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(72) Inventor: **WOJCIK, Andrzej Jerzy**
05-622 Belsk Duzy (PL)

(74) Representative: **AOMB Polska Sp. z o.o.**
Ul. Emilii Plater 53
21st Floor
00-113 Warsaw (PL)

(71) Applicant: **Izodom 2000 Polska sp. z o.o.**
98-220 Zdunska Wola (PL)

(54) **INSULATING AND DRYING PANEL, WALL THERMAL INSULATION AND DRYING SYSTEM, AND MOUNTING METHOD FOR WALL THERMAL INSULATION AND DRYING SYSTEM**

(57) The invention refers to a thermal-insulation and drying panel, made of expanded material and designed for thermal insulation of building walls, in particular requiring wall moisture to be transported away, as well as a wall thermal-insulation and drying system using i.e. the thermal-insulation and drying panel, and a method of installation of wall thermal-insulation and drying system.

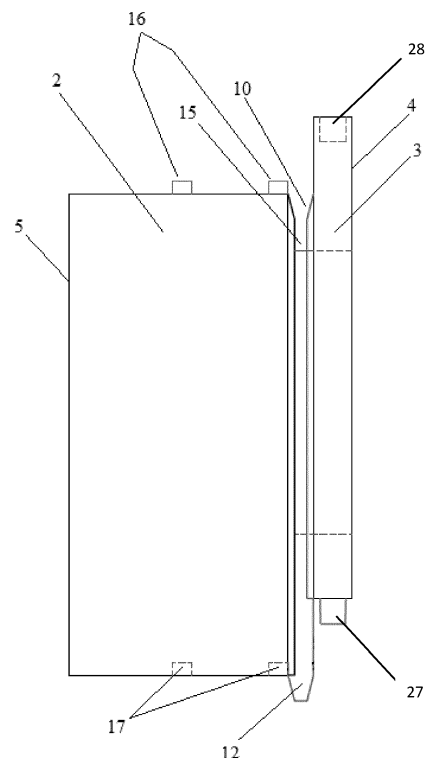


Fig. 7

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Description

[0001] The present invention relates to a thermal-insulation and drying panel, made of expanded material and designed for thermal insulation of building walls requiring wall moisture to be transported away, as well as a wall thermal-insulation and drying system using i.e. the thermal-insulation and drying panel, and a method of installation of the wall thermal-insulation and drying system.

[0002] An insulation panel is known from the patent specification PL 204238 B1, said panel having ventilation slots in form of open ducts, arranged at the panel side which upon installation is contacting the wall of the thermally insulated building. An upper and a lower portion of the thermal-insulation panel according to the patent is formed such that after installing the thermal-insulation panels one above the other, a horizontal ventilation duct is formed between adjacent (vertically) panels, said duct ensuring uniform air distribution from ventilation holes horizontally to individual vertical slots, even if some of the vertical ventilation slots are clogged. According to said patent, during installation of the insulation panels the ductwork of ventilation slots are divided into shorter sections by providing, at defined distances, a horizontal diaphragm disabling further air flow in the vertical direction and by arranging vents extending from the outer part of the panel to the horizontal ventilation duct.

[0003] It turns out that the panel design described in the above-mentioned patent involves some difficulties. The ventilation slots, which according to invention embodiment of the patent PL 204238 B1, are 5mm wide, cause unnecessarily high airflow resistance. Furthermore, the horizontal ventilation duct is contacting the vertical slots of the panel located below the horizontal ventilation duct only with a small area (smaller than cross-section of the narrowest section of the ventilation slot) and such narrow slot mouth to the horizontal ventilation duct generates unnecessary airflow resistance (resulting in formation of local whirl zones). Moreover, the horizontal ventilation duct formed between adjacent thermal-insulation panels according to said patent has a relatively small height (of the order few dozens of mm), and therefore during vent installations frequent difficulties occurred in accurate fitting of the installed vent in the middle of the ventilation duct.

[0004] In view of the above difficulties a thermal-insulation and drying panel was developed, generally realising the same functions as the panel described in the patent PL 204238 B1, however showing no above-mentioned drawbacks, that is thus ensuring airflow at significantly reduced resistance, which in turn has beneficial effect on the wall drying process while reducing heat losses. The thermal-insulation and drying panel according to the present solution also ensures easier and more intuitive installation process, and as well as meets increased requirements for thermal insulation of buildings.

[0005] The present invention relates to a thermal-insulation and drying panel having a shape composed of two

essentially cuboid layers: an inner layer and an outer layer, said layers being offset with respect to each other along two perpendicular edges and constitute an integral element,

5 whereby in a transition area of outer layer into inner layer a displacement region is present, wherein a first side of the inner layer is designed to contact an insulated wall, and the other side of the outer layer which is not in contact with the inner layer, in an assembled state is arranged to face the surroundings of the insulated wall and is designed to be covered with a finishing material, whereby the panel sides other than the first side and the second side constitute side walls of the panel,

10 whereby in the inner layer, at the first side designed to contact the insulated wall, ventilation slots are spaced at regular intervals, and parallel to each other, extending perpendicularly to longer sides of the panel, whereby lower portions of slots are extended so that along the run of ventilation slots within a single thermal-insulation and drying panel ventilation slots comprise, starting from the bottom, an extended portion of an essentially constant width, a contracting portion of a variable width and a non-extended portion of an essentially constant width,

20 whereby in the displacement region between the inner layer and the outer layer, oblong splines and keys are provided, extending along side walls of the thermal-insulation and drying panel,

30 whereby a horizontal key is extending along an upper edge of the outer layer, while a vertical key is extending along a right edge of outer layer, when viewed from the outer side of the thermal-insulation and drying panel, whereby a horizontal spline is extending along a lower edge of the outer layer, so that extensions of ventilation slots pass therethrough, while a vertical spline is extending along a left edge of the outer layer, when viewed from the outer side of the thermal-insulation and drying panel, whereby all oblong keys and splines have slightly convergent cross-section,

35 whereby a depth of the horizontal key in the thermal-insulation and drying panel is greater than a length of the horizontal spline,

40 whereby at surface portions of the inner layer uncovered by the outer layer, cavities for fixing elements are provided for fixing the thermal-insulation and drying panel to the insulated wall,

45 wherein the lower surface of the horizontal key is additionally deepened towards the lower edge of the thermal-insulation and drying panel, whereby said deepening forms a ventilation duct, extending essentially perpendicularly to the ventilation slots, which contact the ventilation duct at least at the half height of the ventilation duct measured from a bottom of the duct, and preferably contact the ventilation duct at least at a section being 0.6 times the height of the ventilation duct.

50 **[0006]** Preferably, at the upper surface of the panel positioning elements are provided in form of first posi-

tioning tongues and/or second positioning grooves, while at the lower surface of the panel corresponding positioning elements are provided in form of first positioning grooves and/or second positioning tongues, respectively.

[0007] Preferably, the upper portion of each ventilation slot connected to the ventilation duct is arcwise, whereby preferably the arc radius is 35 mm.

[0008] Preferably, the upper ends of the ventilation slots have rounded side edges, forming roundings, whereby preferably the roundings of side edges of upper ends of ventilation slots have a radius ranging from 5 mm to 20 mm, preferably equal to 10 mm.

[0009] Preferably, the side of the outer layer, designed to be covered with a finishing material, is covered with an additional layer of material, preferably selected from a group comprising: plaster, ceramic tiles, paint, mineral-based coating or plastic coating.

[0010] Preferably, on the outermost surface of the thermal-insulation and drying panel, designed to be covered with a finishing material, a marking is provided, extending in parallel with the ventilation duct and defining half of the height of the ventilation duct.

[0011] Preferably, in their non-extended portion the ventilation slots have width ranging from 5 mm to 10 mm, preferably equal 7 mm, and in the extended portion are 15 mm wide, whereby centres of adjacent ventilation slots are spaced apart by a distance ranging from 35 mm to 100 mm, preferably equal 50 mm.

[0012] Preferably, the total thickness of the panel ranges from 60 mm to 300 mm, in particular from 120 mm to 300 mm, such as 120 mm, 180 mm or 220 mm.

[0013] Preferably, the thermal-insulation and drying panel is made of a lightweight material having good thermal-insulation properties, preferably of expanded material, in particular expanded polystyrene or polyurethane.

[0014] The present invention relates also to a wall thermal-insulation and drying system, comprising:

the thermal-insulation and drying panels according to the invention,

fastening means, preferably wall fasteners and/or an adhesive for fixing of panels to a wall,

vents, to be arranged in the thermal-insulation and drying panels, whereby length of the vents corresponds to the length measured between the ventilation duct and the outer surface of the thermal-insulation and drying panel which is designed to be covered with finishing material,

ventilation grilles, suitable for covering of outer holes of the vents,

a foil for separating individual vertical air ducts, each time defined by the vents, the ventilation slots and the ventilation ducts, whereby the foil is designed to

be arranged between the horizontal spline and the horizontal key of predetermined and adjacent thermal-insulation and drying panels,

5 start trays for placing therein a first row, starting from the bottom, of the thermal-insulation and drying panels or truncated portions of the thermal-insulation and drying panels,

10 start panels for being placed in the start trays under the thermal-insulation and drying panels or the truncated portions of the thermal-insulation and drying panels.

15 **[0015]** Preferably, the system further comprises:

corner elements for being placed at corners and/or side ends of the wall thermal-insulation and drying system, said corner elements are square in cross-section, whereby a side width of this square cross-section is equal to total thickness of the thermal-insulation and drying panels, and/or

a facade form defined by the designer.

25 **[0016]** Further, the present invention relates to a method of installation of a wall thermal-insulation and drying system, comprising the following steps:

30 a) installing a start tray on a wall using fastening means, preferably wall fasteners and/or adhesive for attaching the panels to the wall;

b) inserting a start panel into the start tray,

35 c) placing the thermal-insulation and drying panel or the truncated portion of the thermal-insulation and drying panel on the start panel inserted into the start tray,

d) fixing the thermal-insulation and drying panels or the truncated portions of the thermal-insulation and drying panels to the wall using fastening means,

45 e) arranging vents in the thermal-insulation and drying panels so that they extend from the outer surface of the thermal-insulation and drying panels to the horizontal ventilation ducts in the thermal-insulation and drying panels,

whereby adjacent horizontal rows of the thermal-insulation and drying panels are fixed with a horizontal offset to each other,

55 whereby between predetermined horizontal rows of the thermal-insulation and drying panels, the horizontal key in the upper portion of the thermal-insulation and drying panel is covered with foil to define vertical air ducts, preferably spaced at regular intervals equal to the height of

a storey,
wherein the thermal-insulation and drying panels according to the invention are used.

[0017] Preferably, edges of the thermal-insulation and drying panels fixed to the walls are secured with cuboid corner elements having a square base with a side length equal to the thickness of the thermal-insulation and drying panels.

[0018] Preferably, the step e) is followed by a step f): f) covering exhausts of vents (20) with ventilation grilles (21).

[0019] Preferably, after installing all the thermal-insulation and drying panels, outer surface thereof, designed to be covered with finishing material, is covered, except from the ventilation grilles, with an additional layer of material, in particular selected from a group comprising plaster, plastic, paint and ceramic tiles.

[0020] The invention will now be presented in greater detail in a preferred embodiment with reference to the accompanying drawings, in which:

Fig. 1 shows a schematic view of the thermal-insulation and drying panel from the side of surface to be covered with a finishing material,

Fig. 2 shows a schematic view of two cross-sections of the thermal-insulation and drying panel, along with horizontal and vertical planes, respectively, parallel to the surface to be covered with a finishing material,

Fig. 3 shows a schematic view of two cross-sections of the thermal-insulation and drying panel, along with vertical planes, perpendicular to the surface to be covered with a finishing material,

Fig. 4 shows a schematic view of cross-section of the truncated portion of the thermal-insulation and drying panel which can be installed as the highest element of the wall thermal-insulation and drying system,

Fig. 5 shows a schematic view of a joint between two panels, with visible vent and separating foil,

Fig. 6 shows a schematic view of a cross-section of the truncated portion of thermal-insulation and drying panel inserted into a start tray as the lowest element of the wall thermal-insulation and drying system,

Fig. 7 shows a schematic side view of the thermal-insulation and drying panel,

Fig. 8 shows a schematic view of a cross-section of the wall thermal-insulation and drying system, along with a vertical plane, said system being installed at a building wall,

Fig. 9 shows a schematic view of a building wall thermally insulated with the wall thermal-insulation and drying system having visible markings on the thermal-insulation and drying panels, defining half of the height of horizontal ventilation ducts,

Fig. 10 shows a schematic view of exemplary mounting regions of corner elements in the wall thermal-insulation and drying system according to the invention,

Fig. 11 shows a schematic view of a cross-section of the thermal-insulation and drying panel along the vertical plane perpendicular to the surface to be covered with a finishing material, with marked arcwise end of an upper portion of ventilation slots and a marked vent, and

Fig. 12 shows a schematic view of a cross-section of the thermal-insulation and drying panel along the vertical plane perpendicular to the surface to be covered with a finishing material, passing through one of ventilation slots, with a visible arcwise end of an upper portion of a ventilation slot.

Preferred embodiment of the invention

[0021] Exemplary thermal-insulation and drying panel 1 according to the invention is a shape composed of a cuboid inner layer 3 which, once installed on the insulated building, is in contact with the building wall, and a cuboid outer layer 2 which, once installed on the insulated building is to be covered with a finishing material.

[0022] The outer 2 and inner 3 layers are offset to each other along both perpendicular edges and form an integral entity (the thermal-insulation and drying panel 1). At the inner layer 3, which is not covered by the outer layer 2, cavities 14 for fastening elements are provided, in particular oval, round or oblong in shape.

[0023] The thermal-insulation and drying panel 1 is designed to be fixed on the insulated wall in a horizontal position (with a longer edge of the panel 1 in a horizontal orientation).

[0024] In the inner layer 3, from a first side 4 designed to be in contact with the building wall, parallel ventilation slots 6 are provided, said slots being spaced at regular intervals and extending perpendicularly to longer sides of the thermal-insulation and drying panel 1. A lower portion of each slot 6 has an extension (an extended portion 7 of ventilation slots), and an upper portion of each slot 6 is a non-extended portion 9, whereby a contracting portion 8 is provided between them.

[0025] In a displacement region between the inner layer 3 and the outer layer 2, oblong splines: a horizontal spline 12 and a vertical spline 13, and keys: a horizontal key 10 and a vertical key 11, are provided, extending along side walls of the thermal-insulation and drying panel 1.

[0026] The horizontal key 10 is provided along the entire length of an upper edge of the outer layer 2, and the vertical key 11 is provided along a right edge of the outer layer 2 (when viewed from the outer layer 2 side of the thermal-insulation and drying panel 1).

[0027] The horizontal spline 12 extends along a lower edge of the outer layer 2, with extended portions 7 of the ventilation slots 6 extending across the spline, thereby dividing the edge of the horizontal spline 12 into shorter sections, and the vertical spline 13 extends along a left edge of the outer layer 2 (when viewed from outer layer 2 side of the thermal-insulation and drying panel 1).

[0028] All the splines 12, 13 and keys 10, 11 provided in the thermal-insulation and drying panel 1 have slightly convergent cross-section. In the embodiment shown in fig. 1 and 7 the keys 10, 11 and the splines 12, 13 with trapezoid cross-section are provided, however it is clear that other cross-sections of the splines 12, 13 and the keys 10, 11 are possible. It is possible to use the splines 12, 13 and the keys 10, 11 having cross-section of triangular, parabolic, semi-circular or mixed shape - e.g. half-trapezium and half-parabolic, etc. The main aim of modification of the cross-section is to facilitate the assembly of adjacent thermal-insulation and drying panels 1 together - even slightly convergent keys/splines facilitate sliding over and locking of one panel above the other.

[0029] On the upper edge of the outer layer 2 first positioning tongues 16 are provided, and on the lower edge of the outer layer 2 corresponding first positioning grooves 17 are provided. The first positioning tongues 16 and the corresponding first positioning grooves 17 are arranged at regular intervals, corresponding to the intervals between the ventilation slots 6. In the embodiment shown in fig. 1, 2, 6 and 7 the first positioning tongues 16 and the first positioning grooves 17 are arranged essentially between the slots, at regular intervals from each side from the adjacent slots 6, but it is not the only possible and preferred configuration. As required, it is possible to provide the first positioning tongues 16 and the first positioning grooves 17 at regular intervals, but offset to the ventilation slots 6 or simply present directly in the same areas as the ventilation slots 6 (when viewed perpendicularly to the outer surface of the thermal-insulation and drying panel 1). Although, in the embodiment shown in fig. 1, 2, 6 and 7 the first positioning tongues 16 and the first positioning grooves 17 each time have square cross-section and straight side walls, it is possible to use the first positioning tongues 16 and the first positioning grooves 17 having other shapes, e.g. oval, truncated pyramid, hemisphere, etc. Further, it is possible to use the first positioning tongues 16 and the first positioning grooves 17 having transverse dimensions greater than the width of cross section of the ventilation slots 6. Moreover, for the thermal-insulation and drying panels 1 of large thickness (in particular with thicker outer layer 2, suitable for thermal insulation of buildings in a harsh climate, e.g. in northern Europe), it is possible and preferable to provide a few rows of the first positioning tongues

16 and the first positioning grooves 17 to ensure stable fixing of adjacent thermal-insulation and drying panels 1 together along their upper and lower edges. In such cases it is particularly preferable to provide two, three or four rows of the first positioning tongues 16 and the first positioning grooves 17.

[0030] Although it was indicated that in a preferred embodiment the first positioning tongues 16 are located on the upper edge of the outer layer 2 and the first positioning grooves 17 are located on the lower edge of the outer layer 2, it is clear that they can be provided in a reverse configuration or even alternately - along the upper edge, tongue-groove-tongue-groove, etc., and along the lower edge - groove-tongue-groove, etc., respectively. It is essential for the thermal-insulation and drying panel 1 that the first positioning grooves 17 and the first positioning tongues 16 have corresponding shapes and are arranged in relation to each other in such a way that during the assembly of the thermal-insulation and drying panels 1 one above the other, they determined such mutual positioning of the panels 1 that the ventilation slots 6 of adjacent panels 1 were positioned facing each other maintaining the vertical continuity of the ventilation slots 6 and ensuring the free air flow along the ventilation slots 6.

[0031] Moreover, in the preferred embodiment shown in fig. 3, 6, 7, 11 on the upper surface of the panel 1, and more precisely - on the upper surface of the inner layer 2 of the panel 1 second positioning grooves 28 are provided, while on the lower surface of the panel 1, and more precisely - on the lower surface of the inner layer 2 of the panel 1 corresponding positioning tongues 27 are provided, preferably having round cross-section, arranged every 1/6 of the panel length, allowing for mounting further rows of panels offset to each other by 1/6 of the assumed panel length, i.e. preferably by 25 cm. Such solution allows rustication to be offset by a half of its width, provided that the length of rustication is 1/3 of the panel length.

[0032] Depth of the horizontal key 10 in the thermal-insulation and drying panel 1 is greater than the height of the horizontal spline 12, so that in assembled state on the wall a horizontal ventilation duct 15 is formed between adjacent panels 1. This ventilation duct 15 has a cross-section with partially contracting sides, which after reaching a certain close-up start to extend in parallel to one another (the cross-section is therefore close to a trapezium with parallel bases, wherein to a shorter base edge a rectangle is joined having a shorter side being equal in length to the shorter base of the trapezium). The ventilation slots 6 provided in the inner layer 3 of the thermal-insulation and drying panel 1 (where the width of the slot 6 in the direction perpendicular to the wall surface is greater than the width of the ventilation duct 15, measured in the same direction) penetrate the horizontal key 10 at least half of the height of the ventilation duct 15, defined by the ventilation duct 15 side walls extending parallel to each other, and preferably are contact the ven-

tilation duct 15 along a section of at least or approximately 0.6 of the height of the ventilation duct 15. Compared to the solution known from PL 204 238 B1, wherein the contact area of the ventilation slots 6 with the ventilation duct 15 was relatively small, in the present solution this contact area is much greater and thus the air flowing through the ventilation slots 6 to the ventilation duct 15 faces significantly lower flow resistance. As a result of experiments (numerical analysis) of the airflow through the slot 6 to the ventilation duct 15 it has been found that in the present panel 1 the airflow may be greater even by 39.86% compared to the panel known from the exemplary embodiment of PL 204 238 B1. As a result of further research, it has been found that preferred modification of the contact area between the ventilation slots 6 and the ventilation duct 15 is an arcwise form of the upper portion of the ventilation slots 6 so as to provide an arc 26 (compare Fig. 3 with Fig. 11 and 12). It has been established that radius of curvature of the arc 26 preferably may be 35 mm.

[0033] Ends of the ventilation slots 6, which in the assembled state are provided in the upper portion of a given thermal-insulation and drying panel 1, according to the present solution have rounded side edges (roundings of side edges 18 are present). Resistance of airflow through the slots 6 is thereby reduced in area, in which the ventilation slots 6 open to the ventilation duct 15 compared to the panel known from PL 204 238 B1, the slots of which are terminated conventionally, essentially having cuboid shape.

[0034] The horizontal ventilation duct 15, in addition to providing better airflow from one thermal-insulation and drying panel 1 to another, located above the first one, enables to arrange vents 20 in the thermal-insulation and drying panel 1. The vents 20 are essential due to the reduction of total length of vertical air ducts along the ventilation slots 6. In such situation vents 20 operate in pairs - the vent 20 provided in the lower area of air duct is an inlet (enables ambient air to enter the area between the thermal-insulation and drying panel 1 and the wall), while the vent 20 provided in the upper area of air duct is an outlet (enables the air to flow outside, thereby transporting the moisture away from the wall). As the vents 20 are placed in some of the thermal-insulation and drying panels 1 already after fixing the thermal-insulation and drying panels 1 to the wall, it is preferable to facilitate installation of these vents 20, in particular so that the vents 20 would allow the air to be effectively removed from underneath the thermal-insulation and drying panel 1. This is achieved by placing the vent 20 axis at the level of the horizontal ventilation duct 15 centre (and more precisely - the centre of the ventilation duct portion with parallel side walls) of a given thermal-insulation and drying panel 1 so that the vent 20 is connected to the horizontal ventilation duct 15 at right angle, which in turn may pose certain difficulty for untrained workers installing the system. For this reason, in the present solution, a guidance in form of a line (marking 19) located on the front

face of the outer layer of the thermal-insulation and drying panel 1, said front face, after installation being parallel to the building wall, whereby this line indicates half of the horizontal ventilation duct height. Arranging the vent at this line minimizes the risk of failure to fit the vent into the horizontal ventilation duct.

[0035] Although arranging the vents 20 at right angle to the thermal-insulation and drying panel 1 is preferred, in other embodiments it might be preferred to arrange the vents 20 inclined downwards in the direction of the outer side of panel, e.g. at an angle of 2° - 8° in relation to the horizontal, e.g. at an angle of 3° , 4° or 5° . Such slight inclination of the vents 20 allows them to realise an additional function of gravitational drainage of condensate from the inside of the thermal-insulation and drying panel 1 to the environment.

[0036] During investigation of the thermal-insulation and drying panels 1 it has been found that in order to provide free airflow through the air duct defined by the vent 20 acting as an inlet opening, the slots 6 and the ventilation ducts 15, and vent 20 acting as an outlet opening, the vents 20 are necessary of accordingly large geometric dimensions. It has been established that due to heat exchange processes (cooling of building) and moisture drainage (wall drying), the vent 20 should have outer opening of bore (opening net area) between 360 mm^2 and 1500 mm^2 . In case of vents 20 in form of tube sections, a diameter of such vent 20 may be e.g. 50 mm. In view of the need to protect the thermal-insulation and drying panel 1 against accumulation of dirt/breeding of insects within the structure, it is preferred that the vent 20 outer opening is provided with an external grille/net 21 (preferably welded, glued or screwed to the vent 20) - in such case the opening bore is counted as a total area of mesh of such grille/net 21.

[0037] The thermal-insulation and drying panel 1 according to the invention preferably is made of expanded material, in particular expanded polystyrene or possibly expanded polyurethane.

[0038] In some embodiments, after arranging the thermal-insulation and drying panels 1 in the assembled position at the wall(s) it is preferred to additionally use two types of protective substances - sealing and anti-fungal. Sealing substances, such as, e.g. foams, can be used, e.g. to fill voids between the panels 1 or fill in the gaps resulting from mechanical damage (accidental chipping off) of portions of the thermal-insulation and drying panels 1. In this regard it is necessary to take care not to fill in the ventilation slots 6, etc. with such sealing substance as this could limit the drying function of the system for thermal insulation and drying of walls. Anti-fungal substances, e.g. in form of sprayed aerosol, can be used after installation of the wall thermal-insulation and drying system, e.g. by delivering such aerosol into the area of the ventilation slots 6 through the vents 20. Although such anti-fungal substances are a preferable addition, they are not required for proper functioning of the wall thermal-insulation and drying system incorporating the thermal-

insulation and drying panels 1 according to the invention.

[0039] In a preferred embodiment, the wall thermal-insulation and drying system includes:

thermal-insulation and drying panels 1 according to the invention,

fastening means, preferably wall fasteners and/or an adhesive for fixing of panels to a wall,

vents 20, to be arranged in the thermal-insulation and drying panels 1, whereby length of the vents 20 corresponds to the length measured between the ventilation duct 15 and the outer surface of the thermal-insulation and drying panel 1 which is designed to be covered with finishing material,

ventilation grilles 21, suitable for covering of outer holes of the vents 20,

a foil 22 for defining individual vertical air ducts, each time defined by the vents 20, the ventilation slots 6 and the ventilation ducts 15, whereby the foil is designed to be arranged between the horizontal spline 12 and the horizontal key 10 of predetermined and adjacent thermal-insulation and drying panels 1,

start trays 23 for placing therein a first row, starting from the bottom, of the thermal-insulation and drying panels 1 or truncated portions of the thermal-insulation and drying panels 1,

start panels 24 for being placed in the start trays 23 under the thermal-insulation and drying panels 1 or the truncated portions of the thermal-insulation and drying panels 1.

[0040] In preferred embodiment, the installation of the wall thermal-insulation and drying system comprises the following steps:

a) installing a start tray 23 on a wall using fastening means,

b) inserting a start panel 24 into the start tray 23,

c) placing the thermal-insulation and drying panel 1 or the truncated portion of the thermal-insulation and drying panel 1 on the start panel 24 inserted into the start tray 23,

d) fixing the thermal-insulation and drying panels 1 or the truncated portions of the thermal-insulation and drying panels 1 to the wall using fastening means,

e) arranging vents 20 in the thermal-insulation and drying panels 1 so that they extend from the outer

surface of the thermal-insulation and drying panels 1 to the horizontal ventilation ducts 15 in the thermal-insulation and drying panels 1,

5 whereby adjacent horizontal rows of the thermal-insulation and drying panels 1 are fixed with a horizontal offset to each other,

whereby between predetermined horizontal rows of the thermal-insulation and drying panels 1, the horizontal key 10 in the upper portion of the thermal-insulation and drying panel 1 is covered with foil 22 to define vertical air ducts.

[0041] In yet other embodiment of the invention, when installing the thermal-insulation and drying panels 1 according to the invention corner elements 25 are also used by being arranged in such areas like wall corners, while in contact areas of the thermal-insulation and drying panels 1 with windows/doors, or for finishings in the building roof area, etc. truncated/prefabricated elements from solid expanded polystyrene are preferably used. Said corner elements 25 preferably are shaped as prisms of different bases - square, rectangular, trapezoid or triangular, or as a quarter round, whereby said elements can be solid/monolithic or can comprise hollow spaces (e.g. extending along the entire height of the corner element 25). Preferably, the corner elements 25 have geometric dimensions adjusted to the thermal-insulation and drying panels 1 being used, i.e. width and thickness of the corner elements 25 is close to or preferably the same as thickness of the thermal-insulation and drying panels 1, and respectively height of the corner elements 25 is close to or preferably the same as the height of the thermal-insulation and drying panels 1.

[0042] Due to various possibilities of fixing the ventilation grilles 21 to the vents 20 when installing the wall thermal-insulation and drying system, an optional and preferable step is to cover the vents 20 with the ventilation grilles 21 - unless the grilles 21 are pre-integrated (e.g. glued) with the vents 20. In such case the grilles 21 are mounted on the vents 20 preferably by screwing threaded connections or using snap-fit connections. It is also important that, during possible further step of covering the outer surface of already assembled thermal-insulation and drying panels 1 (and corner elements 25 - if present) with a layer of finishing material, e.g. plaster, the vents 20/the ventilation grilles 21 remain unobstructed, and therefore airflow is not disabled.

[0043] In preferred embodiments, material(s) to be used for covering outer surfaces of already assembled thermal-insulation and drying panels should be selected in accordance with commonly used technologies of external plastering on expanded polystyrene substrates. Group of materials which are particularly preferable to be used, includes: plaster, ceramic tiles, paint, mineral-based coating or plastic coating.

Designation of references on figures:**[0044]**

- 1 - thermal-insulation and drying panel
- 2 - outer layer of the thermal-insulation and drying panel
- 3 - inner layer of the thermal-insulation and drying panel
- 4 - first side of the outer layer designed to contact the wall to be insulated
- 5 - second side of the outer layer to be covered with a finishing material
- 6 - ventilation slots
- 7 - extended portions of the ventilation slots
- 8 - contracting portions of the ventilation slots
- 9 - non-extended portions of the ventilation slots
- 10 - horizontal key
- 11 - vertical key
- 12 - horizontal spline
- 13 - vertical spline
- 14 - cavities for fixing elements
- 15 - ventilation duct
- 16 - first positioning tongue
- 17 - first positioning groove
- 18 - roundings of upper ends of the ventilation slots
- 19 - marking defining half of the height of the ventilation duct
- 20 - vents
- 21 - ventilation grilles
- 22 - foil
- 23 - start tray
- 24 - start panel
- 25 - corner element

26 - AIR arc - inlet/outlet air stream

27 - second positioning tongue

28 - second positioning groove

Claims

1. A thermal-insulation and drying panel (1) having a shape composed of two essentially cuboid layers: an inner layer (2) and an outer layer (3), said layers (2, 3) being offset with respect to each other along two perpendicular edges and constitute an integral element,
- whereby in a transition area of outer layer (2) into inner layer (3) a displacement region is present, wherein a first side (4) of the inner layer (3) is designed to contact an insulated wall, and the other side (5) of the outer layer (2) which is not in contact with the inner layer, in an assembled state is arranged to face the surroundings of the insulated wall and is designed to be covered with a finishing material, whereby the panel (1) sides other than the first side and the second side constitute side walls of the panel (1),
- whereby in the inner layer (3), at the first side (4) designed to contact the insulated wall, ventilation slots (6) are spaced at regular intervals, and parallel to each other, extending perpendicularly to longer sides of the panel (1),
- whereby lower portions of slots (6) are extended so that along the run of ventilation slots (6) within a single thermal-insulation and drying panel (1) ventilation slots (6) comprise, starting from the bottom, an extended portion (7) of an essentially constant width, a contracting portion (8) of a variable width and a non-extended portion (9) of an essentially constant width,
- whereby in the displacement region between the inner layer (3) and the outer layer (2), oblong splines and keys are provided, extending along side walls of the thermal-insulation and drying panel (1), whereby a horizontal key (10) is extending along an upper edge of the outer layer (2), while a vertical key (11) is extending along a right edge of outer layer (2), when viewed from the outer side of the thermal-insulation and drying panel (1),
- whereby a horizontal spline (12) is extending along a lower edge of the outer layer (2), so that extensions of ventilation slots (6) pass therethrough, while a vertical spline (13) is extending along a left edge of the outer layer (2), when viewed from the outer side of the thermal-insulation and drying panel (1),
- whereby all oblong keys (10, 11) and splines (12, 13) have slightly convergent cross-section, whereby a depth of the horizontal key (10) in the thermal-insulation and drying panel (1) is greater

- than a length of the horizontal spline (11), whereby at surface portions of the inner layer (3) uncovered by the outer layer (2), cavities for fixing elements (14) are provided for fixing the thermal-insulation and drying panel (1) to the insulated wall, **characterised in that** the lower surface of the horizontal key (10) is additionally deepened towards the lower edge of the thermal-insulation and drying panel (1), whereby said deepening forms a ventilation duct (15), extending essentially perpendicularly to the ventilation slots (6), which contact the ventilation duct (15) at least at the half height of the ventilation duct (15) measured from a bottom of the duct (15), and preferably contact the ventilation duct (15) at least at a section being 0.6 times the height of the ventilation duct (15).
2. The thermal-insulation and drying panel (1) according to claim 1, **characterised in that** at the upper surface of the panel (1) positioning elements are provided in form of first positioning tongues (16) and/or second positioning grooves (28), while at the lower surface of the panel (1) corresponding positioning elements are provided in form of first positioning grooves (17) and/or second positioning tongues (27), respectively.
 3. The thermal-insulation and drying panel (1) according to claim 1 or 2, **characterised in that** the upper portion of each ventilation slot (6) connected to the ventilation duct (15) is arcwise, whereby preferably the arc radius (26) is 35 mm.
 4. The thermal-insulation and drying panel (1) according to one of claims 1-3, **characterised in that** the upper ends of the ventilation slots (6) have rounded side edges, forming roundings (18), whereby preferably the roundings (18) of side edges of upper ends of ventilation slots have a radius ranging from 5 mm to 20 mm, preferably equal to 10 mm.
 5. The thermal-insulation and drying panel (1) according to one of claims 1-4, **characterised in that** the side of the outer layer (2), designed to be covered with a finishing material, is covered with an additional layer of material, preferably selected from a group comprising: plaster, ceramic tiles, paint, mineral-based coating or plastic coating.
 6. The thermal-insulation and drying panel (1) according to one of claims 1-5, **characterised in that** on the outermost surface of the thermal-insulation and drying panel (1), designed to be covered with a finishing material, a marking (19) is provided, extending in parallel with the ventilation duct (15) and defining half of the height of the ventilation duct (15).
 7. The thermal-insulation and drying panel (1) according to one of claims 1-6, **characterised in that** in their non-extended portion the ventilation slots (6) have width ranging from 5 mm to 10 mm, preferably equal 7 mm, and in the extended portion are 15 mm wide, whereby centres of adjacent ventilation slots are spaced apart by a distance ranging from 35 mm to 100 mm, preferably equal 50 mm.
 8. The thermal-insulation and drying panel (1) according to one of claims 1-7, **characterised in that** the total thickness of the panel (1) ranges from 60 mm to 300 mm, in particular from 120 mm to 300 mm, such as 120 mm, 180 mm or 220 mm.
 9. The thermal-insulation and drying panel (1) according to one of claims 1-8, **characterised in that** it is made of a lightweight material having good thermal-insulation properties, preferably of expanded material, in particular expanded polystyrene or polyurethane.
 10. A wall thermal-insulation and drying system, comprising:
 - the thermal-insulation and drying panels (1) defined in any of the claims 1-9,
 - fastening means, preferably wall fasteners and/or an adhesive for fixing of panels to a wall, vents (20), to be arranged in the thermal-insulation and drying panels (1), whereby length of the vents (20) corresponds to the length measured between the ventilation duct (15) and the outer surface of the thermal-insulation and drying panel (1) which is designed to be covered with finishing material,
 - ventilation grilles (21), suitable for covering of outer holes of the vents (20),
 - a foil (22) for separating individual vertical air ducts, each time defined by the vents (20), the ventilation slots (6) and the ventilation ducts (15), whereby the foil is designed to be arranged between the horizontal spline (12) and the horizontal key (10) of predetermined and adjacent thermal-insulation and drying panels (1),
 - start trays (23) for placing therein a first row, starting from the bottom, of the thermal-insulation and drying panels (1) or truncated portions of the thermal-insulation and drying panels (1),
 - start panels (24) for being placed in the start trays (23) under the thermal-insulation and drying panels (1) or the truncated portions of the thermal-insulation and drying panels (1).
 11. The system according to claim 10, **characterised in that** it further comprises:
 - corner elements (25) for being placed at corners and/or side ends of the wall thermal-insulation and drying system, said corner elements (25) are square

in cross-section, whereby a side width of this square cross-section is equal to total thickness of the thermal-insulation and drying panels (1).

from a group comprising plaster, plastic, paint and ceramic tiles.

12. A method of installation of a wall thermal-insulation and drying system, comprising the following steps:

- a) installing a start tray (23) on a wall using fastening means, preferably wall fasteners and/or adhesive for attaching the panels to the wall; 10
- b) inserting a start panel (24) into the start tray (23),
- c) placing the thermal-insulation and drying panel (1) or the truncated portion of the thermal-insulation and drying panel (1) on the start panel (24) inserted into the start tray (23), 15
- d) fixing the thermal-insulation and drying panels (1) or the truncated portions of the thermal-insulation and drying panels (1) to the wall using fastening means, 20
- e) arranging vents (20) in the thermal-insulation and drying panels (1) so that they extend from the outer surface of the thermal-insulation and drying panels (1) to the horizontal ventilation ducts (15) in the thermal-insulation and drying panels (1), 25

whereby adjacent horizontal rows of the thermal-insulation and drying panels (1) are fixed with a horizontal offset to each other, 30

whereby between predetermined horizontal rows of the thermal-insulation and drying panels (1), the horizontal key (10) in the upper portion of the thermal-insulation and drying panel (1) is covered with foil (22) to define vertical air ducts, preferably spaced at regular intervals equal to the height of a storey, 35

characterised in that the thermal-insulation and drying panels (1) as defined in any of the claims 1-9 are used. 40

13. The method according to claim 12, **characterised in that** edges of the thermal-insulation and drying panels (1) fixed to the walls are secured with cuboid corner elements (25) having a square base with a side length equal to the thickness of the thermal-insulation and drying panels (1). 45

14. The method according to claim 12 or 13, **characterised in that** the step e) is followed by a step f): 50
- f) covering exhausts of vents (20) with ventilation grilles (21).

15. The method according to one of claims 12-14, **characterised in that** after installing all the thermal-insulation and drying panels (1), outer surface thereof, designed to be covered with finishing material, is covered, except from the ventilation grilles (21), with an additional layer of material, in particular selected 55

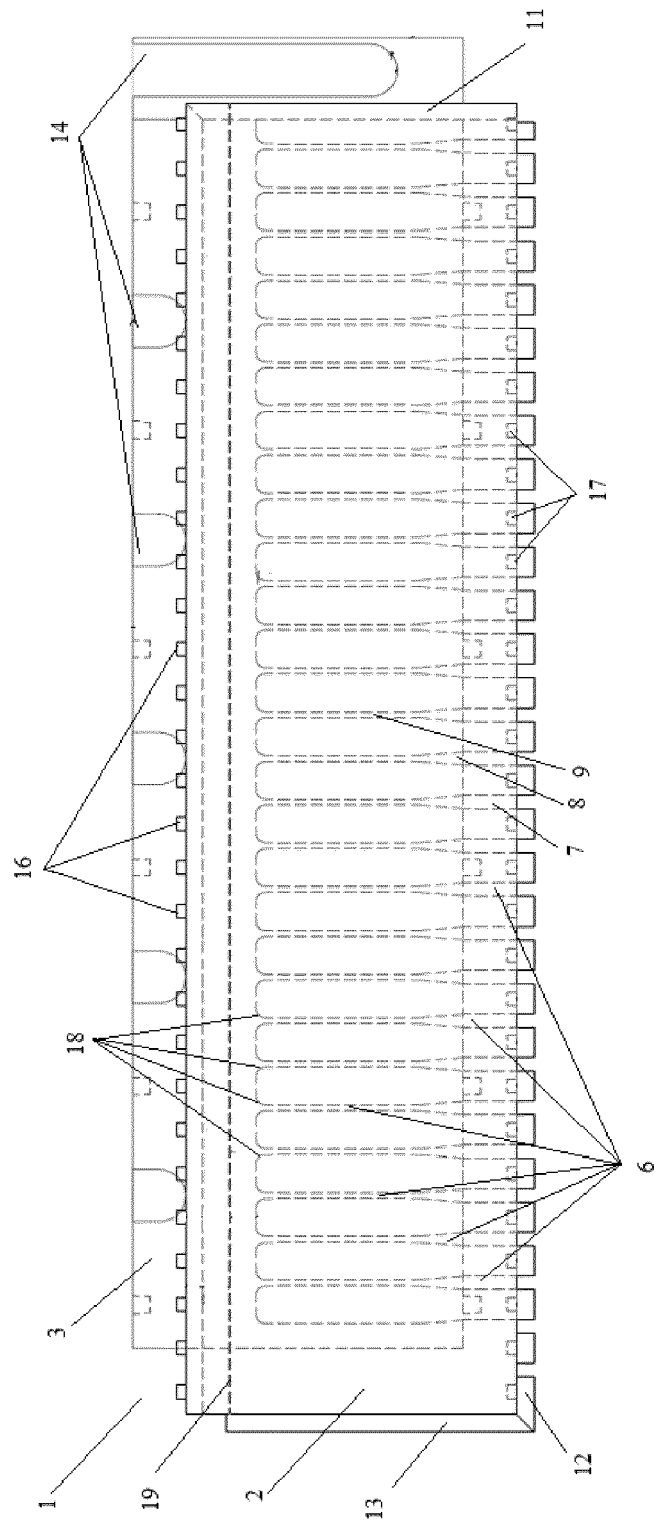


Fig. 1

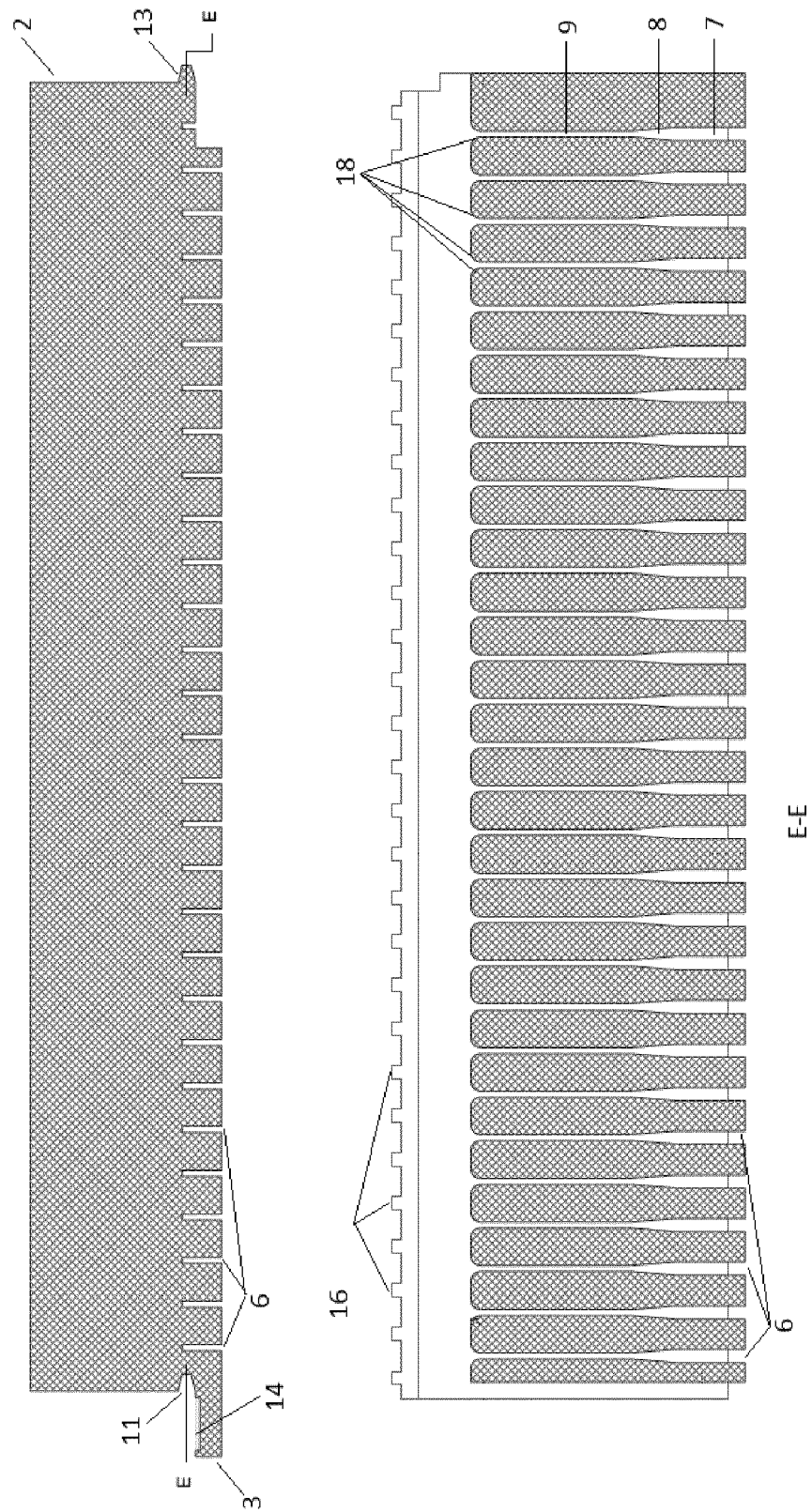


Fig. 2

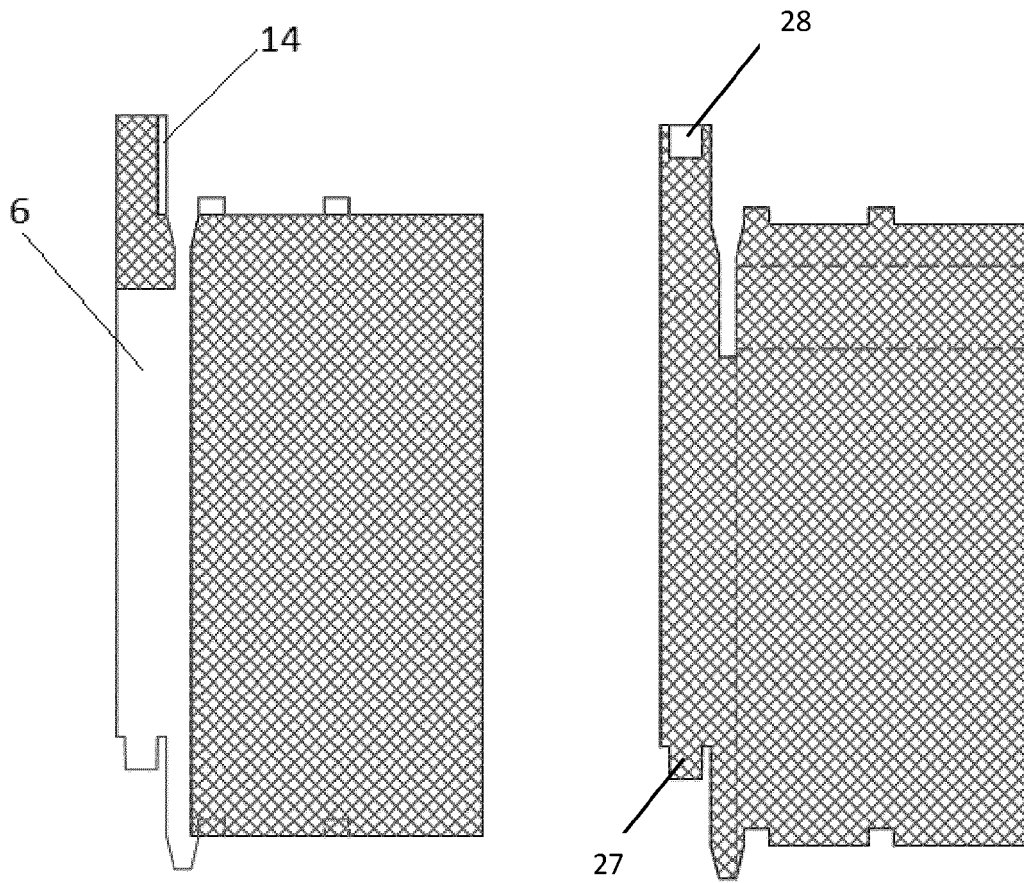


Fig. 3

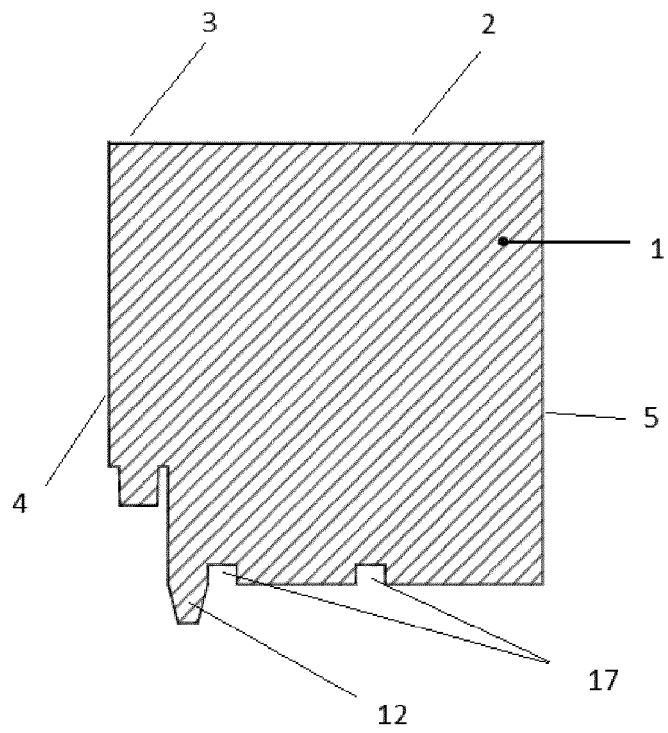


Fig. 4

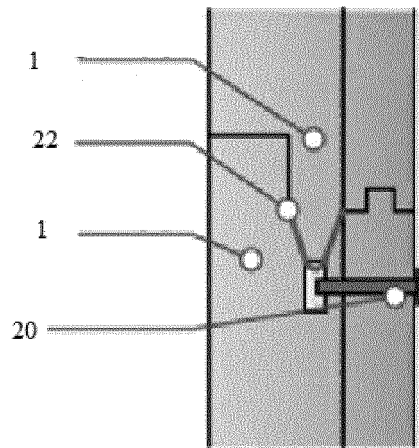


Fig. 5

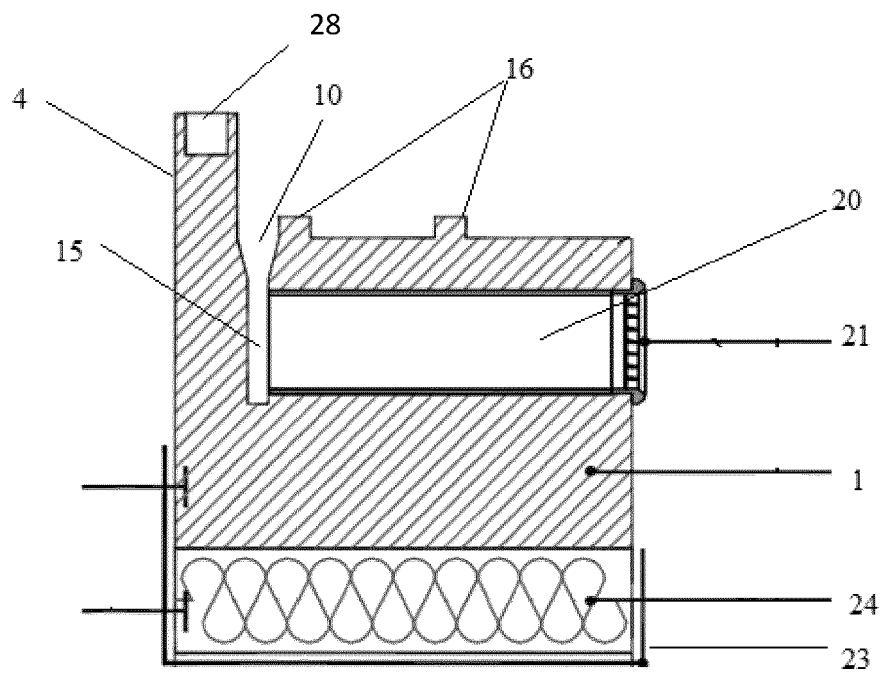


Fig. 6

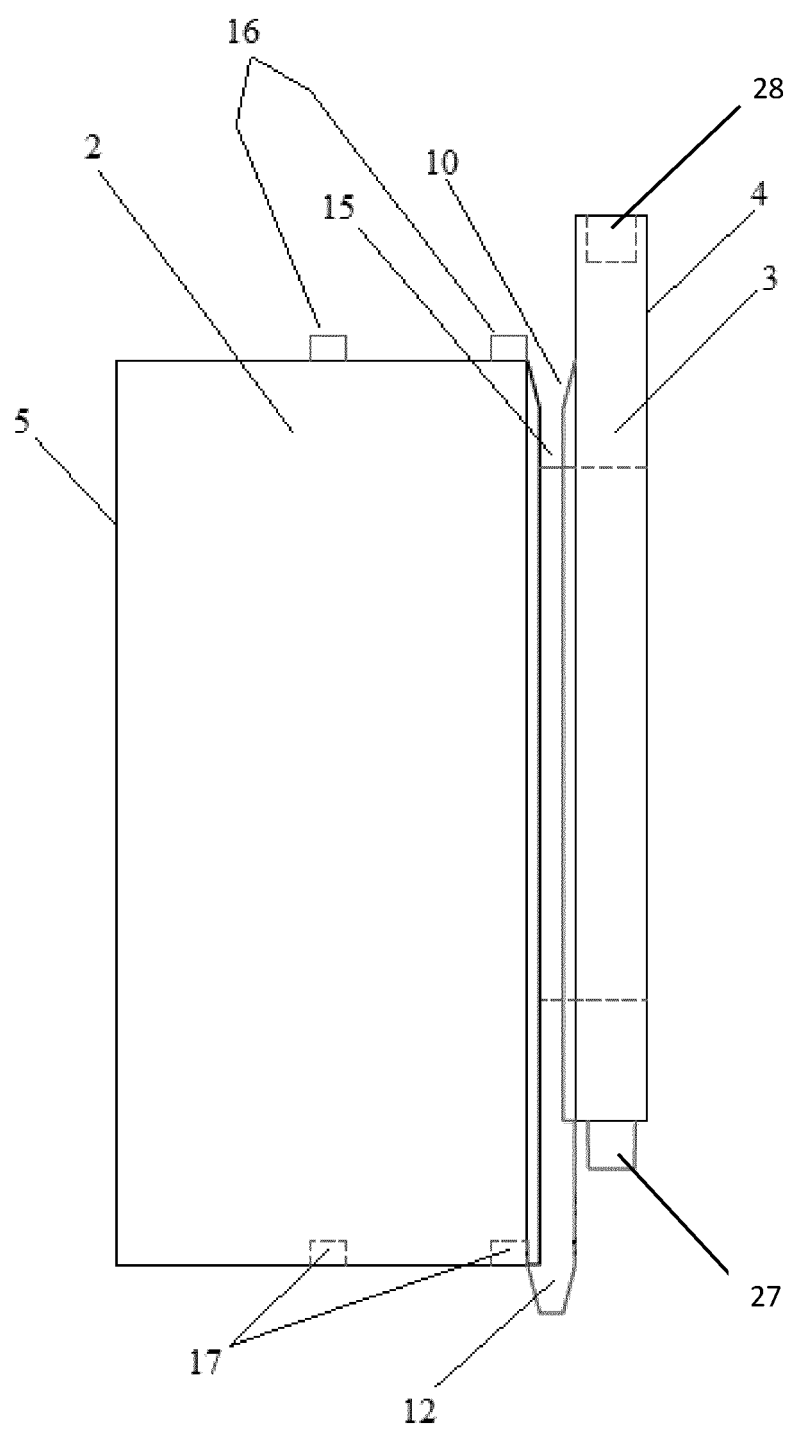


Fig. 7

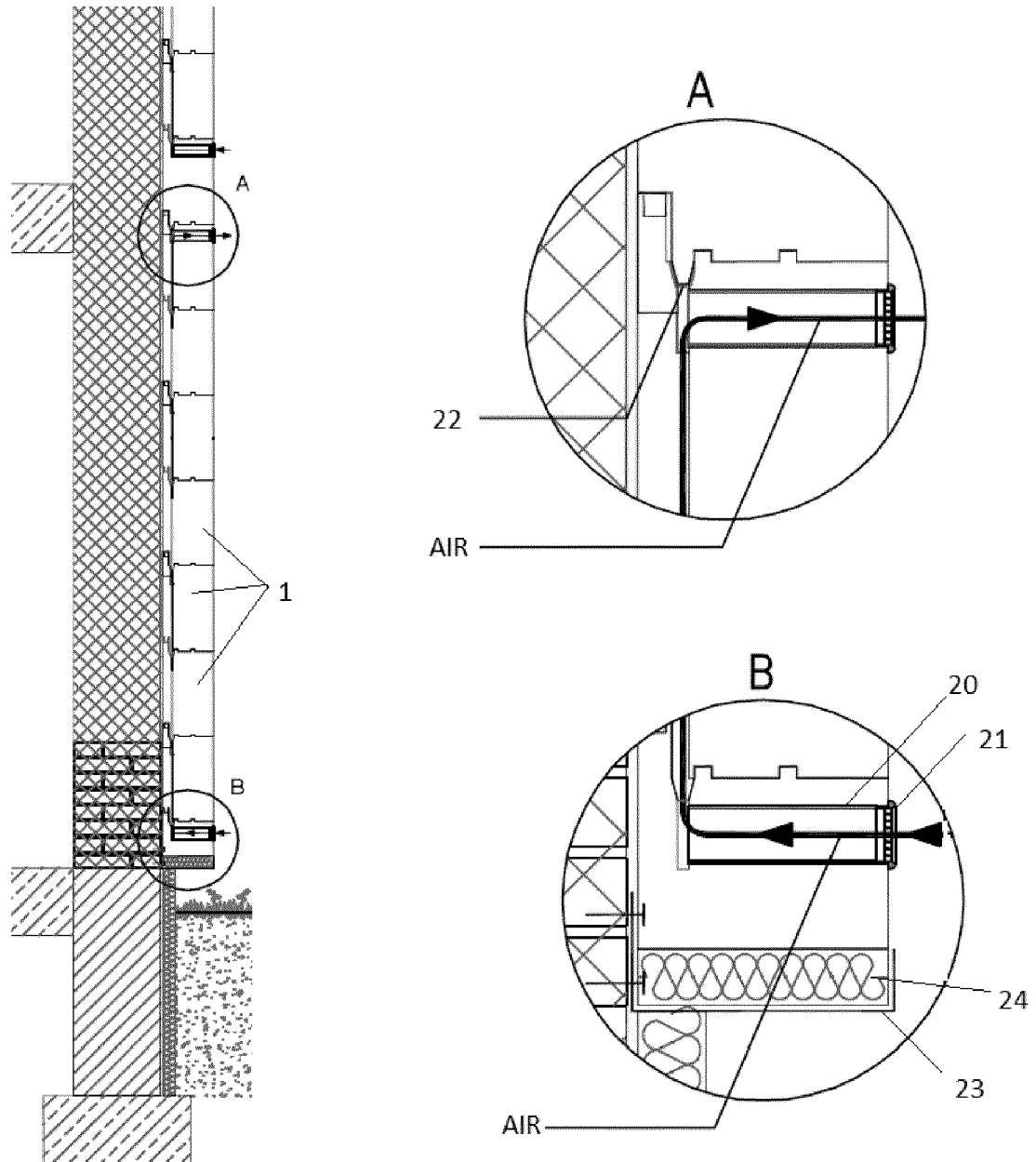


Fig. 8

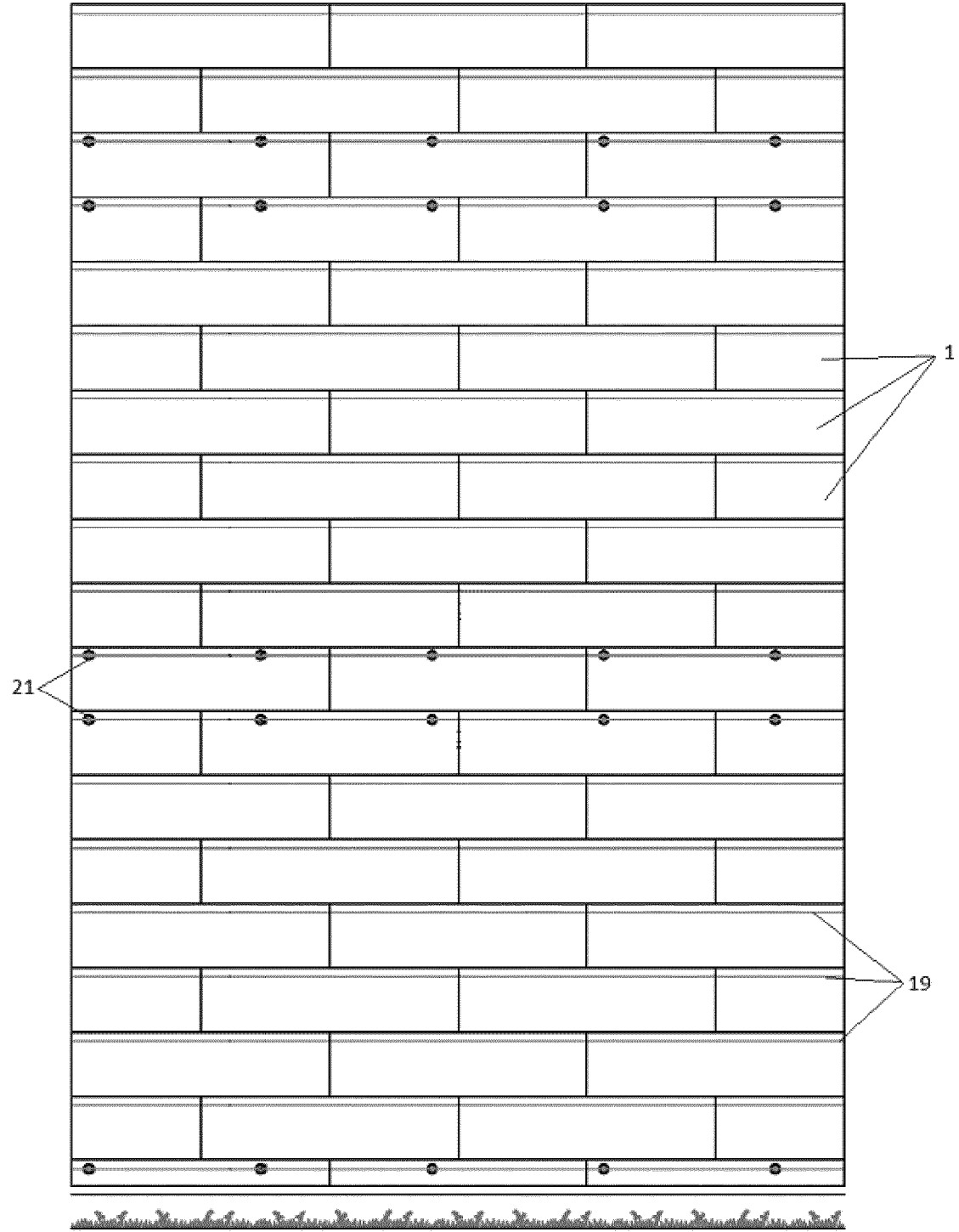


Fig. 9

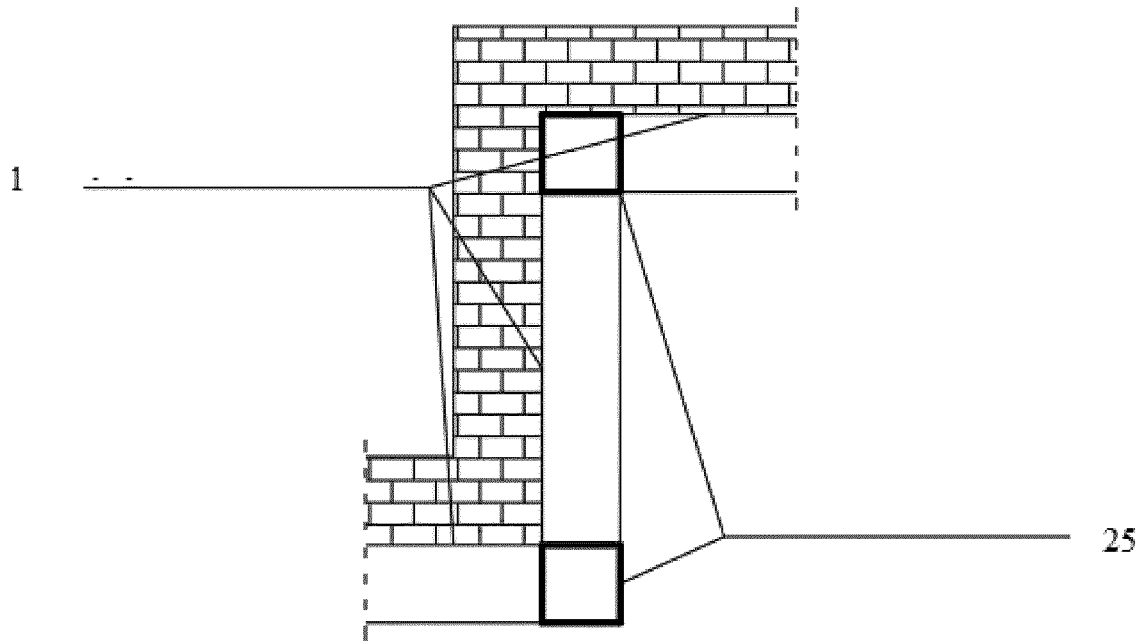


Fig. 10

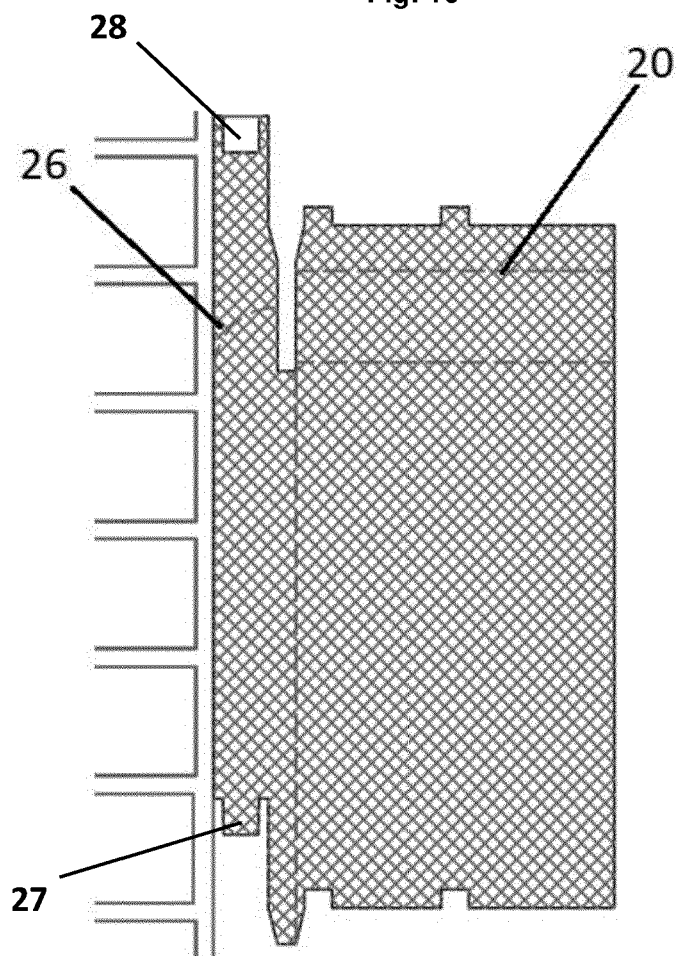


Fig. 11

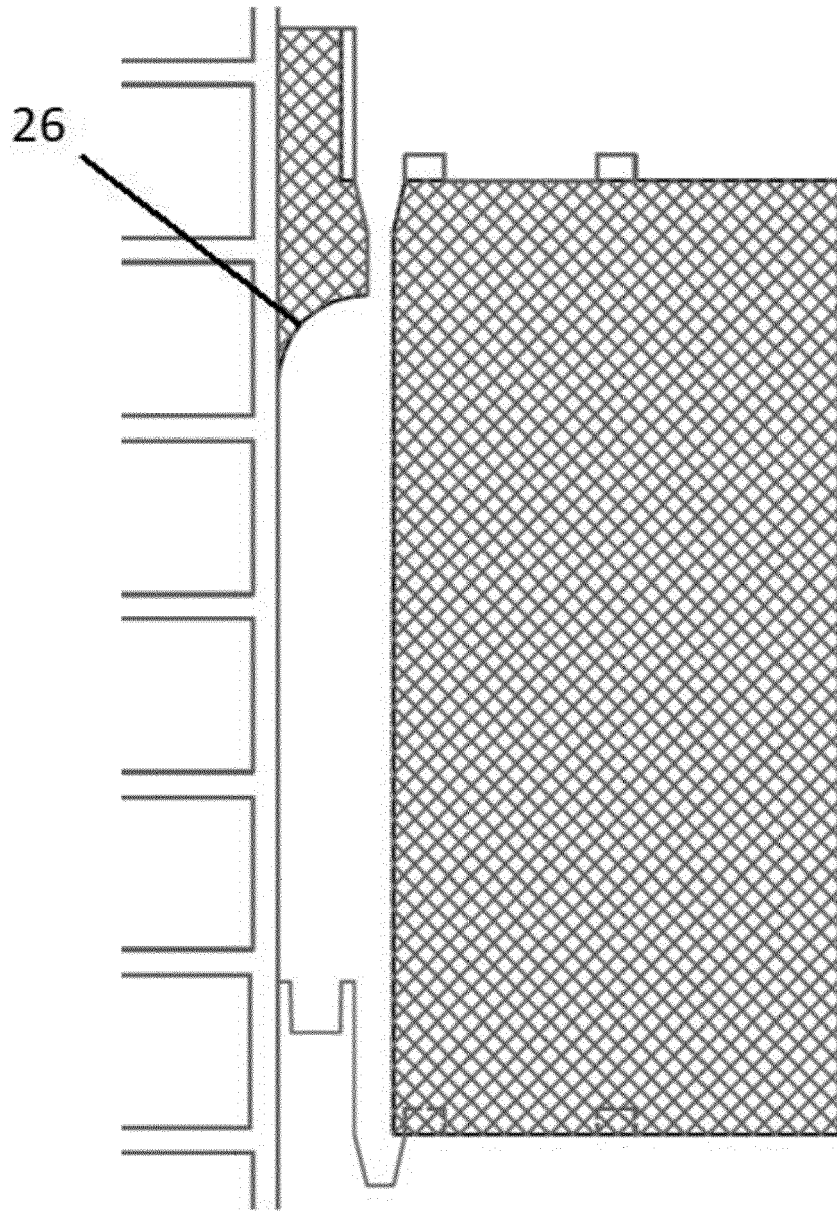


Fig. 12



EUROPEAN SEARCH REPORT

Application Number
EP 19 46 1612

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			TECHNICAL FIELDS SEARCHED (IPC)
			E04B E04C E04F F24S
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 May 2020	Examiner Petrinja, Etjel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 46 1612

5 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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18-05-2020

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