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(71) Applicant: **Saint-Gobain Isover**
92400 Courbevoie (FR)

(72) Inventors:
- **FROMENTIN, Charlotte**
  75005 Paris (FR)
- **SAUVET, Katherine**
  75014 Paris (FR)
- **BARNASSON, Eric**
  94700 Maisons Alfort (FR)

(74) Representative: **Bockhorni & Brüntjen Partnerschaft**
Patentanwälte mbB
Elsenheimerstraße 49
80687 München (DE)

(54) FLAT ROOF INSULATION AS WELL AS SYSTEM FOR THE THERMAL INSULATION OF FLAT ROOFS

(57) With a thermally insulated flat roof (1) based on a wood structure with a support body (2) and a covering (14) suspended from the support body, a thermal insulation (6, 8) out of particularly mineral wool is arranged between the support body (2) and the covering (14), with a humidity adaptive vapour retarder membrane (16) being arranged between the thermal insulation and the suspended covering and a sealing membrane (10) on a PVC basis being arranged on the support body.

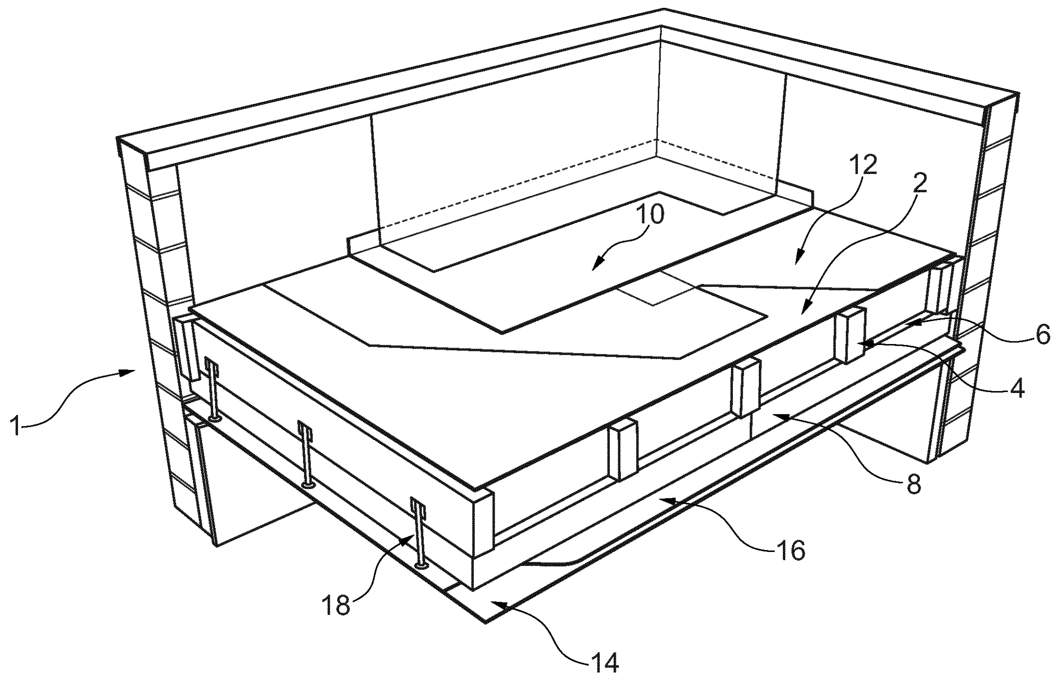

Fig. 1

EP 3 473 781 A1

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Description

[0001] The invention relates to a thermally insulated flat roof according to the preamble of claim 1 as well as to a system for thermally insulating a flat roof according to the preamble of claim 19.

[0002] The invention deals with a special field of the insulation of buildings, namely with the thermal insulation of flat roofs, particularly inaccessible flat roofs which are configured as a wood structure. The term wood structure is to be understood broadly within the invention and comprises, besides purely wooden constructional elements, also those constructional elements which are manufactured out of oriented strand boards (OSB), wooden chips, wooden fibers and the like, as for example particle boards, wooden fiber boards and the like. For this special field of the flat roof construction, there are professional instructions and provisions, as for France Regles de l'Art Grenelle Environnement (abbreviated as RAGE), edition 2014, according to the French standard NF DTU 43.4, which must be considered accordingly in connection with the building construction of flat roofs.

[0003] Generally, a flat roof on a wood structure basis comprises a support body, which is regularly formed by particle boards, oriented strand board or wooden fiber boards for forming a plane support area or floor area. Regularly, these support plates are supported at vertically standing carrier plates or boards, again on a wooden basis, which are arranged in parallel and at a distance to one another. A covering is finally hung up below the support body via hangers, which are mounted at the carrier plates. The covering faces the space below and is typically equipped and covered with plates, particularly plaster boards, gypsum plaster boards or plaster fiber boards.

[0004] According to RAGE, the flat roofs can be equipped atop, i.e. on the support body, with a thermal insulation or below the support body. In the latter case, the thermal insulation is then regularly arranged between the carrier plates which are arranged at a distance to one another and which support the support body. Depending on the construction of the thermal insulation, a thermal insulation layer can be provided in the intermediate space between the lower face edges of the carrier plates and the suspended covering. The thermal insulation can be configured one-layered or two-layered or also multi-layered. Mineral wool or other corresponding thermal insulation materials can be used particularly used in the latter case.

[0005] Such flat roofs on a wood structure basis are often subject to defections depending on the building construction, particularly when insulated from the outside, which can be caused by the construction or the processing. For example, bitumen is often used for such flat roofs, with a layer of bitumen being arranged above the support body in order to protect the substructure against outer influences by forming a corresponding sealing layer. The disadvantage of that however is, that specific experts must be deployed for that and that such an effort is not suitable for smaller surfaces for cost reasons. The flat roof construction with the arrangement of the thermal insulation on the support body inevitably increases the building height of the flat roof covering, which in turn however has a negative impact on the construction of the whole building. Furthermore, the space between the carrier plates which support the support body is not used, which quasi leads to a lost space between the support body and the covering.

[0006] For that reason, the construction of flat roofs has established itself more and more, where the space between the supporting boards that form the support body and the covering for receiving the thermal insulation is used. This construction is called unventilated flat roof construction and also non-insulated roof or non-ventilated roof. Here, the thermal insulation is protected to the bottom side, i.e. to the side of the space, typically by means of a vapour barrier against the moisture, which diffuses through the covering from the space below it. As there is ambient moisture in every used building, this moisture respectively humidity must be led out via a suitable ventilation as otherwise, the moisture condenses which can lead to mould formation within the wood structure. If, moreover, the moisture accumulates in the thermal insulation, the insulation loses its function. Therefore, the moisture gradient and the resulting disadvantages with such flat roofs is still a serious problem, which often appears only after many years as a constructional defect.

[0007] Due to newer developments, vapour barriers are therefore very often replaced by vapour retarders, i.e. humidity adaptive membranes or foils, with which the water vapour diffusion resistance changes depending on the ambient humidity respectively moisture. Such foils are for example known from EP 0 821 755 B1. In this case, foils based on polyamide are used as vapour retarder which have a humidity adaptive characteristic, such, that the foil in case of a relative humidity of the atmosphere which surrounds the foil in the range from 30% to 50% has a water vapour diffusion resistance s_d value of 2 to 5 of diffusion equivalent air layer thickness and with a relative moisture in the range from 60% to 80% a water vapour diffusion resistance s_d value, which is < 1m of diffusion equivalent air layer thickness. Due to this moisture adaptive characteristic of the foil, there is a higher water vapour diffusion resistance under wintry conditions with a comparably dry outer atmosphere than under summery conditions. This can promote the drying out in summer but prevents that the moisture supply under wintry conditions can reach a value, which causes an impairment of the construction materials and the building.

[0008] Here, the s_d value of a foil is defined by the water vapour diffusion resistance factor μ and the foil thickness, namely as follows

$$S_d \text{ value [m]} = \text{water vapour diffusion resistance factor } \mu \text{ x layer thickness [m]}$$

[0009] The resistance factor is a material specific property so that the resistance s_d value for a given material can be set via the layer thickness. The determination of the s_d value of the material can, according to DIN EN ISO 12572:2001, be carried out according to the Dry Cup / Wet Cup method. In this case, suitable measuring devices are used, such as GINTRONIC GraviTest 6300. The standard DIN 52315 in the dry and humid area as well as in two humid areas in between is relevant, in order to determine the vapour diffusion resistance. The water vapour diffusion resistance, the so-called s_d value, which is defined as the water vapour diffusion equivalent air layer thickness, is a measurement for the resistance, which is applied by a roof structure of the water vapour diffusion. The higher the s_d value, the higher is the resistance, which is caused by the structure. An s_d value of 8 m for example means that the vapour retarder of the water vapour diffusion applies an identical resistance as an air layer thickness of 8 m.

[0010] Such vapour retarders out of polyamide with humidity adaptive characteristic are particularly suitable for thermally insulated buildings in northern hemispheres, where there are more pronounced temperature differences between winter and summer so that therefore, the ambient humidity between winter and summer changes correspondingly strong.

[0011] Further corresponding vapour retarders with a humidity adaptive characteristic are known from DE 101 11 319 A1, whereas in this case, the foil is made out of polyethylene or polypropylene, which contains acrylic acid as polar component.

[0012] Finally, vapour barriers with a humidity adaptive characteristic are known (EP 2 554 758 A1), with which the humidity adaptive vapour retarder is configured multi-layered by additionally adding a further layer to the layer which is essential for the humidity adaptive characteristic. This layer is mainly humidity-invariable and thus independent from the ambient humidity. Corresponding vapour retarders with a humidity adaptive characteristic can be gathered for example from EP 2 759 403 B1 with a humidity adaptive and a humidity invariable layer. By that, a distinct directional sensitivity of the water vapour diffusion arises. Depending on where the higher humidity is applied at the vapour retarder, the higher is the impact of the water vapour diffusion permeability to the drier side. Such vapour retarders are particularly suitable for the thermal insulation of rooms with a high humidity, e.g. bathroom, kitchen or canteens.

[0013] However, despite this state of the art of refined vapour retarders, there is still a need to provide an adequate solution in the special field of flat roofs on a wood structure basis, also in terms of humidity, which enables a quick and also inexpensive mounting with simple building elements. In this connection, climatic conditions, which prevail in the southern countries of Europe, particularly in the region of the Atlantic coast should be met with this new development.

[0014] This is achieved with the features mentioned in claim 1 for a flat roof as well as with the features mentioned for a system according to claim 19. Furthermore, this is solved by a vapour retarder according to claim 20. Appropriate further developments and embodiments of the invention are characterized by the features contained in the respective subclaims.

[0015] The invention refers to a thermally insulated flat roof, particularly configured in the kind of an inaccessible terrace, which is produced on a wood structure basis and comprises a support body, which forms the floor of the roof. This body is produced out of wood or on a wood basis and is formed particularly out of plate-like wooden or wood-like support elements. A covering is suspended from the support body. A single-layered or multi-layered thermal insulation, particularly out of mineral wool, is inserted in the intermediate space between the support body and the covering. According to the invention, in case of such a flat roof, a foil-like membrane with at least one moisture-adaptive layer is arranged between the thermal insulation and the covering as well as a sealing mat on a PVC basis is provided on the support body, which support body has a vapour diffusion resistance $s_d < 5$ m, preferably < 4m.

[0016] Due to these provisions, the flat roof according to the invention is particularly equipped for one-family houses in the flat roof construction particularly with respect to climatic conditions as they mainly prevail in southern countries and regions of Europe where there is hardly any frost in winter and where temperatures in summer and in winter are higher compared with northern countries. Typically, the humid conditions of the surrounding, which prevail throughout the year are different, wherein particularly in regions close to the Atlantic, higher humidities in winter besides a high humidity in summer must be expected. Due to the self-concerted construction according to the invention with a sealing membrane on a PVC basis at the support body, the setting of the support body to a vapour diffusion resistance $s_d < 5$m, particularly < 4 m and a multi-layered foil with a layer with a humidity adaptive character, i.e. with a vapour diffusion resistance s_d which changes depending on the ambient humidity, namely decreasing from the dry area to the humid area, a humidity penetration of the wood structure of the flat roof due to an ingress of humidity is prevented at the one hand and at the same time, a flawless drying out throughout the whole year is guaranteed. Nevertheless, this is achieved by a simple and easily mountable construction of such a flat roof.

[0017] It is appropriate that the PVC sealing mat is equipped such that it has an s_d value of ≤ 35 m. In the scope of the invention, it is appropriate to limit the PVC sealing membrane to a lower limiting value of > 15m. It is appropriate that in practical terms, the PVC membrane has a thickness in the range from 1.0 to 2.0 mm, particularly in the range from

1.2 to 1.5 mm. For the use and processing of the membrane on a PVC basis, reference is made to the adherence of standard NF EN 13956. Particularly, the membrane is mounted mechanically on the support body or the supporting boards out of wood. Preferably, PVC membranes are used which are suggested in the French instruction ATEx (Appréciation technique d' expérimentation) for the use on support elements out of wood).

[0018] ATEx is a rapid technical evaluation procedure formulated by a group of experts on any innovative product, process or equipment. This evaluation is often used either in advance of a Technical Opinion, as it allows initial feedback on the implementation of the processes or for a single project. ATEx documents are created by CSTB and the construction industry in particular with technical controllers.

[0019] It is appropriate that a separation foil for the separation of the PVC membrane against the wooden support body is provided between the PVC sealing mat and the support body compared with the support body out of wood, in particular such as mentioned in the ATEx. The sealing foil is applied to protect the PVC sealing mart against damages due to movements of support body. A preferred sealing foil is a glass veil.

[0020] It is appropriate that for the support body, supporting boards based on wood are used, particularly particle boards or wooden fiber boards according to the standard NF EN 312. In this connection, supporting boards are particularly suitable which are suitable for the usage in a humid environment as well as highly strainable boards for the use in a humid environment. It is appropriate that particle boards or wooden fiber boards are particularly used, the fibers of which are bound with a binding agent according to the standard EN 634-2. Furthermore, particle boards and wooden fiber boards in form of laminated boards, particularly so-called OSB boards according to the standard NF EN 300 are particularly suitable. In the following table 1, a summary of correspondingly suitable supporting boards out of wood or on a wood basis is shown.

Table

	Properties/Exigencies
Oriented strand board according to NF EN 300	• Type OSB 3 • Thickness > 15 mm • Max. length 2500 mm • Max. width 910 mm • Sd < 4 m • Quality mark CTB-OSB
Particulates panels according to NF EN 312	• Type P5, P7 • Min. thickness 18 mm • Sd < 4 m (μ_{wet} < 20, μ_{dry} < 50) • Quality mark CTB-H
Cement bonded particulates panels according to NF EN 634-2	• Min. thickness 18 mm • Sd < 4 m (μ_{wet} < 30, μ_{dry} < 50) • Quality mark CTB-H

[0021] As wood elements for the wood structure, particularly such according to standard NF DTU 31.1 are suitable.

[0022] For the thermal insulation, preferably glass wool with a λ value for the thermal conductivity is used within the scope of the invention, the value preferably reaching from 0.030 to 0.035 W/(m·K). The thermal insulation can be configured single-layered, double-layered but also multi-layered. It is appropriate that the thermal insulation is arranged between the support body and the covering; in particular, the thermal insulation is arranged in the intermediate spaces between the carrier plates out of wood, which support the support body. Complementary to that, a thermal insulation can be provided below the carrier plates if need be, particularly in the free space which is bridged by the hangers for the covering, i.e. in the free space between the lower end faces of the supporting boards and the surface of the suspended covering.

[0023] Preferably, the humidity adaptive membrane is configured multi-layered, particularly double-layered or three-layered, with the upper layer, which faces the thermal insulation in case of a double-layered membrane or the middle layer in case of a three-layered membrane preferably being formed by the humidity adaptive membrane layer. The vapour retarder which is formed by the humidity-adaptive membrane and preferably arranged between the thermal insulation below the support body and the ceiling and which is formed by the humidity-adaptive membrane, preferably has a vapour diffusion resistance s_d in the range from 0.1 m to 60 m, preferably 10 m to 60 m, particularly preferably from 16 m to 48 m, something that is of advantage for the vapour blocking function and the air sealing.

[0024] The thickness of the humidity adaptive membrane is in the range from 45 μm to 400 μm.

[0025] In a preferred embodiment, the multi-layered vapour retarder membrane is configured with a central humidity adaptive layer which is formed of polyamide (PA)/ EVOH / polyamide (PA), preferably out of a compound from which the foil-like layer is produced via an extruder by means of a slot die An appropriate thickness range from this humidity adaptive layer reaches from 20 to 40 μm, preferably from 25 to 35 μm, preferably, the layer has a thickness of 30 μm. As an appropriate polyamide, polyamide 6 is preferably used for the middle humidity adaptive layer of the vapour retarder, which essentially has an S-shaped curve shape of the vapour diffusion resistance s_d on the humidity. Foils out of polyamide 4 or polyamide 3 are for example suitable, too. In an appropriate embodiment, the humidity adaptive layer has a vapour diffusion resistance of a maximum of 25 m in the dry area, which decreases in the course of an S curve to a higher humidity up to a value of < 0.4, in particular < 0.3 m for the vapour diffusion resistance. In another appropriate embodiment, the decrease of the humidity adaptive layer of the membrane takes place in form of an S-shaped curve with a turning point in the range from a middle humidity between 40 and 55 %, with the s_d value lying in this middle range between 15 m and 10 m.

[0026] Above the central layer of a multi-layered membrane and thus facing the thermal insulation, it is appropriate that a layer of polypropylene (PP) is arranged, which is preferably non-woven and preferably with a surface weight between 50 and 70 g/m^2, in particular 60 g/m^2 and serves essentially for reinforcing the membrane present in foil-form or for influencing further desired properties of the vapour retarder foil depending on the specific application case.

[0027] For the lower layer of the humidity adaptive membrane which faces the covering, a vapour barrier foil with an essentially constant vapour diffusion resistance s_d is used, which preferably lies in the range between 14 m and 18 m, preferably at 15 m. This does not change its vapour diffusion resistance and is thus humidity invariable.

[0028] For that, particularly a foil of polypropylene is suitable. It is appropriate that the thickness of this layer moves in the range from 20 μm to 30 μm and is preferably 25 μm. Due to this vapour retarder membrane with this layering, a critical entry of humidity into the wooden structure of flat roofs can be prevented throughout the whole season. At the same time, a corresponding drying out of the wooden structure is enabled throughout the whole year, something that effectively prevents mould formation and similar damages.

[0029] In the following, preferred embodiments of the invention are purely schematically described by means of the figures. In

Figure 1 an illustration of an inaccessible flat roof within a wooden structure, illustrated in a perspective view and in partial section,

Figure 2 a roughly schematic illustration of a sectional view of such a flat roof according to figure 1,

Figure 3 a diagram for a vapour retarder membrane used within the invention as well as,

Figure 4 a diagram on the behavior of the humidity adaptive vapour retarder membrane according to fig. 2 over an annual cycle

is shown.

[0030] Figure 1 shows an inaccessible flat roof, which is generally referred to with 1 in cross section and in a perspective view, which is configured as a wooden structure. In detail, this embodiment has a support body 2 of wood or on a wood basis, which - as is generally known - is formed of board-like support elements, particularly particle boards or wooden fiber boards. The support body 2 is carried on vertically arranged carrier plates or boards 4, which are arranged in parallel with a distance to one another. A thermal insulation 6 out of mineral wool, preferably glass wool, is arranged between the carrier plates. According to fig. 1, a thermal insulation 8 can be arranged below the carrier plates 4, too, which is formed of insulation boards, the insulation suitably being formed of glass wool, too.

[0031] A sealing mat 10 on a PVC basis, which is present as a foil-like membrane, is preferably arranged on the support body 2. On that, any appropriate cover can be arranged if need be. A separation layer 12 is preferably arranged between the PVC membrane 10 and the support body 2, with which a chemical separation between the PVC membrane and the support body out of wood or a wood-like material arranged below can be carried out. Below the support body 2, there is a covering, which is generally referred to with 14, which can be formed out principally common building elements, in particular gypsum plaster boards, plaster fiber boards and the like. The covering 14 is suspended by per se known hangers, which are mechanically fixed to the carrier plates 4. A foil-like humidity adaptive membrane layer 16 is preferably arranged on this covering 14.

[0032] As the thermal insulation 6, mineral wool, namely preferably glass wool is used in the shown embodiment. The glass wool can be present in form of insulation boards which are arranged between carrier plates 4 and which bridge the free space between these carrier plates free of gaps. Within this embodiment, it is appropriate that a further insulation layer is provided below the carrier plates 4, which bridges the free space between the lower edge of the parallelaligned carrier plates 4 and the cover 14, which is suspended via the hangers 18, and particularly fills this free space.

[0033] The vapour retarder membrane 16 is preferably arranged below the thermal insulation 8. It is appropriate that the thermal insulation is arranged in the area of the wooden structure such that gaps can largely be avoided, as otherwise, cold bridges would be present. This lies within the professional handling. This does however also apply to the PVC membrane 10, which is applied onto the support body as well as to the vapour retarder layer 16, which is arranged above the covering and below the thermal insulation, which are arranged such that essentially no gaps remain or present gaps are suitably sealed. This can be carried out with suitable adhesive agents, particularly adhesive tapes, and the like.

[0034] It is very appropriate within the scope of the invention that building elements out of wood or based on wood for the wooden structure be used, the water content of which is less than 18% at the time of mounting.

[0035] Finally, figure 2 shows a roughly schematic illustration of the composition of the flat roof construction according to fig. 1 and also schematically indicates the three-layered configuration of the vapour retarder membrane 16. Analogously to figure 1, there is a PVC membrane 10 above the support body 2 and above the covering 14 out of plaster boards which is suspended via the hangers 18, there is the vapour retarder membrane 16 which is preferably present as a three-layered foil, namely an upper layer 16a, a middle layer 16b and a lower third layer 16c which faces the covering 14. If need be, two or more than three layers can be used.

[0036] In the illustrated embodiment, a PVC membrane 10 is used, the vapour diffusion resistance of which is ≤ 35 m. The thickness of the membrane preferably lies in the range from 1.2 mm to 1.5 mm.

[0037] The wood structure with the building elements shown in figure 1, namely particularly wood fiber plates as the support body 2 and vertically aligned support plates 4, is designed for a vapour diffusion resistance < 5m, particularly < 4 m.

[0038] Glass wool is preferably used as the mineral wool, the lambda value for the thermal conductivity of which lies in the range from 0.030 to 0.035 W/(m·K).

[0039] The vapour retarder membrane is configured three-layered in the illustrated embodiment, with an upper layer 16a which faces the thermal insulation 6, preferably a non-woven polypropylene mat with a surface weight of preferably 60g/m^2, wherein this layer contains a mechanical function, and is particularly provided as a reinforcement layer. The middle layer 16b is configured humidity-adaptively in the present embodiment, and preferably configured out of a compound of PA/EVOH/PA with a thickness of 30 μm as a foil-like layer. The lower layer 16c which faces the covering 14 is a vapour barrier foil with a mainly constant s_d value, in the present case preferably made out of polypropylene, with a thickness of preferably 25 μm.

[0040] These details are of course in no way limiting, both with respect to the choice of material as well as the thickness ratios and the like.

[0041] Figure 3 shows the vapour diffusion behavior of the humidity adaptive middle layer 16b and the lower vapour barrier layer 16c, the vapour diffusion resistance s_d constantly lies at 15m, independent of the ambient humidity. Therefore, it is a humidity invariable layer 16c.

[0042] This leads to the directed humidity stream, which is indicated in figure 2 with the arrow direction A and arrow direction B, A referring to wintry conditions and B referring to summery conditions.

[0043] Figure 4 shows a diagram with the course of the vapour diffusion resistance throughout the season, which arises due to the methods according to the invention. It is obvious that in the winter months or colder months from November up to and including February, there are higher barrier values for the water vapour diffusion by means of s_d values in the range from approx. 25 m to just below 48 m and for the warmer months from March up to and including October lower vapour diffusion resistances in the range between approx. 15 to 30 for the s_d values. That means that in the winter months, less humidity enters from the inside via the covering to the upside into the thermal insulation in the wood structure, something that is important for the drying.

Claims

1. A thermally insulated flat roof based on a wood structure with a flat support body (2) out of wood or on a wood basis, which is particularly formed of board-like support elements out of wood or wood-like materials, a covering (14) which is suspended downwards from the support body (2) and with a thermal insulation (6, 8) which is arranged between the support body (2) and the covering (14), in particular out of mineral wool,
characterized in that
a foil-like membrane (16) with at least one humidity adaptive layer is arranged between the thermal insulation (6, 8) and the suspended covering (14), that a sealing membrane (10) on a PVC basis is arranged on the support body (2), and that the support body (2) preferably has a vapour diffusion resistance < 5m, preferably < 4m.

2. The flat roof according to claim 1,
characterized in that
the PVC sealing membrane (10) has a vapour diffusion resistance value s_d of ≤ 35 m.

3. The flat roof according to claim 2,
characterized in that
the s_d value of the PVC membrane is ≥ 15 m.

4. The flat roof according to one of the preceding claims,
characterized in that
the thickness of the PVC membrane (10) lies in the range between 1.0 and 2.0 mm, particularly in the range from 1.2 to 1.5 mm.

5. The flat roof according to one of the preceding claims,
characterized in that
a separation foil (12) is arranged between the PVC membrane (10) and the support body (2), preferably a glass veil.

6. The flat roof according to one of the preceding claims,
characterized in that
the supporting boards of the support body (2) are formed by particle boards or wooden fiber boards with an s_d < 5m, preferably < 4m.

7. The flat roof according to one of the preceding claims,
characterized in that
the humidity adaptive membrane (16) with at least one humidity adaptive layer is configured multi-layered, preferably three-layered, between the support body (2) and the covering (14).

8. The flat roof according to claim 7
characterized in that
the humidity adaptive layer forms a central layer (16b) of the membrane (16).

9. The flat roof according to claim 7 or 8,
characterized in that
the humidity adaptive layer (16b) of the membrane (16) contains polyamide, EVOH and polyamide, and is particularly formed three-layered with these materials, with the EVOH layer preferably being located in the middle, or that the layer (16b) is formed of a compound of these materials.

10. The flat roof according to claims 7 to 9,
characterized in that
the thickness of the humidity adaptive layer (16b) of the membrane (16) lies in the range from 20 to 40 μm, preferably 25 to 35 μm, particularly 30 μm.

11. The flat roof according to one of the claims 7 to 10,
characterized in that
the humidity adaptive layer (16b) has, depending on the ambient humidity, an s_d value in the range from 25 m to < 0.3 m, with the s_d value decreasing as humidity increases.

12. The flat roof according to claim 1,
characterized in that
the decrease of the humidity adaptive layer (16b) of the membrane (16) takes place in form of an S-shaped curve with a turning point in the range from a middle humidity between 40 and 55 %, with the s_d value lying in this middle range between 15 m and 10 m.

13. The flat roof according to one of the claims 7 to 12,
characterized in that
the humidity adaptive layer (16b) is provided with a protective layer out of preferably non-woven polypropylene (PP) on its surface which faces the thermal insulation (6, 8).

14. The flat roof according to claim 13,
characterized in that
the protective layer has a surface weight in the range from 50 to 70 g/m^2, in particular that the surface weight is 60 g/m^2.

15. The flat roof according to one of the claims 7 to 14,
characterized in that
the humidity adaptive vapour retarder membrane is provided with a layer (16c) at its side which faces the covering, the layer having a constant s_d value in the range from 15 to 18 m and preferably being formed of polypropylene.

16. The flat roof according to one of the claims 7 to 14,
characterized in that
the humidity adaptive membrane (16) has a vapour diffusion resistance value s_d in the range from 0,1 m to 60 m, preferably 10 to 60 m, particularly preferably from 16 to 48 m.

17. The flat roof according to one of the claims 7 to 15,
characterized in that
the thickness of the humidity adaptive membrane (16b) lies in the range from 45 μm to 400 μm.

18. The flat roof according to one of the preceding claims,
characterized in that
the thermal insulation (6,8) is formed of glass wool, with the thermal conductivity preferably having a value of 0.030 to 0.035 W/(m·K), with the thermal insulation (6,8) preferably being configured between the support body (2) and the covering (14) with one or two layers.

19. A system for thermally insulating a flat roof on a wood structure basis, with a plane support body out of wood or on a wood basis, particularly out of board-like wooden or wood-like support elements, and with a covering that is suspended from the support body and with a thermal insulation arranged between the support body and the covering, the insulation particularly being formed of mineral wool, preferably of glass wool, with a foil-like membrane (16) with at least one humidity-adaptive layer being arranged between the thermal insulation (6, 8) and the suspended covering (14) as a system component, with a sealing membrane on a PVC base (10) being arranged on the support body as a system component and with the support body as a system component preferably being configured with a vapour diffusion resistance < 5m, preferably 4m, and these components and further system components of the thermal insulation being configured according to at least one of the preceding claims.

20. A vapour retarder with a humidity adaptive characteristic, particularly for the use as a foil-like membrane with a flat roof out of a wood structure on a suspended covering, **characterized by** the features referring to the humidity adaptive vapour retarder (16) of at least one of the preceding claims 1 to 18.

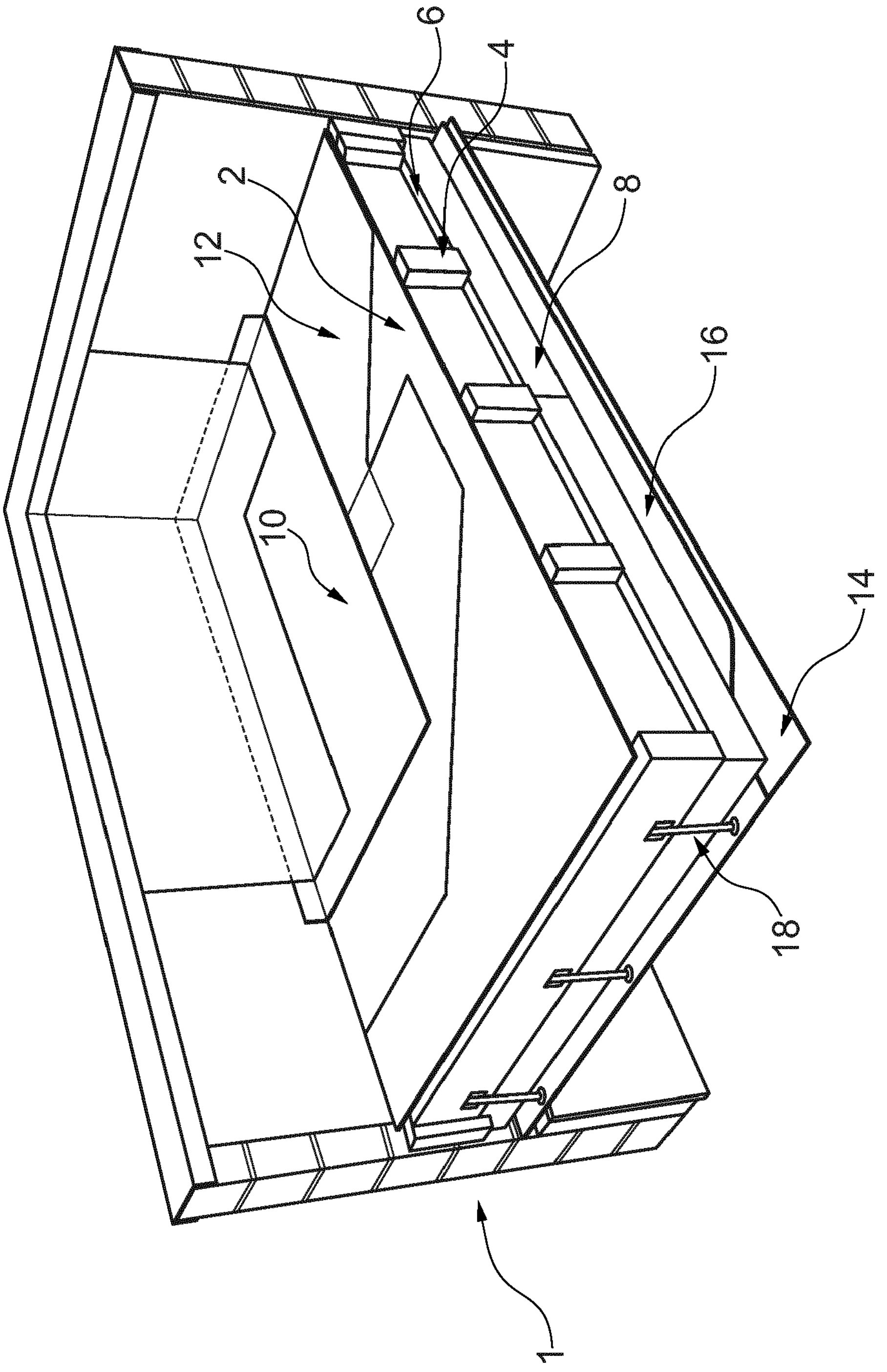


Fig. 1

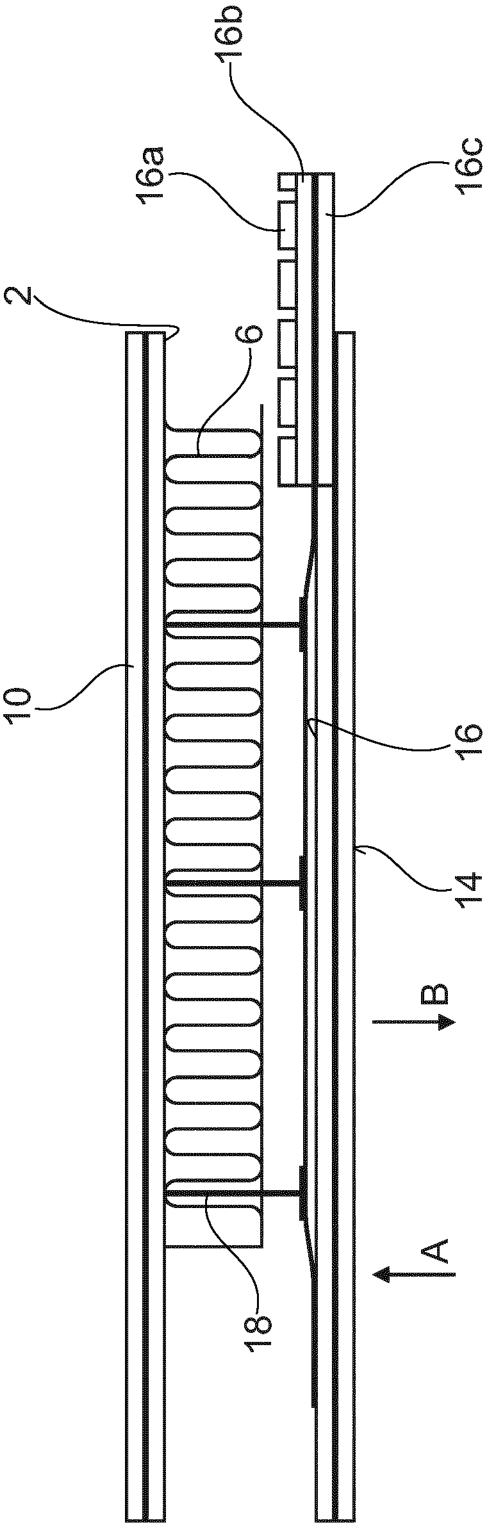


Fig. 2

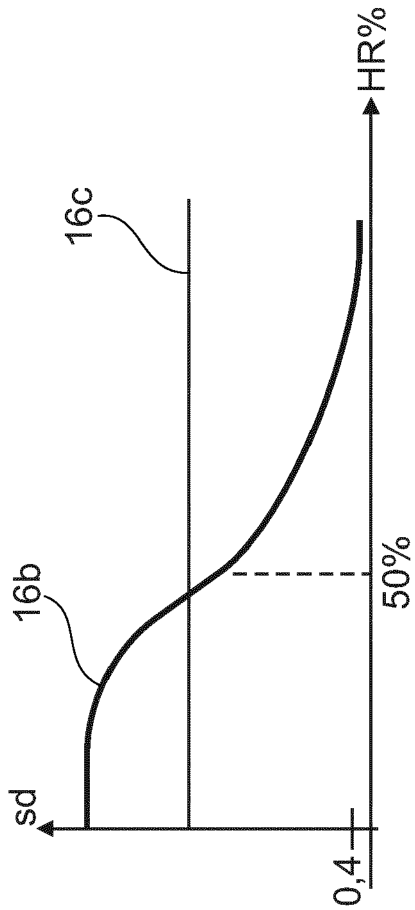
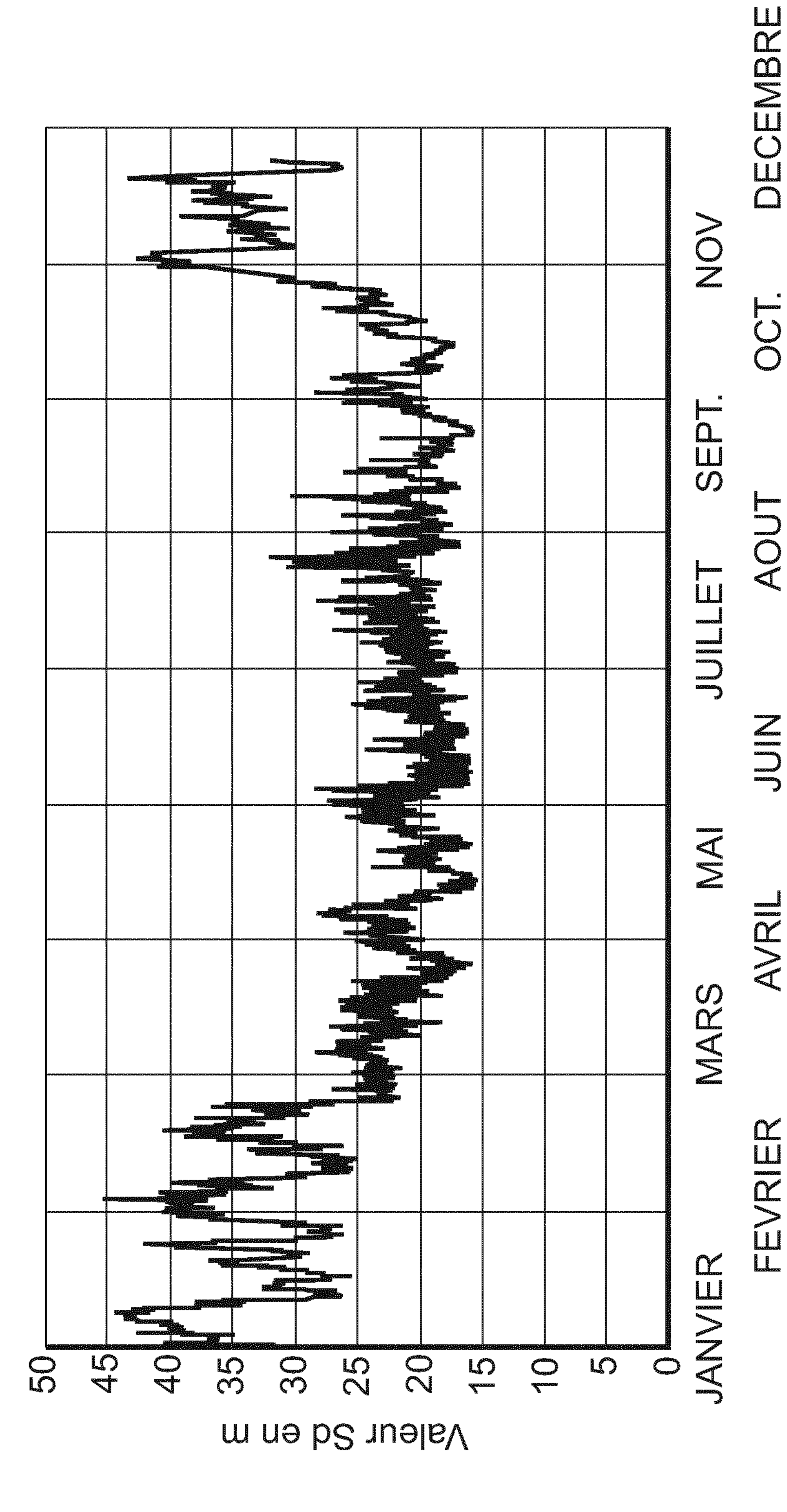


Fig. 3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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 0631

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Place of search	Date of completion of the search	Examiner
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X : particularly relevant if taken alone
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