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(54) **Waterproofing membrane and the method for its manufacture**

Wasserdichte Membran und Verfahren zu dessen Herstellung

Membrane d'étanchéité et procédé pour sa fabrication

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US-A- 2 893 889
US-A- 4 055 453
US-A- 4 755 409
US-A- 4 871 605

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Description

[0001] This invention relates to a bitumen-polymer-based waterproofing membrane which is particularly suitable for the protection of buildings and civil engineering works in general from rainwater or groundwater, as well as for the containment of water, e.g. in water catchment tanks for irrigation, and a new process for the manufacture of that membrane.

[0002] Bitumen-polymer-based waterproofing membranes have been produced for many years and can be found on the market e.g. in the form of rolls ready for application to the surfaces of structures which require waterproofing. In general these membranes comprise:

- a bituminous waterproofing material based on "distilled" or "oxidised" bitumen, appropriately mixed with thermoplastic polymers to modify its strength properties at high and low temperatures, and

- one or more "cores" or mechanical reinforcements intended to provide the final membrane with the required properties of resistance to the stresses to which the membrane is likely to be subjected when in use.

[0003] The following are currently used as cores: glass fleece, non-woven materials and synthetic fibre, plastics films, metal sheets, glass nets and fabrics, cardboard, paper and many others.

[0004] Surface finishing materials are also used on one or both sides of the membrane, and these may have various functions, e.g. an aesthetic function as in the case of the "self-protected" membranes, i.e. coated on the top side or on the surface intended to remain visible, e.g. with slate chippings or metal sheeting, or a functional function, as in the case of membranes lined with films of a textile nature in order to improve their paintability or the application of adhesives or also membranes coated with anti-adherent materials which make them easier and more convenient to lay, preventing sticking between the various turns of the membrane when it is wound in a roll.

[0005] The thermoplastic polymers used to modify the bitumen to obtain waterproofing membranes are those of the polyolefin series and the styrene-butadiene series.

[0006] Bituminous membranes containing modifying agents of the polyolefin series are described as BPP membranes (bitumen - polymer plastomer) or also in some cases "bitumen-APP membranes", as the first modifying agent historically introduced for modifying bitumen for obtaining plastomer waterproofing materials was in fact APP (atactic polypropylene). These membranes are more resistant to high temperatures and are plastomers, i.e.they have a plastic behaviour, that is under the effect of an induced deformation the waterproofing material follows the deformation without offering any constant resilient elasticity.

[0007] On the other hand bituminous membranes containing modifying agents of the styrene-butadiene copolymer series are described as BPE membranes (bitumen-polymer-elastomer) or bitumen-SBS membranes, in that the main modifying agent is in fact styrene-butadiene-styrene. These have better resistance to low temperatures and are elastically resilient, that is under the effect of an induced deformation the waterproofing material tends to return to its original dimensions. In addition to this, waterproofing materials of the BPE type have a greater tear strength.

[0008] To sum up, the advantages and the corresponding limitations of waterproofing materials of the BPP type and the BPE type are, in the case of the former, greater resistance to heat and solar radiation, and in particular UV radiation, and plasticity, while in the case of the latter, better resistance to low temperatures, better bonding to the substrate and elasticity.

[0009] In general waterproofing membranes are manufactured by impregnating the core with the waterproofing material. The core or mechanical support is coated on one or both sides with a waterproofing material previously prepared in suitable heated mixers in which the bitumen has suitable polymers and other additives added to it. The bituminous material is then cooled, surface treated and finally rolled into rolls of predetermined length.

[0010] impregnation, both by immersion and by spreading, is a difficult operation in that the desired thickness has to be imparted to the membrane and reinforcing material, especially when porous products, such as for example polyester non-wovens, have to be perfectly impregnated to ensure absolute uniformity in the finished product.

[0011] In addition to this, the impregnating operation tends to set up tension in the membrane as it is being formed, which is subjected to a variable amount of elongation. This elongation is "frozen" by the immediately subsequent cooling of the membrane and constitutes an important parameter for the quality of the finished product. An assessment of the magnitude of this effect may be made by measuring "dimensional stability" on the finished product, that is the free shrinkage which the membrane exhibits when after heating it is left free to recover the elongation imparted at the time of its manufacture. The greater the shrinkage the less will be the stability of the membrane.

[0012] US-A-2 893 889 discloses a membrane used as building-covering which comprises a base sheet of cellulosic fibers saturated with asphalt or bitumen on which three layers are applied, namely a first layer of thermoplastic bituminous composition containing glass filaments or inorganic filler, a second layer of asphalt and a third layer of roofing granules. The main object of this known prior art is to provide a bituminous composition having enhanced fire-resistant

qualities with respect to the other prior art of the same general character, with no provision of dimensional stability and long lasting protection.

[0013] US-A-4 055 453 relates to a process for manufacturing a laminated bituminous composition comprising a base sheet of ordinary bituminous membrane including a fibre fabric or similar material impregnated with a first layer molten bitumen, coated on all part of both or one face with a second layer of bitumen in turn laminated with a third layer of denaturated bitumen compound including natural or synthetic rubber blended with synthetic resin. Thanks to such arrangement, the composition is particularly suitable to impart high tackiness at ambient temperature while avoiding pouring of molten bitumen common to conventional process. Optionally, the membrane may be covered with a release sheet laid over the whole surface of the compound bitumen layer.

[0014] US-A-4 755 409 teaches a waterproof laminate comprising a reinforcing core sheet with three superposed layers secured to the core on opposite side thereof, including a first layer of bitumen, a second compound bitumen containing a material selected from the group of synthetic or natural rubber, and natural or synthetic resin secured to the first one, a third layer consisting of an elastomeric sheet, and a release sheet secured to the second compound bitumen. Such known waterproof laminate is mainly directed to resist penetration of water and vapour therethrough and to facilitate installation thereof but has no provision for enhancing dimensional stability of the overall membrane.

[0015] The principal object of this invention is to provide waterproofing membranes with enhanced dimensional stability which are therefore suitable for providing lasting and effective protection over a long period of time.

[0016] Another object of this invention is to provide a process for the manufacture of bituminous waterproofing membranes which in addition to yielding membranes with a high degree of dimensional stability is easy to implement and does not require any major investment in plant.

[0017] According to a first aspect of this invention, a waterproofing membrane is provided which, in accordance with claim 1, comprises a core and three different layers of waterproofing material secured to said core, in which one of the layers is impregnating the core, characterised in that the first layer saturating said core comprises a waterproofing material based on bitumen modified with polymers of low molecular weight of a partly polar nature having stabilising and compatibility-enhancing properties, the second layer at one side or both sides of the first layer comprises a waterproofing material different from that of the first layer and based on both elastomer and plastomer, the third layer at one side of said second layer comprises a waterproofing material including compatibility-enhancing polymers of low molecular weight.

[0018] According to another aspect of this invention, a process is provided for the manufacture of waterproofing membranes which, in accordance with claim 4, comprises three successive steps, namely a first step of application to the core of a first layer of waterproofing material based on bitumen modified with thermoplastic polymers of low molecular weight having a partly polar nature and having stabilising and compatibility-enhancing properties until the core becomes saturated, a second step of application to at least one of the surfaces of the core saturated with the waterproofing material of a second layer of elastomer or plastomer-based waterproofing material which is different from that applied in the first step, a third step of application to one side of the membrane treated in the second step of a third layer of a waterproofing material modified with compatibility-enhancing polymers of low molecular weight.

[0019] According to a third aspect of this invention, a plant is provided for the production of waterproofing membrane in three layers characterised in that it comprises a first station in which a core is immersed in a bath of waterproofing mass or material having stabilising and compatibility-enhancing characteristics with respect to the two materials subsequently applied to the core, until saturation, a second station in which the core saturated with waterproofing material has a layer of waterproofing material based on both elastomer and plastomer applied to at least one side, and a third station in which a layer of waterproofing material including compatibility-enhancing materials is spread onto the core from the said second station.

[0020] The plant according to this invention will be further described below with reference to the appended drawings, in which:

[0021] The sole Figure shows a diagrammatical lateral elevation view of a three station plant according to the invention.

[0022] The waterproofing material applied to the core is based on bitumen modified with low molecular weight polymers of a partly polar nature, e.g. EVA (ethylene vinyl acetate), low molecular weight acrylic copolymers and others capable of performing the same bonding function between waterproofing materials.

[0023] This modification is effective from the chemical point of view in that it confers stability and compatibility with the materials subsequently applied to the core. The quantity of waterproofing material applied must in practice be limited to saturation of the core, and the latter may be of any suitable type.

[0024] Three examples are provided below by way of non-limiting indicative examples of compositions which can be used to provide the waterproofing/compatibility-enhancing material.

Example 1	
Type 180/200 distilled bitumen	85%
EVA	10%
Polyethylene wax	5%

Example 2	
Type 180/200 distilled bitumen	80%
Isotactic polypropylene copolymer 300,000 cps	10%
EVA	10%

Example 3	
Type 85/25 oxidised bitumen	80%
Radial SBS type elastomer	5%
Polypropylene homopolymer	10%
Filler with a "10,000 mesh" particle size	5%

[0025] As will be seen in the drawing, the operation of applying this compatibility-enhancing material can be performed by immersing core 1 through use of a suitable immersion roll 2, which can be adjustably set at various levels with respect to a trough 3 containing the bath of waterproofing/compatibility-enhancing material in a first treatment station 4. The immersion operation is performed in combination with a rolling operation performed by a squeezing roller diagrammatically represented by a pair of cylinders 5 and 6 controlled by a balance lever mechanism to exert a maximum pressure of 60 kg/cm^2 on core 1.

[0026] Core 1 is therefore saturated at station 4, and the limitation on the quantity of waterproofing material must in practice be limited to saturation of the core otherwise the compatibility-enhancing effect may be compromised.

[0027] It is important that core 1 is not subjected to any kind of tension, and as a result the operation of applying the waterproofing/compatibility-enhancing material and that of rolling must be controlled electronically so that they take place under closely controlled conditions. Core 1 is therefore carefully "monitored" to avoid stretching during application.

[0028] As a rule the passage through second treatment station 7 should take place at a predetermined distance from first station 4 so the saturated core can cool in ambient air with a temperature drop of approximately 30°C.

[0029] At second station 7 the second type of waterproofing material, for example one with a plastomer or elastomer base, respectively, and therefore of the BPP or BPE type, is applied. The type of waterproofing material is different from that present at station 4 and is therefore prepared and delivered independently by separate pipes (not shown).

[0030] At station 7 the waterproofing material can be applied to the upper or lower side or both sides according to the nature of the final membrane which it is desired to obtain.

[0031] The cooling of core 1, which would have an adverse effect on the bonding of subsequent layers when the compatibility-enhancing material was not present, provides the additional benefit of improving the dimensional stability of the membrane because it confers sufficient rigidity upon the core, even if weakly impregnated or, better, saturated with waterproofing material, to withstand the tensions subsequently induced during the manufacturing process.

[0032] At second station 7 there is provided for example an immersion roller 8 which is preferably interfaced electronically with a drive motor which is capable of controlling the tension on the core between station 4 and station 7 and an inking roller 9 as well as two pairs of calendering rollers 10, 11 and 12, 13.

[0033] At a third station 14 there is provided an inking roller 15 and a spreading roller 16, which apply a further layer of waterproofing material which is different from the previous materials and is therefore likewise produced and delivered in a totally independent way to one side of the membrane being formed. The waterproofing material in this third station comprises bitumen suitably modified with appropriate compatibility-enhancing agents similar to those used at station 4, that is with polymers of the EVA (ethylene vinyl acetate) and low molecular weight acrylic type.

[0034] The advantages resulting from this invention are that membranes having improved dimensional stability are obtained by virtue of the process of manufacture in three passes, all of which are controlled electronically, and in that more cohesive composite membranes are obtained without any danger of detachment between the layers. In addition to this, the use of chemical modifying agents as described above further ensures compatibility between the layers so as to ensure the required uniformity in the composite membrane.

[0035] These advantages are particularly apparent in membranes intended for roofing purposes, which bond better

to the substrate and are therefore able to take advantage of the benefits due to the different waterproofing materials, such as strong bonding on the underside in contact with the substrate and high resistance to radiation on the upper face directly exposed to atmospheric agents.

Claims

1. A waterproofing membrane comprising a core and three different layers of waterproofing material secured to said core, in which one of the layers is impregnating the core, **characterised in that** the first layer saturating said core comprises a waterproofing material based on bitumen modified with polymers of low molecular weight of a partly polar nature having stabilising and compatibility-enhancing properties, the second layer at one side or both sides of the first layer comprises a waterproofing material different from that of the first layer and based on both elastomer and plastomer, the third layer at one side of said second layer comprises a waterproofing material including compatibility-enhancing polymers of low molecular weight.

2. Membrane according to claim 1, **characterised in that** the said low molecular weight polymers of a partly polar nature comprise EVA (ethylene vinyl acetate) and low molecular weight acrylic copolymers.

3. Membrane according to claim 2, **characterised in that** said waterproofing material including compatibility-enhancing products based on low molecular weight polymers comprises bitumen modified with polymers such as EVA (ethylene vinyl acetate) and low molecular weight acrylic polymers.

4. Process for the manufacture of a waterproofing membrane, said membrane having a core and three layers, the process comprising three steps, namely:

   - a first step of application to the core of a first layer of waterproofing material based on bitumen modified with thermoplastic polymers of low molecular weight having a partly polar nature and having stabilising and compatibility-enhancing properties until the core becomes saturated,

   - a second step of application to at least one of the surfaces of the core saturated with the waterproofing material of a second layer of elastomer or plastomer-based waterproofing material which is different from that applied in the first step;

   - a third step of application to one side of the membrane treated in the second step of a third layer of a waterproofing material modified with compatibility-enhancing polymers of low molecular weight.

5. Process according to claim 4, **characterised in that** the said core saturated with waterproofing material is allowed to cool between the first and the second step so that it acquires sufficient rigidity to withstand subsequent induced tensions and therefore improved dimensional stability.

6. Process according to claim 4 or 5, **characterised in that** the said operation of applying the said compatibility-enhancing material takes place by immersing the core in a bath of waterproofing/compatibility-enhancing material for saturating the said core.

7. Process according to claim 6, **characterised in that** the said immersion operation is performed in combination with a calendering operation.

8. Process according to any one of claims 4 to 7, **characterised in that** the said operation of applying the waterproofing/compatibility-enhancing material and calendering are controlled electronically so that they are carried out under strictly controlled conditions.

9. Process according to any one of claims 4 to 8, **characterised in that** after the operation of applying the waterproofing/compatibility-enhancing material a stage of cooling the core is provided.

10. Process according to claim 8 or 9, **characterised in that** plastomer or elastomer-based waterproofing material is applied to at least one side of the said core saturated with waterproofing/compatibility-enhancing material.

11. Process according to claim 10, **characterised in that** a further layer of waterproofing material which is different

from the foregoing, comprising bitumen modified with compatibility-enhancing agents selected from polymers of the EVA (ethylene vinyl acetate) and low molecular weight acrylic type, is applied to only one side of the membrane being formed.

12. Plant for the production of a waterproofing membrane in three layers according to any claims 1 to 3, **characterised in that** it comprises a first station (4) in which a core is immersed in a bath of waterproofing mass or material having stabilising and compatibility-enhancing characteristics with respect to the two materials subsequently applied to the core, until saturation, a second station (7) in which the core saturated with waterproofing material has a layer of waterproofing material based on both elastomer and plastomer applied to at least one side, and a third station (14) in which a layer of waterproofing material including compatibility-enhancing materials is spread onto the core from the said second station.

13. Plant in accordance with claim 12, **characterised in that** the said first station (4) comprises a bath of waterproofing/compatibility-enhancing material, at least one immersion cylinder or roller (2) which can be adjustably set at different levels with respect to the bath, and at least one pair of calendering rollers (5, 6).

14. Plant according to claim 12 or 13, **characterised in that** the said second station (7) comprises a bath of waterproofing material, at least one immersion cylinder or roller (8) which can be adjustably set at different levels with respect to the said bath, an inking roller (9) and at least one pair of squeezing rollers (10, 11 and 12, 13).

15. Plant according to claim 14, **characterised in that** the said third station (14) comprises a bath of waterproofing material, an inking roller (15) and a spreading roller (16), which apply a further layer of waterproofing material which is different from the foregoing to one side of the membrane being formed.

16. Plant according to any one of claims 13 to 15, **characterised in that** it comprises electronic control means for both the operation of applying the waterproofing/compatibility-enhancing material and the calendering operation.

Patentansprüche

1. Wasserabweisende Membran mit einem Kern und drei verschiedenen Schichten aus wasserabweisendem Material, die an dem Kern angebracht sind, wobei eine der Schichten den Kern imprägniert, **dadurch gekennzeichnet, dass** die erste Schicht, die den Kern sättigt, ein wasserabweisendes Material enthält, das auf Bitumen basiert, das modifiziert ist mit Polymeren geringer molekularer Masse teilweise polarer Art mit stabilisierenden und Verträglichkeit erhöhenden Eigenschaften, die zweite Schicht an einer Seite oder beiden Seiten der ersten Schicht ein wasserabweisendes Material aufweist, das sich von dem der ersten Schicht unterscheidet und sowohl auf Elastomer als auch Plastomer basiert, die dritte Schicht an einer Seite der zweiten Schicht ein wasserabweisendes Material aufweist mit Verträglichkeit erhöhenden Polymeren geringer molekularer Masse.

2. Membran gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Polymere mit geringer molekularer Masse teilweise polarer Art EVA (Ethylen Vinyl Acetat) und.akryle Copolymere geringer molekularer Masse enthalten.

3. Membran gemäß Anspruch 2, **dadurch gekennzeichnet, dass** das wasserabweisende Material mit Verträglichkeit erhöhenden Produkten, die auf Polymeren geringer molekularer Masse basieren, mit Polymeren, wie z. B. EVA (Ethylen Vinyl Acetat), und akrylen Polymeren geringer molekularer Masse modifiziertes Bitumen enthalten.

4. Verfahren zur Herstellung einer wasserabweisenden Membran, wobei die Membran einen Kern und drei Schichten aufweist und das Verfahren drei Schritte umfasst, nämlich:

- einen ersten Schritt des Anbringens einer ersten Schicht aus wasserabweisendem Material, das auf Bitumen basiert, das modifiziert ist mit thermoplastischen Polymeren geringer molekularer Masse mit teilweise polarer Art und mit stabilisierenden und Verträglichkeit erhöhenden Eigenschaften bis zur Sättigung des Kerns,
- einen zweiten Schritt des Anbringens an mindestens eine der Oberflächen des mit dem wasserabweisenden Material gesättigten Kerns einer zweiten Schicht aus Elastomer oder Plastomer, die basiert auf wasserabweisendem Material, das sich von dem beim ersten Schritt angebrachten unterscheidet,
- einen dritten Schritt des Anbringens an eine Seite der im zweiten Schritt behandelten Membran einer dritten Schicht eines wasserabweisenden Materials, das modifiziert ist mit Verträglichkeit erhöhenden Polymeren geringer molekularer Masse.

5. Verfahren gemäß Anspruch 4, **dadurch gekennzeichnet, dass** der mit wasserabweisendem Material gesättigte Kern abkühlen kann zwischen dem ersten und zweiten Schritt, so dass er genügend Festigkeit erlangt, um anschließend induzierten Spannungen zu widerstehen, und damit verbesserte dimensionale Stabilität.

6. Verfahren gemäß Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** der Vorgang des Anbringens des Verträglichkeit erhöhenden Materials stattfindet, indem der Kern in ein Bad aus wasserabweisendem, Verträglichkeit erhöhenden Material eingetaucht wird zur Sättigung des Kerns.

7. Verfahren gemäß Anspruch 6, **dadurch gekennzeichnet, dass** der Eintauchvorgang in Kombination mit einem Kalendrierungsvorgang durch geführt wird.

8. Verfahren gemäß einem der Ansprüche 4 bis 7, **dadurch gekennzeichnet, dass** der Vorgang des Anbringens des wasserabweisenden, Verträglichkeit erhöhenden Materials und des Kalendrierens elektronisch gesteuert wird, so dass dieser ausgeführt wird unter streng kontrollierter Bedingungen.

9. Verfahren gemäß einem der Ansprüche 4 bis 8, **dadurch gekennzeichnet, dass** nach dem Vorgang des Anbringens des wasserabweisenden, Verträglichkeit erhöhenden Materials eine Stufe des Kühlens des Kerns vorgesehen ist.

10. Verfahren gemäß Anspruch 8 oder 9, **dadurch gekennzeichnet, dass** auf mindestens eine Seite des Kerns auf Plastomer oder Elastomer basierendes wasserabweisendes Material aufgebracht wird, das gesättigt ist mit wasserabweisendem, Verträglichkeit erhöhendem Material.

11. Verfahren gemäß Anspruch 10, **dadurch gekennzeichnet, dass** eine sich von der vorhergehenden unterscheidende, weitere Schicht aufgebracht wird aus wasserabweisendem Material mit Bitumen, das modifiziert ist mit Verträglichkeit erhöhenden Zusätzen, die ausgewählt sind aus Polymeren des EVAs (Ethylen Vinyl Acetat) und akrylen Polymeren geringer molekularer Masse, auf nur eine Seite der zu bildenden Membran.

12. Fertigungseinrichtung für die Herstellung einer wasserabweisenden Membran mit drei Schichten gemäß einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** eine erste Station (4) vorgesehen ist, bei der ein Kern in ein Bad aus wasserabweisender Masse oder Material eingetaucht wird mit stabilisierenden und Verträglichkeit erhöhenden Eigenschaften hinsichtlich der zwei Materialien, die anschließend auf den Kern aufgebracht werden bis zur Sättigung, eine zweite Station (7) vorgesehen ist, in der der mit wasserabweisendem Material gesättigte Kern eine Schicht aufweist mit wasserabweisenden Material, das basiert auf sowohl Elastomer als auch Plastomer, die auf mindestens eine Seite aufgebracht sind, und eine dritte Station (14) vorgesehen ist, in der eine Schicht aus wasserabweisendem Material mit Verträglichkeit erhöhendem Material von der zweiten Station auf den Kern verteilt wird.

13. Fertigungseinrichtung gemäß Anspruch 12, **dadurch gekennzeichnet, dass** die erste Station (4) ein Bad aus wasserabweisendem, Verträglichkeit erhöhendem Material, mindestens einen Immersions-Zylinder oder Roller (12), der einstellbar auf verschiedene Höhen hinsichtlich des Bads ist, und mindestens ein Paar Kalendrierungs-Roller (5, 6) umfasst.

14. Fertigungseinrichtung gemäß Anspruch 12 oder 13, **dadurch gekennzeichnet, dass** die zweite Station (7) ein Bad aus wasserabweisendem Material, mindestens einen Immersions-Zylinder oder Roller (8), der einstellbar auf verschiedene Höhen hinsichtlich des Bads ist, einen Tintenroller (9) und mindestens ein Paar Press-Roller (10, 11 und 12, 13) umfasst.

15. Fertigungseinrichtung gemäß Anspruch 14, **dadurch gekennzeichnet, dass** die dritte Station (14) ein Bad aus wasserabweisendem Material, einen Tintenroller (15) und einen Verteil-Roller (16) umfasst, der eine weitere Schicht aus wasserabweisendem Material aufbringt, die sich unterscheidet von der vorhergehenden auf einer Seite der zu bildenden Membran.

16. Fertigungseinrichtung gemäß einem der Ansprüche 13 bis 15, **dadurch gekennzeichnet, dass** elektronische Steuereinrichtungen vorgesehen sind sowohl für den Vorgang des Aufbringens des wasserabweisenden, Verträglichkeit erhöhenden Materials und des Vorgangs der Kalendrierung.

Revendications

1. Membrane d'étanchéité comprenant un coeur et trois couches différentes de matière d'étanchéité fixées audit coeur, dans laquelle une des couches imprègne le coeur, **caractérisée en ce que** la première couche saturant ledit coeur comprend une matière d'étanchéité basée sur du bitume modifié avec des polymères de masse moléculaire faible d'une nature partiellement polaire possédant des propriétés de stabilisation et d'amélioration de compatibilité, la deuxième couche au niveau d'un côté ou des deux côtés de la première couche comprend une matière d'étanchéité différente de celle de la première couche et basée à la fois sur un élastomère et un plastomère, la troisième couche au niveau d'un côté de ladite deuxième couche comprend une matière d'étanchéité incluant des polymères améliorant la compatibilité de masse moléculaire faible.

2. Membrane selon la revendication 1, **caractérisée en ce que** lesdits polymères de masse moléculaire faible d'une nature partiellement polaire comprennent de l'EVA (éthylène acétate de vinyle) et des copolymères acryliques de masse moléculaire faible.

3. Membrane selon la revendication 2, **caractérisée en ce que** ladite matière d'étanchéité incluant des produits améliorant la compatibilité basés sur des polymères de masse moléculaire faible comprend du bitume modifié avec des polymères tels que l'EVA (éthylène acétate de vinyle) et des polymères acryliques de masse moléculaire faible.

4. Procédé pour la fabrication d'une membrane d'étanchéité, ladite membrane possédant un coeur et trois couches, le procédé comprenant trois étapes, à savoir :

   - une première étape d'application au coeur d'une première couche de matière d'étanchéité basée sur du bitume modifié avec des polymères thermoplastiques de masse moléculaire faible possédant une nature partiellement polaire et possédant des propriétés de stabilisation et d'amélioration de compatibilité, jusqu'à ce que le coeur devienne saturé ;

   - une deuxième étape d'application à au moins une des surfaces du coeur saturé avec la matière d'étanchéité d'une seconde couche de matière d'étanchéité à base d'élastomère ou de plastomère qui est différente de celle appliquée dans la première étape ;

   - une troisième étape d'application à un côté de la membrane traitée dans la deuxième étape d'une troisième couche d'une matière d'étanchéité modifiée avec des polymères améliorant la compatibilité de masse moléculaire faible.

5. Procédé selon la revendication 4, **caractérisé en ce que** l'on laisse refroidir ledit coeur saturé avec une matière d'étanchéité entre la première et la deuxième étapes de sorte qu'il acquiert une rigidité suffisante, pour résister à des tensions induites ultérieures, et par conséquent une stabilité dimensionnelle améliorée.

6. Procédé selon la revendication 4 ou 5, **caractérisé en ce que** ladite opération d'application de ladite matière améliorant la compatibilité a lieu en immergeant le coeur dans un bain de matière d'étanchéité/améliorant la compatibilité en vue de saturer ledit coeur.

7. Procédé selon la revendication 6, **caractérisé en ce que** l'on effectue ladite opération d'immersion en combinaison avec une opération de calandrage.

8. Procédé selon l'une quelconque des revendications 4 à 7, **caractérisé en ce que** lesdites opérations d'application de la matière d'étanchéité/améliorant la compatibilité et de calandrage sont commandées électroniquement de sorte qu'on les réalise dans des conditions rigoureusement maîtrisées.

9. Procédé selon l'une quelconque des revendications 4 à 8, **caractérisé en ce que** l'on prévoit une étape consistant à refroidir le coeur après l'opération d'application de la matière d'étanchéité/améliorant la compatibilité.

10. Procédé selon la revendication 8 ou 9, **caractérisé en ce que** l'on applique une matière d'étanchéité à base d'élastomère ou de plastomère à au moins un côté dudit coeur saturé avec une matière d'étanchéité/améliorant la compatibilité.

11. Procédé selon la revendication 10, **caractérisé en ce que** l'on n'applique qu'à un côté de la membrane devant être formée, une couche supplémentaire de matière d'étanchéité qui est différente de la précédente, comprenant du bitume modifié avec des agents améliorant la compatibilité choisis parmi des polymères de l'EVA (éthylène acétate d'éthyle) et du type acrylique de masse moléculaire faible.

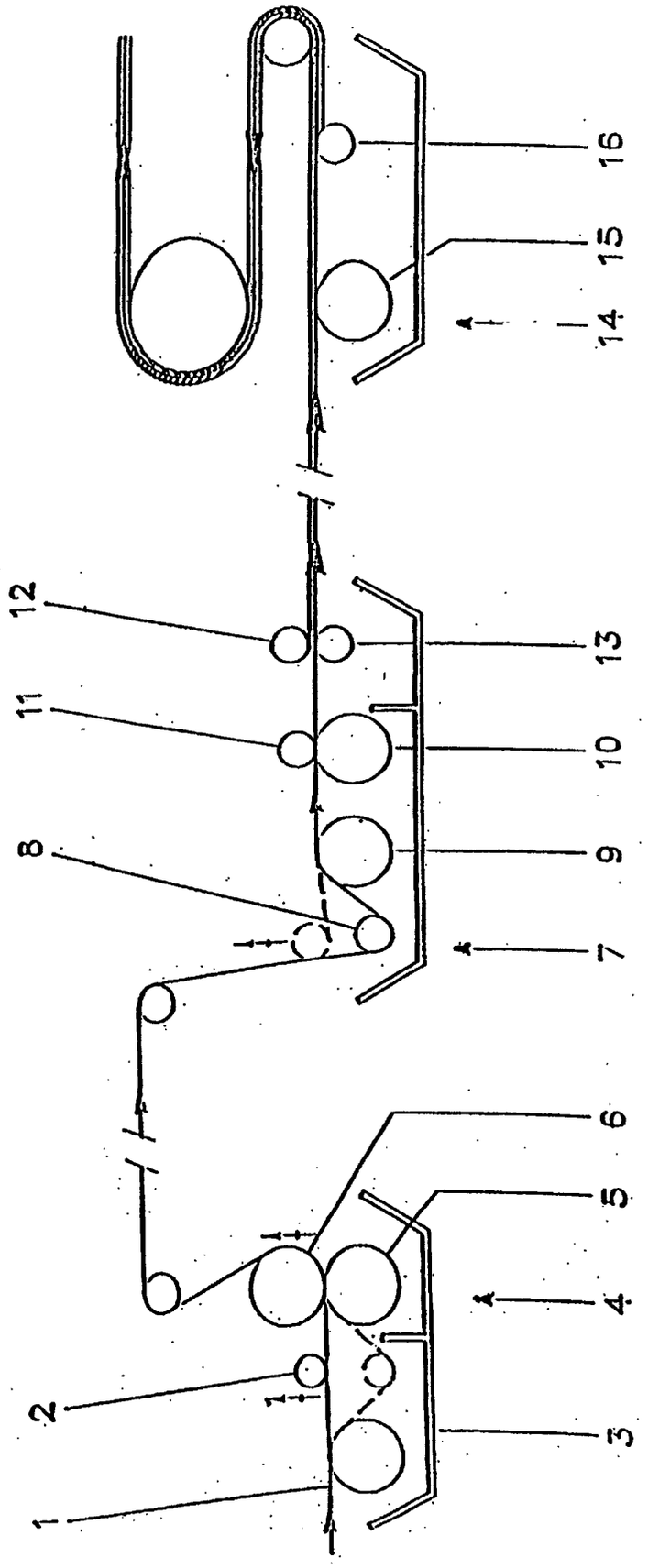
12. Installation pour la production d'une membrane d'étanchéité en trois couches selon l'une quelconque des revendications 1 à 3, **caractérisée en ce qu'**elle comprend une première station (4) dans laquelle un coeur est immergé dans un bain de masse ou matière d'étanchéité possédant des caractéristiques de stabilisation et d'amélioration de compatibilité par rapport aux deux matières ultérieurement appliquées au coeur, jusqu'à saturation, une deuxième station (7) dans laquelle le coeur saturé avec la matière d'étanchéité possède une couche de matière d'étanchéité basée à la fois sur un élastomère et un plastomère appliquée à au moins un côté, et une troisième station (14) dans laquelle une couche de matière d'étanchéité incluant des matières améliorant la compatibilité est étalée sur le coeur provenant de ladite deuxième station.

13. Installation selon la revendication 12, **caractérisée en ce que** ladite première station (4) comprend un bain de matière d'étanchéité/améliorant la compatibilité, au moins un cylindre ou rouleau d'immersion (2) que l'on peut régler de façon à être ajusté à des niveaux différents par rapport au bain, et au moins une paire de rouleaux de calandrage (5, 6).

14. Installation selon la revendication 12 ou 13, **caractérisée en ce que** ladite deuxième station (7) comprend un bain de matière d'étanchéité, au moins un cylindre ou rouleau d'immersion (8) que l'on peut régler de façon à être ajusté à des niveaux différents par rapport audit bain, un rouleau d'encrage (9) et au moins une paire de rouleaux presseurs (10, 11 et 12, 13).

15. Installation selon la revendication 14, **caractérisée en ce que** ladite troisième station (14) comprend un bain de matière d'étanchéité, un rouleau d'encrage (15) et un rouleau d'étalement (16), qui appliquent une couche supplémentaire de matière d'étanchéité qui est différente de la précédente à un côté de la membrane devant être formée.

16. Installation selon l'une quelconque des revendications 13 à 15, **caractérisée en ce qu'**elle comprend des moyens de commande électronique à la fois pour l'opération d'application de la matière d'étanchéité/améliorant la compatibilité et l'opération de calandrage.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