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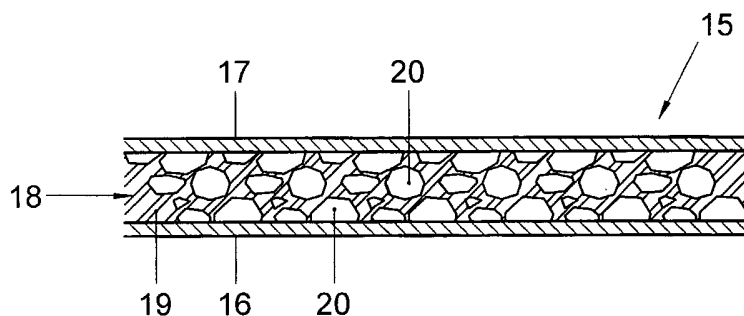
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(54) Title: BOTTOM SEALING MATERIAL, METHOD FOR MANUFACTURING SAME, AND METHOD FOR SEALING THE BED OF A WATERCOURSE.



(57) Abstract: A bottom sealing material for forming a liquid-tight bottom seal wherein material is a bituminous material, which is built-up as a composite membrane comprising a bituminous sub-membrane on which a ballast mass is situated, comprising a mixture of a binder on a mineral material. The ballast mass may be covered with a second bituminous sub-membrane and the binder can contain bitumen.

Title: Bottom sealing material, method for manufacturing same, and method for sealing the bed of a watercourse.

The invention relates to a bottom sealing material, to a method for manufacturing the same, and to a method for sealing the bed of a watercourse.

In various situations, it is of interest to seal a bottom against liquid. For instance, in areas with a low ground water level, it may be desirable to provide watercourses such as channels and the like with a liquid-tight bottom covering. Such a bottom covering prevents water running through the watercourse from disappearing into the ground causing the watercourse to, optionally, go dry. A liquid-tight bottom seal may for instance also be of interest to prevent soil pollution from developing or spreading beyond a specific area.

The invention contemplates providing a suitable bottom sealing material for forming a liquid-tight bottom seal. A further object of the invention is a method for manufacturing such a bottom sealing material and for the use thereof for preventing and/or reducing soil pollution, and for improving dikes. The invention further contemplates providing a relatively simple method for sealing the bed of a watercourse.

A bottom sealing material for forming a liquid-tight bottom seal is characterized according to the invention in a composite bituminous membrane comprising at least one bituminous sub-membrane on which a ballast mass is situated, comprising a mixture of a binder and a mineral material. According to the invention, a method for sealing the bed of a watercourse is further characterized in that strips, plates or tiles of a bituminous material are arranged so as to link up with each other on the bottom and on at least a part of the slopes of the bed.

In the following, the invention will be further described with reference to the accompanying drawings.

Fig. 1 schematically shows, in cross-section, an example of a bottom sealing material according to the invention;

Fig. 2 schematically illustrates in which manner strips or plates of a bottom sealing material according to the invention can be sealingly attached
5 against each other;

Figs. 3, 4 and 5 schematically illustrate a few examples of a method for providing a liquid-tight bottom seal;

Fig. 6 schematically illustrates an example of a method for providing a bottom covering in a channel, while the bottom sealing material is partly
10 formed in situ; and

Figs. 7 and 8 schematically show, in cross-section, the structure of a variant of a bottom sealing material according to the invention.

Fig. 1 schematically shows, in cross section, an example of a bituminous, bottom sealing material 15 according to the invention. The bottom sealing material shown can be considered as a composite membrane which is
15 built up from a first flexible bituminous sub-membrane 16 and a second flexible bituminous sub-membrane 17 with interlocated a layer of ballast material comprising a filling mass 18 consisting of a mixture of binder 19 and a mineral material 20. The binder may comprise bitumen supplemented or not
20 supplemented with one or more other substances such as polymers and fillers. The mineral material may for instance comprise sand and/or gravel 19 and the like.

It is also possible to utilize only a lower sub-membrane. In that case, in Fig. 1, the sub-membrane 17 is not present.

25 A bottom covering material according to the invention can for instance be manufactured as follows.

The sub-membranes 16, 17 can be produced in a manner customary for bituminous roll roofing, but here, preferably, in large lengths whereupon, optionally, several membranes can be attached to each other length-wise
30 and/or width-wise. This can be done through, for instance, welding, while the

bituminous covering layers are melted and pressed together in an overlapping manner and/or by sewing the membranes together in an overlapping manner. Then, the whole is, optionally, rolled up and transported to the production site of the eventual composite membrane.

5 A suitable roll roofing material is applicant's roof-covering material commercially available under the name Universal.

 At the production site, a first sub-membrane is rolled out on a fixed or movable, optionally cooled, underground. Over this, the hot, at least partly melted layer of ballast is poured. This can be a completely prepared mix of
10 binder (bitumen, polymers and fillers) and mineral (sand, stones *et cetera*.) A variant is that first the binder is poured on the sub-membrane, whereupon the minerals are scattered herein. This latter is preferred when no suitable mixing installation is available for binder and minerals, or when the temperature is to be kept lower. The fact is that binder without mineral is more liquid at a
15 specific temperature. The minerals then cool the binder so that the cooling rate is much greater too. As a last step, an upper sub-membrane, if used, is rolled out and pressed tight on the still hot intermediate mass.

 The bottom covering material can be manufactured in prefabrication in a production environment but can also be manufactured in situ as further
20 described in the following.

 The moveable underground can for instance be a movable platform and/or a conveyor or the like.

 Bituminous membranes have as advantage a simple water seal in the overlaps, a great resistance against chemicals, and virtually no leaching
25 towards the water. Below the water, bitumen has a very long lifespan. By modifying (mixing) bitumen with polymers, such as atactic polyolefins or thermoplastic elastomers, the temperature sensitivity, flexibility and, optionally, UV-resistance can be varied within broad margins and be adjusted to the intended use.

A sub-membrane 16, 17 can be built up from, for instance, a carrier consisting of (a combination of) organic fibres (preferably polyester) and/or inorganic fibres (for instance glass) which have been manufactured in two-dimensional shape, in the form of a non-woven material and/or fabric and/or a laid fabric or a combination thereof. This carrier is impregnated and preferably coated two-sidedly with a modified bitumen. Preferably, the sub-membrane is finished with a PP-(spun laid fabric) fleece, provided, for instance, as described in NL patent 1001713. Preferably, this is a sub-membrane as described in NL patent 1001712 because of the high watertightness, bonding properties and punch resistance of this material.

The eventual membrane of the invention consists of one or two sub-membranes 16, 17 on which a mixture 18 of bitumen and minerals in the form of filler, sand, gravel and/or stones 20, respectively, has been provided. Variants are possible by adding aggregates with special functions such as ore-bearing rock with a high density or magnetic materials. However, waste flows such as AVI-waste (incinerator-waste) and/or ground bituminous roof waste can be processed therein too.

Figs. 2 schematically illustrates in which manner two strips, plates or tiles 15a, 15b of the composite membrane can be linked up with each other along a side edge or an end edge. In the example shown, the membrane section 15a has a lower sub-membrane 16 reaching with a free edge 21 beyond the filling mass 18 and an upper sub-membrane 17. An edge part of another membrane section 15b can be laid on the free edge 21 as indicated with an arrow 23. To this end, for instance the edge 21 and/or the edge part of the other membrane section can be heated to obtain a good bonding. It is also possible to use cold or hot adhesive. Optionally, if desired, the other membrane section may be provided with an upper sub-membrane 17 with a free edge which, in a corresponding manner, comes to lie on the membrane section 15a.

In practice, each composite membrane can be produced with a lower sub-membrane projecting on one edge and, optionally, an upper sub-membrane projecting at the opposite edge.

A suitable method for sealing the bottom of a watercourse is briefly
5 elucidated hereinbelow.

Figs. 3 - 5 schematically illustrate in which manner, with the aid of a bottom sealing material according to the invention, a bottom of a watercourse, in this example a channel, can be sealed. Fig. 3 shows a channel 1 with a bottom 2 and slopes 3, 4. The channel has a relatively limited width B1, which is such that strips of bottom sealing material according to the
10 invention can be provided in one length, transversely to the longitudinal direction of the channel from the topside of the one slope over the bottom 2 as far as the topside of the other slope. Fig. 3 shows, at 5, a single strip of bottom sealing material which has been provided in the above-described manner, for
15 instance by rolling out a length of the bottom sealing material supplied on a roller. In practice, the width B1 can be in the range of 10 metres or smaller.

For sealing off a larger part of the channel or even the entire channel in this manner, strips of bottom sealing material linking up with each other can be provided side by side.

20 Fig. 4 shows a channel 1 with a greater width B2 which can be in the order of, for instance, 10 to 20 metres. The channel, including the slopes 3 and 4 is now, each time, sealed off by two strips 6, 7 which are in alignment with each other and extend transversely to the longitudinal direction of the channel. In this example, the strips link up with each other in the centre of the
25 bottom 2.

Fig. 5 shows a channel 1 with a width B3 which can be in the order of 10 metres and more. In this example, the bottom is covered with a strip 8 extending in longitudinal direction of the channel, while the slopes are covered with strips 9, 10 which can extend in longitudinal direction but, as alternative,
30 also transversely thereto. Optionally, the strip 8 can consist of two or more

strips arranged next to each other depending on the width of the channel bottom. The strip or strips 8 are preferably as long as possible but, in practice, will consist of several strips arranged one behind the other.

Naturally, in all cases, it is possible to work with much shorter
5 strips in the shape of plates or tiles. It is thus rendered possible to provide the bottom covering substantially by hand.

Fig. 6 further schematically illustrates a method for manufacturing a composite membrane in situ. In the method as illustrated, use is made of a platform 31, for instance a pontoon, floating on the water 30 in a channel 1 c,
10 d. The platform is provided with a guiding path 33 extending downwards at an inclination in the direction of the bottom 32 of the channel, which path is designed in the example shown as a roller path. When manufacturing a composite membrane in situ according to method represented in Fig. 6, the lower sub-membrane 16 is rolled out from a roller placed on the platform onto
15 the guiding path. Then, the filling mass or the ballast mass 18 is poured, for instance from a hopper 35, on the lower sub-membrane 16. In the event an upper membrane is used, from a second roller 36, the upper sub-membrane 17 is then, in turn, provided on the ballast mass, if an upper membrane is desired. Simultaneously, the platform moves in the direction indicated with an
20 arrow 37 so that the ready composite membrane can then settle down in the wake of the platform on the channel bottom 33, as indicated at 38. Depending on the width of the platform, the thus formed sub-membrane can also cover parts of the slopes of the channel. The rest of the slopes is then covered separately. With a relatively small channel width, also, a channel bridging
25 movable platform could be utilized. If possible, the mineral is preferably won in situ, at least partly. It is possible to first pour at least a part of the mineral filler, for instance stones and/or gravel, on the lower sub-membrane and then pour the liquid binder thereon. Conversely, it is also possible to first pour the liquid binder, already mixed or not already mixed with a part of the mineral
30 filler to be used, on the lower sub-membrane, and to then pour (the rest of) the

mineral filler on the binder. Then, if desired, binder can be added once more. Finally, if desired, an upper sub-membrane can be provided.

Fig. 6 further shows a stopping device 39 which prevents the bottom sealing membrane from gliding from the platform too quickly.

5 In a practical embodiment, the sub-membranes can for instance have a thickness in the order of some millimetres, for instance 3 millimetres, while the intermediate layer could have a thickness in the order of, for instance, 4 to 8 centimetres, for instance 5 centimetres.

10 If the shape of the surface to be sealed or to be enclosed requires the bottom sealing material to make a bend, if desired, at the location of the bend, one of the sub-membranes can be cut into or cut through in order to enhance the hinging action.

In case a membrane according to the invention is used to prevent soil pollution from spreading beyond a predetermined area, the membrane can
15 be dug in vertically around the respective area.

Fig. 7 schematically illustrates, in cross-section, the manner in which a variant of a composite membrane according to the invention can be manufactured and Fig. 8 schematically shows, in cross-section, a bottom seal manufactured in the manner illustrated in Fig. 7.

20 Fig. 7 schematically shows, in cross-section, four strips of lower sub-membranes 40, 41, 42, 43, whose longitudinal axis extends transversely to the plane of the drawing. The longitudinal edge strips 40b, 41a, and 41b, 42a, respectively, and 42b and 43a, respectively, of the sub-membranes are bent upwards and rest against each other in twos. The upwardly bent longitudinal
25 edge strips are attached to each other at a distance from the longitudinal edges through sewing and/or welding as schematically indicated at B. In the thus obtained U-shaped adjoining channels, ballast material 45 is provided in the form of tiles, strips and the like. The ballast material may have been manufactured elsewhere or have been poured into the channels in situ. If
30 already previously manufactured, the ballast material may, if desired, be

provided or may not be provided with a casing. After placing the ballast material, the longitudinal edges of the channel-shaped membranes are folded over the ballast material as is indicated in Fig. 7 with arrows p. Then, if desired, the folded-down longitudinal edges can be bonded on the ballast material through melting and/or with mechanical means such as nails and the like. In one variant, after cooling, the longitudinal edges are cut through width-wise towards the edge at regular distances so that loose side flaps are formed which are alternately cut away, at least partly. Then, the remaining flaps are bonded, for instance burned, on the adjacent cooled ballast mass so that a robust mutual connection is formed allowing a hinge action.

Finally, on the channels filled with ballast material, strips of upper sub-membranes are provided (arrows 9), while the strips of the upper sub-membranes in the example shown extend transversely to the strips of the lower sub-membranes. However, the upper strips can also extend in the same direction as the lower strips or obliquely thereto. In Fig. 7 and Fig. 8, in longitudinal cross section, one strip of an upper sub-membrane 46 is visible. The upper strips may for instance be applied with the aid of the burning method traditionally used when applying roll roofing. If desired, the strips of the lower sub-membranes can also be folded over the ballast material at the extremities, so that the ballast material is completely wrapped, as shown in Fig. 8. This offers the possibility to utilize as ballast material, for instance, tiles containing chemical waste such as, for instance, tar-containing materials. Tar-containing materials are, for instance, aged roofing materials. Leaching of such chemical waste materials is not possible due to the complete enclosing by the sub-membranes.

Apart from being highly suitable for sealing a bed, the material shown in Figs. 7 and 8, like the material shown in Figs. 1 and 2, is also highly suitable for forming a screen to prevent soil polluting substances (from spreading). The material can for instance be dug in approximately vertically around a polluted plot to prevent the polluting substances from spreading. The

material can also be used for, for instance, forming a tray in or on the bottom of a dump to be formed for environmentally harmful waste.

It is noted that after the foregoing, various modifications are readily apparent to the skilled person. The material according to the invention may
5 also be used for, for instance, reinforcing river dikes, sea walls, dams, longitudinal embankments, or quaysides or slopes, respectively, of these and similar damming bodies. Such readily apparent modifications are understood to fall within the framework of the invention.

Claims

1. A bottom sealing material for forming a liquid-tight bottom seal characterized in that the material is a bituminous material, which is built up as a composite membrane which comprises a bituminous sub-membrane on which a ballast mass is situated, comprising a mixture of a binder and a
5 mineral material.
2. A bottom sealing material according to claim 1, characterized in that the composite membrane comprises two sub-membranes between which the ballast mass is situated.
3. A bottom sealing material according to claim 1 or 2, characterized in
10 that the binder contains bitumen.
4. A bottom sealing material according to claim 3, characterized in that the binder further contains polymers and/or fillers.
5. A bottom sealing material according to any one of the preceding claims, characterized in that the mineral material contains one or more
15 materials from a group comprising:
- a. sand
 - b. gravel
 - c. stones
 - d. ore-bearing rock
 - e. magnetic materials
 - 20 f. waste material.
6. A bottom sealing material according to claim 5, characterized in that the waste material contains chemical waste.
7. A bottom sealing material according to any one of the preceding claims, characterized in that at least one of the sub-membranes has a
25 projecting free edge along at least one edge of the composite membrane.

8. A bottom sealing material according to any one of the preceding claims, characterized in that the sub-membranes are composed of strips of the bituminous roofing material type.
9. A method for manufacturing a bottom sealing material according to
5 any one of the preceding claims, characterized in that on an underground a first prefabricated sub-membrane is rolled out, and that on the rolled-out sub-membrane a ballast mass is poured.
10. A method according to claim 9, characterized in that on the ballast mass a second prefabricated sub-membrane is provided.
- 10 11. A method according to claim 9 or 10, characterized in that the underground is formed by a movable platform.
12. A method according to claim 11, characterized in that the movable platform is formed by a conveyor.
13. A method according to any one of claims 9 – 11, characterized in that
15 the underground is cooled.
14. A bottom sealing material according to claim 2 or any one of claims 3 – 8 insofar as dependent on claim 2, characterized in that the lower sub-membrane comprises a number of strips of bituminous material, with the strips adjoining and being attached to each other by raised longitudinal strips
20 at a distance from the longitudinal edges, for forming coupled U-shaped channels, while in the channels ballast material is provided and the longitudinal edges of the channels are folded over the ballast material, while over the obtained assembly, strips of bituminous material have been provided for forming an upper sub-membrane.
- 25 15. A bottom sealing material according to claim 14, characterized in that the ballast material comprises prefabricated tile-shaped or strip-shaped packs.
16. A bottom sealing material according to claim 14 or 15, characterized in that the strips of the upper sub-membrane extend transversely to the
30 longitudinal direction of the channels.

17. A bottom sealing material according to claim 14, 15 or 16, characterized in that the longitudinal edge strips are attached to each other through sewing and/or welding.
18. A bottom sealing material according to any one of claims 14 – 17,
5 characterized in that the longitudinal edge strips are divided by transverse cuts into side flaps which, alternately, have been cut away, at least partly, while the remaining side flaps have been bonded to the ballast material of neighbouring strips of bottom sealing material.
19. A method for screening off an area with polluted soil, characterized
10 in that strips of a bottom sealing material according to any one of claims 1 – 8 or 14 – 16 are dug in around the area to be screened off.
20. A method for forming a dump for environmentally harmful waste, characterized in that in or on the bottom, at the location of the dump to be formed, a tray is formed with the aid of a bottom sealing material according to
15 any one of claims 1 – 8 or 14 – 18.
21. A method for reinforcing at least parts of damming bodies, comprising the use of a bottom sealing material according to any one of claims 1 – 8 or 14 – 18.
22. A method for sealing the bed of a watercourse, characterized in that
20 strips, plates or tiles of a bituminous material are provided, linking up with each other on the bottom and on at least a part of the slopes of the bed.
23. A method according to claim 22, characterized in that a composite membrane is used with at least a lower sub-membrane and ballast layer, the lower sub-membrane having a free projecting edge on at least one of the edges
25 of the composite membrane, and that adjoining sections of the composite membrane are linked up with each other by, each time, applying a membrane section on the free projecting edge of an adjoining membrane section.
24. A method according to claim 22 or 23, characterized in that for forming a bend, a sub-membrane is cut into or cut through.

25. A method for in situ manufacturing and placing a composite membrane in a bed of a watercourse, characterized in that on a floating platform a first prefabricated sub-membrane is rolled out, that on the rolled-out sub-membrane a filling mass is poured and that on the filling mass, a
- 5 second prefabricated sub-membrane is provided while the platform moves and the ready, composite membrane is guided on one extremity from the platform to the bottom to be sealed off.
26. A method according to claim 25, characterized in that the filling mass is composed, at least partly, with mineral material won near the movable
- 10 platform.
27. An area to be obtained with a method according to claim 19.
28. A dump for environmentally harmful waste to be obtained with a method according to claim 20.
29. A damming body to be obtained with a method according to one or
- 15 more of claims 21 – 26.

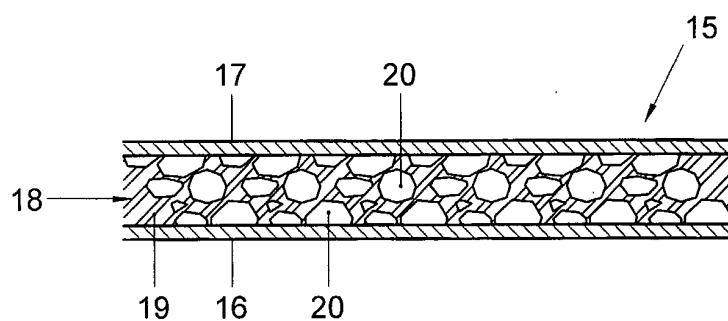


Fig. 1

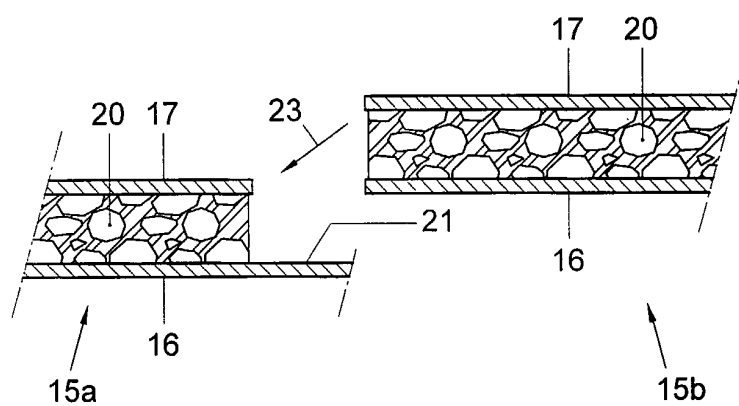


Fig. 2

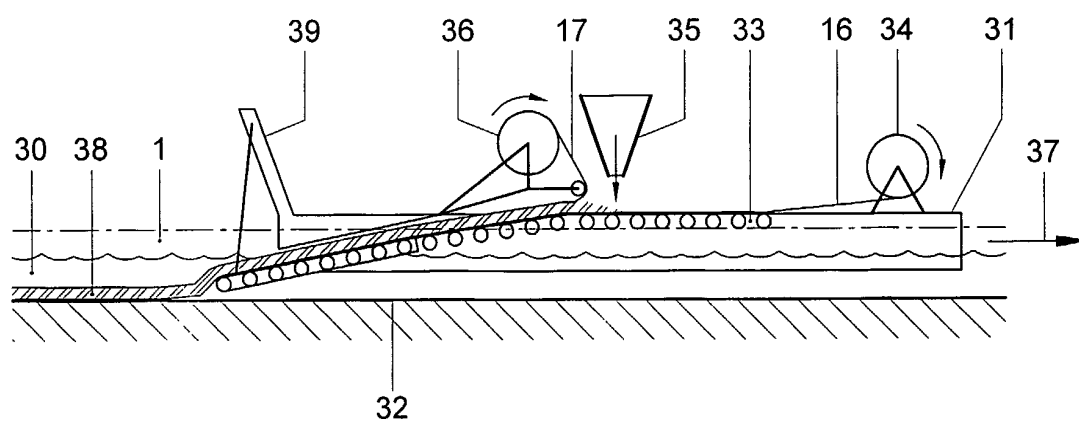


Fig. 6

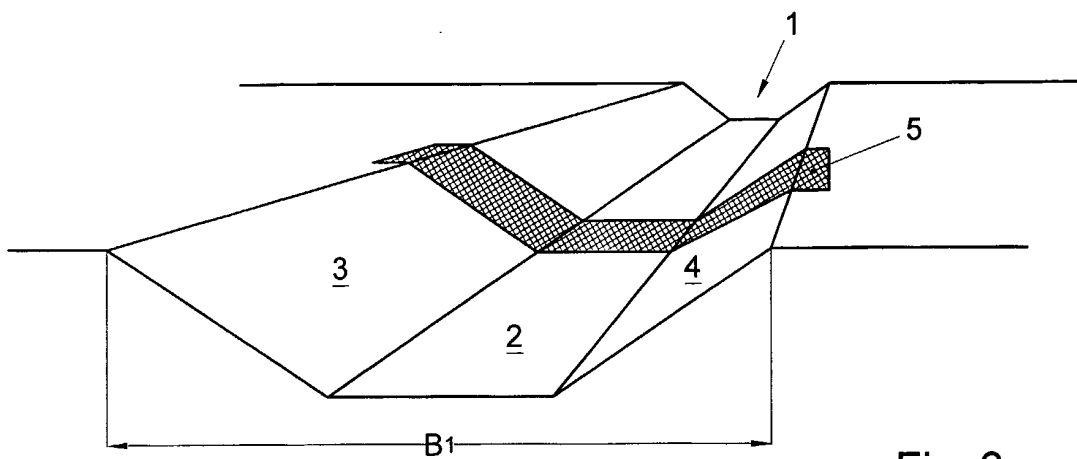


Fig. 3

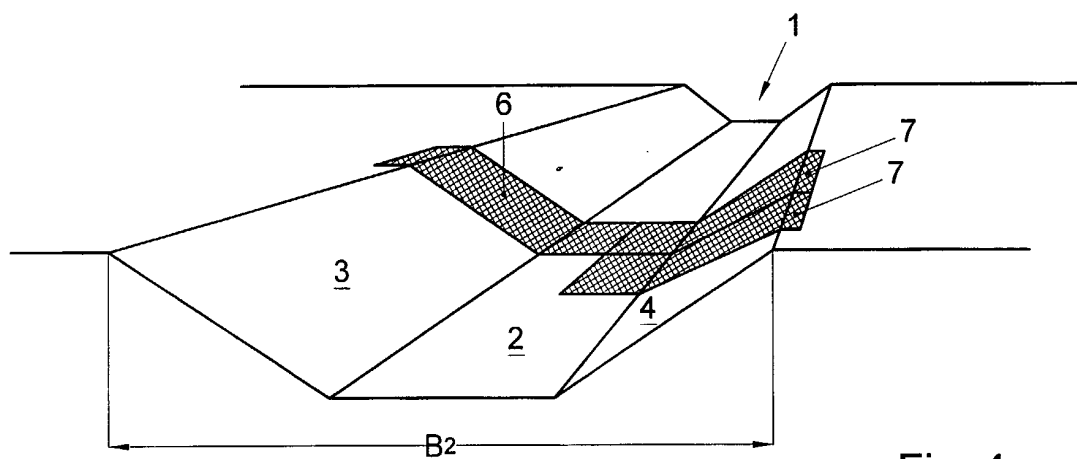


Fig. 4

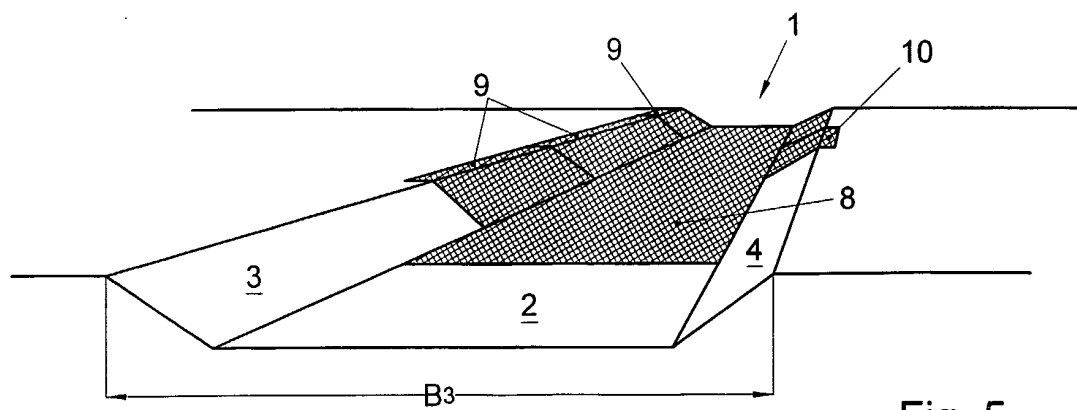


Fig. 5

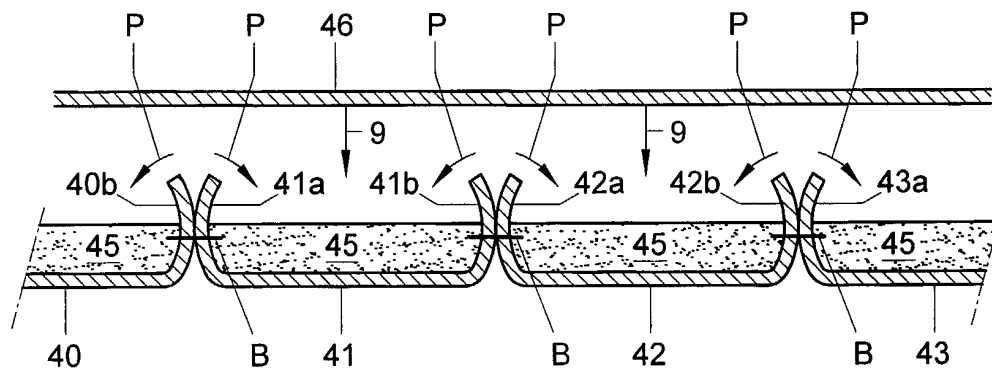


Fig. 7

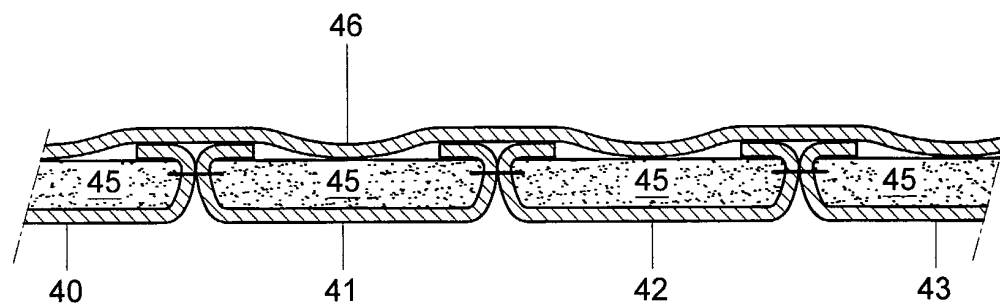


Fig. 8