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(54) **METHOD OF MANUFACTURE OF THE FACADE THERMAL INSULATION FINISHING ELEMENT AND THE FINISHING ELEMENT OBTAINED THERE THROUGH**

(57) The invention relates to a method of manufacturing a thermal insulation finishing element for the insulation and decoration of building facades. Several perforated metal strips (3) are first inserted into the thermal insulation board (2) for fixing the thermal insulation board (2) to the facade of the building. The perforated fastening strips (3) are inserted across the board (2) and are directed from the inner side of the board (2) at an angle of 45° diagonally downwards along the entire thickness of the plate (2). The protruding ends of the perforated fastening strips (3) are bent so that the inner end (3a) of the perforated fastening strip (3) is directed vertically upwards, the outer end (3b) of the perforated fastening strip

(3) having a right-angled part (3c) is directed vertically downwards, and a portion (3c) of the end (3b) engages the thermal insulation board (2). A cementitious mixture containing cement, sand, basalt fiber, pigment, hydrophobizing additive, deaeration promoter, plasticizer, water is then prepared. The mixture is poured into paraffin-coated PVC moulds and vibrated. A thermal insulation element (2) with pre-inserted perforated fastening strips (3) is placed on the pre-vibrated mass, and a pressure of 0.4-1.0 MPa is applied to connect the outer surface of the board with the mixture to form an integrated 8-15 mm thick finishing layer (4). The product is dried in the mould, then removed from the mould and finally dried.

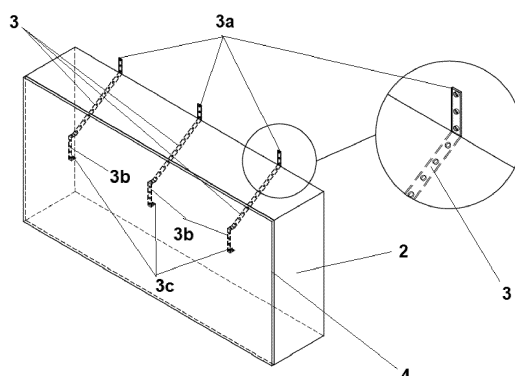


Fig. 2

Description

FIELD OF THE INVENTION

[0001] The invention relates to the construction industry, and more particularly to a method of manufacturing a thermal insulation finishing element for insulating and decorating the external walls of buildings and to a thermal insulating finishing element obtained thereby.

BACKGROUND OF THE INVENTION

[0002] Currently, in the construction industry, the external walls of buildings are insulated by covering them with a suitable thermal insulation material, such as polystyrene foam panels or thermal insulation wool, which are then covered with a desired finish such as plaster, clinker tiles, granite, marble, aluminum or others. The thermal insulation material is attached to the external surface of the building with glue or pins or in combination of both methods.

[0003] Such a method of thermal insulation and finishing of the external walls of buildings becomes problematic to implement in the presence of negative air temperature, because both the finishing of the thermal insulation material and its gluing to the external wall of the building can be performed only at a positive outdoor temperature.

[0004] European patent No. EP2675962 describes the construction, production and installation methods of a thermal insulation product for the insulation and finishing of the external walls of buildings. The product of the invention consists essentially of two elements: a thermal insulation material and a finishing board. The finishing board can be made of ceramic, plastic, wood, glass, metal, aluminum, granite, natural stone, marble, laminate and other materials suitable for finishing. The thermal insulation material is a polyurethane or extruded polyester board, the outer side of which is covered with a finishing board, glued to the thermal insulation board with a polyurethane adhesive covering the entire inner surface of the finishing board. The final product thus obtained - a thermal insulation board with an external finish - is attached to the outer wall of the building with either glue or pins.

[0005] Another variant of realization of a thermal insulation product for insulation of the external walls of buildings is described in Lithuanian patent No. 6693 owned by an applicant of the present invention. The invention describes a thermal insulation finishing element for fixing to the outer wall of a building, where the finishing layer is formed directly on the outer surface of the thermal insulation board. The method according to this invention is realized by creating a cement mixture with special properties, which, using a special technology, is inseparably connected to the thermal insulation board. A thermal insulation finishing element is obtained, which has an integrated 8-15 mm thick decorative finishing layer with a surface imitating marble, natural stone or other decorative

finishing. The thermal insulation finishing element is attached to the external wall of the building both mechanically with pins through appropriate perforated metal strips attached to the inside of the thermal insulation finishing board and with the usual adhesives for attaching polystyrene foam to the external wall of the building.

SUMMARY OF THE INVENTION

[0006] The object of the present invention is to improve the previous method of manufacturing a thermal insulation finishing element, which would include a technology for the production of a thermal insulation finishing element with integrated elements for its fastening to a building facade.

[0007] According to the present invention, a plurality of perforated metal strips are first inserted into the thermal insulation board, which is preferably a polystyrene foam board, for fixing the final formed thermal insulation finishing element to the building facade. The perforated fastening strips are inserted across the thermal insulation board and are directed diagonally downwards from the upper edge of the inner side of the thermal insulation board over the entire thickness of the thermal insulation board. Several such perforated fastening strips are inserted over the entire length of the thermal insulation board and their number depends on the length of the thermal insulation board.

[0008] Perforated fastening strips for fastening the thermal insulation finishing element to the wall of the building facade are inserted so that their inner and outer ends remain partially protruding on opposite inner and outer sides. The protruding ends of the perforated strips are folded so that the inner end of the perforated fastening strip faces vertically upwards and the outer end of the perforated strip faces vertically downwards, covering a part of the outer surface of the thermal insulation board.

[0009] The thermal insulation board is now ready to be covered with an outer finishing layer. First, a special cement mixture, consisting of cement, sand, basalt fiber, various pigments, a hydrophobic additive, an air removal additive, a plasticizer, is added to the mixer. The mixer is switched on, and water and plasticizers are added to the mixture. The resulting mass is poured into special paraffin-coated PVC moulds corresponding to the shape of the thermal insulation element and having the desired relief of the outer surface of the thermal insulation element. The mould with the mixture is placed on a vibrating table and vibrated. A thermal insulation element with already inserted perforated fastening strips is placed in the mould on the vibrated mass, and the lower surface of the board, which is at the same time the outer (facade) surface of the thermal insulation finishing element, is connected with the mixture by means of a pressure. The product is dried in the mould, then removed from the mould and finally dried.

[0010] In this way a ready-to-attach thermal insulation finishing element is obtained, one surface of which is

inextricably joined with the cementitious mixture forming the outer decorative finishing layer without the use of any additional intermediate polyurethane adhesive, and the opposite surface has protruding ends of perforated fastening strips designed for fastening the thermal insulation finishing element to the facade of the building. Selecting the appropriate pigments results in decorative finishing layers of the thermal insulation element in different colours and patterns, imitating, for example, marble, natural stone or other decorative finishes.

[0011] The cementitious mixture of the present invention, pressurized with a thermal insulation element, acquires the properties of a monolith in the final product, becoming resistant to mechanical and atmospheric-temperature effects, while giving the exterior of an insulated building an aesthetic decorative appearance. The thermal insulation finishing element obtained by the method of the present invention is fastened to the outer wall of the building mechanically by means of pins through corresponding openings in the inner ends of the perforated metal fastening strips pierced transversely through the thermal insulation element. As mentioned earlier, the outer ends of the perforated fastening strips under the finishing layer are folded vertically downwards, partially embracing the thermal insulation element and ensuring its reliable pressure on and non-separation from the building facade.

BRIEF DESCRIPTION OF FIGURES

[0012]

Fig. 1 is a general view of a thermal insulation finishing element of the present invention;
 Fig. 2 shows a three-dimensional view of the thermal insulation finishing element;
 Fig. 3 is a top view of a thermal insulation finishing element;
 Fig. 4 is a front view of a thermal insulation finishing element;
 Fig. 5 is the cross-sectional view of the thermal insulation finishing element of Fig. 1 through the line A-A.

DETAILED DESCRIPTION OF THE INVENTION

[0013] As mentioned, the object of the invention is to produce a thermal insulation finishing element with integrated elements of its fastening to the external wall of a building. In the present invention, the term "thermal insulation finishing element" refers to a thermal insulating board, usually in the shape of a rectangular parallelepiped, having integrated elements for its attachment to the wall of the building, and a decorative layer on the outer surface facing the viewer.

[0014] The invention will further be described with reference to Figures 1-5. According to the present invention, the thermal insulation finishing element 1 comprises a

thermal insulation board 2, preferably a polystyrene foam board, having the integrated perforated metal strips 3 for attaching the thermal insulation finishing element 1 to the exterior wall of the building, and a decorative finishing layer 1 covering the surface of the thermal insulation board 2 facing the viewer.

[0015] As shown in Fig. 2, the perforated fastening strips 3 are pierced across the thermal insulation board 2 and are directed diagonally downwards from the upper edge of the inner side of the thermal insulation board 2 over the entire thickness of the thermal insulation board 2 towards the outer side of the thermal insulation board 2. Several such perforated metal strips 3 are inserted over the entire length of the thermal insulation board 2 and their number depends on the length of the thermal insulation board 2. For reliable fastening of the thermal insulation finishing element 1 to the external wall of the building, it is recommended that the distance *a* between adjacent perforated fastening strips 3 would be between 30-40 cm, and the distance *b* from the lateral perforated fastening strips 3 to the side edge of the thermal insulation board 2 would not exceed 20 cm.

[0016] As mentioned, the perforated metal strips 3 are pierced across the thermal insulation board 2. They are directed at an angle of approximately 45° from the upper edge of the inner side of the thermal insulation board 2 down the entire thickness of the thermal insulation board 2.

[0017] The perforated fastening strips 3 are intended for fixing the thermal insulation finishing element 1 to the wall of the building facade and are inserted rated so that their inner ends 3a and outer 3b remain protruding on opposite inner and outer sides of the thermal insulation board 2.

[0018] Preferably, the length of the end 3a of the perforated fastening strip 3 is about 50 mm and the length of the end 3b is about 80 mm. The protruding ends 3a and 3b of the perforated fastening strips 3 are folded so that the inner end of the perforated fastening strip 3a for fastening to the building wall is directed vertically upwards and the outer end 3b of the perforated fastening strip is directed vertically downwards and pressed against the outer surface of the thermal insulation board 2. In addition, the part 3c of the perforated fastening strip 3b is bent at a right angle to the inside of the thermal insulation board 2, thus engaging with the thermal insulation board 2. This method of mounting the perforated fastening strips 3 ensures reliable fixation of the thermal insulation finishing element 1 and its pressing against the external wall of the building.

[0019] After installing the perforated fastening strips 3, the thermal insulation board 2 is forwarded to the next stage, i.e. for forming a decorative finishing layer 4 on the outer surface of the thermal insulation board 2. A special mixture has been created to form the decorative finishing layer 4, the components of which consist of:

- cement and 0/2 mm fraction sand in a ratio of 1:2 to

- 1:3, preferably 1:2.5;
- basalt fiber up to 0.3% w/w of the cementitious mixture;
- pigment from 0.5 to 1.0% w/w of the cementitious mixture to obtain the desired colour of the finishing layer;
- hydrophobizing agent from 0.2 to 0.3% w/w of the cementitious mixture;
- air removal additive up to 0.2% w/w of the cementitious mixture;
- plasticizer up to 0.5% w/w of the cementitious mixture.

[0020] The finishing layer is formed on the thermal insulation board 2 in the following way: the components of the cementitious mixture are added to the mixer in the proportions given above. When the mixer is switched on, water is added in amount from 8 to 9% w/w of the cementitious mixture. The mixture is stirred up for 10 to 15 minutes until a homogeneous mass of the mixture is obtained. The resulting mixture is poured into PVC moulds, coated beforehand with a paraffin mixture. The PVC mould with the mixture is placed on a vibrating table and vibrated for 30 to 90 seconds, preferably up to 60 seconds.

[0021] During further vibration, a thermal insulation board 2 with perforated fastening strips 3, installed into the thermal insulation board 2 in a previous step, is pressed into the liquid cementitious mixture with a side having the ends 3b of the perforated fastening strips 3. By applying a pressure of 0.4-1.0 MPa, the thermal insulation board 2 is joined with the cementitious mixture and left to dry at a temperature of 20-22°C and a humidity of 70-90% for up to 24 hours. Finally, the product is removed from the mould and finally dried to give a thermal insulation finishing element 1, shown in Fig. 1, with an integrated 8-15 mm thick decorative finishing layer 4 covering the outer ends 3b of the perforated fastening strips 3.

[0022] The decorative finishing layer 4, formed on the outer surface of the thermal insulation board 2, achieves monolithic properties resistant to mechanical and atmospheric or temperature impacts, while providing an aesthetic view to the facade of the building covered with thermal insulation finishing elements 1 of the present invention. The thermal insulation finishing element 1 is fastened to the outer wall of the building mechanically by means of pins through the respective inner ends 3a of the perforated fastening strips 3.

[0023] By selecting the appropriate pigments, decorative finishing layers 4 of different colours and patterns are obtained, having a surface imitating marble, natural stone or other decorative finishes.

[0024] The invention is described with reference to a method of manufacturing a rectangular parallelepiped-shaped thermal insulation finishing element having only one decorative surface. It is obvious that the method can be equally applied to the production of other forms of

thermal insulation finishing elements with a decorative coating applied to more than one surface of the same thermal insulation element and intended, for example, for insulation and decoration of the external corners of buildings.

Claims

1. A method of manufacturing a thermal insulation finishing element for insulating and decorating the exterior walls of buildings, comprising formation of a decorative finishing layer on the outer surface of the thermal insulation board, **characterized in** the steps of:
 - a) installing in the thermal insulation board (2) of perforated metal strips (3) for holding the thermal insulation board (2) and fixing it to the facade of the building; and
 - b) forming a decorative finishing layer (4) on the outer surface of the thermal insulation board (2).
2. The method according to claim 1, **characterized in that** the perforated fastening strips (3) are inserted transversely of the thermal insulation board (2) and directed at an angle of approximately 45° downwards from the upper edge of the inner side of the thermal insulation board (2) over the entire thickness of the thermal insulation board (2) towards the outer side of the thermal insulation board 2.
3. The method according to claims 1 and 2, **characterized in that** the perforated fastening strips (3) are installed so that their inner (3a) and outer (3b) ends remain protruding on opposite inner and outer sides of the thermal insulation board (2), and are bent so that the inner end (3a) of the perforated fastening strip (3) for fixing the thermal insulation board (2) to the facade of the building is directed vertically upwards, and the outer end (3b) of the perforated fastening strip (3) is directed vertically downwards, covering a part of the outer surface of the thermal insulation board (2).
4. The method according to claim 3, **characterized in that** the length of the end (3a) of the perforated fastening strip (3) is optimally up to 50 mm and the length of the end (3b) of the perforated fastening strip (3) is up to 80 mm.
5. The method according to claim 3, **characterized in that** the part (3c) of the outer end (3b) of the perforated fastening strip (3) is bent at a right angle into the interior of the thermal insulation board (2), thus engaging with the thermal insulation board (2).
6. The method according to claims 1-5, **characterized**

in that the distance *a* between the adjacent perforated fastening strips (3) is in the range between 30-40 cm, and the distance *b* from the lateral perforated fastening strips (3) to the side edge of the thermal insulation board (2) does not exceed 20 cm.

7. The method according to claim 1, **characterized in that** the formation of the decorative finishing layer (4) on the outer surface of the thermal insulation board (2) comprises the following steps:

a) preparing the mixture consisting of:

- cement and 0/2 mm fraction sand in a ratio of 1:2 to 1:3, preferably 1:2.5;
- basalt fiber up to 0.3% w/w of the cementitious mixture;
- pigment from 0.5 to 1.0% w/w of the cementitious mixture to obtain the desired colour of the finishing layer;
- hydrophobizing agent from 0.2 to 0.3% w/w of the cementitious mixture;
- air removal additive up to 0.2% w/w of the cementitious mixture;
- plasticizer up to 0.5% w/w of the cementitious mixture;

b) with the mixer switched on, adding water in amount of 8 to 9% w/w of the cementitious mixture;

c) stirring up the mixture for 10 to 15 minutes to obtain a homogeneous mass of the mixture;

d) pouring the resulting mixture into PVC moulds coated beforehand with a paraffin mixture;

e) placing the PVC mould with the mixture on a vibrating table and vibrating for 30 to 90 seconds, preferably up to 60 seconds;

f) pressing the thermal insulation board (2) with the pre-installed perforated fastening strips (3) into the pre-vibrated liquid cementitious mass with the side having the ends (3b) of the perforated fastening strips (3);

g) applying a pressure of 0.4-1.0 MPa to connect the thermal insulation board (2) with the cementitious mixture, and letting dry at a temperature of 20-22°C and a humidity of 70-90% for up to 24 hours;

h) removing the product from the mould and finally drying to obtain a final thermal insulation finishing element (1) with an integrated 8-15 mm thick finishing layer (4).

8. A thermal insulating finishing element (1) obtained by a method according to claims 1-7 for insulation and decoration of external walls of buildings.

Amended claims in accordance with Rule 137(2) EPC.

1. A method of manufacturing a thermal insulation finishing element for insulating and decorating the exterior walls of buildings, comprising the step a) of installing in the thermal insulation board perforated fastening strips for holding the thermal insulation board and for fixing it to the facade of the building, and the step b) of forming a decorative finishing layer on the outer surface of the thermal insulation board, wherein the step a) further comprising:

- inserting the perforated fastening strips (3) transversely the thermal insulation board (2) and directing the perforated fastening strips (3) at an angle of approximately 45° downwards from the upper edge of the inner side of the thermal insulation board (2) over the entire thickness of the thermal insulation board (2) towards the outer side of the thermal insulation board 2,
- installing the perforated fastening strips (3) so that their inner (3a) and outer (3b) ends remain protruding on opposite inner and outer sides of the thermal insulation board (2),
- bending the ends (3a) and (3b) so that the inner end (3a) of the perforated fastening strip (3) for fixing the thermal insulation board (2) to the facade of the building is directed vertically upwards, and the outer end (3b) of the perforated fastening strip (3) is directed vertically downwards, covering a part of the outer surface of the thermal insulation board (2).

2. The method according to claim 1, **characterized in that** the length of the end (3a) of the perforated fastening strip (3) is optimally up to 50 mm, and the length of the end (3b) of the perforated fastening strip (3) is up to 80 mm.

3. The method according to claim 1, **characterized in that** the part (3c) of the outer end (3b) of the perforated fastening strip (3) is bent at a right angle into the interior of the thermal insulation board (2), thus engaging with the thermal insulation board (2).

4. The method according to claims 1-3, **characterized in that** the distance *a* between the adjacent perforated fastening strips (3) is in the range between 30-40 cm, and the distance *b* from the lateral perforated fastening strips (3) to the side edge of the thermal insulation board (2) does not exceed 20 cm.

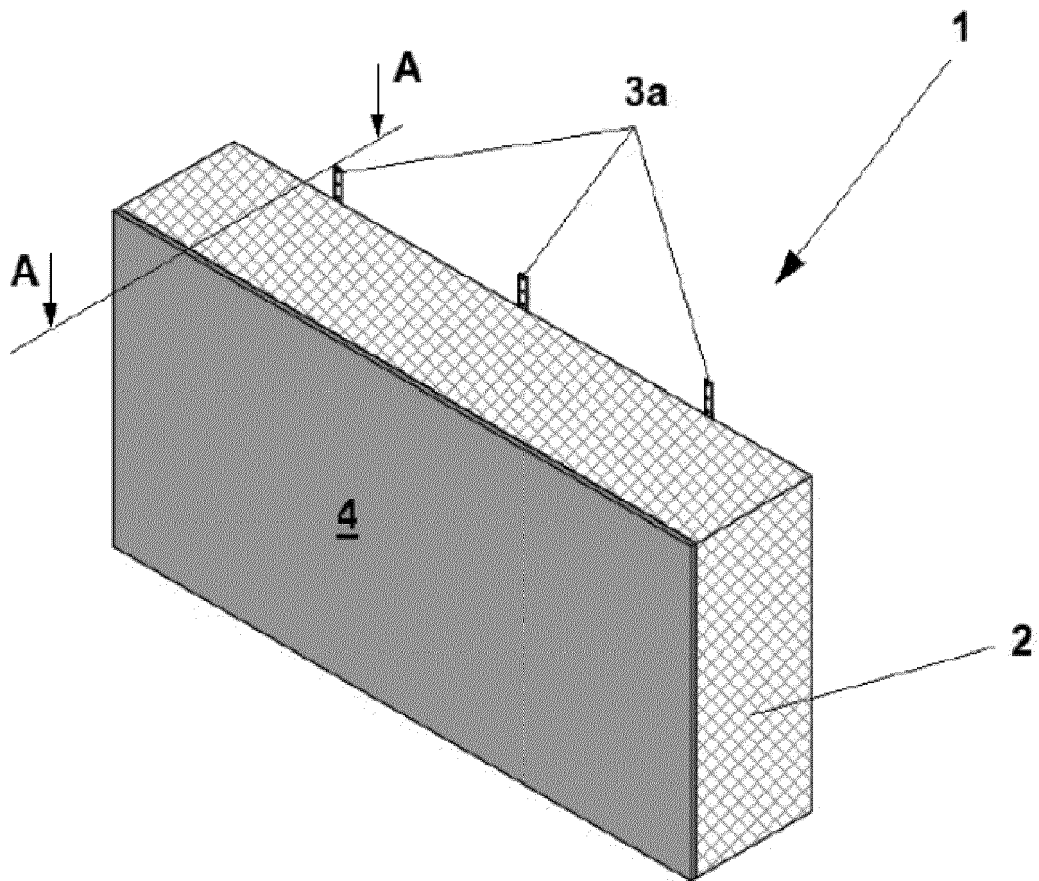


Fig. 1

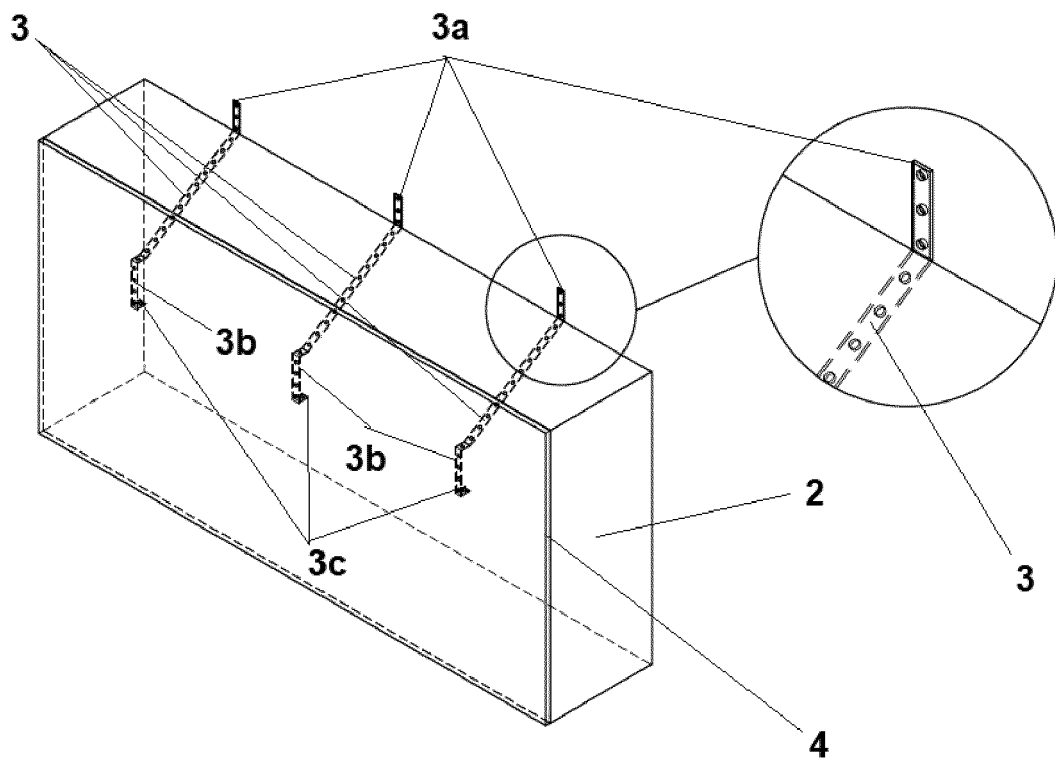


Fig. 2

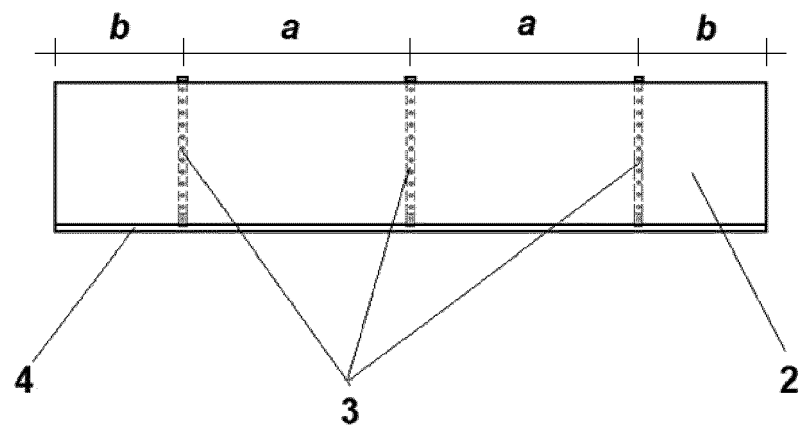


Fig. 3

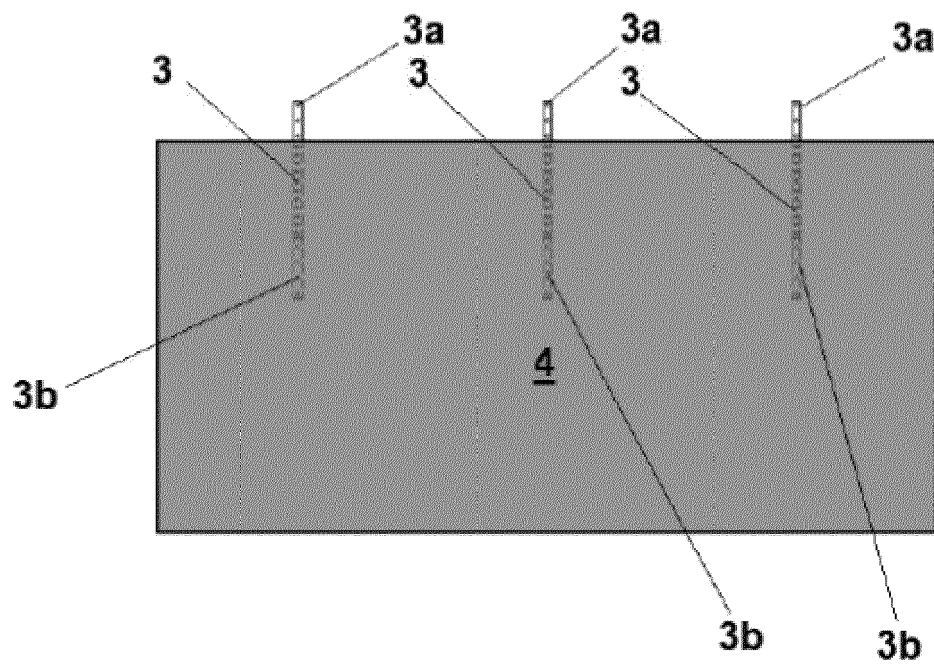


Fig. 4

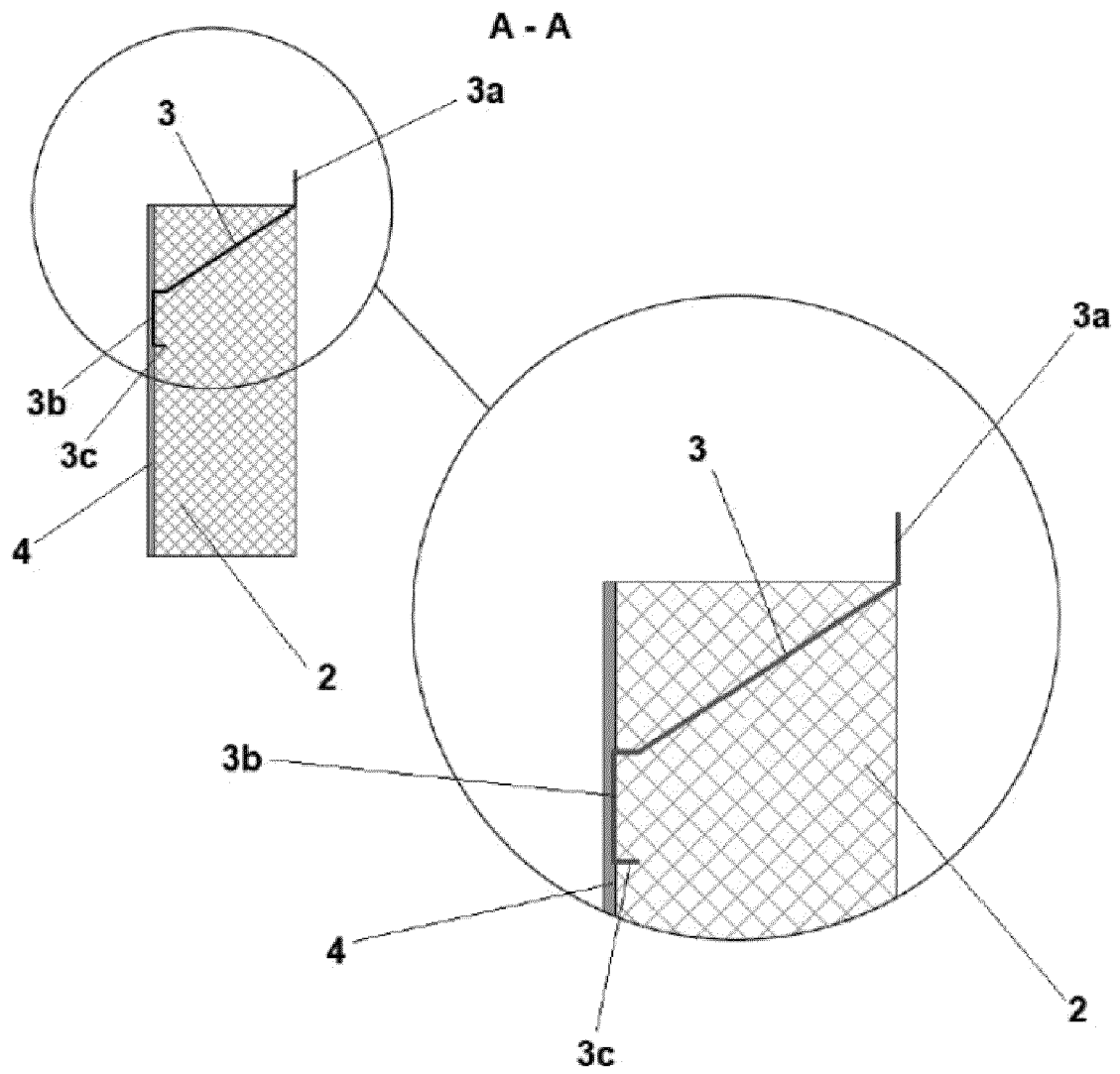


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 21 15 6749

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* claim 1; figure 1 *	2,6	
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A	* column 4, line 2 - column 5, line 42; figure 2 *	3-5	
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			TECHNICAL FIELDS SEARCHED (IPC)
			E04F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 July 2021	Examiner Khera, Daljit
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 21 15 6749

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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20-07-2021

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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