

A LIGHTWEIGHT PROTECTION ELEMENT AND FILTER OF THE MATTRESS TYPE

The present invention relates to a lightweight protection element and filter of the mattress type, and in particular, though in a non-limiting manner, to a ballasted filtering mattress for protecting and covering terrain, more preferably a seabed.

It is known from various documents, also including some from the same Applicant, to use flexible protection elements of parallelepipedal form in order to immobilize and protect, for example, underwater pipes, canal banks and beds. Those elements comprise a flexible external cover which coats a gabion which is constructed from metal material and is filled with a mixture composed of bitumen, sand and stones or pebbles, so as to obtain elements having a high unit weight. Those protection elements, once made up, must be lowered into water by means of handling machines, such as cranes, mechanical arms, and the like. In order to facilitate the above-mentioned laying, operations are known for producing mattress type protection elements comprising support elements which facilitate, when in use, the handling thereof.

One of the main limitations of the elements of known type is constituted by their great thickness and their heaviness, which make the installation operations extremely complex and troublesome.

Another limitation of the elements of known type is constituted by their limited overall dimensions, which are linked to the dimensions of the gabions and/or the forms which are used for constructing them.

An object of the present invention is to provide a protection element and filter of the mattress type which has

significantly reduced weight, which allows easier installation, which has overall dimensions which are variable in accordance with the type of application necessary and which can successfully constitute protection elements and a filter without longitudinal discontinuities, for example, but in a non-limiting manner, up to 200 linear metres.

Another object of the present invention is to provide a protection element and filter which is economical, easy and rapid to construct and which therefore allows a substantial saving in terms of the time and cost of installation.

In order to achieve the above-mentioned objects, the present invention relates to a lightweight protection element and filter of the mattress type as defined in the main claim below.

One of the main advantages of the present invention is constituted in that the protection element further comprises a three-dimensional internal structure with a high cavity index, in which filler material is inserted, such as gravel, silt, finely crushed stone, or any other natural granular element which is available in situ. That advantageous feature avoids the need to create internal diaphragm openings for stabilizing the filler material.

According to another particularly advantageous feature, the mattress type element also comprises a double layer of geotextile material, for example, an upper layer and a lower layer, which, being connected to the three-dimensional internal structure, allow the protection element to act as a filtering element and, at the same time, to remain fitted closely against the terrain to which it is applied owing to the ballast weight of the granular filler material.

Further features and advantages will be appreciated from the following description of one of the preferred embodiments, with reference to the appended drawings, given purely by way of non-limiting example, in which:

- Figure 1 is a schematic perspective view of a lightweight protection element and filter of the mattress type according to the present invention; and
- Figure 2 is a schematic sectioned view along line A'-A' of the element illustrated in Figure 1.

With reference now to the Figures, a lightweight protection element and filter of the mattress type according to the present invention comprises an external containment structure. The external containment structure comprises a lower portion, for example, a bottom sheet 10, and an upper portion, for example, a cover sheet 20. Both the sheets 10 and 20 can be constructed from synthetic material, preferably geosynthetic material, for example, woven geotextiles or woven geogrids, geomembranes, geonets. Alternatively, the sheets 10 and 20 can be constructed from natural material, preferably a biomat and/or a biodegradable bionet, for example, of straw, coconut fibre or wood shavings, and generally natural fibres.

Preferably, a reinforcement element 48, for example, a metal net and/or a geogrid, can be engaged with the bottom sheet 10 so as to increase the resistance to traction of the whole mattress.

Between the lower portion 10 and the upper portion 20, there is arranged a three-dimensional internal structure 30 with a high cavity index, preferably a non-woven geotextile, even more preferably a three-dimensional structure comprising monofilaments of heat-sensitive material, for example, synthetic polymers and/or polyamides. In accordance with a

particular embodiment of the present invention, the monofilaments of heat-sensitive material can be extruded onto the reinforcing metal net and/or geogrid 48.

Granular filler material, for example, gravel, sand, silt, finely crushed stone or any other natural element which is preferably available in situ, is inserted inside the three-dimensional internal structure 30 with a high cavity index. The granular filler material serves as an auxiliary in the filtering action of the three-dimensional draining structure 30, to maintain the thickness of the three-dimensional geosynthetic even under great loads and to weigh down the whole lightweight protection element and filter.

The bottom sheet 10 and the cover sheet 20 are engaged with each other by way of engagement means, preferably of the mechanical type, for example, but in a non-limiting manner, a pair of plates 50, or continuous strips, constructed from synthetic and/or metal materials. The plates 50 are arranged, in an aligned, opposing state, on the external surfaces of the bottom sheet 10 and the cover sheet 20 and distributed over the surfaces in the region of respective openings formed in the surfaces of the two sheets 10 and 20. Each plate 50 comprises a through-hole, inside which there is passed a fixing bar 52 with a thread 54, scarfed in the plate 50 or lower strip. Two blocks 56 are screwed to the ends 54 of the bar 52 so as to secure the position of the two plates 50 along the bar 52 and to engage the bottom sheet 10 and the cover sheet 20 with each other.

Naturally, a person skilled in the art could develop, without any inventive step, different engagement means, mechanical or non-mechanical, with respect to those described above without thereby departing from the scope of the present invention.

As is clearly visible in Figure 1, the engagement means are distributed uniformly over the entire extent of the bottom sheet 10 and cover sheet 20 so as to bring about through-fastening of the protection element and filter. The ends of the sheets 10 and 20 are fixed to each other, for example, by means of continuous seams 53 so as to close the protection element and filter and retain inside it the three-dimensional structure with a high cavity index and the filler material.

In accordance with another of the preferred embodiments of the present invention, the external containment structure of the protection element and filter comprises, for example, but in a non-limiting manner, a pouch or a container of synthetic or natural material, as described above, which is open at one side and inside which there is inserted the three-dimensional structure with a high cavity index and the filler material. Similarly, the open ends of the external structure are fixed to each other, for example, by means of continuous seams 53 so as to close the protection element and filter and retain inside it the three-dimensional internal structure and the filler material.

In accordance with another of the embodiments of the present invention, the filler material may comprise fertile soil, seeds and/or other similar material, should the sheets 10 and 20 have been constructed from geosynthetic materials of natural fibres. The lightweight protection element and filter can thereby be used for covering terrain, embankments and inclinations which have to be renewed.

The embodiments of the invention may change in accordance with the various dimensions and pieces of equipment of the finished mattresses. In particular, for finished mattresses of great linear extent, generally over from 6 to 7 metres in length, there can be used pontoons or rollers on which the elements roll, whilst for single shorter mattresses there can

be used lifting frames of various forms and dimensions. In that last case, the fixing bars 52 can be provided with engagement means, for example, end ring bolts, so as to be able to allow them to be connected to the lifting frame during the installation operations.

Naturally, the principles of the invention remaining the same, the forms of embodiment and details of construction may vary widely with respect to those described and illustrated without thereby departing from the scope of the invention.

CLAIMS

1. A lightweight protection element and filter of the mattress type comprising an external containment structure (10, 20), a three-dimensional internal structure (30) with a high cavity index, a granular filler material which is inserted inside the containment structure and engagement means (50, 52, 56) which are distributed over the external containment structure in order to engage predetermined portions of that external structure with each other.
2. An element according to claim 1, characterized in that the external containment structure comprises a lower portion (10) and an upper portion (20), the engagement means (50, 52, 56) engaging the lower portion (10) with the upper portion (20).
3. An element according to claim 2, characterized in that the engagement means comprise mechanical engagement means (50, 52, 56).
4. An element according to claim 3, characterized in that the mechanical engagement means comprise at least a pair of plates (50), at least a fixing bar (52) and at least a pair of blocks (56) which can selectively be engaged with the ends (54) of those fixing bars (52).
5. An element according to claim 4, characterized in that the ends of the external containment structure are fixed to each other so as to close the protection element and filter and to retain inside it the three-dimensional structure with a high cavity index and the filler material.
6. An element according to claim 1, characterized in that the three-dimensional internal structure (30) with a high

cavity index comprises a non-woven geotextile and/or monofilaments of heat-sensitive material.

7. An element according to claim 2, characterized in that the lower portion (10) and the upper portion (20) of the external containment structure are constructed from at least one of the following synthetic materials: woven geotextiles, woven geogrids, geomembranes, geonets.

8. An element according to claim 2, characterized in that the lower portion (10) and the upper portion (20) of the external containment structure are constructed from at least one of the following natural materials: reed matting, biodegradable bionet, straw, coconut fibre, wood shavings.

9. An element according to any one of the preceding claims, characterized in that it further comprises a reinforcement element (48) in order to increase, during use, the resistance to traction of the whole element.