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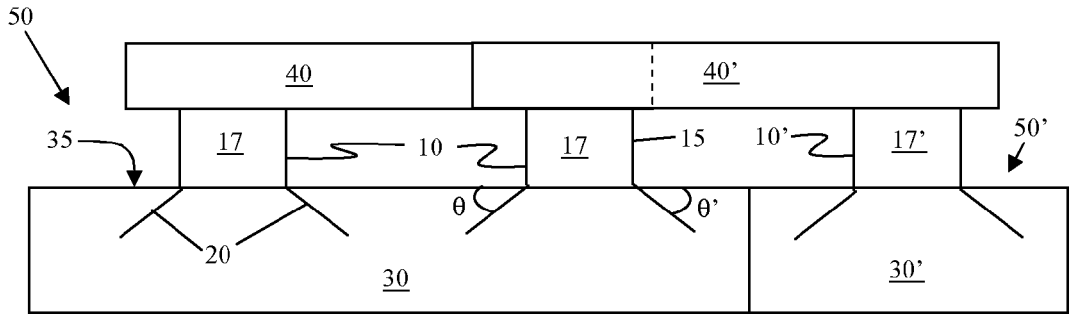
(54) **Insulated batten board for tile roofing and method of roofing a building**

(57) A free-standing insulated batten board article includes both an insulating board (30) and battens (10) affixed to the insulating board with a strength of at least 100 kiloPascals wherein the battens have sides and wings (20), the wings being non-parallel to the sides of the batten profile and the wings residing within the insulating board and the sides extending out from a primary surface (35) of the insulating board and wherein the battens are made of materials other than mortar and are a material different than the insulating board.

FIG 1

(c)



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Description

[0001] The present invention relates to an insulating roofing board article with integrated battens for supporting tile roofing components.

[0002] Tile roofing is common in many parts of the world, including the Mediterranean. One method of installing tile roofing is to install an insulating board to a roof and then install battens on the insulating board and ultimately affix tiles to the battens over the roof. In some areas, particularly Portugal, battens are mortar-based. Unfortunately, use of mortar battens requires a delay in roof installation after applying the wet mortar to form battens in order to allow the mortar to cure into solid battens. Such a delay is undesirable and adds cost and time to the installation process. Also, mortar is a dense material that undesirably adds weight to a roof structure. Other known processes require installation of wood battens on top of the insulating board and then affixing the tiles to the wood battens. Such a process requires independent steps of installing the insulating boards and then the battens. These independent steps result in increased labor costs and time. It is desirable to have an insulating panel that is integrated with battens to form an integrated article that can be handled and installed in a unitary step.

[0003] There are insulating panels made from polymeric foam that is molded or shaped so as to inherently define battens over which tiles can reside. Such an insulating panel offers an advantage over prior structures comprising mortar battens by providing an integrated insulated batten board article and lighter weight battens. However, manufacture of such panels requires either cutting away polymeric foam to define battens or molding insulating foam into a proper shape to define battens. Cutting polymeric foam is a process that undesirably produces foam waste. Molding polymeric foam into a proper shape and size for an insulated batten board is complex and requires large molds for preparing large panels. It is also difficult to prepare unitary structures with foam battens that have ventilation openings through the battens (a desirable feature for promoting air movement in a roof assembly) because any such ventilation openings would need to be milled into the board as a separate step after molding the board. For at least these reasons, it is desirable to have an integrated insulated batten board article that has battens made of a material different from the insulating board (that is not the same as the insulating board).

[0004] The battens must also have strong adherence to the batten boards so that they do not easily tear out during shipping, handling, installation or after installation.

[0005] It is desirable to provide an integrated insulated batten board suitable for delivery to a construction site as a unitary item so that construction workers can simultaneously install the insulation board and battens. Moreover, it is desirable for the battens to be a material other than mortar and other than the same material as the insulating board. Finally, the battens must also have strong adherence to the batten boards so that they do not easily tear out during shipping, handling, installation or after installation.

[0006] The present invention advances the art of tile roofing by and solves the problems associated with providing a freestanding integrated insulation batten board for tile roofing applications. The freestanding integrated insulation batten board can conveniently be shipped, handled and installed as a unit without requiring delays as mortar battens cure and without requiring multiple installation steps as workers install first an insulation board and then multiple battens. Still more, that battens are made of a material other than mortar and other than the same material as the insulating board. Yet more, the battens adhere to the batten boards with sufficient strength that they do not easily tear out during shipping, handling, installation or after installation.

[0007] One particular embodiment of the present invention surprisingly solves an additional problem of providing such an insulated batten board article with battens affixed to an insulating board mechanically, without the use of any adhesives or discrete fasteners yet with sufficient strength to meet requirements of an insulated batten board.

[0008] In a first aspect, the present invention is an insulated batten board article comprising:

> (a) an insulating board having opposing primary surfaces; and (b) one or more than one batten affixed to the insulating board; wherein the battens have sides and wings, the wings being non-parallel to the sides of the batten profile and the wings residing within the insulating board and the sides extending out from a primary surface of the insulating board and wherein the battens and the insulating board are affixed to one another with an adhesion strength of at least 100 kiloPascals when measured according to EN1607 and wherein the insulated batten board is freestanding and the battens are made of materials other than mortar and are a material different than the insulating board.

[0009] In a second aspect, the present invention is a method for applying a tile roof to a building structure comprising: (a) providing the insulated batten board article of the first aspect; (b) affixing the insulated batten board to a building structure so that the battens remain exposed; and (c) providing roofing tiles and affixing them to at least one batten so that at least one tile resides at least partially over at least two battens.

[0010] The article of the present invention is useful for use in tile roofing applications and advances the art of tile roofing by offering ease of installation in combination with providing greater support to the tiles of the roof.

[0011] A number of preferred embodiment os the invention are described in the accompanying drawings, in which:-

Figures 1(a)-(b) illustrate an embodiment of a batten for use in the present invention.

Figure 1(c) illustrates two embodiments of an insulated batten board of the present invention containing the batten of Figures 1(a) and 1(b).

Figure 2 illustrates a porous batten, one embodiment of a batten suitable for use in the present invention.

[0012] Test methods refer to the most recent test method as of the priority date of this document when a different date is not indicated with the test method number. References to test methods contain both a reference to the testing society and the test method number. The following test method abbreviations apply herein: ASTM refers to American Society for Testing and Materials; EN refers to European Norm; DIN refers to Deutsches Institute für Normung; and ISO refers to International Organization for Standards.

[0013] "Multiple" means two or more. "And/or" means "and, or as an alternative". All ranges include endpoints unless otherwise indicated.

[0014] The present invention is an insulated batten board article. An insulated batten board article is an integrated unit comprising an insulating board and battens. The batten board article is "free standing", which means can exist independent from other roof or building components until installed and can be transported as an integrated unit to a job site and installed as an integrated unit, thereby relieving any need to independently install insulating board and then battens over the insulating board.

[0015] The insulating board can be any type of insulating board known now or in the future in the industry of roofing insulation. Desirably, in each embodiment of the present invention the insulating board is a polymeric foam board. Suitable polymeric foam boards include thermoset polymer foam boards including polyurethane and polyisocyanurate foam boards as well as thermoplastic polymer foam boards including extruded and expanded polymer foam boards. In one preferred embodiment, the insulating board is an extruded thermoplastic polymer foam board, more preferably extruded polystyrene (XPS) foam board. Suitable XPS foam boards include those made from polystyrene homopolymer as well as polystyrene copolymers such as styrene-acrylonitrile copolymers.

[0016] An insulating board has opposing primary surfaces. A primary surface includes the surface of a board having the greatest planar surface area of all of the board's surfaces, as well as the surface opposite that surface. A planar surface area is a surface area of a surface as projected onto a plane so as to avoid calculated surface area contribution due to porosity, peaks or pits in the surface. An insulating board also has mutually perpendicular length, width and thickness dimensions. The length is equal to the longest dimension of the insulating board and is commonly along the extrusion direction of an XPS foam board. The thickness is equal to or smaller than the length in magnitude and typically separates opposing primary surfaces. The width is no larger than the length and no smaller than the thickness, but can be equal to either or both. For instance, in a cube the length, width and thickness are all equal.

[0017] Typically, the insulating board has a length of approximately 1.25 meters. The width of the insulating board is generally 600 millimeters (mm) or less, 592.5 mm or less, 585 mm or less, or 577.5 mm or less. In general practice there is no limitation to the thickness of the insulating board. Typically, the thickness of the insulating board is 40 mm or more, preferably 50 mm or more, more preferably 60 mm or more, still more preferably 70 mm or more, yet more preferably 80 mm or more and can be 90 mm or more and even 100 mm or more. Typically, cost and ease of handling is what limits the thickness of the foam rather than any technical limitations. The insulating board is typically less than 500 mm, typically 200 mm or less in thickness.

[0018] It is generally desirable for the insulating board to have mating ship-lap or tongue-in-groove profiles on opposing edges to facilitate tight and secure joining of multiple boards together on a roof.

[0019] The insulating board desirably has a density that is 28 kilograms per cubic meter (kg/m^3) or more, preferably 30 kg/m^3 or more. At the same time, the insulating board typically has a density of 38 kg/m^3 or less. Determine density of the insulating board according to EN 1602.

[0020] Typically, the insulation board has a thermal conductivity of 40 milliWatts per meter*Kelvin (mW/m*K) or less, preferably 38 mW/m*K or less, still more preferably 36 mW/m*K or less, yet more preferably 34 mW/m*K or less and most preferably 32 mW/m*K or less. While a lower limit in thermal conductivity is not part of the broadest scope of the present invention, the insulation board usually has a thermal conductivity of 30 mW/m*K or more. Determine thermal conductivity 90 days after production according to EN12667/EN12939.

[0021] Desirably, the insulation board has a compressive strength of 300 KiloPascals or more according to EN 826.

[0022] Examples of suitable insulating boards include those commercially available as ROOFMATE® SL-A, ROOFMATE® SL-X, ROOFMATE® TG-A and ROOFMATE® TG-X brand insulating boards (ROOFMATE is a trademark of The Dow Chemical Company).

[0023] The insulated batten board includes battens affixed to an insulating board, generally traversing a primary surface of the insulating board along the board's length. The battens are affixed to the insulating board so as to have a batten spacing such that a roofing tile placed or installed over the insulated batten board article desirably can at least partially, preferably completely, overlay at least two, preferably at least three battens. Batten spacing corresponds to the center-to-center spacing between battens and depends on the tiles selected to place over the insulated batten board as well as the desired

support configuration (one, two, three or more battens under a tile) desired. Some common batten spacings are listed with the following embodiments.

[0024] In one embodiment, insulated batten boards are installed on a roof structure adjacent to one another such that one insulating batten board contains two battens and the adjacent insulated batten boards above and below (in a direction perpendicular to the direction battens extend) contain single battens. This configuration can be identified as a 2+1 configuration. In one version of a 2+1 configuration the insulating batten boards have a width of 575-580 millimeters (approximately 578 millimeters ideally) and a length of approximately 1250 millimeters. The insulating batten board containing two battens has the battens spaced approximately 385 millimeters apart and centered across the width and running the length of the insulated batten board. The insulating batten board containing a single batten has the batten centered across the width and running the length of the insulated batten board. The resulting configuration produces a spacing of approximately 385 millimeters between any two battens on the roof. In another version of this 2+1 embodiment the insulating batten boards have a width of approximately 592 millimeters and the spacing between battens on the insulated batten board containing two battens is approximately 395 millimeters. The resulting configuration produces a spacing of approximately 295 millimeters between any two battens on the roof.

[0025] In another embodiment, the insulated batten boards contain three battens and the tiles at least partially span three battens. In the most common form of this embodiment, the insulated batten board has battens spaced apart by 185 millimeters to 200 millimeters (center-to-center spacing). Typically, the spacing between battens (edge of one batten to edge of an adjoining batten) is in a range of 170 mm to 185 mm.

[0026] When installing the insulated batten boards, adjacent boards in the direction parallel to the battens desirably have battens that align to produce straight batten lines, *that is* straight continuous runs of battens.

[0027] The battens are made of a different material than the insulating board. The battens are made of a material other than mortar and generally other than polymeric foam. Desirably, the battens are made from a material selected from wood, metal and plastic (such as polyvinyl chloride). More desirably, the battens are metal and yet more desirably a form of steel. Wood, metal and plastic are all readily shaped into desirably batten shapes and can be made into hollow battens to achieve light weight insulated batten boards and can also be fabricated to define ventilation holes through the batten so as to allow air transport between the insulating board and tiles installed over the insulated batten boards.

[0028] The battens, being a material other than the insulating board, are affixed to the insulating board. The battens can be affixed to the insulating board using an adhesive, by mechanically adhering the batten to the insulating board without an adhesive or by using both mechanical adhesion with an adhesive. Regardless of how the battens are affixed to the insulating board it is important to achieve an adhesion strength of at least 100 kiloPascals (kPa), preferably at least 150 kPa, still more preferably at least 200 kiloPascals, yet more preferably 250 kPa or more, and most preferably of 300 kPa or more when measured according to the test method of EN1607. Such adhesion strength is necessary to ensure structural integrity of the roof and in particular the insulated batten board during installation of tiles and during strong wind after tiles are installed. To be clear, adhesion strength can result from solely mechanical adhesion, solely adhesive adhesion, or from a combination of mechanical and adhesive adhesion.

[0029] Suitable adhesives for adhering battens to the insulating board include one- and two-component polyurethane and polyurethane foam adhesives such as MOR-AD® 660 M, Sika Force ™, MACROPLAST® and INSTA-STIK® brand adhesives (MOR-AD is a trademark of Rohm and Haas Chemicals LLC. Sika Force is a trademark of SIKA Danmark A/S. MACROPLAST is a trademark of Henkel AG & Co. INSTA-STIK is a trademark of Insta-Foam Products, Inc.). Hot melt adhesives are also suitable for adhering battens to the insulating board.

[0030] Mechanical adhesion of the battens to the insulating board is particularly desirable so as to avoid having to incorporate deposition of an adhesive into an insulated batten board article manufacturing process. Mechanical adhesion can occur through the use of discrete fasteners such as nails, screws, staples and tacks by affixing fasteners into both a batten and into an insulating board. However, it is preferable to avoid using discrete fasteners in order to simplify fabricating insulated batten board articles. Therefore, preferred embodiments of the present invention are free of adhesives, discrete fasteners or both adhesives and discrete fasteners.

[0031] In one desirable embodiment, the battens are fabricated into a shape that will promote mechanical adhesion with an insulating board without use of adhesive or discrete fasteners. In one such desirable embodiment battens comprise "wings" that extend from the bottom of the batten. The wings penetrate into an insulating board at an angle less than 90 degrees, preferably 75 degrees or less and at the same time desirably 10 degrees or more, preferably 30 degrees or more, still more preferably 45 degrees or more and yet more preferably 60 degrees or more relative to the surface of the insulating board against which the batten resides. Ideally, the wings penetrate into an insulating board at an angle between 45 and 70 degrees, preferably between 60 and 70 degrees, still more preferably approximately 65 degrees relative to the surface of the insulating board against which the batten resides.

[0032] To illustrate the concept of wings on the battens consider Figure 1. Figure 1(a) illustrates and angled view of batten 10. Figure 1(b) illustrates and end-on view of batten 10. Figure 1(c) illustrates multiple battens 10 affixed to insulating board 30 to form insulated batten board

50. Batten **10** comprises body **15** and wings **20**. Batten body **15** defines hollow body space **17**. As shown in Figure 1(c), batten body **15** stands proud of insulating board **30** and roofing tile **40** rests on the body **15** of battens **10**. Wings **20** establish an angle θ and θ' with respect to surface **35** of insulating board **30** against which batten **10** resides. Typically, angles θ and θ' are the same or nearly the same, although they can be different from one another. Figure 1(c) further illustrates a configuration where insulated batten board **50** is adjoining a second insulated batten board **50**' with at least one similar batten **10**' affixed to insulating board **30**'. Second tile **40**' resides over one batten on insulating batten board **50** and one batten on insulating batten board **50**', while further overlapping tile **40**.

[0033] Figure 1 illustrates battens that define a hollow body space **17**. The body can be hollow, as in Figure 1, or solid. An advantage of having a hollow body space is that the batten will have a lower overall weight with the hollow body.

[0034] The batten can also define holes or pores through the body to facilitate ventilation through the batten. See, for example, Figure 2. Figure 2 illustrates batten **10** with body **15** defined by batten walls **12**. Batten walls **12** further define openings **100** that extend entirely through the body **15**. Notably, body 15 can be hollow (as shown) or solid. Openings **100** can be of any size, orientation or shape and beneficially allow air to circulate between batten spacings under a tile roof. Such circulation can help ventilate hot air and moisture away from the roof. Embodiments where the batten has a hollow body and defines openings such as openings **100** through the body **15** of a batten are especially desirable because air can flow through the interior as well as from one side to the other of the batten, allowing for maximum air circulation and escape.

[0035] One desirable embodiment of the present invention is an insulated batten board article comprising an XPS foam insulating board with hollow battens affixed to it by mechanical means apart from adhesives and discrete fasteners by inserting wings of the batten into the XPS foam insulating board. An even more desirable form of this embodiment includes battens that have openings through the batten walls and extending through the batten.

[0036] Installation of the present insulated batten boards is an easy process that constitutes another aspect of the present invention. First, provide the insulated batten board of the present invention. Second, affix the insulated batten board to a building structure so that the battens remain exposed. Third, provide roofing tiles and affix the roofing tiles to at least one batten so that at least one tile resides at least partially (preferably entirely) over at least two, preferably at least three battens. Typically, the installation process of the present invention includes installation of multiple roofing tiles over multiple batten board articles of the present invention that have been affixed to a building structure with their battens exposed so that each tile extends over at least partially and preferably entirely over three battens. If desirable, one or more tile can be affixed to two or even three battens during the installation process of the present invention to provide optimal roof integrity.

[0037] The following example provides further illustration of one embodiment of the present invention.

Examples

[0038] The present example uses as an insulating board a ROOFMATE® SL-A insulating board that is 50 millimeters thick, 585 millimeters wide and 1250 millimeters long. The battens for the present example made from one millimeter thick sheet metal that has been bent into a shape such as that shown in Figures 1(a)-1(c). Angle θ for these battens is 65 degrees (°). The battens have a hollow body that is 20 mm wide and 30 mm tall (height extends perpendicular to foam surface). The battens are 1250 millimeters long.

[0039] Cut the insulating board with a saw blade so to form grooves at an angle with a primary surface of 65° and to a depth sufficient to receive and house the wings of the battens. The grooves for each batten run the full length of the insulating board and are spaced apart for each batten by the width of the batten body. Cut grooves for the battens with a spacing between battens of 195 mm center-to-center. Slide the battens into the grooves from one end of the insulating board so as to produce an insulated batten board containing three battens spaced apart from each other with wings penetrating into the insulating board. Optionally, include an adhesive in the grooves with the wings of the battens so to adhesively bond the batten to the insulating board. The insulated batten board should appear similar to insulated batten board 50 in Figure 1(c). The adhesion strength between the battens and the insulating board exceeds 150 kPa.

[0040] Multiple insulated batten boards can be made in this manner at a manufacturing location and conveniently shipped to a separate construction site.

[0041] At a construction site, affix the insulated batten boards to a roof structure by, for example, screwing the insulated batten board to the roof structure. Ideally, position insulated batten boards adjacent to one another to create continuous rows of battens running across the slope of the roof (as opposed to down the slope of the roof). The batten spacing is ideal for positioning roofing tiles over three of the battens. For the present example, affix tiles (for example, Marselha from LusoCeram) to the battens so that each tile at least partially covers three battens. Proceed to cover the roof with insulated batten boards and cover the insulated batten boards with tiles to create an insulated, well supported tile roof.

[0042] This example illustrates the ease of assembling a well supported tile roof at a job site using the integrated insulated batten boards of the present invention, as well as one method of manufacturing the insulated batten boards of the present invention.

[0043] The angle of the batten wings and mating grooves in the insulating board can vary from 65° to facilitate assembly and/or maximize mechanical adhesion strength between the insulating board and battens with similar ease of assembly and roof construction.

Claims

1. An insulated batten board article comprising:

(a) an insulating board having opposing primary surfaces; and
(b) one or more than one batten affixed to the insulating board;
wherein the battens have sides and wings, the wings being non-parallel to the sides of the batten profile and the wings residing within the insulating board and the sides extending out from a primary surface of the insulating board and wherein the battens and the insulating board are affixed to one another with an adhesion strength of at least 100 kiloPascals when measured according to EN1607 and wherein the insulated batten board is freestanding and the battens are made of materials other than mortar and are a material different than the insulating board.

2. The insulated batten board article of Claim 1, wherein the battens and the insulating board are affixed to one another with an adhesion strength of at least 150 kiloPascals.

3. The insulated batten board article of Claim 1, wherein the insulated batten board contains at least three battens affixed to the insulating board and wherein the battens affixed to the insulating board having a batten spacing between one another so that a roofing tile resides at least partially over three battens when the roofing tile is placed on the insulated batten board.

4. The insulated batten board article of Claim 1, wherein the battens are made of a material other than polymeric foam.

5. The insulated batten board article of Claim 1, wherein the battens are made of material selected from a group consisting of wood, plastic and metal.

6. The insulated batten board article of Claim 1, wherein the battens are made of metal.

7. The insulated batten board article of Claim 1, wherein the battens are made of steel.

8. The insulated batten board article of Claim 1, wherein the battens have a hollow profile that has sides and wings, the wings being non-parallel to the sides of the batten profile and the wings residing within the insulating board and the sides extending out from a primary surface of the insulating board.

9. The insulated batten board article of Claim 8, wherein the battens are mechanically affixed to the insulating board by the wings and all interfaces between the battens and the insulating board is free of adhesive and discrete fasteners.

10. The insulated batten board article of Claim 1, wherein the batten has wings that extend into the insulating board and form an angle that is less than 70 degrees with respect to the surface against which the body of the batten resides.

11. The insulated batten board article of Claim 1, wherein the insulating board is a polymeric foam board.

12. The insulated batten board article of Claim 1, wherein the insulating board comprises an extruded polystyrene foam board.

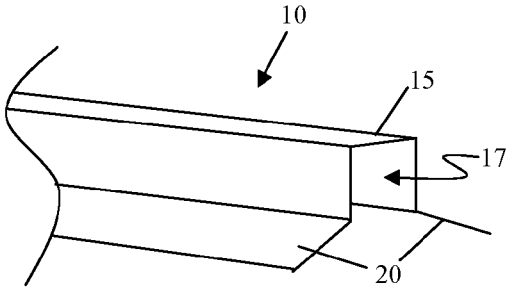
13. A method for applying a tile roof to a building structure comprising:

a. providing at least one insulated batten board article of Claim 1;
b. affixing each insulated batten board from step (a) to a building structure so that the battens remain exposed; and
c. providing roofing tiles and affixing them to at least one batten so that at least one tile resides at least partially over at least two battens.

14. The method of Claim 13, wherein the method includes affixing two or more batten boards adjacent to one another wherein one of the two adjacent insulated batten boards contains a single batten and the other adjacent insulated batten board contains two battens and the spacing between battens is such that a roofing tile will span any two of the battens.

FIG 1

(a)



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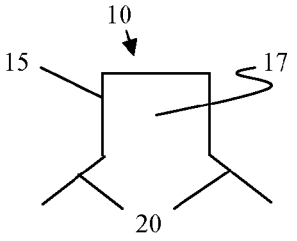

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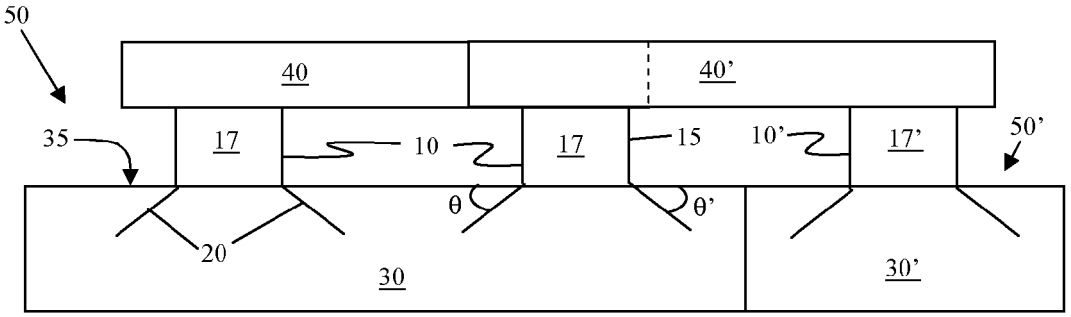
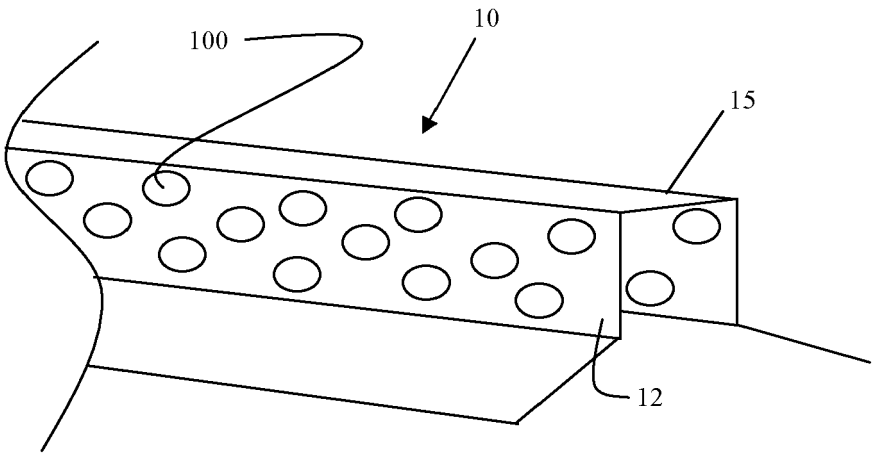


FIG 2



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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 4909

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	US 2009/235598 A1 (MILLER KENNETH ANDREW [US]) 24 September 2009 (2009-09-24) * paragraphs [0002], [0038]; figures 4a,4b *	1-12	INV. E04B7/22 E04C2/22 E04C2/38
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A	FR 2 636 995 A1 (TASSEL OLIVIER [FR]) 30 March 1990 (1990-03-30) * figure 1 *	3	
A	FR 2 571 764 A1 (ISOBOX [FR]) 18 April 1986 (1986-04-18) * figure 3 *	13,14	

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	7 June 2011	Rosborough, John

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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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

1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 15 4909

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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07-06-2011

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