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(54) **INSULATED FAÇADE SYSTEM**

ISOLIERTES FASSADENSYSYSTEM

SYSTEME DE FAÇADE A ISOLATION

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Description

[0001] The invention concerns an insulation panel suitable for application in a building façade. Furthermore, the invention concerns a building façade comprising an insulation panel, a method for providing a building façade and a method for manufacturing insulation panels.

[0002] It is known to build a façade comprising an inner wall of e. g. concrete or bricks, an insulation layer of any type of insulation, an outer cladding layer of e. g. tiles, wood, metal, boards of compressed fibres etc. Furthermore the façade comprises profiles fastened to the inner wall extending through the insulation layer and used for securing the outer cladding layer. The profiles extend vertically from ground level and to the top of the building. During construction the profiles will be secured to the inner wall, and afterwards the insulation is arranged between the profiles. Finally the outer cladding layer is secured to the profiles. The outer cladding layer is made as boards, which are often placed with small gaps in between the boards in order for ventilation air to be able to pass.

[0003] All types of insulation may be applied in such a façade system. However, often fibrous insulation materials such as mineral wool are preferred. Also for fire safety reasons especially stone wool or glass wool insulation materials are preferred. The insulation may be in rolls or in the form of panels or boards. When glass wool has been used it has been in the form of rolls with a density around 18 kg/m³. Stone wool has usually been used in the form of panels with a density around 40 kg/m³. Low density insulation is usually preferred due to the price. This also makes handling and transport on the building site easier.

[0004] One problem with these relatively low densities of the insulation materials is that more fasteners are needed in order to make the insulation fit closely against the inner wall. A close fitting is important for ensuring optimal heat insulating capacity, and also for preventing the ventilation gap from being blocked.

[0005] This problem could be solved by applying an insulation material with a higher density. This will improve the rigidity of the insulation. However, some of the advantages of having low density insulation will be lost and such a solution will also increase the costs for the insulation.

[0006] WO 02/099213 suggests a roof insulation plate made from fibre materials, wherein the roof insulation plate comprises a portion on a major large surface having a different density and an edge portion along a minor edge surface having a flexible zone with a depth of 5 mm. The purpose of this flexible zone is to join the edges of two roof insulation plates.

[0007] Another problem is that the soft insulation layer is more sensitive to mechanical damages during installation on the surface facing the outer cladding layer. Furthermore, the surface of the low density insulation is less resistant to weather influence. Especially for higher build-

ings the action of wind and precipitation, e. g. rain, may be significant, and also the precipitation may easily penetrate the openings for ventilation in the outer cladding layer. These two problems could be solved by applying an insulation material with a higher density as this would result in a more resistant surface.

[0008] It should be noted that the air gap for ventilation is essential for keeping the temperature of the building as low as possible in the summer time. The radiation from the sun on the external cladding can bring the temperature on this surface up to 60 - 70 degrees Celsius or more and without air gap this would also be the temperature of the outer surface of the insulation. Preferably there are also openings for ventilation air in the outer cladding layer. When having the air gap, and especially when also having the openings in the outer cladding, the outer surface temperature of the insulation is more or less equivalent to the air temperature which is often significantly lower than that of the outer cladding layer. Thus the air gap ensures a lower temperature gradient across the insulation layer and thereby a reduced heat flow into the building during summer time. Furthermore, it ensures that any humidity will dry out. It is essential that the insulation panels are sufficiently rigid and/or are supplied with a sufficient amount of fasteners to prevent the insulation from bending out from the inner wall and blocking the ventilation air gap.

[0009] Another known method for improving mechanical properties of the insulation layer is to provide the mineral wool with a fleece layer (e. g. glass fibre fleece) on the outer surface. This will improve the mechanical properties of the surface and reduce the risk of mechanical damage. A fleece layer will also improve the resistance to the disintegration of the insulation caused by weather. However, a fleece layer is a relatively expensive solution, and it does not increase the stiffness of the insulation layer much, and therefore a high number of fastening means is still necessary.

[0010] The objective of the present invention is to obtain a more rigid insulation material with a surface being resistant to mechanical action and the influence of weather without sacrificing the advantageous of the presently used low density insulation, while at the same time the insulation material being more easily to install.

[0011] This has been solved by an insulation panel having two major large surfaces and four minor edge surfaces comprising two layers of different density parallel to the two major surfaces, and an edge portion along a minor edge surface, having a higher flexibility than the rest of the insulation panel in order to ensure that the panel is flexible in at least one direction, the edge portion with a higher flexibility having a depth of at least 35 mm, preferably at least 40 mm, measured perpendicular to the minor edge surface.

[0012] The advantage of this new solution is that the higher density of the outer surface layer will provide the mechanical rigidity of the insulation layer facilitating a reduced number of fasteners and it will also provide good

resistance against mechanical damages as well as against weather influences.

[0013] Document WO 03/042445 A1 discloses an insulation panel according to the preamble of claim and included in the subject-matter of claims 4, 14 and 15.

[0014] One further problem with the existing solution is that when installing such a façade system there will often be a tolerance on the distance between the profiles for holding the outer cladding layer. This tolerance may cause a difference in the distance between the profiles from ground level to the top of a building. This difference could be a few centimetres (e.g. from 53 cm to 55 cm) making it difficult to attach a closely fitting insulation layer.

[0015] Further to this tolerance the necessary distance between the profiles in order to comply with different standards for dimensions of the panels for the outer cladding layer may vary from e.g. 54 to 61 cm. So in order to limit the number of different insulation dimensions manufactured it is necessary that one dimension of the insulation panels can be used for an interval of distances between the profiles.

[0016] Therefore in a preferred embodiment of the invention the insulation panel is provided with a flexible zone along at least one edge surface so that the insulation panel is flexible in at least one direction and can be fitted closely against limiting surfaces. The advantage of this embodiment is that the edge flexibility ensures close connection between the insulation layer and the profiles.

[0017] Profiles are attached to the inner wall and extend through the insulation layer. The profiles provide a basis to which the outer cover layer is secured. Usually T-profiles will be applied for this purpose, but L profiles or C profiles or other types could also be applied. These profiles will usually be made of metal, preferably aluminium, but also steel, e.g. stainless steel, may be applied. The profiles could also be wooden beams.

[0018] When T-profiles are applied the thickness of the material will depend on the weight of the outer cladding layer. The width of the base portion fixed to the inner wall and holding the flange portion depends on the thickness of the insulation panels and the thickness of the ventilation air gap.

[0019] When profiles provided with flanges for securing the outer cladding layer are provided, insulation panels with a flexible zone offer the advantage of being easier to install. This is due to the fact that they will be easier to insert between the flanges of the profiles, since the flexible zone can be compressed. This is a particular advantage when insulation panels having layers of different densities are applied.

[0020] The distance between the profiles is dependent on the dimensions of the external cladding. Different types of external cladding are delivered in different dimensions. Often a distance in the range 54 - 61 centimetres is necessary. Preferably the supplied insulation panels should be able to be flexible enough so that only two different insulation panel dimensions are necessary.

[0021] Preferably, the insulation panels are attached

to the inner wall by mechanical means such as nails or screws. However, any adhesives may also be applied. The mechanical means will anyway secure that de-lamination of mineral wool insulation cannot take place.

[0022] The insulation material for the invention is preferably mineral wool e.g. glass wool or stone wool. It may be delivered to the building site as rolls or panels. When the insulation is of the stone wool type the low density layer facing the inner wall will have a density below 50 kg/m³, preferably below 45 kg/m³, even more preferably 20 - 40 kg/m³. The high density layer facing the external cladding will (in the case of stone wool) have a density of at least 70 kg/m³, preferably at least 80 kg/m³ and even more preferably 80 - 120 kg/m³. The average density of the insulation material will often be in the range 45 - 60 kg/m³.

[0023] Methods for manufacturing dual density insulation panels are described in e.g. EP 1 111 113 A2.

[0024] The thickness of the insulation material will typically be in the range 40 - 250 mm, preferably 50 - 200 mm. The thickness of the high density layer is 10 - 20 mm. When insulation panels are used these will typically have a width of 400 - 700 mm, preferably closer to the actual distance between the profiles, i.e. often in the range 500 - 600 mm. The length of the panels is in the range 1000 - 2400 mm. When rolls are used these will preferably have the same width, while the length will be longer but dependent on the thickness of the insulation.

[0025] The soft part of the insulation material facilitates the possibility of adjusting to irregularities of the inner wall surface. Furthermore, the soft part of the insulation offers the possibility of providing the packages comprising the insulation material with some pre-compression thus reducing the volume which have to be transported and thereby the costs for transport. In order to facilitate the adjustment to the inner wall surface and the compressibility in packaging it might be advantageous to apply the method described in WO 03/042445 A1 for softening the low density surface by mechanical depth wise compression, e.g. by rollers.

[0026] In a further embodiment of the invention an insulation panel having a total thickness in the range 50 - 150 mm, preferably about 100 mm, of which 15 mm has a density of 100 kg/m³, and the rest have a density of 40 kg/m³, is being compressed on the low density major surface by a pressing drum with a compression of 50 %. Following this the product is compressed 35 % when packed.

[0027] If the same mechanical properties should be achieved by a mono-density insulation layer a density of at least 70 kg/m³ would be necessary. Such insulation would not be compressible.

[0028] In a preferred embodiment of the invention the insulation panel is provided with at least one resilient or flexible minor edge surface. This means that the flexible minor edge surface is easily compressible by hand, and is elastically compressible in such a way that removing the compression will make the minor side surface of the

board regain substantially its original dimension, however minor deviations from its original dimension should be expected. The rest of the board away from the flexible surfaces has a higher stiffness. The stiffness may be defined according to EN826. Preferably, the whole minor edge surface should be substantially equally flexible.

[0029] For manufacturing a mineral fibre panel with at least one flexible minor edge surface it must be realised that mineral fibre insulation comprises a large number of individual fibres having different lengths and diameters. For providing a stable mineral fibre board a binder is added to the mineral fibres. Said binder is cured in a curing oven and will thereafter make the fibres stick to each other at the points where the fibres are in contact with each other. A method for making one or more edge surfaces of this mineral fibre insulation panel flexible, i.e. elastically compressible, is to compress one or more rollers a distance into the edge surface. This compression by the roller will break some of the points of bonding in the mineral fibre board and thereby make the edge portion of the mineral fibre board softer and more elastically compressible than the rest of the board. The diameter of the compression applying roller(s) must be relatively small in order to concentrate the compression forces in the desired region. The diameter is usually 200 - 500 mm. The rollers are pressed a distance of 15 - 50 mm, preferably at least 35 mm into the edge. The numbers of rollers would often be 1 - 7, preferably 2-4. The resulting depth of the flexible zone should preferably be at least 35 mm, even more preferably at least 40 mm, in order for two different dimensions of the insulation panels to cover the whole possible span of possible distances between the profiles holding the outer cladding layer.

[0030] On the production line the panels will pass a zone where rollers are compressed into the edge surface. Due to the high density layer of the insulation panels often only one board passes the zone with rollers at a time, and often the board is supported on the majority of its top and bottom surface while passing the zone with rollers. Typically, the rollers will extend different distances into the edge surface in order to gradually compress the edge surface and thereby forming a more homogenous resilient zone.

[0031] In a further embodiment of the invention three fasteners (typically screws or nails) or less are used per square meter for fixation of the insulation panels to the inner wall, preferably two fasteners are used, and even more preferably only one fastener is used per square meter. Any type of adhesive could also be applied for this fixation.

[0032] The ventilation air gap will typically be in the range 20 - 150 mm, preferably 70 - 100 mm. Preferably, there will not be any points or areas of direct contact between the outer cladding layer and the insulation panels. This will secure a free air flow in the ventilation air gap.

[0033] Especially for high buildings it is important to have openings for ventilation in the façade and not just at the bottom and the top of the outer cladding layer.

Preferably the openings are made by having a given vertical distance between the external cladding panels, which will provide the necessary openings for ventilation. The distance between the outer cladding panels is preferably in the range 5 - 20 mm.

[0034] In an embodiment of the installation of the building façade according to the invention profiles e.g. T-profiles are attached to the inner wall, insulation panels having at least two layers having different densities and at least one flexible edge, are installed between the profiles. Finally, the external cladding layer is attached to the profiles, ensuring that an air gap is provided between the outer cladding layer and the insulation panels, and preferably with an opening in the vertical direction between the outer cladding panels.

[0035] In the following the invention will be described in more details with reference to the figures.

Figure 1 shows a cross sectional view of the façade
Figure 2 shows an insulation panel according to the invention.

[0036] Figure 1 illustrates an example of a building façade (1) according to the invention. The inner wall (2) is often made of concrete but also other types of material such as bricks may be applied. Profiles (10), e.g. T-profiles as illustrated, are secured to the inner wall (2) by e.g. 90 degrees L-shaped fittings and screws (not shown). If U- or C-profiles were applied the profile would have a surface to be placed directly against the inner wall and it could be attached directly with e.g. screws without extra fittings. However, this further surface of the profile (10) would be placed against the inner wall along the whole length of the profile (10). L-shaped fittings, however, would be placed with certain distances. Therefore, a further surface on the profiles (10) might increase the cold-bridging slightly and, obviously also increase the used amount of metal.

[0037] When T-profiles are applied the profiles have a base portion (7) extending perpendicular to the inner wall and joined to a flange portion (8) substantially parallel to the inner wall. The outer cladding is secured to the flange portions (8) of the profiles (10), e.g. by screw or nails (not shown), or in the case of metal plates for outer cladding also welding could be applied.

[0038] The insulation is arranged between the base portions (7) of the profiles (10) in the vertical direction parallel to the inner wall, and the insulation (3) is arranged between the inner wall and the outer cladding layer in the vertical direction perpendicular to the surface of the inner wall (2). The insulation comprise layers (4, 5) of different densities, with a high density layer (5) facing the external cladding and a lower density layer (4) facing the inner wall. Along at least one edge of the insulation, facing a profile (10) a flexible zone (9) is provided. This zone is more easily compressible than the rest of the insulation material.

[0039] Between the insulation and the outer cladding

layer an air gap (11) is provided for ventilation air. Air for ventilating this gap enters between openings between the outer cladding panels (6). The outer cladding layer (6) should not be in direct contact with the insulation panels (3).

[0040] Figure 2 illustrates an insulation panel (3) according to claim 1 and 2 of the invention. The insulation panel comprise two major surfaces (12, 13) and 4 minor surfaces (14, 14', 14'', 14'''). The high density layer, facing the outer cladding layer, preferably has a density of at least 70 kg/m³, while the low density layer has a density below 50 kg/m³. A flexible zone (9) is provided along one minor surface (14') extending a distance perpendicular to the minor surface (14') of at least 35 mm into the insulation.

Claims

1. An insulation panel (3) suitable for application in a building façade (1) having an inner wall (2), an outer cladding layer (6) and profiles (10) with a flange portion (8) for securing the outer cladding to the inner wall, where an air gap (11) for ventilation is provided between the insulation layer and the outer cladding, the insulation panel (3) having two major large surfaces (12, 13) and four minor edge surfaces (14, 14', 14'', 14''') the insulation panel comprising two layers (4, 5) of different density parallel to the two major surfaces (12, 13), **characterized in that** the insulation panel comprises an edge portion (9) along a minor edge (14') surface having a higher flexibility than the rest of the insulation panel (3) in order to ensure that the panel is flexible in at least one direction, the edge portion (9) with a higher flexibility having a depth of at least 35 mm, preferably at least 40 mm, measured perpendicular to the minor edge surface (14').
2. An insulation panel according to claim 1 **characterized in that** one layer (5) has a density in the range 70 - 130 kg/m³, preferable 80 - 120 kg/m³, and one layer has a density below 50 kg/m³, preferably 20 - 40 kg/m³.
3. An insulation panel according to claim 1 or 2 **characterized in that** the layer (4) having a lower density is soft and formable, so that it can adjust to irregularities in the inner wall (2) surface.
4. A building facade (1) comprising an insulation panel (3) according to any one of the claims 1 to 3, having an inner wall (2), an outer cladding layer (6) and profiles (10) with a flange portion (8) for securing the outer cladding to the inner wall (2), where said profiles (10) are attached to the inner wall (2), and where said insulation panel (3) is arranged between said profiles (10), where an air gap (11) for ventilation is provided between said insulation panel (3) and said outer cladding layer (6), and where a layer (5) of said insulation panel (3), with a density above an average density of said insulation panel (3), is facing the outer cladding (6).
5. A building façade according to claim 4 **characterized in that** said outer cladding (6) comprises openings for ventilation air.
6. A building façade according to claim 4 or 5 **characterized in that** said insulation panel (3) is being flexible in at least one direction parallel with the major surfaces (12, 13) so that the insulation panel is fitted closely against limiting surfaces.
7. A building façade according to any one of the claims 4 - 6 **characterized in that** said insulation panels (3) are dual density insulation panels.
8. A building façade according to any one of the claims 4 - 7 **characterized in that** said insulation panels are made of a fibrous material preferably mineral wool and even more preferably stone wool.
9. A building façade according to any one of the claims 4 - 8 **characterized in that** said layer (5) with a density above an average density of the insulation panel have a density in the range 60 - 130 kg/m³, preferably 70 - 130 kg/m³, even more preferably 80 - 120 kg/m³.
10. A building façade according to any one of the claims 4 - 9 **characterized in that** said layer (4) of the insulation panels (3) having the lower density has a density below 60 kg/m³, preferably below 50 kg/m³, even more preferably 20 - 40 kg/m³.
11. A building façade according to any one of the claims 4 - 10 **characterized in that** said profiles (10) are T-profiles comprising a base portion (7) and a flange portion (8).
12. A building façade according to any one of the claims 4 - 11 **characterized in that** there is no points or areas of direct contact between the outer cladding layer (6) and the insulation panels (3).
13. A building façade according to any one of the claims 4 - 12 **characterized in that** two or less fasteners are applied per square meter, preferably only one fastener is applied per square meter.
14. A method for providing the building façade (1) of any one of claim 4 - 13, which method comprises the following steps:
 - attaching the profiles (10) to the inner wall (2),
 - installing the insulation panels (3) according to any one of the claims 1 - 3 between the profiles

(10),
attaching the outer cladding layer (6) to the profiles (10) ensuring that there are no areas of direct contact between the outer cladding layer (6) and the insulation panels (3).

15. A method for manufacturing the insulation panels (3) according to any one of the claims 1 - 3 **characterized in that** the dual density insulation panels (3) passes a set of 2 - 4 rollers with diameters in the range 200 - 500 mm, the rollers are pressed at least 35 mm into the edge surface (14') of the insulation panel (3), so that an edge portion (9) with a higher flexibility having a depth of at least 35 mm, preferably at least 40 mm, measured perpendicular to the minor edge surface (14') is formed.
16. A method for manufacturing the insulation panels according to claim 15 **characterized in that** the rollers will extend different distances into the edge surface (14') in order to gradually compress the edge.

Patentansprüche

1. Dämmplatte (3) zur Anwendung in einer Gebäudefassade (1), die über eine Innenwand (2) verfügt, eine äußere Verkleidungsschicht (6) und Profile (10) mit einem Flanschabschnitt (8) zur Befestigung der äußeren Verkleidung an der Innenwand, wobei eine Luftlücke (11) zur Belüftung zwischen der Isolierungsschicht und der äußeren Verkleidung vorgesehen ist, wobei die Dämmplatte (3) über zwei große Hauptflächen (12, 13) und vier kleine Kantenflächen (14, 14', 14'') verfügt, wobei die Dämmplatte zwei Schichten (4, 5) unterschiedlicher Dichte parallel zu den beiden Hauptflächen (12, 13) aufweist, **dadurch gekennzeichnet, dass** die Dämmplatte einen Kantenabschnitt (9) längs einer kleinen Kantenfläche (14') umfasst, der über eine höhere Flexibilität verfügt, als der Rest der Dämmplatte (3), um sicherzustellen, dass die Platte in mindestens einer Richtung flexibel ist, wobei der Kantenabschnitt (9) mit höherer Flexibilität eine Tiefe, senkrecht zur kleinen Kantenfläche (14') gemessen, von mindestens 35 mm aufweist, vorzugsweise von mindestens 40 mm.
2. Dämmplatte nach Patentanspruch 1, **dadurch gekennzeichnet, dass** eine Schicht (5) über eine Dichte im Bereich von 70 - 130 kg/m³, vorzugsweise von 80 - 120 kg/m³ verfügt, und eine Schicht über eine Dichte unter 50 kg/m³, vorzugsweise von 20 - 40 kg/m³.
3. Dämmplatte nach Patentanspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Schicht (4) mit geringerer Dichte weich und formbar ist, so dass sie sich an Unregelmäßigkeiten in der Oberfläche der

Innenwand (2) anpassen kann.

4. Gebäudefassade (1), eine Dämmplatte (3) nach irgendeinem der Patentansprüche 1 bis 3 aufweisend, die über eine Innenwand (2) verfügt, eine äußere Verkleidungsschicht (6) und Profile (10) mit einem Flanschabschnitt (8) zur Befestigung der äußeren Verkleidung an der Innenwand (2), wobei die genannten Profile (10) an der Innenwand (2) befestigt sind und wobei die genannte Dämmplatte (3) zwischen den genannten Profilen (10) angeordnet ist, wobei eine Luftlücke (11) zur Belüftung zwischen der genannten Dämmplatte (3) und der genannten äußeren Verkleidungsschicht (6) vorgesehen ist, und wobei eine Schicht (5) der genannten Dämmplatte (3) mit einer Dichte oberhalb der mittleren Dichte der genannten Dämmplatte (3) der äußeren Verkleidung (6) zugewandt ist.
5. Gebäudefassade nach Patentanspruch 4, **dadurch gekennzeichnet, dass** die genannte äußere Verkleidung (6) Öffnungen für Lüftungsluft aufweist.
6. Gebäudefassade nach Patentanspruch 4 oder 5, **dadurch gekennzeichnet, dass** die genannte Dämmplatte (3) in mindestens einer Richtung parallel zu den Hauptflächen (12, 13) flexibel ist, so dass sich die Dämmplatte an angrenzende Oberflächen eng anlegt.
7. Gebäudefassade nach irgendeinem der Patentansprüche 4 bis 6, **dadurch gekennzeichnet, dass** die genannten Dämmplatten (3) Dämmplatten mit zwei Dichten sind.
8. Gebäudefassade nach irgendeinem der Patentansprüche 4 bis 7, **dadurch gekennzeichnet, dass** die genannten Dämmplatten aus einem Faserwerkstoff bestehen, vorzugsweise Mineralwolle und noch stärker bevorzugt Steinwolle.
9. Gebäudefassade nach irgendeinem der Patentansprüche 4 bis 8, **dadurch gekennzeichnet, dass** die genannte Schicht (5) mit einer Dichte oberhalb der mittleren Dichte der Dämmplatte über eine Dichte im Bereich von 60 - 130 kg/m³, vorzugsweise von 70 - 130 kg/m³ und noch stärker bevorzugt von 80 - 120 kg/m³ verfügt.
10. Gebäudefassade nach irgendeinem der Patentansprüche 4 bis 9, **dadurch gekennzeichnet, dass** die genannte Schicht (4) der Dämmplatten (3) mit der geringeren Dichte über eine Dichte von unter 60 kg/m³ verfügt, vorzugsweise von unter 50 kg/m³ und noch stärker bevorzugt von 20 - 40 kg/m³.
11. Gebäudefassade nach irgendeinem der Patentansprüche 4 bis 10, **dadurch gekennzeichnet, dass**

die genannten Profile (10) T-Profil sind, die über einen Basisabschnitt (7) verfügen und einen Flanschabschnitt (8).

12. Gebäudefassade nach irgendeinem der Patentansprüche 4 bis 11, **dadurch gekennzeichnet, dass** es keine Punkte oder Bereiche unmittelbarer Berührung zwischen der äußeren Verkleidungsschicht (6) und den Dämmplatten (3) gibt.

13. Gebäudefassade nach irgendeinem der Patentansprüche 4 bis 12, **dadurch gekennzeichnet, dass** zwei oder weniger Befestigungselemente pro Quadratmeter angewandt werden und dass vorzugsweise nur ein Befestigungselement pro Quadratmeter angewandt wird.

14. Verfahren zur Errichtung der Gebäudefassade (1) nach irgendeinem der Patentansprüche 4 bis 13, wobei das Verfahren die folgenden Schritte aufweist:

Befestigung der Profile (10) an der Innenwand (2),
Anbringung der Dämmplatten (3) nach irgendeinem der Patentansprüche 1 bis 3 zwischen den Profilen (10),
Befestigung der äußeren Verkleidungsschicht (6) an den Profilen (10) unter Sicherstellung, dass es keine Bereiche unmittelbarer Berührung zwischen der äußeren Verkleidungsschicht (6) und den Dämmplatten (3) gibt.

15. Verfahren zur Herstellung der Dämmplatten (3) nach irgendeinem der Patentansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Dämmplatten mit zwei Dichten (3) einen Satz von 2 - 4 Rollen mit Durchmessern in der Größenordnung von 200 - 500 mm durchlaufen, wobei die Rollen mindestens 35 mm in die Kantenoberfläche (14') der Dämmplatte (3) gedrückt werden, so dass ein Kantenabschnitt (9) mit höherer Flexibilität ausgebildet wird, der über eine Tiefe von mindestens 35 mm, vorzugsweise von mindestens 40 mm, senkrecht zur kleinen Kantenoberfläche (14') gemessen, verfügt.

16. Verfahren zur Herstellung der Dämmplatten nach Patentanspruch 15, **dadurch gekennzeichnet, dass** die Rollen über unterschiedliche Tiefen in die Kantenoberfläche (14') hineinragen, um die Kante schrittweise zu komprimieren.

Revendications

1. Panneau isolant (3) qui convient pour l'application dans une façade de bâtiment (1) ayant un mur intérieur (2), une couche de revêtement extérieur (6) et des profilés (10) avec une portion de bride (8) pour

fixer le revêtement extérieur au mur intérieur, un intervalle d'air (11) pour ventilation étant prévu entre la couche d'isolation et le revêtement extérieur, le panneau isolant (3) ayant deux grandes surfaces principales (12, 13) et quatre surfaces plus petites de bord (14, 14', 14''), le panneau isolant comprenant deux couches (4, 5) de densité différente parallèles aux deux surfaces principales (12, 13), **caractérisé en ce que** le panneau isolant comprend une portion de bord (9) le long d'une surface plus petite de bord (14') ayant une plus grande flexibilité que le reste du panneau isolant (3) pour assurer le fait que le panneau soit flexible dans au moins une direction, la portion de bord (9) avec une plus grande flexibilité ayant une profondeur d'au moins 35 mm, de préférence d'au moins 40 mm, mesurée perpendiculairement à la surface plus petite de bord (14').

2. Panneau isolant selon la revendication 1, **caractérisé en ce qu'**une couche (5) a une densité de l'ordre de 70 à 130 kg/m³, de préférence de 80 à 120 kg/m³ et une couche a une densité inférieure à 50 kg/m³, de préférence de 20 à 40 kg/m³.

3. Panneau isolant selon la revendication 1 ou 2, **caractérisé en ce que** la couche (4) ayant une faible densité est souple et formable si bien qu'elle peut s'ajuster à des irrégularités dans la surface du mur intérieur (2).

4. Façade de bâtiment (1) comprenant un panneau isolant (3) selon l'une quelconque des revendications 1 à 3, ayant un mur intérieur (2), une couche de revêtement extérieur (6) et des profilés (10) avec une portion de bride (8) pour fixer le revêtement extérieur au mur intérieur (2), où lesdits profilés (10) sont fixés au mur intérieur (2) et où ledit panneau isolant (3) est arrangé entre lesdits profilés (10), où un intervalle d'air (11) pour ventilation est prévu entre ledit panneau isolant et ledit revêtement extérieur et où une couche (5) dudit panneau isolant (3) avec une densité supérieure à une densité moyenne dudit panneau isolant (3) est en face du revêtement extérieur (6).

5. Façade de bâtiment selon la revendication 4, **caractérisée en ce que** ledit revêtement extérieur (6) comprend des ouvertures pour l'air de ventilation.

6. Façade de bâtiment selon la revendication 4 ou 5, **caractérisée en ce que** ledit panneau isolant (3) est flexible dans au moins une direction parallèlement aux surfaces principales (12, 13) si bien que le panneau isolant est ajusté de manière serrée contre des surfaces de délimitation.

7. Façade de bâtiment selon l'une quelconque des revendications 4 à 6, **caractérisée en ce que** lesdits

panneaux isolants (3) sont des panneaux isolants double densité.

8. Façade de bâtiment selon l'une quelconque des revendications 4 à 7, **caractérisée en ce que** lesdits panneaux isolants (3) sont en matériau fibreux, de préférence en laine minérale et de manière encore plus préférée en laine de roche. 5
9. Façade de bâtiment selon l'une quelconque des revendications 4 à 8, **caractérisée en ce que** ladite couche (5) avec une densité supérieure à une densité moyenne du panneau isolant a une densité de l'ordre de 60 à 130 kg/m³, de préférence de 70 à 130 kg/m³, de manière encore plus préférée de 80 à 120 kg/m³. 10 15
10. Façade de bâtiment selon l'une quelconque des revendications 4 à 9, **caractérisée en ce que** ladite couche (4) des panneaux isolants (3) ayant la densité inférieure à une densité inférieure à 60 kg/m³, de préférence inférieure à 50 kg/m³, de manière encore plus préférée de 20 à 40 kg/m³. 20
11. Façade de bâtiment selon l'une quelconque des revendications 4 à 10, **caractérisée en ce que** lesdits profilés (10) sont des profilés en T comprenant une portion de base (7) et une portion de bride (8). 25
12. Façade de bâtiment selon l'une quelconque des revendications 4 à 11, **caractérisée en ce qu'il n'y a pas de points ou de zones de contact direct** entre la couche de revêtement extérieur (6) et les panneaux isolants (3). 30 35
13. Façade de bâtiment selon l'une quelconque des revendications 4 à 12, **caractérisée en ce que** deux attaches ou moins sont appliquées par mètre carré, de préférence seulement une attache est appliquée par mètre carré. 40
14. Procédé pour créer la façade de bâtiment (1) selon l'une quelconque des revendications 4 à 13, lequel procédé comprend les étapes suivantes : 45
 - fixation des profilés (10) au mur intérieur (2),
 - installation des panneaux isolants (3) selon l'une quelconque des revendications 1 à 3 entre les profilés (10),
 - fixation de la couche de revêtement extérieur (6) aux profilés (10) assurant qu'il n'y a pas de zones de contact direct entre la couche de revêtement extérieur (6) et les panneaux isolants (3). 50
15. Procédé de fabrication des panneaux isolants (3) selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** les panneaux isolants double 55

densité (3) passent par un ensemble de 2 à 4 galets avec des diamètres de 200 à 500 mm, les galets sont pressés au moins 35 mm dans la surface de bord (14') du panneau isolant (3) si bien qu'une portion de bord (9) avec une plus grande flexibilité ayant une profondeur d'au moins 35 mm, de préférence au moins 40 mm, mesurée perpendiculairement à la surface secondaire de bord (14') est formée.

16. Procédé de fabrication des panneaux isolants (3) selon la revendication 15, **caractérisé en ce que** les galets s'étendent sur différentes distances dans la surface de bord (14') pour compresser graduellement le bord.

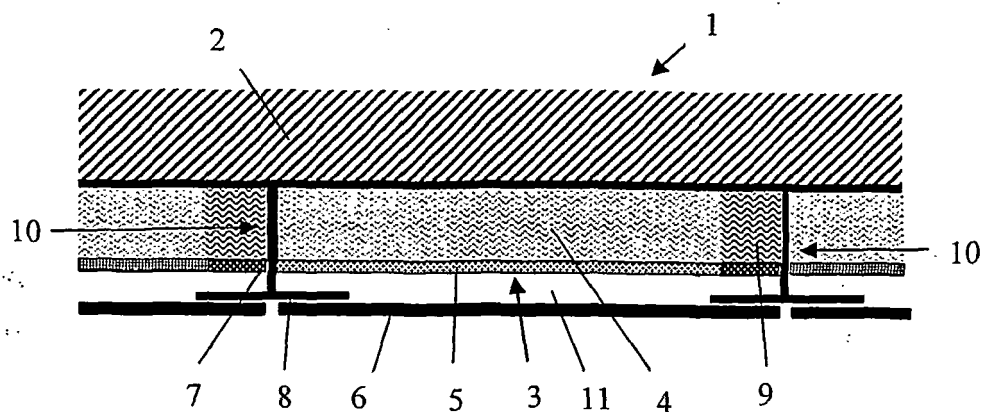


Figure 1

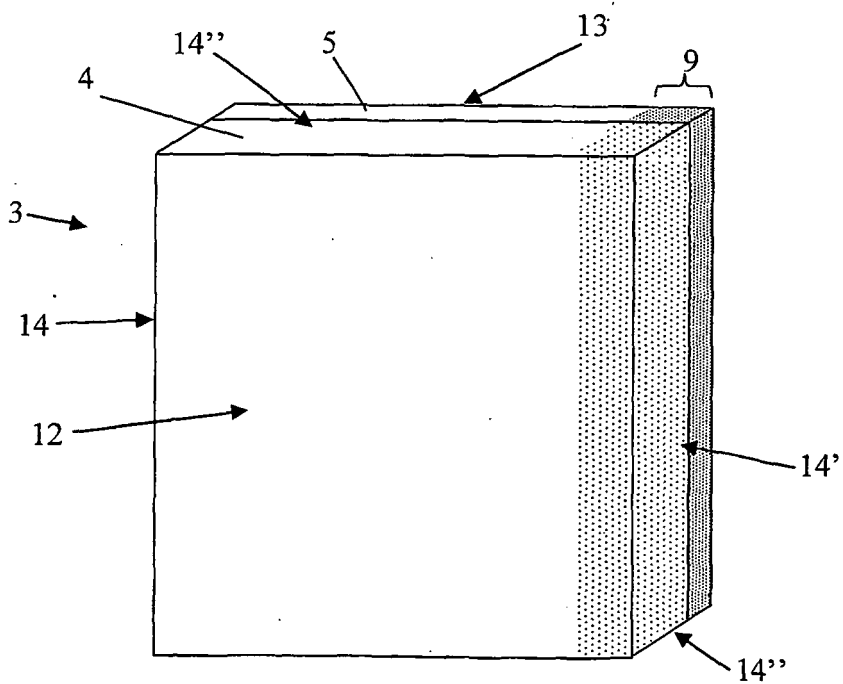


Figure 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- EP 1111113 A2 [0023]