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## (54) Roof tile and method for manufacturing a roof tile

(57) The invention relates to a roof tile, which is intended for covering a roof by combining several roof tiles (10). The various layers of the roof tile (10) include a support layer (14) and an insulating layer (15, 16) on both sides of it. In addition, there is a surface layer (17) on the opposite surface of the first insulating layer (15) to the support layer (14) and a protective layer (18) on the opposite surface of the second insulating layer (16) to the support layer (14). The protective layer (18) is formed of a film (20) arranged permanently in the roof tile (10), which covers entirely the opposite surface of the second insulating layer (16) to the support layer (14). The invention also relates to a method for manufacturing a roof tile.

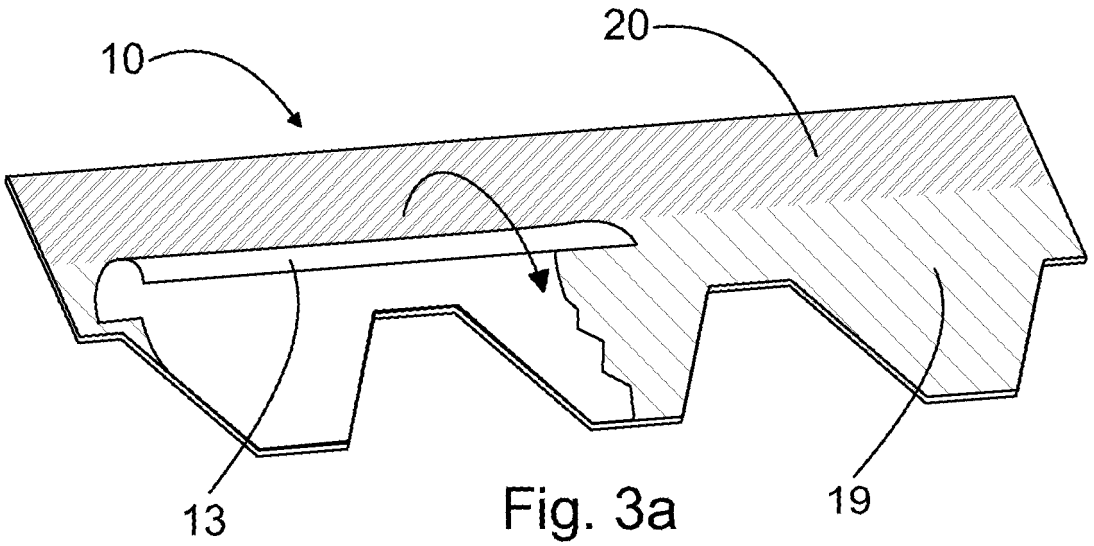


Fig. 3a

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## Description

**[0001]** The present invention relates to a roof tile, which is intended for covering a roof by combining several roof tiles, and which roof rile includes, as various layers,

- a support layer,
- an insulating layer on both sides of the support layer,
- a surface layer on the opposite surface of the first insulating layer to the support layer, and
- a protective layer on the opposite surface of the second insulating layer to the support layer.

The invention also relates to a method for manufacturing a roof tile.

**[0002]** Various kinds of tiles exist for covering a roof. One known type of roof tile is flexible and the roof tiles are set to partly overlap, in order to form a nearly two-layer roof. Such a roof tile includes a support layer, on both sides of which is an insulating layer. The insulating layer usually consists of bitumen. On the upper surface of the roof tile, there is, in addition, a surface layer, which has several alternative colours, in order to create the desired appearance on the roof. On the surface of the lower insulating layer, there is, in addition, a protective layer, to prevent the tiles from adhering to each other during storage and transportation, and to prevent adhesion to the manufacturing equipment during the manufacturing process. However, an adhesive layer is further arranged on the undersurface of the roof tile, on top of which there is then a plastic film preventing the roof tile from unintentionally adhering to the base or to the other roof tiles, as well as preventing it from adhering to the manufacturing equipment during the manufacturing process. However, when the roof tile is installed, the plastic film is removed, so that the roof tile adheres to the part of the roof tile under it that overlaps it.

**[0003]** In known roof tiles, the insulating layers are formed of rubberized bitumen, on which sand, for example, natural sand, is sprinkled to form a protective layer. A great deal of sand should be used to achieve a sufficiently effective protective layer. Especially during manufacture, the sand drops off along the process, leading to quartz dust in the production space and thus in the air breathed, increasing the risk of exposure to it. The sand and dust also increase the need for cleaning and can cause production breaks.

**[0004]** The invention is intended to create a new type of roof tile, which is easier to handle than previously, and which does not have the drawbacks of the prior art. In addition, the invention is intended to create a new type of method for manufacturing roof tiles, which is simpler and more reliable than previously, but which can also be adapted more versatilely than previously. The characteristic features of the roof tile according to the invention are stated in the accompanying Claim 1. Correspondingly, the characteristic features of the method according to the invention are stated in the accompanying Claim 8. In the roof tile according to the invention, new and surprising types of layers are used. Thus, the roof tile is more user friendly than previously and considerably lighter than previously. At the same time, the roof tile can incorporate new properties. The production method can also be adapted more freely than previously.

**[0005]** In the following, the invention is described in detail with reference to the accompanying drawings showing some embodiments of the invention, in which

| | |
|---|---|
| Figure 1a | shows a schematic drawing of the start of the covering of a roof, |
| Figure 1b | shows a top view of one roof tile, |
| Figure 1c | shows an axonometric bottom view of one roof tile, |
| Figure 1d | shows a cross-section of a roof tile according to the invention, along the plane A-A of Figure 1c, |
| Figure 2a | shows a schematic drawing of the initial stages of the method according to the invention, |
| Figure 2b | shows a schematic drawing of the final stages of the method according to the invention, and |
| Figures 3a-c | show bottom views of examples of applications of the roof tile according to the invention. |

**[0006]** Figure 1b shows one roof tile 10 according to the invention. Other models of roof tile also exist, though the model shown here, along with its variations, appears to be the most usual. When using a roof tile, the idea is to cover the roof 11 by combining several roof riles 10. Figure 1a shows the initial stage of roofing. At least at the eaves of the roof 11, a strip 12 is first of all installed, with properties and colour corresponding to those of the roof tile 10. Often, a base membrane (not shown) must also be used over the entire area of the roof. The roof tiles 10 of the first row are installed on top of the strip 12 and nailed onto the roof 11, according to Figure 1a. Other attachments can also be used in place of nails. If the roof tile 10 has a separate adhesive layer, the film-like peelable structure 13 is removed form its undersurface, prior to the installation of the roof tile 10. The roof tiles of the next row are installed to partly overlap the previous row and offset relative to the tiles in it. The finished roof then gains a shingle-like appearance and the joints of the roof tiles set end to end are hidden under the next row. In addition, the roof becomes almost two-layer. In addition to the hidden nailing, the roof tile adheres to its base, or to the area of the roof tile under it, from which the peelable structure was removed prior to installation.

**[0007]** Figure 1d shows a cross-section of one embodiment of the roof tile according to the invention. The roof tile is formed of layers attached to each other, which are shown here clearly enlarged, for reasons of clarity. The various layers of the roof tile 10 include a support layer 14, which is, for example, of glass-fibre felt or polyester

fabric. Next are insulating layers 15 and 16 on both sides of the support layer 14. Usually, the insulating layer is of bitumen or rubberized bitumen. Then there is a surface layer 17 on the surface of the insulating layer 15 opposite to the support layer 14, which determines the appearance of the roof. The surface layer is usually of a mineral material, such as slate or mineral chips. On the other side of the support layer is a protective layer 18, which is on the opposite surface of the insulating layer 16 to the support layer 14. The protective layer is usually spread over the entire area of the roof tile and prevents the roof tile from unintentionally adhering to the manufacturing equipment, such as rollers, during manufacture. The protective layer also prevents the roof tile from unintentionally adhering to its base or to other roof tiles during transport and storage.

**[0008]** According to the invention, the protective layer 18 is surprisingly formed of a film 20 arranged permanently on the roof tile 10, which covers entirely the opposite surface of the second insulating layer 16 to the support layer 14. In other words, the sand is replaced with a film, so that the problems previously caused by the sand can be completely avoided. At the same time, the mass of the roof tile is significantly reduced. Nowadays, the mass of a sales package containing 22 roof tiles is about 25 kilograms, depending on the various surface-chip alternatives. Thanks to the film, two to five more roof tiles can be packed in a sales package of the same weight. Thus, the mass of a single roof tile is about 10 % less than that of a known tile. Correspondingly, it is possible to load 42 sales packages on a pallet, in place of the previous 36. This significantly reduces handling and transport costs. In addition, the film improves the watertightness of the roof tile, while its other properties remain unchanged. In practice, the resistance of the roof tile to water pressure improves. In other words, the technical properties of the roof tile improve. On the other hand, a sales package containing the known number of roof tiles will weigh less than before, thus facilitating handling of the packages on the roof and reducing storage and transport costs.

**[0009]** The film can be made from various kinds of material. The film is preferably made from a plastic film, which is light and thin. The plastic film can be, for example, polyethylene or polypropylene, or a corresponding material in a roll. On the other hand, by manufacturing the film from a woven fabric, the properties of the roof tile will be further improved as the woven fabric increases the strength of the roof tile. A combination of a plastic film and a woven fabric can also be used. The main task of the film is to act as a protective layer, so that even very thin films can be used. In practice, the thickness of the film is 0, 005 - 0,3 mm, preferably 0, 005 - 0,2 mm. A plastic film will generally be thinner than a woven fabric. The film prevents the insulating layer from adhering to the bitumen. Even a thin film will function well, if the film is essentially impenetrable to the material of the insulating layer. However, the film adheres to the bitumen in the manufacturing process and remains permanently in the structure of the roof tile. Normally, an adhesive layer, covered with a peelable plastic, can be arranged on top of the film. Thus, during installation, when the peelable plastic is removed, the roof tile adheres to both its base and to the roof tile underneath it over the entire adhesive layer. If necessary, an adhesive surface can also be arranged on the side of the surface layer.

**[0010]** Thanks to the aforementioned adhesive layer, the roof tiles that are installed to partly overlap each other adhere to each other, thus achieving a watertight and durable roof. Thus an adhesive layer 19, which is usually of rubberized bitumen and is applied on top of the protective layer, can be arranged on the opposite surface of the protective layer 18 to the second insulating layer 16. Again, in order to prevent unintentional adhesion, a peelable structure 13 is arranged detachably on the opposite surface of the adhesive layer 19 to the protective layer 18. Usually, the peelable structure 13 is of silicon film, which is removed from the surface of the adhesive layer prior to the installation of the roof tile 10 (Figure 1c). The peelable structure can also be come other membrane, which is processed in such a way that it can be detached from the surface of the adhesive layer. Figures 3a - c show in greater detail various embodiments of the roof tile according to the invention. According to the invention, the adhesive layer covers part of the surface area of the roof tile, or essentially the entire surface area of the roof tile. In Figure 3a, an adhesive layer 19, which cover part of the surface area of the roof tile 10, is applied on the surface of the film 20. In Figures 3a and 3b, only part of the peelable structure 13 is shown, for reasons of clarity. In the embodiment of Figure 3b, the adhesive layer 19 surprisingly covers the entire surface area of the roof tile 10. In that case, the roof tile adheres entirely to its base. On the other hand, the adhesive layer can be entirely omitted, in which case the undersurface of the roof tile 10 will be formed by the film 20 according to the invention. A roof tile of this kind can be attached by welding or gluing.

**[0011]** Thus, according to the invention, a film is formed, which is arranged permanently on the entire opposite surface of the second insulating layer to the support layer. In addition to improving the properties of the roof tile, advantages are also gained in manufacturing. Figures 2a and 2b show schematically the manufacture of the roof tile. Here, the production process proceeds from left to right, and from up to down. In the manufacture, the roof tile 10 is formed from various layers, in such a way that insulating layers 15 and 16 are applied to both sides of a web-like support layer 14. In Figure 2a, the support layer 14 is fed to the process and the first insulating layer 15 is applied to its upper surface and the second insulating layer 16 to its undersurface. After this, surface chips are sprinkled onto the opposite surface of the first insulating layer 15 to the support layer 14, in order to create a surface layer 17. Next, a film 20, on top of which an adhesive layer 19 is applied to that part of

the roof tile on which adhesion is required, is run onto the surface of the second insulating layer 16. Alternatively, the entire application of the adhesive layer can be omitted (Figure 3c). The film is arranged when the second insulating layer is hot, so that the film adheres firmly to the blank. Next, a peelable structure 13 is arranged detachably on the opposite surface of the adhesive layer 19 to the protective layer 18. In practice, in the process the necessary number of adhesive bitumen strips, which are covered with silicon plastic, are applied on top of the film. Finally, the blank 21 is cooled, after which roof tiles 10, which are bundled and packaged, are cut from the blank 21. In the process, four roof tiles next to each other are cut from a blank about one-metre wide. Figures 2a and 2b show the devices belonging to the process schematically as simple boxes. For example, the insulating layers and adhesive layers are applied as the blank travels through a bitumen cauldron.

**[0012]** The sand that was previously put on the protective layer was sprinkled on the insulating layer while the bitumen was hot. According to the invention, instead of sand the film is run onto the surface of the bitumen. This avoids quartz dust spreading into the production facility. At the same time, the watertightness of the roof tile is improved. Naturally, the film described above is used in the process. The finished roof tile is about three-millimetres thick and has a length of about 1000 mm and a width of about 320 mm. Of course, the dimensions of the roof tile can vary according to different standards.

**[0013]** Using simple tools, a watertight roof can be made from the roof tiles. Usually the insulating material in the roof tile is bitumen, nowadays mostly rubberized bitumen, to which SBS elastomer is often added. This is then termed polymer-modified rubberized bitumen, the stretching and flexibility of which at low temperatures are better than simple bitumen. Fatigue resistance and adhesion, as well as low-temperature properties also improve. In other words, the durability of the roof improves, The surface layer of the roof tile is highly resistant to mechanical strain and creates the desired appearance for the roof tile. The film and structure described above can also be applied in bitumen-membrane products. In addition, differing from the embodiment examples, there can be several layers in the roof tile or other bitumen products.

## Claims

1. Roof tile, which is intended for covering a roof by combining several roof tiles (10), and which roof rile (10) includes, as various layers,

   - a support layer (14),
   - an insulating layer (15, 16) on both sides of the support layer (14),
   - a surface layer (17) on the opposite surface of the first insulating layer (15) to the support layer (14), and
   - a protective layer (18) on the opposite surface of the second insulating layer (16) to the support layer (14),

   **characterized in that** the protective layer (18) is formed of a film (20) arranged permanently in the roof tile (10), which covers entirely the opposite surface of the second insulating layer (16) to the support layer (14).

2. Roof tile according to Claim 1, **characterized in that** the film (20) is formed of a plastic film.

3. Roof tile according to Claim 1, **characterized in that** the film (20) is formed of a woven fabric.

4. Roof tile according to any of Claims 1 - 3, **characterized in that** the thickness of the film (20) is 0,005 - 0,3 mm, preferably 0,005 - 0,2 mm.

5. Roof tile according to any of Claims 1 - 4, **characterized in that** the film (20) is essentially impermeable to the material of the second insulating layer (16).

6. Roof tile according to any of Claims 1 - 5, **characterized in that** on the opposite surface of the protective layer (18) to the second insulating layer (16) there is an adhesive layer (19) and a peelable structure (13) is arranged detachably on the opposite surface of the adhesive layer (19) to the protective layer (18).

7. Roof tile according to Claim 6, **characterized in that** the adhesive layer (19) covers part of the surface area of the roof tile (10), or essentially the entire surface area of the roof tile (10).

8. Method for manufacturing a roof tile, in which method the roof tile (10) is formed of various layers, in such a way that first of all an insulating layer (15, 16) is applied to both sides of a web-like support layer (14), after which a surface layer (17) is applied to the opposite surface of the first insulating layer (15) to the support layer (14) and a protective layer (18) is applied to the opposite surface of the second insulating layer (16) to the support layer (14), and finally several roof tiles (10) of the desired shape are separated from the web-like blank (21) containing the various layers, **characterized in that** the protective layer (18) is formed of a film (20), which is arranged permanently on the entire opposite surface of the second insulating layer (16) to the support layer (14).

9. Method according to Claim 8, **characterized in that** the film (20) is arranged when the second insulating layer (16) is hot.

**10.** Method according to Claim 8 or 9, **characterized in that** the blank (21) is rolled during manufacture.

**11.** Method according to any of Claims 8 - 10, **characterized in that** a film (20) according to Claims 2 - 5 is used as the film (20).

**12.** Method according to any of Claims 8 - 11, **characterized in that** in the method an adhesive layer (19) is further applied to the opposite surface of the protective layer (18) to the second insulating layer (16) and a peelable structure (13) is arranged detachably on the opposite surface of the adhesive layer (19) to the protective layer (18).

**13.** Method according to Claim 12, **characterized in that** the adhesive layer (19) is applied to part of the surface area of the roof tile (10), or to essentially the entire surface area of the roof tile (10).

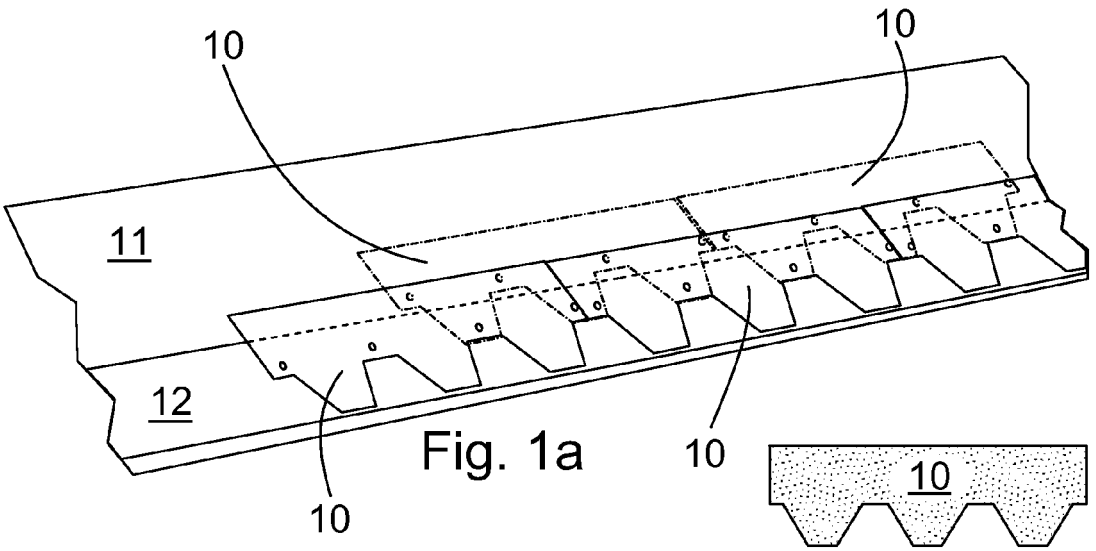


Fig. 1a




Fig. 1b

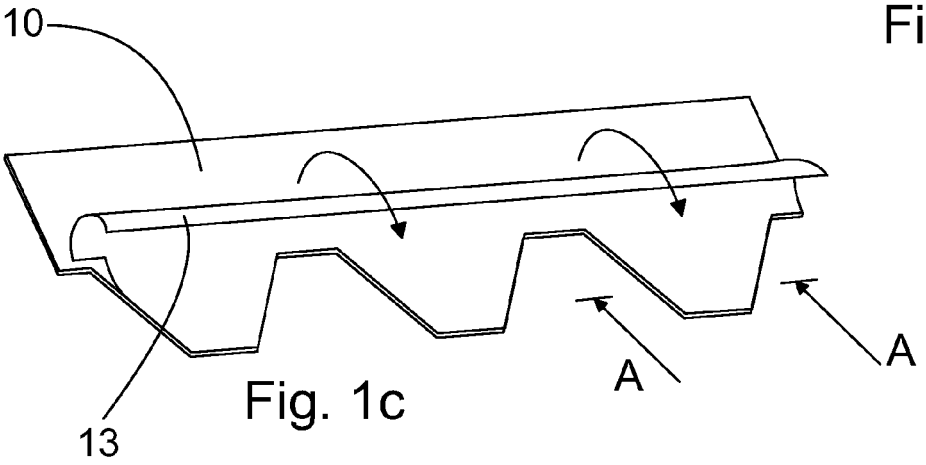


Fig. 1c

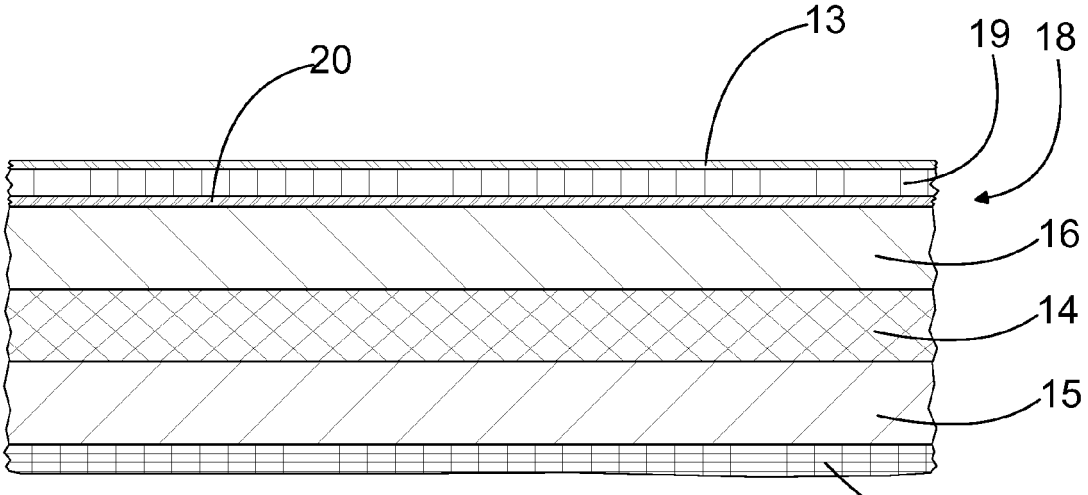


Fig. 1d

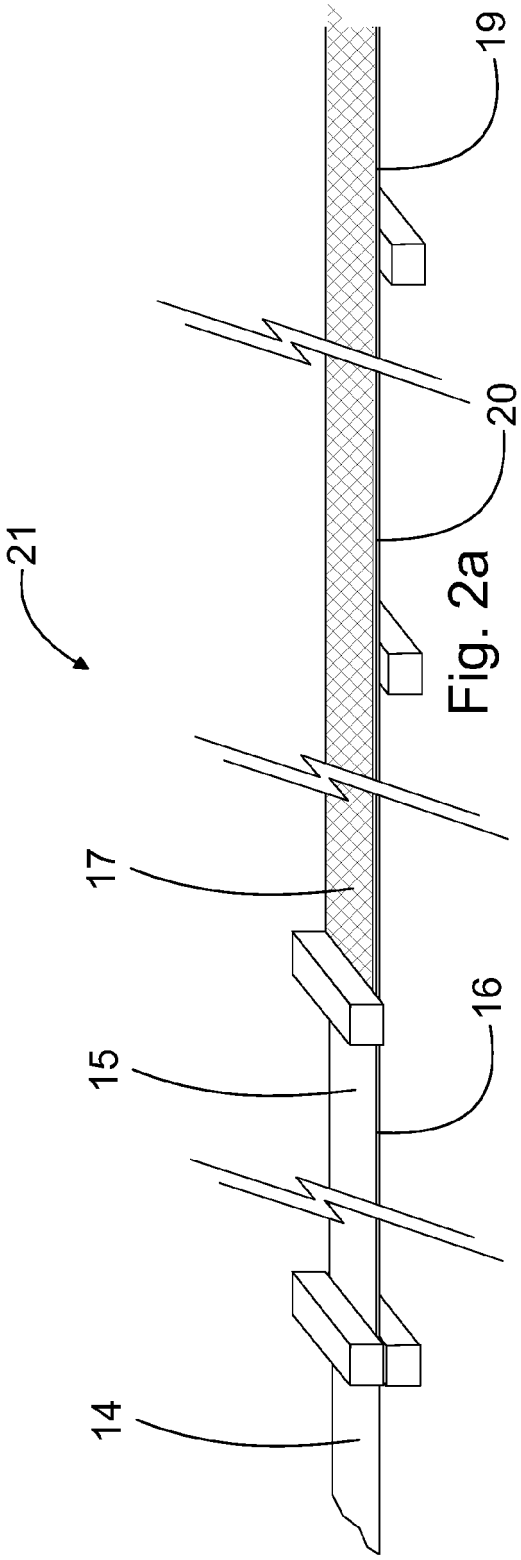


Fig. 2a

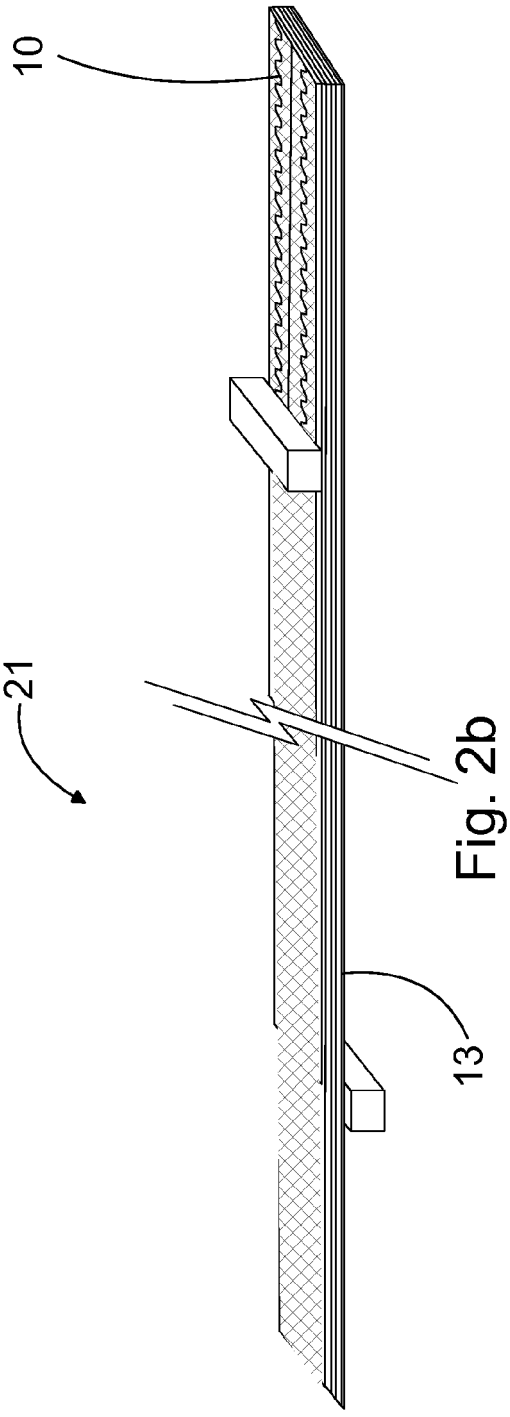


Fig. 2b

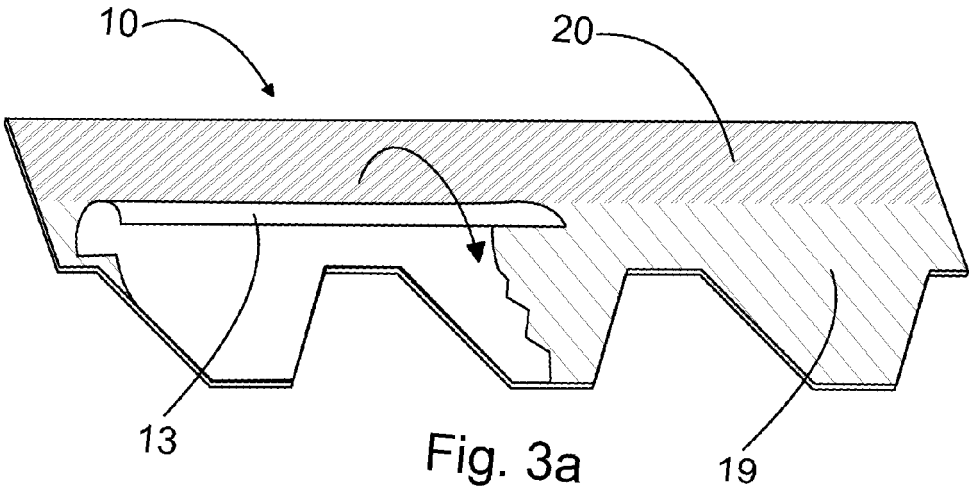


Fig. 3a

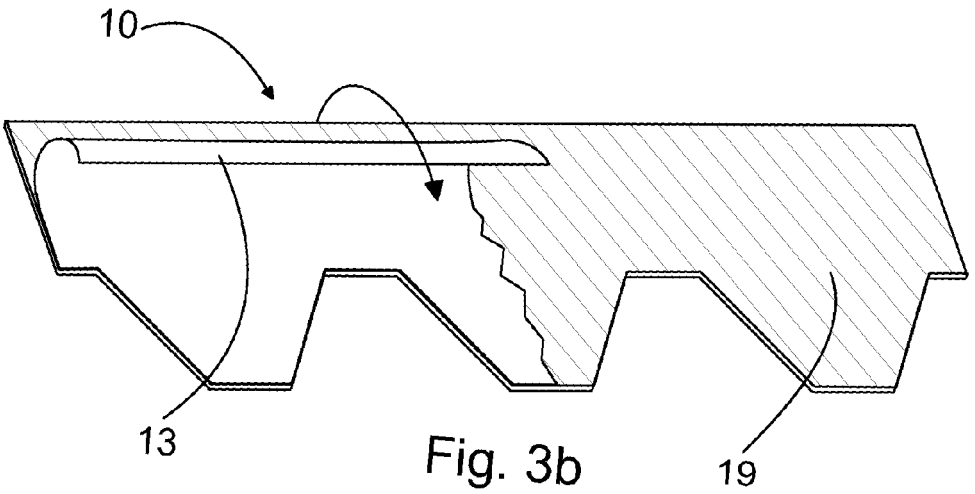


Fig. 3b

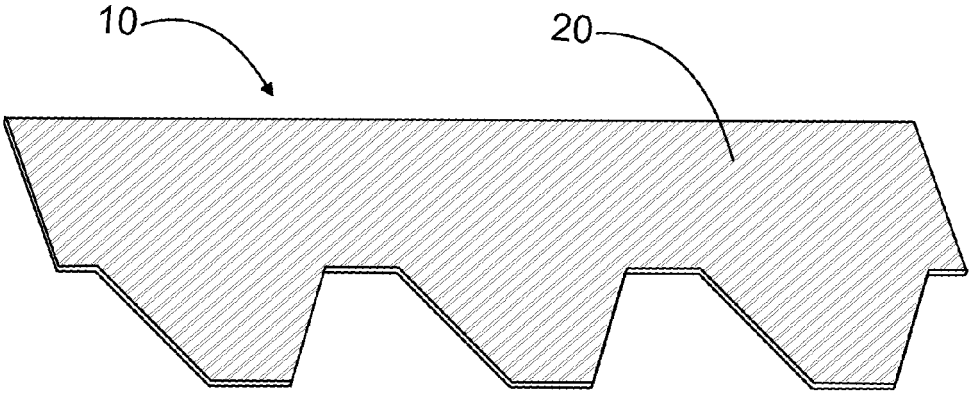


Fig. 3c

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# EUROPEAN SEARCH REPORT

Application Number
EP 08 16 9242

## 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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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 19 February 2009 | Bauer, Josef |

CATEGORY OF CITED DOCUMENTS

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 16 9242

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