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(54) Bossed waterproofing and draining membrane and relative manufacturing process and device.

(57) A bossed draining membrane and the relative manufacturing process and device including a bossed draining membrane consisting of at least one sheet made of plastic material, usually but not exclusively polythene, whose surface, of which at least one of the faces includes a plurality of relieves projecting from the same side and one or more areas free from said projecting relieves, obtained by means of the extrusion of plastic material in the fluid state will form two plastic films subsequently coupled so that then, the coupled sheet obtained in this way, is forced to descend in a softened state on a shaping roller whose shell is provided with numerous projecting and removable shaping bodies and, subsequent to shaping, is air cooled and directed to a reel for packing.

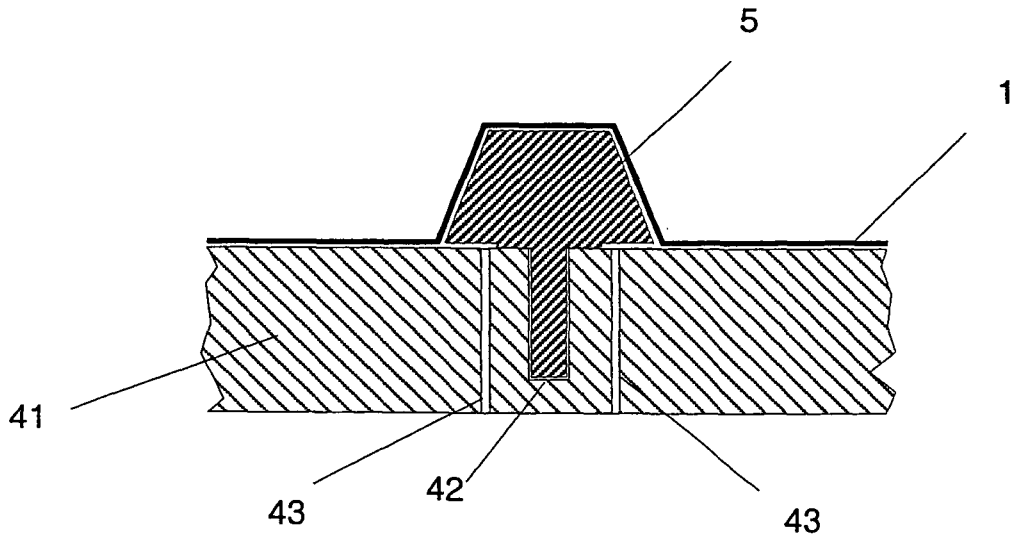

Fig. 3

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Description

[0001] The object of this invention is a bossed waterproofing and draining membrane and the relative manufacturing process and device.

[0002] The proposal finds particular but not exclusive application in the sector of the industry for manufacturing construction materials, in particular in the industry for the production of draining membranes.

Field of the Invention

[0003] Protective membranes are widely used in the construction sector. Among these, draining membranes assume a particular importance and are widely used as support and drainage means for under-soil land surfaces, in tree planting or building foundation works, as well as for the waterproofing of walls or particularly for cement and masonry works. Among the different types of draining membranes, bossed membranes have been known and used for some time. The latter are usually are made up of at least one sheet of plastic material conventionally including, integrated in correspondence with the entire surface and at least in correspondence with one of the two faces, a series of counter-shaped bosses which can be shaped differently. Therefore, as an example, bossed membranes are known whose bosses are indifferently shaped in a semispherical or conical way, or that are square or rectangular. The shape of these types of membranes is such that the bosses contribute to the formation of a series of drainage channels that intersect each other and that are developed in order to allow the verification of the outflow of water infiltrating the soil. Particularly in the case of foundations, typically of buildings as well as in all works that require excavation and the following consolidation of excavated walls, as typically is the case for tunnel ceilings, the need is evident to create a draining interspace between the rock and the walls, particularly in concrete, that allows the outflow of the water present thus preventing the stagnation of said water from creating degradation phenomena in the work. Degrading phenomena are verified as a consequence of expansions caused by the different climatic conditions that typically, due to repeated contractions and expansions according to the temperature increase and decrease, are a cause of stress to the materials of which the structures directly in contact with the ground are constituted. In order to solve these types of drawbacks, certain companies in the sector have developed different solutions for bossed membranes. Among them, a first is found in US3888087 (Bergsland) in which a protective membrane is described for foundation walls whose surface is provided with a series of bosses all identically shaped and regularly spaced with respect to each other, thus allowing regular movement between the membrane and the foundation wall. This shape allows the creation of air channels between the membrane and the foundation wall for greater thermal insulation and to facilitate the drainage of the foundations.

Prior Art

[0004] Many other companies in the sector have developed further solutions for draining membranes of the bossed type among which, as an example, is that described in US6991472 (Hubert) where the teaching concerns a protection membrane for foundation walls that is made up of a smooth external surface, so that said surface can remain attached to the foundation in the event of the lowering of the soil. Said membrane includes a bossed impermeable sheet and a further impermeable membrane that covers the recesses formed by the bosses and provides for the formation of a substantially smooth external surface.

[0005] In US5383314 (Rothberg) a draining membrane is described made in plastic material consisting of a series of projections placed at a regular distance to each other in such a way that drainage channels are created between said projections for the flow of the water. In order to ensure improved support and an improved load resistance capacity, the projections mentioned have a substantially truncated, hemispherical or trapezoidal form. In the known solutions, usually the upper part of the projections holds a small quantity of the drained water, therefore, in order to limit said disadvantage, each projections is provided with a grooved portion.

[0006] Furthermore in W02004/106642 (Hubert) a foundation protection system is described for the external part of the foundation walls consisting of a bossed membrane made in plastic material to be positioned on the external surface of the foundation walls, said membrane is provided with an edge and a stop band that extends along the entire edge of the membrane itself. Both the membrane as well as said stop band are provided with interacting recesses and projection portions, with fastening means made to penetrate between the stop band and the membrane to the foundation wall in this way securing the stop band and the membrane to the foundation wall. The stop band mentioned is further provided with a flexible edge that surmounts the edge of the membrane to which it is associated.

[0007] Also in TV9300032U (Tema) the description is found of a waterproofing membrane particularly for the covering of the exterior and/or interior of walls and floors in general of the type obtained in plastic material and including a plurality of relieves projecting from the same side, in which only on the surmounting area involved or rather along the vertical connection edges, relieves are provided having a different shape with respect to the remaining surface of a sheet with a predetermined width, said relieves respectively constituting a male and female closure provided with a seal, the development of which requires both on the left side and the right side a set of cylindrical shapes joined in groups of five, wherein one or the other provides a series of shapes that are also cylindrical but with a diameter lower than those previous

and interposed in rows vertical to said groups.

[0008] Also in WO94/29530 (Brodeur) a draining membrane solution is described that substantially includes a core consisting of a flexible membrane having at least one bossed face where said bosses are placed at a regular distance to each other and are longitudinally and transversely arranged in parallel rows, as well as including a sheet made in permeable material joined at least to one face of said core made up of the bossed membrane and adapted to be maintained spaced from said bossed membrane through the ends free from bosses, characterised in that said series of bosses present areas free from said bosses that extend longitudinally in relation to said membrane, the dimensions of said areas free from bosses being greater than the intervening distance between adjacent bosses.

Drawbacks

[0009] The known prior art highlights that all the known current solutions for bossed draining membranes are not *per se* free from drawbacks and limitations.

[0010] A first characteristic limitation, in the opinion of the applicant, consists in the difficulty, a characteristic of all the known solutions for bossed draining membranes, of executing the optimal anchorage of the bossed membrane in the absence of areas free from bosses, particularly but not exclusively, if the intended use is the waterproofing and the drainage of the ceiling of a tunnel. The solution described in WO94/29530 (Brodeur) also fails to solve the problem cited because although it concerns a draining membrane including a bossed core provided with longitudinal areas without bosses, the covering materials of said core do not allow the execution of an anchorage in correspondence with areas free from bosses without the consequent damage of said covering materials themselves.

[0011] A second limitation, relative to the known solutions for bossed draining membranes, in the opinion of the applicant and particularly but not exclusively if the intended use is the waterproofing and the drainage of the ceiling of a tunnel, consists not only in the disclosed difficulty of membrane anchorage, but also in the not perfectly efficient drainage that the known solutions for bossed draining membranes allow in relation to the fact that the anchorage means permitted by the absence of areas without bosses are capable of damaging the membrane itself.

[0012] A further characteristic limitation of known solutions for bossed draining membranes, particularly for those intended to be used in waterproofing and drainage works of the ceiling of a tunnel, consists in the need of present solutions to provide material covering layers not protection material of the membrane itself.

[0013] A final limitation of the current solutions for bossed draining membranes, given the obvious difficulty in proceeding with a simple anchorage, consists in the extending of the times necessary for the installation of said membranes.

[0014] In relation to that considered above, the need arises to find alternative solutions and at least more functional solutions with regard to those already in existence.

[0015] The aim of this invention is also to overcome the aforementioned limitations and drawbacks by means of a bossed membrane provided with at least one area free from bosses.

Summary of the Invention

[0016] This and other aims are achieved by the present invention according to the characteristics in the included claims that resolve the problems disclosed by means of a bossed waterproofing and draining membrane and the relative manufacturing process and device including a bossed waterproofing and draining membrane consisting of at least one sheet made in plastic material, usually but not exclusively polythene, whose surface, of which at least one of the faces includes a plurality of relieves projecting from the same side and one or more areas free from said projecting relieves, obtained by means of the extrusion of plastic material in the fluid state will form two plastic films subsequently coupled so that then, the coupled sheet obtained in this way, is forced to descend in a softened state on a shaping roller whose shell is provided with numerous projecting and removable shaping bodies and, subsequent to shaping, is air cooled and directed to a reel for packing.

Advantages

[0017] In this way, certain objectives are achieved by means of the significant creative contribution the effect of which constitutes immediate technical progress.

[0018] A first aim consists in producing a bossed waterproofing and draining membrane which by means of the arrangement of areas free from projecting relieves, namely bosses, allows the optimisation of the anchorage of said membrane while avoiding the drawbacks of the known current solutions for bossed draining membranes.

[0019] A second aim consists in producing a bossed waterproofing and draining membrane that thanks to its particular structuring allows the possibility of predetermining the areas free for anchorage according to the specific positioning requirement demands.

[0020] A third aim consists in producing a bossed waterproofing and draining membrane by means whose particular structuring it is possible to obtain an optimal yield in terms of draining capacity and also avoids the need to associate a protection film to the membrane itself, particularly but not exclusively in the applications intended for the protection of a tunnel ceiling.

[0021] A fourth aim consists in producing a bossed waterproofing and draining membrane by means of whose particular structuring it is possible to obtain greater strength with respect to traditional solutions for membranes particularly in PVC.

[0022] A further aim consists in producing a bossed waterproofing and draining membrane whose innovative manufacturing process allows a significantly more flexible production process with the consequent reduction of the relative manufacturing times and costs.

[0023] A final aim consists in producing a bossed waterproofing and draining membrane thanks to whose particular structuring it is possible to obtain a significant reduction in installation times.

[0024] These and other advantages will appear from the following detailed description of at least one preferred embodiment.

Content of the Drawings

[0025]

Figure 1 represents a plan view of the bossed waterproofing and draining membrane according to the invention that is the object of the present invention;
Figure 2 represents a side view, end-on, of the shaping roller according to the invention that is the object of the present invention;
Figure 3 represents a view, in section, of a characteristic of the shaping roller in Figure 2 with a shaping body highlighted;
Figure 4 represents a view, in section, of the characteristic in Figure 3 with the flat-headed threaded pin highlighted;
Figure 5 represents a view in section of one possible practical embodiment of the invention according to the present invention.

Practical Embodiment

[0026] With reference to the Figures, it is observed that a bossed waterproofing and draining membrane A is of the type consisting of at least one sheet in thermoformable plastic material, usually but not exclusively HDPE, polythene, PVC, PET, PP (polypropylene) or others, such as those having impermeability characteristics. In the preferred embodiment described, the membrane **1** is accompanied by two plastic films obtained through extrusion. By means of a thermoforming process, the surface of the membrane **1,** in correspondence with at least one of the two faces, is provided with a series of projecting relieves **2,** with predefined dimensions, form and number, conventionally defined bosses, said projecting relieves **2** of identical height, are directed in the same direction, so that they all project in relation to the face of the membrane **1.** The shape of the projecting relieves **2** is known and is in a truncated form, usually but not limited to: having the shape of a truncated cone, a truncated pyramid, cylindrical or hemispherical with a flat support base. Thus, in the embodiment example described, the preferred shape of the projected relieves **2** is a truncated cone shape. In relation to the adjacent relief, each projecting relief **2** is placed equidistantly in order, so that said relieves are arranged in parallel rows, preferably regularly spaced. In this way, between the projecting relieves **2** reciprocally intersecting drainage channels will be produced. Provision is made for the projecting relieves **2** not to cover uniformly the entire surface of the membrane **1** but rather the latter presents one or more areas free **3** from projecting relieves **2,** these free areas **3** being the result of a predetermined discontinuity in the regular order of the projecting relieves **2** provided. In more detail, the choice of the distribution of the area or areas free **3** from projecting relieves **2** is determined on the basis of the specific design requirements of the membrane **1** in such a way that the free areas **3** provided can be placed both longitudinally as well as transversely on the surface of the membrane **1.**

[0027] The manufacturing process by means of which the production is achieved of the bossed waterproofing and draining membrane A that is the object of the present invention provides a working cycle organised in more sequential stages in which, following an order that proceeds from upstream to downstream at least the following is provided:

a) a first stage in which the plastic material forming the membrane **1** is transformed to the fluid state;
b) a second stage in which the plastic material forming the membrane **1** softened in this way is forced to exit two extruders producing two plastic films;
c) a third stage in which the two plastic films obtained are adhered and thermally coupled, in order to make a single plastic sheet;
d) a fourth stage in which the plastic sheet, in the softened state, is forced to descend on a power-operated shaping roller **4,** of the vacuum type, whose shell **41** is provided with numerous projecting and removable shaping bodies **5** and by at least one flat-headed threaded pin **6** placed in the holding seat **42** of at least one shaping body **5,** as a substitute for the latter;
e) a fifth thermoforming stage;
f) a sixth stage in which the thermoformed membrane **1** is cooled and a control is executed to verify the presence of holes or the thickness of the membrane;
g) a seventh stage in which the membrane **1** is directed for pulling to a reel and wound in coils for packing.

[0028] In order to allow on the surface of the membrane **1** the production of areas free **3** from projecting relieves **2,** provision is made for the shaping roller **4** to be produced in such a way that the shaping bodies **5** are removable. In more detail, the shaping roller, of the vacuum type, is conventionally provided with outflow channels **43** suitable for allowing the outflow of air present between the shaping roller **4** and the membrane **1,** which is suctioned through suction pressure. Said outflow channels **43** are conventionally placed adjacent to the threaded holding seat **42** of each shaping body **5,** in such a way

that the suction generated allows the necessary adhesion of the material to be formed to the shaping body **5,** the latter being shaped in such a way as to be slightly spaced in relation to the surface of the shell **41** of the shaping roller **4.** This distance provided between the base of the shaping body **5** and the shell **41** of the shaping roller **4** is necessary in order to leave free the entrance of the outflow channels **43,** thus allowing, by means of the suction of the air present between the sheet to be shaped and the shaping body **5,** the relative portion of the sheet that is to be formed to be held in adherence on the walls of the shaping body **5** allowing shaping. In order to be able to produce a membrane which provides areas free **3** from projecting relieves **2,** the holding seats **42** for the anchorage of shaping bodies **5,** with which the shaping roller **4** is provided, are of the threaded type so that said shaping bodies **5** can be easily removed. Thanks to the possibility of removable shaping bodies **5** for the creation of said areas free **3** from projecting relieves **2,** provision is made for the latter to be substituted with flat-headed threaded pins **6.** More precisely, provision is made for the head **61** of each flat-headed threaded pivot **6** to be such that it has a sufficient diameter so as not to obstruct the entrance of the provided outflow channels **43** thus preventing said canals from creating the suction of the air thus avoiding the possibility that said suction could cause any damage to the surface of the membrane **1.**

Claims

1. Bossed waterproofing and draining membrane of the type in impermeable plastic material provided with numerous projecting relieves all of the same height and directed in the same direction in relation to one face of the membrane **characterised in that** the membrane includes at least one area free **3** from projecting relieves **2,** where the areas free **3** from projecting relieves **2** are transversal and longitudinal.

2. Bossed waterproofing and draining membrane of the type in impermeable plastic material provided with numerous projecting relieves all of the same height and directed in the same direction in relation to one face of the membrane **characterised in that** the area free from **3** projecting relieves **2** is transversal.

3. Bossed waterproofing and draining membrane according to claim 1 and 2 **characterised in that** for its production, a shaping roller **4,** of the vacuum type is provided, whose shell **41** is provided with shaping bodies **5,** that project and are removable, and by at least one flat-headed threaded pin **6.**

4. Bossed waterproofing and draining membrane according to the previous claims **characterised in that** the holding seats **42** of the shaping bodies **5** and of the flat-headed threaded pins **6** are threaded.

5. Bossed waterproofing and draining membrane according to the previous claims **characterised in that** the area of the head **61** of each flat-headed threaded pin **6** is such that it does not obstruct the entrance of the outflow channels **43** adjacent to the corresponding holding seat **42** of the flat-headed threaded pin **6.**

6. Bossed waterproofing and draining membrane according to the previous claims **characterised in that** for its production a working cycle is provided including, from upstream to downstream, at least the following stages:

   a) a first stage in which the plastic material forming the membrane **1** is transformed to the fluid state;
   b) a second stage in which the plastic material forming the membrane **1** softened in this way is forced to exit two extruders forming two plastic films;
   c) a third stage in which the two plastic films obtained are adhered and thermally coupled in order to form a single plastic sheet;
   d) a fourth stage in which the plastic sheet, in the softened state, is forced to descend on a shaping roller **4** of the vacuum type, whose shell **41** is provided with numerous shaping bodies **5** that project and are removable, and by at least one flat-headed threaded pin **6;**
   e) a fifth thermoforming stage;
   f) a sixth stage in which the thermoformed membrane **1** is cooled and a control is carried out to verify the presence of holes and the thickness of the membrane;
   g) a seventh stage in which the membrane **1** is directed to a reel and wound in coils for packing.

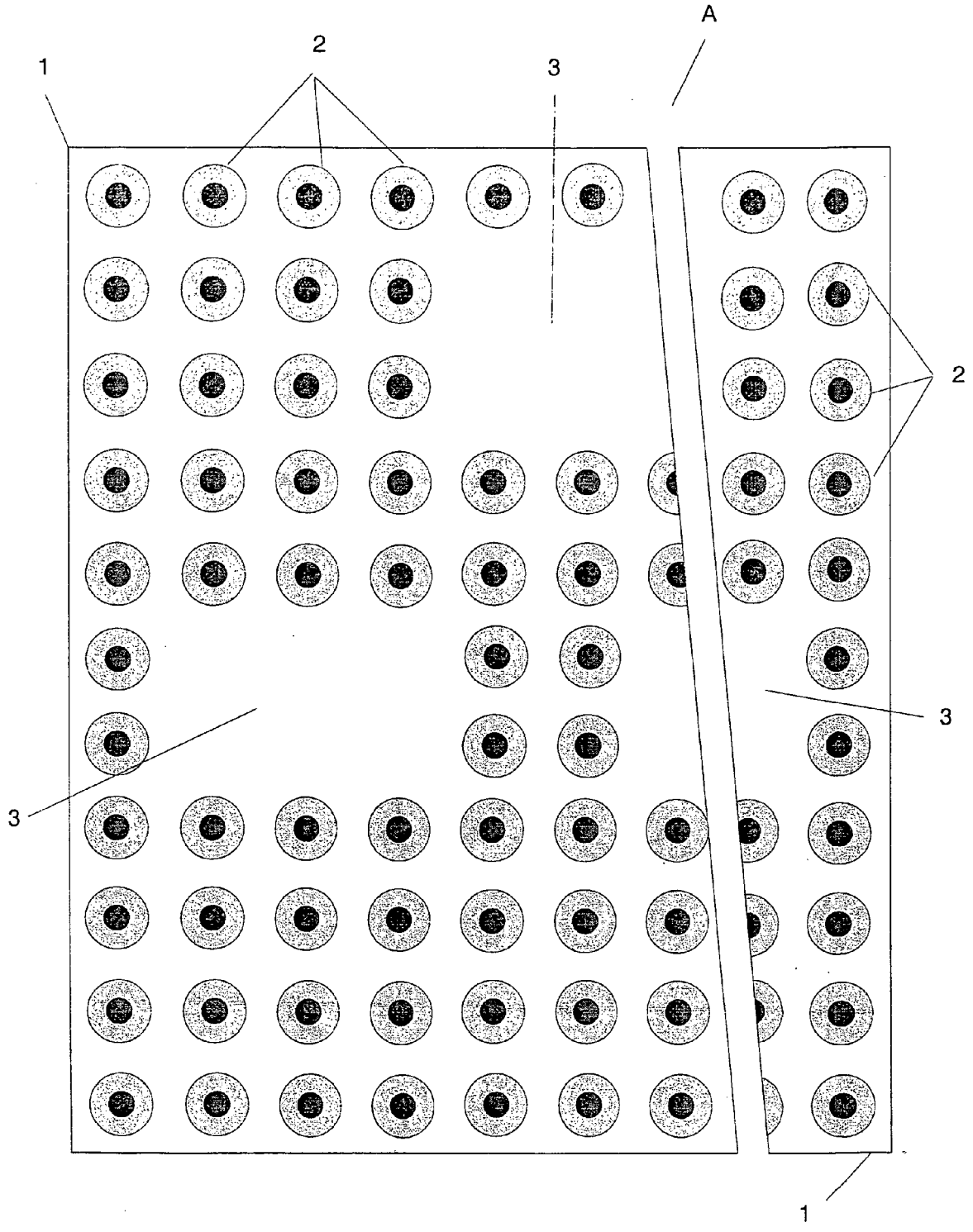

Fig. 1

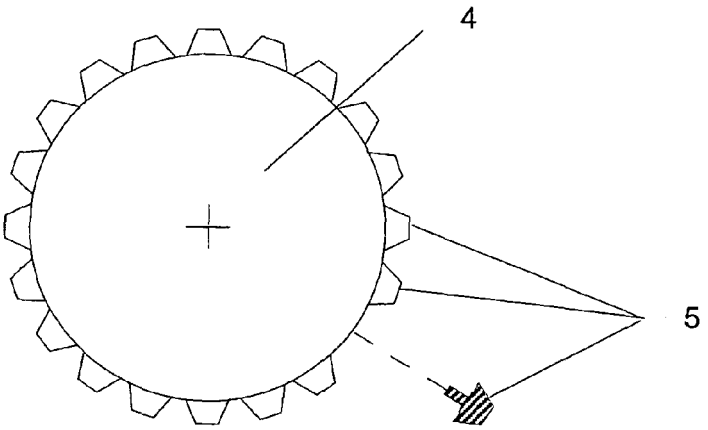

Fig. 2

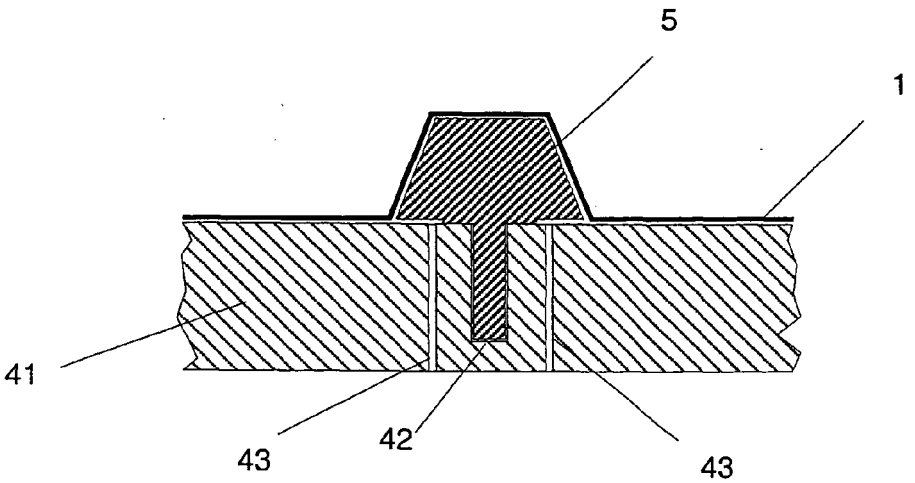

Fig. 3

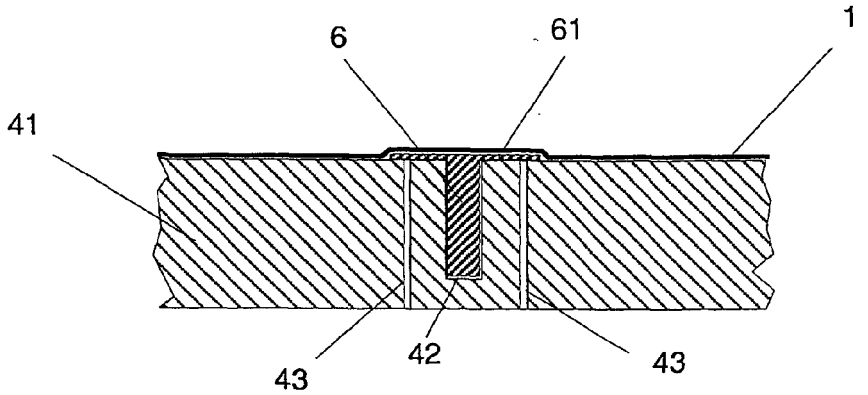

Fig. 4

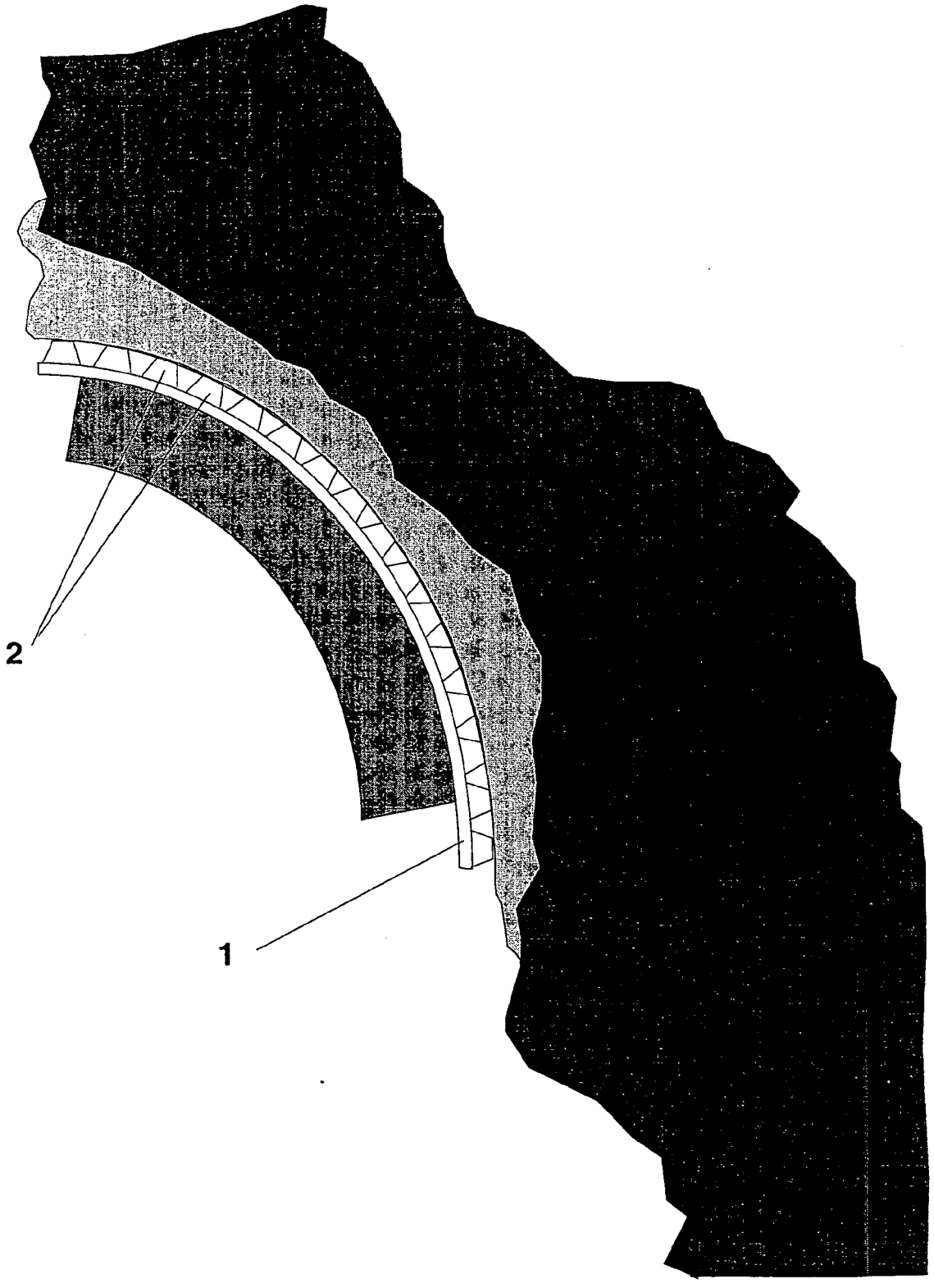

Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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