

[54] WOVEN MAT	1,039,579	9/1912	Neames.....61/38
[72] Inventors: Olaf Heine, Kelkheim/Taunus; Gerhard Knisse, Wohltorf, both of Germany	2,772,699	12/1956	Scruggs.....139/419
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[73] Assignee: Farbwerke Hoechst Aktiengesellschaft vormals Meister Lucius & Bruning, Frankfurt am Main, Germany	3,517,514	6/1970	Visser.....61/38
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[22] Filed: **June 29, 1971**

[21] Appl. No.: **158,036**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 843,518, July 22, 1969, abandoned.

[30] **Foreign Application Priority Data**
 July 30, 1968 Germany.....P 17 84 360.6

[52] U.S. Cl.....61/38

[51] Int. Cl.E02b 3/12

[58] Field of Search61/37, 38, 35; 139/419

[56] **References Cited**

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[57] **ABSTRACT**

An assembly for preventing erosion of sand and pebbles from shores, beaches, waterways and the like. The assembly includes an outer mat made from a thermoplastic material. The mat has an open net weave and includes several compartments which are adjacent one another. A plurality of open net weave bags, also made of thermoplastic material, and filled with entangled ribbons of thermoplastic material are inserted into the compartments of the mat. The assembled mat may be attached to the shore.

11 Claims, 4 Drawing Figures

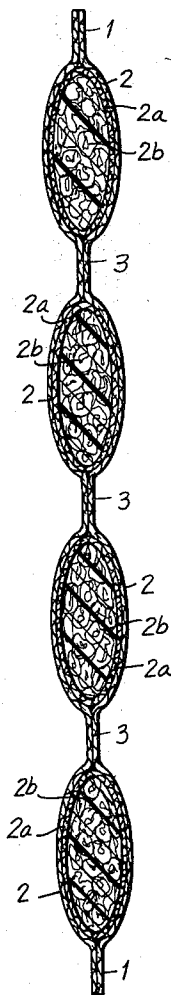


FIG. 1

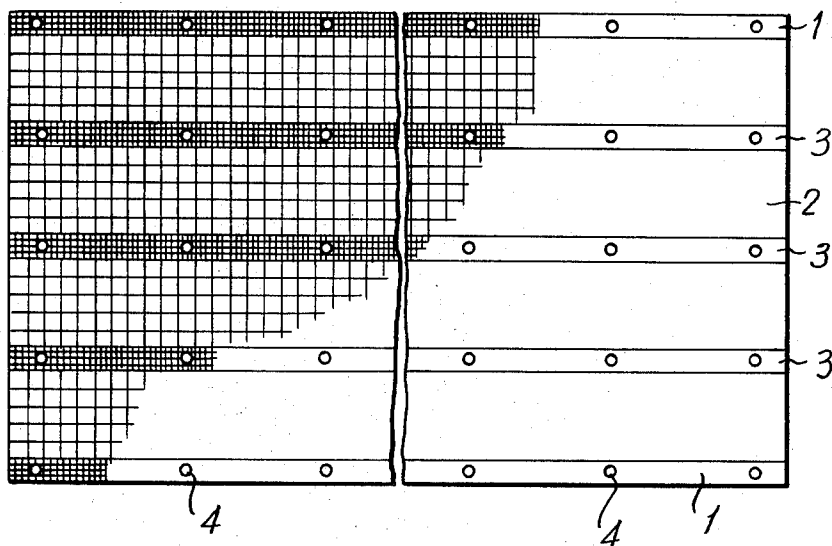


FIG. 2

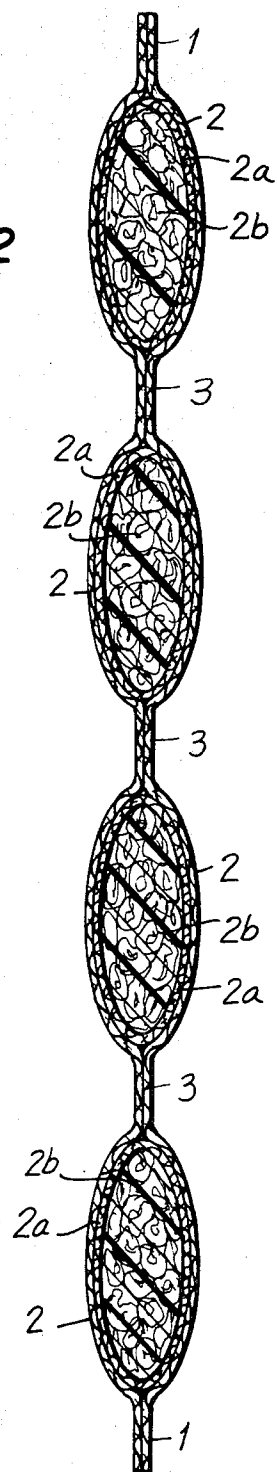


FIG. 3

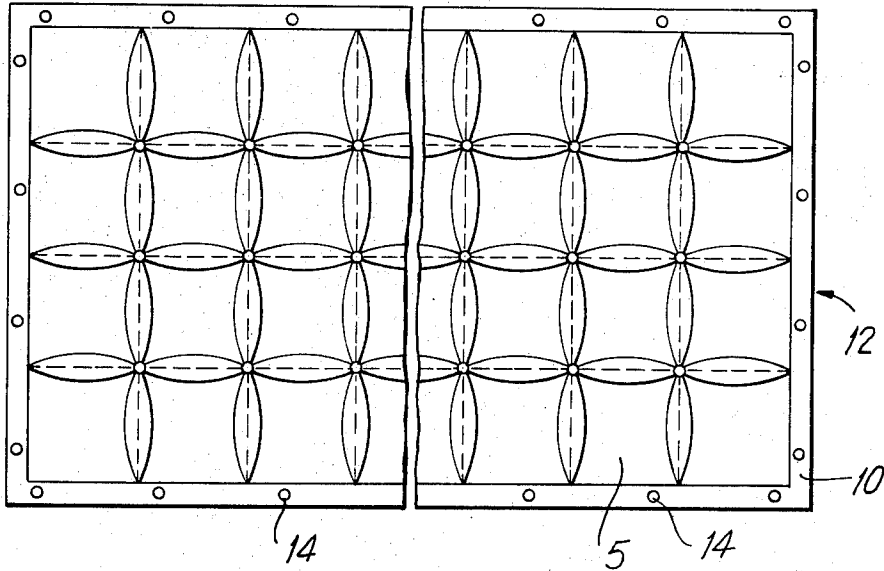
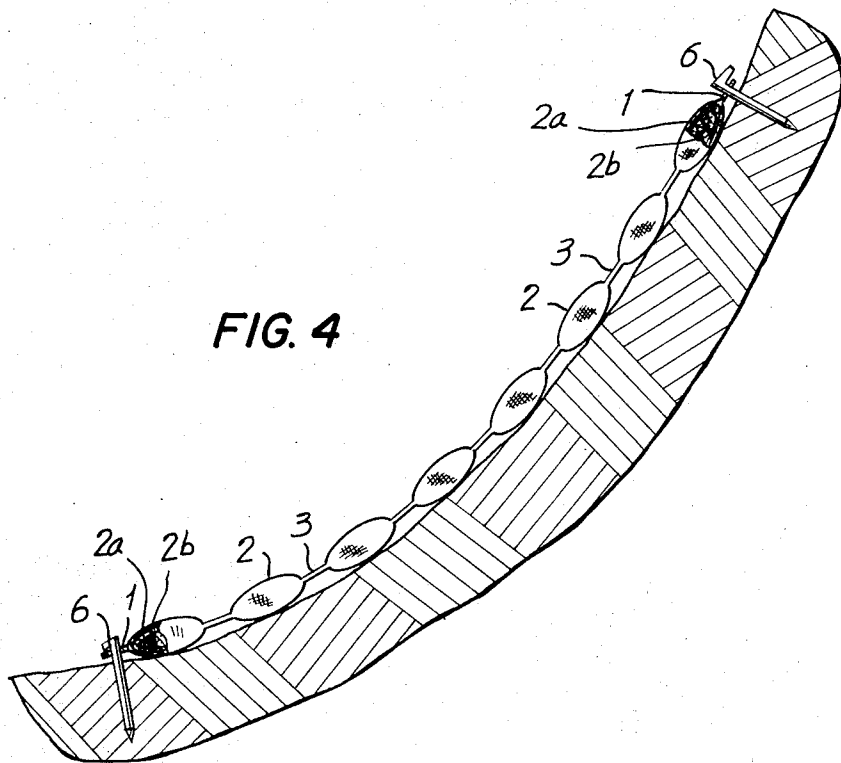


FIG. 4



WOVEN MAT

This application is a continuation-in-part of my copending application Ser. No. 843,518, entitled "Woven Mat," and filed on July 22, 1969, now abandoned.

The present invention relates generally to woven mats, and particularly to mats for use in preventing erosion of shores, beaches, waterways and the like.

Heretofore, a number of proposals have been offered to prevent the erosion of sand and other materials from beaches and waterways. Most of such attempts have involved massive and difficult installations requiring heavy machinery for both initial construction and repair and replacement. Because of its sheer mass, erosion-preventing installations of this kind, cannot be either quickly or inexpensively set up to provide effective and permanent protection.

It has been observed that lightweight seaweed washed ashore has a tendency to retain sand and pebbles which have been drifted by the winds or washed ashore, and thus are the starting point of the natural formation of small sand hills. The band or ribbon-like structure of seaweed is particularly favorable to the formation of such hills, and other band-shaped spacial units will also accumulate sand and pebbles and thus retard erosion.

Satisfactory coastal preservation cannot be achieved by loosely spreading band-shaped spacial units, for example, strips of plastic films or sheets, on the shore. Such unsecured spacial units soon blow away in the wind and wash away in the water, and do not remain in the places where they are needed to build up the sand dunes and prevent erosion.

We have now found that excellent erosion protection is offered by splicing together and/or entangling ribbons of thermoplastic material, stuffing this material into a net sack or bag (also preferably made of thermoplastic material); inserting this net sack stuffed with the spliced entangled ribbons of thermoplastic material into prepared compartments of a large mat (also made of thermoplastic material). The compartments which hold the stuffed net sacks, have an open net weave. In one embodiment, the net compartments of the mat are separated one from another by strips of material. These strips of material may be fastened into the beach, such as with pegs or other suitable means. With this arrangement, the mat is held in place on the beach or other area to be protected. In place of the strips seams may be formed by sewing the two layers of mat netting together, so as to define the compartments.

In summary, the ribbons or bands of thermoplastic material are entangled one with another to form balls or cushions, and these balls retard the erosion. The ribbons or bands are held in place by the inner bag, which in turn is held in place by the outer compartment. The compartments are held in place by the mat which is fastened to the beach. The net bags and net compartments also assist in retarding erosion. Thus, the materials which retard erosion are uniformly spread out over the beach, and are not easily moved by the water or blown about on the beach, as is the case with strips, which are free to rise and fall with the tides. The double net, and long ribbons of material interact to further retard erosion and loss of the erosion-preventing material. Should one of the nets become broken, there is a double net. Should one, or both, become broken, the

long ribbons become entangled with a broken net and thus the ribbons are less easily washed out.

It is desirable that when enmeshed together the ribbons of thermoplastic material, which fill the inner bags, be long, and fairly compact. If the bags should become ruptured, shorter ribbons tend to wash out, but their length and compactness of intermeshing will tend to retain the ends of the ribbon in the inner and outer netting, and the floating or partially freed ribbons will achieve the purpose of preventing the erosion.

As the woven mat, constructed in accordance with this invention, remains on the beach or other area to be protected, sand drifted by the wind, and washed ashore by the water, is kept in the entangled ribbons of films or sheets in a manner such that the sand accumulates in the mat. Within a short time, the mat is completely filled with sand, and offers effective protection, and typically is not even removed by heavy storms or beating waves. As one layer of mats becomes covered, or even in the original installation, it is possible to put one or more mats on top of the first ones, so that they all become filled with sand in the same way. Thus, the erosion of beaches can be effectively reduced and the coastline preserved.

It is important to note that the mat compartments and the bags of the present invention are not filled with a heavy material, such as rocks or wood. This greatly facilitates installation. The inner bags are quite light, and in a typical installation are prepared separately from the outer mats and the large outer mats can be rolled up for transportation. At the site, the inner bags are merely inserted into the compartments in the mat. If it is necessary to repair or replace one mat on the beach, its fastening to the ground is removed, the inner bags may be pulled out, and the outer mat is then rolled up and carried off. In practice, it is envisioned that the size of the mats will be of a manageable size, e.g. 10 meters by 10 meters, so that they can be easily handled by one or two men, without the aid of machinery. As noted, the mat and bags, and fill in the bags are of a thermoplastic material, and therefore, quite light.

Further, it will be appreciated that because of the light weight of the bags and mats, and because of their flexibility, they can be easily transported to remote locations which heavy equipment may find inaccessible, and where they can be laid down to prevent erosion.

According to one aspect of the invention, for securing coastlines there is provided an assembly having a large outer mat made of a thermoplastic material with an open net weave. Seams, or tight strips of fabric, divide this outer mat into several compartments. A number of bags, also made of thermoplastic material and having an open net weave, are filled with spliced or entangled strips or ribbons of thermoplastic material. These bags are then inserted into the several compartments of the large outer bag.

The above and other objects, features and advantages of this invention will be apparent in the following detailed description of illustrative embodiments thereof which are to be read in connection with the accompanying drawings wherein:

FIG. 1 is a plane view of one embodiment of a mat constructed in accordance with the invention.

FIG. 2 is a cross sectional view of the mat of FIG. 1.

FIG. 3 is a plane view of an alternative embodiment of a mat of this invention.

FIG. 4 is a cross sectional view of the mats of FIGS. 1 and 2, fastened to the ground.

Referring now to FIGS. 1 and 2, there is shown a mat having a border strip of fabric 1, and several intermediate strips of fabric 3 parallel to the border strip, and strip, and double layer woven nets 2 attached between adjacent strips. All of these strips 1 and 3 are of a tight fabric, and the woven net 2 is of an open net. The two layers of net between adjacent strips define several compartments. This is shown most clearly in FIG. 2. Into these compartments there is inserted large bags 2a of similar dimensions to the compartments. These bags 2a are also of a woven net, or have an open net weave. Typically, the net of the inner bags 2a may be tighter than the open net of the compartment 2. The bags 2a are filled with thin polyethylene ribbons, or films, or sheets which are loosely fitted and entangled with one another to form balls, and may be spliced together to form long ribbons or long spatial shapes. These enmeshed balls of ribbons are indicated generally as 2b in FIG. 2. The mats 1, 2, 3 and the bags 2a and the fill material 2b are all made of thermoplastic material. The fill material is typically polyethylene, and may come from waste products obtained in the working of plastics. If these waste products are short in length, it is desirable that they be spliced together so as to form long spatial shapes, because long fill is not so easily washed out of the bags and compartments in the event the nets should become broken. The material for making the nets of both the mat 2 and the bags 2a, is preferably low pressure polyolefins, low pressure polyethylene, copolymers of ethylene and propylene, or polypropylene. It is also possible to use several different thermoplastic materials; for example, the strips of fabric 1 and 3 may be of one material, the netting 2 and 2a of another, and the fill films or sheets 2b of still another. The assembly is exposed to intense atmospheric influences, and the polyolefins are advantageously combined with light stabilizers, for example, soot. It is not absolutely necessary to manufacture the mat from drawn strips of films or sheets; it may also be made of monofilaments of thermoplastic material. The woven net used for the compartments 2 and the bags 2a is advantageously of a leno-weave. It is, however, also possible to use netting of other weave.

Referring now to FIG. 3, there is shown an alternative embodiment to the present invention. The mat here has an outer fabric strip 10 with a double netting 12 between the outer fabric strip 10. The netting 12 is divided into cushions of netting 5, which are sewn in a quilt-like manner disposed on the mat 12. The cushions of netting 5 are filled with ribbons, films, or elongated sheets of thermoplastic material of the size and shape previously described.

As shown in FIGS. 1 and 3, the strips of fabric 1, 3 and 10 are provided with eyelets 4 and 14 to facilitate securing the mats to the shore or other surface which is to be protected. This can be best seen in FIG. 4 which is a cross sectional view of the mat of FIGS. 1 and 2 attached to a shore. As shown in this Figure, the outer strips 1 of the mat have tent-pegs 6 driven through the eyelet portion in the end strips 1 of the mat. The tent-peg or other type of fastener, such as other peg or pile,

is driven into the ground through the eyelet. It is also possible to provide the borders of the strips of the fabric with pockets, which are then filled with sand or stone and then laid on the ground to be protected. It may, furthermore, be advantageous to load the surface of the mat with sand or pebbles to prevent the mat from slipping or from being lifted by high winds or waves.

Thus, there has been shown and described a novel assembly for preventing erosion, and for building up shorelines. Because of its design, and the choice of materials, it is easily, rapidly and manually installed. The double net construction of the invention facilitates manufacture and storage with the ribbons or films which retard the erosion, and can be stored in the inner bags while waiting to be inserted into the compartment of the mats. The thermoplastic material is not only lightweight (and thus easy to transport and to install) but also is resistant to the elements and is inexpensive.

Although illustrative embodiments of this invention have been described in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of the invention.

What we claim is:

1. An assembly for inhibiting shore erosion and the like comprising a large outer mat, said mat being made of thermoplastic material and having an open net weave; means for dividing said mat into several compartments; a plurality of bags inside said mat compartments, said bags being also made of thermoplastic material and having an open net weave; and entangled strips of thermoplastic material filling the inner bags.
2. An assembly according to claim 1, wherein said means for dividing said mat are tight strips of fabric.
3. An assembly according to claim 1, wherein said means for dividing said mat are seams.
4. An assembly according to claim 1, wherein said strips of thermoplastic material are spliced.
5. An assembly according to claim 1, wherein said compartments are open at one end to facilitate the insertion and removal of the inner bags.
6. An assembly according to claim 1, wherein said strips are waste products obtained in the working of plastic.
7. An assembly according to claim 1, wherein at least one of said nets are of leno-weave.
8. An assembly according to claim 1, wherein at least one of said nets is made of strips of low pressure polyethylene.
9. An assembly according to claim 1, wherein at least one of said nets and said fill strips are of different thermoplastic materials.
10. An assembly according to claim 2, wherein said tight strips of fabric are provided with eyelets through which pegs can be driven to fasten the mat to the ground.
11. An assembly according to claim 2, wherein said mat includes a border of a tightly woven strip of fabric and said border is provided with means for fastening said mat to the ground.

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