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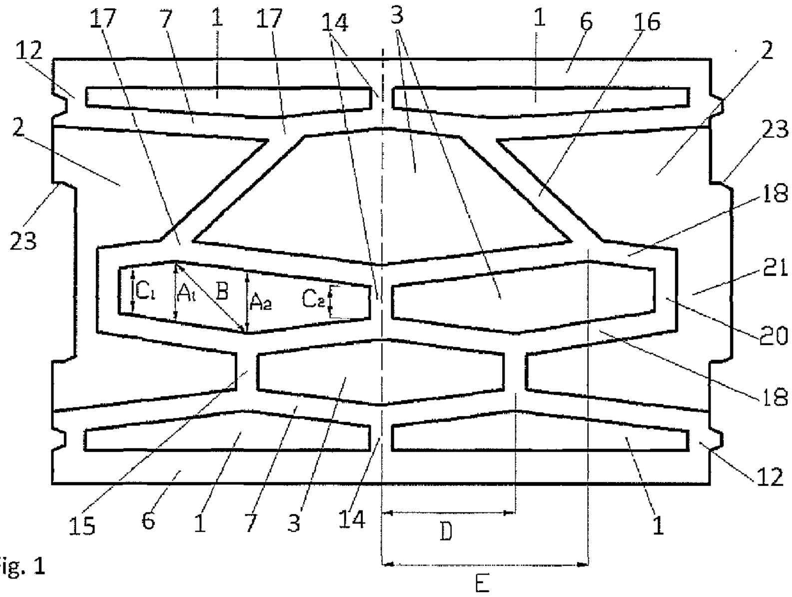

Fig. 1

(57) Abstract: A wall element with heat-insulating core made of heat-insulating materials with strength sufficient to enable formation of supporting matrix, for which, during its production, it forms part of a mould, it contains at least two internal blocks (3) the widths of which (A_1, A_2) at the point of contingence of the joint (11) or (17) or transverse wall (15) to their longitudinal surface is smaller than the distance (B) between the joint or transverse wall abutting the longitudinal surface of the block on one side and the joint or transverse wall abutting the longitudinal surface of that block on the other side, whereas the direct joints and perpendicular transverse walls or oblique joints that connect one pair of adjacent longitudinal walls are spaced from the middle of the element at a distance different from the distance between the middle of the element and joints or walls that connect the next pair of adjacent longitudinal walls.

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Wall element with a heat-insulating core

The invention relates to a wall element with a heat-insulating core integrated with continuous matrix, the wall element being designed for constructing single-layer walls of building structures, including passive and zero-energy buildings.

Energy conservation and sustainable development are gaining in attention, which means that new walls of buildings must exhibit increasingly higher thermal insulating power. In order to meet current heat insulating requirements for walls, increasingly thick layers of heat insulators have to be used. These are applied mainly in double-layer wall systems, where the structural layer is covered with an insulating layer, usually of foamed polystyrene or mineral wool, the thickness of which is 20, 30 or more centimetres. Such a thick insulator layer causes many problems, both during the construction process and afterwards, especially when foamed polystyrene is used as the insulator, and foamed polystyrene is a preferred heat insulation material in the construction industry due to its relatively low price and low sensitivity to moisture. Its disadvantages include low strength, dimensional change proceeding over time after repetitive heating and cooling cycles, and high sensitivity to fire. These drawbacks become more prominent with increasing thickness of the external insulator layer applied onto the wall.

Known to the art are building elements with air-filled voids, wherein the inner walls are formed into various shapes, e.g. along a broken wavy line. These elements are usually bricks or concrete elements. Irrespective of the manner the inner walls are shaped in these elements, using air-filled voids as an insulator substantially reduces the effect that would have been produced by the shaping of the inner walls. Air is a good insulator, provided that two conditions are satisfied: firstly, there must be no possibility of convective movements and, secondly, the air must be dry. Neither of these conditions is satisfied in the elements described. Air contained in voids is subject to free convective movements, and its humidity is same as that of the wall, which is quite substantial, 6 to 12 % on the average, often higher. Shaping of the walls of the matrix in a manner that lengthens the thermal bridge formed by the matrix which shapes and encloses the air-filled voids, causes significant, as compared to walls joined in traditional manner at right angles and forming parallel layers, increase of the contact area between the matrix wall and air in the voids and, consequently, significantly increases the heat exchange surface area between the matrix wall and the air enclosed thereby. This enhances convection movement and heat exchange between the matrix and air and between air and the next layer of the matrix. Therefore, in the elements with air-filled voids it is the number of layers of voids that is much more important than the shape of the voids.

The Polish patent PL 181846 discloses a building element consisting of a shaped continuous core comprising geometric blocks, preferably made of a heat-insulating material and of a matrix that fills the voids of the core formed between these blocks. The continuous core has at least one plane parallel to the base of the core, in which plane the end faces of the geometric blocks lie. The geometric blocks are arranged in at least two rows, forming a labyrinth, wherein the blocks of one row are connected to the blocks of the second row by means of connecting members that are integral with the said blocks.

In the known building elements, in which the supporting matrix has such an intricate and fragile structure, and in which the insulating material separates the supporting matrix into individual fragments, the matrix demonstrates high sensitivity to breaking forces acting either along the length or the width of the element. This is due to the fact that the insulating material penetrates into the matrix wall to a certain depth at various points, starting from the upper and lower surfaces, which in addition to reducing the cross section of the concrete layer at this point, causes a notch effect that further promotes breaking of the layer with the notch. Because of this effect special precautions must be taken when transporting, handling and laying the elements. Structural capabilities of the elements are also diminished due to this effect. Moreover, at the level of the parting plane, as well as above and below the connecting members of the insulating blocks, the heat flow path is relatively short as compared to the rest of the element. As a result the thermal uniformity and the overall heat insulating power of the element is reduced, and full advantage cannot be taken of the heat insulating properties of good insulating materials, such as Neopor.

Elements described in patent application PL 341998 have voids in the form of recesses, therefore the portion of the supporting matrix that is below the recesses and that encompasses all walls of the element constitutes a large direct thermal bridge. Moreover, the supporting matrix is shaped in such manner that its transverse walls in fact form direct thermal bridges. Even the inner transverse walls that connect the longitudinal layers of concrete and are arranged at a certain angle in relation thereto do not extend the thermal bridge that the matrix forms. These walls are only arranged in such manner that the transverse wall that connects the longitudinal walls is slightly shifted in relation to the transverse wall that connects the next longitudinal layer. This configuration of the transverse walls of the matrix can provide only a minor effect in the theoretical calculation of the insulating power of an element with no consideration given to the fact that the heat flows along a path of lower thermal resistance, that is without taking into account the fact that the heat flux bypasses the insulator and flows along the supporting matrix. The side surfaces of the element also form a direct thermal bridge. The oval pocket in the middle part of the side surfaces does not extend the thermal bridge to a degree that could have any effect on the insulating power of the entire element. Moreover, the elements according to application PL 341998 have a closed outline and a very unfavourable ratio of length to width. As a result the structure of these elements is characterised by a large number of direct thermal bridges and a very large area of thermal conduction in relation to the surface area of the entire element. Consequently the travel path of heat is very short and the effect of heat bypassing the insulating material in these elements is very pronounced. The use of good insulating materials in these elements is ineffective. Using materials of decreasing thermal conductivity will result in an increasing heat flux flowing through thermal bridges that bypass the insulating material. The disproportion between the thermal conductivity of the supporting matrix material and that of modern insulating materials that may be used to fill the voids in the element is enormous. The thermal conductivity of lightweight concrete adopted in the patent application PL 341998, that is of a concrete having a density of 1100 kg/m^3, is ca. 0.3 - 0.2 W/mK, while that of, for instance, Neopor, is 0.031 W/mK, so it is obvious that the heat flux will substantially bypass the insulating material and, what is more important, with such thermal resistance imbalances, the side surfaces and the bottom surface of these elements will form a very large direct thermal bridge, which is unacceptable in modern wall construction. For this reason the author of that solution envisages the use of a material of poor insulating performance, such as a mixture of foamed polystyrene pellets with lime and cement binder. The result is an element with a U coefficient of 0.28 W/m^{2}K, as specified by the author. This is much below the performance required of energy-efficient homes.

Patent no. US 5209037 describes a building element which has a matrix separated and at the same time retained by an insulating core of serpentine shape and of distinctly curvilinear structure resembling the letter "T or "omega" and fragments thereof. Such shape of the insulating core which is inseparable from the matrix ensures the retaining of the matrix halves and enables building a wall with a core of continuous structure. Despite some modifications made in relation to the previous solution disclosed in US 4551959, the building element is still sensitive to damage and it is not possible to change its thickness, since there is no rigid connection between both end faces. Increasing the thickness of the insulating portion in order to attain insulation necessary in energy-efficient homes would require the use of additional connections between layers of concrete separated by insulating material, the said connections having the form of anchors or meshes applied during wall construction. These elements are not structurally compact.

Polish patent application PL 361566 describes a building element which comprises a matrix consisting of an inner and an outer wall, between which is disposed an openwork insert having the form of ribs, and the spaces between the ribs and the walls of the matrix being filled with heat-insulating core. The matrix has ribs arranged in an undulating manner between the walls of the matrix, wherein at least one line of the ribs consists of ribs wider than the other ribs, and wherein the cores adjacent to the outer wall are wider than those adjacent to the inner wall. In these elements the relatively long path for the heat flux bypassing the insulating material is attained by making the entire component relatively long and by providing only a small number of ribs of the matrix constituting connecting members of longitudinal ribs. Therefore, in order to make the element sufficiently rigid and strong enough to withstand forces acting in the horizontal plane, the ribs of the matrix are formed in such way as to provide support for the end faces of the elements, as is the case in vaults and other arched structures. As a result the blocks of insulating material, in their horizontal section, take on the shape of convex polygons. The result is that the resistance of the elements with regard to forces acting in horizontal planes is increased. However, the path of heat flux bypassing the insulating blocks and running through the ribs of the matrix is shortened and all walls of the matrix are shaped in a manner consistent with the overall temperature gradient. For this reason, the elements according to patent application PL 361566 must be made of lightweight concrete of low thermal conductivity. Moreover, the shortening of the path of heat bypassing the insulating blocks is compensated by making the entire element relatively long, which additionally implies the use of lightweight concrete to control the resulting weight of the element. The compensation of the shorter path of heat flux bypassing the insulating blocks by using lightweight concretes of low thermal conductivity, and thereby of relatively low compressive strength, imposes some restrictions on the applicability of these elements as structural elements.

Wall elements that contain in its interior a heat insulating material, one of such elements being the one that is the subject of this invention, as a rule, have one major drawback: these elements, and walls made of these elements, have lower heat insulating power than that of the walls made of standard elements that contain no insulating material and are made of the same material as the supporting matrix of the elements with insulating blocks and that are covered with a continuous layer of insulating material obtained from the same amount of identical insulating material. Any decrease in the insulating capacity, resulting from the use of internally applied insulating material in the element rather than covering the element with a continuous outer layer of an identical insulating material, is a loss in relation to the materials used. Currently efforts are made to obtain increasingly low values of heat transmission. Lowering the thermal conductivity of a partition by at least a hundredth of W/m^2K is deemed a success.

The object of the present invention is to provide a structural wall element integrated with a heat-insulating material in a manner that makes maximum use of its heat-insulating properties, the wall element being used to construct single-layer walls of building structures, including passive and zero-energy buildings, that is walls of decreasingly low U coefficient of 0.1 W/m^2K or less, and the wall element having the structural properties of standard elements, such as those with no heat insulator or those that meet the requirements of current wall heat insulation standards and with their width being less than that of elements offered currently on the market, with the capability of using typical aggregates available on the market for forming the supporting matrix of the element, and binders with continuous supporting matrix forming the end faces of the element and providing structural integrity and vapour permeability irrespective of the heat-insulating material used for the heat-insulating core, eliminating thereby the disadvantages of the insulator, and emphasising its advantages while reducing losses in heat-insulating power in relation to that of insulating material applied on the wall.

The essence of the invention is a wall element with heat-insulating core made of heat-insulating materials with strength sufficient to enable formation of supporting matrix, for which, during its production, it forms part of a mould, the heat-insulating core containing face blocks connected by means of connecting members, side blocks forming part of the side surfaces of the elements and penetrating inside the element, and internal blocks, the heat-insulating core further integrated by means of interpenetrating shapes and forces of adhesion with the continuous supporting matrix forming the faces and part of the side surfaces of the element, the supporting matrix filling the spaces between the blocks of the core and containing longitudinal face walls and longitudinal internal walls, interconnected by means of direct joints: face side joints, interfacial side joints, middle-line joints, off-middle-line joints, or by means of transverse walls perpendicular to the faces of the element: side walls, interfacial side walls, middle-line walls, off-middle-line walls, or by means of transverse walls oblique to the faces of the element and connected with the longitudinal walls by means of oblique middle-line joint and oblique off-middle-line joint, wherein the element contains at least two internal blocks the widths of which at the point of contingence of the joint or transverse wall to their longitudinal surface is smaller than the distance between the joint or transverse wall abutting the longitudinal surface of the block on one side and the joint or transverse wall abutting the longitudinal surface of that block on the other side, whereas the direct joints and perpendicular transverse walls or oblique joints that connect one pair of adjacent longitudinal walls are spaced from the middle of the element at a distance different from the distance between the middle of the element and joints or walls that connect the next pair of adjacent longitudinal walls.

Preferably, the width of the block at the point of contingence of the joint to the longitudinal surface of the block is greater than the width of that block at the point of contingence of the block to the wall confining that block or to the joint of the wall confining that block or to the joint directly confining that block.

The element preferably contains at least one internal block to which abuts a joint or a wall transverse to one longitudinal surface of that block.

Preferably the element according to the invention contains at least one internal longitudinal wall the length of which is smaller than the length of the entire element, wherein between the shorter internal longitudinal wall or the direct interfacial joint or the side wall or the side interfacial wall that connects that internal longitudinal wall with adjacent longitudinal wall and the side surface of the element is a layer of heat-insulating core.

Preferably the portion of longitudinal wall located between adjacent joints of subsequent longitudinal walls has, along its length, a segment which, for the flow of heat along the supporting matrix, is oriented opposite to the general direction of the flow of heat across the entire element.

The element preferably has an insulation zone and a support zone, wherein in the support zone there is at least 60% of the supporting matrix volume in the form of at least one longitudinal wall of the matrix which is wider than the longitudinal walls in the insulation zone, or in the support zone there is more longitudinal or transverse walls of the supporting matrix than in the insulation zone.

The element according to the invention, having side surfaces shaped in the form of tongue and groove locks, may have at least one side surface of the tongue or of the groove formed by a side block, and then preferably the tongue is wider than the groove.

It is desirable that side blocks create a lock between abutting elements in the form of a dovetail joint.

The subject of the invention is illustrated in drawings, of which Figs. 1, 2, 4, 5, 6 and 7 depict top views of examples of heat-insulating cores, Fig. 3 depicts side view of the example of a heat-insulating core the top view of which is depicted in Fig. 2, Figs. 8 and 9 depict axonometric views of the examples of heat-insulating cores the top views of which are depicted in Figs. 2 and 4, respectively.

The heat-insulating core includes face blocks (1), side blocks (2) and internal blocks (3) connected by means of connecting members the height of which is less than that of the blocks being connected, wherein connecting members (4) are located inside the core between horizontal surfaces or connecting members (5) abut one of the horizontal surfaces of the element.

Between the blocks or between the blocks and the surface of the element there are intercommunicating spaces designed for the application therein of the material that will form the supporting matrix of the element. The supporting matrix includes longitudinal face walls (6) and longitudinal internal walls (7, 18), and the adjacent longitudinal walls are interconnected by means of direct joints: face side joints (8), interfacial side joints (9), middle-line joints (10), off-middle-line joints (11), or by means of transverse walls perpendicular to the faces of the element: side walls (12), interfacial side walls (13), middle-line walls (14), off-middle-line walls (15), or by means of transverse walls oblique to the faces of the element: oblique walls (16) connected with longitudinal walls by means of oblique joints (17), wherein between internal longitudinal walls there are at least two internal blocks having a width (A) at the point of contingence of a transverse wall or joint to their longitudinal surface, said width being smaller than the distance (B) between the joint or transverse wall abutting the longitudinal surface of the block on one side and the joint or transverse wall abutting the longitudinal surface of that block on the other side, whereas the width (A) at the point of contingence of a transverse wall or joint to the longitudinal surface of the block is greater than width (C) of the block at the point of its contingence to the transverse wall that confines that block or at the point of contingence of the oblique joint of the oblique wall that confines that block or at the point of contingence of the block to the direct joint that confines that block - then the width (C) approaches zero, and the direct joints and perpendicular transverse walls or oblique joints of oblique walls that connect one pair of adjacent longitudinal walls are spaced from the middle of the element at a distance different from the distance between the middle of the element and joints or walls that connect the next pair of adjacent longitudinal walls. These distances are depicted in Figs. 12, 13, 14 and 15, where (D) is the distance of the joint or transverse wall closer to the middle of the element or equal to zero in one layer, and (E) is the distance of the joint or transverse wall in the next layer, more distant from the middle of the element.

As has been demonstrated by tests of the heat-insulating power of elements illustrating the heat flow in elements known to the prior art, when the insulator block dimension parallel to the face of the element is greater than the dimension perpendicular to the surface of the element, the heat flowing across that block between direct joints of longitudinal walls or between joints of longitudinal walls with transverse walls, said joints abutting in the same axis the longitudinal surfaces of the block on its both sides, is relatively large relative to the heat bypassing that block. The location of joints abutting the longitudinal surface of the block at its both sides at different distances from the transverse axis of the block results in a significant increase in the overall thermal resistance of the system, despite the path length for the heat stream bypassing the block remaining unchanged in comparison to the system with the joints abutting the longitudinal surfaces of the block at its both sides lying in the same transverse axis of the block. That effect is increased when the width of the block at the point of contingence of the joint to the longitudinal surface of the block is greater than the width of that block at the point of contingence of the block to the wall confining that block or to the joint of the wall confining that block or to the joint directly confining that block. When the insulator block and supporting matrix surrounding the block are shaped according to the invention, the heat-insulating power of the system is increased to such a degree that it becomes possible to make the supporting matrix of materials with thermal conductivity of 0.10 - 0.40 W/mK or even higher, depending on the type of insulating material used. This expands the range of construction materials that can be used in comparison to those currently used in elements for single-layer walls and it becomes possible to make elements for single-layer walls of passive and zero-energy buildings, these elements having good structural properties and improved heat-accumulating properties, or to make structural elements that meet the requirements of current heat insulation standards with the thickness of the wall being thinner than before, for instance: elements of aerated concrete offered now for single-layer walls with a width of 480 mm have, at the most, a compressive strength of 2 MPa and a U coefficient of 0.19 W/m^2K, while an example of an element of the same width (480 mm) according to this invention with a heat-insulating core made of Neopor (thermal conductivity 0.031 W/mK) and with supporting matrix made of lightweight aggregate concrete (thermal conductivity 0.18 W/mK) has a compressive strength of 2.0 MPa and a U coefficient of 0.1 W/m^2K, which means that its heat-insulating power is much greater than that of the element of aerated concrete of the same strength, and if the element according to the invention is to have the same U coefficient as the element of aerated concrete (i.e. 0.19 W/m^2K), then its width will be 320 mm and its compressive strength 4 MPa. In addition, the parameters of the elements according to the invention can be adjusted within a relatively wide range depending on the type of insulating material and supporting matrix material used for their production. The use of a material of relatively high thermal conductivity of 0.2 W/mK, and consequently of relatively high compressive strength, enables minimising the quantity of the supporting matrix while retaining structural values of the elements. When materials of low thermal conductivity of less than 0.20 W/mK are used, the width of the elements according to the invention can be less than that of the currently available single-layer walls of identical thermal properties, or the U coefficient of the elements according to the invention can be lower than that of the currently available single-layer walls of identical width, and in addition these elements enable constructing walls of excellent properties, that is of U coefficient of 0.2 to 0.1 W/m^2K, using traditional and simple masonry methods, and they minimise the risk of making masonry errors.

Preferably the element according to the invention contains at least one internal longitudinal wall (18) the length of which is smaller than the length of the entire element, wherein between the shorter internal longitudinal wall or the direct interfacial joint (19) or the side wall (20) or the side interfacial wall that connects that internal longitudinal wall with adjacent longitudinal wall and the side surface of the element is a layer of heat-insulating core (21). In the case of insulating blocks according to the invention, it was found that despite substantial shortening of the path of heat flow bypassing the block due to shortening of the internal longitudinal walls, the thermal resistance of the entire system has increased, and in addition the proportion of side blocks forming the side surface of the element has increased, increasing thereby the insulating power of the joint between two elements in a wall, said joint being usually a weak point in single-layer walls. In addition it is easier to shape the locks that replace the vertical joint in a wall and to shape the handle. Examples of elements with shorter longitudinal walls are shown in Figs. 16, 17, 18 and 19, 32, 33 and 34.

When thermal uniformity of an element is of particular importance, or when the thermal resistance of the supporting matrix is low, or when the distance between the joint abutting the longitudinal surface of the block and the joint confining that block is relatively short, then the portion of the longitudinal wall located between the joints has, along its length, a segment (22) which, for the flow of heat along the supporting matrix, is oriented opposite to the general direction of the flow of heat across the entire element, increasing thereby the thermal resistance of this portion of the longitudinal wall for the heat flow bypassing the block and additional dissipation of the heat flux. An embodiment of such element is shown in Figs. 20 and 21, where arrows T1 and T2 indicate the general direction of heat flow across the element when T1 > T2, and arrows T3 indicate the direction of the path formed by the supporting matrix for the heat flow.

Wall elements with an integrated heat insulator constitute some compromise between the heat insulating power of the element and its mechanical strength. In order to obtain the best heat insulation properties of the element according to the invention, it is preferable to uniformly distribute the walls of the supporting matrix and of blocks of the heat-insulating core between the face surfaces in horizontal cross section. Examples of elements featuring uniform distribution of the supporting matrix and of the blocks are shown in Figs. 22 and 23.

When it is desirable that the element according to the invention be characterised by higher structural strength, then in the portion of the element closer to the interior of the building is located most of the supporting matrix in the form of thicker walls of the supporting matrix or in the form of a higher number of walls of the supporting matrix located in the middle of the element looking from the interior of the building. In this way, a bearing area of the element is created to support the element on the foundation with the possibility of extending it beyond the foundation and of supporting ceiling slabs, ring beams, bearing joists or bearing parts of lintels. Due to such configuration of the supporting matrix, the bearing zone occupies relatively little of the width of the element, allowing for proper wall insulation at the level of ceiling slabs, bearing joists and lintels, which in single-layer walls is not straightforward. The division of the element into the bearing zone and insulating zone is illustrated in Figs. 24 and 25, where SI is the insulating zone and SN is the supporting zone, wherein Figs. 24 and 25 show examples of elements comprising a higher number of matrix walls in the bearing zone, Figs. 26 and 27 show examples of elements with a wider face wall in the bearing zone, and Fig. 28 shows an example of an element with a wider internal longitudinal wall, and Fig. 29 shows an example of an element comprising a higher number of transverse walls in the bearing zone.

In order to facilitate masonry work, the element according to the invention has side surfaces shaped in the form of tongue and groove locks, wherein at least one side surface of the tongue or at least one side surface of the groove is formed by the block of the heat-insulating core adjoining the side surface of the element, ensuring thereby a heat-insulating continuity along the locks that join adjacent elements, and due to certain flexibility of the material of the heat-insulating cores the tightness of the lock is ensured, preferably when the tongue is wider than the groove. Examples of elements with tongue and groove locks are shown in Figs. 30, 31 and 32. Fig. 30 shows an example of an element with side surfaces of the groove (23) formed by blocks and with side surfaces of the tongue (24) formed by the supporting matrix. Fig. 31 shows an example of an element with one side surface of the groove and of the tongue formed by a block and second side surface formed by the supporting matrix. Fig. 32 shows an example of an element with a groove and a tongue formed completely by a block.

During masonry work, there may be a problem with glue or mortar accumulating between the side surfaces of the wall elements placed in sequence on the wall, which may prevent moving them close enough one to another. To avoid this, the element being placed must first be moved towards the previous one over the horizontal joint and then lowered vertically to the joint. As experience shows, this creates some problems. If it is essential to avoid them, the elements according to the invention have locks within the blocks adjacent to the side surfaces of the element in the form of dovetail joints, due to which subsequent elements are placed properly on the wall in an easy manner, and additionally providing tightness of the joint and excellent continuity of heat insulation in the critical area of the wall, being the vertical locking of subsequent elements without the use of glue or mortar. An example of an element with a dovetail lock is shown in Figs. 33 and 34.

Figs. 1, 35, 36, 37 and 38 show embodiments of elements according to the invention with various examples of the shapes of the heat-insulating cores and of the walls of supporting matrix.

The shapes of the heat-insulating core and of the supporting matrix ensure interlocking of these parts. In addition, the material of the heat-insulating core sticks to that of the supporting matrix by the forces of adhesion. The continuous heat-insulating core is made of materials of a strength that enables forming of the supporting matrix, such as: foamed polystyrene, Neopor, foamed glass, aerogel, cork, foamed polyurethane and other foamed plastics, fibrous materials such as mineral wool, other heat-insulating materials that can act as a permanent formwork for the supporting matrix. When forming the wall element, a previously formed heat-insulating core is placed in a mould, an example of which is shown in Fig. 10, said mould giving shape to the outer surfaces of the element, and the heat-insulating core placed therein becoming part of the mould that gives shape to the internal structure of the supporting matrix. An example of a mould, part of which is a heat-insulating core (26), is shown in Fig. 11. The thus formed mould is then filled with a material for the supporting matrix. The material for the supporting matrix may be made of various aggregates bound with known non-hydraulic, hydraulic or polymer binders. The supporting matrix may also be made of foamed binders, such as foamed concrete or foamed plaster.

Wall elements according to the invention meet the most stringent requirements for walls of energy-efficient, passive and zero-energy buildings. They can be made from virtually any kind of raw material in a simple way, and in the construction process they provide the ability to erect walls using traditional methods with minimal masonry errors, without any additional training.

Claims

1. A wall element with heat-insulating core made of heat-insulating materials with strength sufficient to enable formation of supporting matrix, for which, during its production, it forms part of a mould, the heat-insulating core containing face blocks (1) connected by means of connecting members (4, 5), side blocks (2) forming part of the side surfaces of the elements and penetrating inside the element, and internal blocks (3), the heat-insulating core further integrated by means of interpenetrating shapes and forces of adhesion with the continuous supporting matrix forming the faces and part of the side surfaces of the element, the supporting matrix filling the spaces between the blocks of the core and containing longitudinal face walls (6) and longitudinal internal walls (7, 18), interconnected by means of direct joints: face side joints (8), interfacial side joints (9), middle-line joints (10), off-middle-line joints (11), or by means of transverse walls perpendicular to the faces of the element: side walls (12), interfacial side walls (13), middle-line walls (14), off-middle-line walls (15), or by means of transverse walls oblique to the faces of the element: oblique walls (16) connected with longitudinal walls by means of oblique middle-line joint and oblique off-middle-line joint, **characterised in that** it contains at least two internal blocks (3) the widths of which (A_1, A_2) at the point of contingence of the joint (11) or (17)or transverse wall (15) to their longitudinal surface is smaller than the distance (B) between the joint or transverse wall abutting the longitudinal surface of the block on one side and the joint or transverse wall abutting the longitudinal surface of that block on the other side, whereas the direct joints and perpendicular transverse walls or oblique joints that connect one pair of adjacent longitudinal walls are spaced from the middle of the element at a distance different from the distance between the middle of the element and joints or walls that connect the next pair of adjacent longitudinal walls.
2. Wall element according to claim 1, characterised in that the width (A) of at least two blocks at the point of contingence of a joint or transverse wall to the longitudinal surface of the block is greater than the width (C) of that block at the point of contingence of the block to the transverse perpendicular wall confining that block or to the joint of the wall confining that block or to the oblique joint of oblique wall confining that block.
3. Wall element according to claim 1, characterised in that it contains at least one internal block (27) to which abuts a joint or a wall transverse to one longitudinal surface of that block.
4. Wall element according to claim 1, characterised in that the length at least one internal longitudinal wall (18) is smaller than the length of the entire element, wherein between the internal longitudinal wall (18) or between the direct interfacial joint (19) formed by that longitudinal wall or between the side wall (20) or the side interfacial wall that connects that internal longitudinal wall, and the side surface of the element is a layer of

heat-insulating core (21).

5. Wall element according to claim 1, characterised in that the portion of longitudinal wall located between adjacent joints of subsequent longitudinal walls has, along its length, a segment (22) which, for the flow of heat along the supporting matrix, is oriented opposite to the general direction of the flow of heat across the entire element.
6. Wall element according to claim 1, comprising an insulation zone (SI) and a support zone (SN), characterised in that in the support zone there is at least 60% of the supporting matrix volume, wherein in the support zone there is at least one longitudinal wall of the matrix which is wider than the longitudinal walls in the insulation zone, or in the support zone there is more longitudinal or transverse walls of the supporting matrix than in the insulation zone.
7. Wall element according to claim 1, having side surfaces shaped in the form of tongue and groove locks, characterised in that at least one side surface (23) of the tongue or of the groove is formed by a side block.
8. Wall element according to claims 1 and 6, characterised in that the tongue is wider than the groove.
9. Wall element according to claim 1, **characterised in that** the side blocks create a lock between abutting elements in the form of a dovetail joint.

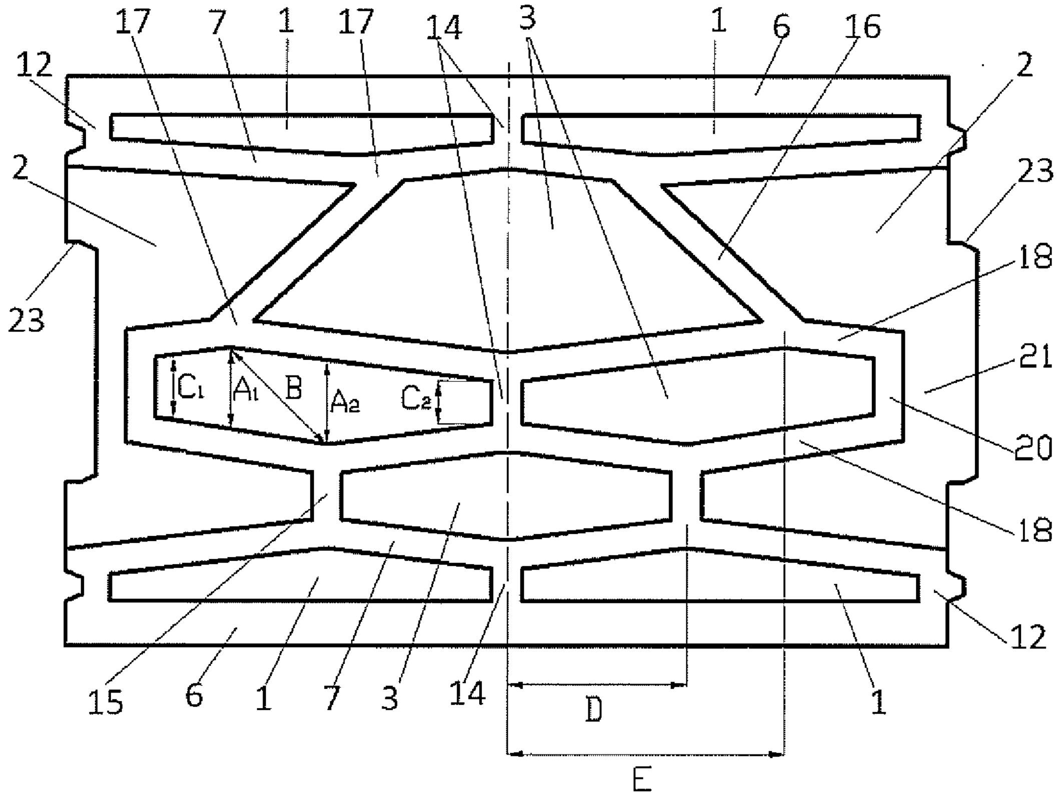


Fig. 1

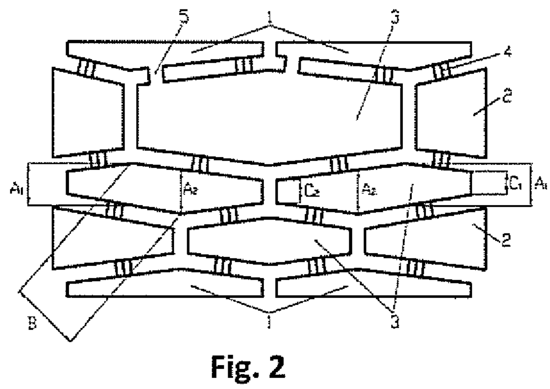


Fig. 2

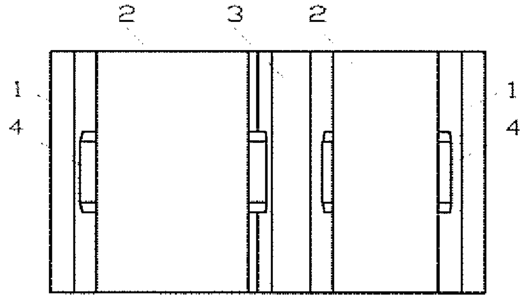
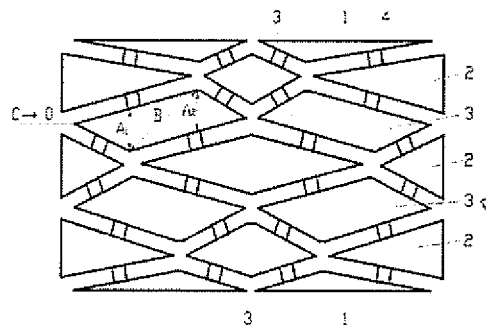


Fig.3



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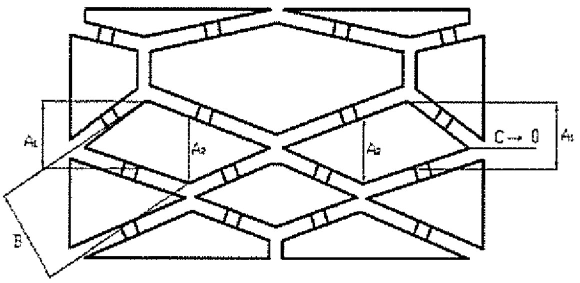

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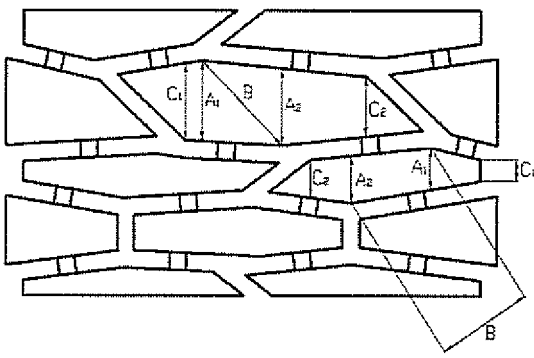

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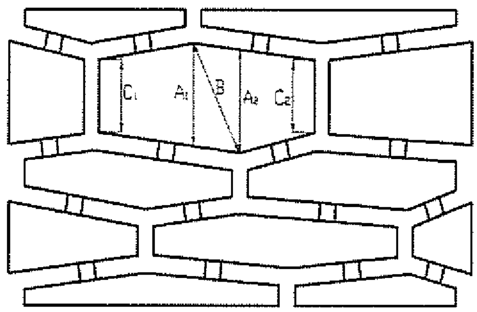


Fig. 7

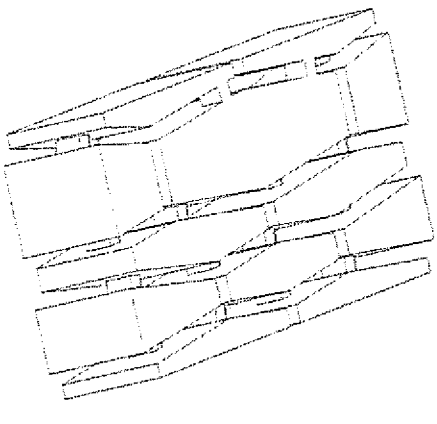
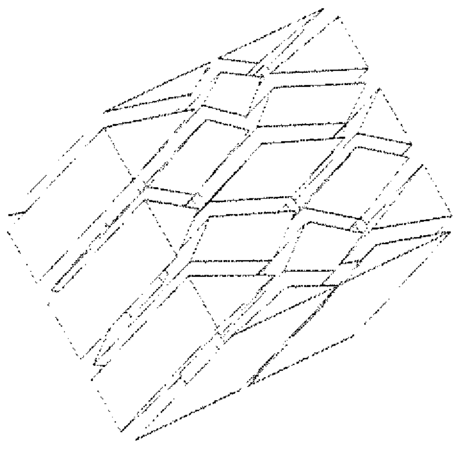


Fig. 8



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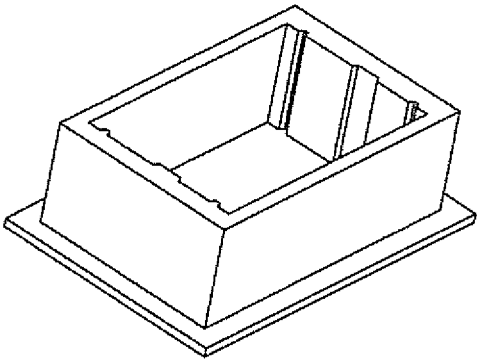

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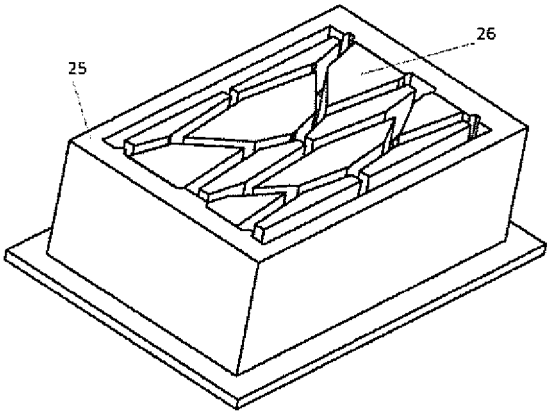

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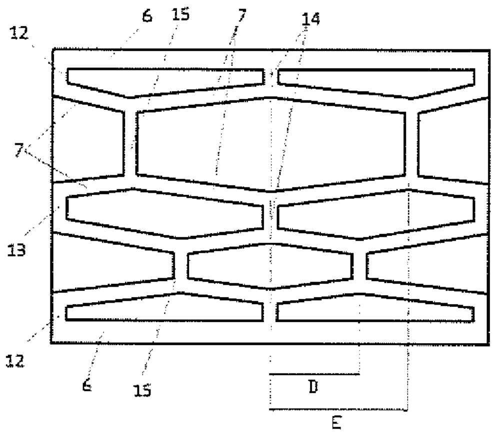

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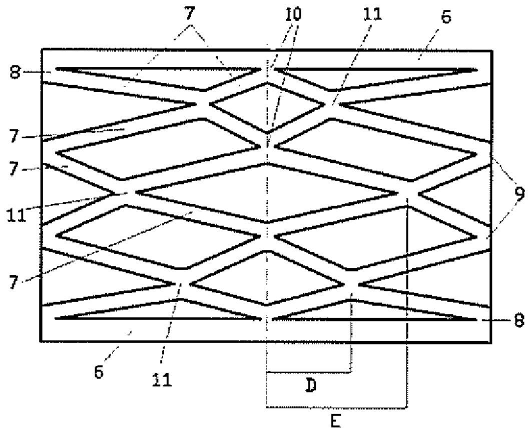

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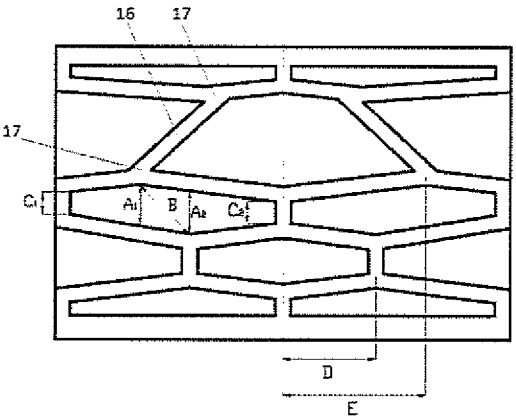

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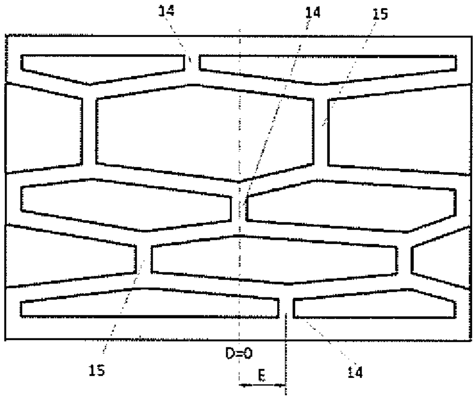

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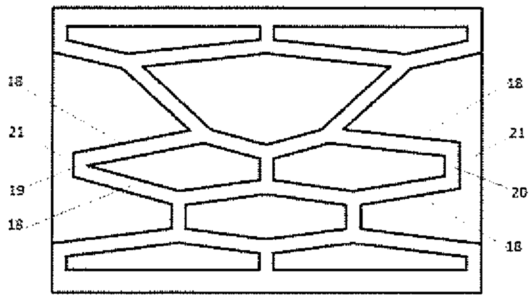

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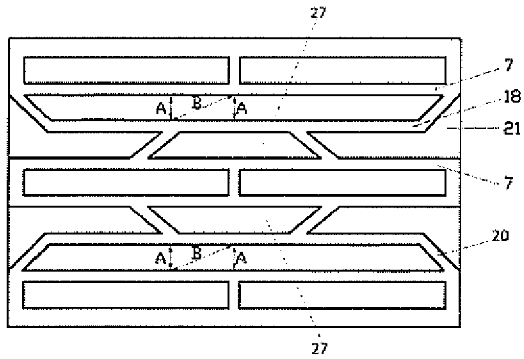

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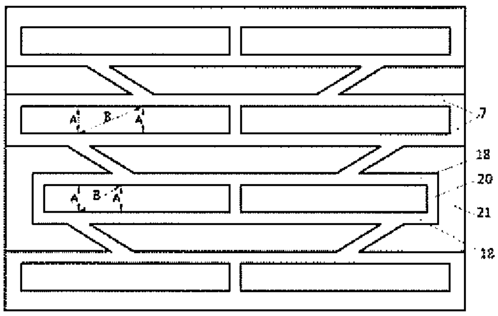

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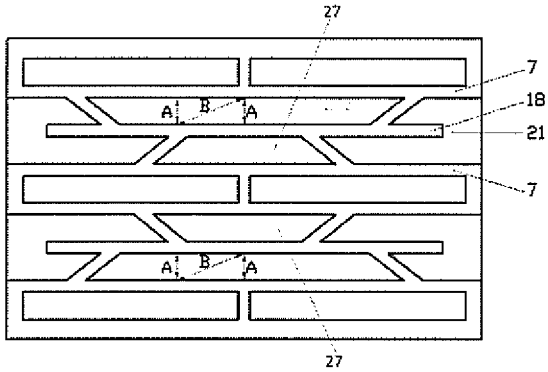

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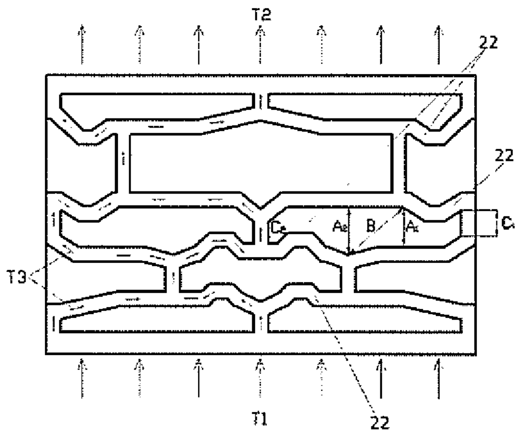

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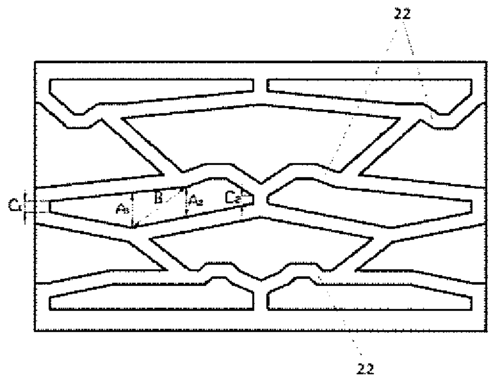

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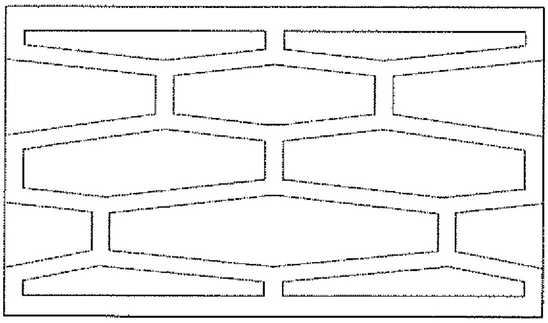

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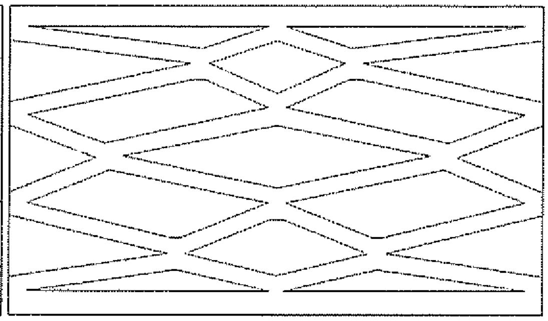

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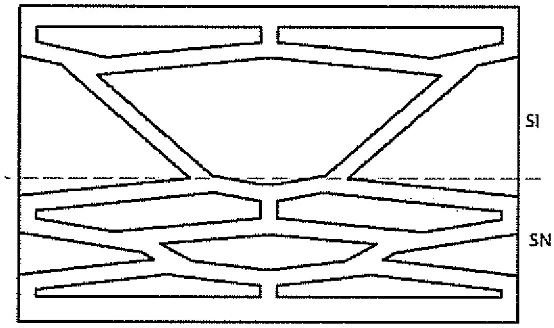

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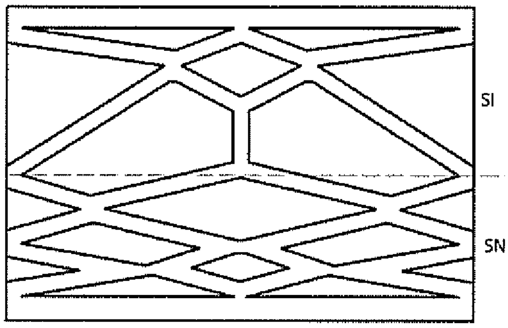

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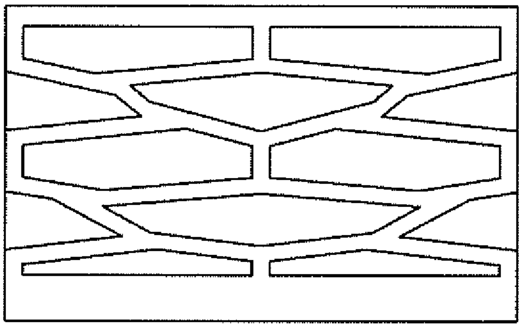

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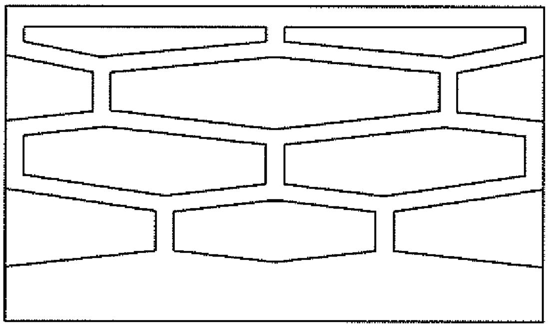

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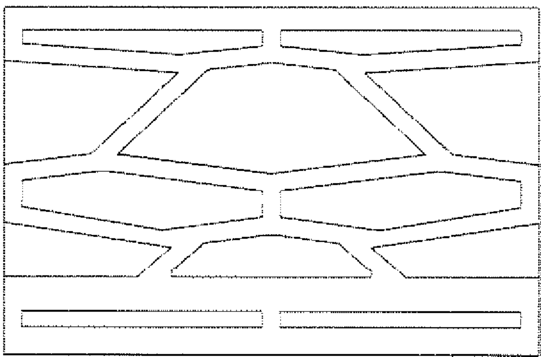

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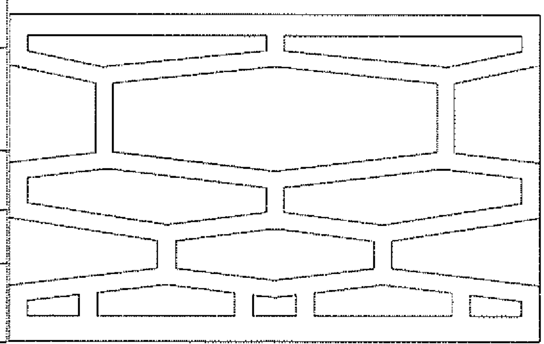

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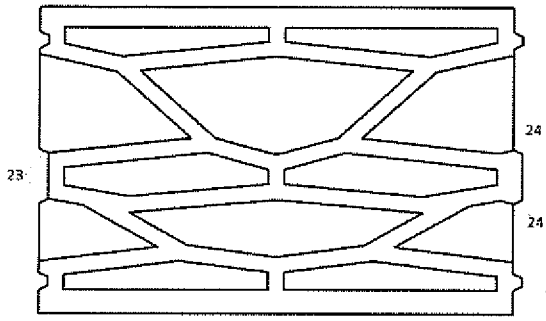

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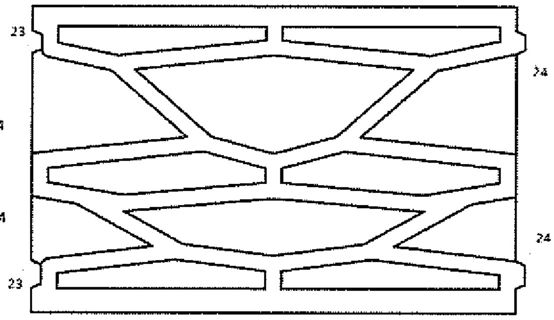

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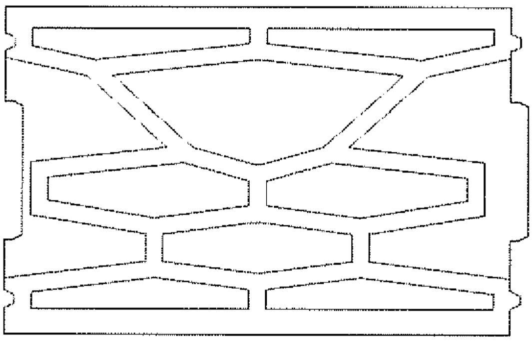

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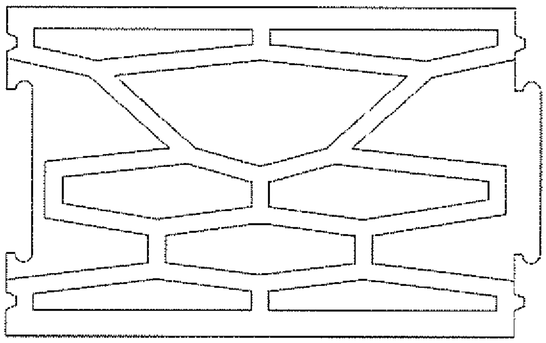

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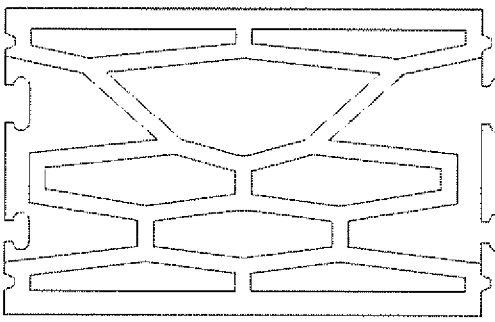

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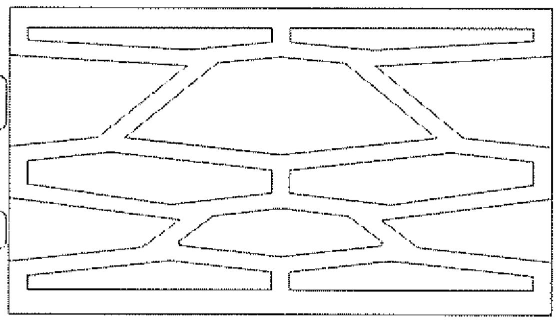
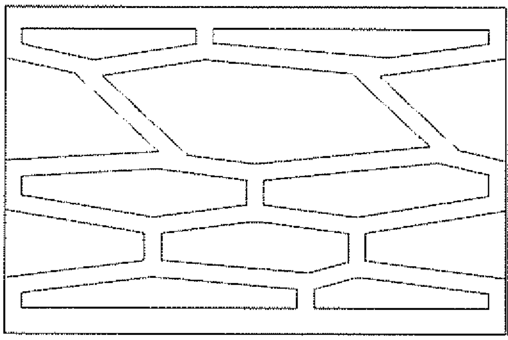


Fig. 35



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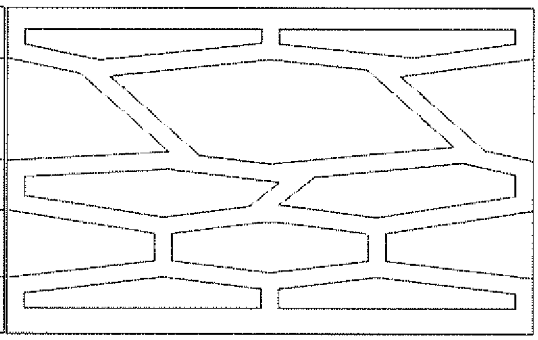

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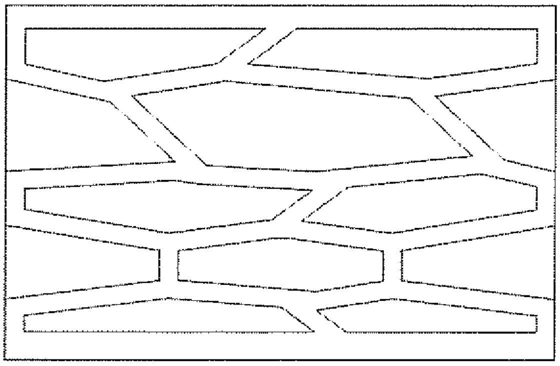

Fig. 38

INTERNATIONAL SEARCH REPORT

International application No
PCT/PL2017/000055

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04B2/14 E04C1/41
ADD. E04B2/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 31 19 105 A1 (GEBHART SIEGFRIED) 30 September 1982 (1982-09-30) figures 1, 3	1-9
X	PL 210 627 B1 (TRZASKOMA MALGORZATA [PL]) 29 February 2012 (2012-02-29) cited in the application figures 1, 4, 5	1-9
A	FR 806 562 A (MATERIAUX ISOLANTS SOC D EXPL) 19 December 1936 (1936-12-19) figure 3	1-9
A	EP 0 214 650 A2 (MUSIL FRITZ N) 18 March 1987 (1987-03-18) figure 1	1-9

[ ] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 November 2017	14/11/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Tryfonas, N

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/PL2017/000055

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 3119105	A1	30-09-1982	NONE		
PL 210627	B1	29-02-2012	NONE		
FR 806562	A	19-12-1936	NONE		
EP 0214650	A2	18-03-1987	DE	3532590 A1	19-03-1987
			EP	0214650 A2	18-03-1987