first case, heat can transmit through radiation from the core of the fireplace to the shell; in the second case, the transmission of heat is prevented. It is also possible that the heat regulation means are made up of perforated plates, the holes of which are covered by a bimetal films which are arranged to cover the holes when a given temperature is exceeded, but which are arranged to turn such that the holes open when the temperature goes below a given value. This latter adjustment is not possible manually, but is fully automatic, which at least in some applications is desirable. Yet another possibility is that the heat regulation means consist of one or more rolling or folding jalousies arranged between the core and shell of the fireplace. The technical structure of the rolling or folding jalousie may correspond to that of rolling or folding jalousies used in rooms. Sufficient temperature endurance naturally needs to be taken in to account when selecting the material. Adjusting the height of the rolling or folding jalousie affects the transmission of radiation heat from the core to the shell.

Claims

1. A fireplace comprising a core (2, 2') with a firebox (3, 3'), and a shell (1, 1') arranged at a distance (S) from the core in such a manner that there is a space (5, 5') between the core and shell, **characterized in that** heat regulation means (4, 4') are arranged into the space (5, 5') between the core (2, 2') and shell (1, 1') to control the amount of radiation heat transmitting from the surface of the core towards the inner surface of the shell.
2. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means comprise a mechanical means (4, 4') arranged to regulate the amount of radiation heat by changing its position in said space (5, 5').
3. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means comprise a plate-like element movable from a first position to a second position, the face surface of the plate-like element being, in the first position, arranged to prevent radiation heat from being transmitted from the surface of the core towards the inner surface of the shell, and the face surface of the plate-like element being, in the second position, at a location where it

is prevented from causing the prevention of the transmission of radiation heat.

4. A fireplace as claimed in claim 3, **characterized in that** the shell has an opening for removing the plate-like element at least partly from the space between the core and shell so as to move the plate-like element to said second position. 5
5. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means comprise a first plate-like element, and a second plate-like element movable from a first position to a second position with respect to the first plate-like element, that the first and the second element have a set of holes, that the second plate-like element is arranged to cover the holes in the first plate-like element when the second plate-like element is in its first position, and that the holes of the second plate-like element are aligned with the holes of the first plate-like element when the second plate-like element is in its second position so as to enable the transmission of radiation heat. 10 15 20
6. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means (4, 4') comprise plate-like elements (13, 13') and a turning mechanism (6, 6') for placing the plate-like elements into the space (5, 5') between the core and shell alternatively in a first position, in which the planes defined by the plate-like elements are mainly parallel to the plane defined by the core (2, 2'), thus preventing radiation heat from being transmitted from the surface of the core towards the inner surface of the shell (1, 1'), and in a second position, in which the planes defined by the plate-like elements are at an angle (α) to the plane defined by the core, in which second position the planes defined by the plate-like elements do not prevent the transmission of radiation heat. 25 30 35 40
7. A fireplace as claimed in claim 6, **characterized in that** the heat regulation means consist of a jalousie (4), the slats (13) of which form said plate-like elements. 45
8. A fireplace as claimed in claim 6, **characterized in that** the heat regulation means consist of a vertical lamella jalousie (4'), the slats (13') of which form said plate-like elements. 50
9. A fireplace as claimed in any one of claims 3 to 8, **characterized in that** the plate-like elements (13, 13') are made of a heat-insulating material that reflects thermal radiation. 55
10. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means consist of a rolling

jalousie.

11. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means extend from the bottom of the firebox (3) of the fireplace until the top of the firebox.
12. A fireplace as claimed in claim 11, **characterized in that** the heat regulation means extend from the firebox (3) until the fire lid.
13. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means (4) are arranged on all main walls of the fireplace.
14. A fireplace as claimed in claim 2, **characterized in that** it comprises an actuator (15') reacting to temperature changes, which is arranged to automatically change the position of the heat regulation means in said space.
15. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means comprise a glass surface.
16. A fireplace as claimed in claim 1, **characterized in that** the heat regulation means consist of material having a temperature-dependent property of transmitting thermal radiation.

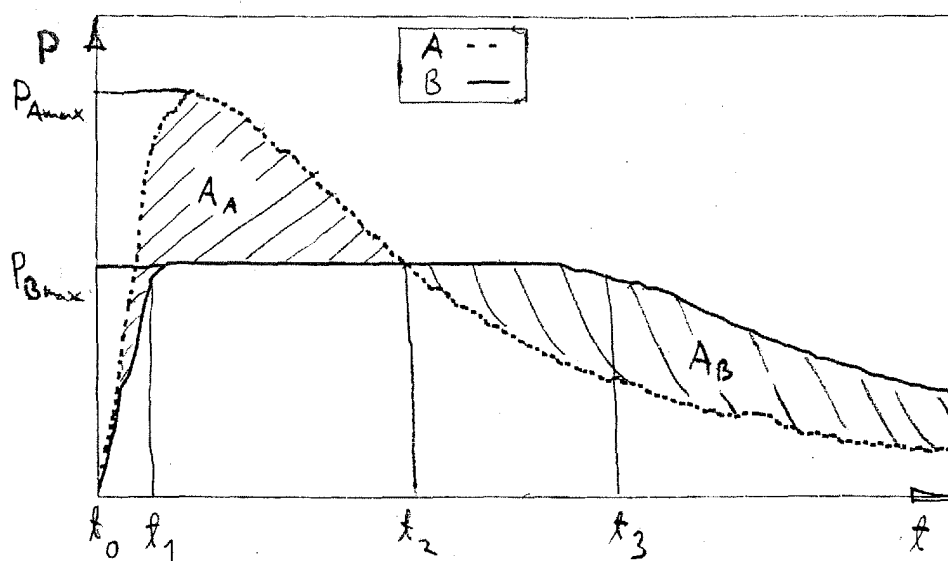


Fig. 1

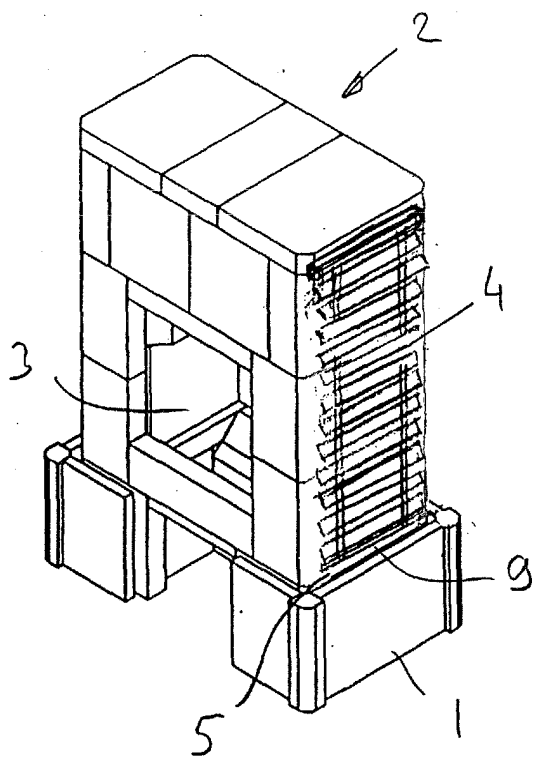


Fig. 2

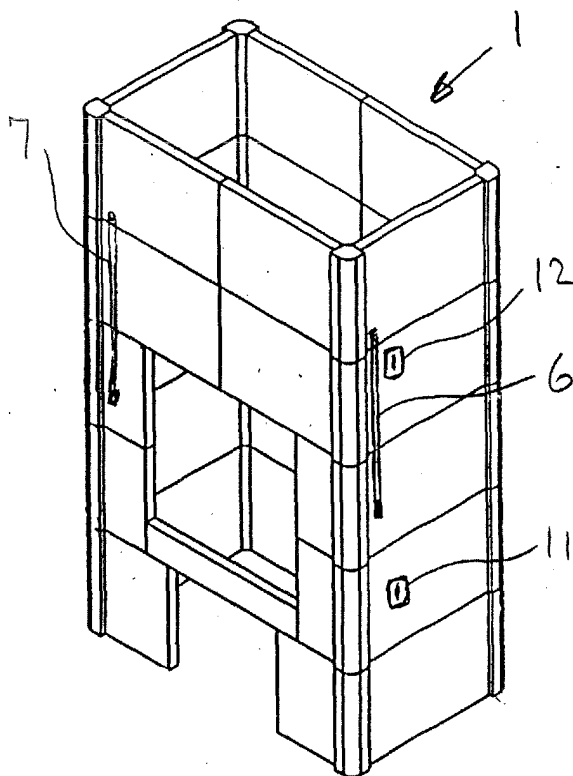


Fig. 3

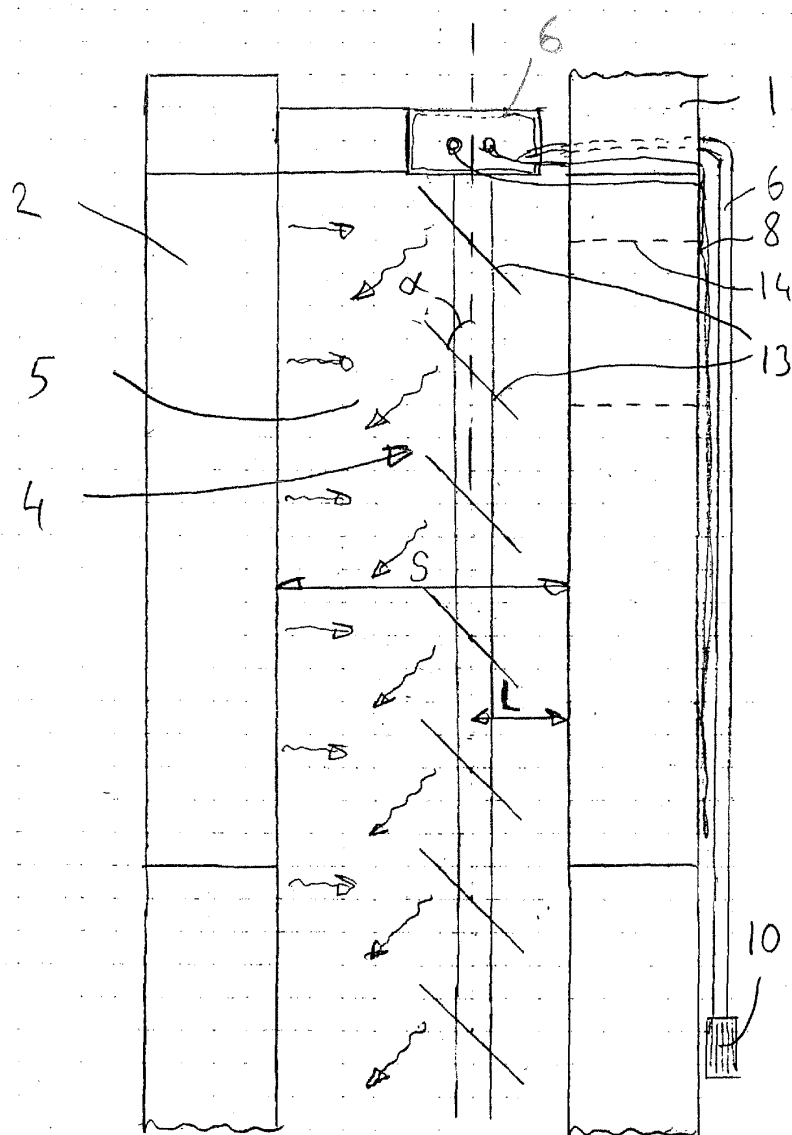
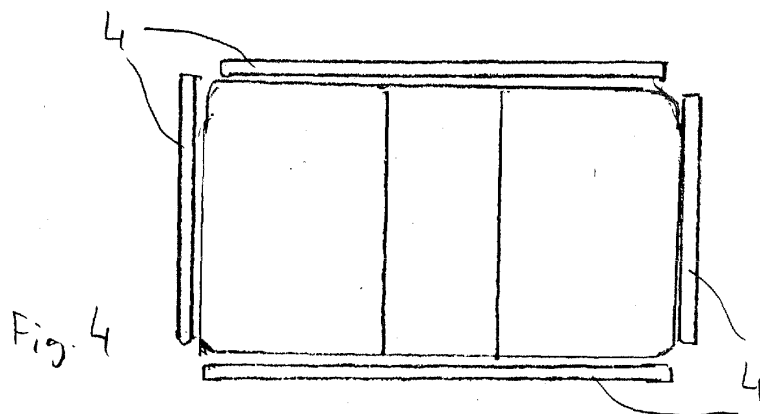


Fig. 5

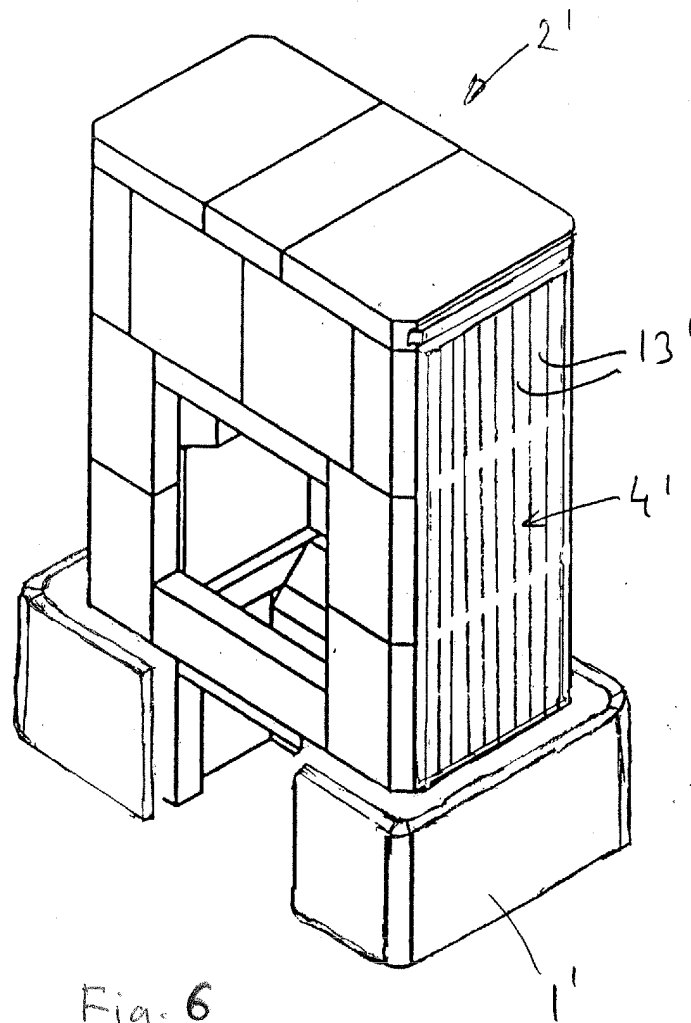


Fig. 6

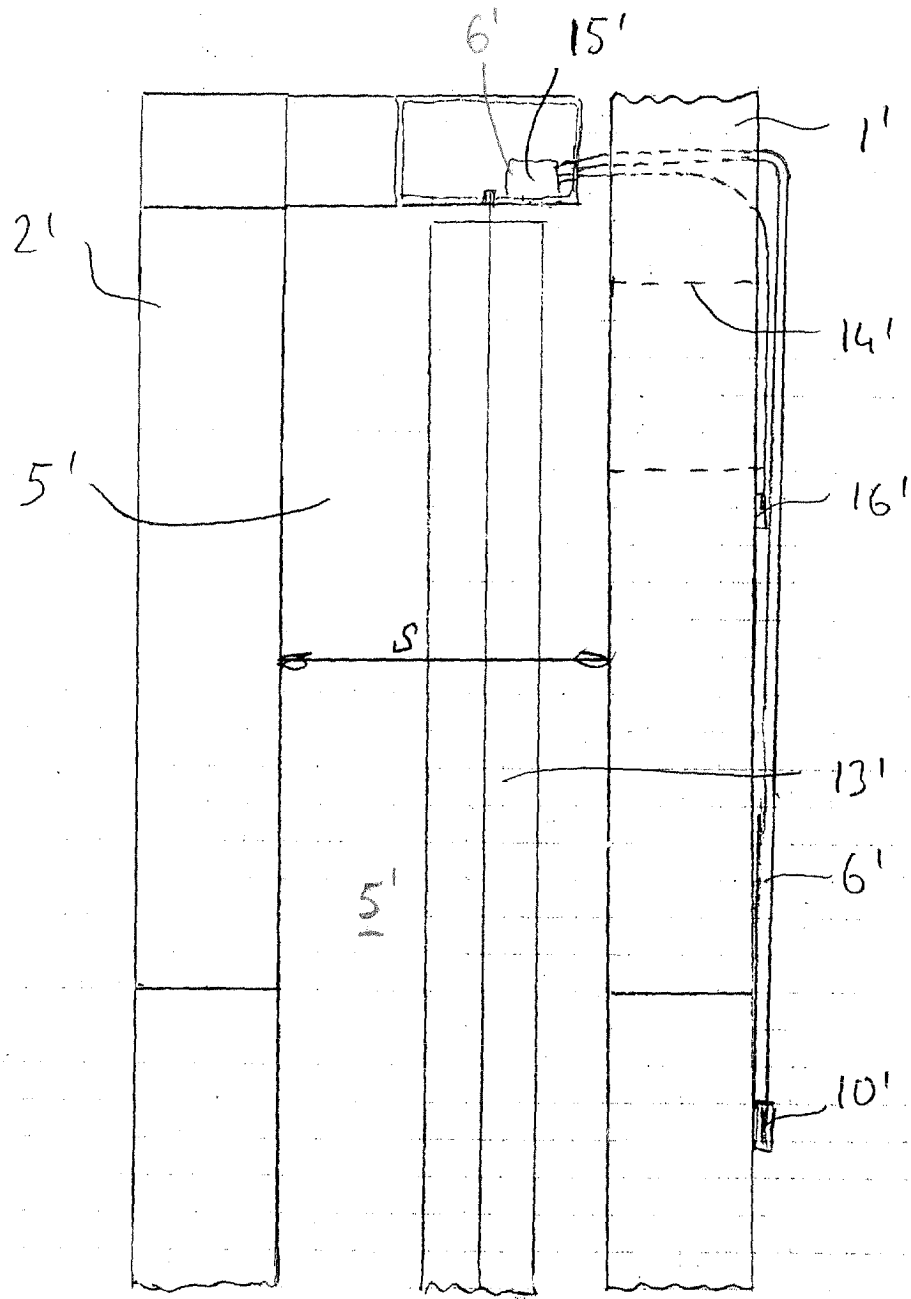
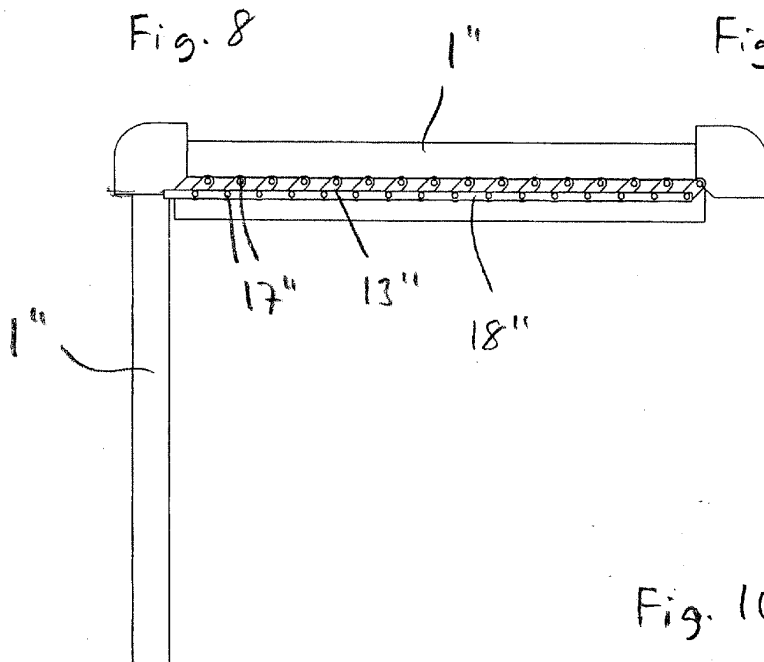
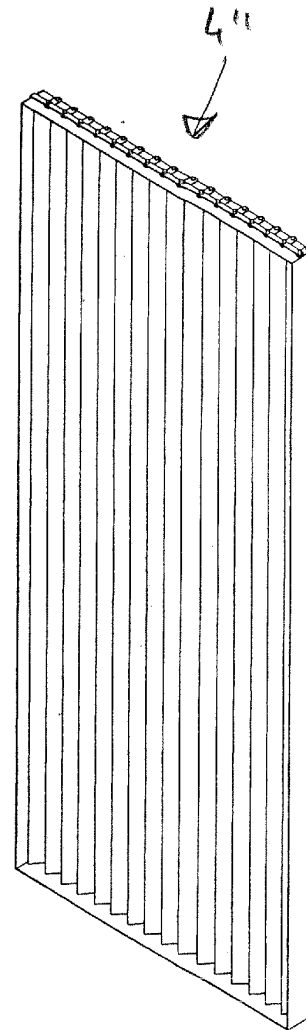
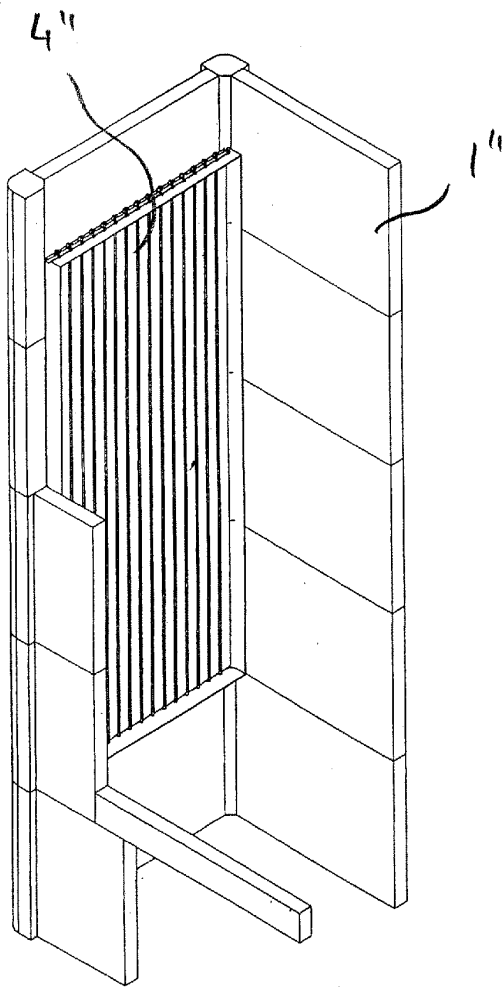


Fig. 7





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 10 1443

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	US 4 455 995 A (HOMOLIK MATTHEW W) 26 June 1984 (1984-06-26) * abstract *	1	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F24B F24H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 August 2004	Examiner Vanheusden, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 04 10 1443

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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