(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 058 285 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
15.11.2017 Bulletin 2017/46

(21) Application number: **14793894.8**

(22) Date of filing: **30.09.2014**

(51) Int Cl.:
F24F 3/044 *(2006.01)* ***E04C 1/39*** *(2006.01)*
F24F 5/00 *(2006.01)*

(86) International application number:
PCT/IB2014/064948

(87) International publication number:
WO 2015/044927 (02.04.2015 Gazette 2015/13)

(54) **AIR-CONDITIONED BUILDING AND CORRESPONDING METHOD TO AIR-CONDITION SAID BUILDING**

KLIMATISIERTES GEBÄUDE UND ENTSPRECHENDES VERFAHREN ZUR KLIMATISIERUNG DES GEBÄUDES

BÂTIMENT CLIMATISÉ ET MÉTHODE CORRESPONDANTE POUR CLIMATISER LEDIT BÂTIMENT

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **30.09.2013 IT UD20130123**

(43) Date of publication of application:
24.08.2016 Bulletin 2016/34

(73) Proprietors:
- **Evoluthion S.r.l.**
  33040 Premariacco (IT)
- **Martini, Giorgio**
  33100 Udine (IT)

(72) Inventors:
- **MARTINI, Giorgio**
  I-33100 Udine (IT)
- **COZZI, Luigi**
  I-33040 Premariacco (IT)

(74) Representative: **Petraz, Davide Luigi et al**
GLP S.r.l
Viale Europa Unita, 171
33100 Udine (IT)

(56) References cited:
JP-A- H09 170 784
JP-A- H10 132 301
JP-A- 2001 303 688
JP-A- 2003 042 484
JP-A- 2003 120 958
JP-A- 2008 101 462
JP-A- 2011 226 677

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 3 058 285 B1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns an air-conditioned building and the corresponding method for air-conditioning a building, either used for residential or industrial use, or for other uses such as for example for making air-conditioned rooms.

[0002] In particular, the present invention can be applied during the reconstruction of already existing buildings or during the construction of new buildings.

[0003] Moreover, the present invention can be applied both to buildings built in the traditional way, for example, with masonry or concrete, and to buildings made with new concepts, for example, with low energy consumption, low environmental impact, with pre-fabricated elements or not.

[0004] Here and hereafter in the description and in the claims, the term air-conditioning comprises both the action of cooling and heating a room.

BACKGROUND OF THE INVENTION

[0005] Known buildings are provided with air-conditioning systems and/or apparatuses able to manage and control ambient conditions, for example the temperature and/or humidity, of at least an area or room of the building.

[0006] In particular, air-conditioning plants are known, installed in a building, for example in one or more rooms, and which can comprise one or more air-conditioning apparatuses such as radiators, radiant plates, convectors, fan coil units, air-conditioners, heat pumps, floor-type radiant heaters or other similar or comparable heating bodies.

[0007] These air-conditioning apparatuses are connected to each other by a fluid-dynamic circuit in which a thermodynamic or heat-carrying fluid is made to flow, necessary to carry out the heat exchange toward the room in which the air-conditioning apparatus is inserted.

[0008] The thermodynamic fluid used can be for example air, water, or generally a liquid or a gas.

[0009] The fluid-dynamic circuit typically comprises a plurality of pipes or channels which connect the air-conditioning apparatuses and in which the thermo-dynamic fluid is made to flow.

[0010] In the heating sector, radiators and radiant plates are known, installed in a fixed zone of a room and which, exchanging heat with water, determine the heating of the room, substantially by irradiation.

[0011] Thermal convectors and fan coil units are also known, also installed in a fixed position in a room or zone to be heated and consisting of a plurality of finned tubes inserted in a casing open at the ends. Inside the thermal convector the column of warm air that is generated determines a chimney effect with consequent circulation of hot air in the room. Fan coil units, unlike thermal convectors, are also provided with a fan to provide forced ventilation of the ambient air and increase the efficiency of heat exchange.

[0012] These air-conditioning apparatuses have the disadvantage that, in the room where they are installed, they generate zones of differentiated temperature due precisely to the concentrated heating action of the apparatuses themselves. Even the adoption of forced ventilation, although reducing this disadvantage, is extremely unsuitable since it causes the movement of dust and generates annoying air currents for the users present in the immediate vicinity.

[0013] To obtain an almost uniformly distributed heating on the surfaces of a room in a building, or construction, floor installations of radiant panels are known, in which the radiant body consists of the floor itself and in the structure of which tubes are inserted for the passage of the heat-carrying fluid, generally water.

[0014] Even though it allows heat distribution over the whole surface of the building in which it is installed, floor heating has the disadvantage of generating air stratifications at different heights in the room. Moreover, for some applications, for example domestic ones, this type of heating has proven unsuitable, since it causes people health problems, for example of the cardiovascular apparatus.

[0015] In the field of cooling of spaces, air-conditioning plants are known which, using the principles of a refrigeration cycle, cool a thermo-dynamic fluid and generate a cooling action of the space.

[0016] In this case conditioning units are installed, possibly served by suitable air feed pipes, that provide to emit cooled air into a space to reduce the temperature.

[0017] These conditioning units, in some cases, can have not only an air cooling function but also an air heating function, providing, for example, to use heating elements, such as electric resistances.

[0018] In practice, conditioning units do not define a homogeneous distribution of heat in the space either, and can generate unpleasant air currents, damaging for people's health.

[0019] From documents JP-A-2008.101462, JP-A-H09.170784, JP-A-2003.042484, JP-A-H10.132301, JP-A-2003.120958, JP-A-2011.226677, JP-A-2001.303688 air-conditioned buildings are known comprising a plurality of habitable floors each with one or more living spaces defined by internal walls.

[0020] The known air-conditioned buildings described in these documents also comprise external perimeter walls and separation walls between habitable floors inside which the living spaces are disposed.

[0021] The perimeter walls and separation walls, together with the walls of the living spaces, define one or more hollow spaces for the passage of a heat-carrying fluid.

[0022] The heat-carrying fluid is heated or cooled by a conditioning unit connected to the hollow spaces.

[0023] In all the solutions presented in the above documents, it is difficult to optimize the flow of the heat-car-

rying fluid in the hollow spaces because the hollow spaces of the different habitable floors are reciprocally connected to each other. The difficulty of optimizing the heat-carrying flow does not allow to obtain uniformity and homogeneity of temperature inside the living spaces and therefore causes the creation of hotter and colder living spaces, even on the same habitable floor.

[0024] Surface zones which are hotter and/or colder of the same living space can also occur, triggering upward and/or downward drafts in the living space.

[0025] The solutions described in documents JP-A-H09.170784 and JP-A-2003.042484 also provide that the heat-carrying fluid that circulates in the hollow spaces is also made to circulate inside the living spaces themselves.

[0026] This solution is particularly complex to obtain in that it is necessary to suitably and accurately treat the heat-carrying fluid in order to introduce clean, uncontaminated air into the living space, which can be breathed by persons residing therein. Moreover, in these solutions, the heat-carrying fluid introduced into the living space can generate annoying drafts for the persons residing therein, or a movement of dust which is damaging for users' health.

[0027] In the solutions described in documents JP-A-2008.101462, JP-AH10.132301, and JP-A-2011.226677 the conditioning unit is located directly in the hollow space. This condition causes uncontrollable variations at least of the temperature of the heat-carrying fluid inside the hollow spaces due to overheating of the conditioning unit for example. Moreover, possible moving parts of the conditioning unit, or possible breakdowns of the latter, can cause a contamination of the heat-carrying fluid in the hollow space.

[0028] In the documents JP-A-H10.132301, JP-A-2003.120958, JP-A-2011.226677 and JP-A-2001.303688 solutions are described in which the conditioning unit is connected to the outside in order to take in, on each occasion, air to be heated and/or cooled and to be made to circulate in the hollow spaces.

[0029] The air circulating in the hollow spaces is subsequently expelled through apertures made in the external walls of the air-conditioned building.

[0030] This causes considerable consumption by the conditioning unit since the thermal power accumulated by the air present in the hollow spaces when expelled is completely dispersed.

[0031] One purpose of the present invention is to make an air-conditioned building that allows to resolve the disadvantages linked to the non-uniformity of heating of living spaces.

[0032] Another purpose of the present invention is to make an air-conditioned building that allows to increase the heat exchange efficiency inside the building.

[0033] Another purpose of the present invention is to put into action energy saving measures, and measures intended to obtain comfortable ambient conditions.

[0034] The invention thus proposes to manage and to put into practice the construction plan of an air-conditioned building so that the behavior of the building is optimized during the various seasonal cycles, combining the traditional energy conservation approach with aspects connected to the inertial behavior of the building, the dynamic control of exposure to the sun, the architectural structure in relation to an upgrading of natural ventilation, the control of excessive exposure to the sun and the physical contextualization in relation to exposure to breezes, shade and similar phenomena and the exploitation of possible renewable energy sources present on site.

[0035] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0036] The present invention is set forth and characterized in the independent claims, claim 1 and claim 9, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0037] In accordance with the above purposes, an air-conditioned building according to the present invention comprises a plurality of first walls configured to define together at least a first compartment, and a plurality of second walls located inside the first compartment and connected with each other to define together at least a second compartment, which, during use, can define one or more rooms of the air-conditioned building, or one or more rooms or spaces which can be air-conditioned depending on particular needs.

[0038] Each of the second walls faces at least one of the first walls and is distanced from the latter so as to define at least a continuous hollow space, closed with respect to the second compartment, and configured to contain a heat-carrying fluid.

[0039] The building also comprises an air-conditioning apparatus configured to regulate the thermal state of the heat-carrying fluid present in the hollow space.

[0040] In order to regulate the thermal state it is provided that the heat-carrying fluid can be heated or cooled according to needs by means of heat exchange.

[0041] According to one aspect of the present invention, the air-conditioning apparatus comprises a conditioning unit located outside the hollow space and a fluid-dynamic circuit that connects the hollow space to the conditioning unit with a closed-ring circuit, to make the heat-carrying fluid circulate in the hollow space and to provide thermal control of the second walls. The heat-carrying fluid, heated or cooled by the conditioning unit, transmits the heat by convection to the second walls which, in their turn, act as a radiant body, both for heat and for cold, toward the second compartment.

[0042] The hollow space that substantially surrounds the whole second compartment allows to make the thermal conditions inside the latter uniform, consequently

making the temperature uniform too, and preventing the onset of unwanted and annoying air currents to persons residing therein.

[0043] A uniform temperature condition inside the second compartment allows to obtain controlled and uniform conditions of humidity both in the second compartment and in the hollow space. A uniform and controlled condition of humidity guarantees optimal conditions of thermo-hygrometric well-being for the persons residing therein.

[0044] In this way it is also possible to prevent the onset of hot and cold points inside the second compartment and therefore the generation of mold.

[0045] The positioning of the conditioning unit outside the hollow space allows to control the thermal state of the heat-carrying fluid precisely and accurately, preventing contamination thereof.

[0046] Moreover, a closed-ring circulation of the heat-carrying fluid in the hollow space allows the conditioning unit to always control the thermal state of the heat-carrying fluid, preventing heat dispersions to the outside and reducing energy consumption in the functioning of the conditioning unit.

[0047] According to a possible form of embodiment of the present invention, the building comprises one or more habitable floors, and the at least one first compartment, the at least one second compartment and the at least one hollow space are present in one of the one or more of said habitable floors. The conditioning unit and the fluid-dynamic circuit are connected only to the at least one hollow space of one of the habitable floors. This allows to precisely control point-by-point the thermal conditions of the second compartments of each habitable floor, because each habitable floor has its own conditioning unit which allows to optimize the flows of heat-carrying fluid in the hollow space so that all the second walls of a habitable floor are affected uniformly by a flow having the same heat power.

BRIEF DESCRIPTION OF THE DRAWINGS

[0048] These and other characteristics of the present invention will become apparent from the following description of some forms of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a section view of a possible form of embodiment of an air-conditioned building according to the present invention;
- fig. 2 is a section view along the section line II-II of fig. 1 according to a possible form of embodiment of the present invention;
- fig. 3 is an enlarged view of detail A in fig. 1;
- fig. 4 is an enlarged view of detail B in fig. 1;
- fig. 5 is an enlarged view of detail C in fig. 1;
- fig. 6 is a cross section of fig. 1 according to a possible form of embodiment,
- fig. 7 is an enlarged view of detail D in fig. 6;
- fig. 8 is a longitudinal section view of an air-conditioned building according to a possible form of embodiment;
- fig. 9 is an enlarged view of details E in fig. 8;
- fig. 10 is a partial section view along the line X-X in fig. 9, of a construction detail;
- fig. 11 is a longitudinal section view of an air-conditioned building according to another form of embodiment;
- fig. 12 is an enlarged view of detail F in fig. 11;
- fig. 13 is a longitudinal section view of an air-conditioned building according to another form of embodiment;
- fig. 14 is a section view of fig. 1 according to a possible variant form of embodiment;
- fig. 15 is a graph comparing the air-conditioning method according to the present invention and known air-conditioning methods.

[0049] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one form of embodiment can conveniently be incorporated into other forms of embodiment without further clarifications.

DETAILED DESCRIPTION OF SOME FORMS OF EMBODIMENT

[0050] A possible embodiment of an air-conditioned building 10 is shown schematically in figs. 1 and 2 and comprises a plurality of first walls 11 configured to define together at least a first compartment 12.

[0051] Here and hereafter in the description, except where expressly specified, the term wall means any constructive element of a building with the function of defining the lateral perimeter, or part of it, the ceiling or the floor.

[0052] The first walls 11 can include for example first lateral walls 11a, at least a first upper wall 11b, or ceiling, and a first lower wall 11c, or floor.

[0053] The air-conditioned building 10 also comprises an air-conditioning apparatus 13 configured to regulate the thermal state of a heat-carrying fluid and to consequently manage the air-conditioning conditions of the air-conditioned building 10.

[0054] In particular, the air-conditioning apparatus 13 can be able to manage at least one of either the temperature, the humidity or possibly also the emission speed of the heat-carrying fluid.

[0055] In the air-conditioning apparatus 13 the heat-carrying fluid is heated and cooled by heat exchange, in order to obtain pre-determined thermal/thermal-dynamic conditions.

[0056] The air-conditioning apparatus 13 can be chosen from a group consisting of a heating plant, a cooling plant, a geothermal plant, a solar thermal plant, or possible combinations thereof.

[0057] As heat-carrying fluid it can be provided to use air or gas, possibly treated opportunely as will be described hereafter.

[0058] According to one aspect of the present invention, a plurality of second walls 14 are disposed inside the first compartment 12, positioned facing the first walls 11 and distanced from the latter.

[0059] The second walls 14 can include second lateral walls 14a, at least one second upper wall 14b, or ceiling, and at least one second lower wall 14c or floor.

[0060] The second walls 14 are connected to each other so as to define together at least a second compartment 16 which can constitute, for example, one or more rooms of the air-conditioned building 10, or one or more chambers or cells which can be air-conditioned depending on the applicative needs of the application.

[0061] In other words, the second walls 14 define a container which is substantially closed on all its sides, whose internal cavity is the second compartment 16.

[0062] Between each of the first walls 11 and the second walls 14 a substantially continuous hollow space 15 is defined, in which the air-conditioning apparatus 13 is connected in order to make the heat-carrying fluid circulate inside it.

[0063] By substantially continuous hollow space 15, we mean that each hollow space which is defined between the first walls 11 and the second walls 14 is fluidically connected to the adjacent one and there are no interruptions or dividing walls which can interrupt or obstruct the flow of the heat-carrying fluid. That is, the hollow space 15 is comprised between the whole external perimeter development of the container 30 and the first compartment 12 defined by the first walls 11.

[0064] The hollow space 15 is closed on itself between the first walls 11 and the second walls 14.

[0065] In this way, the heat-carrying flow hits all the second walls 14 of the second compartment 16 homogeneously, thus guaranteeing a uniform heat exchange on all the second walls 14. Moreover, the heat-carrying flow does not go into the second compartment 16, generating annoying drafts harmful for the people residing in the second compartment 16.

[0066] According to possible formulations of the present invention, the hollow space 15 can have a thickness comprised between 10mm and 100mm, preferably between 20 mm and 80 mm, even more preferably about 30 mm.

[0067] According to possible formulations of the present invention, the air-conditioning apparatus 13 can comprise a conditioning unit 22 of the heat-carrying fluid and a fluid-dynamic circuit 23 that connects the conditioning unit 22 to the hollow space 15 with a closed-ring circuit. In this way the heat-carrying fluid present in the hollow space 15 is constantly re-circulated upon itself and in the hollow space 15 itself, preventing heat losses toward the outside.

[0068] The conditioning unit 22 can comprise, for example, a boiler, one or more electric resistances, a conditioner, a humidifier, a heat pump or possible combinations thereof. Filters for the treatment of the heat-carrying fluid which is introduced into the hollow space 15 can also be associated to the conditioning unit 22.

[0069] The conditioning unit 22 is located outside the hollow space 15 in order to prevent possible contamination of the heat-carrying fluid contained in the hollow space 15 and to prevent the latter from undergoing uncontrolled variations of its thermal state.

[0070] According to a possible form of embodiment, shown in figs. 1 and 13, the conditioning unit 22 is located outside at least the first compartment 12, in this case, outside the building 10, and the fluid-dynamic circuit 23 is positioned through, through at least the first walls 11 of the first compartment 12.

[0071] According to a variant embodiment, shown for example in fig. 8, the conditioning unit 22 is located inside the building 10, in this case inside one of the second compartments 16, and the fluid-dynamic circuit 23 connects the conditioning unit 22 to the hollow space 15.

[0072] The first walls 11 or the second walls 14 can be provided with at least two apertures, respectively a first aperture 26 and a second aperture 27 provided to allow the connection of the air-conditioning apparatus 13 with the hollow space 15 and allow the introduction and discharge of the heat-carrying fluid in the latter.

[0073] In particular, according to the forms of embodiment in figs. 1-4, 6, 13 and 14, the first aperture 26 and the second aperture 27 are made in the first walls 11. According to this form of embodiment the conditioning unit 22 can be located outside the second compartment 16, in this case outside the building 10, even if it is not excluded that in possible forms of embodiment the conditioning unit 22 is located inside the second compartment 16.

[0074] According to the form of embodiment in fig. 8, the first aperture 26 and the second aperture 27 are made in the second walls 14. According to this form of embodiment the conditioning unit 22 can be located inside the second compartment 16, as shown in fig. 8, or outside the second compartment 16.

[0075] In particular, it can be provided in some forms of embodiment that the conditioning unit 22 is predisposed to introduce the heat-carrying fluid through the first aperture 26 in a forced way, using ventilators for example, and to aspirate, for example by a depression action, the heat-carrying fluid through the second aperture 27, or vice versa.

[0076] According to some formulations of the present invention, the first aperture 26 is made in a high part of the hollow space 15 while the second aperture 27 is made in a low part of the hollow space 15.

[0077] According to possible forms of embodiment of the present invention (figs. 1-4, 6, 13 and 14) it is provided that the first aperture 26 is made in the first upper wall 11b, while the second aperture 27 is made in the first lower wall 11c.

[0078] According to the form of embodiment in fig. 8,

the first aperture 26 is made in the second upper wall 14b and the second aperture 27 is made in the second lower wall 14c.

[0079] The opposite disposition of the first aperture 26 and the second aperture 27 allows to make the passage and movement conditions of the heat-carrying fluid uniform inside the hollow space 15, and to prevent heat stratification phenomena.

[0080] According to one solution, the fluid-dynamic circuit 23 is connected on one side to the first aperture 26 and on the other side to the second aperture 27 to connect, with a closed circuit, the hollow space 15 to the conditioning unit 22.

[0081] According to a possible formulation of the present invention the first aperture 26 and the second aperture 27 are made in a central portion of the surface extension respectively of the at least one first upper wall 11b and of the at least one first lower wall 11c, or of the at least one second upper wall 14b and of the at least one second lower wall 14c.

[0082] This allows the air-conditioning apparatus 13 to generate a flow of heat-carrying fluid that uniformly laps all the walls of the second compartment 16, also those defining a ceiling or a floor of a living space, preventing a direct passage of the heat-carrying fluid from a lower part to an upper part of the second compartment 16.

[0083] In particular, if a heating action of the second compartment 16 is provided, the heated heat-carrying fluid is introduced from the first aperture 26 and removed from the second aperture 27. This solution prevents air stratification conditions and allows to generate spontaneous convection motions able to make the temperatures in the second compartment 16 uniform.

[0084] Vice versa, if it is necessary to cool the second compartment 16, the cold heat-carrying fluid is introduced from the second aperture 27 and removed from the first aperture 26.

[0085] Possible implementations of the present invention provide that the first aperture 26 and the second aperture 27 are provided with mouths 28 to connect to the conditioning unit 22. An example embodiment of the connection of the mouths 28 to the first aperture 26 and to the second aperture 27 is shown respectively in figs. 3 and 4.

[0086] The mouths 28 can be served by closing means, manual or automated, which allow to control the flow of heat-carrying fluid through the first aperture 26 and the second aperture 27. The flow can be controlled by simple choking or total interception thereof.

[0087] The fluid-dynamic circuit 23 can comprise one or more pipes 25 provided to connect the conditioning unit 22 at least to the first 26 and to the second 27 aperture, possibly by means of the mouths 28, if provided. The pipes 25 can be provided, in a known manner, with insulating materials, provided to contain the heat losses to the outside.

[0088] A forced ventilation device 24 can be associated with the conditioning unit 22, provided to move the heat-carrying fluid inside the fluid-dynamic circuit 23 and subsequently inside the hollow space 15, with a determined intensity or speed. The speed of the flow of heat-carrying fluid allows to regulate the thermal exchange modalities of the latter with the second walls 14, and consequently of the second walls 14 with the second compartment 16.

[0089] The forced ventilation device 24 can comprise at least one of either a ventilator, a blower, an aspirator or similar or comparable devices and suitable to the purpose.

[0090] The conditioning unit 22 can be served by a commutation member 29 provided to invert the flow of heat-carrying fluid in the fluid-dynamic circuit 23, between the first aperture 26 and the second aperture 27. In this way, depending on the cooling or heating actions of the second compartment 16, it is possible to commutate the delivery and the aspiration of the heat-carrying fluid into or from the hollow space 15, to optimize the flow of the heat-carrying fluid in the latter.

[0091] Some solutions of the present invention can provide that the commutation member 29 is connected to the forced ventilation device 24 and is configured to invert the direction of feed of the heat-carrying fluid through the first aperture 26 and the second aperture 27. It can be provided for example that the commutation member 29 inverts the movement of the forced ventilation device in order to invert the direction of the feed flow.

[0092] In possible forms of embodiment, the second walls 14 can be distanced from the first walls 11 by means of spacer elements 17.

[0093] The spacer elements 17 can be attached to the first walls 11 and to the second walls 14 by means of substantially known attachment members such as threaded connections, pins, blocks or suchlike. Other forms of embodiment can provide a connection of the spacer elements 17 by means of glues or adhesive tape for example.

[0094] According to possible forms of embodiment, the spacer elements 17 can extend for at least part of the length of the second walls 14.

[0095] According to other forms of embodiment, the spacer elements 17 can extend for the entire length of the second walls 14.

[0096] Possible solutions of the present invention can provide that the spacer elements 17 comprise oblong bars disposed parallel to each other and reciprocally distanced on the surface extension of the first 11 and the second 14 walls. In this way it is possible to guarantee the correct positioning of the second walls 14, preventing flection and deformation thereof.

[0097] According to possible forms of embodiment of the present invention it can be provided that the portion of hollow space 15 comprised between the first upper walls 11b and the second upper walls 14b, and between the first lower walls 11c and the second lower walls 14c is wider, with respect to the portion of hollow space 15 comprised between the first lateral walls 11a and the second lateral walls 14a. This solution allows to optimize the

convective motions that are generated spontaneously in the hollow space 15, for example due to the effect of the different temperatures of the first 11 and second walls 14, and to speed up the flow of heat-carrying fluid in the vertical direction.

[0098] To this purpose it can be provided that the spacer elements 17 connected to the first 11a and to the second lateral walls 14a are less thick than the spacer elements 17 connected to the first 11b and the second upper walls 14b and to the first 11c and the second lower walls 14c.

[0099] According to possible forms of embodiment, the spacer elements 17 associated to the first lateral walls 11a and the second lateral walls 14a, that is, to the walls that during use are substantially vertical, are disposed with their longitudinal development in a vertical or subvertical direction. This disposition has the function of containing the losses of load of the heat-carrying fluid in transit, and limiting the obstruction effect conferred by the spacer elements 17 in the hollow space 15.

[0100] In possible forms of embodiment, the spacer elements 17 have a first edge 18 and a second edge 19, opposite the first edge 18 which, when functioning, are disposed resting against the first walls 11 and against the second walls 14 or vice versa.

[0101] In possible solutions, shown for example in figs. 1, 2 and 5, the first edge 18 of at least some of the spacer elements 17 is provided on the surface with a plurality of concavities 20 that, in the condition where the spacer elements 17 are attached to the first walls 11 or to the second walls 14, define with the latter corresponding apertures 21 for the passage of the heat-carrying fluid.

[0102] In possible variant embodiments, not shown in the drawings, it can be provided that the spacer elements 17 are provided with a plurality of passage apertures made through in the thickness of the spacer element 17.

[0103] The presence of apertures 20 allows to make the passage of the heat-carrying fluid in the hollow space 15 uniform and homogeneous, in order to optimize the heat exchange toward the second compartment 16.

[0104] According to possible formulations of the present invention, the spacer elements 17 associated with the first walls 11 and the second walls 14, which are vertical during use, have the first edge 18 disposed resting against the second walls 14. Thanks to the presence of the concavities 20, this solution allows to reduce the usable contact surface between the spacer elements 17 and the second lateral walls 14a, in practice also reducing the thermal transmission of heat or cold, from the first lateral walls 11a.

[0105] According to possible formulations of the present invention, the spacer elements 17 associated with the first upper walls 11b and the second upper walls 14b, that is, with the first walls 11 and the second walls 14, during use located in the upper part of the second compartment 16, have the first edge 18 disposed resting against the first walls 11.

[0106] This solution allows to obtain a good distribution of the heat over the whole surface of the second upper walls 14b. It is in fact known that the heat-carrying fluid at a higher temperature tends to move into the upper parts of the hollow space 15 and therefore in this case toward the second upper walls 14b.

[0107] By disposing the spacer elements 17 with the concavities facing against the first upper walls 11b it is therefore possible to increase the stratification effect of the heat-carrying fluid toward the second upper wall 14b, in practice increasing the heat exchange toward the second compartment 16.

[0108] According to other forms of embodiment, possibly combinable with the forms of embodiment described here, the spacer elements 17 associated with the first lower walls 11c and the second lower walls 14c, or to the first walls 11 and the second walls 14, during use located in the lower part of the second compartment 16, have the first edge 18 resting against the first walls 11. In this way it is possible to obtain a good distribution of heat over the whole surface of the second lower walls 14c. For the same consideration described above, the heat-carrying fluid at a higher temperature will tend to move toward the second lower walls 14c. By disposing the spacer elements 17 with the concavities facing against the first lower walls 11c it is therefore possible to increase the stratification effect of the hot heat-carrying fluid toward the second lower wall 14c.

[0109] According to other forms of embodiment of the present invention, for example shown in figs. 6 and 7, the connection edges between the second upper walls 14b and the second lateral walls 14a are provided with partial obstruction members 31 which from the end edge of the second lateral walls 14a extend in the hollow space 15 toward the first upper walls 11b.

[0110] According to possible variant embodiments it can be provided that the partial obstruction members 31 are also connected along the connection edges between the second lower walls 14c and the second lateral walls 14a, and extend from the end edge of the second lateral walls 14a, in the hollow space 15, toward the first lower walls 11c.

[0111] According to a possible implementation of the present invention, the partial obstruction members 31 comprise a barrier, a blade, a section bar that extends for the whole length of the connection edge between the second lateral walls 14a and the second upper walls 14b and/or the second lower walls 14c.

[0112] According to another aspect of the present invention, the partial obstruction members 31, together with the second upper walls 14b and/or the second lower walls 14c, define box-like cavities 32 open toward the first upper walls 11b and the first lower walls 11c. The partial obstruction members 31 define, in the hollow space 15 and with the first upper wall 11b and the first lower wall 11c, a passage gap 33 for the heat-carrying fluid which can be distributed along the first lateral walls 11a and the second lateral walls 14a.

[0113] The box-like cavities 32 allow to obtain a strat-

ification effect of the heat-carrying fluid in correspondence with the surfaces of the second upper walls 14b and/or the second lower walls 14c, in order to optimize the efficiency of heat exchange with the latter and consequently with the ambient of the second compartment 16.

[0114] According to possible variant embodiments of the present invention, shown for example in fig. 8, it can be provided that the second compartment 16 defined by the second walls 14 can be divided into a plurality of rooms 34, in this case shown in the drawings, divided into three rooms 34.

[0115] To this purpose, it is provided to insert partition walls 35 in the second compartment 16, configured to determine the division into a plurality of rooms 34.

[0116] In possible implementations of the invention, not shown in the drawings, the partition walls 35 can be directly connected to the second walls 14 by means of brackets, threaded connection members, pegs, or similar or comparable connection members.

[0117] With reference to the form of embodiment shown in figs. 8 and 9, the partition walls 35 can be directly connected to the first walls 11 passing through the second walls 14 and the hollow space 15.

[0118] According to this form of embodiment, the partition walls 35 can be provided with at least a passage aperture 36, in this case a plurality of passage apertures 36, configured to allow the passage through them of the heat-carrying fluid and prevent the interruption of the flow through the hollow space 15.

[0119] The passage apertures 36 can be served by a closing member 37 provided to partly or totally close the passage apertures 36 of the heat-carrying fluid. The closing member 37 can be driven manually or automatically.

[0120] According to some forms of embodiment it can be provided that the closing member 37 comprises a holed plate, a shutter or occlusion elements able to at least partly regulate the gap of the passage aperture 36. An example embodiment of the closing member 37 is shown in fig. 10, in which the closing member 37 comprises a plate 40 provided with through holes 41 and selectively positionable to modify the passage of the heat-carrying fluid.

[0121] The presence of the closing member 37 allows to regulate the delivery of heat-carrying fluid that laps the second walls 14 and consequently allows to modulate in a desired and differentiated manner the air-conditioning of the rooms 34. To this purpose is is advantageous to provide that the position of the closing member 37 is determined by a command and management unit suitable to regulate the entity of choking of the flow of heat-carrying fluid, depending on the temperature set by the user.

[0122] According to one aspect of the present invention, in correspondence to the partition walls 35 the first walls 11 are provided with structural elements 38, for example, beams and/or pillars, in which the partition walls 35 are connected.

[0123] In the case where the structural elements 38 extend toward the hollow space 15 too, in practice interrupting the continuity thereof, it can be provided that these are also provided with through apertures 39 through which to make the heat-carrying fluid circulate. In this case too, the presence of closing members 37 can be provided to regulate the flow of heat-carrying fluid through the hollow space 15. In this form of embodiment it can be provided that the through apertures 39 are located aligned with the passage apertures 36 of the second walls 14.

[0124] In a possible form of embodiment, shown for example in figs. 11 and 12, it is provided that the air-conditioned building 10 is provided with several first compartments 12 divided by first lateral walls 11a, in this case having the function of partition walls between the two first compartments. Inside each of the first compartments 12 the second walls 14 are positioned to define respective second compartments 16.

[0125] In this form of embodiment, between the first walls 11 and the second walls 14 two hollow spaces 15 are defined in which the heat-carrying fluid is made to flow.

[0126] In a possible form of embodiment, not shown in the drawings, it can be provided that each hollow space 15 of the second compartments 16 is connected to its own air-conditioning apparatus 13. In this way, by intervening directly on each air-conditioning apparatus 13 it is possible to differentiate the air-conditioning effect of each second compartment 16.

[0127] In an alternative solution, shown for example in figs. 11 and 12, each hollow space 15 is fluidically connected to the other and to a single air-conditioning apparatus 13. In this case, a possible form of embodiment provides that the first lateral wall 11a, with the function of partition wall between the second compartments 16, is provided with one or more through apertures 42 provided to put the hollow spaces 15 of the two compartments into fluidic communication.

[0128] In this form of embodiment too, it can be provided that closing members 37 are associated with the through apertures 42 and are provided to regulate the flow of heat-carrying fluid from one hollow space 15 to another in a desired way, with a similar function to that described with reference to figs. 8 to 10.

[0129] According to the form of embodiment shown in fig. 11, the building 10 according to the present invention comprises a single habitable floor 47 in which the two hollow spaces 15 are present located adjacent to each other and on the same habitable floor 47. The air-conditioning apparatus 13 is configured to regulate the thermal state only of the heat-carrying fluid present in the hollow spaces 15 of said habitable floor 47.

[0130] In the solution shown in fig. 12, the through apertures 42 are made in the thickness of structural elements of the partition wall, in this case in correspondence to a beam of the latter.

[0131] Fig. 13 shows a possible form of embodiment of an air-conditioned building 10 comprising two habita-

ble floors 47, each provided with its own first compartment 12. In each first compartment 12 second walls 14 are positioned, provided to define a second compartment 16 for each first compartment 12.

[0132] In each of the second compartments 16 partition walls 35 can be provided, as described with reference to figs. 8, 9 and 10.

[0133] In this case too, between the first walls 11 and the second walls 14 the hollow spaces 15 are defined for the passage of the heat-carrying fluid.

[0134] With reference to fig. 13, each hollow space 15 is connected to its own air-conditioning apparatus 13 provided to regulate the air-conditioning modes of its second compartment 16.

[0135] According to a possible form of embodiment, for each hollow space 15 of each habitable floor 47 there is a respective air-conditioning apparatus 13 to regulate the thermal state of the heat-carrying fluid only of one habitable floor 47. In this way the onset of upward or downward thermal flows is prevented inside the hollow spaces 15 between the compartments of several habitable floors, which can generate stratifications of heat-carrying fluid in the upper or lower parts of the building. Indeed stratifications of heat-carrying fluid would not be able to guarantee a uniform distribution of heat in the second compartments and would cause the onset of hot zones and/or cold zones even inside the same second compartment.

[0136] However, it is not excluded that, in other forms of embodiment, the same air-conditioning apparatus 13 is adopted to feed the flow of heat-carrying fluid through both the hollow spaces 15.

[0137] Another form of embodiment is shown in fig. 14, in which the construction of an air-conditioned building 10 is provided, according to the present invention, with a gable roof.

[0138] In this case too, the air-conditioned building comprises a plurality of first walls 11, at least two of which define the first upper walls 11b that are disposed angled with respect to each other according to the inclination of the gables of the roof.

[0139] The first walls 11 together define the first compartment 12 in which the second walls 14 are located, distanced from the first walls 11. The second walls 14 also comprise at least two upper walls 14b disposed distanced from the respective first upper walls 11b.

[0140] The first walls 11 can be made in a known way, for example comprising concrete, prefabricated panels, wood panels, thermal and/or acoustic insulating materials, or by-products thereof

[0141] An example embodiment of the first walls 11 is shown in fig. 5, in which they comprise an external layer of plaster 43, a first panel 44, a layer of insulating material 45 and a second panel 46.

[0142] According to possible solutions, and where provided, the partition walls 35 can also be made in the same way as the first walls 11.

[0143] In possible solutions the layer of insulating material 45 can be made of rockwool, polyurethane foam or other insulating materials.

[0144] By adopting a suitable thickness and type of insulating material 45, it is possible to limit and prevent heat losses, that is, either cold or hot toward the outside, concentrating the thermal exchange of the heat-carrying fluid toward the second walls 14.

[0145] According to other forms of embodiment the first panel 44 and the second panel 46 can be made of wood or by-products of wood, such as for example panels of LDF, MDF, HDF, OSB or suchlike.

[0146] In the same way the second walls 14 can be made with panels of plasterboard, plaster fibers, wood or wood by-products.

[0147] According to a possible form of embodiment of the present invention, at least some of either the first walls 11 or the second walls 14 can be made of a material transparent to visible light, for example glass or plastic materials, such as polycarbonate. In particular, it can be provided that at least one first transparent wall 11 is located facing at least one second transparent wall 14 in order to allow visibility through them. According to this form of embodiment, the first walls 11 and the second walls 14, or at least one of them, can be made with one or more insulating glass units.

[0148] The air-conditioned building 10 can also include, in a known way, also a bearing structure comprising for example foundations, pillars, support beams or substantially known structural elements.

[0149] According to possible formulations of the present invention it is possible to provide that the air-conditioned building is provided with one or more detection devices provided to control at least the temperature and humidity of the heat-carrying fluid that circulates through the hollow space 15.

[0150] Merely by way of example it can be provided that the detection devices are associated in correspondence to the first aperture 26 and the second aperture 27 provided in the hollow space 15 so as to control the conditions of introduction and expulsion of the heat-carrying fluid into and from the hollow space 15.

[0151] A possible solution of the present invention provides that the detection devices comprise at least a detection probe to detect the humidity of the heat-carrying fluid so as to control its conditions.

[0152] In possible implementations of the present invention it can be provided that the detection devices are provided to detect the ambient conditions of the second compartment 16, and in particular at least one of either temperature or humidity.

[0153] The data detected by the detection devices can be processed by a control and management unit able to suitably command the activation and functioning modes of the air-conditioning apparatus 13 also depending on the particular needs of the users, which can be set for example through a thermostat or a command unit.

[0154] According to forms of embodiment of the present invention, the method for air-conditioning the air-

conditioned building 10 provides to make the heat-carrying fluid circulate inside the hollow space 15 in a controlled intensity mode, that is ,speed, temperature and humidity of the flow of heat-carrying fluid.

[0155] According to formulations of the present invention it is provided to introduce or aspirate the heat-carrying fluid from the first aperture 26 or from the second aperture 27.

[0156] In particular, if a heating action of the second compartment 16 is provided, the heat-carrying fluid is introduced through the first aperture 26, located in an upper part of the hollow space 15, whereas heat-carrying fluid is taken in from the second aperture 27, in a lower part of the hollow space 15.

[0157] Due to the action of the convective motions that occur inside the hollow space 15 because of the different temperatures at which the second walls 14 can be found, the heat-carrying fluid generates flows, shown for example in fig. 1 with a continuous-line arrows. The heat-carrying fluid transmits heat by conduction to the second walls 14 which in their turn transmit the heat, substantially by irradiation, inside the second compartment 16.

[0158] If a cooling action of the second compartment 16 is provided, the heat-carrying fluid is introduced through the second aperture 27 which is disposed in the lower part of the hollow space 15, and heat-carrying fluid contained in the hollow space 15 is taken into the upper part of the latter.

[0159] In this case too convective motions are established, shown for example in fig. 1 with broken-line arrows, which allow to make the cooling conditions inside the second compartment 16 uniform.

[0160] Both the heating and the cooling processes performed as described above allow to make the temperature uniform on all the internal surfaces of the second walls 14, even in the presence of big differences in heat/cold of the different external surfaces.

[0161] In some formulations of the present invention and during the normal functioning cycle, it is provided that the plant can have a controlled and automated inverse circulation for a short period. In other words it can be provided that during the heating and/or cooling operations of the air-conditioned building 10 the inversion is commanded of the delivery and discharge of the heat-carrying fluid through the first 26 and the second 27 apertures.

[0162] With the present invention, all the second walls 14, which in practice make up the perimeter of one or more rooms of the air-conditioned building 10, become radiant bodies for the internal compartment to be heated or cooled. The thermal flux, heat or cold, is distributed homogeneously for the whole surface extension of the second compartment 16, preventing the onset of unwanted air flows inside the compartment which are unpleasant for the people residing there.

[0163] By adopting first walls 11 with high acoustic insulation toward the outside it is possible to make the air-conditioning apparatus 13 function with a reduced difference in temperature with respect to the temperature desired inside the second compartment 16.

[0164] Merely by way of example, it can be provided that the difference in temperature between the heat-carrying fluid and the ambient temperature of the second compartment 16 is comprised between 2°C and 5°C.

[0165] It must also be added that with the air-conditioning method according to the present invention, as well as heating and cooling, it is also possible to maintain the ambient inside the second compartment 16 at a constant temperature both in summer and in winter without entering into contact with the heat-carrying fluid that is made to circulate in the hollow space 15. In this way all movements of air which form with traditional air-conditioning apparatuses, for example fans, are eliminated, or thermal-convective movements deriving from different heating of the walls, floors and ceilings.

[0166] Moreover, thanks to the reduced thermal inertia and to the low differential between the temperature of the heat-carrying fluid and the ambient of the second compartment 16, the method according to the present invention can be efficiently used by means of heat pumps in order to contain air-conditioning costs. From numerous tests carried out it has emerged that the heat-carrying fluid during movement generates an insurmountable barrier in the hollow space 15 that prevents external atmospheric agents from influencing the internal ambient.

[0167] Fig. 15 shows a graph comparing the air-conditioning method according to the present invention, the reference curve for which is curve 1 with a continuous line, and other substantially known air-conditioning methods.

[0168] In particular, fig. 15 shows the trends of modes of:

- floor heating, curve 2 with a broken line;
- air heating, curve 3 with a double line;
- radiator heating, curve 4 with dots.

[0169] As can be seen by comparing the graphs, the air-conditioning mode of the present invention allows to obtain a uniform temperature distribution along the entire height of the room, or of the compartment in which it is adopted. Other air-conditioning modes, on the other hand, have very variable temperature gradients along the height, for example between floor and ceiling, which as well as generating unwanted air flows, can also cause the generation of humidity or mold on the walls.

[0170] It is clear that modifications and/or additions of parts may be made to the air-conditioned building and corresponding air-conditioning method as described heretofore, without departing from the field and scope of the present invention.

[0171] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of air-conditioned building and air-conditioning method, having the

characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Air-conditioned building comprising:

- a plurality of first walls (11) configured to define together at least a first compartment (12), said first walls (11) including first lateral walls (11a), at least a first upper wall (11b) and at least a first lower wall (11c), opposite said first upper wall (11b),
- a plurality of second walls (14) located inside the first compartment (12) and connected with each other to define together at least a second compartment (16), each of the second walls (14) facing at least one of the first walls (11) and distanced from the latter so as to define a continuous hollow space (15), closed with respect to said second compartment (16), and configured to contain a heat-carrying fluid, said second walls (14) including second lateral walls (14a), at least a second upper wall (14b), and at least a second lower wall (14c), disposed facing respectively said first lateral walls (11a), first upper wall (11b) and first lower wall (11c),
- an air-conditioning apparatus (13) configured to regulate the thermal state of said heat-carrying fluid, and comprising a conditioning unit (22) located externally to said hollow space (15) and a fluid-dynamic circuit (23) that connects said hollow space (15) to said conditioning unit (22) with a closed-ring circuit, to make said heat-carrying fluid circulate in said hollow space (15) and to provide thermal control of said second walls (14), **characterized in that** a first aperture (26) is made in said at least one first upper wall (11b) or in said at least one second upper wall (14b), and a second aperture (27) is made in said at least one first lower wall (11c), or in said at least one second lower wall (14c), **in that** said fluid-dynamic circuit (23) is connected on one side to said first aperture (26) and on the other to said second aperture (27) in order to connect the hollow space (15), with a closed circuit, to said conditioning unit (22), **and in that** said conditioning unit (22) is served by a commutation member (29) provided to invert the flow of heat-carrying fluid in the fluid-dynamic circuit (23), between the first aperture (26) and the second aperture (27).

2. Air-conditioned building as in claim 1, **characterized in that** it comprises one or more habitable floors (47), **in that** said at least one first compartment (12), said at least one second compartment (16) and said at least one hollow space (15) are present in one of said one or more habitable floors (47), **and in that** said conditioning unit (22) and said fluid-dynamic circuit (23) are connected only to the at least one hollow space (15) of one of said habitable floors (47).

3. Building as in claim 1 or 2, **characterized in that** said first aperture (26) and said second aperture (27) are made in a central portion of the surface extension respectively of said at least one first upper wall (11b) and said at least one first lower wall (11c), or of said at least one second upper wall (14b) and said at least one second lower wall (14c).

4. Building as in claim 1, 2 or 3, **characterized in that** the portion of said hollow space (15) comprised between the first upper walls (11b) and the second upper walls (14b) and between the first lower walls (11c) and the second lower walls (14c), is bigger, compared with the portion of hollow space (15) comprised between the first lateral walls (11a) and the second lateral walls (14a).

5. Building as in any claim hereinbefore, **characterized in that** said second walls (14) are distanced from said first walls (11) by spacer elements (17), provided with a plurality of passage apertures made through in their thickness.

6. Building as in claim 5, **characterized in that** said spacer elements (17) comprise oblong bars disposed parallel to each other and reciprocally distanced on the surface extension of said first walls (11) and said second walls (14).

7. Building as in claim 1, **characterized in that** the connection edges between said second upper walls (14b) and said second lateral walls (14a) are provided with partial obstruction members (31) which from the end edge of said second lateral walls (14a) extend, in the hollow space (15), toward said first upper walls (11b), to obtain a stratification of said heat-carrying fluid.

8. Building as in claim 1 or 7, **characterized in that** the connection edges between said second lower walls (14c) and said second lateral walls (14a) are provided with partial obstruction members (31) which from the end edge of said second lateral walls (14a) extend, in the hollow space (15), toward said first lower walls (11c), to obtain a stratification of said heat-carrying fluid.

9. Method to air-condition a building, said building (10) comprising a plurality of first walls (11) configured to define together at least a first compartment (12), and a plurality of second walls (14) located inside the first compartment (12) and connected with each other to

define together at least a second compartment (16), each of the second walls (14) facing at least one of the first walls (11) and distanced from the latter so as to define a continuous hollow space (15), closed with respect to said second compartment (16), and configured to contain a heat-carrying fluid, said method comprising a regulation of the thermal state of said heat-carrying fluid in said hollow space (15) and the air-conditioning of at least said air-conditioned building (10), the regulation of the thermal state of the heat-carrying fluid occurring outside said hollow space (15) in a conditioning unit (22), **and** the heat-carrying fluid being made to circulate, in said hollow space (15), in a closed-ring circuit, in a fluid-dynamic circuit (23) and in said conditioning unit (22) in order to provide a thermal control of said second walls (14), **characterized in that,** if it is provided to heat said second compartment (16), the method provides to introduce said heat-carrying fluid through a first aperture (26) accessing said hollow space (15), located in an upper part of the latter, and to discharge said heat-carrying fluid through a second aperture (27) accessing said hollow space (15) located in a lower part of the latter **and in that,** if it is provided to cool said second compartment (12), the method provides to introduce said heat-carrying fluid through the second aperture (27) and to discharge said heat-carrying fluid through the first aperture (26), passing from the heating condition to the cooling condition, or vice versa, an inversion of the flow of heat-carrying fluid in the fluid-dynamic circuit (23), between the first aperture (26) and the second aperture (27), being performed by a commutation member (29).

Patentansprüche

1. Klimatisiertes Bauwerk mit

- einer Anzahl von ersten Wänden (11), die dazu eingerichtet sind, zusammen wenigstens einen ersten Raumbereich (12) zu bilden, wobei die ersten Wände (11) erste seitliche Wände (11a), wenigstens eine erste obere Wand (11b) und wenigstens eine der ersten oberen Wand (11b) gegenüberliegende erste untere Wand (11c) umfassen,
- einer Anzahl von zweiten Wänden (14), die innerhalb des ersten Raumbereichs (12) angeordnet und miteinander verbunden sind, um wenigstens einen zweiten Raumbereich (16) zu bilden, wobei jede der zweiten Wände (14) wenigstens einer der ersten Wände (11) gegenüberliegend und von dieser beabstandet angeordnet ist, um einen zusammenhängenden Hohlraum (15) zu bilden, der gegen den zweiten Raumbereich (16) abgeschlossen und dazu eingerichtet ist, ein wärmeführendes Fluid aufzunehmen, wobei die zweiten Wände (14) zweite seitliche Wände (14a), wenigstens eine zweite obere Wand (14b) und wenigstens eine zweite untere Wand (14c) umfassen, die jeweils den ersten seitlichen Wänden (11a), der ersten oberen Wand (11b) und ersten unteren Wand (11c) gegenüberliegend angeordnet sind,
- einer Klimatisierungsvorrichtung (13), die dazu eingerichtet ist, den thermischen Zustand des wärmeführenden Fluids zu beeinflussen, und die über eine Aufbereitungseinheit (22), die außerhalb des Hohlraums (15) angeordnet ist, und über einen fluiddynamischen Kreislauf (23) verfügt, der den Hohlraum (15) mit der Aufbereitungseinheit (22) in einem geschlossenen Ringkreislauf verbindet, um das wärmeführende Fluid in dem Hohlraum (15) zirkulieren zu lassen und eine thermische Beeinflussung der zweiten Wände (14) bereitzustellen, **dadurch gekennzeichnet, dass** in der wenigstens einen ersten oberen Wand (11b) oder in der wenigstens einen zweiten oberen Wand (14b) eine erste Ausnehmung (26) und in der wenigstens einen ersten unteren Wand (11c) oder in der wenigstens einen zweiten unteren Wand (14c) eine zweite Ausnehmung (27) eingebracht sind, **dass** der fluiddynamischen Kreislauf (23) an einer Seite mit der ersten Ausnehmung (26) und mit der anderen an der zweiten Ausnehmung (27) angeschlossen ist, um den Hohlraum (15) in einem geschlossenen Kreislauf mit der Aufbereitungseinheit (22) zu verbinden, **und dass** die Aufbereitungseinheit (22) durch ein Umschaltteil (29) angesteuert ist, das dazu eingerichtet ist, den Strom an wärmeführendem Fluid in dem fluiddynamischen Kreislauf (23) zwischen der ersten Ausnehmung (26) und der zweiten Ausnehmung (27) umzukehren.

2. Klimatisiertes Bauwerk nach Anspruch 1, **dadurch gekennzeichnet, dass** es ein oder mehrere bewohnbare Geschosse (47) aufweist, **dass** in einem der Anzahl von bewohnbaren Geschossen (47) der wenigstens eine erste Raumbereich (12), der wenigstens eine zweite Raumbereich (16) und der wenigstens eine Hohlraum (15) vorhanden sind, **und dass** die Aufbereitungseinheit (22) und der der fluiddynamischen Kreislauf (23) nur an den wenigstens einen Hohlraum (15) eines der bewohnbaren Geschosse (47) angeschlossen sind.

3. Bauwerk nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die erste Ausnehmung (26) und die zweite Ausnehmung (27) in einem mittigen Bereich der Flächenerstreckung jeweils der wenigstens einen ersten oberen Wand (11b) und der wenigstens einen ersten unteren Wand (11c) oder der wenigstens einen zweiten oberen Wand (14b) und der we-

nigstens einen zweiten unteren Wand (14c) ausgebildet sind.

4. Bauwerk nach Anspruch 1, 2 oder 3, **dadurch gekennzeichnet, dass** der zwischen den ersten oberen Wänden (11b) sowie den zweiten unteren Wänden (14b) und zwischen den ersten unteren Wänden (11c) sowie den zweiten unteren Wänden (14c) Abschnitt des Hohlraums (15) im Vergleich zu dem Teil des Hohlraums (15) zwischen den ersten seitlichen Wänden (11a) und den zweiten seitlichen Wänden (14a) größer ist.

5. Bauwerk nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die zweiten Wände (14) von den ersten Wänden (11) durch Abstandselemente (17), die mit einer Anzahl von sich in deren Dickenrichtung erstreckenden Durchlassausnehmungen ausgebildet sind, auf Abstand gehalten sind.

6. Bauwerk nach Anspruch 5, **dadurch gekennzeichnet, dass** die Abstandselemente (17) längliche Stangen aufweisen, die parallel zueinander und auf der Oberflächenerstreckung der ersten Wände (11) und der zweiten Wände (14) wechselweise beabstandet angeordnet sind.

7. Bauwerk nach Anspruch 1, **dadurch gekennzeichnet, dass** die Verbindungskanten zwischen den zweiten oberen Wänden (14b) und den zweiten seitlichen Wänden (14a) mit Abschnittshemmungsteilen (31) ausgestattet sind, die sich von einer Abschlusskante der zweiten seitlichen Wände (14a) in den Hohlraum (15) in Richtung der ersten oberen Wände (11b) erstrecken, um eine Schichtung des wärmeführenden Fluids zu bewirken.

8. Bauwerk nach Anspruch 1 oder 7, **dadurch gekennzeichnet, dass** die Verbindungskanten zwischen den zweiten unteren Wänden (14c) und den zweiten seitlichen Wänden (14a) mit Abschnittshemmungsteilen (31) ausgestattet sind, die sich von einer Abschlusskante der zweiten seitlichen Wände (14a) in den Hohlraum (15) in Richtung der ersten unteren Wände (11c) erstrecken, um eine Schichtung des wärmeführenden Fluids zu bewirken.

9. Verfahren zum Klimatisieren eines Bauwerks, wobei das Bauwerk (10) eine Anzahl von ersten Wänden (11), die dazu eingerichtet sind, wenigstens einen ersten Raumbereich (12) auszubilden, und eine Anzahl von zweiten Wänden (14) umfasst, die innerhalb des ersten Raumbereichs (12) angeordnet und zum Ausbilden wenigstens eines zweiten Raumbereichs (16) miteinander verbunden sind, wobei jede der zweiten Wände (14) wenigstens einem der ersten Wände (11) gegenüberliegend und beabstandet angeordnet sind, um einen zusammenhängenden Hohlraum (15) auszubilden, der in Bezug auf den zweiten Raumbereich (16) abgeschlossen und dazu eingerichtet ist, ein wärmeführendes Fluid aufzunehmen, wobei das Verfahren ein Beeinflussen des thermischen Zustands des wärmeführenden Fluids in dem Hohlraum (15) und das Klimatisieren wenigstens eines klimatisierten Bauwerks (10) aufweist, wobei das Beeinflussen des thermischen Zustands des wärmeführenden Fluids außerhalb des Hohlraums (15) in einer Aufbereitungseinheit (22) erfolgt **und** wobei das wärmeführende Fluid in dem Hohlraum (15) in einem geschlossenen Ringkreislauf, in einem fluiddynamischen Kreislauf (23) und in der Aufbereitungseinheit (22) zum Durchströmen gebracht wird, um ein thermisches Beeinflussen der zweiten Wände (14) bereitzustellen, **dadurch gekennzeichnet, dass** im Falle eines durchzuführenden Erwärmens des zweiten Raumbereichs (16) das Verfahren ein Zuführen des wärmeführenden Fluids durch eine einen Zugang zu dem Hohlraum (15) schaffende erste Ausnehmung (26), die in einem oberen Bereich desselben angeordnet ist, und ein Abführen des wärmeführenden Fluids durch eine einen Zugang zu dem Hohlraum (15) schaffende zweite Ausnehmung (27), die in dem unteren Bereich desselben angeordnet ist, bereitstellt, **und dass** im Falle eines durchzuführenden Abkühlens des zweiten Raumbereichs (12) das Verfahren ein Zuführen des wärmeführenden Fluids durch die zweite Ausnehmung (27) und ein Abführen des wärmeführenden Fluid durch die erste Ausnehmung (26) bereitstellt und für einen Übergang von dem Erwärmungszustand zu dem Kühlzustand oder umgekehrt mittels eines Umschaltteils (29) eine Umkehr der Strömung von wärmeführenden Fluid in dem fluiddynamischen Kreislauf (23) zwischen der ersten Ausnehmung (26) und der zweiten Ausnehmung (27) erfolgt.

Revendications

1. Bâtiment climatisé comprenant :

- une pluralité de premières parois (11) conçues pour définir ensemble au moins un premier compartiment (12), lesdites premières parois (11) comprenant des premières parois latérales (11a), au moins une première paroi supérieure (11b) et au moins une première paroi inférieure (11c) opposée à ladite première paroi supérieure (11b),
- une pluralité de secondes parois (14) situées à l'intérieur du premier compartiment (12) et raccordées les unes aux autres pour définir ensemble au moins un second compartiment (16), chacune des secondes parois (14) faisant face à au moins une des premières parois (11) et étant

séparée de celle-ci de manière à définir un espace creux continu (15), fermé par rapport audit second compartiment (16), et conçu pour contenir un fluide caloporteur, lesdites secondes parois (14) comprenant des secondes parois latérales (14a), au moins une seconde paroi supérieure (14b) et au moins une seconde paroi inférieure (14c) situées en face respectivement desdites premières parois latérales (11a), de ladite première paroi supérieure (11b) et de ladite première paroi inférieure (11c),
- au moins un appareil de climatisation (13) conçu pour réguler l'état thermique dudit fluide caloporteur, et comprenant une unité de climatisation (22) située à l'extérieur dudit espace creux (15) et un circuit hydraulique (23) reliant ledit espace creux (15) à ladite unité de climatisation (22) en boucle fermée, afin de faire circuler ledit fluide caloporteur dans ledit espace creux (15), et d'assurer la régulation thermique desdites secondes parois (14), **caractérisé en ce qu'**une première ouverture (26) est pratiquée dans ladite au moins une première paroi supérieure (11b) ou dans ladite au moins une seconde paroi supérieure (14b), et une seconde ouverture (27) est pratiquée dans ladite au moins une première paroi inférieure (11c) ou dans ladite au moins une seconde paroi inférieure (14c), **en ce que** ledit circuit hydraulique (23) est relié sur un côté à ladite première ouverture (26) et sur l'autre à ladite seconde ouverture (27) afin de relier l'espace creux (15), en boucle fermée, à ladite unité de climatisation (22), et **en ce que** ladite unité de climatisation (22) est servie par un élément de commutation (29) conçu pour inverser l'écoulement de fluide caloporteur dans le circuit hydraulique (23) entre la première ouverture (26) et la seconde ouverture (27).

2. Bâtiment climatisé selon la revendication 1, **caractérisé en ce qu'**il comprend un ou plusieurs étages habitables (47), **en ce que** ledit au moins une premier compartiment (12), ledit au moins un second compartiment (16) et ledit au moins un espace creux (15) sont présents dans l'un desdits un ou plusieurs étages habitables (47), **et en ce que** ladite unité de conditionnement (22) et ledit circuit hydraulique (23) sont reliés seulement à l'au moins un espace creux (15) de l'un desdits étages habitables (47).

3. Bâtiment selon la revendication 1 ou 2, **caractérisé en ce que** ladite première ouverture (26) et ladite seconde ouverture (27) sont pratiquées dans une partie centrale de l'étendue de surface respectivement de ladite au moins une première paroi supérieure (11b) et ladite au moins une première paroi inférieure (11c), ou de ladite au moins une seconde paroi supérieure (14b) et de ladite au moins une seconde paroi inférieure (14c).

4. Bâtiment selon la revendication 1, 2 ou 3, **caractérisé en ce que** la partie dudit espace creux (15) comprise entre les premières parois supérieures (11b) et les secondes parois supérieures (14b) et entre les premières parois inférieures (11c) et les secondes parois inférieures (14c), est plus grande, par rapport à la partie de l'espace creux (15) comprise entre les premières parois latérales (11a) et les secondes parois latérales (14a).

5. Bâtiment selon n'importe laquelle des revendications précédentes, **caractérisé en ce que** lesdites secondes parois (14) sont séparées desdites premières parois (11) par des éléments intercalaires (17), pourvus d'une pluralité d'ouvertures de passage pratiquées dans leur épaisseur.

6. Bâtiment selon la revendication 5, **caractérisé en ce que** lesdits éléments intercalaires (17) comprennent des barres oblongues agencées parallèlement et espacées les unes des autres sur l'étendue de surface desdites premières parois (11) et desdites secondes parois (14).

7. Bâtiment selon la revendication 1, **caractérisé en ce que** les bords de liaison entre lesdites secondes parois supérieures (14b) et lesdites secondes parois latérales (14a) sont pourvus d'éléments d'obstruction partielle (31) s'étendant du bord d'extrémité desdites secondes parois latérales (14a) dans l'espace creux (15), vers lesdites premières parois supérieures (11b), pour obtenir une stratification dudit fluide caloporteur.

8. Bâtiment selon la revendication 1 ou 7, **caractérisé en ce que** les bords de liaison entre lesdites secondes parois inférieures (14c) et lesdites secondes parois latérales (14a) sont pourvus d'éléments d'obstruction partielle (31) s'étendant du bord d'extrémité desdites secondes parois latérales (14a) dans l'espace creux (15), vers lesdites premières parois inférieures (11c), pour obtenir une stratification dudit fluide caloporteur.

9. Procédé de climatisation d'un bâtiment, ledit bâtiment (10) comprenant une pluralité de premières parois (11) conçues pour définir ensemble au moins un premier compartiment (12), et une pluralité de secondes parois (14) situées à l'intérieur du premier compartiment (12) et raccordées les unes aux autres pour définir ensemble au moins un second compartiment (16), chacune des secondes parois (14) faisant face à au moins une des premières parois (11) et étant séparée de celle-ci de manière à définir un espace creux continu (15), fermé par rapport audit second compartiment (16), et conçu pour contenir

un fluide caloporteur, ledit procédé comprenant une régulation de l'état thermique dudit fluide caloporteur dans ledit espace creux (15) et la climatisation d'au moins ledit bâtiment climatisé (10), la régulation de l'état thermique du fluide caloporteur étant effectuée à l'extérieur dudit espace creux (15) dans une unité de climatisation (22), et le fluide caloporteur étant forcé à circuler dans ledit espace creux (15) en boucle fermée, dans un circuit hydraulique (23) et dans ladite unité de climatisation (22) afin d'assurer une régulation thermique desdites secondes parois (14), **caractérisé en ce que,** si ledit second compartiment (16) doit être chauffé, le procédé comporte l'introduction dudit fluide caloporteur à travers une première ouverture (26) d'accès audit espace creux (15), située dans une partie supérieure de celui-ci, et la décharge dudit fluide caloporteur à travers une seconde ouverture (27) d'accès audit espace creux (15) située dans une partie inférieure de celui-ci, et **en ce que**, si ledit second compartiment (12) doit être refroidi, le procédé comporte l'introduction dudit fluide caloporteur à travers la seconde ouverture (27), et la décharge dudit fluide caloporteur à travers la première ouverture (26), afin de passer de la condition de chauffage à la condition de refroidissement, ou inversement, une inversion de l'écoulement de fluide caloporteur étant effectuée par un élément de commutation (29) dans le circuit hydraulique (23) entre la première ouverture (26) et la seconde ouverture (27).

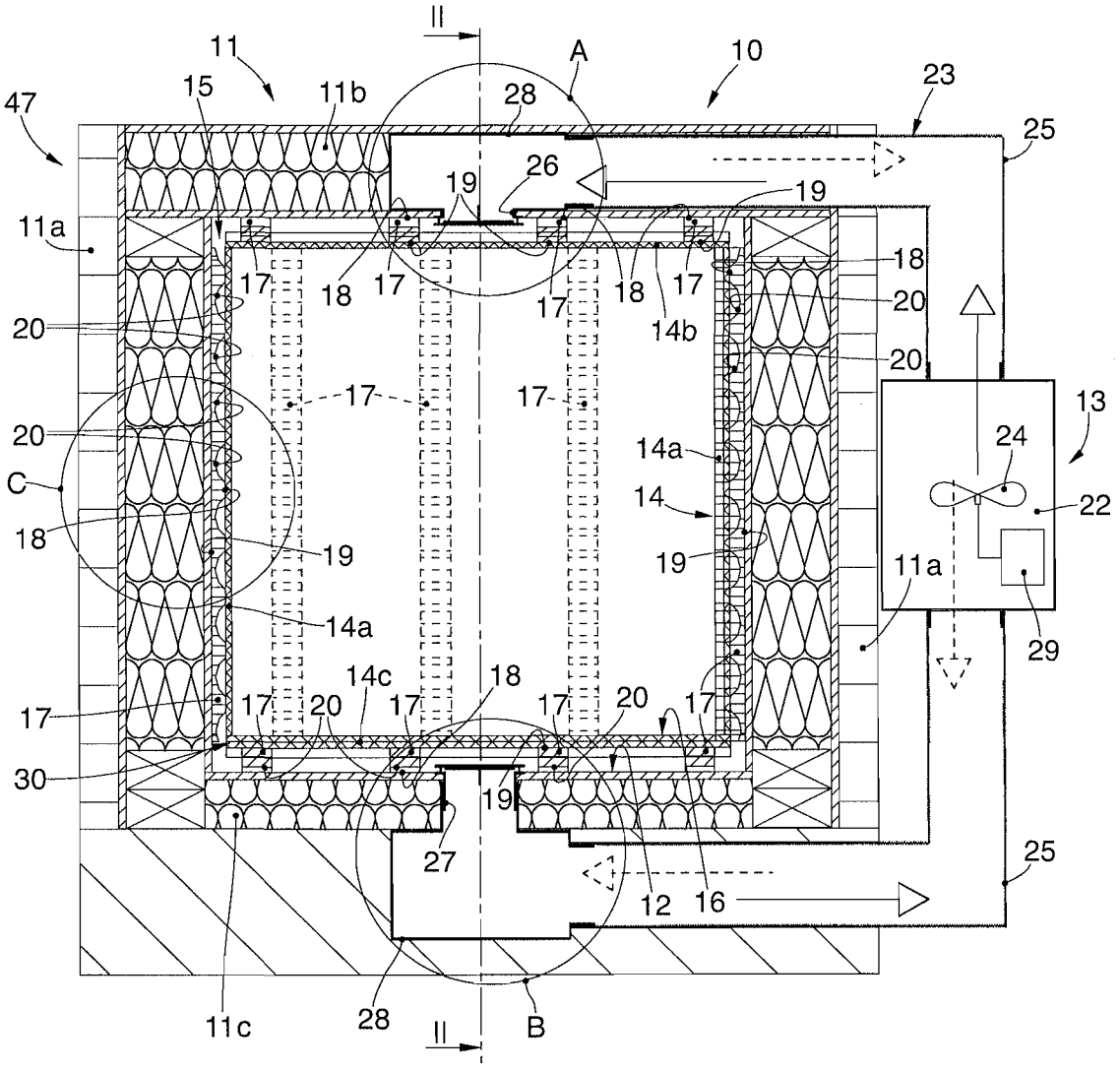

II
11
A
10
23
47
15
11b
28
25
26
19
19
11a
18
17
18
17
17
18
17
14b
18
20
20
20
17
17
13
20
14a
24
C
14
22
18
19
19
11a
19
14a
29
14c
18
17
17
20
17
17
20
17
17
30
19
27
25
12
16
11c
28
II
B

fig. 1

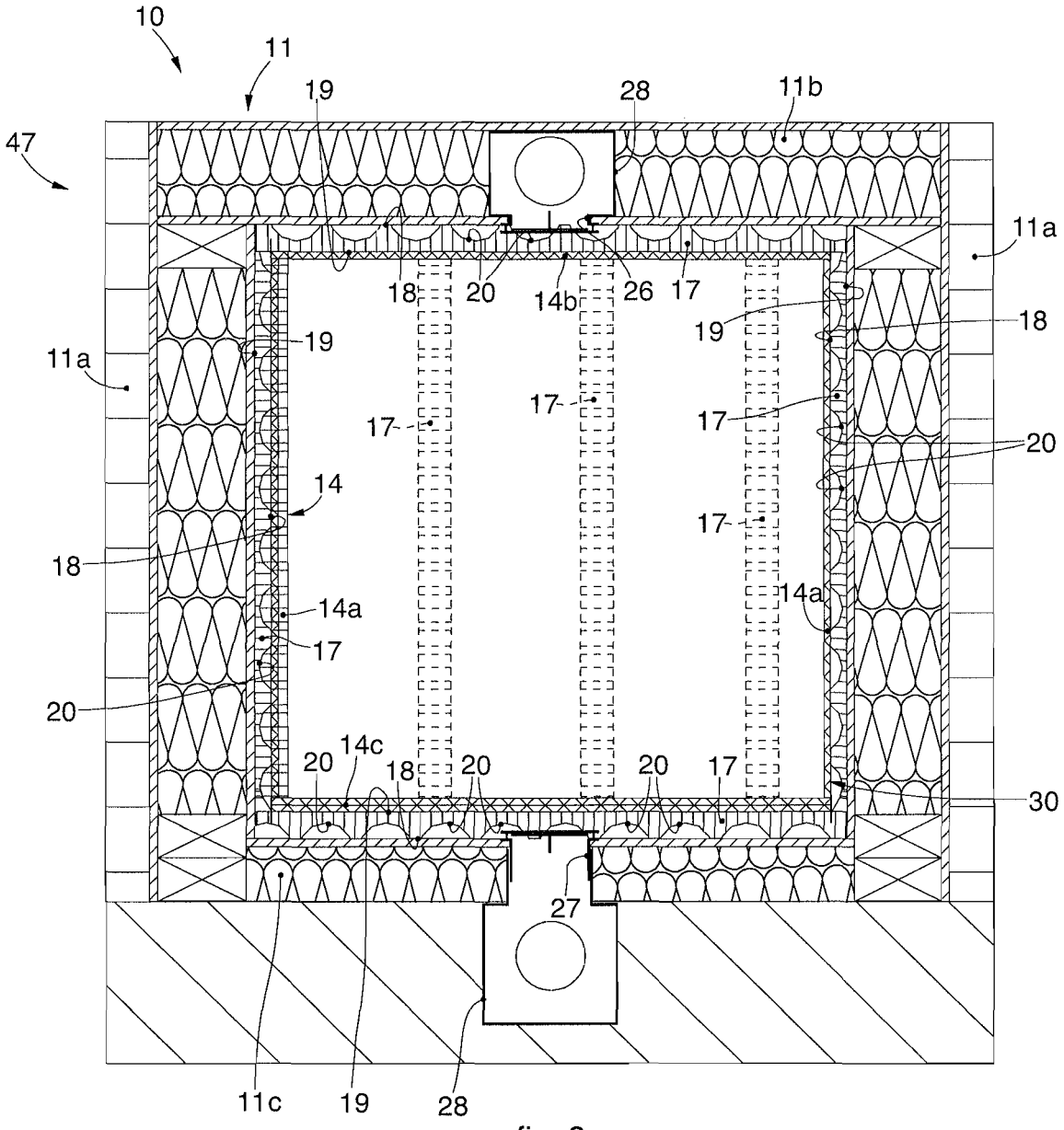

10
11
19
28
11b
47
11a
18
20
14b
26
17
19
18
11a
19
17
17
17
20
14
17
18
14a
14a
17
20
14c
20
18
20
20
17
30
27
11c
19
28

fig. 2

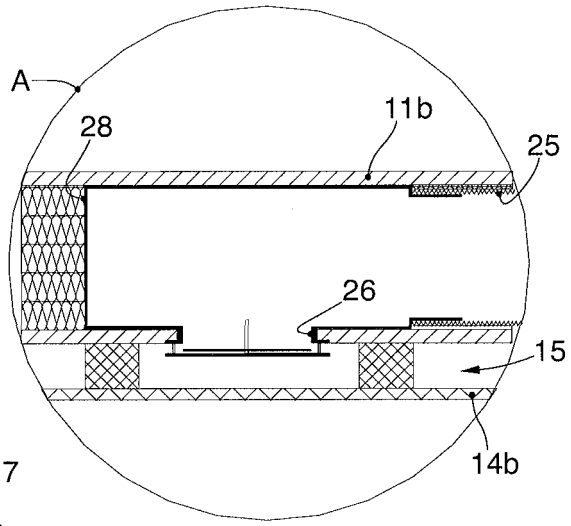


fig. 3

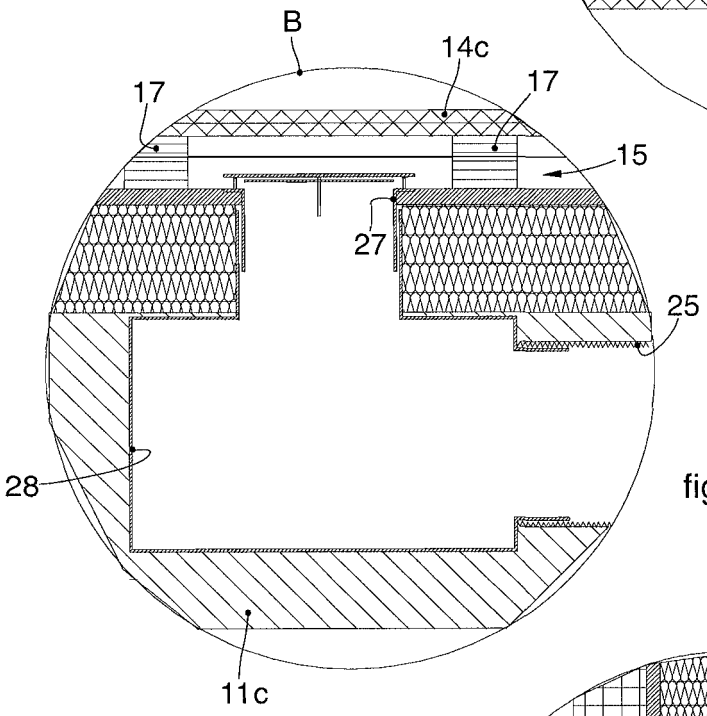


fig. 4

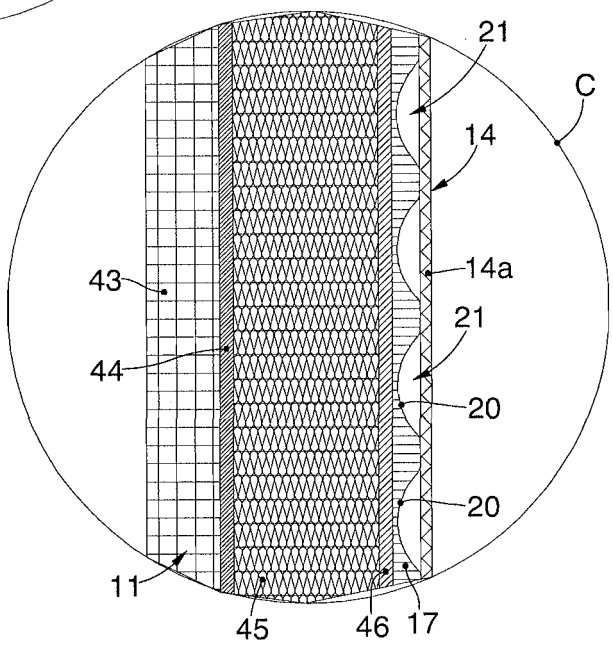


fig. 5

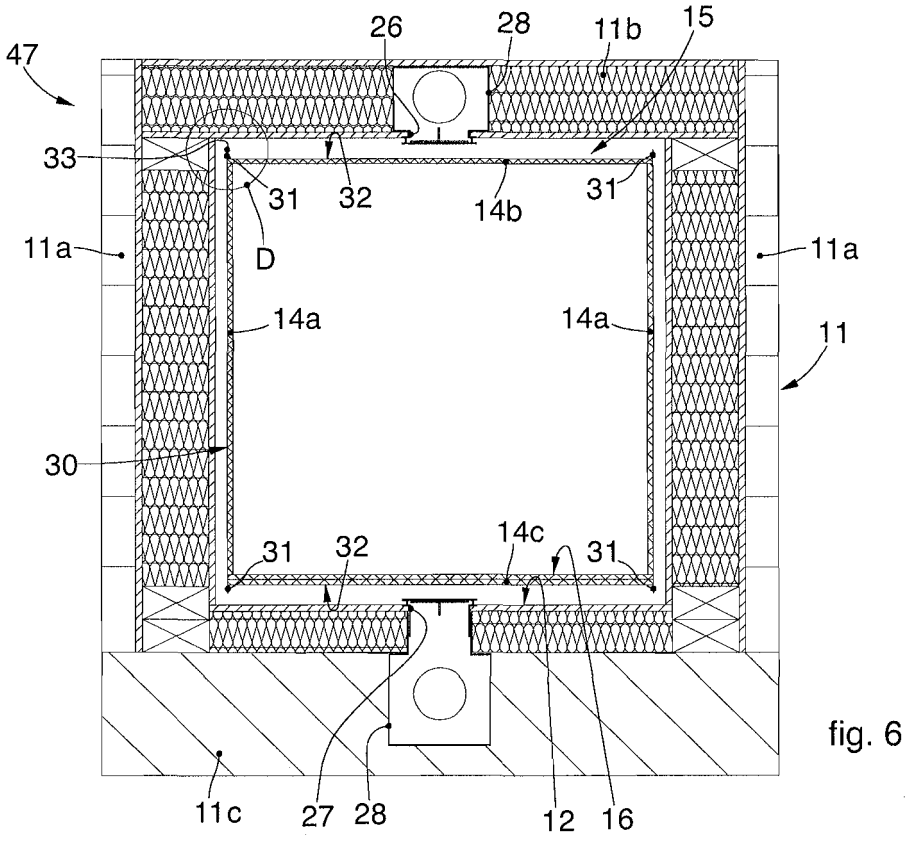

47
26
28
11b
15
33
31
32
14b
31
D
11a
11a
14a
14a
11
30
31
32
14c
31
11c
27
28
12
16

fig. 6

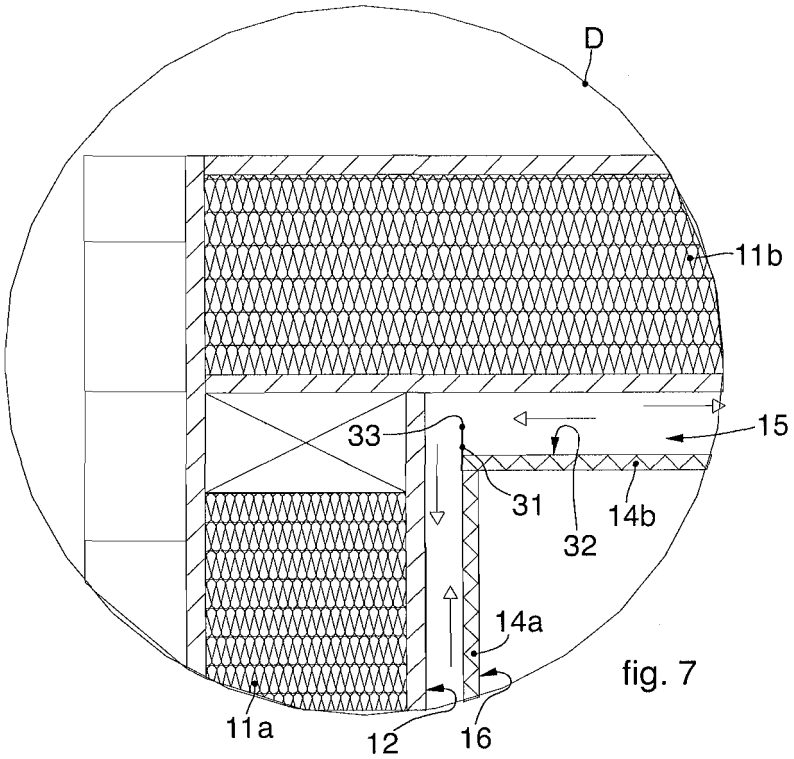

D
11b
15
33
31
32
14b
14a
11a
12
16

fig. 7

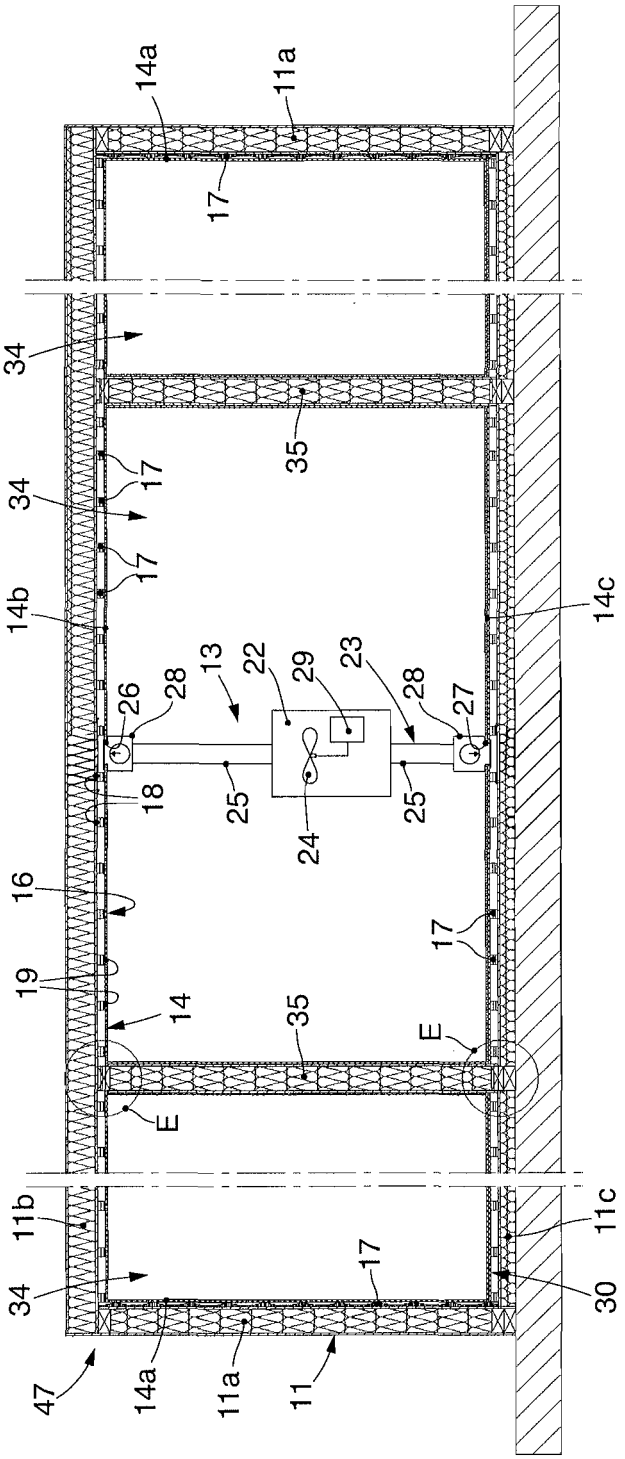

14a
11a
17
34
35
34
17
17
14b
14c
13
22
29
23
28
26
28
27
18
25
24
25
16
17
19
14
35
E
E
11b
11c
34
17
30
47
14a
11a
11

fig. 8

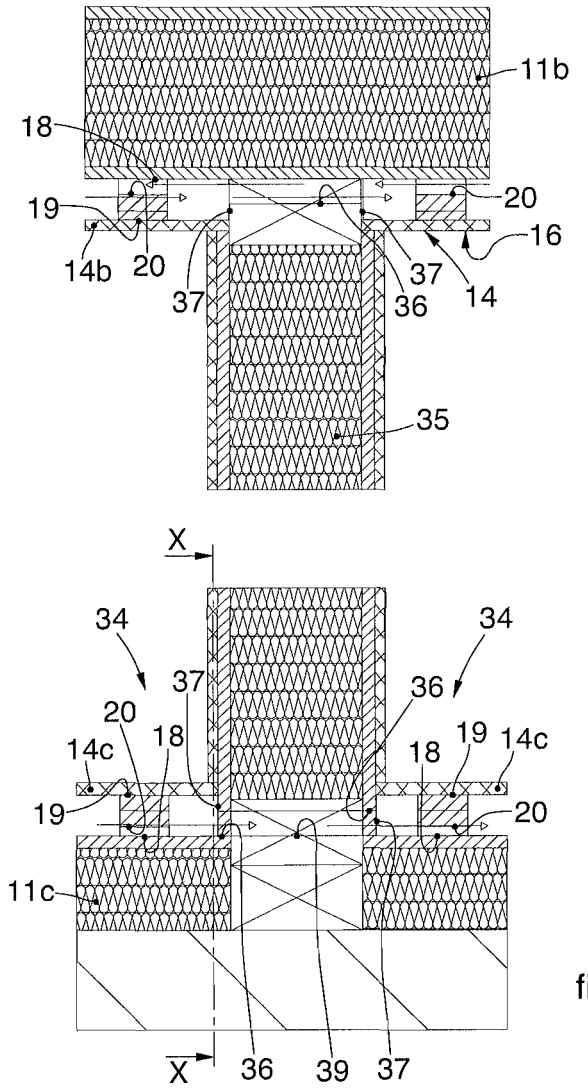

11b
18
19
20
16
14b
20
37
37
36
14
35
X
34
34
37
36
20
18
19
14c
14c
18
19
20
11c
X
36
39
37

fig. 9

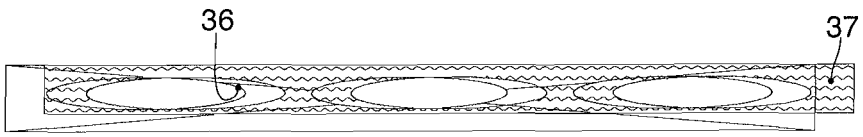

36
37

fig. 10

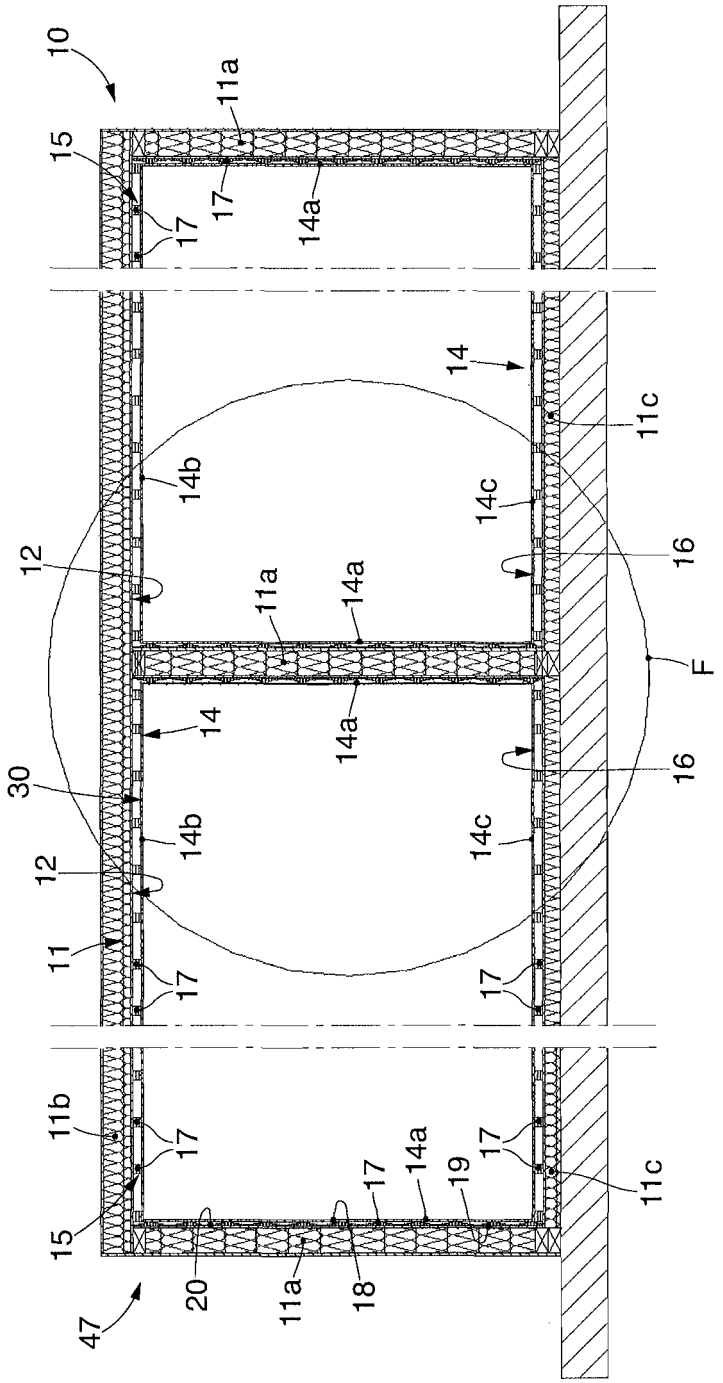

10
11a
15
17
17
17
14a
14
11c
14b
14c
16
12
11a
14a
F
14
14a
16
30
14b
14c
12
11
17
17
11b
17
14a
17
17
19
11c
15
20
11a
18
47

fig. 11

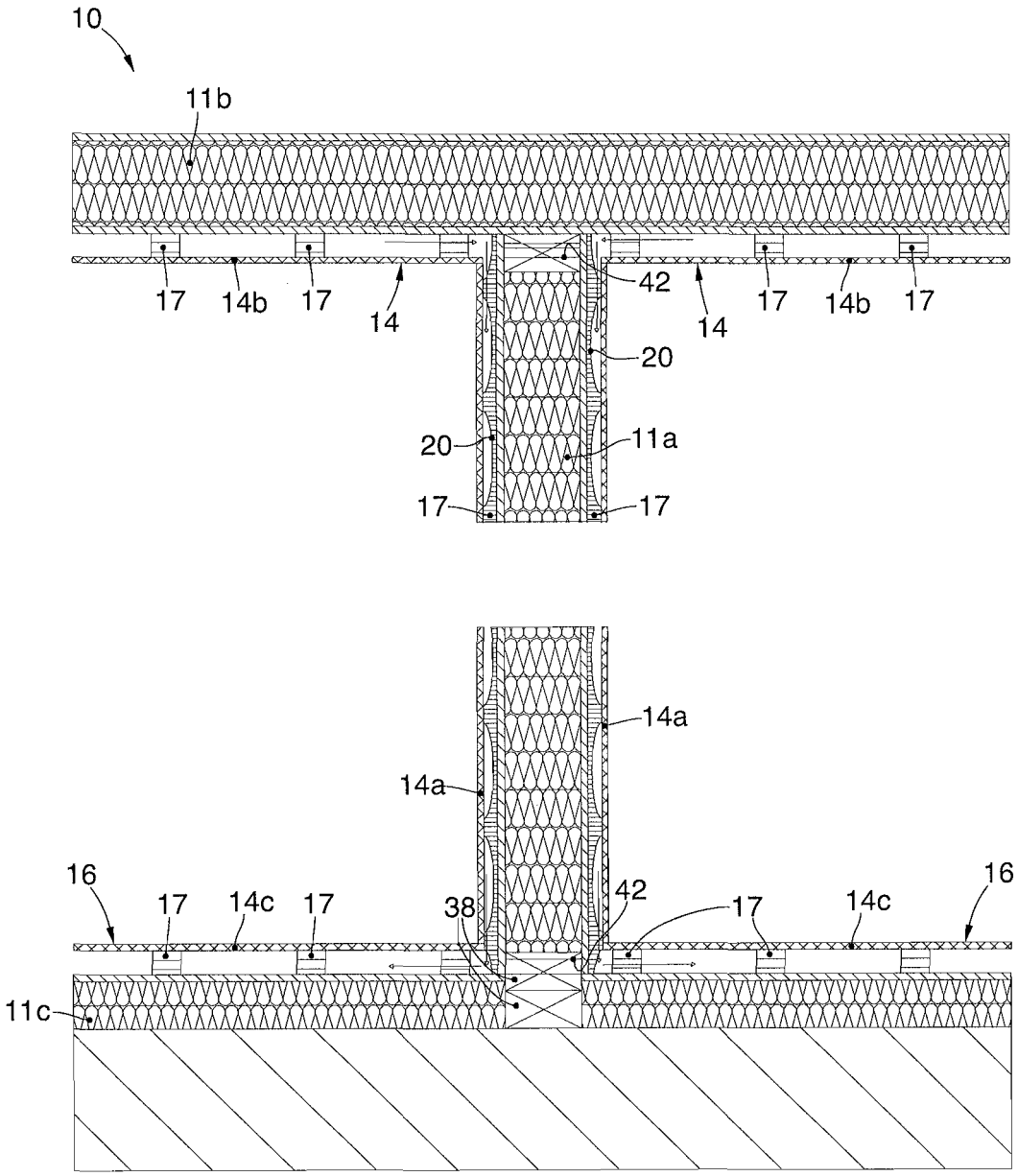

10
11b
17
14b
17
14
42
14
17
14b
17
20
20
11a
17
17
14a
14a
16
17
14c
17
38
42
17
14c
16
11c

fig. 12

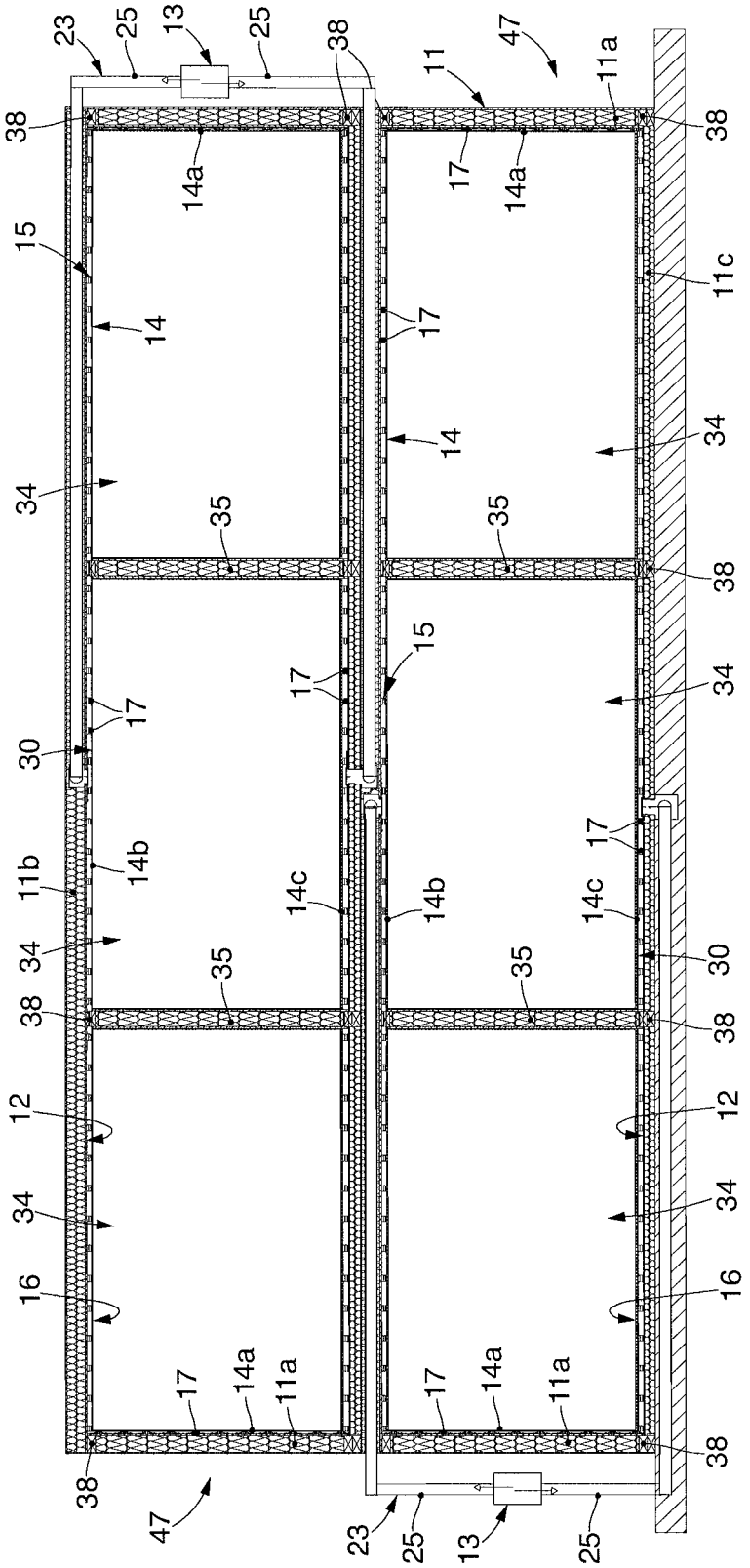

23
25
13
25
38
11
47
11a
38
38
14a
17
14a
15
11c
14
17
14
34
34
35
35
38
15
17
17
34
30
14b
11b
14c
14b
14c
17
34
35
35
30
38
38
38
12
12
34
34
16
16
17
14a
11a
17
14a
11a
38
38
47
23
25
13
25

fig. 13

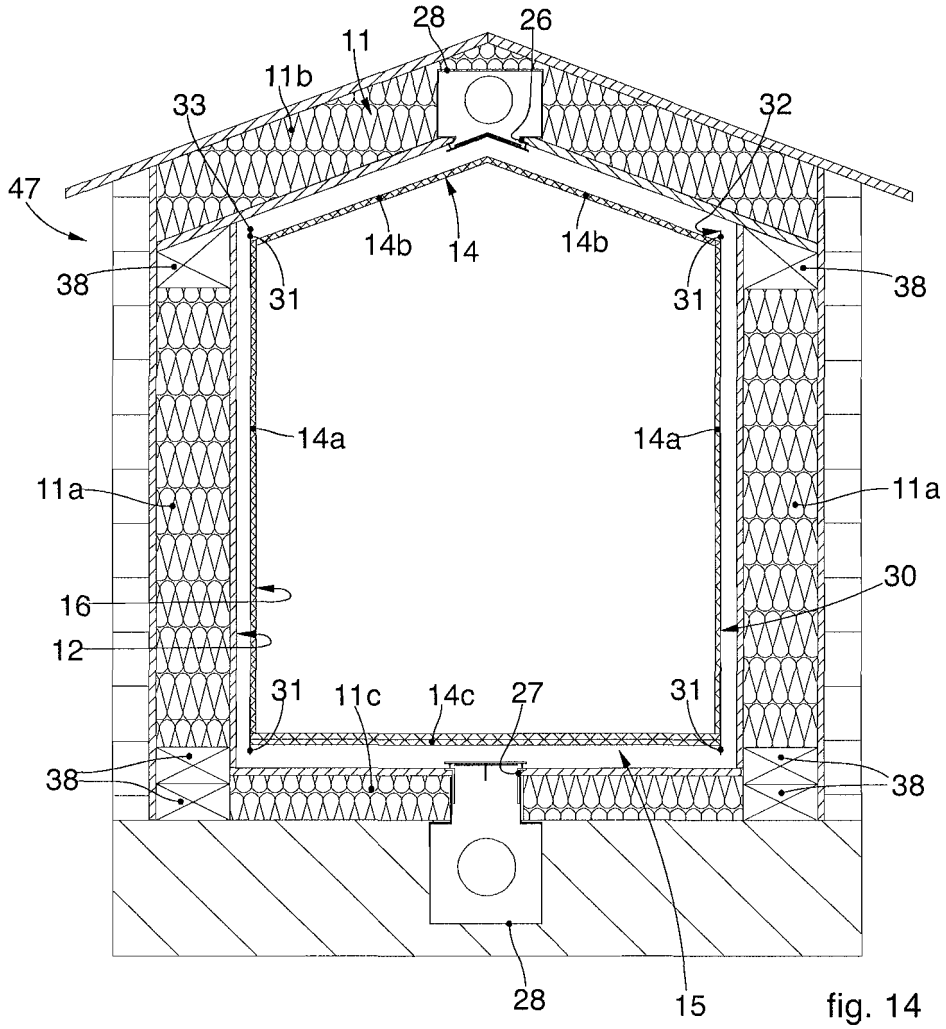

28
26
11
11b
33
32
47
14b
14
14b
38
31
31
38
14a
14a
11a
11a
30
16
12
31
11c
14c
27
31
38
38
28
15

fig. 14

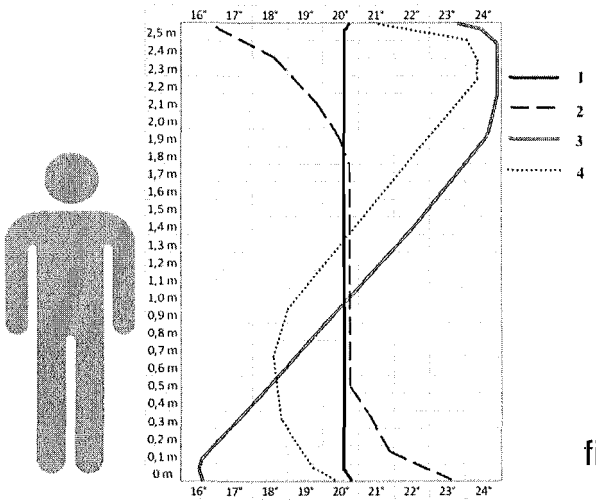

16° 17° 18° 19° 20° 21° 22° 23° 24°
2,5 m
2,4 m
2,3 m
2,2 m
2,1 m
2,0 m
1,9 m
1,8 m
1,7 m
1,6 m
1,5 m
1,4 m
1,3 m
1,2 m
1,1 m
1,0 m
0,9 m
0,8 m
0,7 m
0,6 m
0,5 m
0,4 m
0,3 m
0,2 m
0,1 m
0 m
1
2
3
4

fig. 15

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2008101462 A **[0019] [0027]**
- JP H09170784 A **[0019] [0025]**
- JP 2003042484 A **[0019] [0025]**
- JP H10132301 A **[0019] [0027] [0028]**
- JP 2003120958 A **[0019] [0028]**
- JP 2011226677 A **[0019] [0027] [0028]**
- JP 2001303688 A **[0019] [0028]**