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(54) **Composite-structure panel for buildings**

(57) A composite-structure panel (1) for buildings is provided, comprising a base structure (10) having a plane of development substantially parallel to the plane of development of the panel (1a). Said base structure (10) comprises a plurality of layers (11) having a plane of lie substantially perpendicular to the plane of development (1a) of the base structure (10). Said layers (11) are made of corrugated laminar material and each of them defines a plurality of preferably linear waves (12) parallel to one another, which extend in a direction of extension (12a) oblique with respect to the plane of development (1a) of the base structure (10). Also provided is a wall (30) made of said base structure (10) and a process of construction of said wall (30).

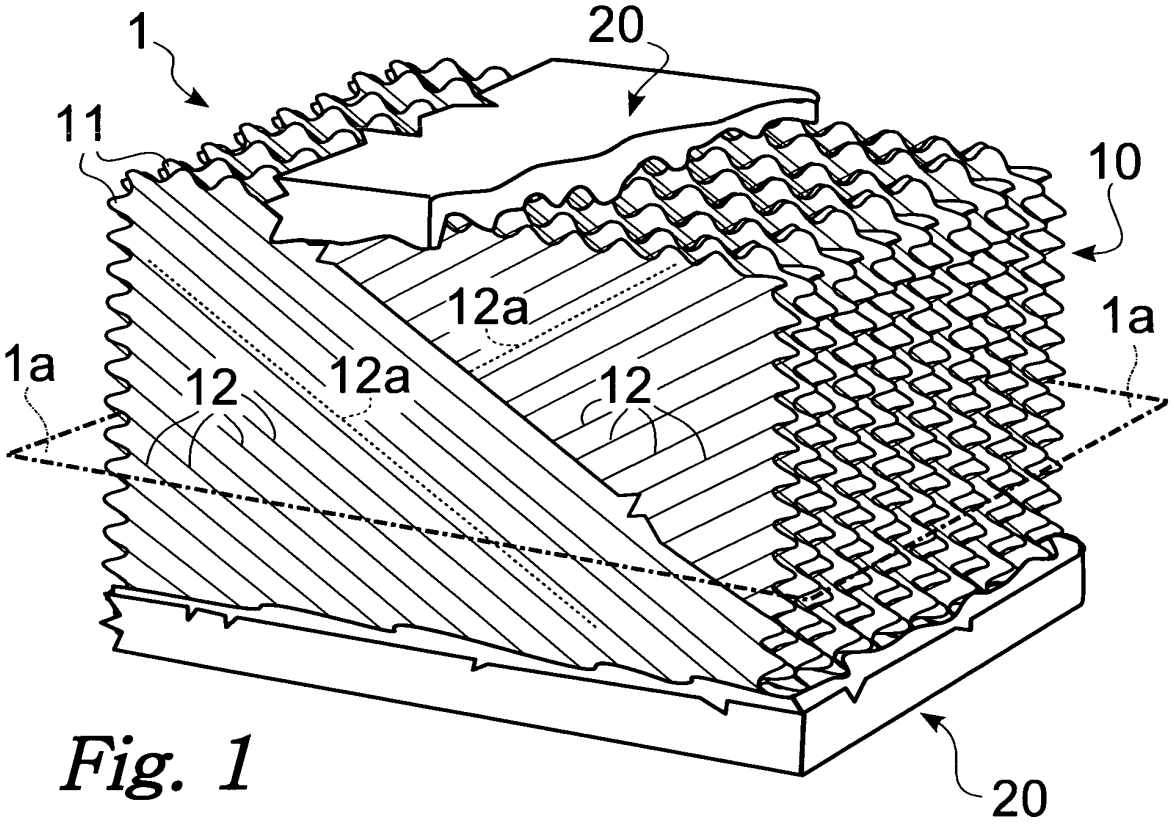

Fig. 1

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Description

[0001] The subject of the present invention is a composite-structure panel for buildings, a wall, made using said panel, and a process for the construction of said wall, of the types specified in the preamble of the independent claims.

[0002] As is known, currently the most widely used building materials for building walls and the like are bricks and cement.

[0003] The bricks form the internal part and the resistant part of the wall. They have extremely small dimensions but are set on top of and alongside one another to build the walls.

[0004] The cement, or more in general the cementitious material, is used for binding the bricks to one another and for binding them to the floor or to the ceiling.

[0005] Furthermore, the wall made of bricks is very frequently coated with cementitious material that bestows an attractive exterior appearance upon the part itself, as well as additional strength.

[0006] On said walls there can be easily arranged shelves or brackets, furniture, shelving, picture frames and other objects, which are constrained to the walls themselves by means of nails or screws or screw anchors, which penetrate into the bricks and are thus fixed thereto.

[0007] The above walls afford numerous advantages, such as low cost, ease of construction and possibility of supporting even quite heavy loads consisting of furniture, radiators, shelves, and the like.

[0008] Said walls, however, present certain important drawbacks.

[0009] In fact, if said walls are economically advantageous from the points of view of the material, they are not economically advantageous from the standpoint of transport and of construction.

[0010] In fact, the bricks that form said walls have a high weight/volume ratio.

[0011] Furthermore, the walls described prove complex, laborious and slow to assemble.

[0012] On account of the shortcomings referred to, walls are frequently made of different materials, such as in particular plaster board, wood, or the like.

[0013] Said walls are fast and inexpensive to assemble and have a very small mass, but present a low strength and are unable to support shelving, furniture or brackets. Furthermore, they are not suited to absorbing the sounds and noises that are created in the different environments.

[0014] Finally, other types of walls exist or are realizable, in particular using honeycomb panels.

[0015] Said panels are in fact very light and resistant, but present a low acoustic insulation. In addition, these panels are not suited to being coated with cementitious material or the like; in fact, said material, in the case where it is laid on the surface of said panels, would penetrate completely within them, rendering them heavy and constituting a waste of material that substantially nullifies the advantages of said panels. They may moreover be too degradable, in particular on account of the high humidity that frequently is present in walls and the like.

[0016] Consequently, the technical problem of how to provide an economically advantageous, light and resistant panel or wall for building purposes remains unresolved.

[0017] In this situation, the technical task underlying the present invention is to devise a composite-structure panel for buildings, a wall made using said panel, and a process for the construction of said wall that is able to overcome substantially the drawbacks referred to above.

[0018] In the framework of said technical task, an important purpose of the invention is to provide a light, resistant, and inexpensive panel and a wall, or ceiling or floor, with the same characteristics of low cost and high strength.

[0019] Another important purpose of the invention is to devise a process of construction of said walls, ceilings or floors that is fast and economically advantageous.

[0020] The technical task and the purposes specified are achieved by a composite-structure panel for buildings and the like, a wall or ceiling or floor, made using said panel, and a process for the construction of said wall or ceiling or floor, as specified in the annexed independent claims.

[0021] Preferred embodiments are specified in the dependent claims.

[0022] Further characteristics and advantages of the invention are more fully clarified hereinafter by the detailed description of a preferred embodiment of the invention, with reference to the attached plate of drawings, in which:

Figure 1 is a cutaway axonometric view of a panel according to the invention;
Figure 2 illustrates a horizontal cross section of the panel according to the invention;
Figure 3a presents a vertical cross section of a first type of panel according to the invention;
Figure 3b presents a vertical cross section of a first type of panel according to the invention;
Figure 4 illustrates a front portion of a panel according to the invention;
Figure 5 is a schematic illustration of a wall or the like, according to the invention;
Figure 6 provides a horizontal cross section of the wall according to the invention;
Figure 7 is a schematic illustration of a portion of the wall according to the invention;
Figure 8a illustrates a different type of wall according to the invention; and
Figure 8b illustrates a further type of wall according to the invention.

[0023] With reference to the above figures, the panel according to the invention is designated as a whole by the reference number **1**.

[0024] The panel develops prevalently along the plane of development **1a** and comprises a base structure **10**, shaped like a plate and having a plane of development substantially parallel to the plane of development 1a of the panel 1.

[0025] Said base structure 10 comprising a plurality of layers **11**, which are substantially parallel to one another and lying on planes of lie substantially perpendicular to the plane of development 1a of the base structure 10 and of the panel 1 (Figure 1).

[0026] Said layers 11 are preferably made of paper material impregnated with artificial resins. By "paper material" is in general meant a material of vegetal origin present in the form of thin laminas, where the term "thin lamina" is used to mean in particular: paper, card, cardboard, and other equivalents.

[0027] Said layers 11 are in particular made of paper of the "kraft" type, so called because it is obtained with the known process of the same name. Paper of the "kraft" type is in fact characterized by a considerable strength and toughness and presents a high-quality Havana colour.

[0028] For the layers 11 said paper moreover preferably has a substance of between 20 g/m^2 and 200 g/m^2, more preferably between 80 g/m^2 and 140 g$_{/m}{}^2$.

[0029] Finally, said paper is preferably obtained by means of recycling of waste or scrap materials, so as to reduce the costs and diminish the environmental impact of the panel 1.

[0030] Alternatively, different types of papers can be used, such as newspaper and the like.

[0031] The artificial resins that impregnate the paper to make the layers 11 are polymeric materials, preferably obtainable via the known process of polycondensation, so that it is possible to impregnate the paper material with the polymers not yet condensed and then await solidification of the polymers themselves.

[0032] Preferably, melaminic resins are used or, alternatively, phenolic resins.

[0033] Said artificial resins bestow upon the paper material a high resistance to water, humidity, and chemical agents, as well as a higher mechanical resistance.

[0034] Alternatively, the layers 11 can be made of polymeric materials, metal materials, composite materials, such as, in particular, glass-reinforced plastic (GRP), or even others.

[0035] Each of the layers 11 is made of corrugated laminar material, which defines a plurality of corrugations or waves 12, preferably waves that extend in directions 12a substantially linear and parallel to one another (Figure 1).

[0036] Alternatively, the laminar material can be corrugated differently, i.e., it can present waves constituted by broken lines or curves even not parallel to one another.

[0037] The linear waves 12 preferably present regular shapes and dimensions. For example, each wave 12 has a length approximately twice its height, advantageously a length of between approximately 5 mm and 30 mm, preferably between 16 mm and 20 mm, and a height of between 3 mm and 15 mm, preferably between 8 mm and 10 mm. By increasing or reducing the amplitude and the height of said waves 12, it is possible, respectively, to reduce and increase the strength of the base structure 10.

[0038] The linear waves 12 moreover extend in a direction 12a oblique with respect to the plane of development 1a of the base structure 10, as illustrated in Figure 2.

[0039] Said direction of extension 12a of the waves 12 preferably forms with the plane of development 1 a, in the plane of lie of the layer 11, an angle α of between 5° and 85°, more advantageously between one third and two thirds of a right angle, and more advantageously still an angle α close on one half of a right angle.

[0040] Furthermore, the linear waves 12 of two successive layers 11 extend in different directions of extension 12a, preferably in directions of extension 12a that are opposite to or specular with respect to the plane of development 1 a.

[0041] Consequently, the waves 12 of two successive layers 11 have directions 12a that are inclined, with respect to the plane of development 1a, by angles equal to $+\alpha$ and $-\alpha$, more preferably equal to +45° and -45° as illustrated in Figure 2, or alternatively +30° and -30° or +60° and -60°, and so forth.

[0042] The successive layers 12 are moreover preferably bound together by means of the same artificial resins with which the paper is impregnated, i.e., by means of artificial resins, more preferably still by means of vinyl resins or similar bonding agents. Alternatively, different bonding agents of a known type can be used.

[0043] Bonding of the layers to one another proves very simple since the waves 12 extend in different directions 12a; in fact, a top layer can rest on the crests of the waves 12 of a bottom layer and thus define the appropriate cavities, without it being necessary to insert intermediate layers and the like.

[0044] The panel 1 moreover conveniently comprises at least one edge structure **20,** defined for example by a lamina **21a** having a plane of development substantially parallel to the plane of development 1a of the panel 1, and constrained to the base structure 10 via means of connection **21 b** of said lamina to said base structure 10.

[0045] The number of edge structures 20 are preferably two, in a way designed to cover both of the sides of prevalent development of the panel 1.

[0046] The laminas 21a can be made of different materials, such as cements, mortars, cements reinforced with fibre glass or polypropylene, woods, polymers, artificial resins, paper material, metals, and the like.

[0047] The means of connection 21b are appropriately constituted by adhesives, i.e., artificial resins, foamed polymer glues, polymers in general, cements, mortars, etc. Alternatively, the means of connection 21b can be mechanical means, such as fixed joints, screw anchors, screws, nails, sectional elements, etc.

[0048] Particularly advantageous from the mechanical

and economic standpoint is the application of edge structures 20 made of cementitious material, mortars, resins, or other composites.

[0049] In this case, the edge structure 20 is defined by just one element, which constitutes both the lamina 21a and the means of connection 21b (Figure 3a), and for the construction thereof it is sufficient to apply the cementitious material, mortars, resins, or various composite materials on the base structure 10 because it/they grips/grip to the outer surface of the base structure 10 itself.

[0050] The outer surface of the base structure 10, illustrated in Figure 4, has in fact a very uneven surface, on which the cementitious material or the like has a high gripping power, i.e., the cementitious material or the like is easily withheld by the outer surface of the base structure 10. It is then sufficient to apply the cementitious material on the base structure 10 and smooth the outer surface to form the edge structure 20.

[0051] The gripping power of the outer surface, illustrated in Figure 4, of the base structure 10, can be varied by varying the angle α, previously defined.

[0052] In fact, if the angle α increases, also the gripping power of the base structure 10 increases; the cement or other material can in fact be inserted more easily within the channels formed by the waves 12 in the base structure 10. If, by excess, the angle α has a value of 90°, the base structure has a structure similar to honeycomb structures; hence, it is not suitable for application of cement since the latter would overfill the inside of the base structure 10.

[0053] Instead, if the angle α decreases, the gripping power of the base structure 10 decreases, and if, by excess, α is equal to 0°, the cementitious material or the like cannot be inserted within the base structure 10, since the channels formed by the waves 12 are not present.

[0054] On account of what has been set forth above, the angle α usually assumes values of between 30° and 60°, as previously indicated.

[0055] Furthermore, it is possible to increase or reduce the gripping power of the base structure 10 by increasing or decreasing, respectively, the amplitude and height of the waves 12.

[0056] It is then advantageous for the edge structures 20, made of cementitious material or the like, to form laminas 21 a with a thickness of between 1 cm and 5 cm, and means of connection 21b that extend within the base structure 10 for a thickness of between 1 cm and 5 cm.

[0057] A panel 1 of this sort is illustrated in cross-sectional view in Figure 3a. It presents characteristics that are ideal for building applications, in particular for ceilings, walls and floors, which will hereinafter and in the ensuing claims generally be referred to simply as walls. Said panel 1 is in fact characterized by a high strength and a low cost. Other applications of the panel 1 are possible, such as naval and aeronautic applications; in this case, it is preferable to use laminas 21a made of composite, or plastic, or paper, or wood laminates.

[0058] In order to increase the strength of said panel 1, it is moreover possible to use special cements, or cements containing appropriate additives. Amongst these, the cements with additives in the form of glass fibre or polypropylene fibre or glass microspheres present excellent characteristics. It is moreover possible to use a reinforcement mesh, embedding it in the lamina 21a.

[0059] Said reinforcement mesh is advantageously made of glass fibre or, alternatively, steel, or even other materials.

[0060] A different solution for the construction of the panel 1 is illustrated in Figure 3b. In this case, the means of connection 21 a are constituted by polymeric material or resins, in particular foamed polymeric material, more in particular polyurethane foam, and the laminas 20 are made of material chosen between wood, metal, polymers, reinforced polymers, paper, and composite materials.

[0061] Such a solution enables a very light panel 1 to be obtained with outer surfaces having an appropriate coating; in fact, the laminas 21a can constitute substantially a veneer of the base structure 10. Said solution in any case affords an adequate strength which enables the use of said panel 1 for partition walls, ceilings, floors, and the like.

[0062] In the latter case, since the gripping power of the polymeric materials is on average higher than the gripping power of the cementitious materials, it is advantageous to increase the angle α, on the basis of the arguments set forth above.

[0063] Finally, the base structure 10 can be internally filled with various materials, such as in particular scrap or recycled polymers, in order to reduce the costs and the environmental impact of the panel 1.

[0064] The invention moreover comprises a building wall 30 made with the panel 1 and illustrated in Figures 5, 6 and 7. Said wall 30 is inserted in an environment that necessarily comprises other building elements **40,** such as, for example, a floor **41,** and a ceiling **42.**

[0065] Said wall 30 made using the panel 1 can be arranged not only as a vertical wall, but also as a horizontal wall and thus forms at least part of a ceiling and of a floor, or the base wall of a raised floor or platform, or the like.

[0066] Said wall 30 comprises an inner core **31** that includes a plurality of plates 10, described previously, having a plane of development substantially parallel to the plane of development of the wall 30.

[0067] The inner core 31 moreover advantageously comprises means of engagement **32,** designed to join said plates together, so that the inner core 32 is formed substantially by a single base structure 10; said means of constraint 32 can be of a chemical type, i.e., bonding agents, polymers, cements, resins, or mechanical means, i.e., screws, fixed joints, screw anchors, etc.

[0068] Illustrated in Figure 6 are, for example, means of mechanical constraint 32, constituted by fixed joints.

[0069] The wall 30 moreover comprises means of con-

straint **33,** designed to constrain said inner core 31 to the surrounding building elements 40, namely, the floor 41 and the ceiling 42.

[0070] Said means of constraint 33 can, also in the present case, be chemical means, i.e., bonding agents, polymers, cements, resins, or mechanical means, i.e., screws, fixed joints, screw anchors, etc.

[0071] In particular, illustrated in Figure 7 is an advantageous type of mechanical means of constraint 33, constituted by guides **34** constrained to the floor 41 and to the ceiling 40 by means of purposely provided screw anchors **35,** metal brackets or the like.

[0072] Alternatively, the means of constraint 33 can be constituted by classic and low-cost cementitious materials.

[0073] Said wall 30 moreover comprises at least one edge structure 20 that coats at least partially the inner core 30. Said edge structure 20 is of the type described previously.

[0074] Also in the present case, it is advantageous to use an edge structure 20 made of cementitious material, as already described. Furthermore, in this case, such a solution means that no discontinuity of the inner core 30, due to the presence of a number of plates 10, will be present on the outside, where a single layer of cementitious material is spread, as illustrated in Figure 5.

[0075] There may instead be provided edge structures 20 made using connection means 21 b, for example polymeric bonding agents or the like, and laminas 21 a, for example made of wood or artificial wood, or wallpaper.

[0076] Besides may be provided, for the realization of a sound absorbing wall 30, two inner cores 31 placed side by side and spaced out by a polyurethane wall preferably a perforated polyurethane wall that better absorbs noises. In this case the inner cores 31 have preferably a thickness near to 50 mm.

[0077] In the case where the wall 30 is arranged horizontally, as illustrated in Figures 8a and 8b, and constitutes the support for the intermediate storeys of buildings, it assumes the name of slab floor.

[0078] In this case, the panels 1 are advantageously arranged between the load-bearing beams **36** of the wall 30 or slab floor. Advantageously, in this case, the top portion of the wall, which substitutes the floor of the upper storey, is equipped with edge structures 20 formed by means of connection 21b made of cementitious material and laminas 21 a made of the same material and having a height of approximately 2-10 cm; said top edge structure 21a can possibly be coated with tiles or the like.

[0079] The bottom surface, instead, which constitutes the ceiling of the storey underneath, can be equipped with edge structures 20, which are designed to bestow upon it exclusively a high-quality exterior appearance, as illustrated in Figure 8a, and hence are constituted by cementitious materials, mortars and the like, preferably having a thickness of less than 5 cm.

[0080] Alternatively, the bottom surface can be equipped with edge structures 20 made using cements, mortars or the like, designed to bestow a high mechanical resistance upon the wall 30 or floor; in this case, said bottom edge structure 20 is equipped with laminas 21a having thicknesses of between 2 cm and 10 cm, as illustrated in Figure 8b.

[0081] Illustrated in Figure 8a is a wall 30 or slab floor.

[0082] Finally, the cementitious material can also function by means of constraint 33 and by means of engagement 32. However, there are preferably provided guides 34 and different means of engagement 32 of a mechanical type, to bestow a higher strength upon the wall 30.

[0083] The invention moreover comprises a process for the construction of a building wall 30, which can be used also for naval or aeronautic applications, etc.

[0084] Said process consists in arranging a plurality of plates 10, previously described, along the path of the wall 30, in constraining, directly or indirectly, said plates 10 to the building elements 40 surrounding the wall 30, and in coating said plates by means of the laminas 20 and of the means of connection 21 b described previously.

[0085] Advantageously, the plates are coated by application of cementitious material or the like on the outer faces of the plates 10.

[0086] The invention enables important advantages to be achieved.

[0087] In fact, the panel 1 is light, mechanically and chemically resistant, and extremely inexpensive.

[0088] In particular, the wall 30 presents economic and mechanical advantages as compared to the classic walls made of cement and bricks.

[0089] The plates 10, which replace the bricks, are in fact far lighter than the latter, and can thus be conveniently transported.

[0090] Furthermore, precisely on account of their lightness and strength, said plates 10, can have considerably larger dimensions than the bricks themselves. This leads to a greater strength, seeing that the wall is less fragmented, and a shorter time of assembly, seeing that the pieces to assemble are much fewer.

[0091] In addition, coating of the plates 10 by means of cementitious materials or the like is much faster and more convenient than is coating of classic bricks with cementitious materials.

[0092] In fact, the plates 10 have a gripping power that is much higher than the gripping power of classic bricks, and moreover said gripping power is a variable that can be easily selected, as mentioned previously.

[0093] The edge structure 20 can then be easily and quickly coated with cementitious or similar materials, for example by means of adequate pumps and the like.

[0094] The wall 30 is moreover very strong, and its strength is improved if it is constrained to the ceiling 42 and to the floor 41 by means of the purposely provided guides 34.

[0095] The chemical resistance of the wall is instead bestowed thereupon by impregnation with polymeric material, as described above. Said operation bestows exceptional durability upon the paper material.

[0096] The wall 30 is moreover transpirant, which is a characteristic of fundamental importance for building elements and the like. It is also transparent to radio waves, which are increasingly used for various applications in buildings.

[0097] On the wall 30 or on the panel 1 there can moreover be arranged the classic elements of constraint to the walls, such as nails, screw anchors etc., which are arranged on classic walls; hence, the use of the wall for the end user does not vary. Furthermore, said walls 30 can support shelves, brackets, furniture, radiators, and shelving, thanks to their strength.

[0098] Finally, said wall 30 presents a low environmental impact since it can be made using recycled materials.

[0099] Finally, the process described herein enables advantages of rapidity and low cost to be achieved in assembly of the wall 30.

Claims

1. A composite-structure panel (1) for buildings, comprising: a base structure (10) shaped like a plate and having a plane of development (1 a) substantially parallel to the plane of development of said panel (1), said panel (1) being **characterized in that** said base structure (10) comprises a plurality of layers (11) having a plane of lie substantially perpendicular to said plane of development (1a) of said base structure (10), said layers (11) being made of corrugated laminar material designed to define a plurality of waves (12), said waves (12) extending in a direction of extension (12a) oblique with respect to said plane of development (1a), said waves (12) of two of said successive layers (11) having said different directions of extension (12a).

2. The panel according to Claim 1, in which said waves (12) of each of said layers (11) extend linearly and are substantially parallel to one another.

3. The panel according to Claim 2, in which said waves (12) of two of said successive layers (11) have said directions of extension (12a) specular with respect to said plane of development (1a).

4. The panel according to Claim 3, in which the direction of extension (12a) of said linear waves (12) of each layer (11) forms with said plane of development (1 a) of said base structure (10), in the plane of lie of said layer, an angle (α) of between 5° and 85°.

5. The panel according to Claim 4, in which the direction of extension (12a) of said linear waves (12) of each layer (11) forms with said plane of development (1a) of said base structure (10), in the plane of lie of said layer, an angle (α) of between one third and two thirds of a right angle.

6. The panel according to Claim 5, in which the direction of extension (12a) of said linear waves (12) forms with said plane of development (1a) of said base structure (10), in the plane of lie of said layer, an angle (α) close to one half of a right angle.

7. The panel according to Claim 1, in which said layers (11) are made of paper material impregnated with artificial resins.

8. The panel according to Claim 7, in which said layers (11) are made of paper material with a substance of between 80 g/m^2 and 140 g/m^2.

9. The panel according to Claim 8, in which said layers (11) are made of recycled paper material of the "kraft" type.

10. The panel according to Claim 1, in which said layers (11) are bonded together by means of adhesive.

11. The panel according to Claim 1, comprising at least one edge structure (20) having a plane of prevalent development, substantially parallel to the plane of development (1a) of said panel (1).

12. The panel according to Claim 11, in which said edge structure (20) is made of cementitious material.

13. The panel according to Claim 12, in which said edge structure (20) made of cementitious material forms a lamina (21a), having a plane of development substantially parallel to the plane of development of said panel (1a), with a thickness of between 1 cm and 5 cm, and means of connection (21b) of said lamina (21a) to said base structure (10) that extend within said base structure (10) for a thickness of between 1 cm and 5 cm.

14. The panel according to Claim 11, in which said edge structure comprises a lamina (21a) having a plane of development substantially parallel to the plane of development of said panel (1a) and substantially set alongside said base structure (10), and means of connection (21 b) of said lamina (21a) to said base structure (10).

15. The panel according to Claim 14, in which said means of connection (21 b) are made of foamed polymeric material.

16. The panel according to Claim 14, in which said laminas (21a) are made of material chosen between wood, metal, polymers, reinforced polymers, and paper.

17. A wall comprising an inner core (31), at least one outer edge structure (20) coating at least partially

said inner core (31), said wall being **characterized in that**: said inner core (31) comprises a plurality of base structures (10) shaped like a plate having a plane of development (1a) substantially parallel to the plane of development of said wall (30), said base structures (10) comprising a plurality of layers (11) having a plane of lie substantially perpendicular to said plane of development (1a) of said base structure (10), said layers (11) being made of corrugated laminar material designed to define a plurality of waves (12), said waves (12) extending in a direction of extension (12a) oblique with respect to said plane of development (1a), said waves (12) of two of said successive layers (11) having said different directions of extension (12a), and **in that** said wall (30) comprises means of constraint (33) designed to constrain said inner core (31) to surrounding building elements (40).

18. The wall according to Claim 17, in which said core (31) of said wall (30) comprises means of engagement (32) of said base structures (10), designed to join said base structures (10) together.

19. The wall according to Claim 18, in which said means of engagement (32) of said base structures (10) are of a mechanical type and are designed to form fixed joints.

20. The wall according to Claim 17, which extends between a floor (41) and a ceiling (42), in which said means of constraint (33) of said base structures (10) are of a mechanical type, designed to form fixed joints, and are constrained to said floor (41) and to said ceiling (42).

21. A process for the construction of a wall (30), consisting in: arranging a plurality of base structures (10) along the path of said wall (30), said base structures (10) being shaped like a plate comprising a plurality of layers (11) having a plane of lie substantially perpendicular to said plane of development (1a) of said base structure (10), said layers (11) being made of corrugated laminar material designed to define a plurality of waves (12), said waves (12) extending in directions of extension (12a) oblique with respect to said plane of development (1a), said waves (12) of two of said successive layers (11) having said different directions of extension (12a); constraining together said plates (10); constraining at least part of said plates (10) to the building elements (40) surrounding said wall (30); and coating said plates (10) by means of laminas (20) and means of connection (21) of said laminas (20) to said wall (30).

22. The process according to Claim 21, in which said plates (10) are coated by the application of cementitious material on the outer faces of said plates (10).

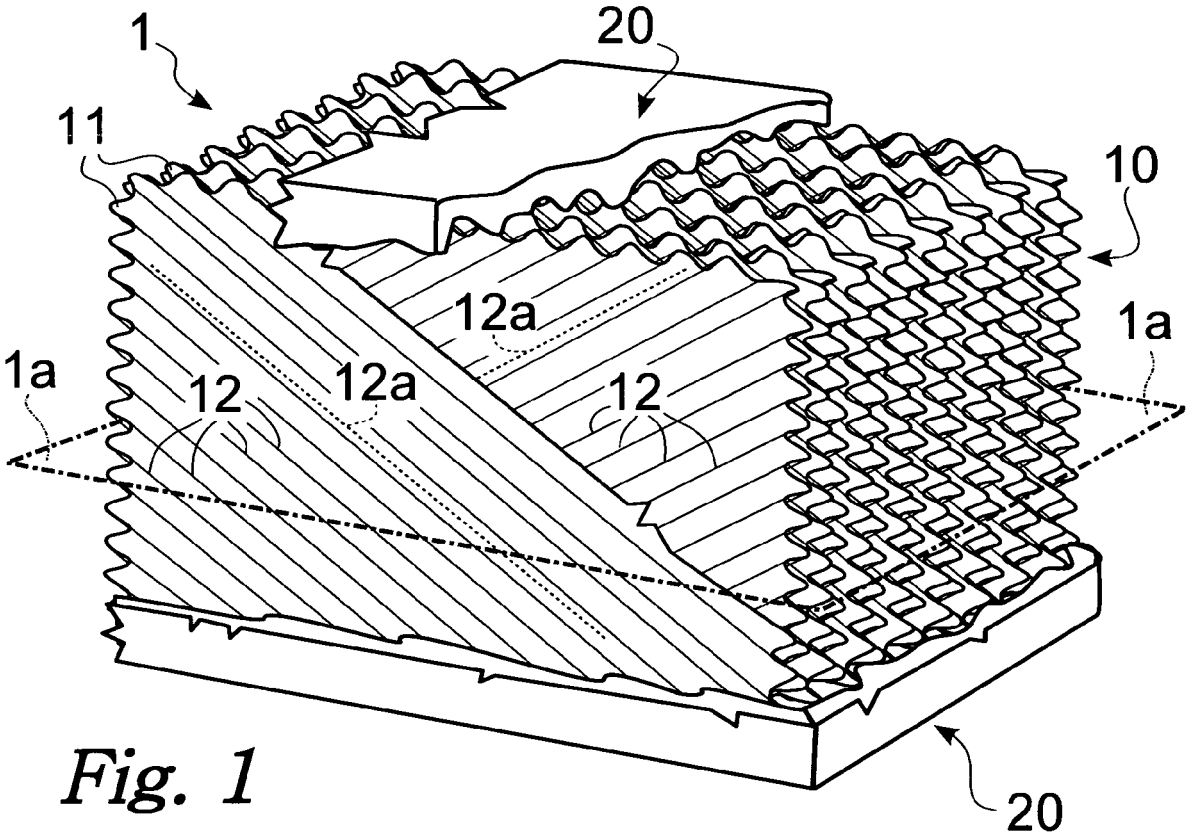


Fig. 1

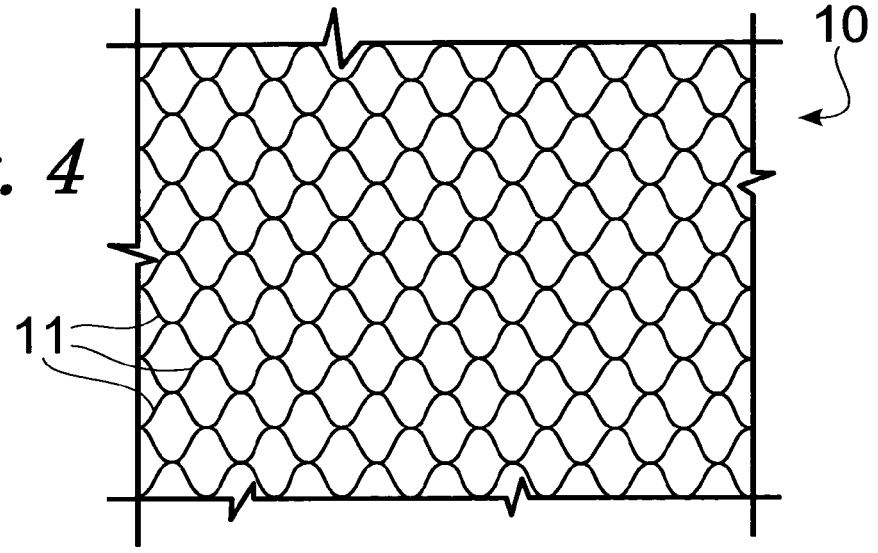


Fig. 4

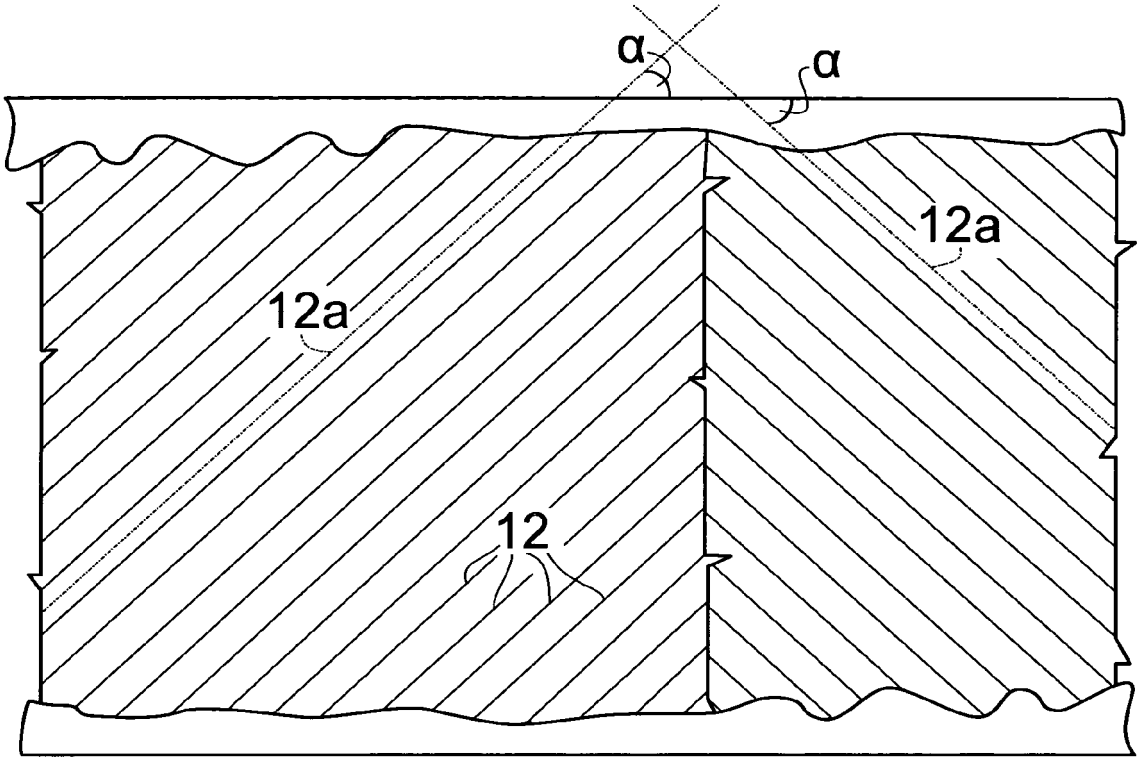


Fig. 2

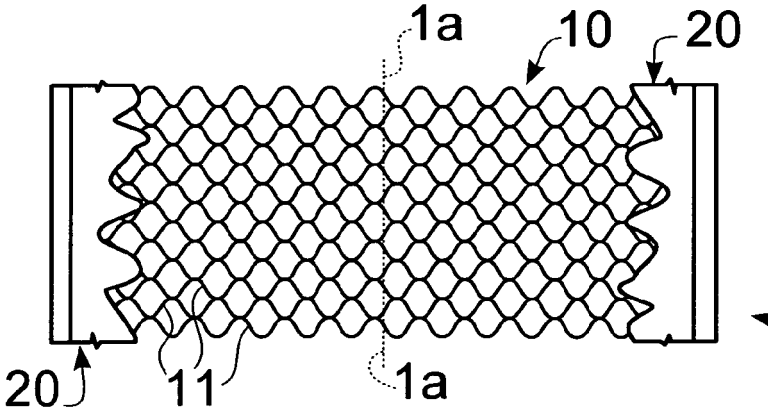


Fig. 3a

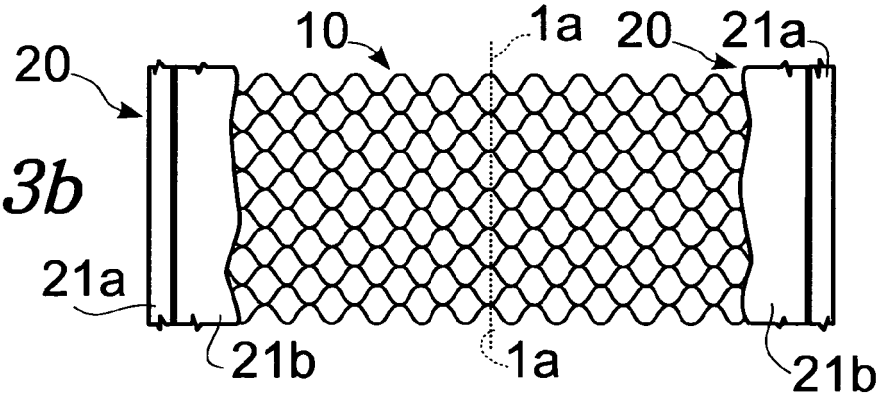


Fig. 3b

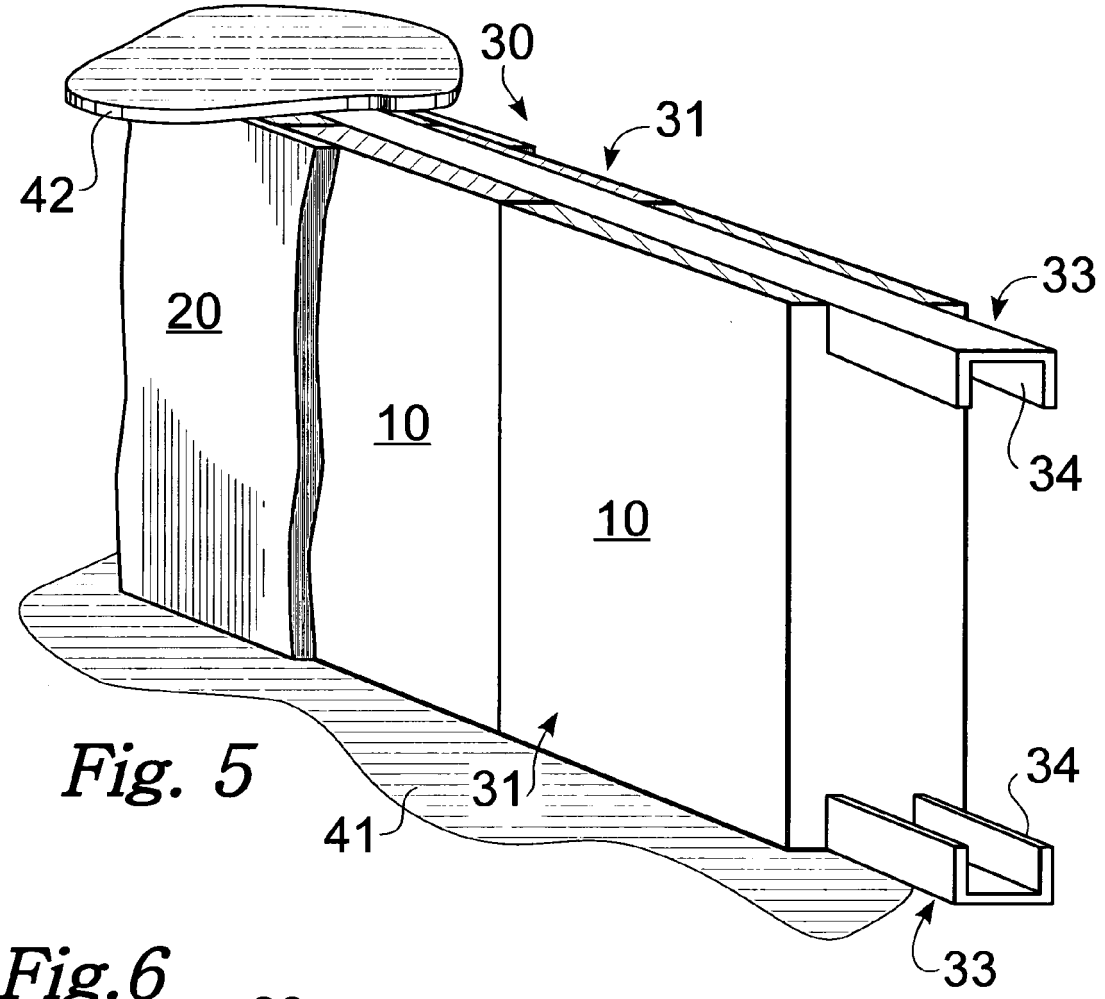
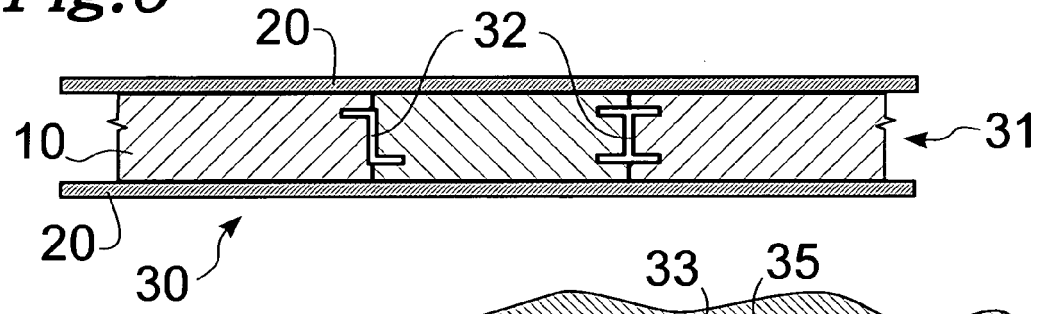


Fig. 5

Fig.6



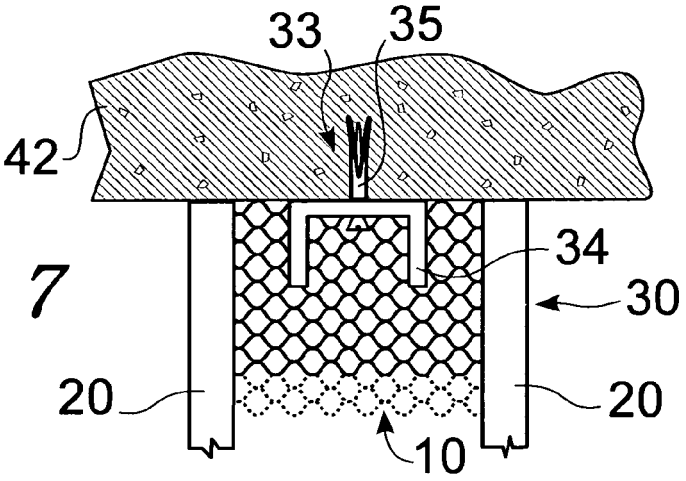
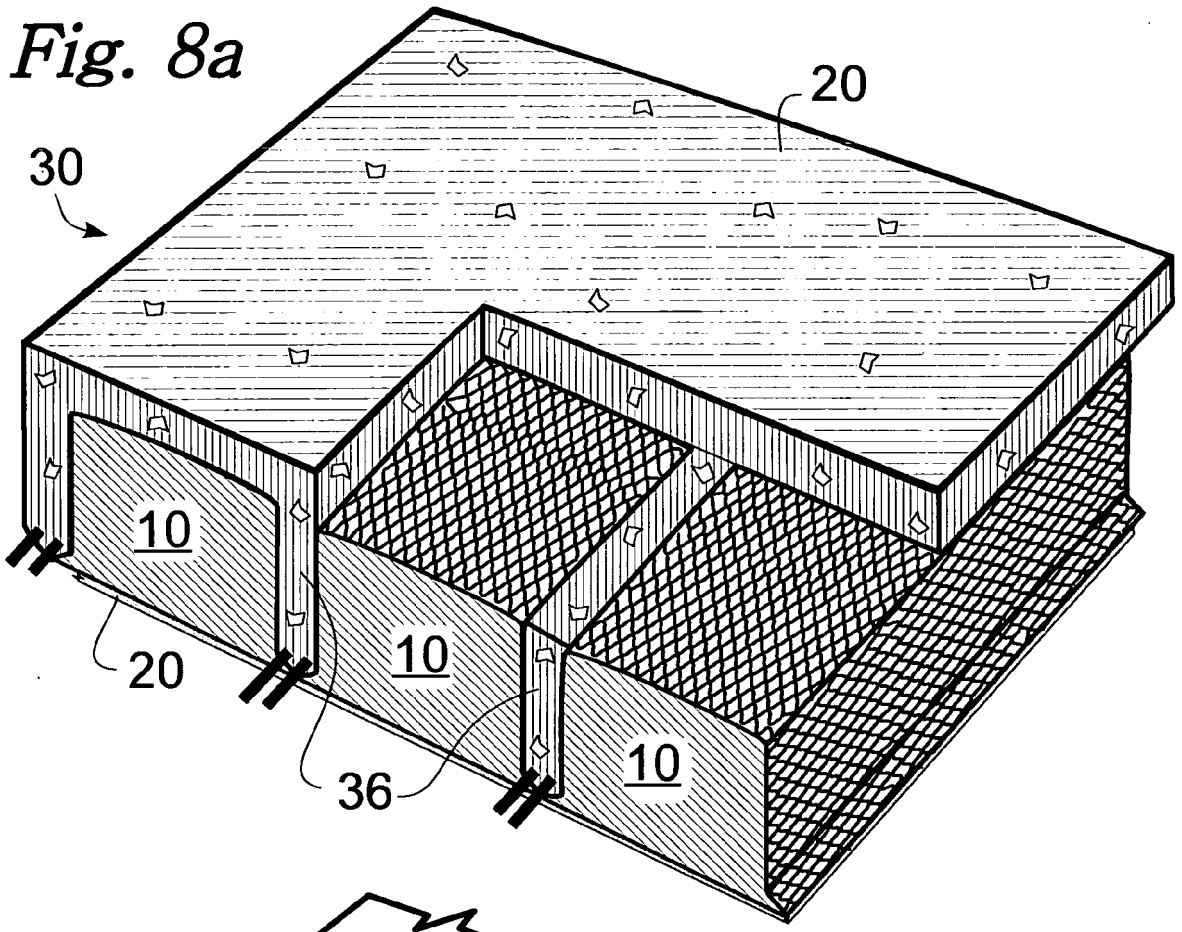


Fig. 7

Fig. 8a



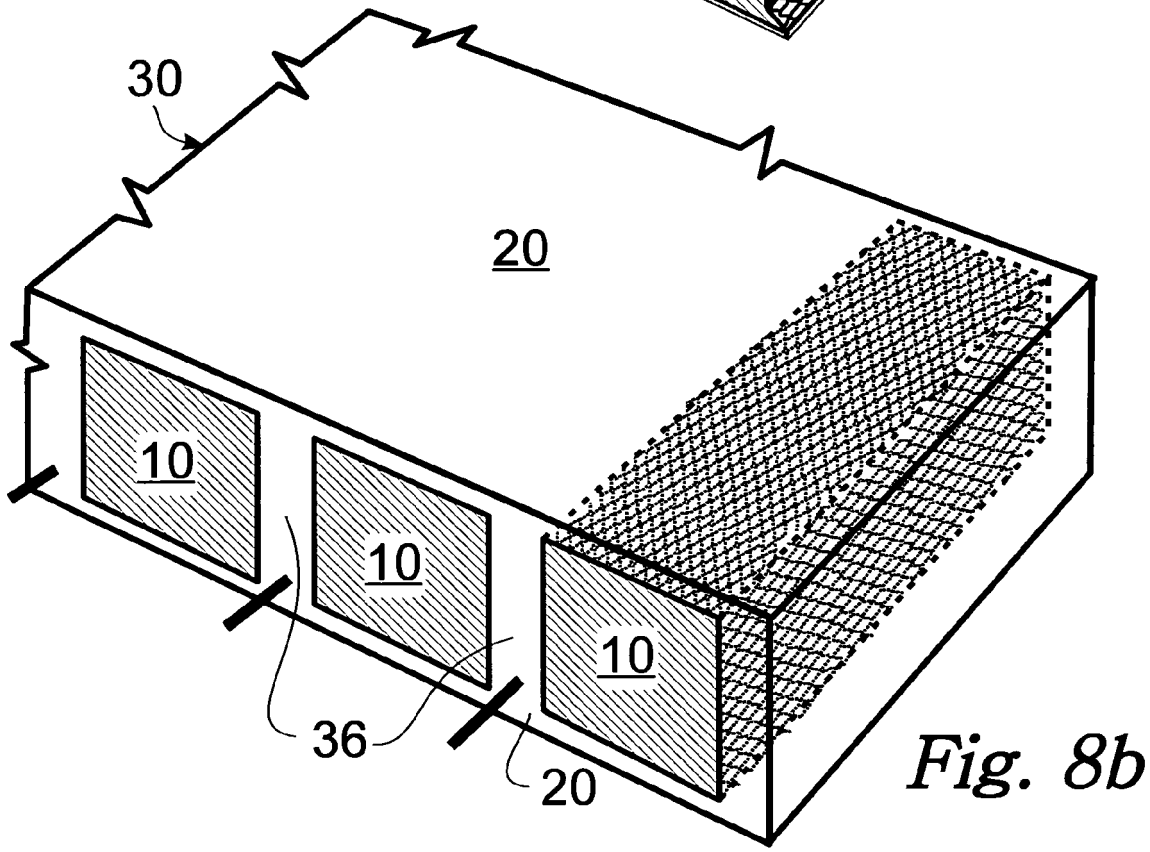


Fig. 8b

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 August 2006	Mysliwetz, W

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