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(54) **PROCESS FOR INSULATING AND SEALING ESSENTIALLY FLAT ROOFING AND COATING USED IN THIS PROCESS**

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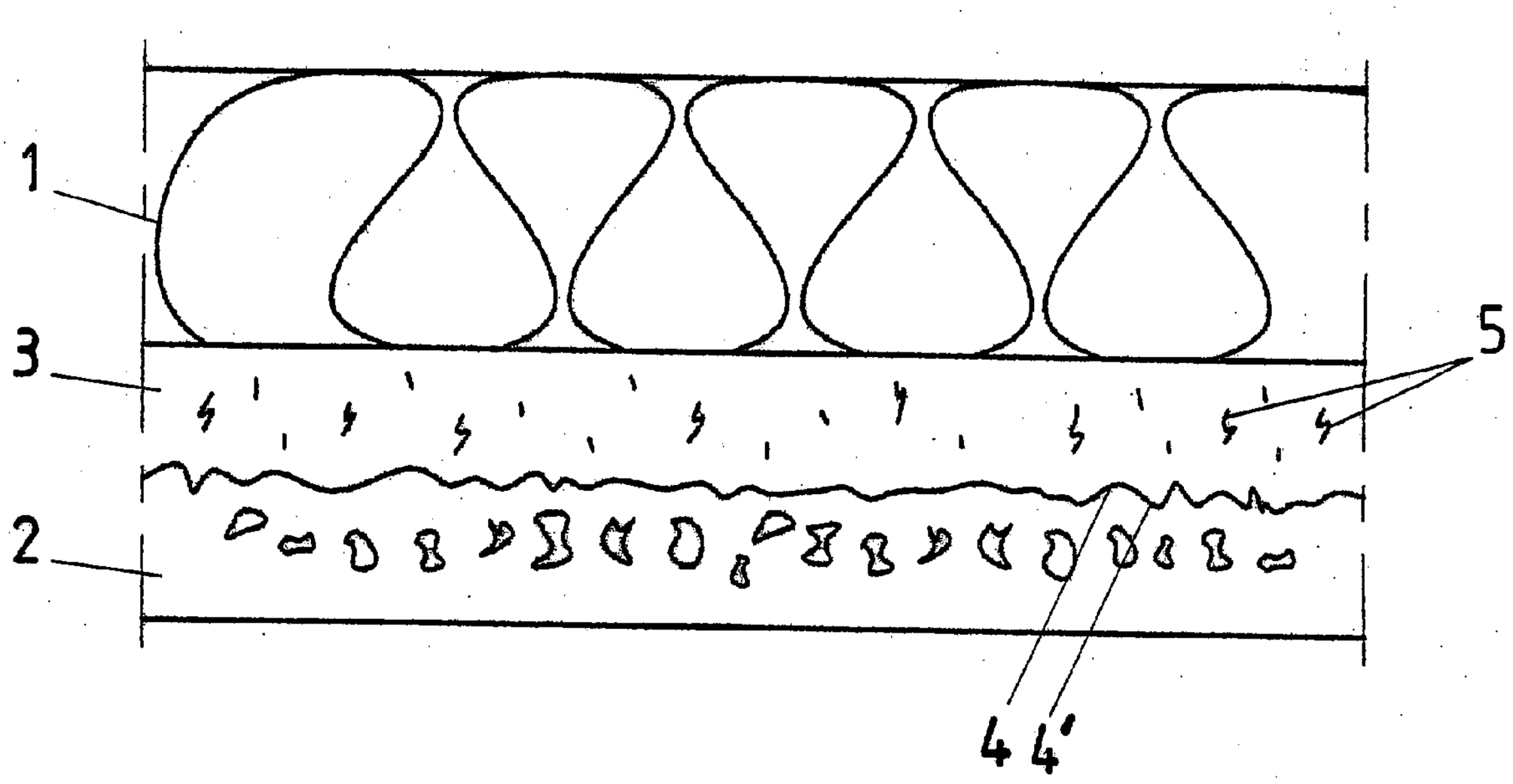
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(57) **ABSTRACT**

A process for insulating and sealing roofing comprises coating the substrate (**2**) with a liquid or viscous composition (**3**) that is based on modified bitumen or a bitumen/polyurethane mixture by covering rough spots (**4**) and by filling the hollows or emergent cavities (**4'**) that are present on the surface of the substrate (**2**), then applying the insulating layer (**1**) or individual elements that are intended to form the insulating layer (**1**) on the coated surface of the substrate (**2**) before the previously applied coating layer (**3**) solidifies, whereby the coating layer (**3**) forms, after drying or polymerization, a water-vapor barrier and an agent for adhesion of insulating layer (**1**) to the attachment substrate (**2**), and, finally, applying to insulating layer (**1**) a sealing coating (**6**).



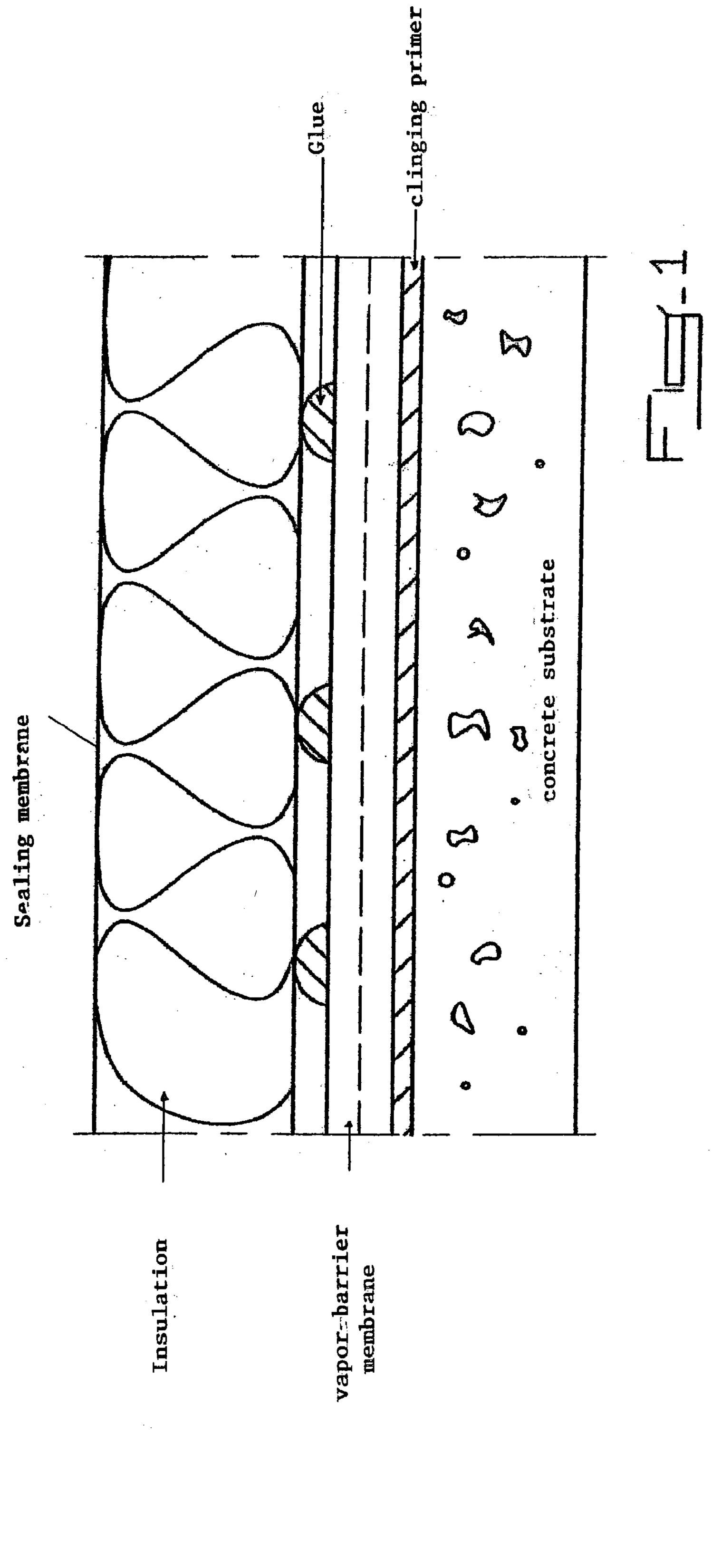
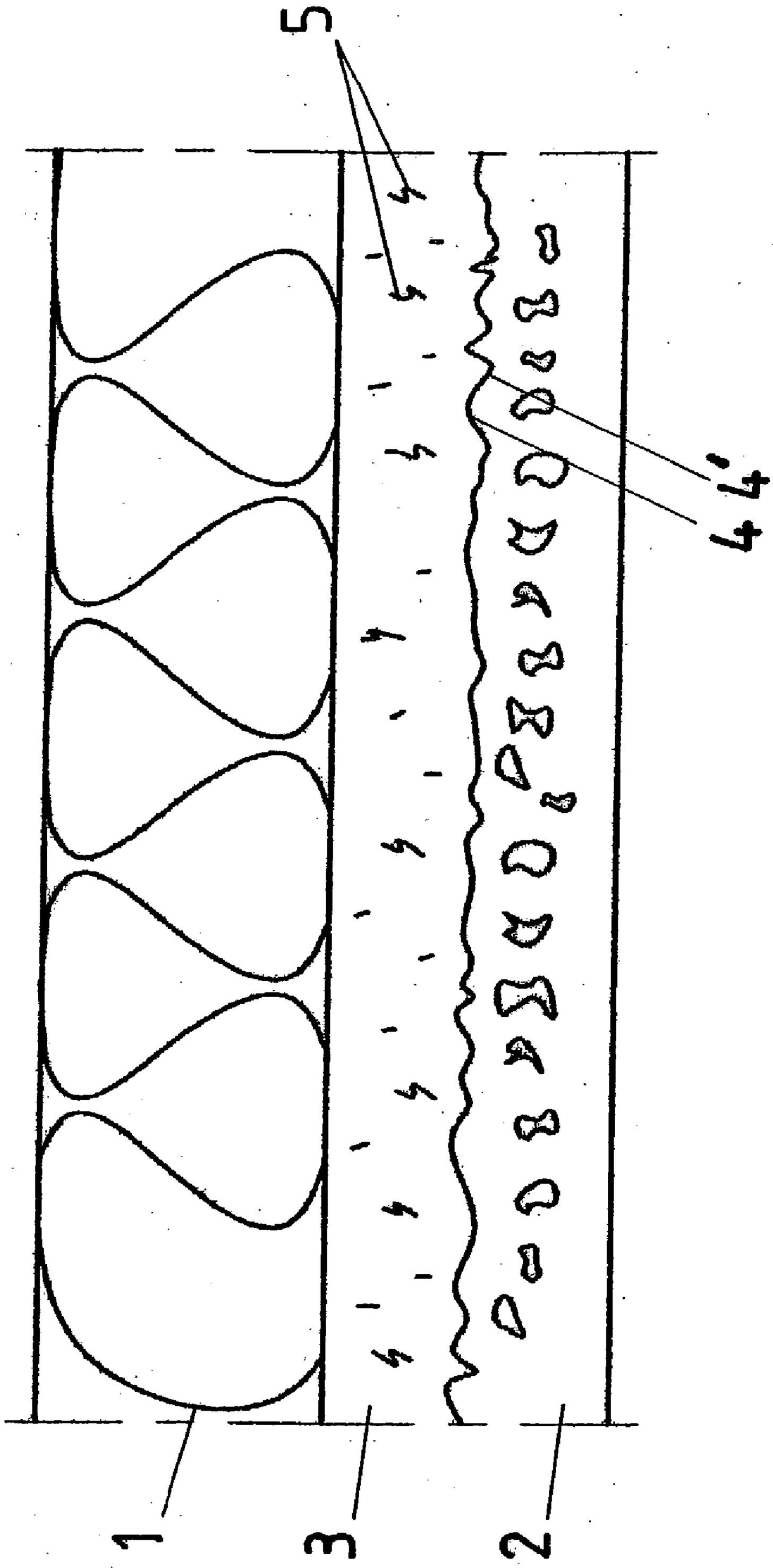

Glue
clinging primer
concrete substrate
Sealing membrane
Insulation
vapor-barrier membrane

FIG-1


5
4
4'
1
3
2

PROCESS FOR INSULATING AND SEALING ESSENTIALLY FLAT ROOFING AND COATING USED IN THIS PROCESS

[0001] This invention relates to the field of substrate coating, in particular thermo-acoustic insulation and the sealing of essentially flat roofing, and it has as its object a process for insulating and sealing such roofing and a liquid vapor-barrier coating that is suitable for the implementation of such a process.

[0002] In some applications, the installation and the attachment of insulating and sealing materials should meet special criteria.

[0003] Thus, in the sealing sector of roofing, in particular terrace roofing with concrete sealing substrate, it is necessary, if a non-vapor-barrier heat insulation is used, to apply a water vapor-barrier membrane before applying said insulation.

[0004] Actually, in moderate regions, the absence of a vapor barrier would cause there to be a dew point inside the heat insulation.

[0005] In contrast, to withstand partial-vacuum and detachment stresses due to wind, the sealing systems (insulation+outside sealing membrane) should either have ballast or should adhere perfectly to the substrate.

[0006] The attachment process that is used in the prior art of the unballasted systems is generally as follows today:

[0007] Application of a clinging primer to the concrete substrate;

[0008] Installation of the vapor-barrier membrane;

[0009] Bonding of the heat insulation.

[0010] Once this preparatory work of attaching the insulation is carried out, the sealing membranes are applied to the heat insulation.

[0011] This process, however, has drawbacks and limitations.

[0012] Thus, its necessary decomposition in three successive operating phases, each requiring one material and, if necessary, different tools, makes it costly in labor and in materials.

[0013] In addition, the vapor-barrier membranes are generally thin structures that are subject to tearing or to perforation during their handling and after installation.

[0014] In addition, to ensure high-quality attachment of the vapor barrier to the substrate, it is necessary first to treat the surface of said substrate to make it level and smooth, to remove any rough spots and to ensure attachment over the entire surface of said substrate.

[0015] Finally, for reasons of economic practicability (material and labor costs), the insulation is generally bonded to the vapor-barrier membrane only by spaced zones, from which there results a limited attachment force and the impossibility of attaching low-cohesion insulations;

[0016] Known by document U.S. Pat. No. 3,726,754, furthermore, is a process for the production of an insulating and sealing system for roofing that consists of an intermediate sealed membrane bonded to the substrate and foam panels bonded to said intermediate membrane. It is also provided that said intermediate membrane can be applied in the form of a liquid primer by spraying or by means of a trowel.

[0017] Nevertheless, the known system of this document exhibits major drawbacks.

[0018] Actually, taking into account the discontinuous structure of the insulating layer (foam panels), the latter necessarily will not be sealed at least over the long term, and in particular at the joints between adjacent panels, even if the panels have, in themselves, a water-tight structure. During ageing of said system, infiltrations will therefore be produced, with stagnation of the water under the insulating panels.

[0019] In addition, and in particular in moderate regions, condensation will be found in the thickness of the insulating layer, hence a loss of insulating qualities of said layer, and even long-term damage to the latter.

[0020] This invention has as its object to remedy at least some of the drawbacks above and to overcome at least some of the above-mentioned limitations.

[0021] To this end, the invention has as its main object a process for insulating and sealing a roofing that forms an essentially flat substrate, such as a concrete terrace roofing, characterized in that it essentially consists of:

[0022] Coating said substrate with a liquid or viscous composition by covering the rough spots and filling the hollows or emergent cavities that are present on the surface of said substrate,

[0023] Applying said insulating layer or individual elements that are intended to form said insulating layer on the coated surface of said substrate before the previously applied coating layer solidifies, whereby said coating layer forms, after drying or polymerization, a water-vapor barrier and an agent for adhesion of the insulating layer to said attachment substrate, and, finally,

[0024] Applying to the insulating layer a sealing coating that comprises at least one layer of bituminous or synthetic or analogous membranes.

[0025] The invention will be better understood thanks to the description below, which relates to a preferred embodiment, given by way of nonlimiting example and explained with reference to **FIG. 2** of the attached schematic drawings, in which:

[0026] **FIG. 1** is a side cutaway view of an insulating material that is attached to a concrete substrate according to the current process of the prior art, and

[0027] **FIG. 2** is a cutaway view of an insulating material that is attached to a concrete substrate according to the process of the invention.

[0028] As is evident from **FIG. 2** of the attached drawings, the process according to the invention essentially consists in:

[0029] Coating said substrate **2** with a liquid or viscous composition **3** by covering rough spots **4** and by filling hollows or emergent cavities **4'** that are present on the surface of said substrate **2**,

[0030] Applying said insulating layer **1** or individual elements that are intended to form said insulating layer **1** on the coated surface of said substrate **2** before the previously applied coating layer **3** solidifies, whereby said coating layer **3** forms, after drying or polymerization, a water-vapor barrier and an agent for adhesion of insulating layer **1** to said attachment substrate **2**, and, finally,

[0031] Applying to insulating layer **1** a sealing coating **6** that comprises at least one layer of bituminous or synthetic or analogous membranes.

[0032] The invention thus makes it possible to replace the three stages of the known process, mentioned above (and whose result is illustrated in **FIG. 1**) and costly in labor and in materials (three different materials), by a single operating stage, by using a product in coating form **3** that is easy to spread on substrate **2** and that simultaneously performs the following three functions: vapor barrier (controlled vapor barrier), adhesion to substrate **2** and bonding of insulation **1**.

[0033] According to a first characteristic of the invention, composition **3** that forms a coating is selected from the group that is formed by the bituminous compositions based on a bitumen/thermoplastic elastomer mixture and the compositions that are based on a bitumen/polyurethane mixture or in the group that is formed by the mixtures that are based on a polyurethane prepolymer, with or without solvent, and the resin/hardener mixtures (such as, for example, epoxy resin/amine hardener).

[0034] Advantageously, composition **3** that forms a coating has a viscosity at 20° C. of between 50 and 300 poise, preferably between 100 and 200 poise and very preferably between 100 and 150 poise.

[0035] The fluidity of composition **3** thus will be fixed such that the coating can be carried out by means of a brush, a roller, a spatula, a scraper or a similar tool and has a good spreadability of between 5 and 40° C.

[0036] In addition, the amount of liquid or viscous composition **3**, continuously applied over the entire surface of substrate **2**, is at least adequate to obtain a smooth upper surface (compensation for rough spots of substrate **2**) and to ensure an adhesion of insulating layer **1** to essentially its entire lower face.

[0037] This arrangement will make possible the bonding of low-cohesion insulating materials (mineral wool and perlite, for example), while providing a coating layer **3**, linking insulating layer **1** to substrate **2**, with a high structural cohesion due to homogeneous consistency (relative to three layers [primer/vapor barrier/glue] of the prior art).

[0038] To be able to carry out the process that is described above, the coating that is used, preferably in the form of an essentially liquid composition, should comprise a mixture of substances that are compatible with one another and that contribute in combination to the expression of the three above-mentioned functions, whereby each of them can be accomplished in practice in several different ways, if necessary by acting on several parameters and/or on the types and the amounts of compounds falling within its formulation.

[0039] Thus, the function of adhesion to substrate **2**, in particular concrete substrate **2**, can be obtained by selecting one or more of the following possibilities:

[0040] High fluidity of the product in the application to have a good wetting of the concrete substrate.

[0041] Use of adherence dope(s) facilitating adhesion, including on the wet concrete substrate.

[0042] Use of materials with remarkable adhesive properties: bitumen that may or may not be modified, thermoplastic elastomers, epoxy resin monocomponent polyurethane prepolymer or bicomponent polyurethane prepolymer or the like.

[0043] The water vapor-barrier function can be accomplished by integrating in coating **3** materials or substances that have good hydrophobic properties and that are resistant to the transfer of water vapor. In some cases, the bitumen by itself is adequate to obtain a vapor-barrier function to a sufficient degree.

[0044] Finally, to carry out or to reinforce the bonding function of the insulation, an existing cold bonding solution optionally can be combined with coating **3** that is used within the scope of the invention.

[0045] Found among these potential solutions is in particular solvent-containing bituminous glue, polyurethane glue and bitumen/monocomponent or bicomponent polyurethane glue.

[0046] This invention therefore also has as its object a coating that is used for the implementation of the process that is described above, making it possible in particular to perform the three functions that are mentioned above.

[0047] For this purpose, coating **3** consists of a preferably essentially liquid composition, i.e., a viscosity as mentioned above and that comprises, by weight:

[0048] 0 to 30% of solvent,

[0049] 0 to 60% of bitumen,

[0050] 0 to 40% of liquefier(s),

[0051] 10 to 40% of mineral and/or metal feedstock(s),

[0052] 0 to 10% of additive(s) reinforcing the bonding properties,

[0053] 0 to 50% of at least one structuring and adhesive component that is selected from the group that is formed by the thermoplastic elastomeric polymers, the polyurethane prepolymers and the resin/hardener mixtures.

[0054] According to a first embodiment of the invention, composition **3** consists of, by weight:

[0055] 8 to 15% of solvent,

[0056] 35 to 45% of bitumen,

[0057] 0 to 20% of liquefier(s),

[0058] 10 to 30% of mineral or metal feedstocks,

[0059] 0 to 10% of additive(s) reinforcing the bonding properties,

[0060] 0 to 25% of at least one structuring and adhesive component that is selected from the group

that is formed by the thermoplastic elastomeric polymers, the polyurethane prepolymers and the resin/hardener mixtures.

[0061] The thermoplastic elastomer or elastomers that modify the bitumen can, for example, be selected from the group that is formed by SBS (styrene-butadiene-styrene), SIS (styrene-isoprene-styrene), EVA (ethylene/vinyl acetate copolymer) and mixtures of the latter.

[0062] Bitumen is advantageously a direct distillation bitumen, for example of type 70/100. However, the coating can also be carried out with an oxidized or semi-blown bitumen.

[0063] According to a second preferred embodiment of the invention, composition **3** consists of a mixture that is based on reactive resin, preferably consisting of, by weight:

[0064] 15 to 25% of solvent,

[0065] 15 to 25% of liquefier(s),

[0066] 15 to 35% of mineral and/or metal feedstocks,

[0067] 0 to 5% of an additive that reinforces the bonding properties,

[0068] 20 to 40% of a PUR prepolymer or a resin/hardener mixture.

[0069] According to a third preferred embodiment of the invention, composition **3** consists of a mixture without a solvent that is based on polyurethane prepolymer, preferably consisting of, by weight:

[0070] 30 to 40% of liquefier,

[0071] 15 to 30% of mineral and/or metal feedstocks,

[0072] 0 to 5% of an additive that reinforces the bonding properties,

[0073] 30 to 50% of a polyurethane prepolymer.

[0074] At least one said mineral or metal feedstock can be selected from the feedstock that is selected from the group that is formed by slate powder, aluminum paste, chalk, aluminosilicates and mica.

[0075] The feedstock preferably consists of laminating flakes that, after coating **3** dries, form a continuous film on the aluminum or mica surface.

[0076] According to a first variant embodiment of the invention, coating **3** consists of a monocomponent composition.

[0077] According to a second variant embodiment of the invention, coating **3** consists of a bicomponent composition of which a first component comprises in particular a polyol and of which the second component comprises in particular an isocyanate.

[0078] In this second variant, the polyol/isocyanate pair can, for example, correspond to the hydroxylated polybutadiene/methyldiphenyldiisocyanate pair.

[0079] According to a third variant of the invention, coating **3** consists of a bicomponent composition, of which a first component comprises in particular an epoxy resin and of which the second component comprises in particular an amine hardener.

[0080] To reinforce the structural cohesion of coating **3**, in particular when it is applied on a relatively significant thickness, coating **3** can comprise an additional structuring feedstock in the form of short fibers **5**, preferably fibers made of a polymer material.

[0081] By way of practical sample embodiments of the invention, four actual formulations by weight of coating **3** will now be described according to the invention, as well as their characteristics of application and their properties.

EXAMPLE 1

[0082]

Component A:		Component B:	
Direct distillation bitumen, preferably 70/100:	40.00		
Solvent:	10.00	MDI:	2.50
Plasticizing oil:	8.00	(methyldiphenyldiisocyanate)	
Slate powder:	21.00	A/B ratio:	40/1
Hydroxylated polybutadiene:	21.00		
Adhesion:			
Amount of glue applied:		1.5	kg/m^2
PSE adhesion	(expanded polystyrene:	25	kg/m^3)
on concrete:		1.2	daN/cm^2
(cohesive rupture in PSE)			
Water vapor permeability:			
Less than 0.1 g/m^2.24 h			

EXAMPLE 2

[0083]

Direct distillation bitumen, preferably 70/100:	40.00
Solvent:	13.00
Tackifying resin:	4.00
SBS/SIS mixture:	3.00
Slate powder:	18.00
Aluminum paste:	22.00
Adhesion:	
Amount of glue applied:	2 kg/m^2
PSE adhesion to concrete after 28 days:	6 N/cm^2
(50% cohesive rupture in PSE; 50% cohesive rupture in adhesive binder)	
Water vapor permeability:	
0.10 g/m^2.24 h.	

EXAMPLE 3

[0084]

Polyurethane prepolymer:	29.00
Diluting agent:	23.00
Solvent:	22.50
Chalk:	25.50

EXAMPLE 4

[0085]

Polyurethane prepolymer:	40.00
Liquefier:	40.50
Chalk:	19.00
Silane:	0.50

[0086] The invention also has as its object a composite insulating and sealing system for roofing that forms an essentially flat substrate, such as a concrete terrace roofing, obtained by means of the process above, characterized in that it has a stratified composite structure and consists of, starting from substrate **2**, a dried or polymerized coating layer **3** that simultaneously forms a controlled passage water vapor barrier, a leveling coating and an agent for surface adhesion to substrate **2**, by an insulating layer **1** that is attached by coating layer **3** to substrate **2**, whereby said insulating layer **1** is preferably formed by the juxtaposition of individual elements in the form of strips or panels, and by a sealing coating **6** that comprises at least one layer of bituminous, synthetic or analogous membranes, whose adjacent edge zones advantageously at least partially overlap one another.

[0087] Upper sealing coating **6** can be formed in particular by a layer that consists of bituminous membranes that are cold or hot glued to insulating layer **1**, whereby these membranes are themselves provided with an upper coating of mechanical and/or chemical protection, integrated with said membranes.

[0088] Of course, the invention is not limited to the embodiments that are described and shown in the attached drawing. Modifications remain possible, in particular from the viewpoint of the constitution of various elements or by substitution of equivalent techniques, without thereby exceeding the field of protection of the invention.

1. Process for insulating and sealing a roofing that forms an essentially flat substrate, such as a concrete terrace roofing, characterized in that it essentially consists of:

Coating said substrate **(2)** with a liquid or viscous composition **(3)** by covering rough spots **(4)** and by filling hollows or emergent cavities **(4')** that are present on the surface of said substrate **(2)**,

Applying said insulating layer **(1)** or individual elements that are intended to form said insulating layer **(1)** on the coated surface of said substrate **(2)** before the previously applied coating layer **(3)** solidifies, whereby said coating layer **(3)** forms, after drying or polymerization, a water-vapor barrier and an agent for adhesion of insulating layer **(1)** to said attachment substrate **(2)**, and, finally,

Applying to insulating layer **(1)** a sealing coating **(6)** that comprises at least one layer of bituminous or synthetic or analogous membranes.

2. Process according to claim 1, wherein composition **(3)** that forms a coating is selected from the group that is formed by the bituminous compositions that are based on a bitumen/thermoplastic elastomer mixture and the compositions that are based on a bitumen/polyurethane mixture.

3. Process according to claim 1, wherein composition **(3)** that forms a coating is selected from the group that is formed by the mixtures that are based on a polyurethane prepolymer, with or without solvent, and the resin/hardener mixtures.

4. Process according to any one of claims 1 to 3, wherein composition **(3)** that forms a coating has a viscosity at 20° C., between 50 and 300 poise, and preferably between 100 and 200 poise.

5. Process according to any one of claims 1 to 4, wherein the coating is carried out by means of a brush, a roller, a spatula, a scraper or a similar tool and wherein the amount of liquid or viscous composition **(3)**, continuously applied over the entire surface of the substrate, is at least adequate to obtain a smooth upper surface and to ensure an adhesion of insulating layer **(1)** to essentially its entire lower face.

6. Liquid or viscous coating that is intended to be used within the scope of the insulating and sealing process according to any one of claims 1 to 5, wherein it consists of a preferably essentially liquid composition **(3)** that comprises, by weight:

0 to 30% of solvent,

0 to 60% of bitumen,

0 to 40% of liquefier(s),

0 to 40% of mineral and/or metal feedstock(s),

0 to 10% of additive(s) reinforcing the bonding properties,

0 to 50% of at least one structuring and adhesive component that is selected from the group that is formed by the thermoplastic elastomeric polymers, the polyurethane prepolymers and the resin/hardener mixtures.

7. Coating according to claim 6, wherein it has a viscosity at 20° C., between 50 and 300 poise, preferably between 100 and 200 poise.

8. Coating according to any one of claims **6** and **7**, wherein composition **(3)** consists of, by weight:

8 to 15% of solvent,

35 to 45% of bitumen,

0 to 20% of liquefier(s),

10 to 30% of mineral or metal feedstocks,

0 to 10% of additive(s) reinforcing the bonding properties,

0 to 25% of at least one structuring and adhesive component that is selected from the group that is formed by the thermoplastic elastomeric polymers, the polyurethane prepolymers and the resin/hardener mixtures.

9. Coating according to any one of claims **6** and **7**, wherein composition **(3)** consists of a mixture that is based on reactive resin, preferably consisting of, by weight:

15 to 25% of solvent,

15 to 25% of liquefier(s),

15 to 35% of mineral and/or metal feedstocks,

0 to 5% of an additive that reinforces the bonding properties,

20 to 40% of a PUR prepolymer or a resin/hardener mixture.

10. Coating according to any one of claims **6** and **7**, wherein composition **(3)** consists of a mixture without a solvent that is based on polyurethane prepolymer, preferably consisting of, by weight:

30 to 40% of liquefier,

15 to 30% of mineral and/or metal feedstock(s),

0 to 5% of an additive that reinforces the bonding properties,

30 to 50% of a polyurethane prepolymer.

11. Coating according to any one of claims 6 to 8, wherein the bitumen is a direct distillation bitumen, for example of type 70/100, and wherein at least one said mineral or metal feedstock is selected from the group that is formed by slate powder, aluminum paste, aluminosilicates, chalk and mica.

12. Coating according to claim 11, wherein the feedstock consists of laminating flakes of mica or aluminum.

13. Coating according to any one of claims 6 to 12, wherein it consists of a monocomponent composition.

14. Coating according to any one of claims 6 to 9 and **11** to **13**, wherein it consists of a bicomponent composition of which a first component comprises in particular a polyol and of which the second component comprises in particular an isocyanate.

15. Coating according to any one of claims 6 to 9 and **11** to **13**, wherein it consists of a bicomponent composition, of which a first component comprises in particular an epoxy resin and of which the second component comprises in particular an amine hardener.

16. Coating according to any one of claims 6 to 15, wherein it comprises an additional structuring feedstock in the form of short fibers **(5)**, preferably fibers made of a polymer material.

17. Composite insulating and sealing system for roofing that forms an essentially flat substrate, such as a concrete terrace roofing, obtained by means of the process according to any one of claims 1 to 5, wherein it has a stratified composite structure and consists of, starting from substrate **(2)**, on the one hand, a dried or polymerized coating layer **(3)** that simultaneously forms a controlled passage water vapor barrier, a leveling coating and an agent for surface adhesion to substrate **(2)**, and on the other hand, an insulating layer **(1)** that is attached by coating layer **(3)** to substrate **(2)**, whereby said insulating layer **(1)** is preferably formed by the juxtaposition of individual elements in the form of strips or panels, and, finally, by a sealing coating **(6)** that comprises at least one layer of bituminous, synthetic or analogous membranes, whose adjacent edge zones advantageously at least partially overlap one another.

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