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(54) MASONARY BLOCK WITH THERMALLY INSULATING AND LOAD BEARING PROPERTIES

(57) The invention relates to a masonary block (1) comprising, thin sectional wall elements (2, 2'), which are made of thermoplastic material and surrounding all block sides (3, 3'), an inner space (4) between the wall elements (2), and a plurality of support columns (5) inside the inner space (4), which are made of thermoplastic material, wherein all surrounding wall elements (2) and support columns (3) are monolithically firmly connected. All wall elements (2, 2') and support columns (5) consist of the same material and are produced by an injection molding process, wherein the inner space (4) is filled with light weight thermal insulating material (6) injected or poured inside through at least one breakthrough in at least one of the surrounding elements (2, 2').

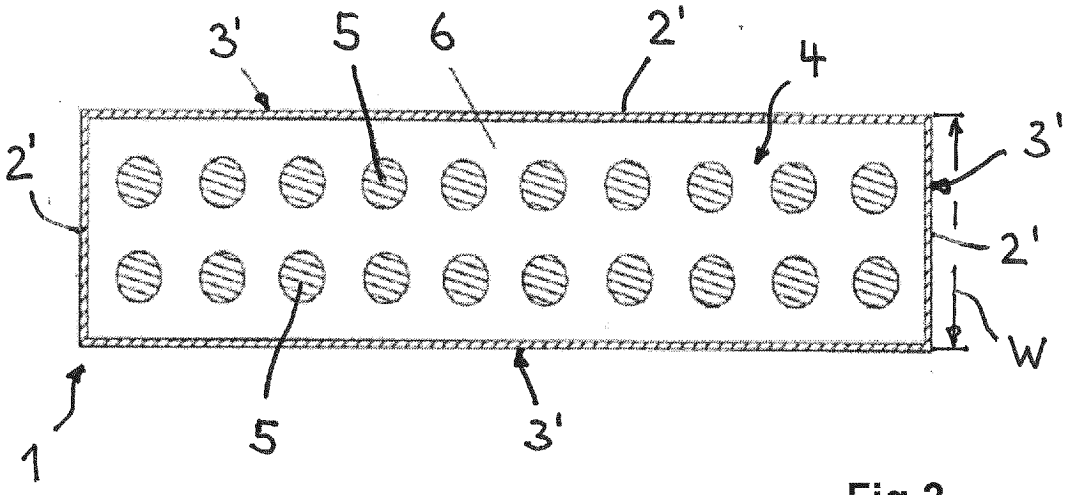

Fig.2

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Description

[0001] The invention relates to a thermally insulating and load bearing masonary block, which can also be used to achieve thermal insulation between a wall and a floor or a wall and a ceiling in load bearing and non-load bearing walls for a building.

[0002] Such heat insulating blocks are known for a long time for example from EP 2 151 531 A2 where a plurality of support columns are provided inside pre-made vertical holes in a heat insulating body coated from upper and lower surfaces with fiber reinforced mortar.

[0003] JP S 55-21257 A discloses a precast concrete part, which comprises a thermal insulation plate with several through-holes. CZ 2013715 A3 relates to a thermal insulation module having a frame, which comprises a lattice structure or several hollow cylinders.

[0004] The object of the present invention is to provide a new masonary block with improved mechanical and heat insulating properties as well as advantageous in its production compared to similar masonary blocks in the market.

[0005] The invention attains the underlying object at a masonary block arranged preferably between a wall and a floor or a wall and a ceiling in load bearing and non-load bearing walls having the features of claim 1. In paticular, the masonary block comprises thin sectional wall elements surrounding block sides and forming an inner space between the wall elements, and incorporating a plurality of support columns inside the hollow inner space, wherein all surrounding wall elements and support columns are monolithically firmly connected.

[0006] According to the invention, the approach adopted is that, instead of providing an insulating body through which support columns extends between the upper and lower support or contact surfaces, that masonary block now comprises thin sectional wall elements, which define surrounding block sides and define the outer dimensions and hull of the masonary block. In a preferred embodiment the inner space of the masonary block is defined by the thin sectional wall elements and define a hollow space within the masonary block. Two of the thin sectional wall elements define in particular an upper and a lower wall element having a support or contact surface and are oriented parallel to each other. The other four wall elments define lateral wall elements, which limit the upper and lower wall elements laterally. The support columns preferably extend between the upper and lower wall elements.

[0007] According to a preferred development of the present invention the masonary block, in particular all thin sectional wall elements and support columns, consist(s) of the same material and preferably are produced by an injection molding process or the surrounding wall elements including the connected support columns are produced in two or more separate pieces to be assembled and firmly fixed together to form the complete block by mechanical and /or chemical means. Using the same material for designing all wall elements and support columns and thus the complete hollow masonary block provides an improved and simplified design as a monolithically firmly connected unit. Together with an injection molding process the wall elements and support columns and coplete masonary block can easily be formed in an efficient manufacturing method.

[0008] In an alternative embodiment, due to some limitations of the injection molding process, the surrounding elements including the connected support columns are produced in two or more separate pieces, which to be assembled and firmly fixed together in a subsequent step to form the complete building block using mechanical and/or chemical means.

[0009] In a preferred configuration of the masonary block, the inner hollow space is filled with light weight thermal insulating material, which is injected or poured inside the hollow inner space through at least one opening or breakthrough, like a hole, in at least one of the surrounding wall elements. The thermal insulating material is used to overcome the negative effect of possible air convection inside the inner space on the thermal insulating property of block and improves the thermal insulation properties and/or reduces the overall thermal conductivity of the masonary block.

[0010] The inventional masonary block (1) has in a preferred embodiment a height of 40 mm to 100 mm a length of 300 mm to 600 mm and width, which corresponds to the thickness of the generated wall, of 80 mm to 360 mm.

[0011] The masonary block (1) according to the invention is adapted to be arranged between a wall and a floor and/or a wall and a ceiling of a building for heat transfer decoupling. Especially the heat transfer between a floor or a ceiling and a respective wall in contact therewith shall be reduced advantageously.

[0012] The material used for the production of the surrounding elements and support columns could be any material suitable for injection molding process. The selection of such material depends mainly on higher mechanical strengths, better heat insulation, waterproofness, water vapor and gas diffusion resistances and cost consideration. Thermosetting plastic materials like for example polystyrene, acrylic, Polycarbonate, PET, PVC, ABS or polyamide, which could also be extra reinforced with glass or polymeric fibers, are preferred for this application.

[0013] In an further embodiment the material selected to produce the surrounding wall elements and the support columns comprises a compressive strength, which ranges from approximately 20 N/mm^2 to 150 N/mm^2 and/or comprises a thermal conductivity, which ranges from approximately 0,10 W/m.K to 0,5 W/m.K.

[0014] The thickness of the surrounding wall elements comprises a thickness which is constant or variable, wherein the thickness is in the range from approximately 0,5 mm to 5,0 mm, preferably between 1,0 mm and 3,0 mm and could be stiffened with projections or rips to

increase its bending and deflection resistances.

[0015] The support columns have a shape, size, number and positions, which depend on the desired load capacity to be transferred between the upper and lower wall elements with its support or contact surfaces of the masonary block as well as the desired thermal insulation, which has to be achieved between the upper and lower support or contact surfaces of the masonary block. In other words, shape, size, number and positions of the support columns depend mainly on desired load capacities and thermal insulation capacities.

[0016] According to a preferred embodiment of the present invention, the support columns have a cross-section form, which preferably consist of circular, squared, pentagonal, star-shape, or combinations thereof or any other shape selected by the designer within the limitations of injection molding process.

[0017] Preferably the support columns have a cross-sectional area (3) which depends mainly on desired loading capacities and which ranges preferably approximately between 0,5 cm^2 and 4,0 cm^2. The cross-sectional area of the support columns can be variable from one column to another, depending on the distance to the thin sectional wall elements of the masonary block. The cross-sectional area of the support columns near the lateral wall elements is less than the cross-sectional area of the support columns arranged in the center of the block.

[0018] According to a preferred development of the masonary block the support columns have a cross-sectional area, which varies at least along a section of the column height, preferably at each end of the support columns. The columns are preferably connected at each end with the upper or the lower wall elements of the masonary block, wherein preferably a cross-sectional area is conically expanding in the direction of the respective adjacent wall elements.

[0019] The spacings between adjacent support columns (3) in both directions have a distance, which can vary preferably between 20 mm and 100 mm. The distance is the radial distance between the longitudinal axis of the respective support columns to each other. The distance between the support columns depends on the desired load capacity to be transferred between the the upper and lower wall elements with its support or contact surfaces of the masonary block

[0020] The heat insulating material which fills the inner space inside the surrounding wall elements is made of plastic foam, preferably such as but not limited to foam of polystyrene, PU, PIR or PVC or made of foam of hydraulic binders such as cement or gypsum. The choice of the insulating material depends mainly in addition to cost considerations on its better heat insulating property, but irrespective of its mechanical strengths since this filling material is completely enveloped and protected by the surrounding elements.

[0021] The filling material has a thermal coefficient of conductivity, which ranges from approximately 0,02 W/mK to 0,12 W/mK and preferably from approximately 0,02 W/mK to 0,04 W/m.K.

[0022] A further aspect of the present invention concerns a masonary block comprising, thin sectional wall elements surrounding block sides, and an inner space defined by the wall elements, wherein all surrounding wall elements are monolithically firmly connected and preferably consist of the same material.

[0023] The preferred embodiments or developments described in relation to masonary block according to the first aspect of the invention are at the same time also preferred configurations of the masonary block according to the second aspect of the invention, if these should not contradict each other. For the avoidance of repetition attention is directed to the foregoing description.

[0024] According to another preferred embodiment the surrounding elements are resistant against water permeability and /or water vapor and gas diffusion.

[0025] The invention is described in greater detail hereinafter by means of preferred embodiments with reference to the accompanying drawings which show:

Fig. 1:	a perspective view of a heat insulating block in accordance with the invention,
Fig. 2 and 3:	horizontal cross sectional views of two different embodiments of a heat insulating block;
Fig. 4:	a heat insulating block (1) in a vertical cross sectional view;
Fig. 5 and 6:	a further embodiment of a heat insulating block in accordance with the invention in horizontal and vertical cross-sections.

[0026] In Fig. 1 is shown a heat insulating block 1 comprising thin sectional wall elements 2, 2', which surround all block sides 3, 3'. The wall elements 2, 2' are produced of the same material. The upper and lower wall element 2 define a support or contact surface, which are oriented parallel to each other.

[0027] Furthermore, as visible in the sectional views of Fig. 2 to 4 the block 1 comprises a plurality of support columns 5, which are firmly connected to the wall elements 2, 2', preferably monolithically connected. The inner hollow space 4 enveloped by the surrounding elements 2, 2' is preferably filled with a heat insulating material 6, as such as foam.

[0028] The support columns 5 have for example a cylindrical cross section, which is constant along the entire length of the columns 5. In Fig. 2 the support columns 5 are arranged at a distance from the wall elements 2'. In an alternative embodiment the support columns 5 as shown in Fig. 3 are arranged adjacent to the wall elements 2', in particular at least partly with its perimeter area in contact with an inner side of the wall

elements 2'.

[0029] As an further embodiment according to the invention, fig. 5 and 6 show a masonary block 1 which has a height of 80 mm., length of 300 mm. and a width of 140 mm. the thickness of all surrounding elements 2 is in the range from approximately 0,5 mm to 5,0 mm, in the shown embodiment preferably 1,50 mm.

[0030] The support columns 5 are circular with a diameter d_1 of 16 mm. The support columns 5 have a cross-sectional area, which varies at least along a section of the column height, preferably at each end of the support columns 5. In particular, the support columns 5 have conic parts 7 at both upper and lower ends with an outside diameter d_2 of 40 mm and a height h_1 of 12 mm.

[0031] Half circular columns 5 shown in Fig. 5 are arranged at straight sides (wall elements 2') of block 1 and quarter circular columns 5 are arranged at the corners as shown in fig. 5 and 6. Adjacent support columns 5 are speced to each other, wherein the spacings between the column 5 in both directions have a distance, which can vary preferably between 20 mm and 100 mm

[0032] In a preferred embodiment the inner space 4 is also filled with light weight thermal insulating material 6 injected or poured inside through at least one breakthrough in at least one of the surrounding elements 2, 2'.

[0033] All surrounding wall elements 2, 2' and the support columns 5 are made by injection molding of polycarbonate having 30% glass fiber reinforcement of the following properties:

- Compressive strength = 125.0 N/mm2
- Thermal conductivity = 0.18 W/m.K

[0034] The hollow space 4 enveloped by the surrounding wall elements 2, 2' is filled with PIR foam 6 of a thermal conductivity of 0.025 W/m.K and density of 30 kg./m^3.

[0035] The compressive strength and thermal properties in vertical direction of the block 1 are calculated and given as follows:

- Vertical compressive strength = 10.5 N/mm^2
- Vertical equivalent thermal conductivity = 0.037 W/m.K
- Vertical thermal resistance (R-value) = 2.08 m^2K/W

[0036] Preferred aspects of the present invention are indicated below.

1. Masonary block (1) comprising,

   thin sectional wall elements (2, 2') surrounding block sides (3, 3'),
   an inner space (4) between the wall elements (2), and
   a plurality of support columns (5) inside the inner space (4),
   wherein all surrounding wall elements (2) and support columns (3) are monolithically firmly connected.

2. The masonary block (1) according to aspect 1,

   characterized in that all wall elements (2, 2') and support columns (5) consist of the same material and preferably are produced by an injection molding process.
   or
   the surrounding wall elements (2, 2') including the connected support columns (5) are produced in two or more separate pieces to be assembled and firmly fixed together to form the complete block (1) by mechanical and /or chemical means.

3. The masonary block (1) according to aspects 1 or 2,
characterized in that the inner space (4) is filled with light weight thermal insulating material (6) injected or poured inside through at least one breakthrough in at least one of the surrounding elements (2, 2').

4. The masonary block (1) according to at least one of the aspects 1 to 3, characterized in that the block (1) has a height (H) of 40 mm to 100 mm, a length (L) of 300 mm to 600 mm and width (W) of 80 mm to 360 mm.

5. The masonary block (1) according to at least one of the aspects 1 to 4, characterized in that the block (1) is adapted to be arranged between a wall and a floor and/or a wall and a ceiling of a building for heat transfer decoupling.

6. The masonary block (1) according to at least one of the aspects 1 to 5, characterized in that the surrounding wall elements (2) and support columns (5) are made of thermoplastic material such as but not limited to polystyrene, acrylic, polycarbonate, PET, PVC, ABS or polyamide which could also be reinforced with glass or polymeric fibers.

7. The masonary block (1) according to at least one of the aspects 2 to 6, characterized in that the material selected to produce the surrounding wall elements (2, 2') and the support columns (5) comprise a compressive strength, which ranges from approximately 20 N/mm^2 to 150 N/mm^2 and/or its thermal conductivity coefficient, which ranges from approximately 0,10 W/m.K to 0,5 W/m.K.

8. The masonary block (1) according to at least one of the aspects 1 to 7, characterized in that the surrounding wall elements (2, 2') comprises a thickness

which is constant or variable, wherein the thickness is in the range from approximately 0,5 mm to 5,0 mm, preferably from approximately 1,0 mm to 3,00 mm and could be stiffened with for example projections or rips of same material.

9. The masonary block (1) according to at least one of the aspects 1 to 8, characterized in that support columns (5) have a cross-section form, which consists of circular, squared, pentagonal, star-shape, or combinations thereof or any other shape selected by the designer within the limitations of injection molding process.

10. The masonary block (1) according to at least one of the aspects 1 to 9, characterized in that the support columns (5) have a cross-sectional area, which preferably ranges from approximately 0,5 cm^2 to 4,0 cm^2 and can be different from one column (5) to another.

11. The masonary block (1) according to at least one of the aspects 1 to 10, characterized in that the support columns (5) have a cross-sectional area, which varies at least along a section of the column height, preferably at each end of the support columns (5).

12. The masonary block (1) according to at least one of the aspects 1 to 11, characterized in that the spacings between adjacent support columns (5) in both directions have a distance, which can vary preferably between 20 mm and 100 mm.

13. The masonary block (1) according to at least one of the aspects 1 to 12, characterized in that the heat insulating material (6) filling the inner space (4) inside the block (1) is made of plastic foam, preferably such as but not limited to foam of polystyrene, PU, PIR or PVC, or made of foam of hydraulic binder such as cement or gypsum.

14. The masonary block (1) according to at least one of the aspects 1 to 13, characterized in that the filling material (6) has a heat coefficient of conductivity, which ranges from approximately 0,02 W/mK to 0,12 W/mK, preferably between 0,02 W/mK and 0,04 W/mK.

15. Masonary block (1) comprising,

thin sectional wall elements (2, 2') surrounding block sides (3, 3'), and
an inner space (4) between the wall elements (2, 2'),
wherein all surrounding wall elements (2, 2') are monolithically firmly connected and preferably consist of the same material.

16. The masonary block (1) according to at least one of the claims 1 to 15 , characterized in that the surrounding elements (2, 2') are resistant against water permeability and /or water vapor and gas diffusion.

List of reference signs

[0037]

1	masonary block
2, 2'	wall element
3, 3'	block side
4	inner space
5	support column
6	Insulating material
7	conic part

Claims

1. Masonary block (1) comprising,

thin sectional wall elements (2, 2'), which are made of thermoplastic material and surrounding all block sides (3, 3'),
an inner space (4) between the wall elements (2), and
a plurality of support columns (5) inside the inner space (4), which are made of thermoplastic material,
wherein all surrounding wall elements (2) and support columns (3) are monolithically firmly connected,
characterized in that all wall elements (2, 2') and support columns (5) consist of the same material and are produced by an injection molding process,
wherein the inner space (4) is filled with light weight thermal insulating material (6) injected or poured inside through at least one breakthrough in at least one of the surrounding elements (2, 2').

2. The masonary block (1) according to claim 1, **characterized in that** the block (1) has a height (H) of 40 mm to 100 mm, a length (L) of 300 mm to 600 mm and width (W) of 80 mm to 360 mm.

3. The masonary block (1) according to claims 1 or 2, **characterized in that** the block (1) is adapted to be arranged between a wall and a floor and/or a wall and a ceiling of a building for heat transfer decoupling.

4. The masonary block (1) according to at least one of the claim 1 to 3, **characterized in that** the thermoplastic material is polystyrene, acrylic, polycarbonate, PET, PVC, ABS or polyamide which could also be reinforced with

glass or polymeric fibers.

5. The masonary block (1) according to at least one of the claims 1 to 4, **characterized in that** the material selected to produce the surrounding wall elements (2, 2') and the support columns (5) comprise a compressive strength, which ranges from approximately 20 N/mm^2 to 150 N/mm^2 and/or its thermal conductivity coefficient, which ranges from approximately 0,10 W/m.K to 0,5 W/m.K.

6. The masonary block (1) according to at least one of the claims 1 to 5, **characterized in that** the surrounding wall elements (2, 2') comprises a thickness which is constant or variable, wherein the thickness is in the range from approximately 0,5 mm to 5,0 mm, preferably from approximately 1,0 mm to 3,00 mm and could be stiffened with for example projections or rips of same material.

7. The masonary block (1) according to at least one of the claims 1 to 6, **characterized in that** support columns (5) have a cross-section form, which consists of circular, squared, pentagonal, star-shape, or combinations thereof or any other shape selected by the designer within the limitations of injection molding process.

8. The masonary block (1) according to at least one of the claims 1 to 7, **characterized in that** the support columns (5) have a cross-sectional area, which preferably ranges from approximately 0,5 cm^2 to 4,0 cm^2 and can be different from one column (5) to another.

9. The masonary block (1) according to at least one of the claims 1 to 8, **characterized in that** the support columns (5) have a cross-sectional area, which varies at least along a section of the column height, preferably at each end of the support columns (5).

10. The masonary block (1) according to at least one of the claims 1 to 9, **characterized in that** the spacings between adjacent support columns (5) in both directions have a distance, which can vary preferably between 20 mm and 100 mm.

11. The masonary block (1) according to at least one of the claims 1 to 12, **characterized in that** the heat insulating material (6) filling the inner space (4) inside the block (1) is made of plastic foam, preferably such as but not limited to foam of polystyrene, PU, PIR or PVC, or made of foam of hydraulic binder such as cement or gypsum.

12. The masonary block (1) according to at least one of the claims 1 to 13, **characterized in that** the filling material (6) has a heat coefficient of conductivity, which ranges from approximately 0,02 W/mK to 0,12 W/mK, preferably between 0,02 W/mK and 0,04 W/mK.

13. The masonary block (1) according to at least one of the claims 1 to 12, **characterized in that** the surrounding elements (2, 2') are resistant against water permeability and /or water vapor and gas diffusion.

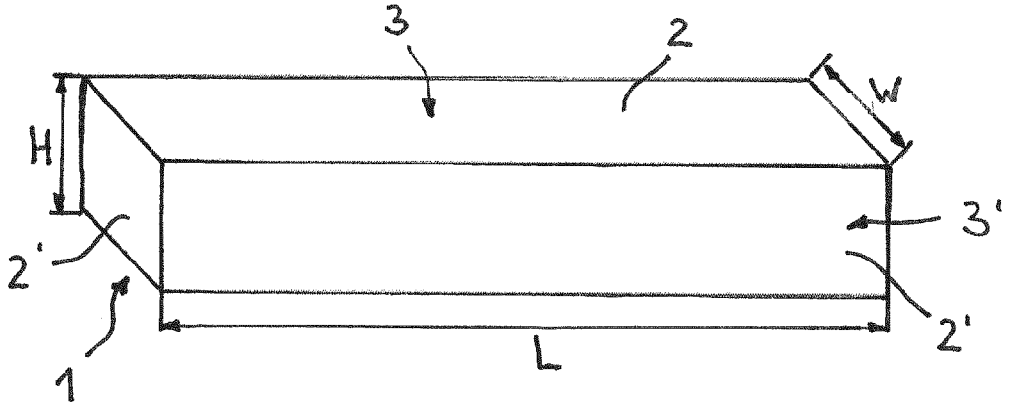

Fig.1

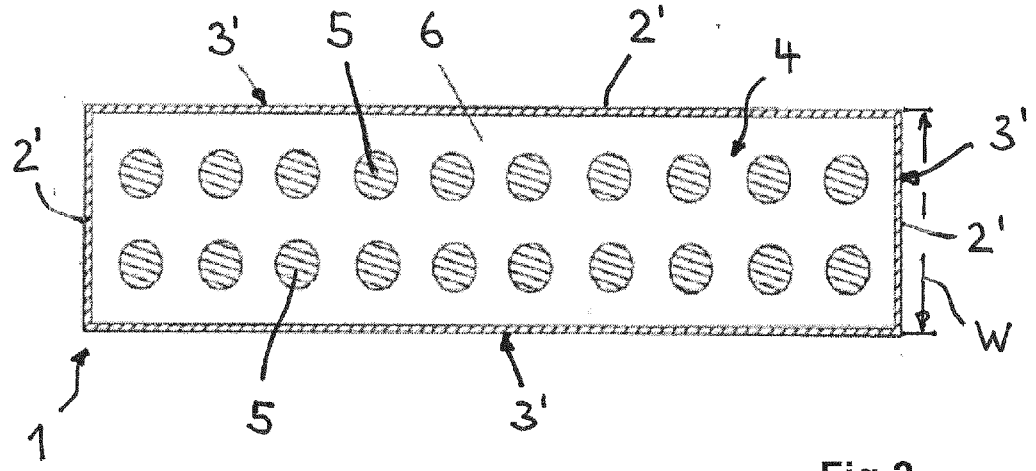

Fig.2

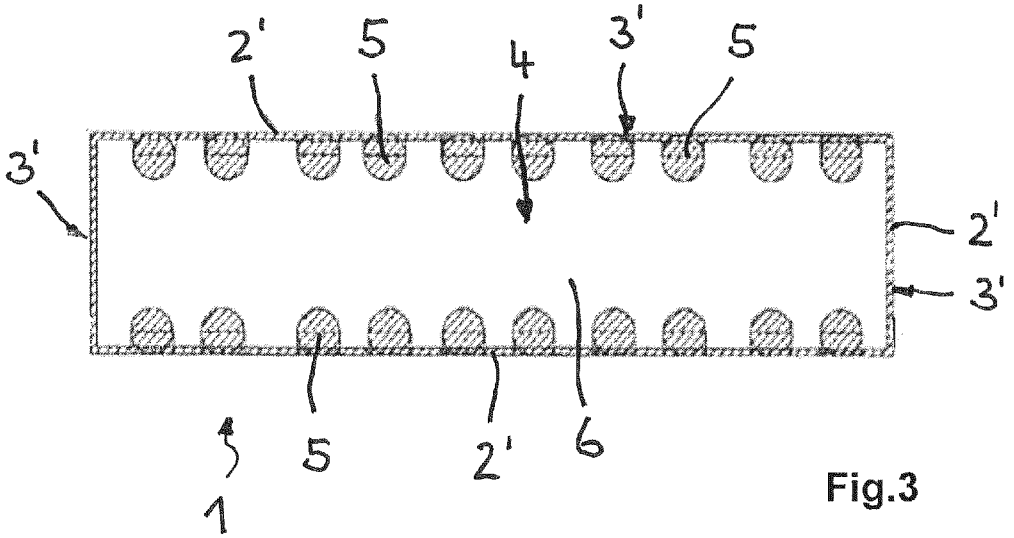

Fig.3

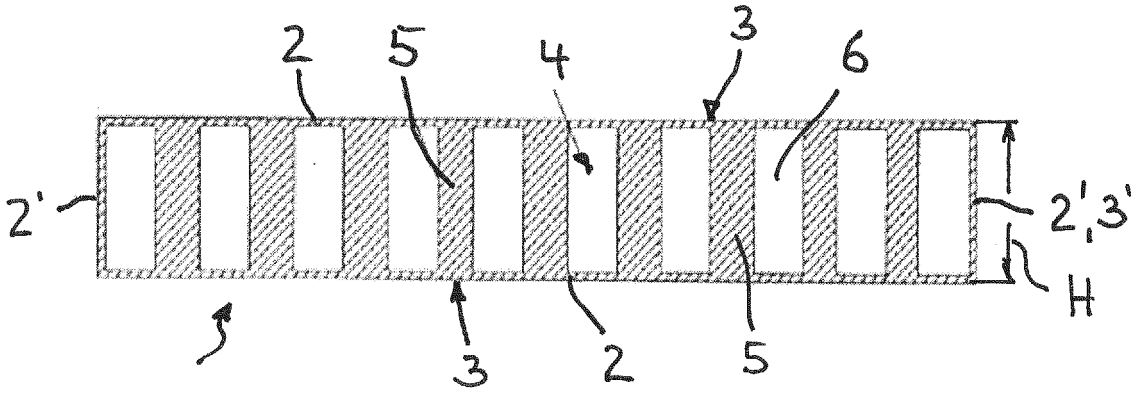

Fig.4

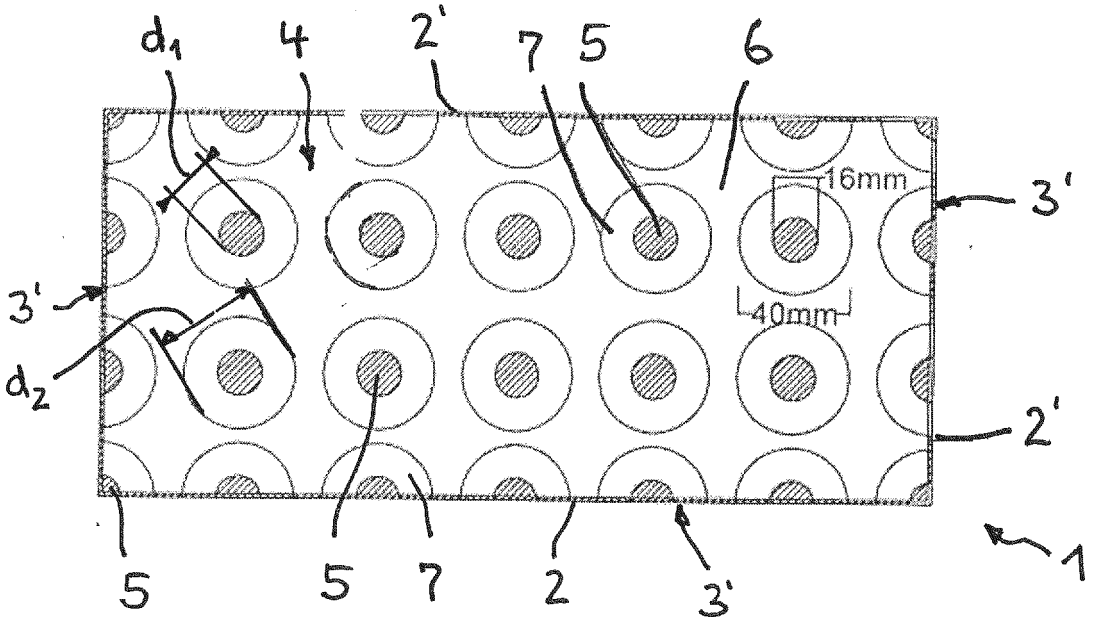

Fig.5

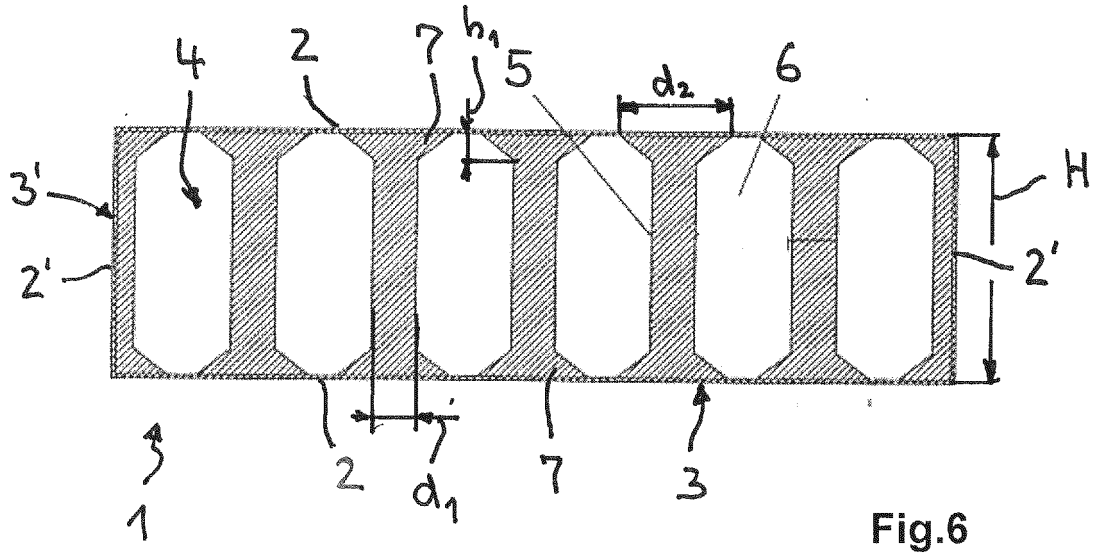

Fig.6

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EUROPEAN SEARCH REPORT

Application Number
EP 24 18 8053

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 3 440 788 A (MERGET ARTHUR B) 29 April 1969 (1969-04-29) * the whole document * -----	1,3-8, 10,13 11,12	INV. E04B2/14 E04B1/78 E04B2/26
X	US 11 643 806 B2 (BERGER ERIC [US]; BERGER REGAN [US]) 9 May 2023 (2023-05-09) * column 5, line 40 - column 6, line 50; figures 1-5 * -----	1-3,6-8, 10,13	E04B2/86 E04C1/40 E04C1/42
X	EA 028 825 B1 (VANDENBEMPT PATENT CV [BE]) 31 January 2018 (2018-01-31) * paragraph [0001] * * paragraph [0017] * * paragraph [0039] - paragraph [0085]; figures 1-12 * -----	1,3,6, 8-10,13	
Y	CN 110 685 399 B (ANHUI KUNMENG NEW BUILDING MAT CO LTD) 2 April 2021 (2021-04-02) * paragraph [0002] * * paragraph [0035] - paragraph [0056]; figures 1-5 * -----	11,12	
A	US 3 180 060 A (PERSAK JR GEORGE) 27 April 1965 (1965-04-27) * the whole document * -----	1-13	

TECHNICAL FIELDS SEARCHED (IPC)
E04B
E04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 November 2024	Giannakou, Evangelia

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 18 8053

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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04-11-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3440788 A	29-04-1969	NONE	
US 11643806 B2	09-05-2023	US 2022018115 A1	20-01-2022
		WO 2022015693 A2	20-01-2022
EA 028825 B1	31-01-2018	AU 2013239111 A1	13-11-2014
		BE 1020597 A3	07-01-2014
		CA 2868950 A1	03-10-2013
		CN 104321493 A	28-01-2015
		EA 201491794 A1	30-07-2015
		EP 2831347 A1	04-02-2015
		JP 6193347 B2	06-09-2017
		JP 2015513020 A	30-04-2015
		MA 20150068 A1	27-02-2015
		TN 2014000407 A1	21-12-2015
		US 2015075106 A1	19-03-2015
		WO 2013144913 A1	03-10-2013
		ZA 201407849 B	27-07-2016
CN 110685399 B	02-04-2021	NONE	
US 3180060 A	27-04-1965	NONE	

EPO FORM P0459

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Patent documents cited in the description

- EP 2151531 A2 **[0002]**
- JP S5521257 A **[0003]**
- CZ 2013715 A3 **[0003]**