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(54) Device having adjustable heat-insulating properties

(57) A device (1) has adjustable heat-insulating properties on the basis of the fact that the device (1) may be put in at least two different conditions, wherein in one of the conditions, a heat-insulating quantity of still fluid is present in the device (1), and wherein in another of the conditions, the quantity of still fluid is absent.

In a specific embodiment, the device (1) comprises a heat-insulating core (15) and an assembly (14) of channels (13, 21) surrounding the core (15), wherein a passage (24) in the channels (13, 21), which is positioned between portions of the channels (13, 21) extending at opposite sides of the device (1), may be blocked or left open, depending on the desired functioning of the device (1). Furthermore, fluid may be supplied to the channels (13, 21), or there may be no fluid supply, or even a removal of fluid.

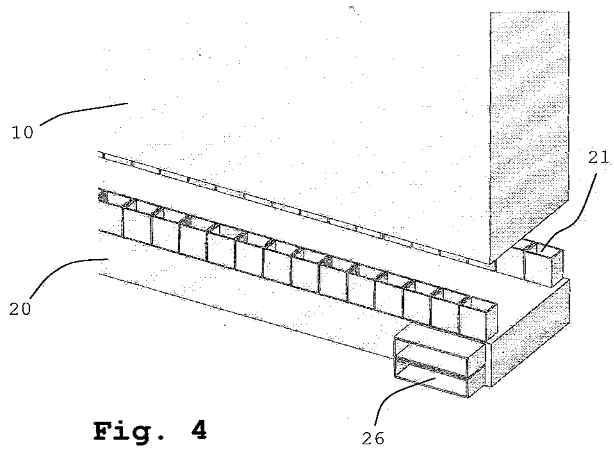

Fig. 4

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Description

[0001] The present invention relates to a device that is adapted to be put in different conditions, and that is adapted to at least have a heat-insulating function in one of the possible conditions.

[0002] In many inhabited areas of the world, relatively cold periods may occur, during which buildings are heated in order to realize a temperature inside the buildings that is higher than the outside temperature, so that the buildings are comfortable for people to stay in. In those areas, it is common practice to provide the buildings with heat-insulating devices. For example, sheets of glass wool may be used.for covering the inside of an outside wall or the roof of a building, which has the effect that during cold periods, a loss of heat from the building is less than a loss that would occur when the insulation would not be present. In general, the functioning of many heat-insulating devices is based on the use of still air as a heat-insulator, in view of the fact that a transfer process of heat through still air takes place at a much lower rate than a transfer process of heat through materials which are commonly used in walls and roofs.

[0003] A disadvantage of the use of heat-insulating devices is that when a relatively warm period occurs, the functioning of the heat-insulating devices opposes a desired process of realizing that heat is retained inside buildings to an as low as possible extent. It is not a practical option to remove the heat-insulating devices during relatively warm periods, and to put the heat-insulating devices back in place again during relatively cold periods. Therefore, it is an objective of the present invention to provide a new type of heat-insulating device, in particular a heat-insulating device having adjustable heat-insulating properties, so that the extent to which the heat-insulating device fulfills its heat-insulating function can be adjusted such as to meet varying requirements.

[0004] The objective of the present invention is achieved by providing a device that is adapted to be put in different conditions, and that is adapted to at least have a heat-insulating function in one of the possible conditions, comprising:

- a plurality of insulating units which are each containing hollow space, which hollow space is suitable for containing a fluid such as air or water, and which are each having portions which are located at opposite sides of the device;
- a core having heat-insulating properties, which is positioned between the portions of the insulating units which are located at opposite sides of the device; and
- closing means which are adapted to be put in different conditions, in order to close a passage between the portions of the insulating units which are located at opposite sides of the device to a greater or lesser extent.

[0005] In the device according to the present invention, a plurality of insulating units is arranged, wherein each of the units has portions which are located at opposite sides of the device, and wherein a heat-insulating core is positioned between these portions. Furthermore, the device comprises closing means for varying an effective flow-through area of a passage between the portions of the insulating units. In the condition for closing the passage to a greater extent, the flow-through area is relatively small, and a flow of fluid from one portion of the insulating units to another, i.e. from one side of the device to the opposite side, is hindered. When it is desired to have an optimal flow of fluid as mentioned, all that needs to be done is to put the closing means in the condition for closing the passage to a least possible extent.

[0006] When the device according to the present invention is applied, it is possible to realize a condition of the device in which an optimal heat-insulating function of the device is obtained by keeping the insulating units in a condition in which it is not possible for fluid to flow from one side of the device to another, so that heat transfer on the basis of such a flow from the one side of the device to the other cannot take place. In this heat-insulating condition, it is possible to have still fluid inside the insulating units and/or to have as less as possible fluid inside the insulating units. In respect of the latter option, it is noted that when the fluid is a gas such as air, an underpressure may be created by sucking the gas from the insulating units, so that there are less molecules which may contribute to a heat transfer process.

[0007] An important advantage of application of the device according to the present invention resides in the fact that the heat-insulating function of the device may be cancelled. This is due to the fact that the closing means of the device may be put in such a condition that a flow of fluid is actually possible from one side of the device to another. When such a flow is realized, a process of heat transfer from the one side of the device to the other takes place at a relatively fast rate. In such a case, a situation in which the insulating device is absent is approximated. In fact, in the device according to the present invention, a kind of short circuit effect can be created between those portions of the insulating units that are arranged at opposite sides of the device when it is not desired for the device to have a heat-insulating function.

[0008] It follows from the foregoing description of the device according to the present invention that the device is very well suitable to be applied in situations in which it may sometimes be desirable to have a heat-insulating function of the device, like a conventional, non-adjustable heat-insulating device, and in which it may sometimes be desirable not to have a heat-insulating function of the device, but to have an opportunity for fluid to freely pass from one side of the device to another. Hence, when the device according to the invention is applied, situations in which heat is retained in buildings where it is desired to remove the heat are avoided, while it is just as well possible to avoid heat loss from the building if so desired. In essence, all that is needed to switch functions of the device according to the invention is to change the condition of the closing means of the device.

[0009] All in all, the device according to the present invention may be used in various situations, including the following:

- when a temperature outside a building is relatively low and the building is heated, for keeping the heat inside the building as much as possible and thereby saving energy costs;
- when a temperature outside a building is relatively high and it is desired to keep the inside of the building as cool as possible;
- when a temperature outside a building is relatively high and the building is cooled by applying air conditioning, for example, for preventing the inside of the building from heating up under the influence of outside conditions as much as possible and thereby saving energy costs;
- when a temperature inside a building has become relatively high during daytime and it is desired to cool the inside of the building under the influence of cool night air; and
- when a temperature outside a building more or less corresponds to an average, comfortable ambient temperature for people, and the inside of the building is (still) chilly.

[0010] In a practical embodiment, the plurality of insulating units is formed like an assembly of channels, wherein the closing means are adapted to constitute at least a partial blockage in the channels of the assembly of channels in one of the possible conditions, and to leave the channels of the assembly of channels open in another of the possible conditions.

[0011] In a device having the assembly of channels as mentioned in the foregoing, the channels provide for hollow space all the way from one side of the device to another, wherein the channels may be arranged such as to surround the heat-insulating core. In such arrangement, one length of the channels is extending at one side of the core, and another length of the channels is extending at another side of the core, wherein these sides of the core are associated with opposite sides of the device.

[0012] In one condition of the device, the channels are blocked by.the closing means to such an extent that it is not possible to have a flow of fluid in the channels. As a result, the heat-insulating function of the heat-insulating core is supported. However, in another condition of the device, the channels are left open, so that it is possible to have a flow of fluid through the channels, circulating from one side of the device to another. If such a flow actually takes place, the heat-insulating core is bypassed, so that a transfer of heat from a side of the device where a higher temperature is prevailing to a side where a lower temperature is prevailing can be realized as if the device according to the invention and its heat-insulating core are not present.

[0013] In a very practical embodiment of the device according to the present invention, the heat-insulating core is incorporated in a panel, which further comprises channels which are arranged at opposite sides of the panel. Furthermore, besides the panel, two closing pieces are provided, which serve for interconnecting the channels which are located at the two opposite sides of the panel, at both ends of the channels. When the panel and the two closing pieces are in the assembled condition, a plurality of closed channels is obtained, wherein the channels are surrounding the heat-insulating core of the panel. The number of channels may be chosen freely within the scope of the present invention.

[0014] In a commercial application of the present invention, the panel and the closing pieces may come in standard sizes, wherein any desired size and a related number of channels may easily be obtained by sawing off portions of the panel and the closing pieces. Also, it is possible to arrange more than one panel between two closing pieces, wherein the panels are simply positioned one after another, and the channels of the panels are interconnected.

[0015] The closing pieces may be provided with connecting channels of which one end is suitable to be connected to channels which are located at one side of the panel, and of which another end is suitable to be connected to channels which are located at another side of the panel. The connecting channels of the closing pieces may be provided as closed conduits extending through the closing pieces, but it is also possible that the connecting channels are realized on the basis of suitable grooves in a surface of the closing pieces that is intended for facing a panel. In principle, it is even possible that the connecting channels are not formed as separate channels, but that at least one recess acting as a number of combined channels is provided in the closing pieces. In any case, the connecting channels may be interconnected.

[0016] Furthermore, when the connecting channels as mentioned are present in the closing pieces, it may be so that the closing means are arranged in each of a continuous entirety of channels of the panel and the connecting channels of the closing pieces connected thereto. Also, the closing means may be located in one of the closing pieces, in each of the connecting channels of that closing piece.

[0017] In another very practical embodiment of the device according to the present invention, use is made of a panel comprising a heat-insulating core and two channel plates which are arranged at opposite sides of the panel. For sake of completeness, it is noted that a channel plate is a hollow, plate-shaped device comprising a number of channels which are present in the hollow interior of the plate. In particular, a number of partitions are arranged inside the plate, which partitions delimit the various channels.

[0018] In the embodiment comprising a heat-insulating core and channel plates, the heat-insulating core is provided with openings, and the channels of the channel plates are connected to these openings. Hence, the channel plates which are arranged at opposite sides of the device are interconnected through the openings in the heat-insulating core. It is understood that the closing means are preferably arranged in the openings. In any case, by using the closing means, it is possible to realize an open connection between the channel plates whenever it is desired to by-pass the heat-insulating core, and to realize at least a partial blockage between the channel plates whenever it is desired to have a heat-insulating function of the device.

[0019] It is practical for each of the channel plates to contain open spaces at the position of the connections to the openings of the heat-insulating core, in order to ensure that the channels of a channel plate are interconnected. For example, a standard channel plate may be used, wherein a portion of the partitions delimiting the channels is removed by means of milling or another useful technique.

[0020] The possibility of having a by-pass of the heat insulation does not require a situation in which the channel plates entirely cover the sides of the heat-insulating core. For example, each of the channel plates may be arranged such as to cover only 25% of a total surface at one side of the core. In such a situation, only a portion of the core is physically by-passed, but this may be sufficient to have a complete functional by-pass of the heat insulation.

[0021] Advantageously, the device according to the present invention comprises means for realizing a forced displacement of a fluid in the insulating units. A practical example of such means is a pump or a ventilator. The functioning of the device according to the present invention can be very effective when the insulating units comprise channels which are relatively narrow, as in that case, natural circulation of a fluid that is present inside the channels may be prevented as much as possible, so that a heat-insulating function of the device may be optimal in case this function is needed. To this end, it is also possible to have a restricted opening at a defined position in the channels, for example. In any case, by using means such as a pump or a ventilator for realizing a forced displacement of a fluid, heat transfer from one side of the device to another when the channels are open may be considerably enhanced, wherein it is ensured that the by-pass of the heat-insulating core of the device is functional.

[0022] The means for realizing a forced displacement of a fluid in the insulating units may be effectively applied for fulfilling the function of the closing means, as an advantageous result of which there is no need for separate components for doing so. In other words, the means may be adapted such as to combine the capability to realize a flow of fluid and the capability to vary the flow-through area of a passage between the portions of the insulating units which are located at opposite sides of the device. In particular, the means may be adapted such as to close the passage to a greater extent in an inactive condition than in an operating condition. In this way, an operating condition of the means is associated with an increased flow-through area. In a practical embodiment, the means may comprise a ventilator having pivotably arranged blades, wherein the position of the blades is varied automatically under the influence of centrifugal forces, so that the size of flow-through openings between the blades is varied.

[0023] Preferably, material of the structure of the device according to the present invention, such as the material of channel walls, is chosen such as to be a material having poor qualities when it comes to heat transfer. Otherwise, any desired heat-insulating function of the device might get deteriorated to an unacceptable extent. A suitable material in this respect is a plastic material. An example of a suitable material is 25% glass reinforced polyamid. The heat-insulating core may be made of any suitable, known heat-insulating material such as glass wool.

[0024] The device according to the present invention may be provided with a plurality of channels extending through the core, which are connected to the insulating units. The additional channels may be formed as gaps between two plates, for example, wherein these channels may be used for creating an underpressure in the device. Furthermore, in general, the device according to the present invention may be equipped with means having sound-insulating properties.

[0025] The closing means of the device according to the present invention may comprise a controllable valve construction, for example, but other embodiments of the closing means are feasible as well, including the combination with the means for realizing a forced displacement of a fluid in the insulating units, as described in the foregoing. In any case, the closing means may be adapted such as to be operated manually, or to be operated both manually or automatically, depending on a choice of a user of the device according to the present invention, or to be operated only automatically. In view of the possibility of realizing automatic control of the closing means, it may be advantageous to have means for detecting a temperature at least at one side of the device, particularly a side that is intended to be at an outside of a building in which the device is applied. An additional advantage of having such means is that in a dangerous situation in which a fire starts somewhere in the building, the fire may be detected at an early stage, so that a fire alarm may be timely activated.

[0026] In general, in a device in which the closing means can be operated automatically on the basis of appropriate input such as a value of the outside temperature, controlling the condition of the closing means may be carried out by any suitable means such as a microcontroller.

[0027] A number of advantageous aspects of the device according to the present invention, and advantageous possibilities for application of the device, which have not been explicitly mentioned in the foregoing, are listed below.

- The device may easily be.arranged in or on any building construction. For example, the device may be arranged between a supporting outer wall of a building and a cladding structure.
- The device may be connected to any climate control system of a building, for example, to a heating system or a heat recovery system.
- A construction in which the device is incorporated may be provided with a foil or the like for blocking or deflecting radiation.
- A construction in which the device is incorporated may be provided with a foil or the like for preventing fungous growth.
- The device may be used for buffering heat and/or energy.
- The device may be arranged such as to play a role in equalizing air pressure differences in tall buildings.
- The manufacturing process of the device, in particular the manufacturing process of a heat-insulating panel having a plurality of channels, possibly in the form of channel plates, on two opposite sides, may very well be carried out by bringing various layers together, for example. Furthermore, the manufacturing process does not need to involve the production of much waste, and the device can be made such as to be recyclable.
- When the condition of the device is controlled automatically, the control system may be coupled to a system for detecting CO_2 at the inside.

[0028] The present invention further relates to a device that is adapted to be put in different conditions, and that is adapted to at least have a heat-insulating function in one of the possible conditions, comprising:

- a plurality of insulating units, which are each containing hollow space, and which are extending from one side of the device to the opposite side of the device, and
- closing means which are adapted to be put in different conditions, which are arranged at the insulating units, at one side of the device, and which are adapted to keep the insulating units closed in one of the possible conditions, and to open the insulating units in another of the possible conditions.

[0029] In the device having the plurality of insulating units as mentioned, a heat-insulating function of the device can simply be obtained by keeping the insulating units in a closed condition, as in that condition, the units are filled with still air, which is a very good insulator. When a heat-insulating function of the device is no longer required, the insulating units are opened. Preferably, the device according to the invention is applied in such a way that a side of the device where the insulating units can be opened is at the outside (of a building). When the insulating units are opened, the units are filled with outside air, and there is no longer an intermediate quantity of still air in the device, so that the heat-insulating effect of the presence of the device is lost.

[0030] The closing means of the device may be controlled in an automatic manner. In such a case, the device is equipped with any suitable means such as a microcontroller for determining the condition of the closing means. The closing means may comprise a suitable flap construction, for example.

[0031] The present invention will now be explained on the basis of the following description of embodiments of the device according to the invention with reference to the drawing, in which equal reference signs indicate equal or similar components, and in which:

figure 1 shows a perspective view of a portion of a panel which is part of a first preferred embodiment of the device according to the present invention;
figure 2 diagrammatically shows a sectional view of the panel shown in figure 1 and closing pieces arranged at ends of the panel;
figure 3 shows a perspective view of the panel and the closing pieces;
figures 4 and 5 show details of figure 3;
figures 6-9 diagrammatically show perspective views of portions of the closing pieces;
figure 10 diagrammatically shows an alternative of the sectional view of the panel shown in figure 1;
figure 11 shows a perspective view of a core element of a second preferred embodiment of the device according to the present invention;
figure 12 shows a perspective view of the device according to the second preferred embodiment, in an assembled condition;
figure 13 shows a perspective view of the core element of the device according to the second preferred embodiment and ventilators which are arranged in openings of the element;
figure 14 shows a detail of a channel plate which is part of the device according to the second preferred embodiment; and figures 15 and 16 diagrammatically show two different sectional views of an embodiment of an alternative device according to the present invention.

[0032] Figure 1 shows a portion of a panel 10 which is part of a first preferred embodiment of the device 1 according to the present invention, which is a device having adjustable heat-insulating properties. In the shown example, the panel 10 has a rectangular shape, and a certain thickness. At two main sides of the panel 10, a hollow structure 11 is present, in which a plurality of partitions 12 is located, so that a plurality of channels 13 is formed. The hollow structure 11 is also known as channel plate 11.

[0033] The panel 10 is intended to be used in combination with two closing pieces 20, as is illustrated in figures 2-5. An example of the closing pieces 20 is illustrated in more detail in figures 6-9, wherein portions of closing pieces 20.are shown. An important function of the closing pieces 20 is interconnecting the channels 13 from the two main sides of the panel 10, in such a way that a continuous entirety 14 is formed, which is a channel surrounding a core element 15 of the panel 10. To this end, the closing pieces 20 may comprise a plurality of connecting channels 21, wherein one end of the connecting channels 21 is suitable to be connected to an end of channels 13 extending at one main side of the panel 10, and wherein another end of the connecting channels 21 is suitable to be connected to an end of channels 13 extending at the opposite main side of the panel 10. This option is illustrated in figures 6-9, wherein figure 8 illustrates an interior construction of one of the closing pieces 20 by means of dashed lines. Figure 9 serves to illustrate that the connecting channels 21 may be interconnected through holes 22 in partitions 23 which are present between the connecting channels 21.

[0034] The core element 15 of the panel 10 has heat-insulating properties, and may comprise a block of any suitable heat-insulating material.

[0035] In one of the closing pieces 20, means 30 are arranged for closing a passage 24 that is present in the connecting channels 21. In figure 2, the passage 24 is diagrammatically indicated as a dashed line. Furthermore, the closing means 30 are diagrammatically indicated as a continuous line which represents a valve for closing the passage 24. In another of the closing pieces 20, a restriction 25 is present in the connecting channels 21.

[0036] For the purpose of supplying a fluid such as air or water to the entirety 14 of channels 13 and connecting channels 21, an inlet in the form of a tube 26 or the like is provided, which is arranged such as to provide access to the said entirety 14, and which is suitable to be coupled to a system for supplying a fluid. Preferably, such a system is adapted to pump the fluid towards the channel entirety 14, so that it is possible to have a forced flow of fluid through the channel entirety 14, assuming that the closing means are in a condition for leaving the passage 24 in the connecting channels 21 open. A portion of a closing piece 20 having a tube 26 as mentioned is shown in figure 6.

[0037] In case the fluid is air, it may be useful to have a ventilator (not shown) that is arranged at a suitable place in the channel entirety 14, which may be in the connecting channels 21 in the closing piece 20 where the passage 24 and the means 30 for closing the passage 24 are located.

[0038] The device 1 according to the present invention can be used in at least two conditions. In a first condition, which is a heat-insulating condition, the closing means 30 are kept in a position for closing the passage 24 in the connecting channels 21, and there is no supply of fresh fluid, so that it is ensured that the fluid that is present inside the channel entirety 14 is in a still condition. In this condition of the device 1, the heat-insulating effect of the core element 15 of the panel 10 is supported, wherein direct contact between the channels 13 at one main side of the panel 10 and the channels 13 at the opposite main side of the panel 10 is hindered. A diameter of the channel entirety 14 and the restriction 25 may be small enough for preventing a natural flow of fluid sunder the influence of temperature. Hence, the channel entirety 14 has a heat-insulating function in the condition of the device 1 in which the closing means 30 are in a position for closing the passage 24 in the connecting channels 21, and in which there is no supply of fresh fluid under pressure.

[0039] When it is desired to cancel the heat-insulating function of the device 1, the closing means 30 are put to a position for leaving the passage 24 in the connecting channels 21 open, and the supply of fluid is initiated. In that condition, the fluid is forced to circulate around the heat-insulatirig core element 15 of the panel 10, through the channel entirety 14. On the basis of the direct contact between channels 13 at opposite main sides of the panel 10, the heat-insulating core element 15 of the panel 10 is by-passed, and the heat-insulating function of the device 1 is cancelled.

[0040] For example, when the outside temperature is higher than the inside temperature, a heating effect of the device 1 on the inside may be obtained instead of a heat-insulating effect due to the continuous displacement of fluid through the channel entirety 14. When it is desired to keep the heat out as much as possible, the device 1 may be operated such as to be in the condition as described in the foregoing, i.e. the condition in which there is practically no interaction between fluid that is present in the channels 13 on one main side of the panel 10 and fluid that is present in the channels 13 on the other main side of the panel 10. Another option is supplying a cold fluid to the channel entirety 14. In general, an important advantage of the device 1 according to the present invention is that it is possible to have a flow of fluid around a heat-insulating core 15, wherein the fluid may be supplied to the device 1 at any appropriate temperature.

[0041] For sake of completeness, it is noted that a heat-insulating function of the device 1 according to the present invention may be enhanced by sucking fluid from the channel entirety 14, such that an underpressure is obtained.

[0042] The core element 15 of the panel 10 may comprise a single block of heat-insulating material, but it is also possible that more blocks 16, 17 of heat-insulating material are arranged in the panel 10, wherein these blocks 16, 17 are separated by channels 18. An example of a panel 10 having two blocks 16, 17. and channels 18 arranged between the blocks 16, 17 is illustrated in figure 10. In the shown example, the channels 18 are formed between two plates which are connected through suitable elements 19 such as dots of putty or pieces of double-sided adhesive tape. It is noted that when the panel 10 as.shown is put in a heat-insulating condition, and fluid is sucked from the channels 13, 18 of the panel 10 in the process, it is possible to have separate systems for controlling the underpressure in each of the channels 13, 18.

[0043] It is noted that a valve construction or another suitable type of closing means may be present at more positions than in just one of the closing pieces 20. Actually, depending on the size of the device 1, it may be very advantageous to have more valves or the like in order to allow for access to the channel entirety 14 at several positions. In the embodiment as described in the foregoing, in which the closing means 30 are provided in one of the closing pieces 20, and a restriction 25 is provided in another of the closing pieces 20, it is possible that a valve is arranged for closing the restriction 25 when a heat-insulating function of the device 1 is required.

[0044] Figures 11-14 relate to a second preferred embodiment of the device 2 according to the present invention. In these figures, for sake of clarity, a number of components are shown as if they are transparent, so that interior details as well as exterior details can be seen.

[0045] Figure. 11 shows a portion of a core element 15 which is part of the second preferred embodiment of the device 2 according to the present invention, which, like the first preferred embodiment as described in the foregoing, comprises a panel 10 of which the core element 15 and two channel plates 11 are part. A main difference between the embodiments resides in the fact that in the second embodiment, passages 24 between the channel plates 11 extend through the core element 15, which is provided with openings 27 to that end. In the shown example, the number of openings 27 and passages 24 is four, which does not alter the fact that the number may be larger or smaller within the scope of the present invention.

[0046] Figure 12 shows the entire panel 10 of the device 2, i.e. the assembly of the core element 15 and the channel plates 11. The fact that the channel plates 11 are arranged at opposite main sides of the core element 15 is clearly illustrated in figure 12. Furthermore, it is clear that the channel plates 11 do not cover the core element 15 entirely, which is another difference in comparison with the first embodiment.

[0047] Figure 13 serves to illustrate the fact that the device 2 may comprise ventilators 28 for creating a flow of air or another suitable fluid through the channels 13 of the channel plates 11 and the passages 24 extending between the channel plates 11. A suitable positioning of the ventilators 28 is a positioning as shown in the figures, i.e. a positioning inside the openings 27 of the core element 15 Further details of the ventilators 28 will be discussed later.

[0048] In figure 14, a detail of one of the channel plates 11 is shown. Each channel plate 11 has inlets 29 which are intended to be matched with the openings 27 of the core element 15. In other words, when a channel plate 11 and the core element 15 are joined, this is done in such a way that the inlets 29 of the channel plate 11 are put at the positions of the openings 27. In that way, it is actually possible for a channel plate 11 to be in fluid communication with another channel plate 11, through the openings 27.

[0049] Besides the inlets 29 which are intended to be matched with the openings 27 of the core element 15, the channel plate 11 may comprise at least one more inlet which is arranged such as to provide access to the interior of the channel plate 11 at another side of the channel plate 11 than a side which is intended to face the core element 15, and which is suitable to be coupled to a system for supplying a fluid.

[0050] In a standard channel plate, the channels 13 extend from one side of the plate to another, wherein the channels 13 are separated from each other, and it is not possible to have a flow of fluid from one channel 13 to another inside the channel plate 11 itself. However, in the second preferred embodiment of the device 2 according to the present invention, it is advantageous if the channels 13 are interconnected. To that end, it is proposed to have an open space 35 inside the channel plate 11, at a position of at least one inlet 26 which, in the shown example, is a position of end portions of the channels 13. For example, the open space 35 can be realized by removing end portions of the partitions 12 which are present for delimiting the channels 13. In the process, milling or another suitable technique may be applied. However, it is also possible that the partitions 12 are provided with holes (not shown), or that another solution is chosen for realizing an interconnection of the channels 13 inside the channel plate 11.

[0051] In the shown example, four openings 27 are present in the core element 15, which are arranged in a pattern resembling the corners of a rectangle. The inlets 29 of the channel plate 11 are arranged in the same pattern. The channels 13 of the channel plate 11 extend in a direction of a long side of the virtual rectangle, and each channel plate 11 has two open spaces 35, wherein each open space 35 is present at a short side of the virtual rectangle, at a position where two inlets 29 are present. The open space 35 has an elongate shape, like the channels 13, and may be regarded as being a transversely arranged channel 35 which is extending at the ends of the other channels 13, and which is open to the other channels 13.

[0052] The functioning of the second preferred embodiment of the device 2 according to the present invention has two aspects. In the first place, when there is a need for heat insulation, a flow of fluid from one channel plate 11 to another should be avoided. In the second place, when it is desired to not support the heat-insulating function of the core element 15, the core element 15 should be by-passed on the basis of an open connection between the channel plates 11, through the openings 27 of the core element 15. In order to vary the size of the passages 24 through the openings 27, separate means 30 such as a movable slide or a step valve may be arranged in the openings 27. However, in order to keep the number of components, especially movably arranged components, as small as possible, it is proposed to use the ventilators 28 not only for realizing a flow of fluid, but also as the means 30 which are capable of adapting the size of the passages 24 between the channel plates 11 to actual functional requirements. This is done by using ventilators 28 having pivotably arranged blades. The distribution of weight over the blades can be chosen such that when the ventilators 28 are activated, the orientation of the blades changes under the influence of centrifugal forces. A pivoting movement of the blades may be the result of an eccentric load of the blades.

[0053] In particular, when the ventilators 28 are used as the closing means 30 for controlling a flow of fluid between the channel plates 11 which are arranged at opposite sides of the heat-insulating core element 15, the design of the ventilators 28 should be such that the blades pivot such as to be more out of the way of the flow of fluid when the ventilators are activated, and to have a more closing function when the ventilators 28 are shut off. It is possible to have this interrelation of functions on the basis of the fact that the ventilators 28 are only activated in a situation in which a flow of fluid between the channel plates 11 is required.

[0054] For sake of completeness, the way in which the functioning of the panel 10 is changed will be described. In a first condition, the panel 10 has a heat-insulating function. In that case, there is practically no flow of fluid in the channel system of the whole of the two channel plates 11, so that there is no interaction between the channel plates 11, and the heat-insulating function of the core element 15 is supported. The ventilators 28 are kept in a deactivated state, wherein the passages 24 between the channel plates 11 are blocked to the greatest extent. The functioning of the panel 10 is changed by ensuring that the channel system is filled with a fluid, and activating the ventilators 28. As a result, a by-pass of the heat-insulating core element 15 is obtained, on the basis of the interaction of the channel plates 11. In the process, a heat difference between the sides of the panel 10 cause the temperature at the relatively cold side to increase, and the temperature at the relatively hot side to decrease. The blades of the ventilators 28 are pivoted out of the way of the flow of fluid, so that the interaction of the channel plates 11 can be optimal.

[0055] As is the case in the shown example, the channel plates 11 do not necessarily need to cover all of the main sides of the heat-insulating core element 15. Even when portions of an exterior surface of the core element 15 are left uncovered, the by-passing function of the interconnected channel plates 11 may be sufficient to overrule the heat-insulating function of the core element 15.

[0056] It is noted that it may be possible to have four ventilators 28 arranged in four openings 27 in the core element 15 as shown, and to use only two ventilators 28, namely one ventilator 28 per end of the channels 13 of the channel plates 11, preferably in a diagonal relation. In such a case, the lifespan of the panel 10 can be extended beyond the average lifespan of a ventilator 28. When one ventilator 28 at a particular end breaks down, the other ventilator 28 at that end can be used from that moment on. Naturally, it is also possible to control the ventilators 28 in such a way that each time there is a need for ventilation, another set of ventilators 28 is used, so that each ventilator 28 is used during the entire lifespan of the panel 10, but in a way which is half as intensive. As soon as it appears that a ventilator 28 has reached the end of its lifespan and does not function anymore, the control should be aimed at only using the other ventilator 28 at that particular end for the remainder of the lifespan of the panel 10.

[0057] It is understood that it is also possible to have an embodiment which is as light and cheap as possible, in which only two ventilators 28 are used, and in which the core element 15 has no more than two holes 27. In principle, application of only one ventilator 28 is possible as well. For sake of completeness, it is noted that the use of a ventilator 28 is not essential within the scope of the present invention.

[0058] Figures 15 and 16 illustrate an alternative embodiment of the device 3 according to the present invention. According to this embodiment, the device 3 comprises a plurality of hollow insulating units 40, which are extending from one main side of the device 3 to an opposite main side.

[0059] Figure 15 shows a longitudinal section of a portion of the alternative device 3, and figure 16 shows a cross-section of a portion of the device 3. At a side which is intended to be positioned at an outside, each of the insulating units 40 is provided with closing means 30 in the form of a flap construction or the like. Adjustment of the functioning of the device 3 is based on adjustment of the condition of the closing means 30. When the closing means 30 are in a closed condition, the device 3 fulfills a heat-insulating function on the basis of the fact that the insulating units 40 constitute insulators in the form of a quantity of still air that is trapped inside the units 40. When the closing means 30 are put to an open condition, as indicated in figure 15, the insulator is removed, as it were, and the heat-insulating function of the device 3 is cancelled.

[0060] In a practical embodiment of the alternative device 3 according to the present invention, a panel (not shown) having a certain number of insulating units 40 is provided, so that a number of insulating units 40 may be handled like an entirety and easily be put in any desired place.

[0061] In the devices 1, 2, 3 as described in the foregoing, the condition of the closing means 30 may be controlled automatically, without the need of intervention of a user of the device 1, 2, 3. However, that does not alter the fact that manual control is possible as well. In the case of an automatic control system, any suitable controlling means may be applied with the device 1, 2, 3, and the controlling means may use any type of information as the basis of the controlling process. An example of relevant information is a value of an outside temperature.

[0062] It will be clear to a person skilled in the art that the scope of the present invention is not limited to the examples discussed above, but that several amendments and modification thereof are possible without deviating from the scope of the invention as defined in the appended claims.

[0063] For example, the insulating units may comprise channels 13 which are part of a channel plate 11 as disclosed in the foregoing, but that does not alter the fact that the insulating units may also be realized in different ways, and may comprise any suitable means for containing a fluid, such as flexible hose pipes, wherein it is not necessary for the pipes or other means to be positioned in a closely adjoining manner.

[0064] The device 1, 2, 3 according to the present invention can be applied in buildings, as mentioned in the foregoing. Other possible applications are application in swimming pools, and applications in cooling units. In the latter case, a cooling unit, which may be suitable for containing foodstuff, for example, is placed in a cold environment first, with the device 1, 2, 3 according to the present invention in a condition in which the heat insulation is by-passed. As soon as the cooling unit is taken from the cold environment and transported from there, the cold is kept inside the cooling unit by putting the device 1, 2, 3 according to the present invention in a condition in which the heat insulation is optimal.

[0065] The present invention may be summarized as follows.

[0066] A device 1, 2, 3 has adjustable heat-insulating properties on the basis of the fact that the device 1, 2, 3 may be put in at least two different conditions, wherein in one of the conditions, a heat-insulating quantity of still fluid is present in the device 1, 2, 3, and wherein in another of the conditions, the quantity of still fluid is absent.

[0067] In a specific embodiment, the device 1 comprises a heat-insulating core 15 and an assembly 14 of channels 13, 21 surrounding the core 15, wherein a passage 24 in the channels 13, 21, which is positioned between portions of the channels 13, 21 extending at opposite sides of the device 1, may be blocked or left.open, depending on the desired functioning of the device 1. Furthermore, fluid may be supplied to the channels 13, 21 in order to realize a forced flow of fluid through the channels 13, 21, or there may be no fluid supply, or even a removal of fluid.

[0068] The device 1, 2, 3 according to the present invention is very well suitable to be applied in a wall, roof or floor of a building. In such a case, the device 1, 2, 3 is positioned between an inner construction and an outer construction, wherein the device 1, 2, 3 may be used to transfer heat or cold toward the inner construction. In the building, wall ties may be used for interconnecting the inner construction and the outer construction. It is no problem for such wall ties to extend through the device 1, 2, 3 according to the present invention, as this would only involve a loss of functionality of a limited number of channels 13, 21 or insulating units 40.

[0069] The device 1, 2, 3 according to the present invention functions such as to cooperate with its immediate surroundings in a sophisticated manner, wherein use is made of a heat resistance of surrounding air gaps, and of the inner construction and the outer construction between which the device 1, 2, 3 may be sandwiched. The characteristics of its surroundings are used to determine an optimal extent of heat insulation offered by the device 1, 2, 3 in all circumstances. In this respect, it is even possible to have different conditions of the device 1, 2, 3 at different sides of a building, assuming a practical situation in which more than one device 1, 2, 3 is applied in the building. In any case, when the device 1, 2, 3 according to the present invention is'applied, it is possible to create an interior climate in buildings according to desires of people staying in these buildings, with the additional advantage that energy may be saved as much as possible, since use is made of environmental factors.

Claims

1. Device (1, 2) that is adapted to be put in different conditions, and that is adapted to at least have a heat-insulating function in one of the possible conditions, comprising:

   - a plurality of insulating units (13, 21) which are each containing hollow space, which hollow space is suitable,for containing a fluid such as air or water, and which are each having portions which are located at opposite sides of the device (1);
   - a core (15; 16, 17) having heat-insulating properties, which is positioned between the portions of the insulating units (13, 21) which are located at opposite sides of the device (1); and
   - closing means (28, 30) which are adapted to be put in different conditions, in order to close a passage (24) between the portions of the insulating units (13, 21) which are located at opposite sides of the device (1) to a greater or lesser extent.

2. Device (1) according to claim 1, comprising an assembly which comprises the following components:

   - a panel (10) having a core (15; 16, 17) having heat-insulating properties, and channels (13) extending at two sides of the heat-insulating core (15; 16,17); and
   - two closing pieces (20) for interconnecting the channels (13) which are located at the said two sides of the panel (10), at both ends of the channels (13).

3. Device (1) according to claim 2, wherein the closing pieces (20) are provided with connecting channels

(21) of which one end is suitable to be connected to channels (13) which are located at one side of the panel (10), and of which another end is suitable to be connected to channels (13) which are located at another side of the panel (10).

4. Device according to claim 2 or 3, wherein the closing means (30) are located in one of the closing pieces (20), in each of the connecting channels (21) of that closing piece (20).

5. Device (2) according to claim 1, comprising a panel (10) having a core (15) having heat-insulating properties, and two channel plates (11) extending at two sides of the heat-insulating core (15), wherein the heat-insulating core (15) is provided with openings (27), and wherein the channels (13) of the two channel plates (11) are connected to the openings (27) in the core (15).

6. Device (2) according to claim 5, wherein, at the position of the connections to the openings (27) of the heat-insulating core (15), open spaces (35) are present in each of the channel plates (11), which provide for mutual connections of channels (13) of a channel plate (11).

7. Device (2) according to claim 5 or 6, wherein the closing means (28, 30) are arranged in the openings (27) of the heat-insulating core (15).

8. Device (2) according to any of claims 5-7, wherein the channel plates (11) cover only a portion of the relevant sides of the heat-insulating core (15).

9. Device (1, 2) according to any of claims 1-8, comprising means (28) for realizing a forced displacement of a fluid in the insulating units (13, 21).

10. Device (1, 2) according to claim 9, wherein the said means (28) for realizing a forced displacement of a fluid in the insulating units (13, 21) are adapted to close a passage (24) between the portions of the insulating units (13, 21) which are located at opposite sides of the device (1, 2) to a lesser extent in an operating condition than in an inactive condition.

11. Device (1, 2) according to any of claims 1-10, comprising a plurality of channels (18) which are extending through the heat-insulating core (15; 16, 17), and which are connected to the insulating units (13, 21).

12. Device (1, 2) according to any of claims 1-11, wherein the closing means (30) comprise a controllable valve construction.

13. Device (1, 2) according to any of claims 1-12, comprising means for detecting a temperature at at least one side of the device (1, 2).

14. Device (1, 2) according to any of claims 1-13, comprising means having sound-insulating properties.

15. Device (1, 2) according to any-of claims 1-14, comprising means such as a microcontroller for determining the condition of the closing means (28, 30).

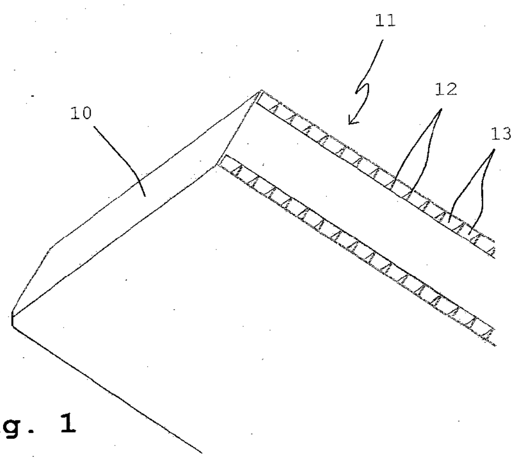

Fig. 1

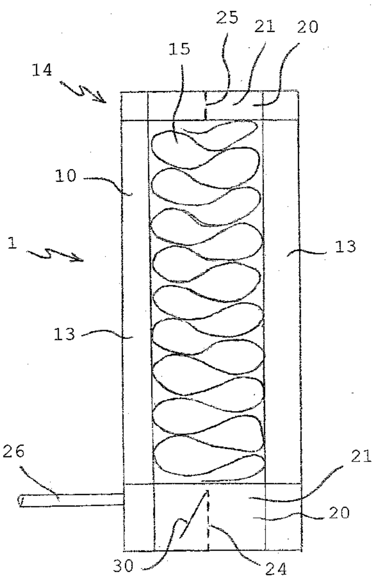

Fig. 2

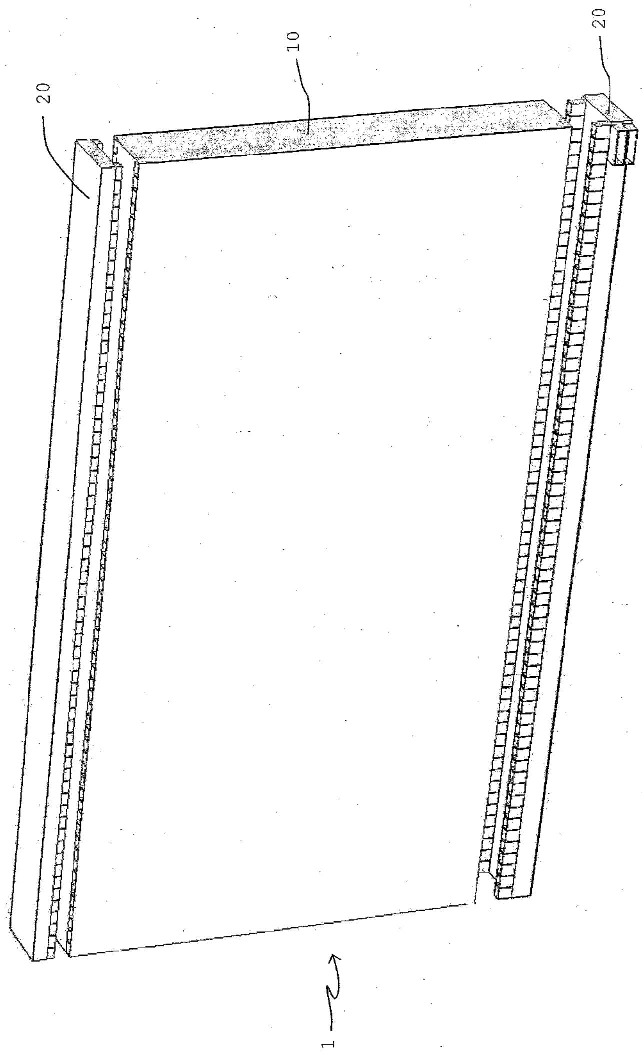

Fig. 3

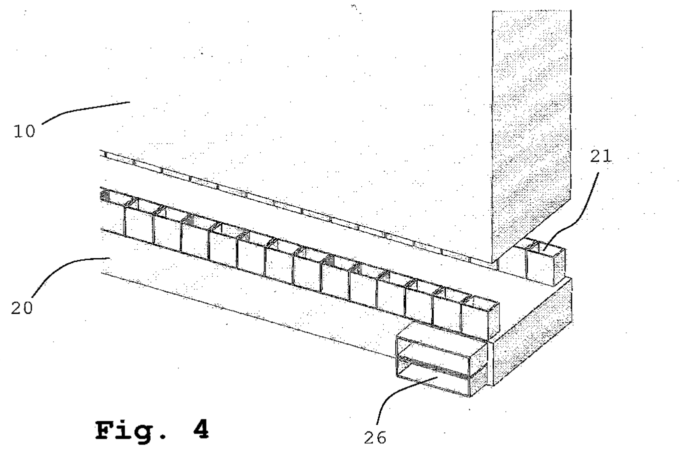

Fig. 4

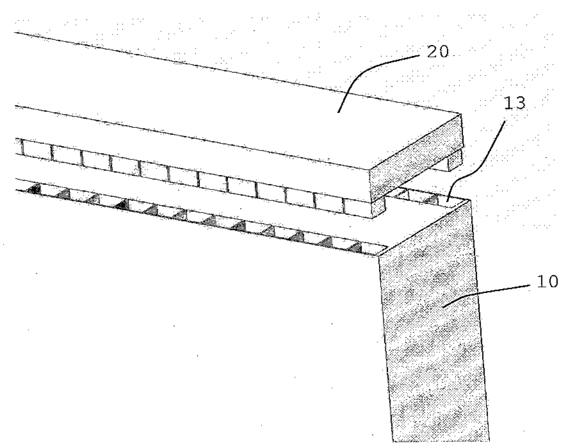

Fig. 5

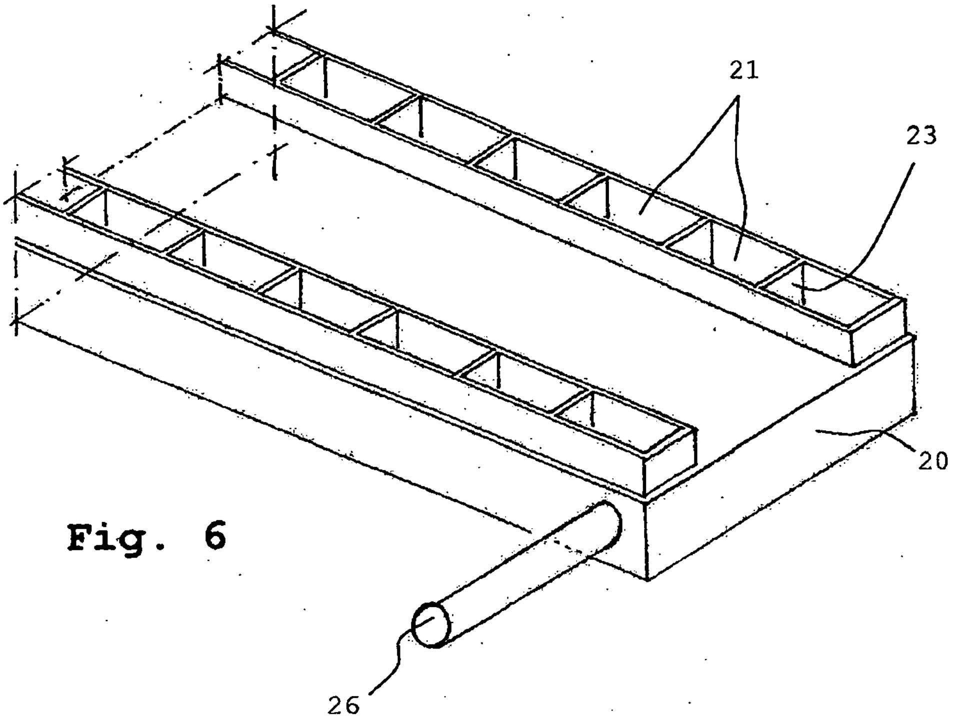

Fig. 6

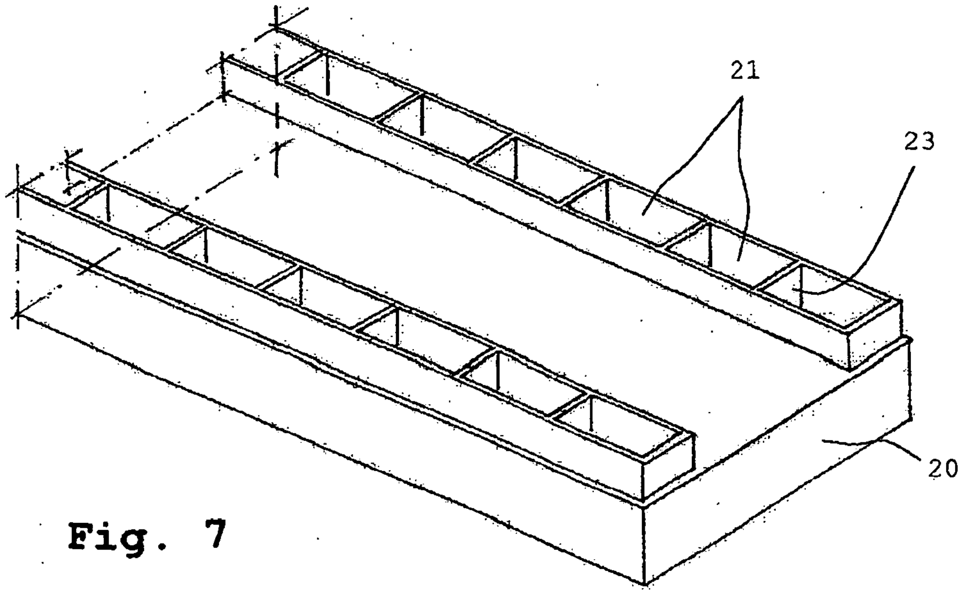

Fig. 7

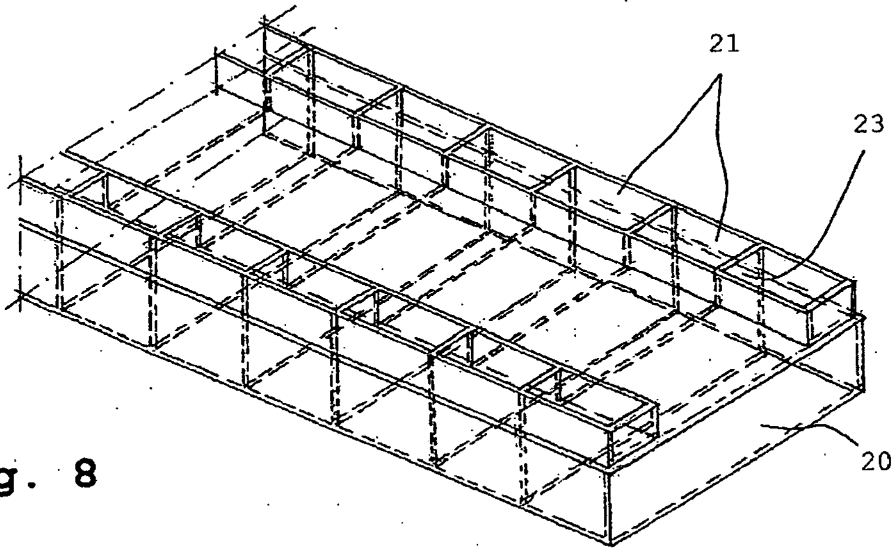

Fig. 8

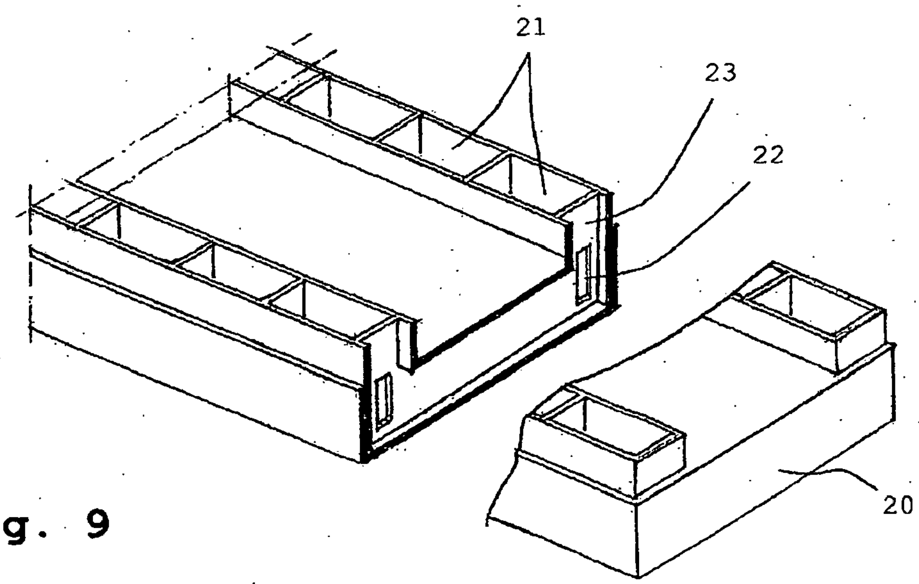

Fig. 9

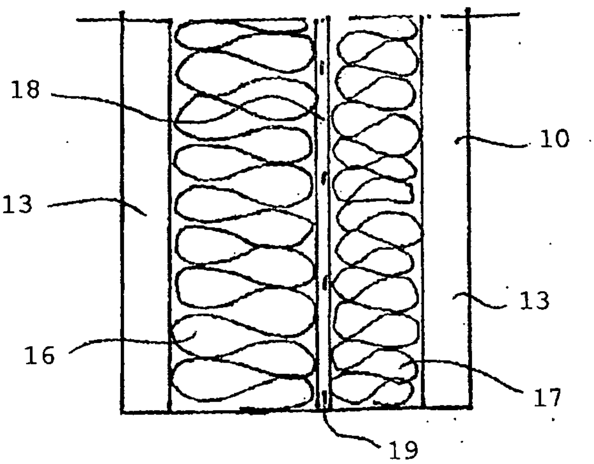

Fig. 10

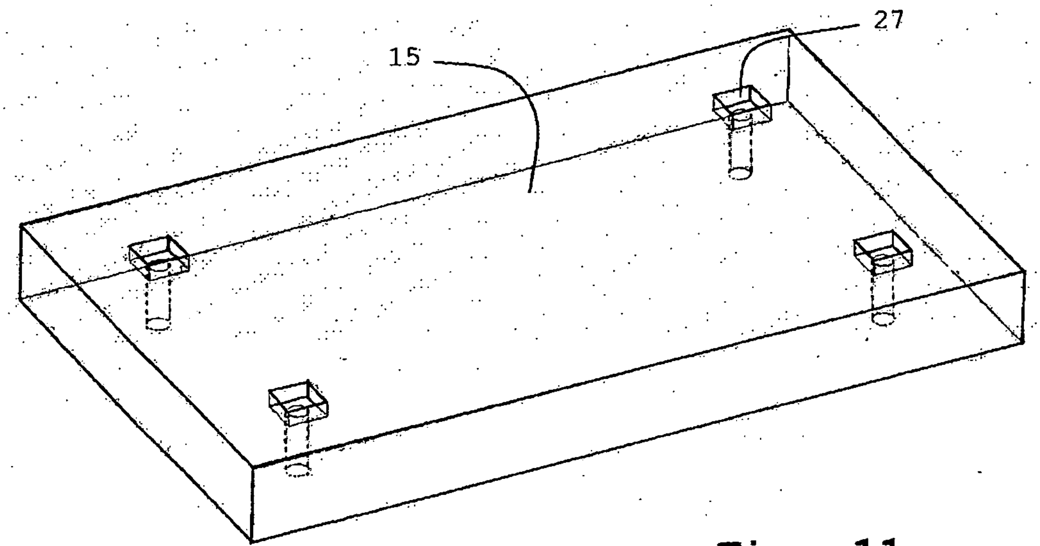

Fig. 11

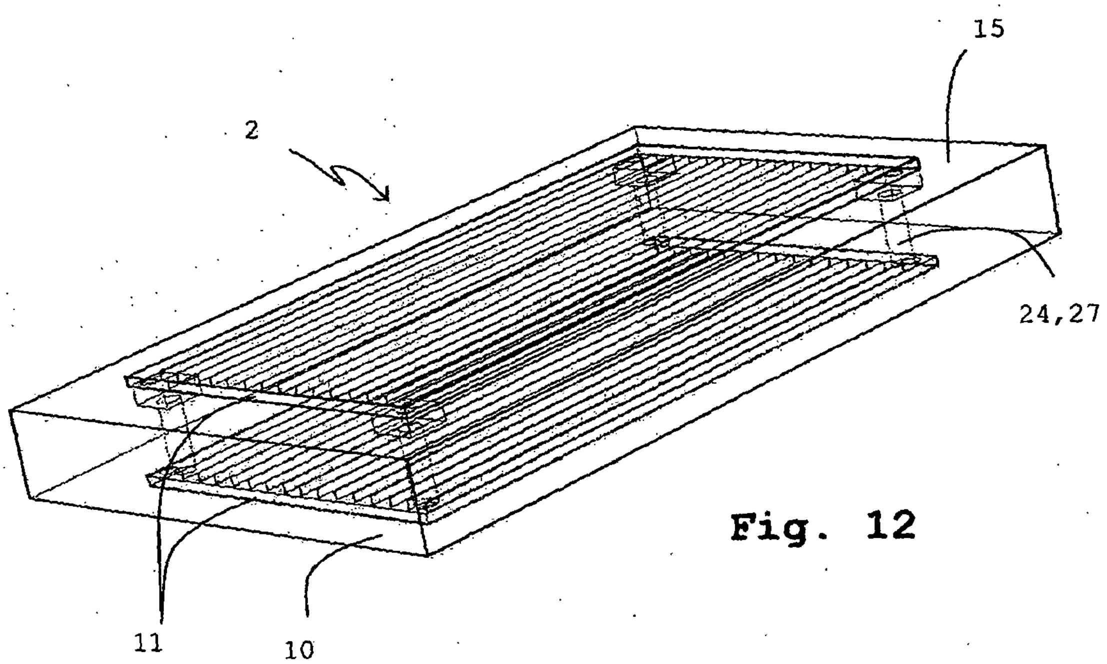

Fig. 12

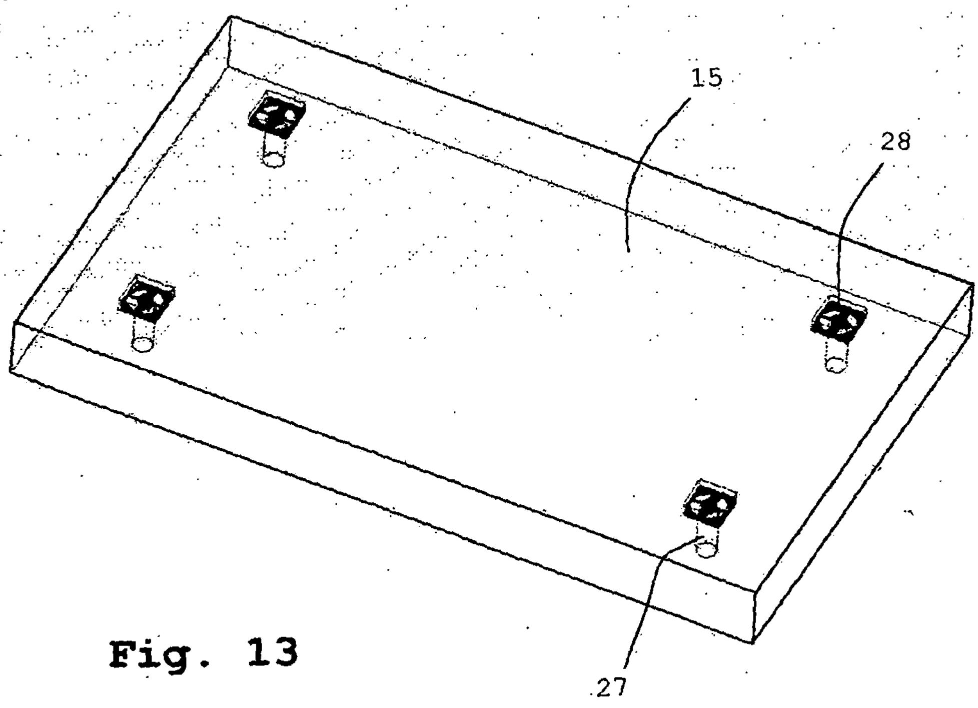

Fig. 13

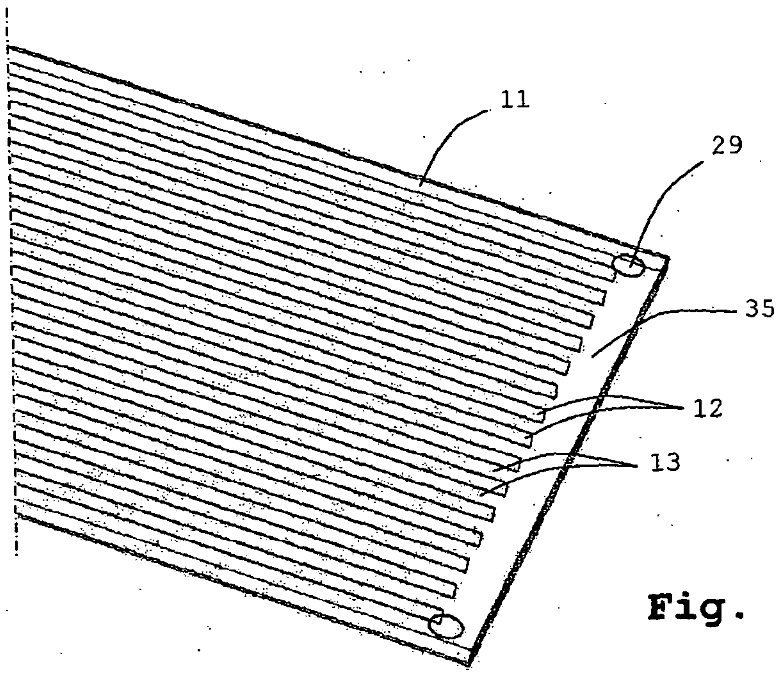

Fig. 14

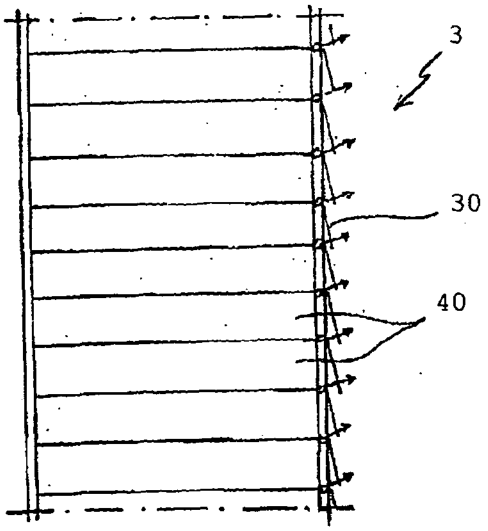

Fig. 15

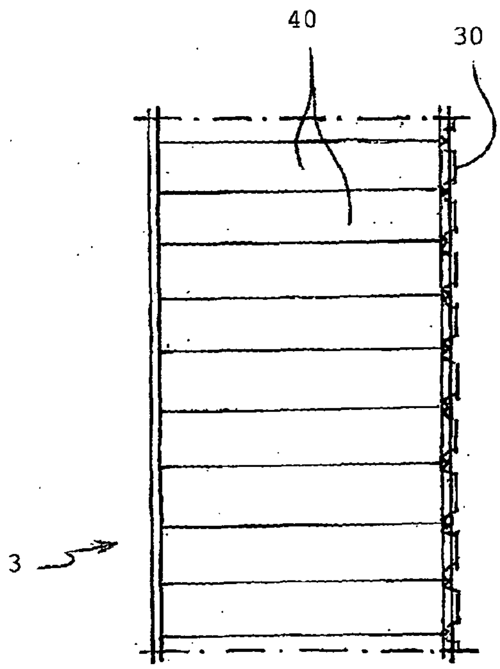

Fig. 16

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EUROPEAN SEARCH REPORT

Application Number
EP 10 00 3255

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 526 225 A (STANTON AUSTIN N [US]) 2 July 1985 (1985-07-02) * column 1, line 45 - column 2, line 56 * * column 3, line 5 - column 4, line 11; figure 5 * -----	1-15	INV. E04B1/74 E04B1/80
A	WO 2009/025786 A1 (BLUNDELL JOSEPH TIMOTHY [US]; PERKINS SARAH GRACE [US]) 26 February 2009 (2009-02-26) * page 9, line 8 - line 11; figures 1-5 * -----	1-8	
A	DE 35 07 594 A1 (SCHWARZ THEO DIPL ING) 27 March 1986 (1986-03-27) -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26 July 2010	Zuurveld, Gerben

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 00 3255

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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26-07-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4526225 A	02-07-1985	NONE	
WO 2009025786 A1	26-02-2009	US 2009049763 A1	26-02-2009
DE 3507594 A1	27-03-1986	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82