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(54) Structurally stable insulating geosynthetic product

(57) The present invention relates to a geosynthetic product, which finds application in creating roof, wall, bottom or any other insulating layers. The objective of the present invention consists in creating an insulating geosynthetic flexible sheet-shaped product preliminarily composed of several layers interconnected to one another.

The main variant of the present invention is an insulating geosynthetic flexible multi-layer sheet-shaped product consisting of a lower carrying textile layer 1, a middle accumulating and reinforcing layer 3 filled with water-swelling powdered or granulated substance, partially penetrate 2 or not into lower layer 1, and upper covering layer 5 composed of staple fibers.

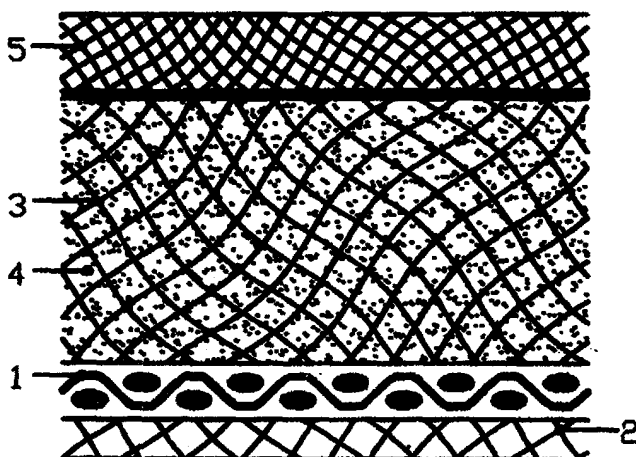


fig.1

Description**TECHNICAL FIELD**

[0001] The present invention relates to a geosynthetic product, which finds application in creating roof, wall, bottom or any other insulating layers with low permeability for gases and liquids in the construction of structures of landfills, natural or artificial depots of waste products, natural or artificial depositories for substances, materials, products or articles, artificial water reservoirs, etc.

STATE OF THE ART

[0002] A geosynthetic product is known [1], which consists of two textile layers, an upper one and a lower one, with a powdered filling, placed between them, that swells, when wetted by water, and acquires the ability of preventing to a great extent the penetration of liquids through its structure. In said product the two textile layers are interconnected to each other by tufted fibers drawn out of the upper layer by the method of "needle-punching", transferred through the powdered filling, and introduced into the lower layer. The shortcoming of this method is that the tufted fibers passing through said powdered filling are not sufficient to build a stable fiber-skeleton structure that would prevent the filling from migrating during transportation or application. Furthermore, bonding between said upper and lower layers is weak and after swelling, even at small loads, a slippage may occur between these layers.

[0003] Another geosynthetic material is also known [2], which consists of two layers, a lower textile layer called a carrying sheet, on which a layer of bentonite in the form of granules is placed, and an upper layer called cover sheet. Said two textile layers are connected to each other by threads composed of synthetic fibers. Each thread forms bight portions or loops spreading through the upper surface of the cover sheet, through the bentonite layer and finally through the primary carrying sheet. This product has the same shortcoming as the first one. In said product the connecting threads are monolithic, i. e. there is no uniform distribution of threads throughout the bentonite, and the reinforcement is anisotropic.

SUMMARY OF THE INVENTION

[0004] The objective of the present invention consists in creating an insulating geosynthetic flexible sheet-shaped product preliminarily composed of several layers interconnected to one another; said product containing a middle accumulating and reinforcing layer with stable structure that is invariable along its length; said structure being filled with a water-swelling powdered or granulated substance being in stable state before product application, but when the product is applied and wet-

ted by water said substance swells up and forms a dispersively reinforced insulating structure. The main variant of the present invention is an insulating geosynthetic flexible multilayer sheet-shaped product consisting of:

a lower carrying textile layer representing a woven fabric of synthetic threads with thick structure; a middle accumulating and reinforcing layer built up preliminarily or being built during its connection with said lower layer, where said middle layer may partially penetrate or not into said lower layer; said middle layer being composed of staple fibers of the same or diverse parameters, which include length, linear density and melting point, and involving water-swelling substance introduced into said middle layer after its construction; upper covering layer composed of staple fibers with the same or diverse parameters, which include length, linear density and melting point; said upper layer being realized either as a pseudo-layer by modifying the upper boundary surface or the upper boundary zone of said middle layer, or as a real autonomous layer connected with said middle layer through bonding with or without any additional adhesive substance.

BRIEF DESCRIPTION OF THE DRAWINGS**[0005]**

Fig. 1 is a schematic view of the main variant of the geosynthetic product, in which the middle layer is filled with a water-swelling powdered substance and passes through the lower layer.

Fig. 2 is a schematic view of the geosynthetic product with a middle layer filled with water-swelling granulated substance and bonded to the lower layer.

Fig. 3 is a schematic view of a geosynthetic product, in which the middle layer forms an upper covering pseudo-layer and a sealing is applied to the upper surface of said covering pseudo-layer.

Fig. 4 is a schematic view of a geosynthetic product, which is covered by an autonomous upper layer and the middle layer of which is composed of fibers of differing linear densities.

Fig. 5 is a schematic view of a geosynthetic product with compacted upper pseudo-layer.

Fig. 6 is a schematic view of a geosynthetic product, in which the upper part of the autonomous upper covering layer is of volumetric density higher than that of its lower part.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0006] Various variants of the geosynthetic product are illustrated in Figs. 1 through 6.

1. A schematic view of the geosynthetic product in its main variant is shown in Fig. 1. Said variant of the product consists of following elements: a lower carrying textile layer 1 representing a thick woven fabric, which is liquid- and gas-permeable and made of synthetic threads resistant to chemical, biological or UV impacts; a middle accumulating and reinforcing layer 3 containing a water-swelling powdered substance 4; an upper covering layer 5 representing a thick textile material, which is liquid- and gas-permeable. Said middle layer 3 consists of fibers of constant linear density and has a relatively constant volumetric density, fibers of said middle layer 3 passing partially through said lower layer 1 and being connected to it. That part of said middle layer 3, which is situated above said lower layer 1, is filled with a water-swelling powdered substance 4.

2. Fig. 2 illustrates a variant of the invention, in which said middle accumulating and reinforcing layer 3 is filled with a water-swelling substance in the form of granules 6. Here said middle layer 3 is bonded to said lower layer 1, without passing through it, and is composed of fibers of constant linear density. The volumetric density of the thread-like structure of said middle accumulating and reinforcing layer 3 is relatively low and invariable over the entire layer cross-section.

3. Fig. 3 illustrates schematically a variant of the geosynthetic product, in which the water-swelling substance 4 is in the form of powder and the upper part 7 of said middle layer 3 is of volumetric density that is higher than that of its lower part 8, said upper part 7 forming an upper covering pseudo-layer 14 at the upper boundary surface. In this case said upper boundary surface is additionally compacted.

4. Fig. 4 illustrates a variant of the geosynthetic product in which said middle accumulating and reinforcing layer 3 is composed in its upper part by synthetic fibers 9 of linear density (thickness) that is lower than that of fibers 10 in its lower part, said middle layer 3 being covered by an autonomous upper layer 5.

5. Fig. 5 illustrates a variant of the geosynthetic product in which the upper covering layer is realized as a pseudo-layer 11 and created by compacting the structure of the upper boundary zone of said middle accumulating and reinforcing layer.

6. To prevent the migration of said water-swelling substance said autonomous upper covering layer 5 may have higher volumetric density of its upper part 12 in comparison with the volumetric density of its lower part 13 as shown in Fig. 6.

[0007] The present invention being described by means of concrete examples of embodiment, other modifications or variants may be realized without any deviation from the scope of the present invention as dis-

closed in the patent claims.

USE OF THE INVENTION

5 [0008] The invention relates to an insulating geosynthetic flexible sheet-shaped product, which is preliminarily composed of several layers connected to one another; said product consisting of: a lower carrying permeable textile layer providing the total continuity of said
10 insulating product; a middle accumulating and reinforcing layer passing partially through said lower layer or situated entirely above it, said middle layer having a stable structure of chaotically oriented and uniformly distributed synthetic staple fibers and being filled with a sufficient amount of water-swelling powdered or granulated
15 substance later on, said water-swelling substance providing the required low permeability of the insulating product; an upper covering permeable layer realized either as a pseudo-layer by modifying the upper boundary surface or the upper boundary zone of said middle accumulating and reinforcing layer, or as a real autonomous layer connected to said middle layer.

LITERATURE

[0009]

1. Bodenmatte — EO 0731220.
2. Tufted geosynthetic clay liner and method of manufacture thereof — US 5 436 050.

Claims

- 35 1. A geosynthetic product consisting of a lower carrying textile layer and upper covering textile layer connected to each other and of a layer of water-swelling substance placed between said lower and upper textile layers, and **characterized by** the placement
40 of a structurally stable middle accumulating and reinforcing layer between said lower and upper textile layers, said middle layer being filled with water-swelling substance and connected firmly to said two layers.
- 45 2. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said middle accumulating and reinforcing layer in its upper part is composed of thermoplastic fibers of melting point lower than that of fibers in its lower part.
- 50 3. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said middle accumulating and reinforcing layer in its upper part is of volumetric density higher than that of its lower part.
- 55

4. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said middle accumulating and reinforcing layer in its upper part is composed of synthetic fibers of linear density lower than that of fibers in its lower part. 5
5. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said middle accumulating and reinforcing layer in its upper part is composed of fibers with staple length greater than that of fibers in its lower part. 10
6. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said accumulating and reinforcing layer containing water-swelling substance is compacted by modification of its upper part in a way to serve as an upper covering layer. 15
7. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said upper covering layer in its lower part is composed of synthetic fibers of melting point lower than that of fibers in its upper part. 20
25
8. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said upper covering layer in its lower part is of volumetric density higher than that of its lower part. 30
9. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said upper covering layer in its lower part is composed of synthetic fibers of linear density higher than that of fibers in its upper part. 35
10. A structurally stable insulating geosynthetic product according to claim 1, **characterized by** the fact that said upper covering layer in its upper part is composed of synthetic fibers with staple length greater than that of fibers in its lower part. 40

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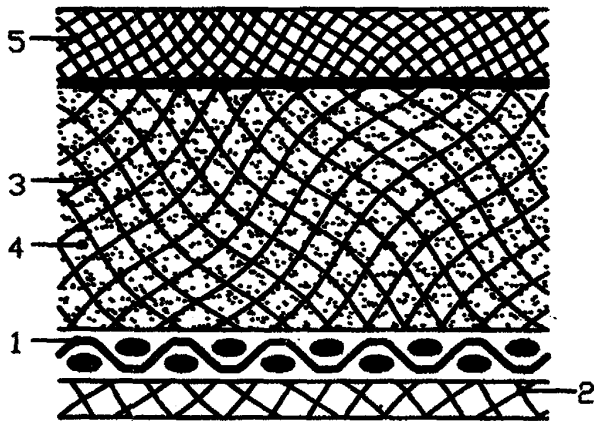


fig.1

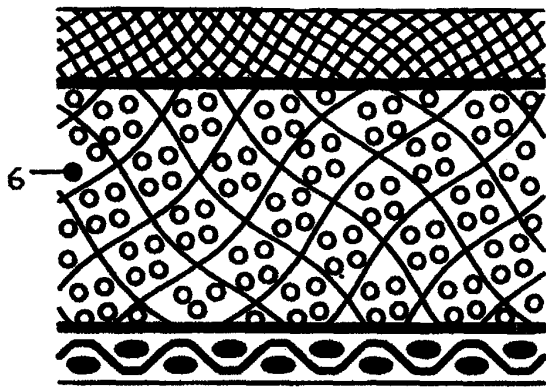


fig.2

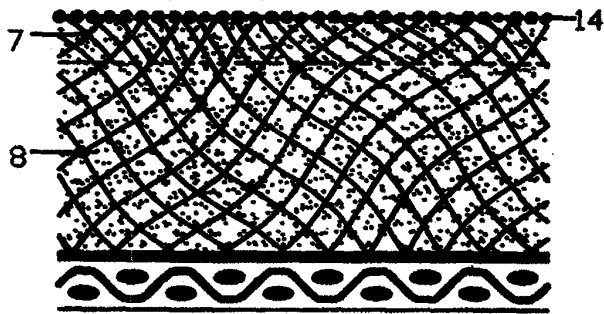


fig.3

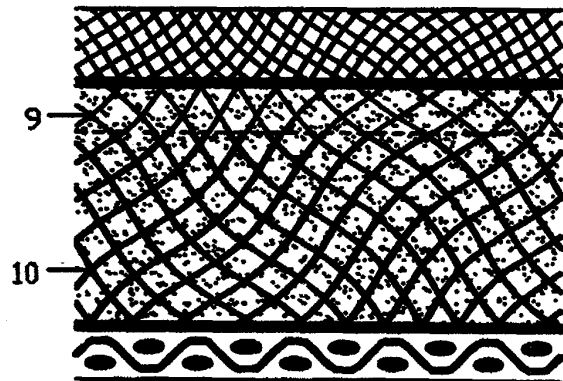


fig.4

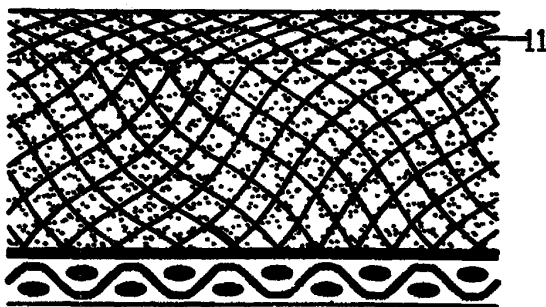


fig.5

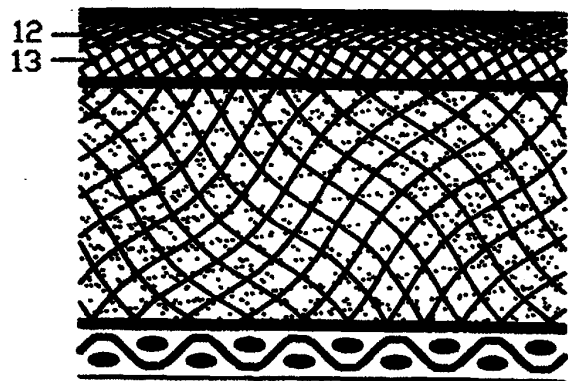


fig.6



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Application Number
EP 03 47 2005

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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 19 December 2003	Examiner Kanetakis, I
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