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(54) **Multilayer bituminous-polymeric material and method for producing same**

(57) The invention relates to a multilayer bituminous-polymeric material comprising a base, an upper layer and a lower layer, which have different operational properties, as well as to a method for producing the said material. The invention may be used for the production of a roll roofing material exhibiting water-proofing and fire-retardant properties. The technical effect of the claimed inven-

tion in respect of the method is development of a method (production process) for producing a multilayer bituminous-polymeric material which upper and lower layers differ from each other by their compositions and properties, the said method simplifying the process of production of the finished product and improving productivity of equipment.

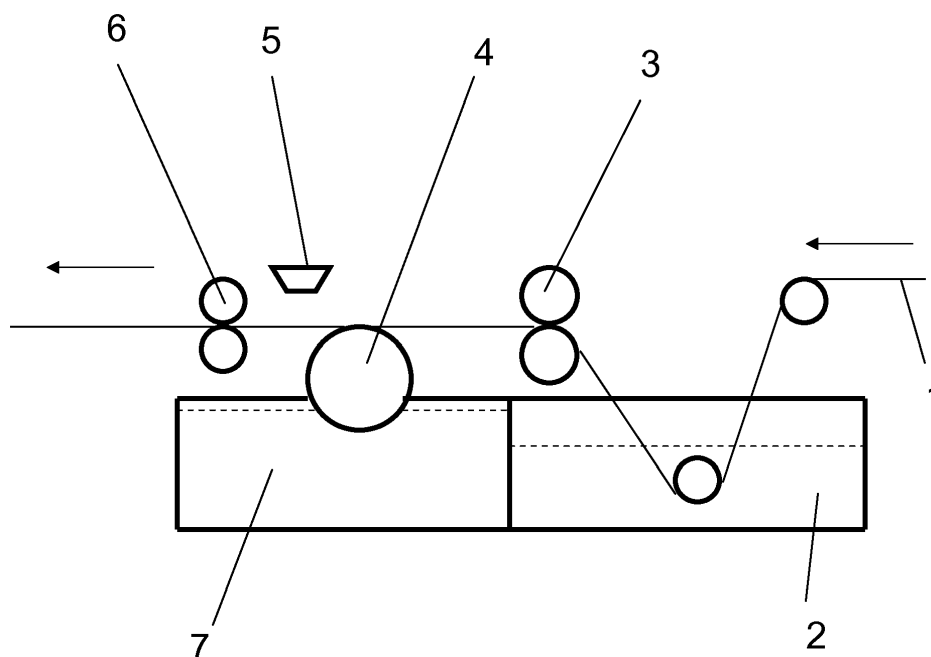


Fig.1

Description

[0001] The invention relates to a multilayer bituminous-polymeric material comprising a base, an upper layer and a lower layer, which have different operational properties, as well as to a method for producing the said material. The invention may be used for the production of a roll roofing material exhibiting water-proofing and fire-retardant properties.

[0002] Conventional bituminous and bituminous-polymeric materials are produced by dipping a base into a coating basin with a hot bituminous-polymeric mixture with the result that a layer of a homogenous binding material is applied on the upper and the lower sides of the base. Apparently, during the service life the upper and the lower layers of such a material are exposed to external influences differing as to their types and degree: the upper layer is mostly subjected to mechanical loads, solar radiation, and flame in a case of a fire, and the lower layer is subjected to tensile forces generated by base strains. Thus, there exists the issue of producing a multilayer roll bituminous-polymeric material having the upper and the lower layers different in their compositions and properties.

[0003] RF Patent No. 2117578, B32B 11/04, E04 D 5/12, publ. 08/20/1998, describes a multilayer material for the protection of coatings applied to construction buildings and structures. The said material comprises a support (base) coated with bituminous layers on both sides and an upper protective layer that, for the purpose of improving performance, may comprise filling and modifying agents.

[0004] The said material is produced by passing a support through melted bitumen and then applying an upper protective layer by rolling, with subsequent cooling the produced material. The said Patent does not teach how exactly the upper protective layer is applied and whether it comprises an agent improving fire-retarding property, in particular.

[0005] USSR Inventor's Certificate No. 697540, IPC C08L 95/00, publ. 11/15/1979, described a formulation of a coating mass for a roll roofing material, which improves fire-retarding property of the finished product due to introduction of a nepheline fire-retarding agent. The said formulation is produced by a conventional method - by mixing mechanically.

[0006] The closest analogous solution to this invention are a bituminous-polymeric material exhibiting fire-retardant properties and a method for producing same, which are described in EP 0634515, D06N 5/10, E04D 5/10, publ. 09/18/1996. This material comprises a reinforcing base of a thermoplastic material, which both sides are coated with an impregnating compound improving its (i.e., base) stability to a thermal or mechanical influence, a fire-retardant or fireproof material (fire-retarding agent) applied on the impregnated reinforcing base and exhibiting fire-retarding and fireproofing properties activated at a temperature of 300°C or higher, a weldable lower layer of a polymeric bitumen that may comprise one or more filling agents, and an upper layer that may be selected from a group of materials including bitumen, polymeric bitumen, plastomeric artificial material and elastomeric artificial material, the upper layer being able to comprise one or more filling agents.

[0007] The proposed method for producing the above material includes the following production steps: a reinforcing base is impregnated with an impregnating compound raising the base stability to thermal and/or mechanical action; a fire-prevention or fireproof material (fire-retarding agent) is applied to the upper side of the impregnated reinforcing base; the upper and the lower layers are applied to the impregnated reinforcing base which upper side is already coated with a fire-prevention or fireproof material (fire-retarding agent).

[0008] A fire-prevention or fireproof material (fire-retarding agent) is applied to the upper side by scattering it over the upper side mechanically, or in an electrostatic field, or with the use of an adhesive.

[0009] The said method may include an additional operation of scattering a mineral bulk material over the upper and/or the lower layer or coating same with a cover film.

[0010] Disadvantages of the known material include the fact that a fire-retarding agent is not used in the mixture forming the upper layer. First, a fire-retarding agent is applied to the base, and then the thus applied layer of the fire-retarding agent is coated with the upper layer which, in this case, has no fire-retarding properties. This makes the material performance poorer in this respect.

[0011] A disadvantage of the method for producing the known material is that it includes relatively many steps, which is conditioned by the presence of a separate operation of applying a fire-retarding agent to the upper surface of the base in advance, and then applying the upper layer to the already applied fire-retardant material, which complicates the process of producing the finished material and, hence, lowers productivity and increases the cost of the finished product.

[0012] The technical effect of the claimed invention in respect of the method is development of a method (production process) for producing a multilayer bituminous-polymeric material which upper and lower layers differ from each other by their compositions and properties, the said method simplifying the process of production of the finished product and improving productivity of equipment.

[0013] The technical effect of the claimed invention in respect of the multilayer bituminous-polymeric material is simplification of making and production of a material which upper layer exhibits prominent fire-retardant properties.

[0014] The above technical effect is achieved in respect of the multilayer bituminous-polymeric material due to the fact that the claimed material comprises a base, an upper and a lower layers, wherein a nonwoven polyester cloth or a glass fabric or a glass cloth is used as the base, and the upper layer comprises a roofing bitumen or a mixture of a roofing bitumen and a paving bitumen, a polymeric modifier, a fire-retarding agent and a mineral filler, they all being

mixed, and the lower layer comprises a mixture of a roofing bitumen, a polymeric modifier and a mineral filler.

[0015] The BNK40/180 or BNK45/190 bitumen is used as the roofing bitumen, and the BND 60/90 or BND 90/130 bitumen is used as the paving bitumen, and the amount of a roofing bitumen or a mixture of a roofing bitumen and a paving bitumen for the upper layer is from 45% to 75% by weight, and the amount of a roofing bitumen for the lower layer is from 35% to 65% by weight.

[0016] A butadiene-styrene thermoplastic elastomer (SBS modifier) is used as the polymeric modifier for the upper and lower layers, wherein its amount for the upper layer is from 0.5% to 15% by weight, and for the lower layer from 2% to 15% by weight.

[0017] Dolomite or granite powder or talc is used as the mineral filler for the upper and lower layers, the respective amount for the upper layer being from 20% to 55 % by weight and for the lower layer from 30% to 55% by weight.

[0018] Thermally expanding graphite in the form of flakes in fraction from 0.1 mm to 3 mm and in the amount from 0.5% to 15% is used as a fire-retarding agent.

[0019] A nonwoven polyester cloth with the density from 100 to 300 g/m² or a glass fabric with the density from 120 to 250 g/m² or a glass cloth with the density from 40 to 110 g/m² is used as the base, the base width being from 0.95 m to 1.1 m.

[0020] The above technical effect is achieved in respect of the method for producing a double-layer bituminous-polymeric material due to the fact that the claimed method consists in drawing the base, treating it with an impregnating compound, squeezing it, then applying the upper and lower layers to it, a nonwoven polyester cloth or a glass fabric or a glass cloth being used as the base; the lower layer is made as a mixture consisting of a roofing bitumen, a polymeric modifier and a mineral filler, and the upper layer is in the form of a ready mixture comprising a roofing bitumen or a mixture of a roofing bitumen and a paving bitumen, a polymeric modifier and a mineral filler; the upper layer being applied to the base through a diffuser, and then the formed material is passed through size rolls for producing material of required density and thickness.

[0021] As a general case, the claimed method for producing a double-layer bituminous-polymeric material according to the claimed compositions and ratios of the components forming the claimed material may be implemented as follows.

[0022] In accordance with the production line diagram shown in Fig. 1, the base 1, being a nonwoven polyester cloth with the density from 100 to 300 g/m² or a glass fabric with the density from 120 to 250 g/m² or a glass cloth with the density from 40 to 110 g/m² is drawn through an impregnating basin 2, where it is impregnated with an impregnating compound being a low-viscosity compound based on bitumen and modifying additives with or without a fire-retarding agent. An exemplary compound: a roofing bitumen (BNK 40/180) - 90-97 % by weight; SBS (styrene-butadiene-styrene) modifier - 2-6% by weight; a fire-retarding agent (thermally expanding graphite) - 1-4 % by weight.

[0023] After application of an impregnating compound the base is squeezed in squeezing rolls 3 and goes further to an application roll 4 arranged in a coating basin 7 comprising a prepared mixture forming the lower layer of the produced material. The lower layer representing a mixture of a roofing bitumen, a polymeric modifier and a mineral filler is applied to the lower surface of the base with the use of the said application roll 4. The amount of a roofing bitumen in this mixture is from 35% to 65 % by weight, that of a polymeric modifier from 2% to 15 % by weight, and that of a mineral filler from 30% to 55 % by weight. After the base passes the application roll, its upper surface is provided with the upper layer comprising, all of them being pre-mixed, a roofing bitumen or a mixture of a roofing bitumen and a paving bitumen, a polymeric modifier, a fire-retarding agent and a mineral filler, the amount of a roofing bitumen or a mixture of a roofing bitumen and a paving bitumen being from 45% to 75% by weight, that of a polymeric modifier from 0.5% to 15 % by weight, that of a mineral filler from 20 to 55 % by weight, and that of a fire-retarding agent from 0.5 to 15 % by weight. The upper layer is prepared as follows. A hot bitumen is added to a mixer at a temperature ranging from 180 to 200°C, then an SBS modifier is loaded, mixing takes place for 40-60 minutes in circulation: the mixer - a homogenizer - the mixer. After the polymeric modifier is dissolved completely, a mineral filler is added to the mixer, and mixing continues for 15-20 minutes at a temperature ranging from 180 to 190°C, and then a thermally expanding graphite is added to the obtained mixture.

[0024] A mixture forming the lower layer is produced similarly, but without adding a thermally expanding graphite.

[0025] The produced mixture is fed on the base 1 through a diffuser 5 being a headbox arranged above the base, to which the produced mixture is fed continuously during the operation time of the process line. The lower part of the diffuser is provided with a slot which width is equal to the base width and from which the mixture uniformly flows to the base surface, thus ensuring uniformity and homogeneity of the base upper layer.

[0026] After the base is provided with the upper and lower layers, the produced material will be passed through size rolls 6 for ensuring the required density and thickness of the finished product.

[0027] Several examples of the material produced with the use of the above-described process line are given below.

Example 1. Base - glass fabric, density 150 g/m²

[0028] Upper layer:

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5	roofing bitumen 52% by weight polymeric modifier 6% by weight fire-retarding agent..... 2 % by weight mineral filler (talc)... 40 % by weight
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[0029] Lower layer:

10	roofing bitumen 54 % by weight polymeric modifier 6 % by weight mineral filler (granite powder)..... 40 % by weight
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[0030] Impregnating mixture:

15	roofing bitumen 92 % by weight polymeric modifier 6 % by weight. fire-retarding agent..... 2 % by weight.
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Example 2. Base - polyester cloth 180 g/m²

[0031] Upper layer:

25	roofing bitumen and paving bitumen 60% by weight polymeric modifier 7% by weight fire-retarding agent..... 3 % by weight mineral filler (dolomite)..... 30 % by weight
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[0032] Lower layer:

35	roofing bitumen..... 62 % by weight polymeric modifier..... 8 % by weight mineral filler (talc)..... 30 % by weight
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[0033] Impregnating mixture:

40	roofing bitumen..... 92 % by weight polymeric modifier..... 6 % by weight fire-retarding agent..... 2 % by weight.
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45 **[0034]** Specimens of the material produced with a fire-retarding agent in the upper layer were tested at VNIPO. The tests (for flame spread, GOST R 51032-97) were also carried out for the material without a fire-retarding agent in the upper layer and in the impregnating mixture (Example 3), which has the following composition:

Example 3. Base - glass fabric, density 150 g/m²

50 **[0035]** Upper layer:

55	roofing bitumen 52% by weight polymeric modifier..... 6% by weight mineral filler (talc)..... 40 % by weight
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[0036] Lower layer:

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roofing bitumen 54 % by weight
polymeric modifier..... 6 % by weight
mineral filler (granite powder)..... 40 % by weight

[0037] Impregnating mixture:

roofing bitumen..... 92 % by weight
polymeric modifier..... 6 % by weight.

[0038] The test results for the specimen according to Example 1 (with a fire-retarding agent in the upper layer and in the impregnating mixture) and for the specimen without a fire-retarding agent are shown in Table 1.

Table. 1

Material specimen	Fire spread length, mm	Burning time, sec	Fire spread group
Example 1 (material with a fire retarding agent in the upper layer and in the impregnating mixture)	43	745	RP 1
Example 3 (material without a fire retarding agent in the upper layer and in the impregnating mixture)	400	1500	RP 3

[0039] The results show that the specimens of the material produced according to the claimed method and in the claimed component ratios, unlike the material which upper layer does not contain a fire-retarding agent, belong to Fire Spread Group RP 1, which confirms that the claimed invention has achieved the stated technical effect, namely, production of a multilayer bituminous-polymeric material, which upper layer exhibits prominent, improved fire-retardant properties, according to the inventive simplified method.

Claims

1. A multilayer bituminous-polymeric material comprising a base, an upper layer and a lower layer, **characterized in that** a nonwoven polyester cloth or a glass fabric or a glass cloth is used as the base, the upper layer comprising a roofing bitumen or a mixture of a roofing bitumen and a paving bitumen, a polymeric modifier, a fire-retarding agent and a mineral filler, and the lower layer comprising a roofing bitumen, a polymeric modifier and a mineral filler.
2. A multilayer bituminous-polymeric material according to Claim 1, **characterized in that** the BNK 40/180 or BNK 45/90 is used as the roofing bitumen, and the BND 60/90 or BND 90/130 bitumen is used as the paving bitumen.
3. A multilayer bituminous-polymeric material according to Claim 1, **characterized in that** a butadiene-styrene thermoplastic elastomer in an amount from 0.5% to 15% by weight is used as the polymeric modifier.
4. A multilayer bituminous-polymeric material according to Claim 1, **characterized in that** dolomite or granite powder in an amount from 20% to 55% by weight is used as the mineral filler for the upper and lower layers.
5. A multilayer bituminous-polymeric material according to Claim 1, **characterized in that** thermally expanding graphite in the flake form with fraction from 0.1 to 3 vv and in an amount from 0.5% to 15% by weight is used as the fire-retarding agent.
6. A multilayer bituminous-polymeric material according to Claim 1, **characterized in that** the polymeric modifier for the lower layer is used in an amount from 2% to 15% by weight.
7. A multilayer bituminous-polymeric material according to Claim 1, **characterized in that** the mineral filler for the lower layer is used in an amount from 30% to 55% by weight.
8. A multilayer bituminous-polymeric material according to Claim 1, **characterized in that** the base width is from 0.95 to 1.1 m.

9. A method for producing a multilayer bituminous-polymeric material consisting in drawing the base, treating it with an impregnating compound, squeezing it, then applying the upper and lower layers to it, a nonwoven polyester cloth or a glass fabric or a glass cloth being used as the base; the lower layer is made as a mixture consisting of a roofing bitumen, a polymeric modifier and a mineral filler, and the upper layer is in the form of a ready mixture comprising a roofing bitumen or a mixture of a roofing bitumen and a paving bitumen, a polymeric modifier and a mineral filler; the upper layer being applied to the base through a diffuser, and then the formed material is passed through size rolls for producing material of required density and thickness.
10. A method according to Claim 9, **characterized in that** the impregnating compound is a low-viscosity compound based on a bitumen and modifying additives.
11. A method according to Claim 9, **characterized in that** the impregnating compound is a low-viscosity compound based on a bitumen, modifying additives and an fire-retarding agent.

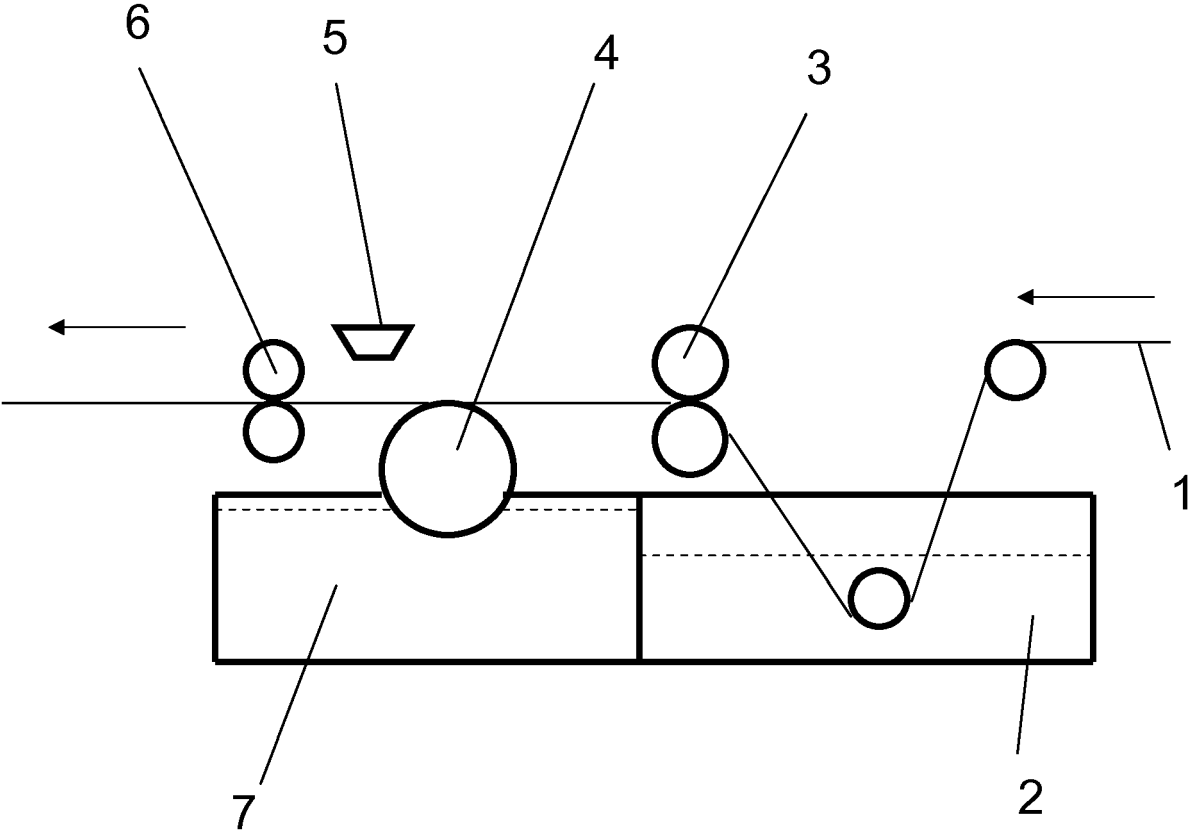


Fig.1



EUROPEAN SEARCH REPORT

Application Number
EP 12 17 0890

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/148250 A1 (O'CONNOR TERENCE J [CA] ET AL) 7 July 2005 (2005-07-07) * the whole document *	1-11	INV. B32B27/12 D06N5/00 E04D5/10 B32B11/10
X	US 2008/248241 A1 (KALKANOGLU HUSNU M [US] ET AL) 9 October 2008 (2008-10-09) * the whole document *	1-11	
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A	US 7 776 417 B2 (MOHSEEN SHAIK [US] ET AL) 17 August 2010 (2010-08-17) * column 10, line 7 - column 11, line 24; claims 1-85; figure 1 *	1-11	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B32B E04D D06N
Place of search		Date of completion of the search	Examiner
Munich		27 July 2012	Chindia, Evangelia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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27-07-2012

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