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(54) SIDEWALK-ROADWAY COMBINED BLOCK SYSTEM WITH RAINWATER PERMEABILITY

(57) The present disclosure provides sidewalk-roadway combined block system improved rainwater permeability with gap with excellent water-permeability by structurally forming gaps when assembling unit assembly blocks (10) and thereby improving the drainage efficiency of rainwater and the discharge of debris and sediment. Furthermore, in the connection part with a parking area, it is not only firmly assembled for vehicle passage using fully filled first auxiliary unit assembly blocks (10) without a sub-hollow part but also prevents edge contact surface breakage, offering an effect of providing a pavement joint block system for pedestrian use. Furthermore, the present disclosure offers sidewalk-roadway combined block system improved rainwater permeability with gap that can be utilized as a utility duct by connecting integrated second auxiliary unit assembly blocks (10) with an underpass section to create a waterway, preventing the loss of sand and similar materials on sloped areas, and allowing the passage of communication cables. Additionally, it prevents the accumulation of debris and sediment by directing them towards the underpass, thereby preventing weed growth between the blocks and ensuring the sustainability of permeability. This makes it advantageous for applications in water management and ecological area enhancement, providing sidewalk-roadway combined block system improved rainwater permeability with gap that is favorable for both installation and ecological aspects.

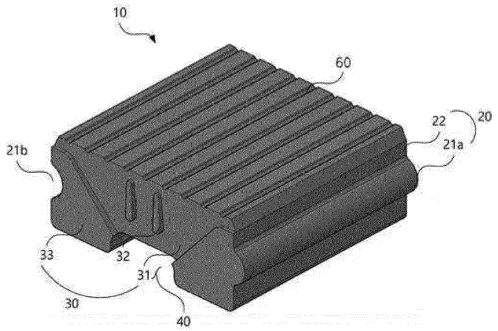

Fig. 1

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Description

[0001] The present disclosure relates to a sidewalk-roadway combined block system for improved rainwater permeability, and more particularly, to a sidewalk-roadway combined block system for improved rainwater permeability for use in eco-area developments.

[0002] Due to the recent rapid urbanization, there has been an increase in cement and paved roads, leading to an expansion of impermeable surfaces. It has been reported that more than 73% of urbanized areas now consist of impermeable surfaces. The increase in impermeable surfaces has led to various environmental issues. During localized heavy rainfall events, runoff from these impermeable surfaces can lead to flooding incidents. On the other hand, during droughts, the lack of water retention and the heat-absorbing properties of paved surfaces can contribute to the urban heat island effect.

[0003] The proposed porous permeable blocks for conventional road use, aimed at addressing these issues, have encountered a problem where the pores get clogged by foreign substances, leading to a significant decrease in permeability within six months after installation. As a result, maintenance standards recommend "a minimum of 2 times a year vacuum high-pressure suction cleaning" to mitigate this issue.

[0004] For example, in the pre-registered KR patent No. 10-1227275 titled "Block for Road Paving, Road Paving Structure Using the Same, and Construction Method Thereof," a technology is proposed using high-performance permeable surface blocks with excellent permeability capabilities for road paving. These blocks are designed to allow runoff water from large areas of roads and their surroundings to permeate through the pavement surface into the underlying layers. Additionally, deep blocks are stacked in the substructure of the pavement to enable the percolation of rainwater from the upper pavement surface into the ground and underground layers.

[0005] Furthermore, Korean patent application 10-2016-0089918 discloses a concept related to road blocks designed to enhance rainwater permeability sustainability through improved efficiency in discharging solid and liquid waste materials from the pavement. This concept also includes the road paving structure and construction method. However, it has been noted that the complex structure of these blocks, as well as the S-shaped interlocking connections with other blocks, make mass construction challenging. Additionally, replacing damaged sections can be difficult due to these design complexities.

[0006] Recently, in accordance with the "Natural Environment Conservation Act," the application scope and calculation methods of ecological area ratios have been unified and regulated in official notices. As a result, the "permeable joint block pavement" was introduced. Additionally, the standards for permeability performance testing have been expanded beyond the testing of only in-house permeable blocks, as was the case with the indoor water permeability coefficient test method (KS F 4419). The revised standards now include field water permeability testing (KS F 2394) and field infiltration capacity testing (ASTM C 1701), allowing for the testing of various permeable blocks. These changes have paved the way for the widespread adoption of "permeable joint block pavement," which is advantageous for enhancing urban ecological areas and improving permeability capabilities.

[0007] It is thus an object of the present invention to address the aforementioned issues by providing a sidewalk-roadway combined block system having improved rainwater permeability. Furthermore, the objective of this invention's improved sidewalk-roadway combined block system improved rainwater permeability is to provide a robust assembly that safely allows for vehicle passage. Additionally, the system aims to prevent the cracking of edge contact surfaces, thus offering a solution for sidewalk-roadway combined block system improved rainwater permeability that can withstand vehicle traffic while avoiding damage to the edges.

[0008] In order to achieve one or more of the objects identified above, the present invention suggests a sidewalk-roadway combined block system with improved rainwater permeability by providing a gap structure rendering the block system permeable to surface water. In particular, in accordance with the invention a sidewalk roadway combined block system is provided, said block system comprising a number of unit assembly blocks, wherein each unit assembly block features a side connecting part where the left and right sides are physically inserted and joined together; wherein a gap portion is formed between the front and rear of the unit assembly block, wherein on an upper surface of each unit assembly block there is a number of grooves forming a recessed area, and wherein the bottom side of each unit assembly block comprises a central cavity where rainwater or debris can accumulate and flow downward from the gap.

[0009] Preferred embodiments of the invention are defined in the dependent claims.

[0010] In embodiments of this invention, the blocks may be designed as follows: The side edges of the unit assembly blocks may be physically inserted and connected to form connecting parts. Gaps are formed between the front and rear sides of the unit assembly blocks. The upper surface of the blocks may comprise multiple grooves that allow rainwater to flow down into the gaps. The lower part may be designed to collect rainwater or solid waste materials that flow downward from the gaps. In other words, this invention pertains to the sidewalk-roadway combined block system having improved rainwater permeability by providing gaps, and it offers the advantage of providing a sidewalk-roadway combined block system improved rainwater permeability with gap with excellent permeability sustainability. It achieves this by structurally creating gaps through the assembly of unit

assembly blocks, which enhance the efficiency of discharging rainwater, solid waste materials, and liquid waste materials.

[0011] In a preferred embodiment, the unit assembly blocks may be made of concrete or synthetic resin material.

[0012] Another embodiment of the sidewalk-roadway combined block system improved rainwater permeability with gap according to the present invention features a side connecting part where the left and right sides of the unit assembly block are physically inserted and joined together. This configuration allows for easy removal and replacement of individual blocks by inserting a tool into the gap and applying upward force.

[0013] In another preferred embodiment, the system may further comprise a number of horizontal plate-shaped guides to the second subunit assembly block, which is manufactured in a way that the lower cavity part is integrated with the block itself. This prevents the phenomenon of the lower stratum being washed away on sloped roads. It also allows for the use of the lower cavity part as an alternative to a drain or as a common conduit for passing through communication cables and the like, particularly on one side of the sloped road.

[0014] Further, the gaps formed between the front and rear sides of the unit assembly blocks can be designed to have a sloping surface, where the gap between blocks widens as it descends from the upper part to the lower part.

[0015] Further, the gaps formed between the front and rear sides of the unit assembly blocks may be characterized by having 1 to 5 spacing maintenance protrusions within them.

[0016] Further, in an embodiment this invention provides a sidewalk-roadway combined block system with improved rainwater permeability with gaps by connecting integral auxiliary unit assembly blocks with an integrated sub-base section to guide water flow and prevent the loss of sand and similar materials caused by water flow in sloped areas. Further, multiple voids for the accumulation of rainwater or solid waste materials can be formed within the sub-base section. In this embodiment, the invention aims to provide sidewalk-roadway combined block system improved rainwater permeability that can guide water flow by connecting integral auxiliary unit assembly blocks with an integrated sub-base section. This design prevents the loss of sand and similar materials caused by water flow in sloped areas, effectively addressing this issue.

[0017] Further, the voids for the accumulation of rainwater or solid waste materials can be configured to be integral with the lower part of the unit assembly blocks.

[0018] The connecting parts where the side edges of the unit assembly blocks physically insert and interlock can be designed to fit within circular or square grooves.

[0019] A particularly robust assembly that allows vehicle passage may be achieved in an embodiment by using tightly filled auxiliary unit assembly blocks specifically designed for the parking lot and connection areas. These blocks may be assembled without any voids underneath. In this embodiment, this invention provides the advantage of offering a particularly robust assembly for vehicle passage using tightly filled auxiliary unit assembly blocks specifically designed for the parking lot and connection areas, without any voids underneath. It also prevents cracking of the edge contact surfaces, making it an effective solution for sidewalk-roadway combined block system improved rainwater permeability with gap.

[0020] Furthermore, this invention aims to provide sidewalk-roadway combined block system improved rainwater permeability with gap that prevents weed growth between the blocks by efficiently discharging solid and liquid waste materials into the sub-base. This design ensures the sustainability of permeability capabilities and is advantageous for the construction of ecological area ratio in eco-area development.

[0021] In summary, an aspect of the present invention provides gaps for the blocks that, through the assembly of unit assembly blocks, structurally create gaps allowing for the enhancement of rainwater permeability and the efficiency of discharging solid and liquid waste materials. This system offers excellent permeability and sustainability.

[0022] Embodiments of the present invention are explained further by referring to the drawings. Therein:

FIG. 1	depicts an elevation view of the unit assembly block, which forms the basis of the sidewalk-roadway combined block system improved rainwater permeability with gap according to the embodiment of this invention.
FIG. 2	shows an elevation view of modified auxiliary unit assembly blocks derived from the unit assembly block, forming the basis of the sidewalk-roadway combined block system improved rainwater permeability with gap according to another embodiment of this invention.
FIG. 3	represents a perspective view of the sidewalk-roadway combined block system improved rainwater permeability with gap according to an embodiment of this invention. Figure 3(a) illustrates the assembly state, and Figure 3(b) provides a diagram explaining the principle of edge damage occurrence due to the assembly.
FIG. 4 through 5	are diagrams that explain the principle of the sidewalk-roadway com-

bined block system improved rainwater permeability with gap assembly.

FIG. 6 is a diagram that illustrates the assembly and usage of the sidewalk-roadway combined block system improved rainwater permeability with gap according to an embodiment of this invention, showing the principle of edge damage prevention.

[0023] Identical parts are provided with identical reference numerals.

[0024] Below, a detailed description of a preferred embodiment of the present invention will be provided with reference to the attached drawings. In describing the present invention below, if it is deemed that providing detailed explanations regarding related functional features or components may unnecessarily obscure the essence of the invention, such detailed explanations will be omitted.

[0025] Firstly, the present invention provides a sidewalk-roadway combined block system improved rainwater permeability with gaps that allow for easy assembly of basic blocks while creating structural gaps for the passage of rainwater. This system not only facilitates rainwater permeation but also enhances the efficiency of discharging solid and liquid waste materials, ensuring the sustainability of permeability capabilities. It is advantageous for the application of ecological area ratios.

[0026] FIG. 1 is an elevation view of the unit assembly block 10, which forms the basis of the sidewalk-roadway combined block system improved rainwater permeability with gaps to an embodiment of this invention. FIG. 2 is an elevation view of auxiliary unit assembly blocks 10a, which may serve as the basis for the sidewalk-roadway combined block system improved rainwater permeability with gaps according to another embodiment of this invention. FIG. 3 is a perspective view representing the sidewalk-roadway combined block system improved rainwater permeability with gaps according to an embodiment of this invention. FIG. 4 through 6 are diagrams illustrating the principles of the sidewalk-roadway combined block system improved rainwater permeability with gaps according to an embodiment of this invention.

[0027] In this invention, "sidewalk-roadway" includes blocks suitable for pedestrian pathways and blocks designed for vehicular traffic, allowing both pedestrians and vehicles to pass.

[0028] In this invention, the unit assembly block 10 is designed to be easily assembled while creating structural gaps, allowing rainwater to pass through. Additionally, it enhances the efficiency of discharging solid and liquid waste materials, ensuring the sustainability of permeability capabilities. These blocks are typically installed on surfaces like parking lots, parks, and walkways. They utilize the gap spaces between the blocks to temporarily retain moisture, which is gradually absorbed into the underlying layers. This helps prevent flooding on pedestrian pathways during localized heavy rainfall or snowmelt events. Furthermore, it can be used to address the issue of clogging in conventional permeable blocks caused by the block's voids.

[0029] According to an embodiment of the sidewalk-roadway combined block system improved rainwater permeability with gap in this invention, as seen in FIG. 1, it features side connecting parts 20 where the side edges of the unit assembly block 10 physically insert and interlock. In the embodiment shown, the connecting parts 20 are designed to provide a tongue and groove connection 20. Between the front and rear sides of the unit assembly block 10, there are front gap sections 30 and corresponding rear gap sections, providing gaps for rainwater flow. On the upper surface, there is an upper surface void section 60 consisting of numerous grooves, allowing rainwater to flow towards the front and rear gap sections. Additionally, there is a sub-base void section 40 formed underneath, collecting rainwater or solid waste materials flowing downward from the gap sections.

[0030] In this invention, the gap sections feature specific components: Front gap sections 31: These are shaped in an inverted triangular form with the lower part cut off, positioned slightly apart in the central area of the front gap section 31. They consist of spacing maintenance ribs 32 that are narrower at the top than at the bottom in a vertical direction. Rainwater guides 33: These extend from the lower part with a preset gap from the upper surface and have a gradient on both sides to allow rainwater to slide towards the bottom part of the block 10. In other words, the rainwater guides 33 provide side slopes which together with the front gap surfaces 31 provide drain channels or guide channels through which water may pass from the upper surface of the block 10 down into a drain region at its lower part, in particular into the sub-base void 40. When constructing the joint block system, as shown in FIG. 3a and as seen in FIG. 3b (complemented by the respective longitudinal and cross sectional views in FIGs. 3c and 3d, respectively) and 6, an area starting from the lower part with a preset gap from the upper surface can be formed to prevent product edge damage during transportation and installation. This area can have a flat shape with a fixed damage prevention gap. Additionally, on the upper part of the side connecting sections, slope sections can be added to prevent damage to the edges of the unit assembly blocks 10 caused by collisions between them.

[0031] On the other hand, as shown in FIG. 2a, the first auxiliary unit assembly block 10a without a sub-base void is attached between a predetermined number of unit assembly blocks 10. This block is installed in areas like slopes where water should not flow, serving to prevent the loss of sand or soil by forming a barrier against the flow of water. Additionally, as seen in Figures 4 and 5, the first auxiliary unit assembly block 10a without a sub-base

void is more solid compared to unit assembly blocks 10 with sub-base voids, making it suitable for construction as a road surface in areas with frequent vehicle traffic.

[0032] FIG. 2b represents a second sub-unit assembly block 10b, which is a modified form of the unit assembly block 10. It includes horizontal plate-shaped guides 50 on the lower part, and the sub-base void section 40 in this embodiment is manufactured in an integrated form with the block. The sub-base void section 40 in this block can guide the flow of water to prevent the phenomenon of the sub-base layer being washed away. It can be used as an alternative to drainage in sloped road surfaces, and the integrated sub-base void section can also serve as a conduit for passing communication cables and similar utilities.

[0033] In this regard, the unit assembly block 10 can be characterized as being made of concrete or synthetic resin material. Unlike conventional porous permeable blocks that suffer from clogging issues due to debris, and a decrease in flexural strength due to the block's porosity, this invention eliminates the porosity in the blocks and manufactures them using compression methods to increase their flexural strength. Instead, the blocks allow water to permeate through the gaps between them, and any rainwater, sand, dust, or other debris that falls on the block's upper surface can also pass through the gaps and flow down to the lower layer. To prevent clogging of the gaps by debris, the lower part is designed to be wider than the upper part.

[0034] The unit assembly blocks 10 can be manufactured in various forms depending on the construction area and situation. These blocks can be appropriately combined to construct the joint gap road block system.

[0035] As depicted in FIG. 3, the invention allows for continuous usage in both left and right directions, with blocks arranged in various patterns. Unlike traditional porous permeable blocks, which experience rapid deterioration of permeability within six months due to blockage by debris, there are recent developments in testing methods and construction techniques that consider the concept of "ecological area ratio." This concept evaluates impermeable surface pavement construction within urban areas and addresses the limitations associated with relying solely on unit block permeability testing as an indicator. Recently, in accordance with the "Natural Environment Conservation Act," regulations related to the application of ecological area ratios, calculation methods, and testing have been consolidated in the guidelines. This has led to the introduction of "Combined Seam Permeable Paving" systems. Moreover, the testing of permeability performance has been revised to include not only the previous indoor water permeability coefficient testing method (KS F 4419) limited to self-permeable blocks but also field water permeability testing (KS F 2394) and field infiltration testing (ASTM C 1701). These changes allow for the testing of various permeable blocks and open up possibilities for the widespread use of combined seam permeable paving, which contributes to enhancing urban ecological areas and improving permeability capabilities.

[0036] This invention is designed to align with the environmental conservation concept of "ecological area ratio" and is well-suited to maintaining a permeable environment for urban roads.

[0037] Further, the gap 30 formed between the front and rear of the unit assembly blocks 10 can be designed to widen as it descends from the upper part to the lower part. This configuration reduces the likelihood of blockage in the gap as it widens when it descends from the upper to the lower part, and it creates an empty space in the lower part. This prevents blockage in the gap by allowing any entrapped material to fill the lower space before causing a blockage in the gap, thereby preventing a decrease in permeability due to entrapped materials.

[0038] Further, the gap or space formed between the front and rear of the unit assembly blocks 10 can be characterized by having 1 to 5 spacing ribs to help maintain a specific gap. Multiple voids or cavities can be formed where rainwater or entrapped materials can accumulate.

[0039] Further, the voids or cavities where rainwater or entrapped materials accumulate can be formed integrally as one unit in the lower part of the unit assembly blocks 10.

The side connection parts 20, where the unit assembly blocks 10 are physically inserted and combined, can be designed to fit into circular or square recessed areas. This configuration allows the side connection parts 20 to interlock and distribute the gravity throughout the entire road block system, making it capable of withstanding heavy loads from vehicles, including cars and trucks.

[0040] The invention forms connection parts on the left and right sides, which can be pushed and fitted together with other permeable blocks, creating an easy combination without the need for filling gaps with sand. This prevents lateral displacement between blocks. If a block becomes damaged, it can be raised and separated using extensions or other means, and a new block of the appropriate size can be installed. To achieve this, it is preferable to configure the side connection parts 20 in a circular shape, although a reclining trapezoidal rectangle is also feasible.

[0041] To achieve a more secure interlocking between the blocks and distribute gravity, various shapes and numbers of protrusions on the gap parts can be combined to provide the joint gap block system. In other words, the connecting protrusions of the side connection parts, where the left and right sides of the unit assembly block 10 are physically inserted and joined, can be formed in multiple shapes and placed in circular or square recesses.

[0042] In summary, the present invention provides a pedestrian-friendly joint block system by assembling unit assembly blocks 10 to create structural gaps that enhance the efficient drainage of rainwater, debris, and sediment, thereby improving water permeability. Addi-

tionally, it offers a robust assembly for vehicle passage using tightly filled auxiliary unit assembly blocks 10a specifically designed for parking lots and connection areas without any voids underneath. Furthermore, it prevents cracking of the edge contact surfaces, making it an effective solution for sidewalk-roadway combined block system improved rainwater permeability with gap.

[0043] Furthermore, the present invention offers sidewalk-roadway combined block system improved rainwater permeability with gap that can prevent the loss of sand or other materials due to water drainage on sloped surfaces. This is achieved by connecting integral secondary unit assembly blocks 10 with an integrated lower cavity to guide water flow or use as a conduit for communication cables. Additionally, it facilitates the discharge of debris from pedestrian areas, preventing weed growth between blocks and ensuring the long-term water permeability required for ecological surface area applications.

List of reference numerals

[0044]

10	unit assembly blocks
20	side connection part
21a,b	joint groove part
22	side part
30	gap
31	front gap section
32	spacing maintenance ribs
33	rainwater guide
40	sub-base void section
50	horizontal plate-shaped guides
60	upper surface void section

Claims

1. Sidewalk roadway combined block system comprising a number of unit assembly blocks (10) wherein each unit assembly block (10) features a side connecting part (20) where the left and right sides are physically inserted and joined together; wherein a gap portion is formed between the front and rear of the unit assembly block (10), wherein on an upper surface of each unit assembly block (10) there is a number of grooves forming a recessed area, and wherein the bottom side of each unit assembly block (10) comprises a central cavity where rainwater or debris can accumulate and flow downward from the gap.

2. System according to claim 1, wherein one or more of said the unit assembly blocks (10) are of concrete or synthetic resin material.

3. System according to claim 1 or 2, wherein the gap (1) formed between the front and rear of the unit assembly blocks is widening as it descends to the lower part of the blocks (10).

4. System according to any one of claims 1 to 3, wherein the gap (1) formed between the front and rear of the unit assembly blocks, through which extensions can be inserted and lifted for easy replacement, is **characterized by** the side connection part forming a semi-circular protrusion and a corresponding semi-circular groove for accommodating it.

5. System according to any one of claims 1 to 4, wherein the gap (1) formed between the front and rear of the unit assembly blocks (10) is **characterized by** the presence of 1 to 5 spacing maintaining protrusions.

6. System according to any one of claims 1 to 5, further comprising a number of hollow spaces in the lower part where rainwater or debris accumulates.

7. System according to any one of claims 1 to 6, further comprising a number of hollow spaces in the lower part, which are integrally formed in the lower part of the unit assembly block (10), where rainwater or debris accumulates.

8. System according to any one of claims 1 to 7, further comprising a number of overlapping connection protrusions on the connecting ribs that physically insert and interlock the left and right sides of the unit assembly block (10) into circular or square recesses.

9. System according to any one of claims 1 to 8, further comprising a number of horizontal plate-shaped guides (50) to the second subunit assembly block (10b), which is manufactured in a way that the lower cavity part is integrated with the block itself.

10. System according to any one of claims 1 to 9, preferrably designed for vehicle traffic, wherein the first auxiliary subunit assembly block is solidly assembled without a lower cavity part.

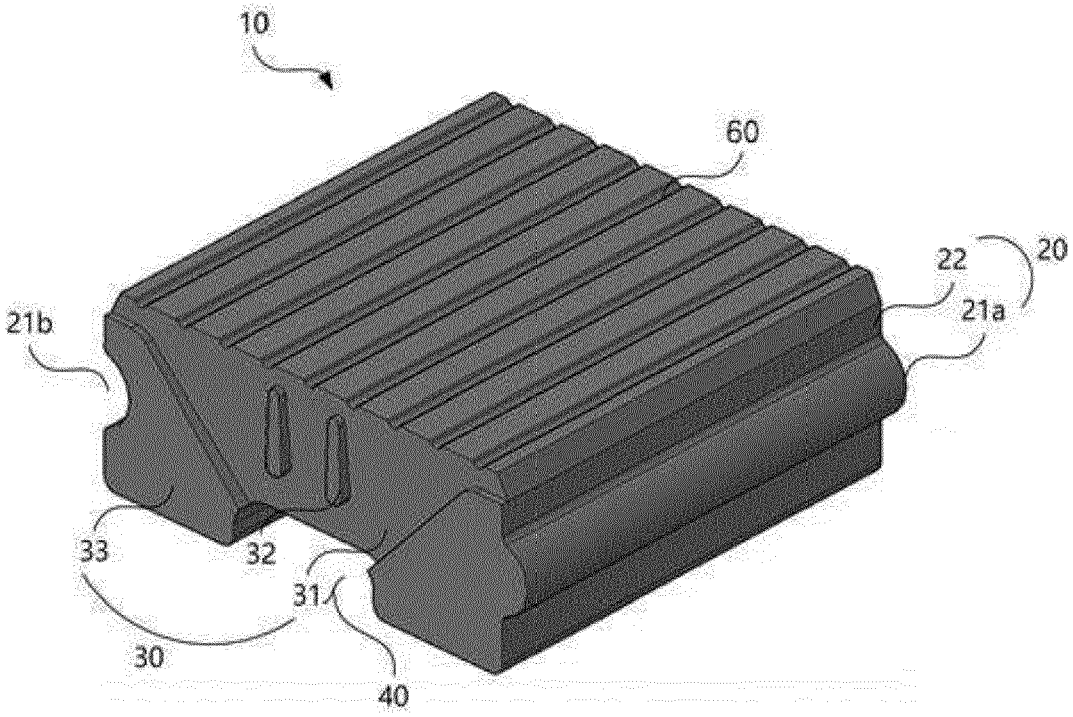

Fig. 1

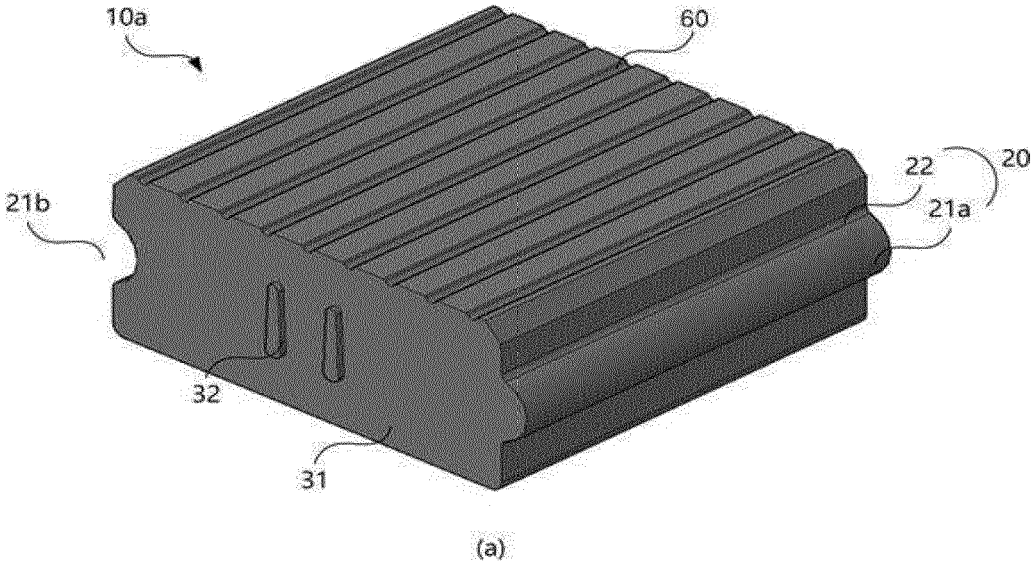

Fig. 2a

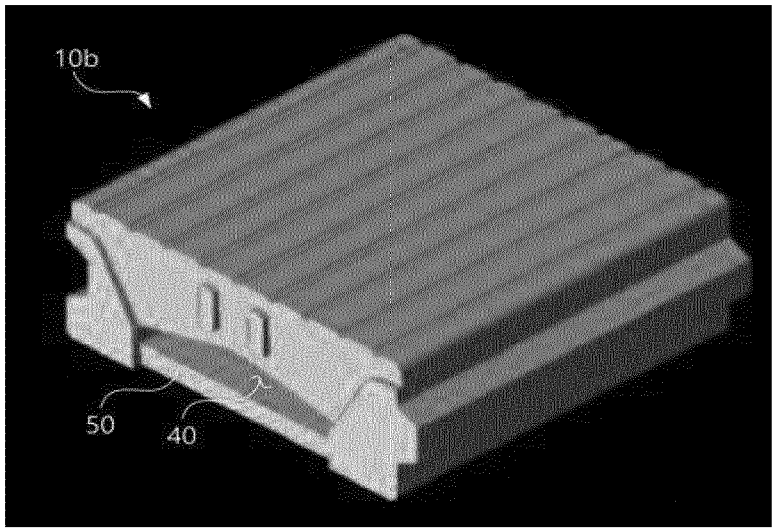

Fig. 2b

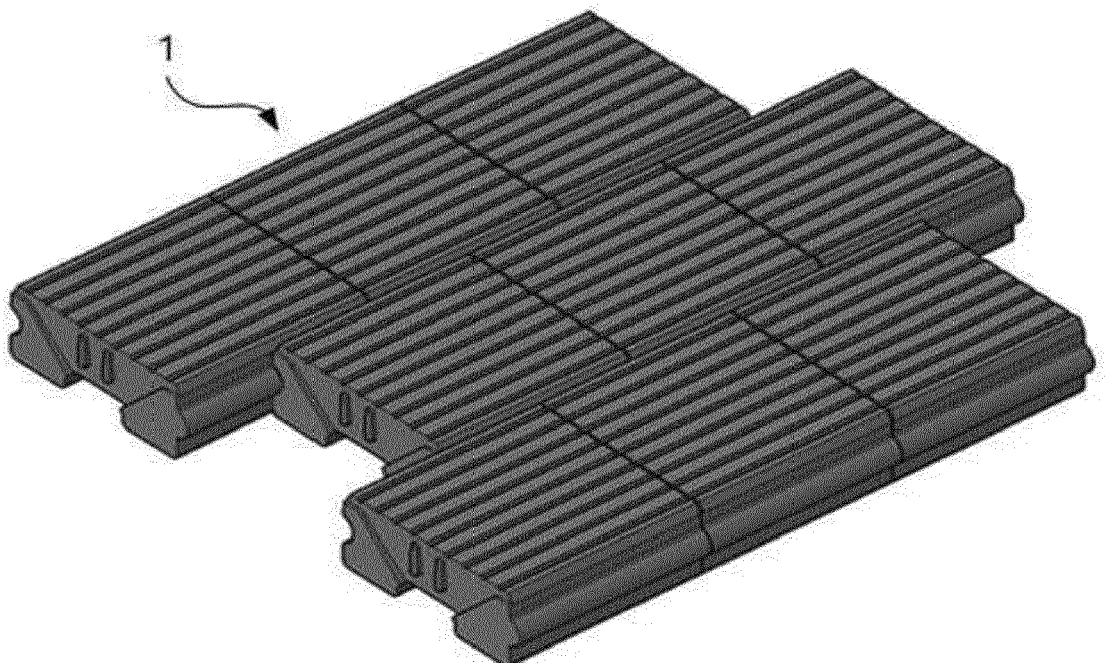

Fig. 3a

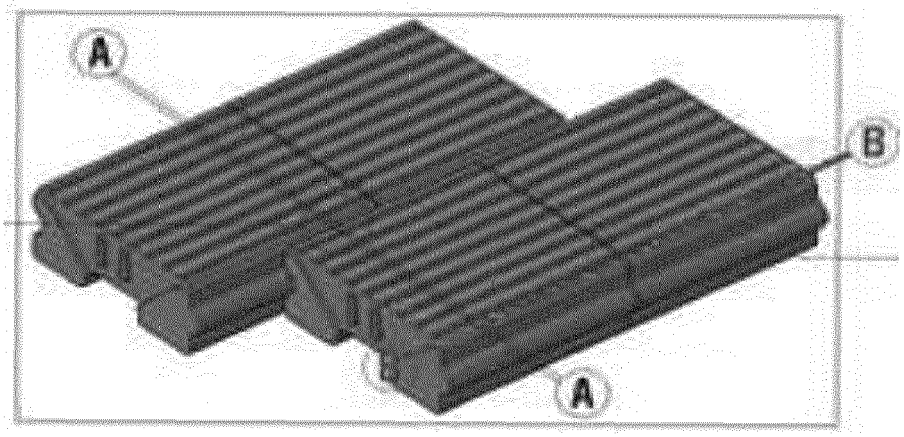

Fig. 3b

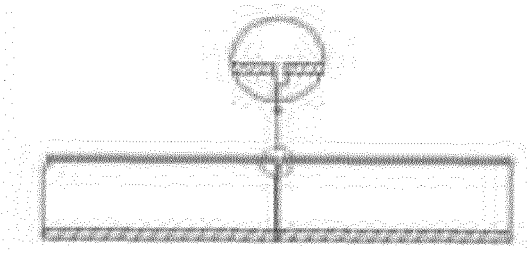

Fig. 3c

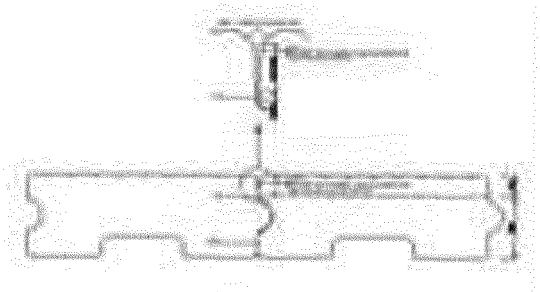

Fig. 3d

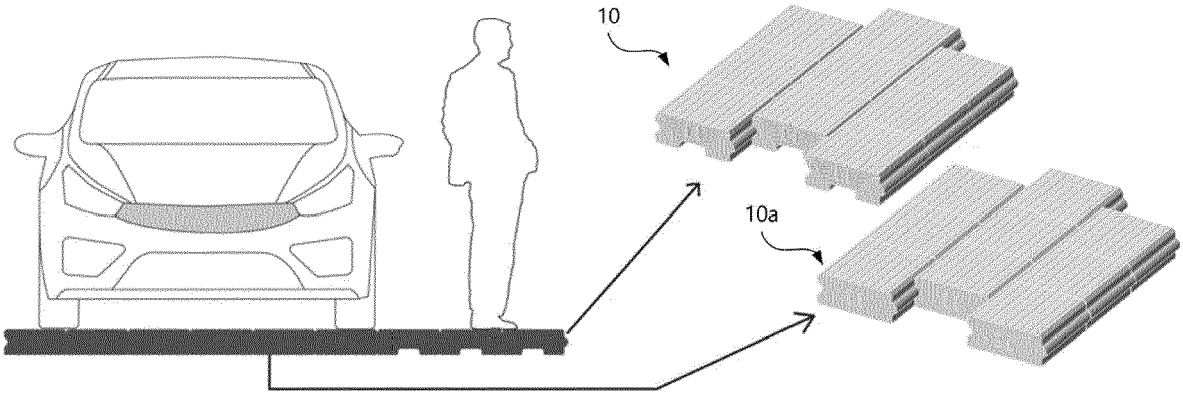
10
10a

Fig. 4

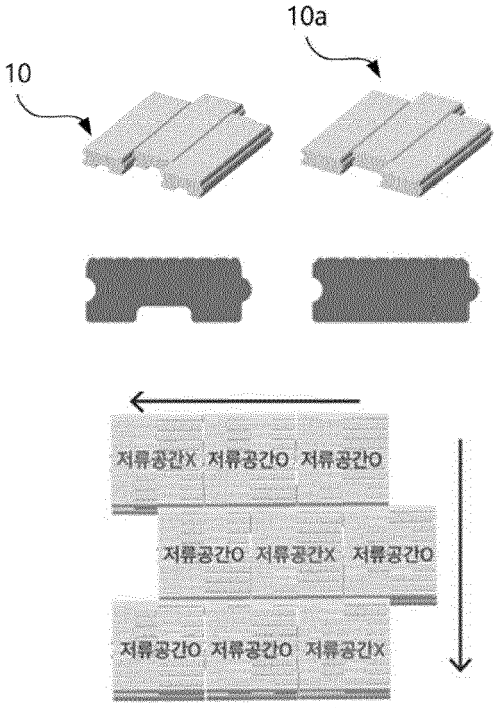
10
10a
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Fig. 5

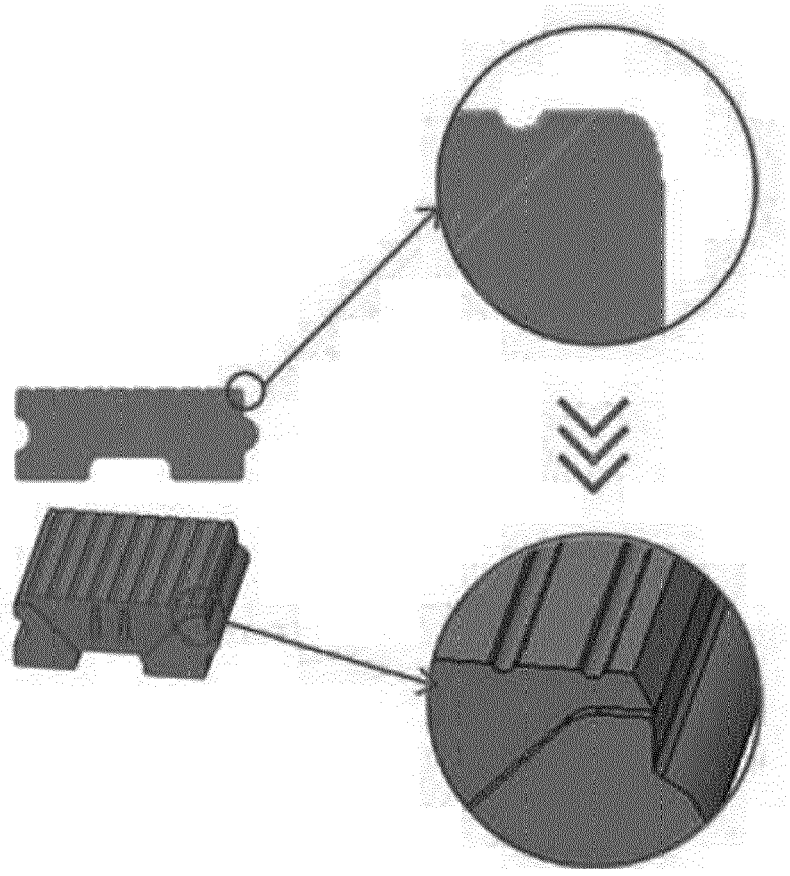

Fig. 6

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 23 21 2706

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 2016/117778 A1 (ECO TOP CO LTD [KR]) 28 July 2016 (2016-07-28) * the whole document * -----	1-4,6-10 5	INV. E01C5/06 E01C5/20 E01C11/22
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TECHNICAL FIELDS SEARCHED (IPC)

E01C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 April 2024	Movadat, Robin

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 21 2706

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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11-04-2024

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