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(54) **SPORTS PITCH AND METHOD OF CONSTRUCTING SAME**

SPORTPLATZ UND VERFAHREN ZU DEREN KONSTRUKTION

EMPLACEMENT SPORTIF ET SON PROCÉDÉ DE CONSTRUCTION

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EP 3 332 066 B1

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Description**Field of the Invention**

5 **[0001]** The invention relates to a sports pitch according to the preamble of claim 1 and to a method of constructing a sports pitch according to the preamble of claim 11.

Background

10 **[0002]** Since the 1960s some sports teams and governing bodies have experimented with the introduction of artificial playing surfaces to replace traditional grass pitches. Natural grass pitches are expensive to maintain, and limit use of the pitch in inclement weather, becoming, for example, too muddy in heavy rain or too hard when the ground freezes. Natural grass pitches can also be very difficult to grow satisfactorily in partially or fully enclosed stadia. Examples of artificial playing surfaces are disclosed in EP 2154291, US 2005/042394, KR 100881167, WO 9301356, WO 2011036600, 15 KR 20120044788 and GB 2248024.

[0003] The original artificial pitches were found to be unsatisfactory. Their surfaces were harder than a grass surface, increasing the risk of injury and altering the dynamics of play in games like cricket. The abrasive artificial grass blades of artificial turf were painful to slide over, limiting their use for higher contact sports.

20 **[0004]** Many of the problems of the original artificial pitches have been solved by the current "third generation" of artificial playing surfaces. Indeed, a recent study concluded that there is no difference between the injuries sustained on a third generation artificial pitch and those sustained on a natural grass pitch. As a result, participants and governing bodies of many sports are once again looking at the introduction of artificial pitches as a way of saving money on pitch maintenance.

25 **[0005]** An artificial playing surface typically comprises three key elements. A surface layer such as artificial turf rests on a layer providing performance regulation, which in turn sits on a layer providing stability. In a common system currently in use, synthetic blades of grass are tufted into a backing fabric to form the artificial turf. An infill of sand and/or rubber is then placed between the synthetic blades. The infill keeps the blades upright, and provides suitable shock absorbency for the sport being played on the surface.

30 **[0006]** In an alternative embodiment of current pitch design, a shock absorbing layer is placed underneath the synthetic grass layer, typically comprising rubber or closed-cell foam shock pads.

[0007] In both of these embodiments, sometimes referred to as 'dynamic' systems, a substantial stabilising layer is required to provide the necessary stability to ensure the surface layer can provide the desired performance characteristics. Typically, the stabilising layer is a thick layer of stones. A large area of ground must be excavated with a large volume of soil and earth being removed, which normally needs disposing of away from site. A large amount of stone is then put 35 into the excavated space. This is an expensive process with a large carbon footprint.

[0008] It is also known to provide a stabilising layer, which incorporates a Macadam layer on top of the thick layer of stones. Such pitches are sometimes referred to as 'engineered' systems. Laying the Macadam layer requires the use of specialist machinery. Accordingly, complexity, and time required to install the pitch may be increased. The specialist machinery may also be heavy and therefore any layer of stone must support the weight of the specialist machinery 40 during construction.

[0009] For outside pitches, further excavation is typically needed to create drainage channels running under the stabilising layer, further adding to the time needed for producing the artificial pitch.

[0010] Therefore, despite the progress made in artificial playing surfaces, there is still room for further improvement to reduce construction time, spoil disposal and carbon emissions associated with building an artificial pitch.

45 **[0011]** It is an object of the invention to address one or more of the above mentioned problems.

Summary of the Invention

50 **[0012]** In accordance with a first aspect of the invention there is provided a sports pitch comprising a base layer, an intermediate layer, an impervious layer located between the intermediate layer and the base layer and a surface layer, wherein the base layer comprises stones and is up to 200mm thick, wherein the intermediate layer comprises or consists essentially of a foam layer comprising expanded polypropylene, and wherein the intermediate layer has a thickness of at least 40mm and up to 65mm and has a density of at least 30 grams per litre and up to 60 grams per litre.

55 **[0013]** The required performance standard will depend on the intended use or uses of the playing surface, which may include one or more sports. For instance, the required performance standard may be governed by the guidelines, rules and/or regulations of one or more sports' organisations or governing bodies.

[0014] In this way, the depth of the supportive base layer can be greatly reduced, requiring less excavation, less transporting of materials such as stone and spoil, and reducing installation times.

[0015] In a particular embodiment, the intermediate layer or foam layer comprises one or more energy dissipating formations. The energy dissipating formations may be configured to dissipate energy of an impact on the playing surface through deformation. In some embodiments, the foam layer comprises a plurality of downwardly extending energy dissipating projections.

[0016] The intermediate layer or foam layer may be formed of a plurality of tiles. The tiles may be placed adjacent to each other without interlocking, or may comprise a plurality of interlockable tiles, each tile having formations for cooperating with formations on the other tiles for interlocking the tiles together.

[0017] In this arrangement of the intermediate layer or foam layer, the projections may deform into the spaces between the projections upon impact from the playing surface. Appropriately shaped and arranged projections can change the profile of how energy is dissipated, and so can allow the performance regulating ability of the intermediate layer or foam layer to be tuned for a given sport or activity on the playing surface.

[0018] The top surface of the intermediate layer or foam layer may comprise a rough surface that contacts the surface layer to provide high frictional resistance to the relative movement between the top surface and surface layer. The surface layer may be adapted for the playing of a particular sport. For example, the surface layer may be an artificial turf for playing traditionally grass-based sports such as football or rugby.

[0019] The density of the intermediate layer may be up to 50 grams per litre. The density of the intermediate layer may be up to or at least 35 grams per litre and/or up to or at least 45 grams per litre. The density of the intermediate layer may be approximately 40 grams per litre.

[0020] A thinner intermediate or foam layer may not provide adequate support to the surface layer, and could break apart during use. In some embodiments, at least two of the plurality of projections may have a height of at least approximately 10mm, and preferably, the majority of the plurality of projections have a height of at least approximately 10mm. For example, at least two of the plurality of projections may have a height of approximately 15mm.

[0021] The stones may be clean stones, without any dust on or between the stones. Alternatively, some or all of the stones may be dusty. Previous systems have required the supportive base layer to comprise clean stones to prevent frost heave. The reduced depth of supportive base layer allowed by the first aspect of the invention prevents the occurrence of frost heave, and so permits the use of dusty stones. Dusty stones do not require energy to be expended in cleaning the stones, and so may be cheaper than clean stones. Additionally, finer stones may be used than previously, which can provide increased stability.

[0022] The supportive base layer may be between 100mm and 200mm thick. The supportive base layer may have a thickness of up to or at least 100mm, up to or at least 125mm, up to or at least 150mm, and/or up to or at least 175mm. In some embodiments, the supportive base layer may be approximately 150mm thick. In previous systems, a much thicker base layer of approximately 300-350mm has typically been required.

[0023] In some embodiments, the intermediate layer or foam layer or each tile of the intermediate layer or foam layer may further comprise one or more holes configured to drain water away from the surface layer. The or each hole may extend from the top surface to the bottom surface of the intermediate layer or foam layer or each tile of the intermediate layer or foam layer.

[0024] The impervious layer between the intermediate or foam layer and the supportive base layer prevents fluids draining from the surface layer from reaching the supportive base layer. Water may collect at the interface between the intermediate or foam layer and the impervious layer, and drain out of the edge of the pitch. The impervious layer may be configured to direct liquid to a preferred edge of the intermediate or foam layer. Water may be collected from the edge of the pitch by a drainage system, and may be recycled. This may be advantageous over previous inventions where water was drained through the supportive base layer into constructed drainage channels, or lost into the ground. Advantageously, the present invention may not require the construction of drainage channels and installation of pipes running under the pitch, thereby reducing installation times compared with previous pitch construction methods.

[0025] The impervious layer may be up to or at least 0.5mm thick, up to or at least 0.75mm thick, up to or at least 1.0mm thick, up to or at least 1.25mm thick and/or up to or at least 1.5mm thick. For instance, the impervious layer may have a thickness between 0.75mm and 1.5mm. The impervious layer may be formed of an impervious membrane. The impervious layer may comprise a polymeric material, e.g. polyethylene or polypropylene. The impervious layer may comprise or be made of polyethylene or coated polypropylene.

[0026] The supportive base layer may have a slight incline across at least a portion of its surface. The slight incline across the surface of the supportive base layer may be at least, up to or approximately 1%, at least, up to or approximately 3%, and/or at least, up to or approximately 5%.

[0027] In an embodiment, in which the playing surface comprises an impervious layer, the playing surface may be configured such that the playing surface has a horizontal drainage flow capacity of 0.4 litres per metre per second ($1/(m*s)$) or more, 0.5 $1/(m*s)$ or more, 0.6 $1/(m*s)$ or more, 0.7 $1/(m*s)$ or more, 0.8 $1/(m*s)$, 0.9 $1/(m*s)$ or more, or 1 $1/(m*s)$ or more.

[0028] According to a second aspect of the invention, there is provided a method of constructing a playing surface comprising the steps of: partially filling a vacant space to form a base layer; placing an impervious layer above the base

layer; placing an intermediate layer above the impervious layer; and placing a surface layer above the intermediate layer; wherein the base layer comprises stones and is up to 200mm thick, wherein the intermediate layer comprises or consists essentially of a foam layer comprising expanded polypropylene, and wherein the intermediate layer has a thickness of at least 40 mm and up to 65 mm and has a density of at least 30 grams per litre and up to 60 grams per litre.

[0029] Optionally, the method may comprise the step of excavating a layer of soil to form the vacant space.

[0030] The vacant space may have a depth of no more than 300 mm or no more than 250 mm.

[0031] In some embodiments, the intermediate layer or foam layer may comprise a top surface and a plurality of downwardly extending energy dissipating projections, wherein the plurality of projections are arranged to dissipate energy of an impact through deformation. Placing the foam layer may comprise placing a plurality of foam tiles, each tile comprising a top surface and a plurality of downwardly extending energy dissipating projections, wherein the plurality of projections are arranged to dissipate energy of an impact through deformation.

[0032] Partially filling the vacant space may comprise partially filling the vacant space with stones, wherein the stones may be clean stones or dusty stones or a combination of both.

[0033] The supportive base layer may be built with a slight incline across at least a portion of its surface.

[0034] The method may further comprise the step of placing an impervious layer between the supportive base layer and the intermediate layer or foam layer, and optionally or additionally may comprise the step of providing a drainage system to collect fluid from the surface of the impervious layer.

Detailed Description

[0035] The invention is described in further detail below by way of example and with reference to the accompanying drawings, in which:

figure 1 is a schematic cross sectional diagram of an embodiment of a playing surface;

figure 2 is a schematic cross sectional diagram of a foam layer;

figure 3 is a schematic diagram of a tile of a foam layer; and

figure 4 is a schematic cross sectional diagram of an alternative embodiment of a playing surface.

[0036] Figure 1 illustrates schematically a cross section of an embodiment of a playing surface 1, such as an artificial sports pitch, according to the invention. The term "playing surface" is widely used in the art, and is understood to mean the layer or layers, either natural or artificial, that provide the uppermost portion of the playing pitch, court or suchlike. The playing surface of the present invention comprises a supportive base layer 2, an intermediate layer 3 and a surface layer 4.

[0037] The supportive base layer 2 is typically composed of stones. To build a playing surface according to conventional systems, a large volume of ground must first be excavated, producing a large amount of soil that must be removed from the site and disposed of. This process is both time-consuming and environmentally damaging.

A large amount of stones must be brought to the site to fill the majority of the depth of the excavated hole. A thick stone layer is necessary to provide sufficient support and stability to the surface layer above, in particular a macadam layer and the laying of it with heavy, specialist machinery. Providing this large amount of stone is again time-consuming and environmentally damaging.

[0038] It is an aim of this invention to reduce the thickness of the supportive base layer required to provide sufficient support to the above layers. This will reduce the number of stones and amount of excavation needed, and make building the playing surface more environmentally friendly, as well as reducing the time required for installation of the pitch.

[0039] This aim is achieved by providing an intermediate layer such as a foam layer 3 that is configured to provide both stability and performance regulation to the surface layer 4 above. In this way, the thickness of the supportive base layer 2 may be significantly reduced from approximately 300-350mm, as is typical in conventional playing surfaces, e.g. to about 150mm thick.

[0040] Performance regulation is crucial to replicating the feel of a natural grass pitch, and to providing a playing surface that can absorb the impact of falls and minimise the risk of injury to players on playing surface. In conventional systems, this has been provided by a regulation layer such as foam or shock pads. In those systems, the regulation layer did not provide a supportive function, and so required a large stone supportive layer.

[0041] Advantageously, by using a suitable foam layer, the foam layer can provide both the necessary performance regulation and support to the surface layer above and the stability of the overall construction. In this way, the thickness of the supportive base layer may be greatly reduced, e.g. to around half or even a third, of the values typical in conventional playing surfaces.

[0042] In a preferred embodiment shown in figure 2, the foam layer 3 comprises a top surface 5 and a bottom surface 6. The top surface 5 may have a roughened texture to provide high frictional resistance to relative motion between the top surface 5 and the surface layer 4. A high resistance may prevent movement of the surface layer 4 during games

played upon the surface layer 4.

[0043] The bottom surface 6 comprises a plurality of energy dissipating projections 7 extending downwards away from the top layer. The plurality of projections 7 are arranged to dissipate energy of an impact through deformation. The projections 7 have a height that is less than the total thickness of the foam layer 3. The projections 7 are shaped (tapered) such that they are narrowest at their bottom-most part. Valleys 8 are formed between the projections 7.

[0044] In the illustrated embodiment, the projections 7 are dome shaped, however it will be understood that other shapes may be used for the projections 7. In particular, the shape of the projections 7 may be selected to provide the most suitable performance regulation to the surface layer 4 for the sport or game that is intended to be played upon the surface layer 4.

[0045] In this preferred embodiment, the dome shaped projections 7 are arranged in a pseudo-hexagonal packing arrangement with each projection 7 being close to, but spaced from, adjacent projections 7. The spaces between the projections form part of the valleys 8.

[0046] In this embodiment, the foam layer 3 is formed of expanded polypropylene with a density of approximately 40 grams per litre. In other embodiments, the density of the foam layer 3 may be greater than about 30 grams per litre, or preferably, approximately 30 to 50 grams per litre, or approximately 30 to 60 grams per litre. Lower densities could be used, but generally cannot provide the performance regulation and stability required of the foam layer 3.

[0047] Alternatively, foam layer 3 may be formed of other suitable materials, such as polyurethane, or expanded polyethylene.

[0048] The foam layer 3 may have a thickness, defined from the top surface 5 to the bottom-most part of the bottom surface 6, of around 40 to 65mm. In the illustrated embodiment, the foam layer 3 has a thickness of approximately 55mm. The plurality of projections 7 have a height h of approximately 15mm, defined from the vertical position where the projection 6 is narrowest to the vertical position where the projection 6 is widest. In other embodiments, at least two of the plurality of projections may have a height of at least approximately 10mm, and preferably the majority of the plurality of projections 7 have a height of at least approximately 10mm. In a preferred embodiment, the majority of the plurality of projections have a height of approximately 15mm.

[0049] In some embodiments, the foam layer 3 illustrated in figure 2 may comprise a plurality of foam tiles, wherein each tile comprises a top surface 5 and a plurality of downwardly extending energy dissipating projections 7, the plurality of projections 7 being arranged to dissipate energy of an impact through deformation. Providing the foam layer 3 as a plurality of tiles may facilitate transportation and construction of the playing surface 1. The foam tiles may have any shape. For example, the foam tiles may be substantially rectangular in shape, e.g. with lengths of at least 1100mm and/or to up to 1700mm, and widths of at least 800mm and/or up to 1300mm. In a preferred embodiment, the dimensions of the foam tile may be approximately 1200mm x 900mm. In an alternative embodiment, the dimensions of the foam tile may be approximately 1600mm x 1200mm.

[0050] Figure 3 schematically illustrates a preferred embodiment of a foam tile 9. In this embodiment, tile 9 further comprises recesses 10 and protrusions 11. These formations are configured to cooperate with corresponding formations on adjacent tiles 9 in order to interlock adjacent tiles 9. Interlocking the tiles 9 may make foam layer 3 more stable.

[0051] In this embodiment, the tile 9 further comprises one or more holes 12 extending from the top surface 5 to the bottom surface 6 of the tile 9. Typically, each hole 12 may extend from the top surface 5 to a part of the bottom surface 6 that is between projections 7. The holes 12 allow water to drain from the surface layer 4 through to the bottom surface 6 of the foam layer 3. Adequate drainage is necessary to keep the surface layer 4 in a good condition. Holes 12 may be present in any other embodiment of the playing surface 1. Figure 3 shows six holes provided evenly across the extent of the tile 9, but it will be appreciated that any number (e.g. 1, 2, 3, 4, 5, or more) may be provided. The hole(s) 12 may be of any size and shape, in any location, and arranged in any pattern as suits the requirement of the playing surface 1.

[0052] The holes 12 may have a diameter of up to or at least 5mm, up to or at least 10mm or up to or at least 20mm. Typically, the holes may have a diameter of approximately 5mm.

[0053] The tile may comprise up to or at least 10, up to or at least 20, up to or at least 30, up to or at least 40, and/or up to or at least 50 holes extending from the top surface to the bottom surface of the tile.

[0054] In an example embodiment, the tile may comprise 30 holes extending from the top surface to the bottom surface of the tile, the holes being arranged in a five-by-six array.

[0055] If the playing surface is to be used in an enclosed environment, such as a covered stadium, drainage may not be required. For outside playing surfaces, particularly in wet climates, adequate drainage is essential to maintain the quality of the surface.

In some embodiments, one or more additional foam layers 3 may be stacked on top of foam layer 3, to provide additional support. Tiles 9 may be stacked vertically stacked to produce such a stacking of foam layers 3.

[0056] The surface layer 4 of a playing surface 1 may be any suitable surface for playing sports or games on, and may be adapted for the playing of a particular sport. For sports traditionally played on natural grass pitches, for example, surface layer 4 may comprise an artificial turf.

[0057] Conventional artificial pitches may suffer from frost heave. Frost heave may cause a pitch to swell upwards

due to growing ice trapped under the surface in freezing conditions. To minimise this effect, the depth of the supportive layer is generally increased, increasing cost, environmental impact and installation times.

[0058] In contrast, in the much thinner supportive base layer 2 of embodiments of the present invention, frost heave is unlikely. The foam layer 3 may provide good thermal properties to minimise the effects of frost. For example, it has been found that the foam tiles of the present invention have equivalent thermal properties to a 1.7m-deep layer of stone or aggregate.

[0059] The present invention also allows the use of stone with a finer content than in previous 'dynamic' systems, and a thinner depth of stone than 'engineered' systems. Finer stones provide even more stability, and so may allow the thickness of the supportive base layer 2 to be further reduced.

[0060] Figure 4 schematically illustrates an alternative embodiment of a playing surface 13, configured to provide adequate drainage. Playing surface 13 comprises a supportive base layer 14, a foam layer 15 and a surface layer 16, as in the embodiment illustrated in figure 1. Any of the different embodiments of the supportive base layer 2, foam layer 3 and surface layer 4 described above may be incorporated, alone or in combination, into playing surface 13.

[0061] Playing surface 13 further comprises an impervious layer 17 between the foam layer 15 and the supportive base layer 14. Impervious layer 17 may collect water draining downwards from the surface layer 16, and prevent the water from entering the supportive base layer 14, as will be discussed in more detail below.

The impervious layer 17 may be an impervious membrane. The impervious layer may comprise a polymeric material, e.g. polyethylene or polypropylene. For instance, the impervious layer may comprise or be made of polyethylene or coated polypropylene.

[0062] In an embodiment, foam layer 15 is comprised of the tiles 9 discussed above, each tile having a plurality of downwardly extending energy dissipating projections 7, and drainage holes 12. Water from the surface layer 16 may drain downwards through the holes 12 until it reaches impervious layer 17. The valleys 8 between the projections 7 form channels so that water may flow between the impervious layer 17 and the foam layer 15.

[0063] In conventional playing surfaces, drainage is provided by installing drainage pipes or channels under the supportive base layer of the playing surface to carry water to an appropriate outlet. Some water is also lost to the ground below the playing surfaces. This method requires additional deep excavation to house the drainage pipes.

[0064] By using the embodiment of figure 4, drainage channels do not need to be excavated under the playing surface, reducing the installation time.

[0065] The impervious layer 17 may be configured to direct water to a preferred edge or edges or portion(s) thereof of the foam layer 15 so that uncertainty as to where water will drain from is removed. For example, the supportive base layer 14 may be built with a slight incline across at least a portion of its surface, so that the impervious layer 17 is slightly inclined. The slight incline across the surface of the supportive base layer may be at least, up to or approximately 1%, at least, up to or approximately 3%, and/or at least, up to or approximately 5%. Water on the impervious layer 17 may thus be directed to the lowest part(s) of the impervious layer 17. For example, the impervious layer 17 may be inclined by at least, up to or approximately 1%, at least, up to or approximately 3%, and/or at least, up to or approximately 5%. A drainage system 18 may be installed at the edge of the playing surface 13. Drainage system 18 may comprise a pipe or channel that can collect water running off the impervious layer 17, and transport it away from the playing surface 13. Draining water in this way is more efficient than conventional drainage systems, and may allow the collected water to be recycled.

[0066] Tests carried out by the applicant have shown that a pitch according to the present invention may have exceptional horizontal drainage characteristics. The tests were carried out on a pitch according to the invention, in which the intermediate layer comprised a plurality of interlocking tiles made of expanded polypropylene. Each tile comprised a plurality of downwardly extending, hemispherical projections. The pitch further comprised an impervious layer between the intermediate layer and the supportive base layer. In use, water can flow horizontally (i.e. drain from the pitch) in the spaces between the downwardly extending projections and on top of the impervious layer.

[0067] Some results from the applicant's horizontal drainage testing are shown in Table 1 below.

Table 1

Flow capacity l/(m*s)				
Gradient	Sample 1 l/(m*s)	Sample 2 l/(m*s)	Sample 3 l/(m*s)	Mean value l/(m*s)
0.01	0.553	0.551	0.556	0.55
0.03	0.845	0.853	0.849	0.85
0.05	1.023	1.024	1.024	1.02

[0068] Referring to the data in Table 1, for an incline of the supportive base layer and the impervious layer of 1% (a

gradient of 0.01), a mean horizontal drainage (flow capacity) of 0.55 litres per metre per second (l/(m*s) was achieved. For an incline of 3% (a gradient of 0.03), the mean horizontal drainage increased to 0.85 l/(m*s), while for an incline of 5% (a gradient of 0.05), the mean horizontal drainage was 1.02 l/(m*s).

[0069] By way of comparison, in similar tests, a pitch comprising a rubber performance layer arranged on a macadam base typically achieves a horizontal drainage (flow capacity) of around 0.09 l/(m*s), i.e. much lower than the horizontal drainage characteristics that can be achieved with a pitch according to the present invention. In order to boost the horizontal drainage characteristics of a pitch comprising a rubber performance layer arranged on a macadam base, additional drainage channels may be excavated, thereby increasing complexity and the time required to build the pitch.

[0070] Advantageously, however, due to its exceptional horizontal drainage characteristics, a pitch according to the invention may be built without needing to excavate such drainage channels.

[0071] In order to construct the playing surface 1 described above, first a layer of soil may be excavated to form a vacant space, followed by partially filling the vacant space to form a supportive base layer 2. A foam layer 3 is placed above the supportive base layer 2, and a surface layer 4 placed above the foam layer 3. The foam layer 3 is configured to provide a predetermined amount of stability and performance regulation to the surface layer 4.

[0072] Excavating the layer may be achieved using any suitable tool or machine. The excavated space must have the same or slightly larger areal dimensions as the playing surface 1, and its depth must be substantially the same or at least a substantial fraction of the total height of the playing surface 1.

[0073] The vacant space may be partially filled with stones or crushed stones to form the supportive base layer 2. The stones may be clean stones or dusty or dirty stones or a combination of both.

[0074] A foam layer 3 as described above is placed on top of the supportive base layer 2. In an embodiment, placing the foam layer 3 on to the supportive base layer 2 comprises placing a plurality of interlocking foam tiles 9 onto the supportive base layer 2 to form the foam layer 3.

[0075] In some embodiments of the method, an impervious layer 17 is placed on top of the supportive base layer 2 before the foam layer 3 is located. In these embodiments, placing the foam layer 3 comprises placing a foam layer 3 on top of the impervious layer 17, which is in turn on top of the supportive base layer 2.

[0076] The impervious layer 17 may be provided as a roll of material, and placing the impervious layer 17 may comprise unrolling the material across the supportive base layer 2.

[0077] Other embodiments are intentionally within the scope of the invention as defined by the appended claims.

Claims

1. A sports pitch (13) comprising a base layer (14), an intermediate layer (15), an impervious layer (17) located between the intermediate layer (15) and the base layer (14), and a surface layer (16), wherein the intermediate layer (15) comprises or consists essentially of a foam layer comprising expanded polypropylene and has a thickness of at least 40 mm and up to 65 mm, **characterised in that** the base layer (14) comprises stones and is up to 200 mm thick and the intermediate layer (15) has a density of at least 30 grams per litre and up to 60 grams per litre.
2. The sports pitch (13) of claim 1, wherein the intermediate layer (15) comprises one or more energy dissipating formations, optionally wherein the energy dissipating formations are configured to dissipate energy of an impact on the sports pitch through deformation and/or wherein the intermediate layer comprises a plurality of downwardly extending energy dissipating projections, optionally wherein at least two of the plurality of projections have a height of at least 10 mm or wherein a majority or all of the plurality of projections have a height of at least 10 mm.
3. The sports pitch (13) of claim 2 wherein the one or more energy dissipating formations are shaped (e.g. tapered) such that they are narrowest at their bottom-most part, optionally wherein the one or more energy dissipating formations are dome shaped.
4. The sports pitch (13) of any preceding claim, wherein the intermediate layer (15) is formed of a plurality of tiles, optionally wherein the plurality of tiles comprise a plurality of interlockable tiles, each tile having formations for cooperating with formations on the other tiles for interlocking the tiles together.
5. The sports pitch (13) of any preceding claim, wherein the intermediate layer (15) comprises a top surface that contacts the surface layer, the top surface of the intermediate layer being (15) configured to provide high frictional resistance to the relative movement between the top surface and surface layer, optionally wherein the top surface of the intermediate layer (15) is rough, uneven or irregular.
6. The sports pitch (13) of any of the preceding claims, wherein the surface layer (16) is or comprises a layer of artificial

turf.

7. The sports pitch (13) of any of the preceding claims, wherein the base layer (14) comprises clean stones or dusty stones or a combination of both.

8. The sports pitch (13) of any of the preceding claims, wherein the base layer (14) is up to or at least 100 mm thick, for example approximately 150 mm thick.

9. The sports pitch (13) of any of the preceding claims, wherein the intermediate layer (15) further comprises one or more holes configured to drain water away from the surface layer, optionally wherein each hole extends from a top surface to a bottom surface of the intermediate layer (15).

10. The sports pitch (13) of any of the preceding claims, wherein the impervious layer (17) is formed of or comprises an impermeable membrane, and/or wherein the impervious layer (17) is configured to direct liquid to a preferred edge, edges or portion(s) thereof of the intermediate layer (15), and/or further comprising a drainage means or drainage system (18) configured to collect fluid from the surface of the impervious layer (17), and/or wherein the sports pitch (13) is configured such that the sports pitch (13) has a horizontal drainage flow capacity of 0.4 litres per metre per second or more.

11. A method of constructing a sports pitch (13) comprising the steps of:

partially filling a vacant space to form a base layer (14);
placing an impervious layer (17) above the base layer (14);
placing an intermediate layer (15) above the impervious layer (17); and
placing a surface layer (16) above the intermediate layer (15);
wherein the intermediate layer (15) comprises or consists essentially of a foam layer comprising expanded polypropylene and has a thickness of at least 40 mm and up to 65 mm, **characterised in that** the base layer (14) comprises stones and is up to 200 mm thick and the intermediate layer (15) has a density of at least 30 grams per litre and up to 60 grams per litre.

12. The method of claim 11 further comprising the step of excavating a layer of soil to form the vacant space, and/or wherein the vacant space has a depth of no more than 300 mm or no more than 250 mm.

13. The method of claim 11 or claim 12, wherein the foam layer comprises one or more energy dissipating formations, and/or wherein placing the intermediate layer (15) comprises placing a plurality of foam tiles on top of the impervious layer, each tile comprising one or more energy dissipating formations.

14. The method of any of claims 11 to 13, wherein partially filling the vacant space comprises partially filling the vacant space with stones, wherein the stones comprise clean stones or dusty stones or a combination of both.

15. The method of any of claims 11 to 14, wherein the intermediate layer (15) comprises one or more holes configured to drain water away from the surface layer, optionally wherein each hole extends from a top surface to a bottom surface of the intermediate layer, and/or further comprising the step of providing a drainage means or drainage system (18) to collect fluid from the surface of the impervious layer (17).

Patentansprüche

1. Sportplatz (13), eine Grundsicht (14), eine Zwischenschicht (15), eine undurchlässige Schicht (17), die sich zwischen der Zwischenschicht (15) und der Grundsicht (14) befindet, und eine Oberflächenschicht (16) umfassend, wobei die Zwischenschicht (15) im Wesentlichen aus einer Schaumschicht besteht oder diese umfasst, die geschäumtes Polypropylen umfasst und eine Stärke von mindestens 40 mm und bis zu 65 mm aufweist, **dadurch gekennzeichnet, dass** die Grundsicht (14) Steine umfasst und bis zu 200 mm stark ist und die Zwischenschicht (15) eine Dichte von mindestens 30 Gramm pro Liter und bis zu 60 Gramm pro Liter aufweist.

2. Sportplatz (13) nach Anspruch 1, wobei die Zwischenschicht (15) eine oder mehrere Energieableitungsformationen umfasst, optional wobei die Energieableitungsformationen dazu ausgelegt sind, Energie eines Aufpralls auf dem Sportplatz durch Verformung abzuleiten und/oder wobei die Zwischenschicht mehrere sich nach unten erstreckende

Energieableitungsvorsprünge umfasst, optional wobei mindestens zwei der mehreren Vorsprünge eine Höhe von mindestens 10 mm aufweisen oder wobei die meisten oder alle der mehreren Vorsprünge eine Höhe von mindestens 10 mm aufweisen.

- 5 3. Sportplatz (13) nach Anspruch 2, wobei die eine oder die mehreren Energieableitungsformationen derart geformt (z. B. abgeschrägt) sind, dass sie am untersten Teil am schmalsten sind, optional wobei die eine oder die mehreren Energieableitungsformationen kuppelförmig sind.
- 10 4. Sportplatz (13) nach einem der vorstehenden Ansprüche, wobei die Zwischenschicht (15) aus mehreren Fliesen ausgebildet ist, optional wobei die mehreren Fliesen mehrere ineinandergreifende Fliesen umfassen, wobei jede Fliese Formationen aufweist, die mit Formationen an den anderen Fliesen zusammenwirken, um die Fliesen aneinander zu befestigen.
- 15 5. Sportplatz (13) nach einem der vorstehenden Ansprüche, wobei die Zwischenschicht (15) eine Deckfläche umfasst, die die Oberflächenschicht berührt, wobei die Deckfläche der Zwischenschicht (15) dazu ausgelegt ist, einen hohen Reibungswiderstand zur relativen Bewegung zwischen der Deckfläche und der Oberflächenschicht vorzusehen, optional wobei die Deckfläche der Zwischenschicht (15) rau, uneben oder unregelmäßig ist.
- 20 6. Sportplatz (13) nach einem der vorstehenden Ansprüche, wobei die Oberflächenschicht (16) eine Schicht Kunstrasen umfasst oder daraus besteht.
7. Sportplatz (13) nach einem der vorstehenden Ansprüche, wobei die Grundsicht (14) saubere Steine oder staubige Steine oder eine Kombination davon umfasst.
- 25 8. Sportplatz (13) nach einem der vorstehenden Ansprüche, wobei die Grundsicht (14) bis zu oder mindestens 100 mm stark ist, zum Beispiel etwa 150 mm stark ist.
9. Sportplatz (13) nach einem der vorstehenden Ansprüche, wobei die Zwischenschicht (15) ferner ein oder mehrere Löcher umfasst, die dazu ausgelegt sind, Wasser von der Oberflächenschicht weg abzulassen, optional wobei sich jedes Loch von einer Deckfläche zu einer Bodenfläche der Zwischenschicht (15) erstreckt.
- 30 10. Sportplatz (13) nach einem der vorstehenden Ansprüche, wobei die undurchlässige Schicht (17) aus einer undurchlässigen Membran besteht oder diese umfasst und/oder wobei die undurchlässige Schicht (17) dazu ausgelegt ist, Flüssigkeiten zu einer bevorzugten Ecke, bevorzugten Ecken oder einem oder mehreren Abschnitten davon der Zwischenschicht (15) abzuleiten, und/oder ferner eine Entwässerungseinrichtung oder ein Entwässerungssystem (18) umfasst, das dazu ausgelegt ist, Flüssigkeiten von der Oberfläche der undurchlässigen Schicht (17) zu sammeln, und/oder wobei der Sportplatz (13) derart ausgelegt ist, dass der Sportplatz (13) eine horizontale Entwässerungsstromkapazität von 0,4 Liter pro Meter pro Sekunde oder mehr aufweist.
- 35 11. Verfahren zur Konstruktion eines Sportplatzes (13) die folgenden Schritte umfassend:
teilweises Füllen eines leeren Raums, um eine Grundsicht (14) auszubilden;
Platzieren einer undurchlässigen Schicht (17) über der Grundsicht (14);
Platzieren einer Zwischenschicht (15) über der undurchlässigen Schicht (17); und
45 Platzieren einer Oberflächenschicht (16) über der Zwischenschicht (15);
wobei die Zwischenschicht (15) im Wesentlichen aus einer Schaumschicht besteht oder diese umfasst, die geschäumtes Polypropylen umfasst und eine Stärke von mindestens 40 mm und bis zu 65 mm aufweist, **dadurch gekennzeichnet, dass** die Grundsicht (14) Steine umfasst und bis zu 200 mm stark ist und die Zwischenschicht (15) eine Dichte von mindestens 30 Gramm pro Liter und bis zu 60 Gramm pro Liter aufweist.
- 50 12. Verfahren nach Anspruch 11, ferner den Schritt des Ausgrabens einer Bodenschicht umfassend, um den leeren Raum auszubilden, und/oder wobei der leere Raum eine Tiefe von maximal 300 mm oder maximal 250 mm aufweist.
- 55 13. Verfahren nach Anspruch 11 oder Anspruch 12, wobei die Schaumschicht eine oder mehrere Energieableitungsformationen umfasst und/oder wobei das Platzieren der Zwischenschicht (15) das Platzieren mehrerer Schaumfliesen auf der undurchlässigen Schicht umfasst, wobei jede Fliese eine oder mehrere Energieableitungsformationen umfasst.

14. Verfahren nach einem der Ansprüche 11 bis 13, wobei das teilweise Füllen des leeren Raums das teilweise Füllen des leeren Raums mit Steinen umfasst, wobei die Steine saubere Steine oder staubige Steine oder eine Kombination davon umfassen.

15. Verfahren nach einem der Ansprüche 11 bis 14, wobei die Zwischenschicht (15) ein oder mehrere Löcher umfasst, die dazu ausgelegt sind, Wasser von der Oberflächenschicht weg abzulassen, optional wobei sich jedes Loch von einer Deckfläche zu einer Bodenfläche der Zwischenschicht erstreckt und/oder ferner den Schritt des Vorsehens einer Entwässerungseinrichtung oder eines Entwässerungssystems (18), um Flüssigkeiten von der Oberfläche der undurchlässigen Schicht (17) zu sammeln, umfassend.

Revendications

1. Emplacement sportif (13) comprenant une couche de base (14), une couche intermédiaire (15), une couche imperméable (17) située entre la couche intermédiaire (15) et la couche de base (14), et une couche de surface (16), la couche intermédiaire (15) comprenant ou consistant essentiellement en une couche de mousse comprenant du polypropylène expansé et ayant une épaisseur d'au moins 40 mm et inférieure ou égale à 65 mm, **caractérisé en ce que** la couche de base (14) comprend des pierres et a une épaisseur inférieure ou égale à 200 mm et la couche intermédiaire (15) a une densité d'au moins 30 grammes par litre et inférieure ou égale à 60 grammes par litre.

2. Emplacement sportif (13) selon la revendication 1, dans lequel la couche intermédiaire (15) comprend une ou plusieurs formations de dissipation d'énergie, éventuellement dans lequel les formations de dissipation d'énergie sont conçues pour dissiper l'énergie d'un impact sur l'emplacement sportif par déformation et/ou dans lequel la couche intermédiaire comprend une pluralité de projections de dissipation d'énergie s'étendant vers le bas, éventuellement dans lequel au moins deux de la pluralité de projections ont une hauteur d'au moins 10 mm ou dans lequel une majorité ou la totalité de la pluralité de projections ont une hauteur d'au moins 10 mm.

3. Emplacement sportif (13) selon la revendication 2, dans lequel la ou les formations de dissipation d'énergie sont façonnées (par exemple, effilées) de sorte qu'elles sont les plus étroites dans leur partie inférieure, éventuellement dans lequel la ou les formations de dissipation d'énergie sont en forme de dôme.

4. Emplacement sportif (13) selon l'une quelconque des revendications précédentes, dans lequel la couche intermédiaire (15) est formée d'une pluralité de tuiles, éventuellement dans lequel la pluralité de tuiles comprend une pluralité de tuiles à emboîtement, chaque tuile ayant des formations pour coopérer avec des formations sur les autres tuiles pour emboîter les tuiles ensemble.

5. Emplacement sportif (13) selon l'une quelconque des revendications précédentes, dans lequel la couche intermédiaire (15) comprend une surface supérieure qui est en contact avec la couche de surface, la surface supérieure de la couche intermédiaire (15) étant conçue pour fournir une résistance de friction élevée au mouvement relatif entre la surface supérieure et la couche de surface, éventuellement dans lequel la surface supérieure de la couche intermédiaire (15) est rugueuse, inégale ou irrégulière.

6. Emplacement sportif (13) selon l'une quelconque des revendications précédentes, dans lequel la couche de surface (16) est ou comprend une couche de gazon artificiel.

7. Emplacement sportif (13) selon l'une quelconque des revendications précédentes, dans lequel la couche de base (14) comprend des pierres propres ou des pierres poussiéreuses ou une combinaison des deux.

8. Emplacement sportif (13) selon l'une quelconque des revendications précédentes, dans lequel la couche de base (14) a une épaisseur maximale ou minimale de 100 mm, par exemple une épaisseur d'environ 150 mm.

9. Emplacement sportif (13) selon l'une quelconque des revendications précédentes, dans lequel la couche intermédiaire (15) comprend en outre un ou plusieurs trous conçus pour évacuer l'eau de la couche de surface, éventuellement dans lequel chaque trou s'étend d'une surface supérieure à une surface inférieure de la couche intermédiaire (15).

10. Emplacement sportif (13) selon l'une quelconque des revendications précédentes, dans lequel la couche imperméable (17) est formée de ou comprend une membrane imperméable, et/ou dans lequel la couche imperméable

(17) est conçue pour diriger le liquide vers un bord, des bords ou une ou des parties de ceux-ci préférés de la couche intermédiaire (15), et/ou comprenant en outre un moyen de drainage ou un système de drainage (18) conçu pour collecter le fluide de la surface de la couche imperméable (17), et/ou dans lequel l'emplacement sportif (13) est conçu de telle sorte que l'emplacement sportif (13) a une capacité de flux de drainage horizontal d'au moins 0.4 litres par mètre par seconde.

11. Procédé de construction d'un emplacement sportif (13) comprenant les étapes consistant à :

remplir partiellement un espace vide pour former une couche de base (14) ;
 placer une couche imperméable (17) au-dessus de la couche de base (14) ;
 placer une couche intermédiaire (15) au-dessus de la couche imperméable (17) ; et
 placer une couche de surface (16) au-dessus de la couche intermédiaire (15) ;
 dans lequel la couche intermédiaire (15) comprend ou consiste essentiellement en une couche de mousse comprenant du polypropylène expansé et a une épaisseur d'au moins 40 mm et inférieure ou égale à 65 mm, **caractérisé en ce que** la couche de base (14) comprend des pierres et a une épaisseur inférieure ou égale à 200 mm et la couche intermédiaire (15) a une densité d'au moins 30 grammes par litre et inférieure ou égale à 60 grammes par litre.

12. Procédé selon la revendication 11 comprenant en outre l'étape d'excavation d'une couche de sol pour former l'espace vide, et/ou dans lequel l'espace vide a une profondeur maximale de 300 mm ou de 250 mm.

13. Procédé selon la revendication 11 ou la revendication 12, dans lequel la couche de mousse comprend une ou plusieurs formations de dissipation d'énergie, et/ou dans lequel le placement de la couche intermédiaire (15) comprend le placement d'une pluralité de tuiles en mousse sur la couche imperméable, chaque tuile comprenant une ou plusieurs formations de dissipation d'énergie.

14. Procédé selon l'une quelconque des revendications 11 à 13, dans lequel le remplissage partiel de l'espace vide consiste à remplir partiellement l'espace vide avec des pierres, dans lequel les pierres comprennent des pierres propres ou des pierres poussiéreuses ou une combinaison des deux.

15. Procédé selon l'une quelconque des revendications 11 à 14, dans lequel la couche intermédiaire (15) comprend un ou plusieurs trous conçus pour drainer l'eau de la couche de surface, éventuellement dans lequel chaque trou s'étend d'une surface supérieure à une surface inférieure de la couche intermédiaire, et/ou comprenant en outre l'étape consistant à fournir un moyen de drainage ou un système de drainage (18) pour collecter le fluide de la surface de la couche imperméable (17).

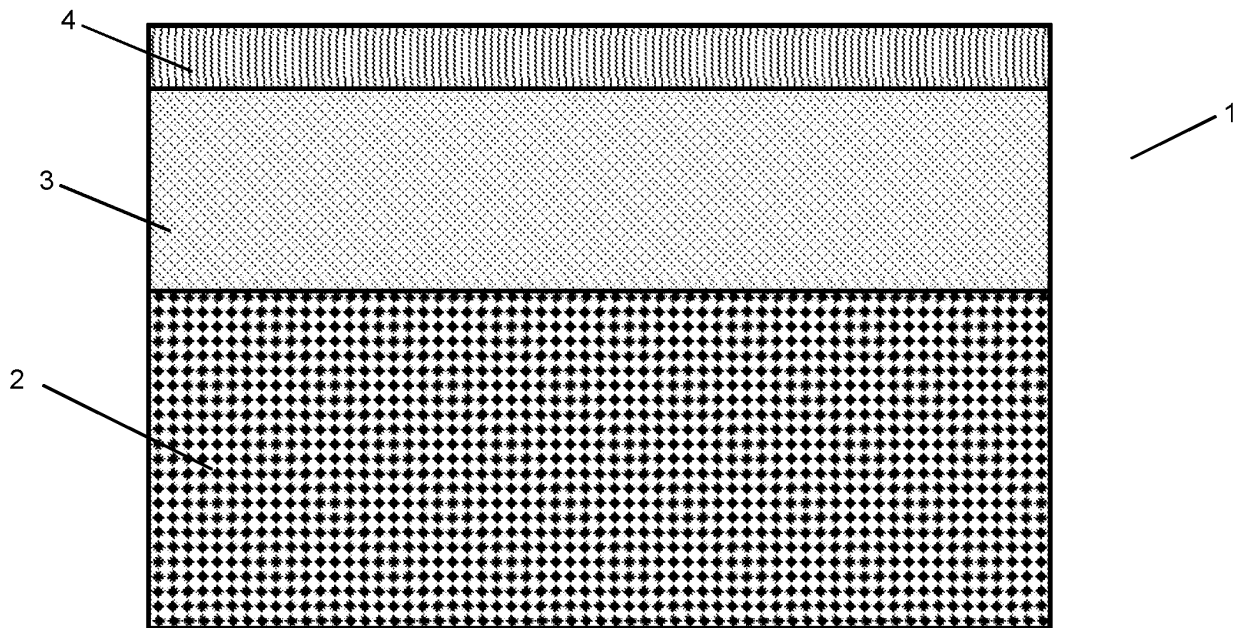


Figure 1

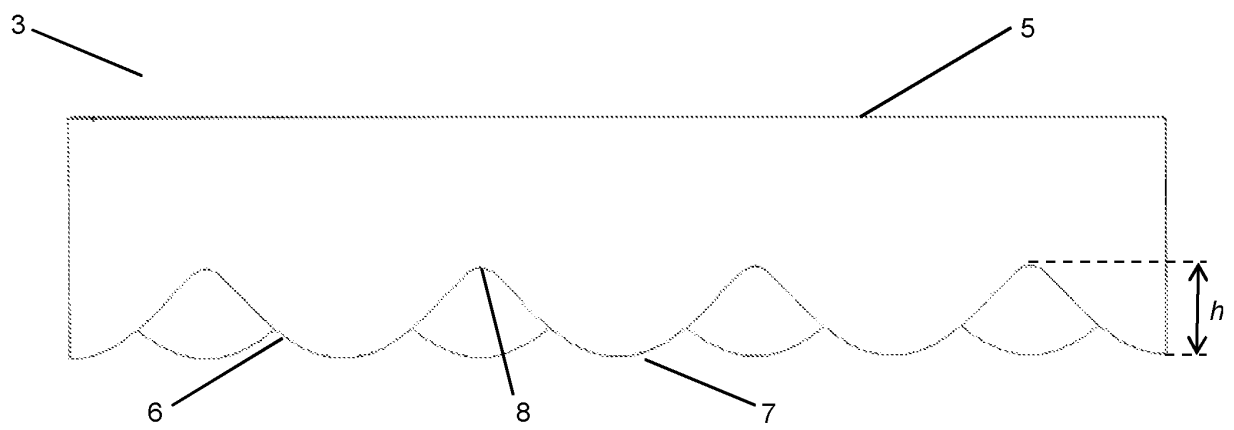


Figure 2

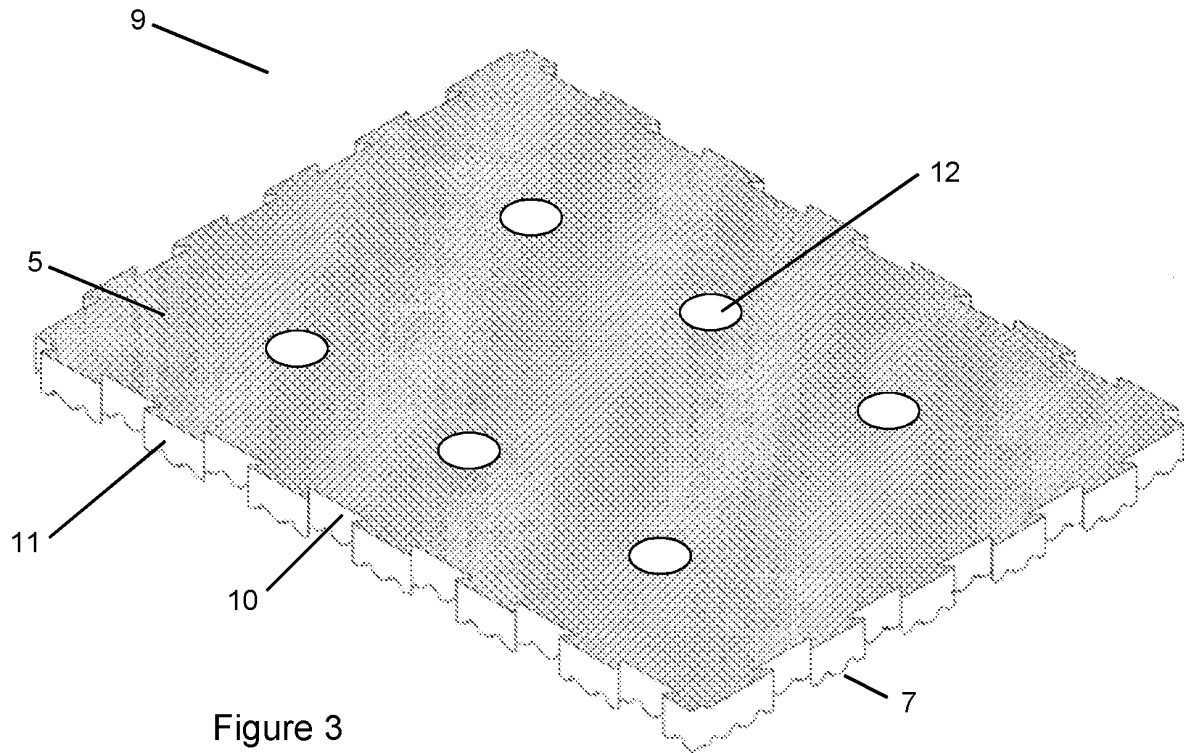


Figure 3

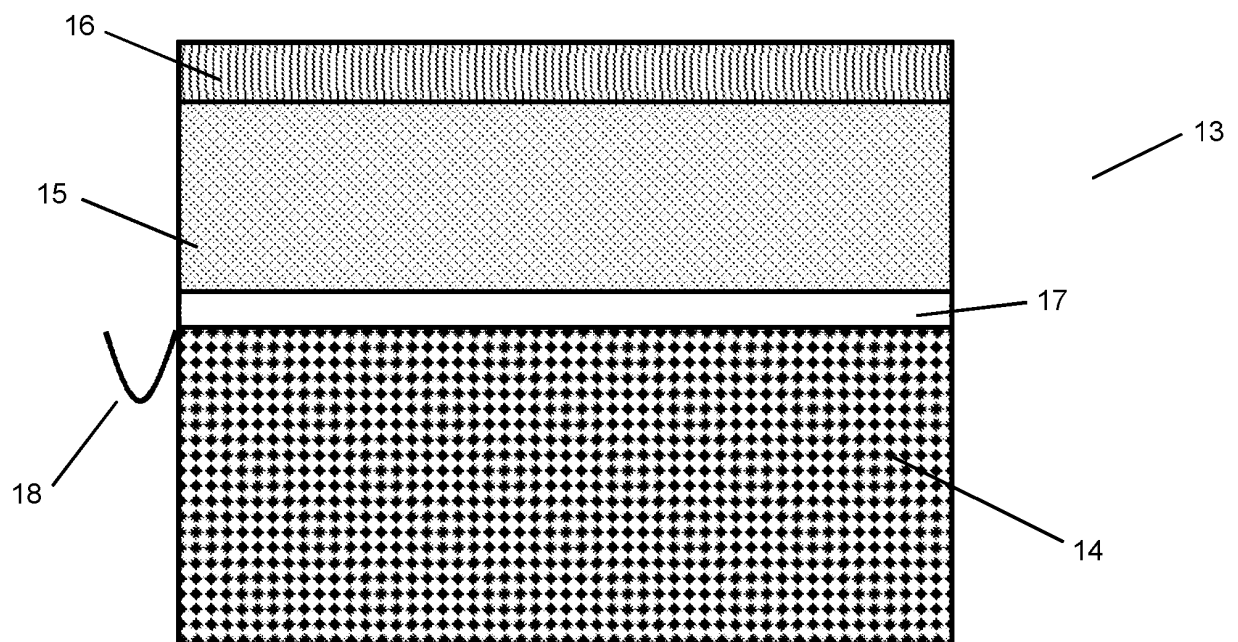


Figure 4

REFERENCES CITED IN THE DESCRIPTION

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