

[54] **STITCHED WEBS OF FLEECES OF SYNTHETIC FIBERS AND METHOD OF MAKING SAME**

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[22] Filed: **Sept. 7, 1972**

[21] Appl. No.: **286,913**

[44] Published under the Trial Voluntary Protest Program on January 28, 1975 as document no. B 286,913.

[30] **Foreign Application Priority Data**

Sept. 7, 1971 Germany..... 7133997.4

[52] U.S. Cl. **428/102; 28/77; 61/38; 156/93; 428/152; 428/255**

[51] Int. Cl.².. **B32B 7/08; B32B 27/02; B32B 3/28; E02B 3/12**

[58] Field of Search 161/50, 89, 128; 28/77; 61/38; 428/102, 255, 152; 156/93

[56]

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Primary Examiner—Philip Dier

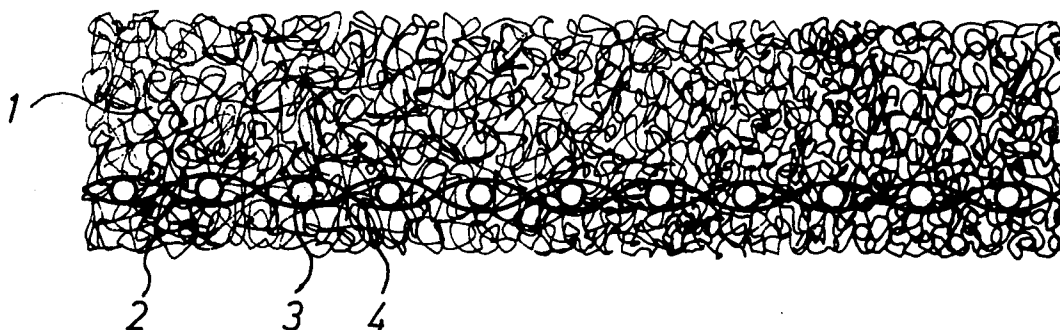
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[57]

ABSTRACT

Erosion preventing structural elements in the form of stitched fleeces comprising a fleece from polyamide staple fibers of certain dtex and length, a mesh fabric of synthetic endless yarns and a waterproof binder.

10 Claims, 1 Drawing Figure



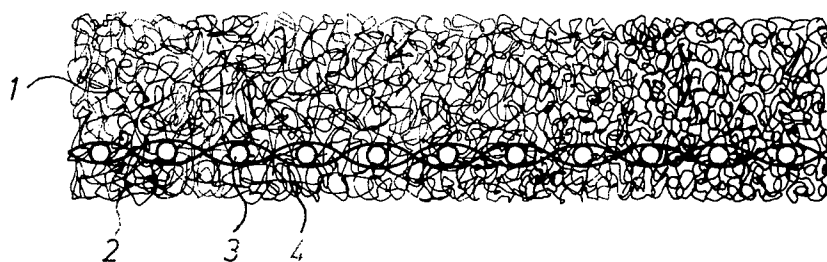


FIG. 1

STITCHED WEBS OF FLEECES OF SYNTHETIC FIBERS AND METHOD OF MAKING SAME

This invention relates to erosion preventing structural elements which consist of stitched webs of fleeces made of coarse, crimped polyamide fibres.

It is known to use synthetic fibre fabrics for reinforcing dams and the walls of water reservoirs and containers. For larger objects, however, the use of textile fabrics as erosion preventing and reinforcing elements is out of the question because of economical or functional considerations.

The use of webs of non-woven fleeces of synthetic fibres as erosion preventing elements for reinforcing dykes, banks, strands, dams and embankments of river courses and canals is also known. The three dimensional form of such a web of fleece provides the desired filtering effect and in addition the elastic properties of the web enable it to fit closely to the ground on which it is laid, thereby preventing erosion and slipping of the ground.

These fleeces are resistant to rotting and decay. Fleece binders are applied to fix the points of intersection and contact between the fibres and the fleeces may also be bonded by means of thermoplastic adhesive fibres.

These bulky fleece webs are laid down wherever it is required to prevent erosion by water and/or wind. They are fixed in position e.g. by weighing them down with stones or covering them with sand, gravel or asphalt, concrete and/or soil or by nailing them down with stakes, etc.. These webs of fleece may also be used for fixing turf and for arresting the movement of dunes and for reinforcing dams or dykes.

It has been found, however, that normal fleece constructions do not always have sufficient strength and dimensional stability to perform their reinforcing function.

It is an object of this invention to provide structural elements that do not have these deficiencies. This object is accomplished by an erosion preventing structural element in the form of a stitched web of fleece made of coarse synthetic fibres, which comprises

- a. crimped polyamide fibres with dtex 5 to 250, preferably dtex 30 to 140, and staple lengths 20 to 150 mm, preferably 50 to 100 mm, stitched with 60 to 180 stitches per cm², preferably 80-120 stitches per cm²,
- b. a mesh fabric of synthetic yarns or tapes comprising at least two warp yarns and two weft yarns per cm² stitched into the web in the lower third thereof and
- c. at least 15% by weight and preferably 20 to 45% by weight —based on the weight of the fleece— of a waterproof binder based on polyacrylic acid esters, this web of fleece having a thickness of 4 to 10 mm and a weight per square metre of between 500 and 2000 g, preferably between 500 and 1700 g.

The erosion preventing structural element according to the invention is produced by a process which comprises laying crimped polyamide staple fibres of dtex 5 to 250 to form a fleece, the formed fleece and a mesh being stitched together, the stitched fleece being impregnated with a waterproof binder based on polyacrylate and subjecting the impregnated fleece to a heat treatment at temperatures of between 100° and 150°C.

The waterproof binders based on polyacrylates are, for example, binders produced from self cross-linking acrylic acid esters, preferably butyl acrylate. They are preferably applied in the form of aqueous dispersions. Fillers such as barium sulphate, kaolin or chalk may be added to the aqueous dispersions to increase the weight of the element so that the web will sink more quickly when laid under water. Sinking of the web may also advantageously be speeded up by the addition of wetting agents (tensides) in quantities of 2 to 20% by weight, preferably 4 to 10% by weight, based on the finished web of fleece. The wetting agents used may be alkyl-(aryl) sulphonic acids or sulphonates or also non-ionogenic compounds.

The mesh fabric is advantageously produced from multifilamentary polyester yarns of dtex 900 to 1200 woven to produce a fabric having 4 warp yarns and 4 weft yarns per cm²; the weight per square metre of the mesh fabric should be between 80 and 160 g. The fabric is arranged in the lower third of the web of fleece so that loops of fibres projecting from the undersurface of the fleece will provide a firm hold on the ground which is to be protected. The layers of fleece on both sides of the mesh fabric are protected against mechanical damage, for example from gravel or broken stone.

It is only by observing the special conditions indicated above (titre of the fibres of the fleece, formation of the fleece, specified mesh fabric, density of stitching, binder content and other fillers, and thickness and weight per square metre of the web of fleece), which vary according to the conditions under which the fleece is to be used, for example the size of the particles of the ground which is to be protected, that optimum properties are obtained in these fleeces as regards their strength and functional suitability so that they satisfy all requirements for use in the construction of dykes and canals.

The webs of fleece may be produced by known methods in any fleece forming installations, preferably by the aerodynamic principle. The binder is introduced into the web of stitched fleece in the form of an aqueous dispersion, for example by slop padding or spraying, and is then condensed, usually at elevated temperatures. In this operation, the web of fleece may be drawn through a pair of heated rollers (Calender rollers). The process for producing erosion preventing structural elements in the form of webs and stitched fleeces is characterised in that crimped polyamide staple fibres of dtex 5 to 250 are laid to form a fleece by an aerodynamic process and/or using a carding machine, and the fleece is then stitched to a mesh fabric and the stitched fleece is impregnated with a waterproof polyacrylate binder and the impregnated fleece is subjected to a heat treatment at temperatures of between 100° to 150°C. In order to produce self-sinking mats, the mats produced by the process indicated above are treated with a wetting agent (tenside), preferably 2 to 20% by weight. If desired, sinking may be facilitated by applying a filler of high specific gravity (e.g. barium sulphate, kaolin or chalk) together with a binder.

The following Examples illustrate more particularly the invention.

EXAMPLE 1

Polyamide-6 staple fibres (70% by weight of fibres of dtex 70 and staple length 90 mm and 30% by weight of a mixture of fibres of dtex 5 to 30) were mixed in a

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fibre mixing machine and continuously formed into a web of fleece weighing about 500 g/m² on a carding machine. The resulting web of fleece and a polyester mesh fabric (endless multifilament fibres 1100 dtex, 4 warp yarns and 4 weft yarns per cm²) are stitched together with 110 stitches per cm² using a 28 gauge needle. A 20% by weight aqueous dispersion of polybutyl acrylate is applied by padding to the stitched fleece (passed over heated rollers and squeezed off) and dried at 120°C and then condensed at temperatures of about 150°C.

EXAMPLE 2

Polyamide-6 staple fibres (130 dtex, staple length 60 mm) are worked up in an aerodynamic fleece laying apparatus to form a web of fleece weighing 1000 g per m². The fleece is then treated as described in Example 1 and after condensation of the polybutyl acrylate it is impregnated with a 70% by weight aqueous solution of a wetting agent mixture consisting of 70% by weight of alkyl (C₁₂ to C₂₂) sulphonate and 30% by weight of nonylphenolpolyglycol ether (7 mols of ethylene oxide), 120 g of this solution being introduced per m² of fleece web. After drying at 100°C, the finished web of fleece contains 6% by weight of wetting agent and has a final weight of about 1500 g/m² and a thickness of 9 mm.

The figure illustrates an example of an erosion preventing structural element according to the invention in the form of a web of fleece (in cross-section) of polyamide-6 fibres.

Fleece 1 is composed of polyamide-6 fibers 2 (diameter 0.10 mm, staple length 60 mm), some of the loops of fibers being stitched through the mesh fabric consisting of warp yarns 3 and weft yarns 4 mechanical strengthening of the web was carried out in a stitching apparatus by applying 90 stitches per cm² with 28 gauge needles. The polyacrylate binder content is 30% by weight.

The mesh fabric has 4 warp threads and 4 weft threads of multifilament polyester fibres of 1100 dtex and has a weight per m² of 110 g. The finished web of fleece has a thickness of 8 mm and a weight per m² of 1600 g.

What we claim is:

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1. An erosion preventing structural element in the form of a stitched web of fleece of coarse, crimped fibres, consisting of a web of fleece produced from

- a. crimped polyamide fibres of dtex 5 to 250 and staple length 20 to 150 mm stitched with 60 to 180 stitches per cm²,
- b. a mesh fabric of synthetic endless yarns stitched into the fleece, the fabric having at least 2 warp yarns and 2 weft yarns per cm² and being arranged in the lower third of the web of fleece, and
- c. a waterproof binder based on polyacrylic acid ester of at least 15% by weight, this web of fleece having a thickness of 4 to 10 mm and a weight per m² of between 500 and 2000 g.

2. The erosion preventing structural element of claim 1, said crimped polyamide fibres having 80 to 110 stitches per cm².

3. A process for the production of erosion preventing structural elements in the form of webs of stitched fleeces of synthetic fibres, which comprises laying crimped polyamide staple fibres of dtex 5 to 250 to form a fleece, stitching together the formed fleece and a mesh fabric, impregnating the resultant combination with a waterproof binder based on polyacrylate and subjecting the impregnated fleece to a heat treatment at temperatures of between 100° and 150°C.

4. The process according to claim 3, in which said binder is applied as an aqueous dispersion.

5. The process according to claim 4, in which aqueous dispersion of binder contains a filler having a high specific gravity.

6. The process according to claim 3, in which said laying is achieved by an aerodynamic process.

7. The process according to claim 3, in which said laying is achieved on a carding machine.

8. The erosion preventing structural element according to claim 1 which contains 2 to 20% by weight of a wetting agent.

9. The erosion preventing structural element according to claim 1, wherein said mesh fabric consists of 4 warp yarns and 4 weft yarns of dtex 900 to 1200 per cm² and has a weight per m² between 100 and 150 g.

10. The process according to claim 3, wherein said stitched fleece and mesh fabric combination is impregnated with an aqueous solution of a wetting agent.

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