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(71) Applicant: **Chen, Jui-Wen**
New Taipei City 238, Taiwan (TW)

(72) Inventor: **Chen, Jui-Wen**
New Taipei City 238, Taiwan (TW)

(74) Representative: **Horak, Michael**
Horak. Rechtsanwälte Partnerschaft mbB
Georgstraße 48
30159 Hannover (DE)

(54) HIGH-STRENGTH ROAD FOR WATER RESOURCE REGULATION SYSTEM IN RESPONSE TO CLIMATE CHANGE

(57) A high-strength road for a water resource regulation system in response to climate change. An underground structural space (30) is formed by a structural system formwork (31), which is provided with a hollow unit body (30a), by means of grouting and solidifying concrete grout (302), and the high-strength road is formed by paving a road or a pavement (10) over the underground structural space (30). The hollow unit body (30a) is at least provided with a structural formwork (31) and is formed by means of combining a plurality of side slabs (32). An upper surface of the formwork (31) is provided with a plate (312), which is provided with a through hole (311) and at least one through pipe (33). After the structural system formwork (31) and the side slabs (312) are combined, the concrete grout (302) is grouted and solidifies to form the underground structural space (30) with a high support strength.

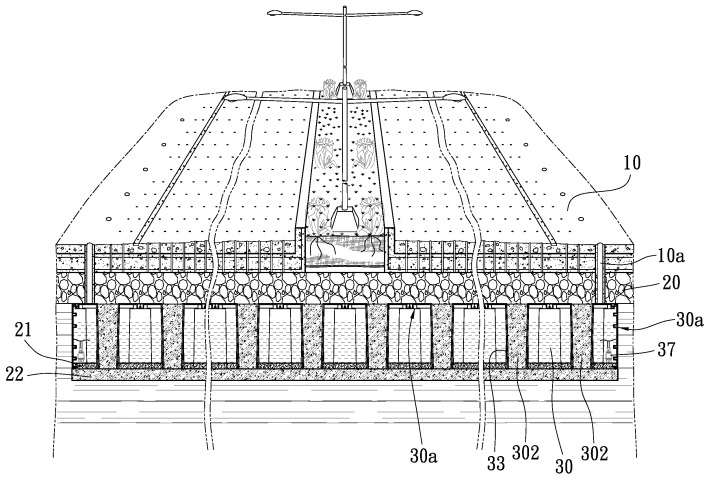

FIG. 1

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a high-strength road for water resources regulation in response to climate change, and more particularly to a high-strength high-occupancy road, in which a structural space system having a high strength is constructed in an underground in combination with various types of road pavement or water-permeable pavement or additionally arranged water-permeable material constructed on a top of the structural space to also feature bearing of heavy loading of vehicles.

DESCRIPTION OF THE PRIOR ART

[0002] Due to increasing expansion of cities, with all sorts of man-made facility being massively built, road areas are continuously increased, resulting in catchment basins losing the functionality of water retention, leading to a great increase of runoff flows on the ground. Traditional roads are not water permeable and cause massive surface runoff flows. This is one of the major causes for flooding in the cities, and this, together with the impact caused by climate change resulting from global warming, forces all urban areas to encounter an increased strain for flooding prevention. In addition, the traditional ways of flood control often place emphasis on flood control of points and lines by building up various facilities of large- and small-sized dams and drainage ditches. Extreme weather often causes sudden strong precipitation, and the traditional roads and drainage ditches are incapable of handling in-city flooding resulting from the strong precipitation and large-area water accumulation or even large-area flooding may thus result due to poor drainage in the large area. The traditional flood control standard and the road construction standard and concept are far less than necessity for handling climate change.

[0003] The traditional roads isolate the natural circulation of water and air between the ground surface and the underground, making the underground of the road areas becoming an ecological dessert devoid of water and oxygen. The traditional roads place emphasis on traveling of heavy vehicles thereon and thus have to have a compacted road base and an arrangement of drainage ditch, resulting in a disadvantage that the road base is not allow to contain water and is not allowed to store water therein. Consequently, the traditional roads, either general roads or water-permeable pavement roads, or even high-occupancy high-flow public roads must have a compacted road base and have to have the road base or road bed enclosed to prevent rainwater from invading into the road bed or road base in order to avoid softening and collapsing of the road base due to soaking in water, which may result in casualty loss of public security persons.

[0004] As a result, the traditional water-permeable pavement road must prevent rainwater from penetrating into the road bed or road base, not allowing the rainwater to invade into the road bed. Thus, drainage facility must be built up to drain rainwater through the drainage ditches, and it becomes very pity for not keeping the water resources, which are precious. Thus, a novel road that features water permeability and constructs a high-strength water storage space building underground is proposed for an effect of water retention.

[0005] Concerning the water permeability function and the water storage function of the traditional roads, the traditional roads are incapable of full water permeability and are also incapable of full water storage, and may cause massive surface runoff flows, this being one major cause for in-city flooding.

[0006] To fight against the global warming in order to reduce the loading of the environment and the negative impacts caused thereby, low-impact development techniques have been made popularized, yet a concern about whether the popularization of the low-impact techniques over more than two decades is partly imperfect emerges, particularly flooding or drought, and influences resulting from extreme climate caused by global warming seemingly getting even worse sometimes. Maintenance costs for popularizing the low-impact techniques are very high, and in this concern, one that is sustainable, economic and easy to maintain is the best condition of perfection and attraction, and among others, a construction concept of a sponge city is a novel planned city construction in which functions of flood prevention and waterlogging prevention in combination with ecology and environmental protection is built in the city. For example, building a water-permeable road to replace a non-water-permeable road in order to absorb water, store water, and seeps water during raining, and also to set up water banks underground in parks and squares to store water therein. In drought and hot weather, water moisture can be released to alleviate the heat island effect and prevents situations of global warming. With respect to the making and materials of a sponge city, the water permeability function of water-permeable bricks and the water storage function of the water banks are generally incapable of carrying heavy loads and cannot be sustainably secured and reliable to resist damages resulting from by for example shaking caused by earthquakes or pressurizing caused by heavy vehicle running on the road surface, and are only usable in building sites, such as sidewalks, parks, and squares, where the heavy vehicles are not allowed, in order to avoid public security concerns resulting from collapsing caused by pressurizing and running of heavy vehicles. And, there is still a need to build up drainage ditches at two sides of the road in order to drain off the rainwater falling on the ground surface. Thus, the urban drainage ditches may easily result in environmental pollution and may be easily jammed, and it is not easy to maintain and keep clean. The draining openings of the drainage ditches, once jammed by garbage, becomes visually unaesthetic for the outside appearance thereof.

[0007] In view of the above, in response to and collab-

orating with the construction of various water-permeable pavement on the ground surface, to effectively achieve effective storage and reuse of rainwater directed down into the underground, the present invention aims to provide a high-occupancy road that features interconnection between ground surface and underground and supportability of repeated running and pressurizing of heavy vehicles of tens of tons or hundred tons to achieve a system formwork space of a ground surface and underground co-constructed structural space to generate a water storage and water drainage system.

SUMMARY OF THE INVENTION

[0008] The primary objective of the present invention is to provide a high-strength road for a water resource regulation system in response to climate change, which comprises a hollow unit body subjected to grouting with concrete grout and combining through solidification thereof to form an underground structural space, with a permeable pavement or regular concrete or asphalt laid on a top of the space, wherein the underground structural space is buried underground for water storage and water drainage to serve an underground dam of a road base of man-made road and also featuring functions of rivers and drainage ditches, so that with water so stored, the water resources can be effectively supplied on site for easy retrieval and reuse to respond to the possibility of occurrence of vehicle traveling on the ground surface to induce heavy loading and the occurrence of rainwater washing out and prevention of flooding and droughts. The high-occupancy high-strength underground structural space mainly comprises a strengthened concrete supporting pillar formed in the system formwork to improve the strength for high-occupancy loading and pressurizing bearing capacity of the road to prevent breaking of the road by heavy vehicles traveling thereon.

[0009] Another objective of the present invention is to provide a high-strength road for a water resource regulation system in response to climate change, which is a system formwork space water storage and water drainage system that is applicable to building of roads, airports, parks, squares, and parking lots, and is a high-occupancy pavement resisting heavy loading and supporting repeated pressurizing and running by heavy vehicles of tens of tons of hundred tons, and is also capable of co-construction of structural space of ground surface and underground.

[0010] To achieve the above objectives a high-strength road for a water resource regulation system in response to climate change designed according to the present invention comprises an underground structural space formed by combining a structural formwork of a hollow unit body by means of grouting and solidifying concrete grout, and a pavement laid on a top of the underground structural space, characterized in that the hollow unit body comprises at least one structural formwork and a plurality of side slabs combined with each other; a plate is disposed on an upper surface of the structural formwork, the plate being provided with a through hole and at least one through pipe, wherein the structural formwork and the side slabs are combined together and laid, and then concrete grout is grouted into and solidifies in the through pipe of the structural formwork to form an underground structural space with a high support strength, a water resources regulation road having a water storage and drainage system.

[0011] In an embodiment, the hollow unit body is constructed by combining two, upper and lower, structural formworks and four side slabs, the upper and lower structural formworks being provided with a plate on an upper surface, the plate being provided with through holes and at least one through pipe, tenons and mortises, which correspond to each other, being formed in a periphery of the plate of the upper and lower structural formworks to allow the upper and lower structural formworks of two adjacent unit bodies to joint to each other by means of tenon and mortise joints., in the side slabs, the slabs are formed with the through holes and are provided, in locations of a side edge, with snap fastening structures for the side slabs to fast attach, through snap engagement, to outsides of the upper and lower structural formworks to thereby form a hollow body; concrete grout is grouted on outside of the hollow unit body, and when the upper and lower structural formworks are combined, the upper-side and lower-side through pipes are connected to form a hollow formwork grouting channel, and concrete grout is grouted into the hollow grouting channel to form an underground structural space system of high support strength.

[0012] In another embodiment, outside of the hollow unit body is covered with nonwoven fabric to carry out back-filling of soil or grouting of concrete grout.

[0013] Effective advantages of the present invention are that heavy rain, when falling on a road surface, can be collected by means of various types of permeable pavement or water passage pipe to direct rainwater into underground, and is stored in the high-strength structural formwork structural space buried underground, so as to not only effectively prevent chance of flooding occurring on the surface, but also serving for re-supplementing the underground water resources to allow the rainwater to be stored and recovered for subsequent reuse.

[0014] Other features of the present invention and embodiments will be described in detail with reference to the attached drawings for better understanding.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a cross-sectional view showing a high-strength road according to the present invention.

FIG. 2 is an enlarged schematic view showing a partial structure of the present invention.

FIG. 3 is an exploded view showing a structure of a

hollow unit body according to the present invention.

FIG. 4 is a perspective view of FIG. 3 in an assembled formed.

FIG. 4a is an enlarged schematic view showing a partial structure of FIG. 4 according to the present invention.

FIG. 5 is a schematic view showing structural formworks mutually jointed and expanded according to the present invention.

FIG. 5a is an enlarged schematic view showing a partial structure of FIG. 5 according to the present invention.

FIG. 6 is a schematic view showing laying nonwoven fabric on top of a through pipe according to the present invention before a grouting operation is carried out.

FIG. 7 is a schematic view showing arrangement of hollow tubular pillars beside the through pipe of the formwork according to the present invention.

FIG. 8 is a schematic view showing the present invention combined with water-permeable asphalt road surface.

FIG. 9 is a schematic view showing a high-strength road after completion of filling concrete grout in the through pipe according to the present invention.

FIG. 10 is a schematic view showing water drainage of an underground space according to the present invention.

FIG. 11 is a schematic view showing preparation of a grouting operation of concrete grout after through pipes are connected in cascade in an arrangement of hollow unit bodies stacked in an upper-lower fashion according to the present invention.

FIG. 12 is a schematic exploded view showing a structure of an upper hollow unit body according to the present invention.

FIG. 13 is a schematic view a side slab arranged and backing under the hollow unit body structural formwork according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] Referring to FIGS. 1 and 2, the present invention provides an underground structural space 30 formed by grouting concrete grout on a hollow unit body 30a to solidify and combine therewith, and a permeable pavement 10 laid on the structural space. One technical solution of the permeable pavement 10 includes a permeable pavement structure proposed early by the present inventor, including a water passage pipe 10a or a water passage hole formed through drilling for quickly directing surface rainwater to accumulate in the underground structural space water storage and drainage system of high support strength according to the present invention.

[0017] Gravel grading 20 is laid under the permeable pavement 10 to quickly receive the rainwater penetrates down from the road surface through the permeable pavement 10 to get into the system facility of the underground space 30 to prevent occurrence of flooding.

[0018] Referring to FIGS. 3, 4, and 4a, the hollow unit body 30a of the present invention comprises a structural formwork 31 and a plurality of side slabs 32 combined together. A plate 312 is arranged on an upper surface of the structural formwork 31, and the plate 312 is provided with through holes 311 and at least one through pipe 33. The plate 312 is formed with recessed portions 313. The structural formwork 31 and the side slabs 32 are combined together to form a hollow unit body, which is laid on a road base, followed by grouting concrete grout into the through pipe 33 to form, after solidified, an underground structural space system having a high support strength.

[0019] Referring to FIGS. 5, 5a, and 6, a plurality of corresponding tenons 317 and mortises 318 are formed on a periphery of the plate 312 of the structural formwork 31, so that the structural formworks 31 of two adjacent hollow unit body can be joined together by means of tenon and mortise joints.

[0020] Referring to FIG. 3, the side slab 32 is formed with through holes 321 to allow for water entry from side surfaces of the hollow unit body 30a and is also provided, at locations corresponding to an edge of the structural formwork 31 in which snap notches 319 are formed, with snap fastening structures. In the drawing, the snap fastening structure is provided as a hooking barb 322 to allow the side slab 32 to fast connect, through snap engagement, to an outside of the structural formwork 31 of each unit body 30a to form a hollow body structure.

[0021] Referring to FIG. 7, the structural formwork 31 is constructed such that in addition to a through pipe 33 arranged at the center, four hollow tubular pillars 314 are arranged around a circumference of the through pipe 33, the through pipe 33 or the hollow tubular pillars 314 being preferably arranged to include an inner wall having tapering, and also, an end portion of each of the hollow tubular pillars 314 of the structural formwork 31 being backed with a side slab 32, so that in case of an uneven underside or an easily-recessing underside, the backing is necessary, as shown in FIG. 13, and after being combined and positioned, the side slabs 32 are disposed on the side surfaces thereof for jointing thereto.

[0022] Referring to FIGS. 6, 8, and 9, when the present invention is assembled to form the hollow unit body 30a, a hollow formwork grouting channel is formed with the structural formwork 31 on which the through pipe 33 is provided, and under the through pipe 33 or the hollow tubular pillars 314, a sand layer 21 is selectively laid, and if necessary, a concrete layer 22 is bottomed below the sand layer 21. If necessary, a reinforcement bar 34 may be selectively disposed in the through pipe 33 of the hollow grouting channel, as shown in FIG. 8. During grouting concrete grout into the through pipe 33, an entire structural body of combination of a plurality of hollow unit bodies 30a is entirely covered, on an outside thereof, with nonwoven fabric 30b and concrete grout 302 is subse-

quently grouted into the through holes 301, so that after the concrete gets solidified, a supporting pillar formed of the solidified concrete in the hollow grouting channel is solidified into a high-strength building body, forming a column structure similar to a house structure to shape up and form building body facility as sturdy as an underground dam, constructing buried underground and more durable to shaking and impacting of earthquake and pressurizing of large-sized heavy vehicles without causing collapse and damage to the road surface, and being easy to keep the road surface flat.

[0023] It is noted that a conduit 35 may be built in advance in the interior of the hollow water storage unit body 30a to ease arrangement for line penetration and arrangement of lines for water supply, water drainage, electrical wires, telephone lines, and optical fiber lines of cable television.

[0024] Referring to FIG. 9, the present invention provides the underground space 30 formed of the hollow unit body 30a by means of solidifying and combining with concrete grout poured thereto, and the permeable pavement 10 or a regular concrete or asphalt paved on the top of the water storage space. The pavement 10 is the permeable pavement road surface formed by laying water-permeable asphalt, so that rainwater in addition to seeping downward through the permeable pavement for draining accumulated water, so as to achieve collection of the rainwater to be reused through being pumped out by using a water pumping device 37, as shown in FIG. 1.

[0025] Referring to FIG. 10, the water drainage function of the structural space under the road surface according to the present invention is arranged, according to drainage requirement or being close to a river side, to set up an overflow hole 36 communicating between the underground space 30 of the present invention and the river, for directly discharging when a level of rainwater penetrating down through the road surface reaches the overflow hole 36 to fulfill a function similar to a drainage ditch under the road surface.

[0026] Referring to FIGS. 11 and 12, in another embodiment of the present invention, to increase the high-strength structural space for water storage and water drainage under the road surface, the structural formwork of the hollow unit body according to the present invention is arranged to stack in an upper-lower fashion so that the through pipes 33 in the structural formworks 31 of the hollow unit body 30a are connected in cascade to form a formwork channel for grouting of concrete grout, so that the concrete, after grouting, is allowed to solidify to form a concrete supporting pillar, while the system formwork is kept on the outside to protect the concrete supporting pillar from being invaded by water and also to protect the concrete against aging caused by oxidation, forming a deeper and bigger under-road space high-strength underground water resources regulation structural space.

[0027] As shown in FIG. 12, the hollow unit body 30a of the different embodiment of the present invention is changed to be formed of a combination of two structural formworks, including an upper structural formwork 31a and a lower structural formwork 31b and four side slabs 32. When assembled, the upper structural formwork 31a and the lower structural formwork 31b, the two being of the same structure, are arranged to stack in an upper-lower and symmetric fashion, and the four side slabs 32 are snap fit to the circumferential edges of the upper structural formwork 31a and the lower structural formwork 31b to joint together to form a hollow body having a space.

[0028] The present invention provides a system having a high-occupancy high-strength pressurizing-resistant space under a road surface and also providing water storage and water drainage, for achieving an effect of water storage and water drainage for a large area in a short period of time, featuring prevention of probability of occurrence of regional flooding and drought and also allowing rainwater to slowly penetrate into the underground soil layer to re-supplement the underground water resources, and as such, a function of effective and fast draining of water on surface in a short period of time and recovery of rainwater and re-supplementing of underground water is achieved.

[0029] From the above, the present invention provides the following practical advantages:

(1) A hollow and high-occupancy, high-strength structural underground space is provided in a road to serve as a water storage, water drainage, and catastrophe prevention system, similar to a man-made underground dam and waterway facility, which may automatically store water and prevent catastrophe during rainwater flooding season for supplying to the ground surface with a simple water pumping device for fulfilling an environmental protection efficacy through subsequent repeated reuse and repeated recirculation of rainwater so as to achieve an effect of full storage of water and recovery and reuse of rainwater resources.

(2) A jointed underground structural space formed of a structural formwork is provided, which not only has high porosity and high supporting, but also features light weight and small size and high reusability, allowing construction to be carried out more easily and faster, shortening the construction time, lowering cost, and also providing an effect of environmental protection.

(3) Improvement is achieved for inconsistency of traditional roads and water conservancy constructions and catastrophe prevention and water resources regulation, and is even good for alleviating the probability of occurrence of flooding and droughts and the occurrence of public security events of the traditional roads being easy to collapse.

(4) Surface runoff flow can be improved, and probability of occurrence of flooding and droughts can be reduced, and underground water resources can be re-supplemented, so as to not only achieve water

retention for base, but also build up a reliable and effect sponge city ecological environment.

(5) The disadvantage of a traditional road base being necessarily compacted and isolating water and air from naturally circulating can be alleviated to thereby provide facility that places more emphasis on catastrophe prevention and environmental ecology.

(6) Disadvantages of traditional way of using water and water management only being made in spots (such as water dams) with water supply being not easy and maintenance being difficulty and cost being high, and disadvantages of lines (such as ditches) being necessarily cleaned and maintained, and having malodors, mosquitos and insects, cockroaches, mice that cause contamination to the environment can be alleviated.

[0030] In summary, the present invention provides a high-strength road for water resources regulation in response to climate change, which constructs an underground water storage and water drainage structural space of efficacy of underground water resources regulation and use and featuring both underground space and high supporting, showing a value of use in the industry, and as such, a patent application is proposed. However, the above provides only the preferred embodiments of the present invention and should not be construed as limiting to the scope of implementation of the present invention. All simple equivalent variations and modifications that are based on the claims and the contents of the specification of the present invention are considered falling in the scope of the present invention defined by the claims.

Claims

1. A high-strength road for a water resource regulation system in response to climate change, comprising an underground structural space (30) formed by combining a structural formwork (31) of a hollow unit body (30a) by means of grouting and solidifying concrete grout (302), and a pavement (10) laid on a top of the underground structural space (30), **characterized in that** the hollow unit body (30a) comprises at least one structural formwork (31) and a plurality of side slabs (32) combined with each other; a plate (312) is disposed on an upper surface of the structural formwork (31), the plate (312) being provided with a through hole (311) and at least one through pipe (33), wherein the structural formwork (31) and the side slabs (32) are combined together and laid, and then concrete grout (302) is grouted into and solidifies in the through pipe (33) of the structural formwork (31) to form an underground structural space (30) with a high support strength, a water resources regulation road having a water storage and drainage system.

2. The high-strength road for a water resource regulation system in response to climate change according to claim 1, **characterized in that** in the structural formwork (31) of the hollow unit body (30a), tenons (317) and mortises (318), which correspond to each other, are formed in a periphery of the plate (312) to allow the structural formworks (31) of two adjacent unit bodies (30a) to joint to each other by means of tenon and mortise joints; and in the side slabs (32), the slabs (32) are formed with the through holes (321) and are provided, in locations of a side edge, with snap fastening structures.

3. The high-strength road for a water resource regulation system in response to climate change according to claim 1, **characterized in that** the hollow unit body (30a) is constructed by combining two, upper and lower, structural formworks (31) and four side slabs (32).

4. The high-strength road for a water resource regulation system in response to climate change according to claim 1, **characterized in that** the plate (312) of the structural formwork (31) is provided with hollow tubular pillars (314) arranged in a circumference of the through pipe (33).

5. The high-strength road for a water resource regulation system in response to climate change according to claim 2, **characterized in that** the plate (312) of the structural formwork (31) is provided, on four sides of a top, with snap notches (319), and snap fastening structures provided in locations of side edges of the side slabs (32) are hooking barbs (322).

Amended claims under Art. 19.1 PCT

1. A high-strength road for a water resource regulation system in response to climate change, comprising a structure formed by combining a structural formwork (31) of a hollow unit body (30a) and solidified concrete grout (302), the structure forming an underground structural space (30), a pavement (10) being laid on a top of the underground structural space (30), **characterized in that** the hollow unit body (30a) comprises at least one structural formwork (31) and a plurality of side slabs (32) combined with each other; a plate (312) is disposed on an upper surface of the structural formwork (31), the plate (312) being provided with a through hole (311) and at least one through pipe (33), wherein the structural formwork (31) and the side slabs (32) are combined together and laid, and concrete grout (302) is grouted into the through pipe (33) of the structural formwork (31), and the concrete grout (302) solidifies and is capable of forming an underground structural space (30) with a high support strength, the underground structural

space (30) forming a water resources regulation road having a water storage and drainage function.

2. The high-strength road for a water resource regulation system in response to climate change, **characterized in that** in the structural formwork (31) of the hollow unit body (30a), tenons (317) and mortises (318), which correspond to each other, are formed in a periphery of the plate (312) to allow the structural formwork (31)s of two adjacent unit bodies (30a) to joint to each other by means of tenon and mortise joints; and in the side slabs (32), the slabs (32) are formed with the through holes (321) and are provided, in locations of a side edge, with snap fastening structures for the side slabs (32) to fast attach, through snap engagement, to outsides of the structural formwork (31) to thereby form a hollow unit body (30a).

3. The high-strength road for a water resource regulation system in response to climate change according to claim 1, **characterized in that** the hollow unit body (30a) is constructed by combining two, upper and lower, structural formworks (31) and four side slabs (32).

4. The high-strength road for a water resource regulation system in response to climate change according to claim 1, **characterized in that** the plate (312) of the structural formwork (31) is provided with hollow tubular pillars (314) arranged in a circumference of the through pipe (33).

5. The high-strength road for a water resource regulation system in response to climate change according to claim 2, **characterized in that** the plate (312) of the structural formwork (31) is provided, on four sides of a top, with snap notches (319), and snap fastening structures provided in locations of side edges of the side slabs (32) are hooking barbs (322).

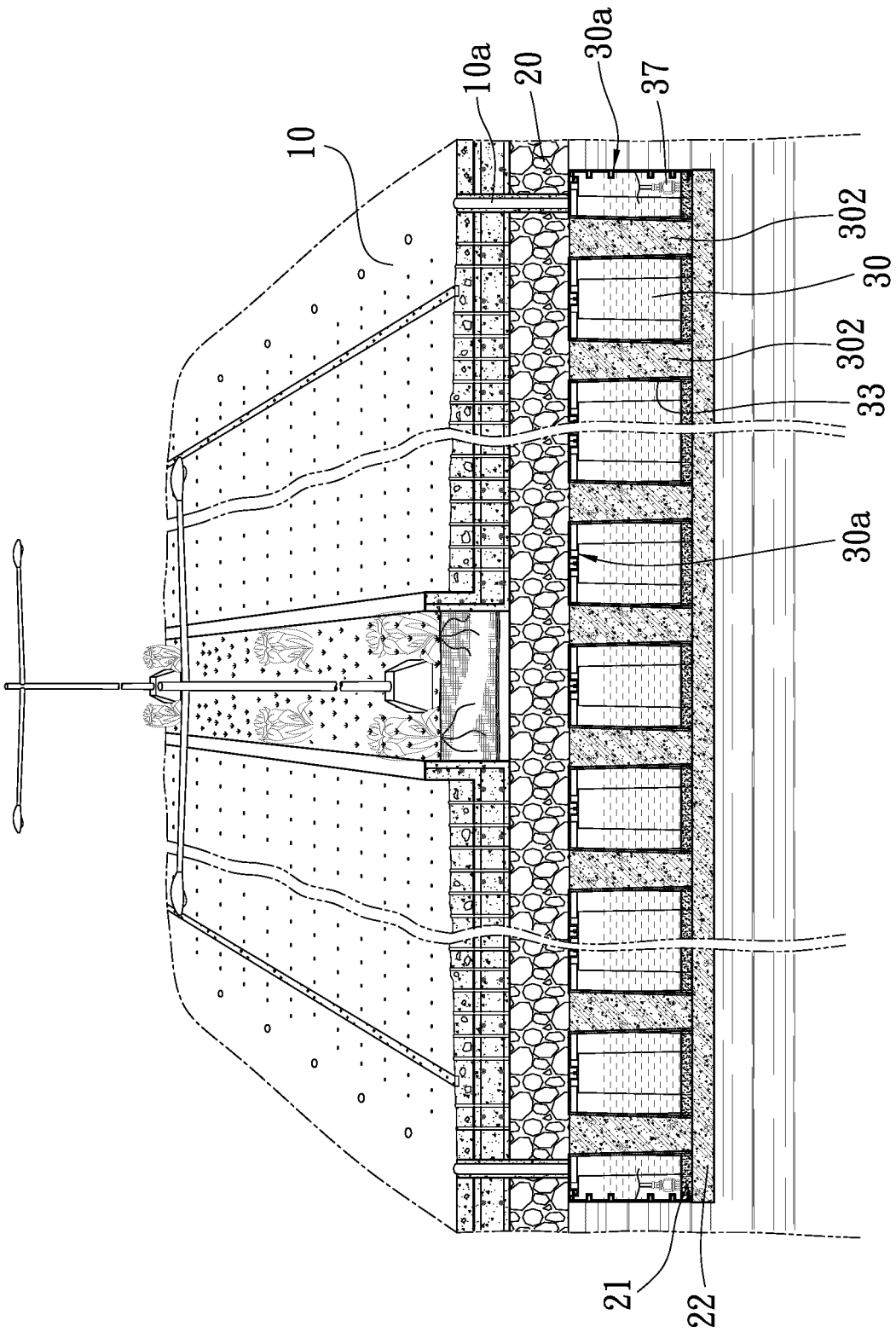


FIG. 1

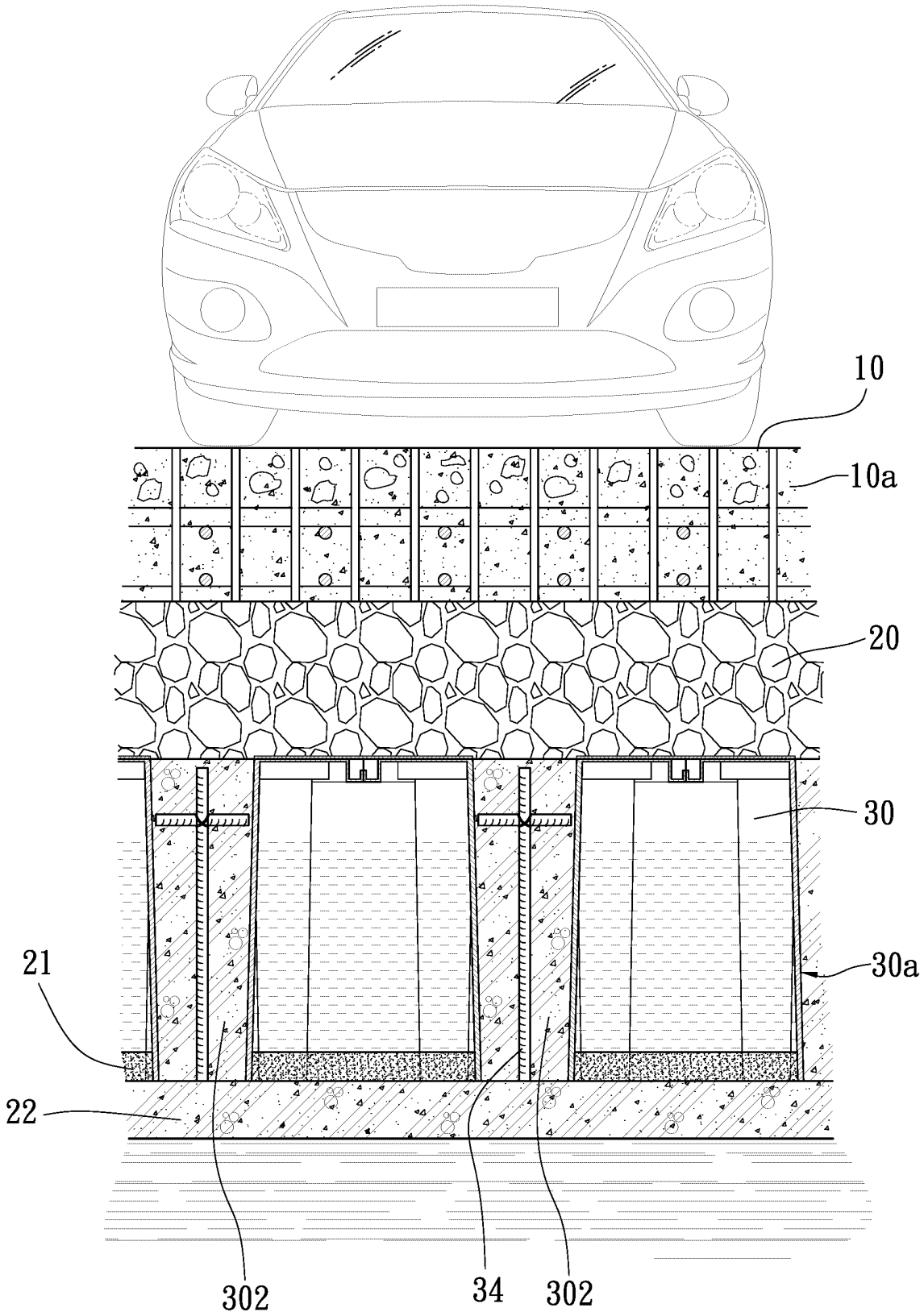


FIG. 2

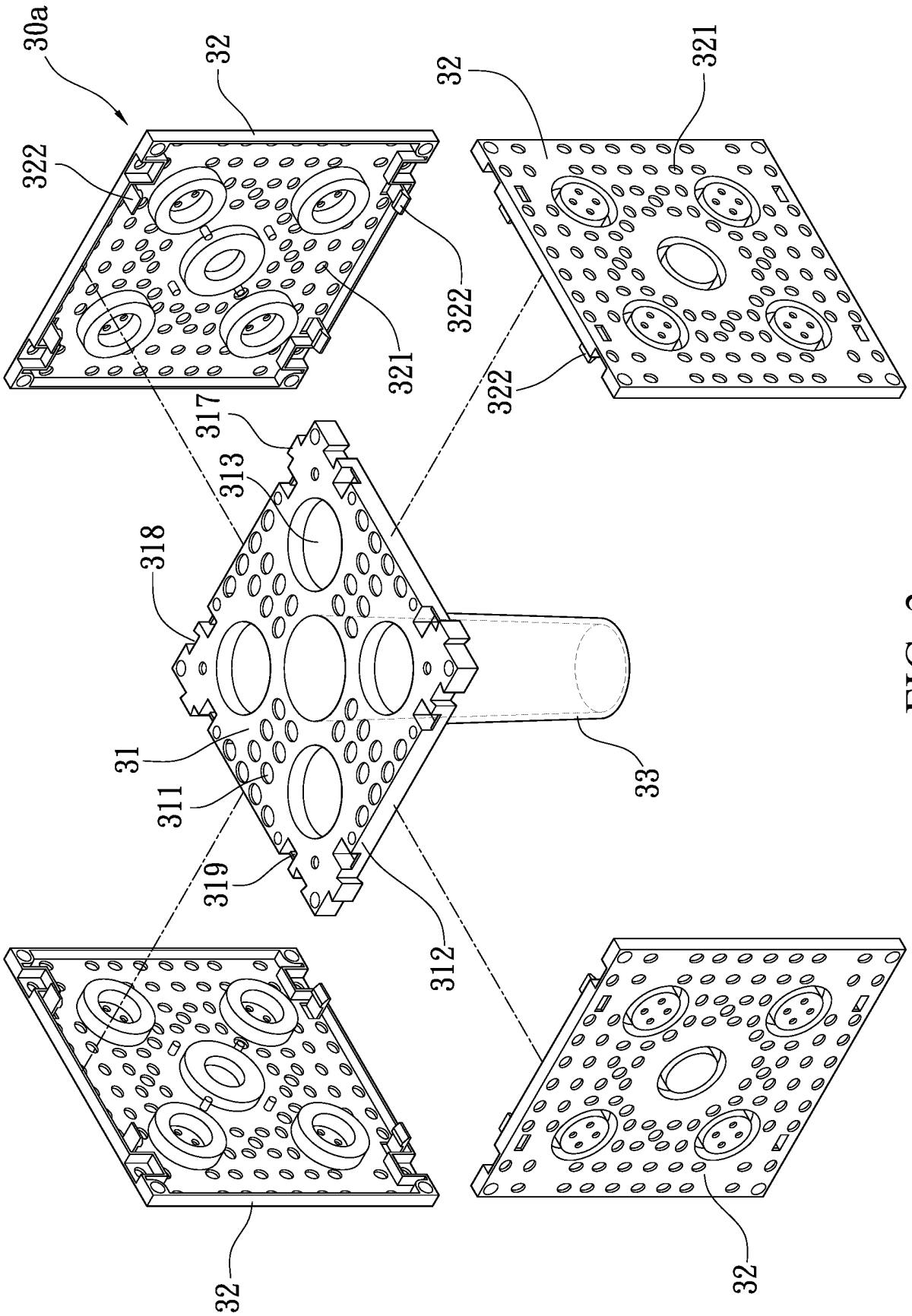


FIG. 3

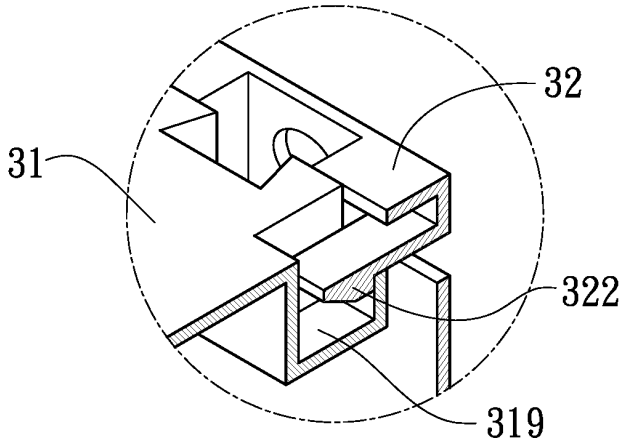


FIG. 4a

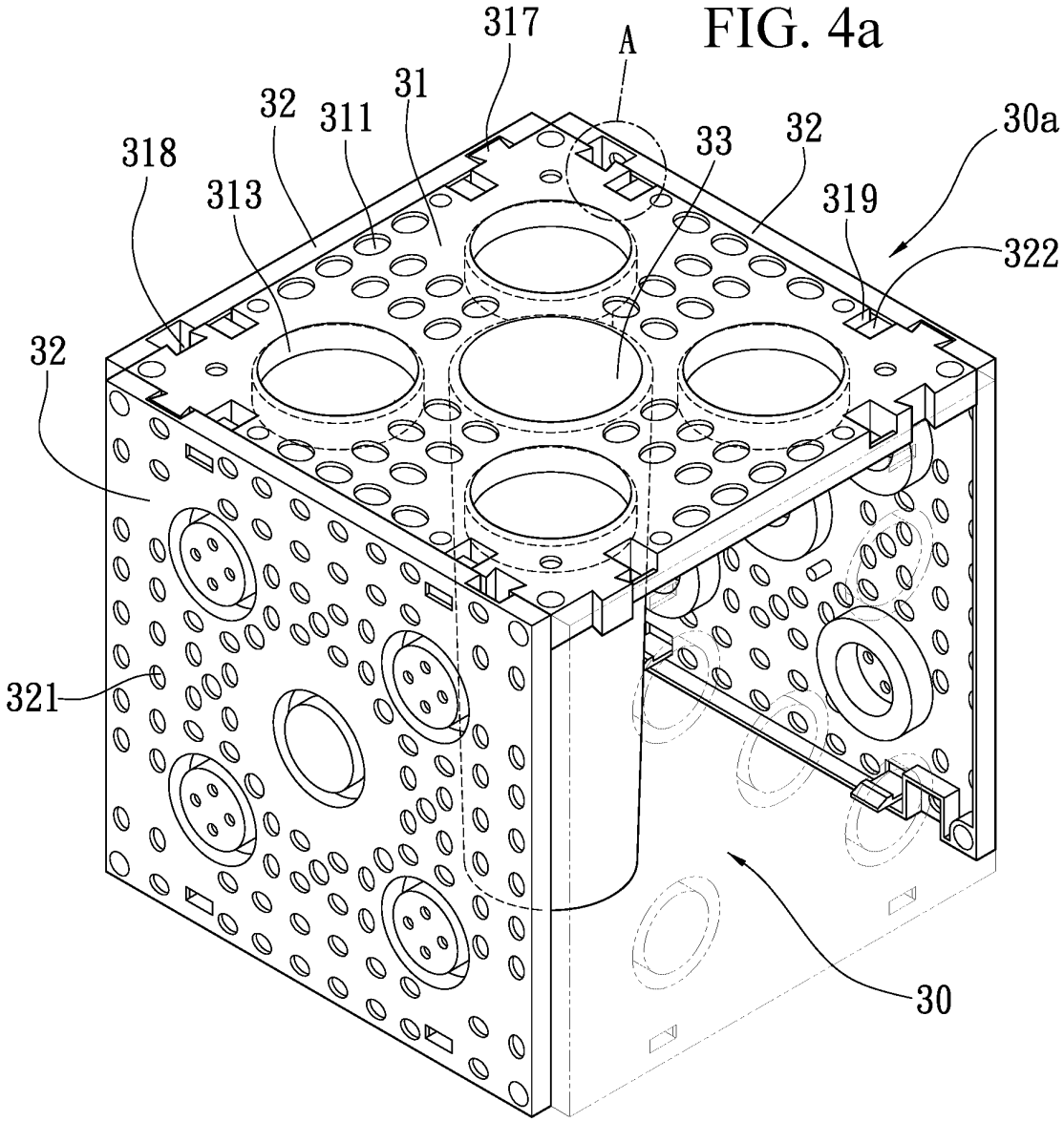


FIG. 4

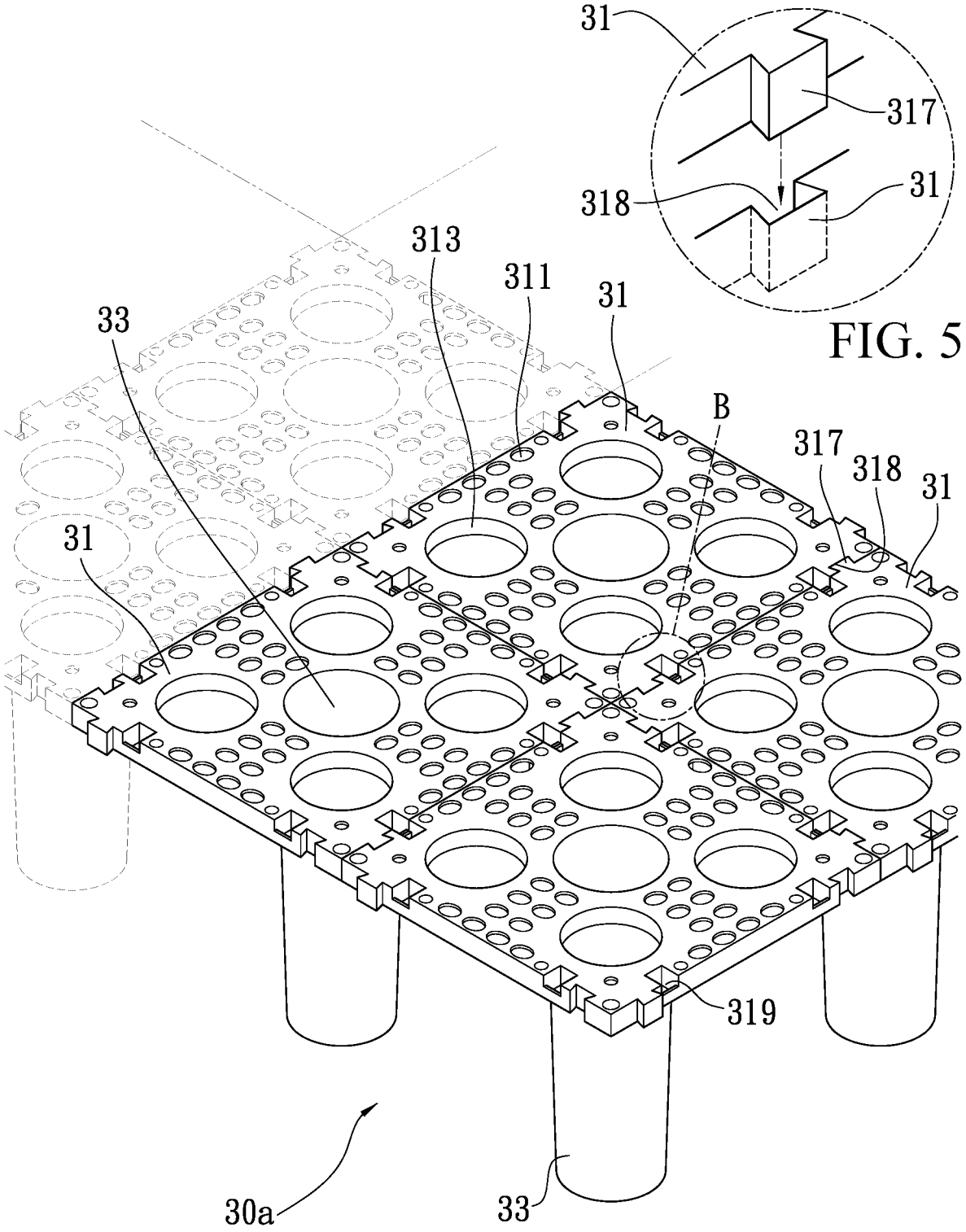


FIG. 5a

FIG. 5

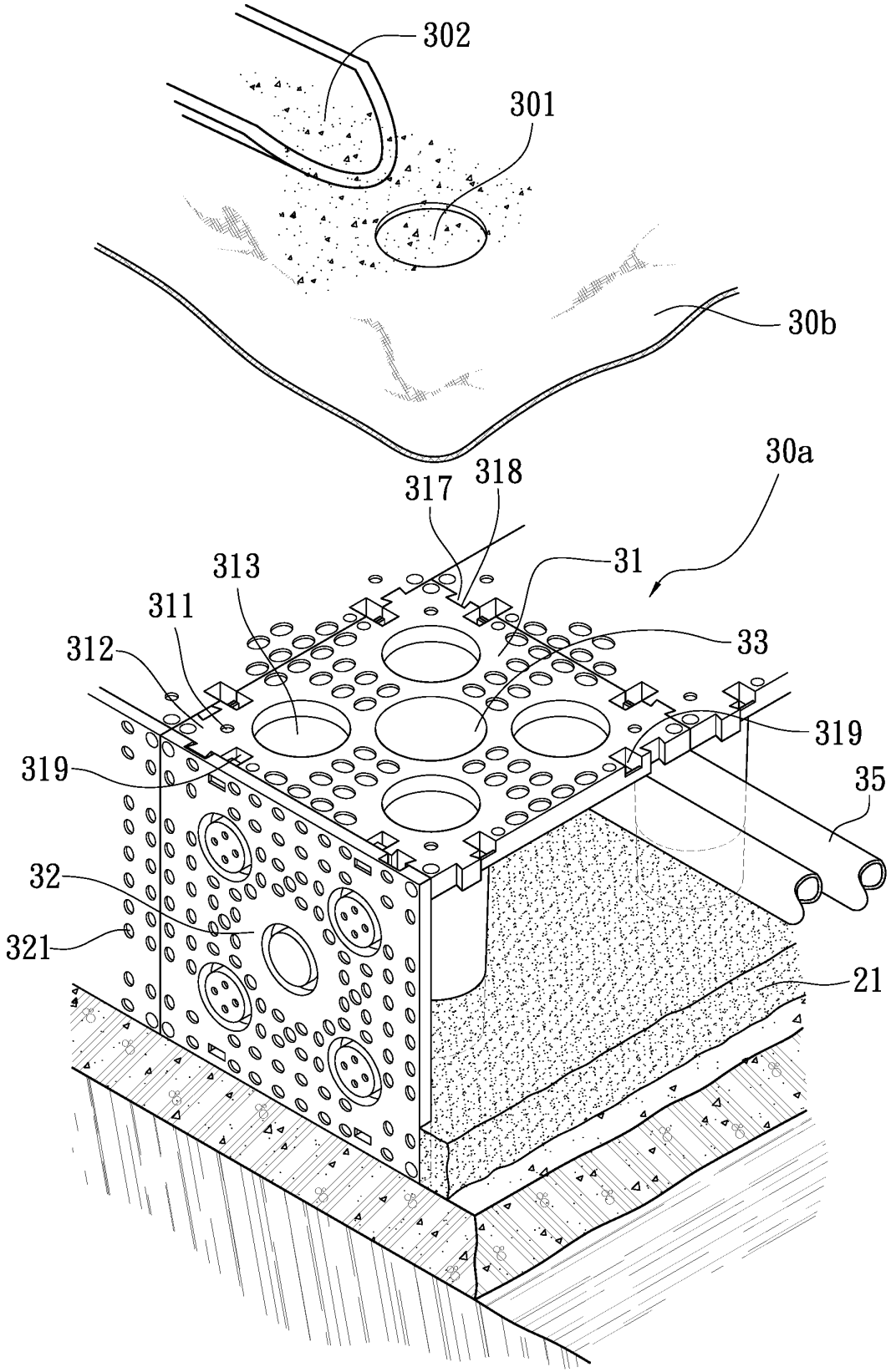
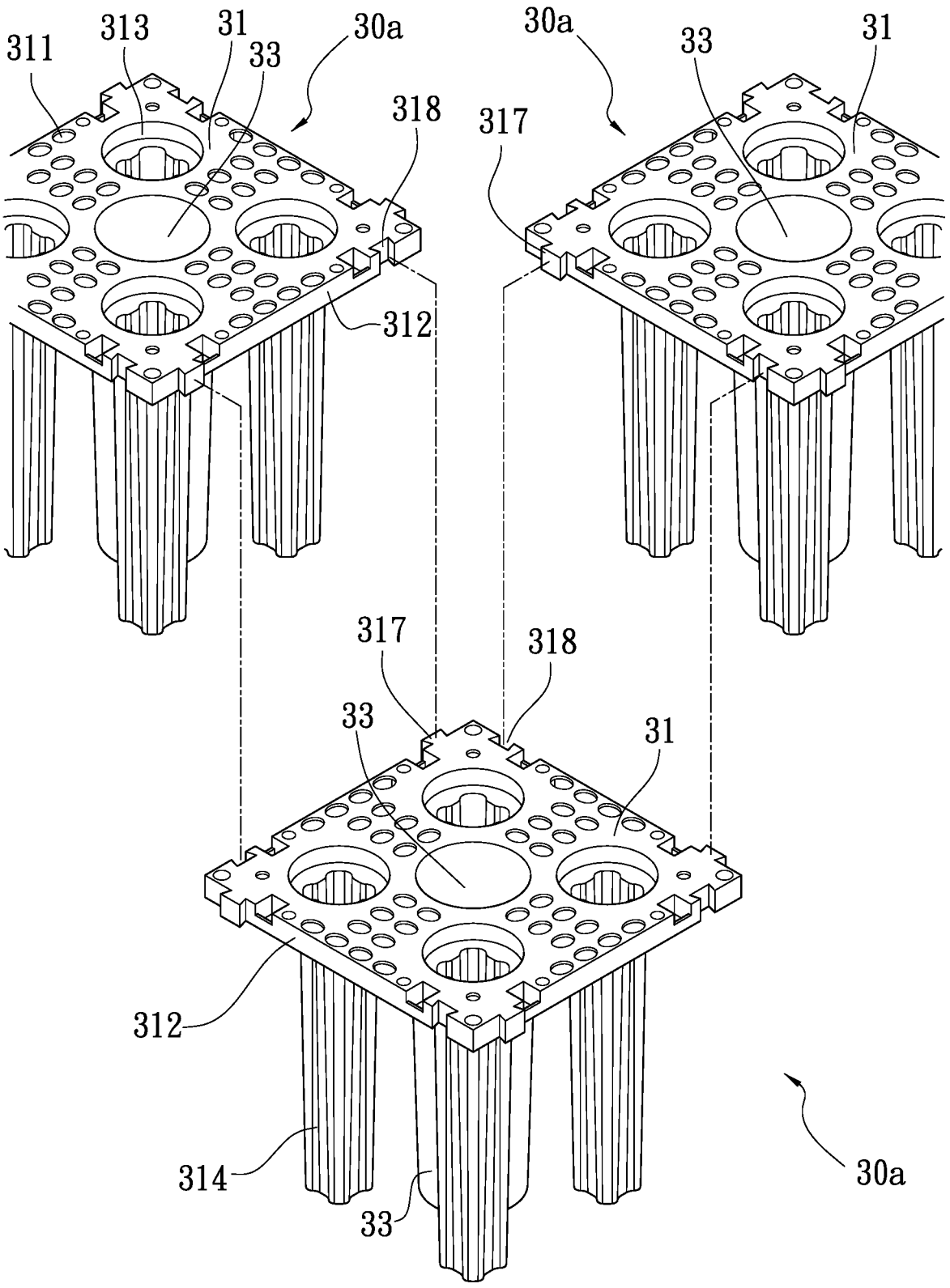


FIG. 6


311
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317
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312
314
33
30a

FIG. 7

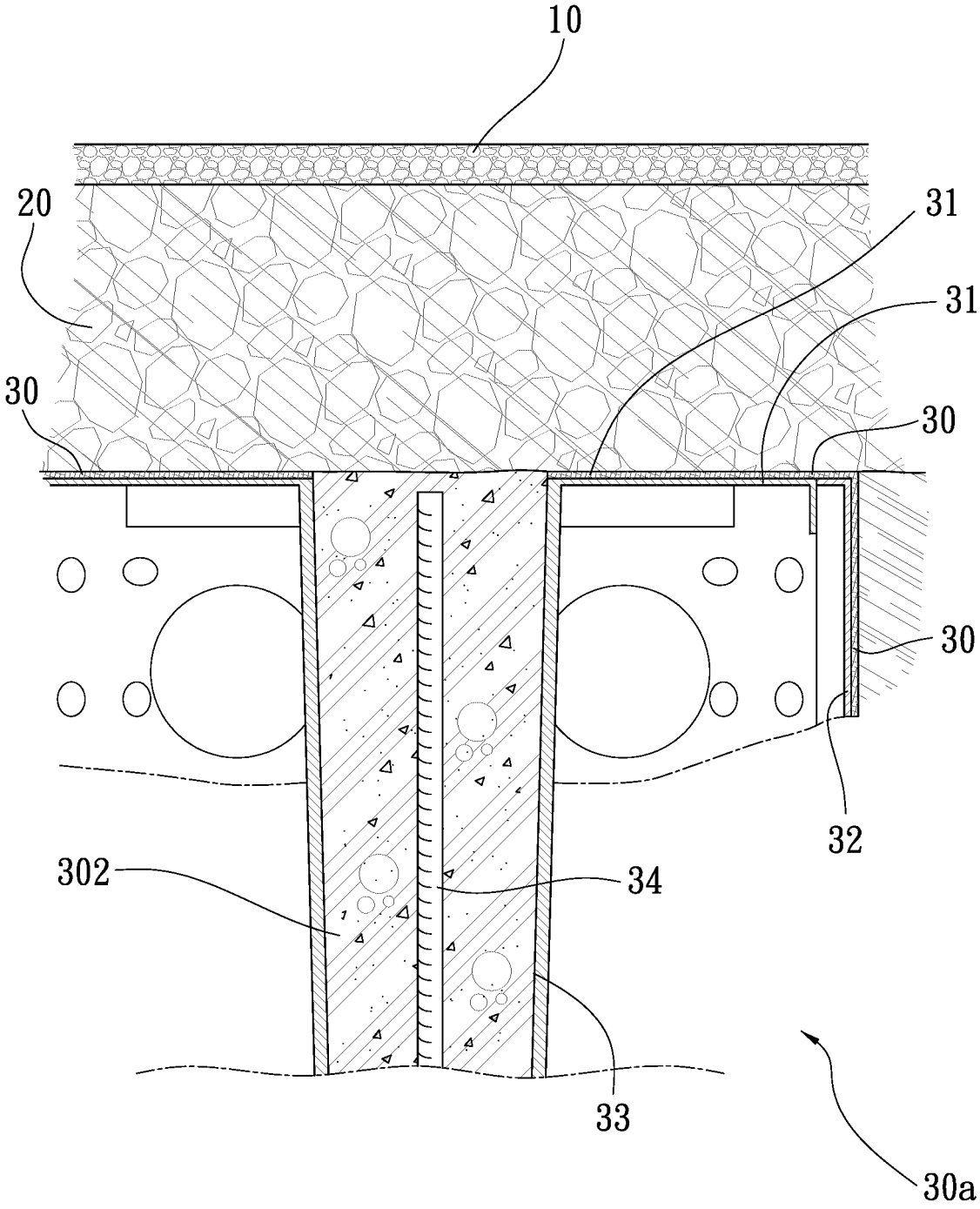

FIG. 8

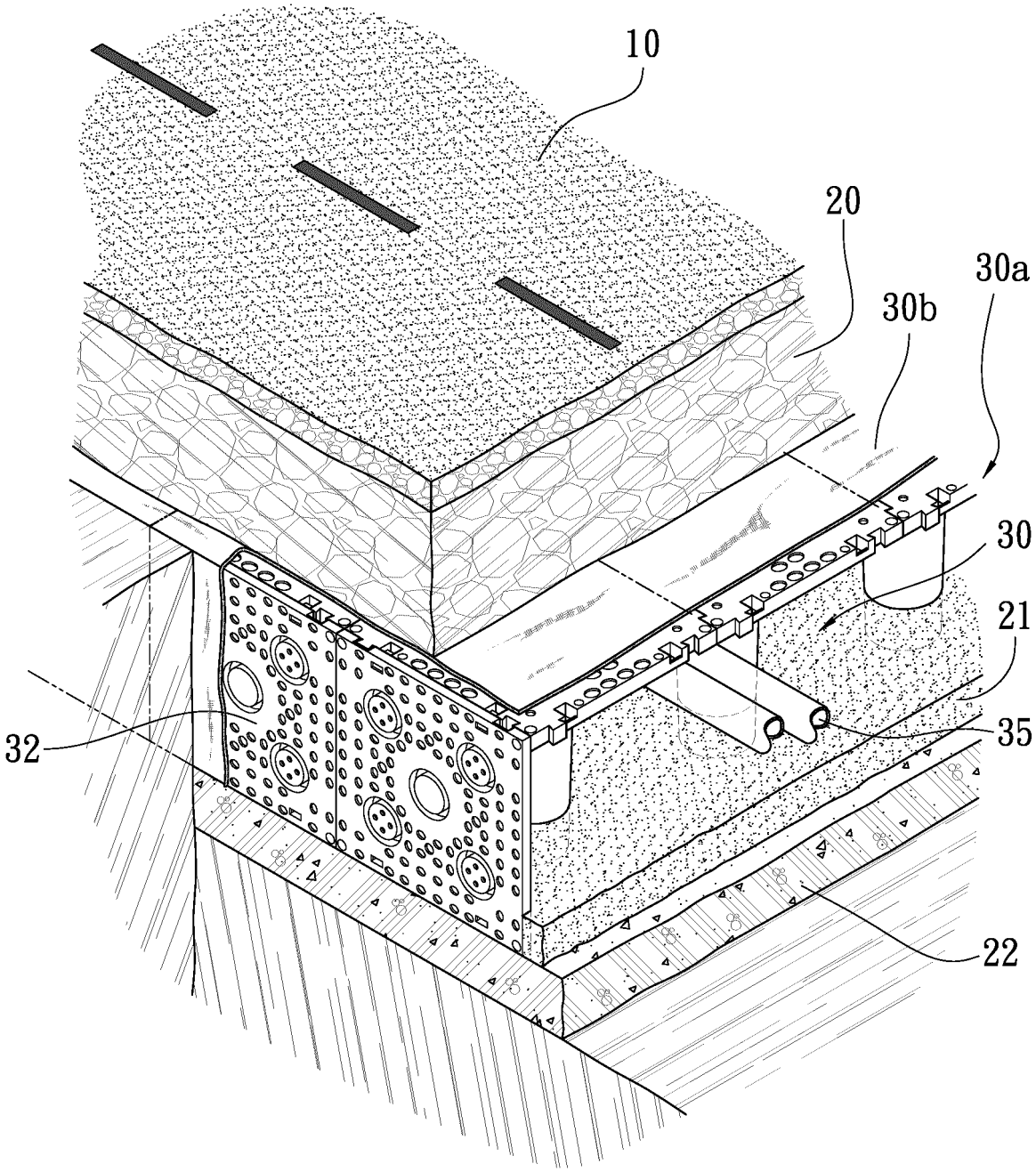

FIG. 9

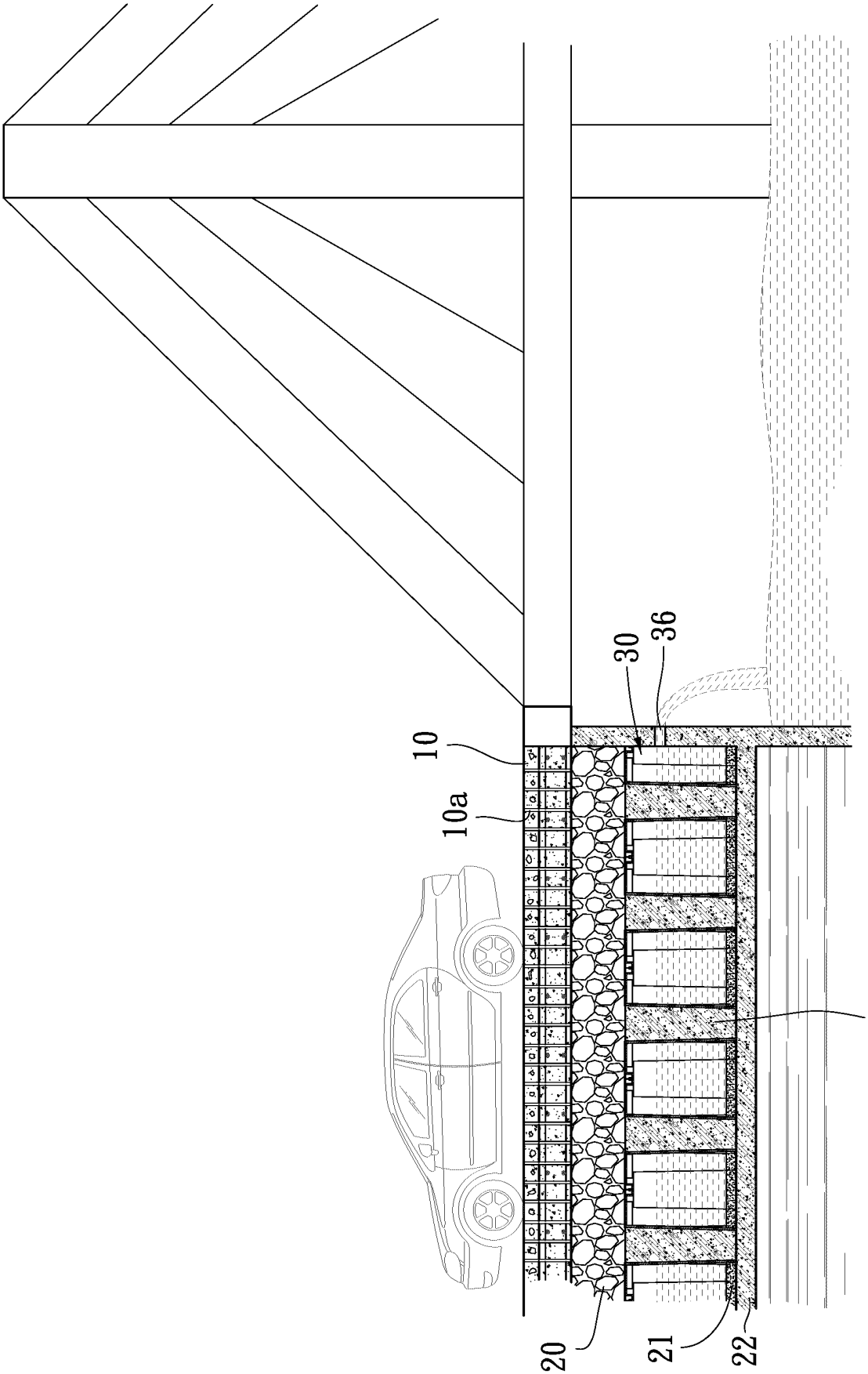

FIG. 10

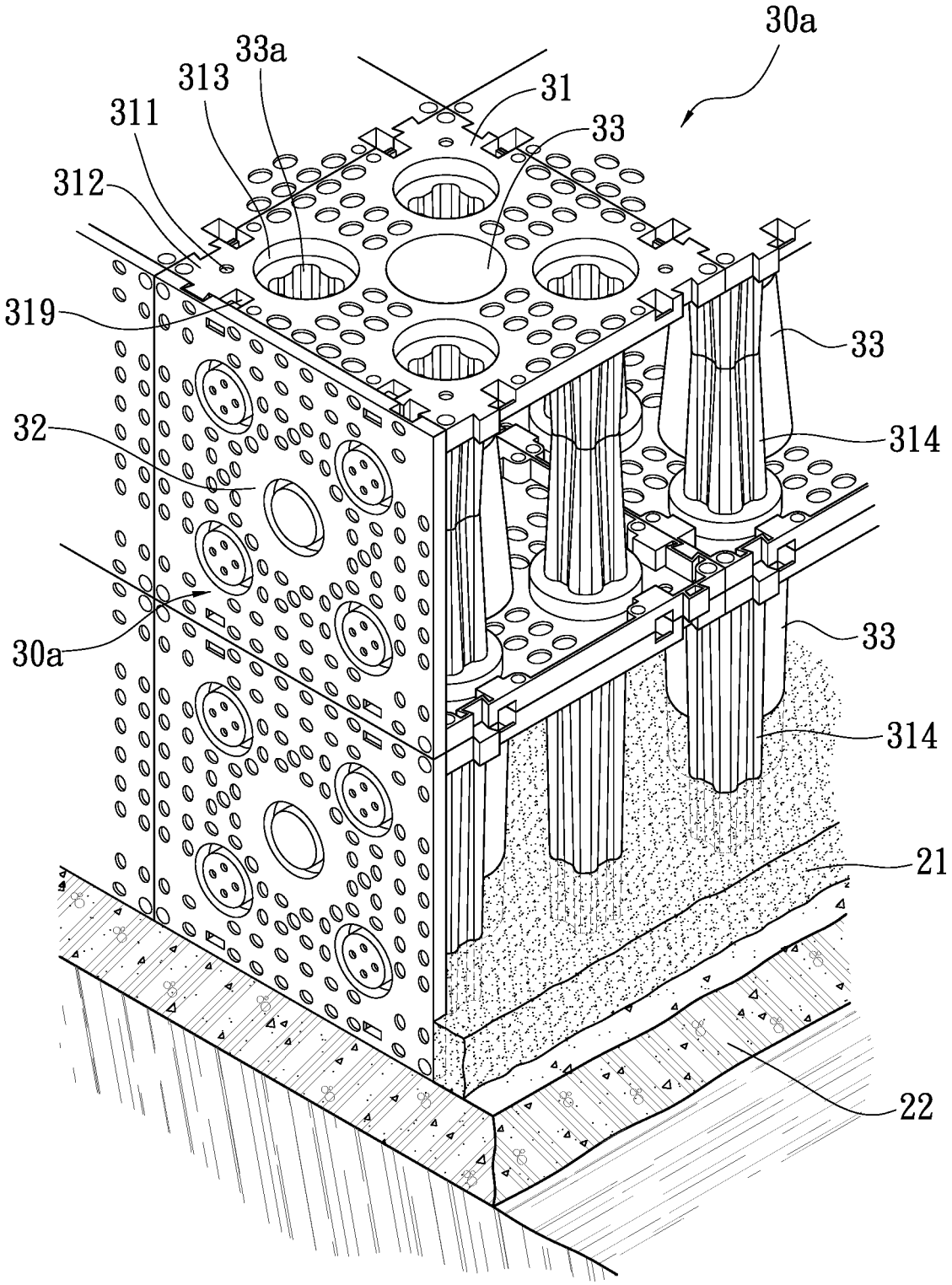

FIG. 11

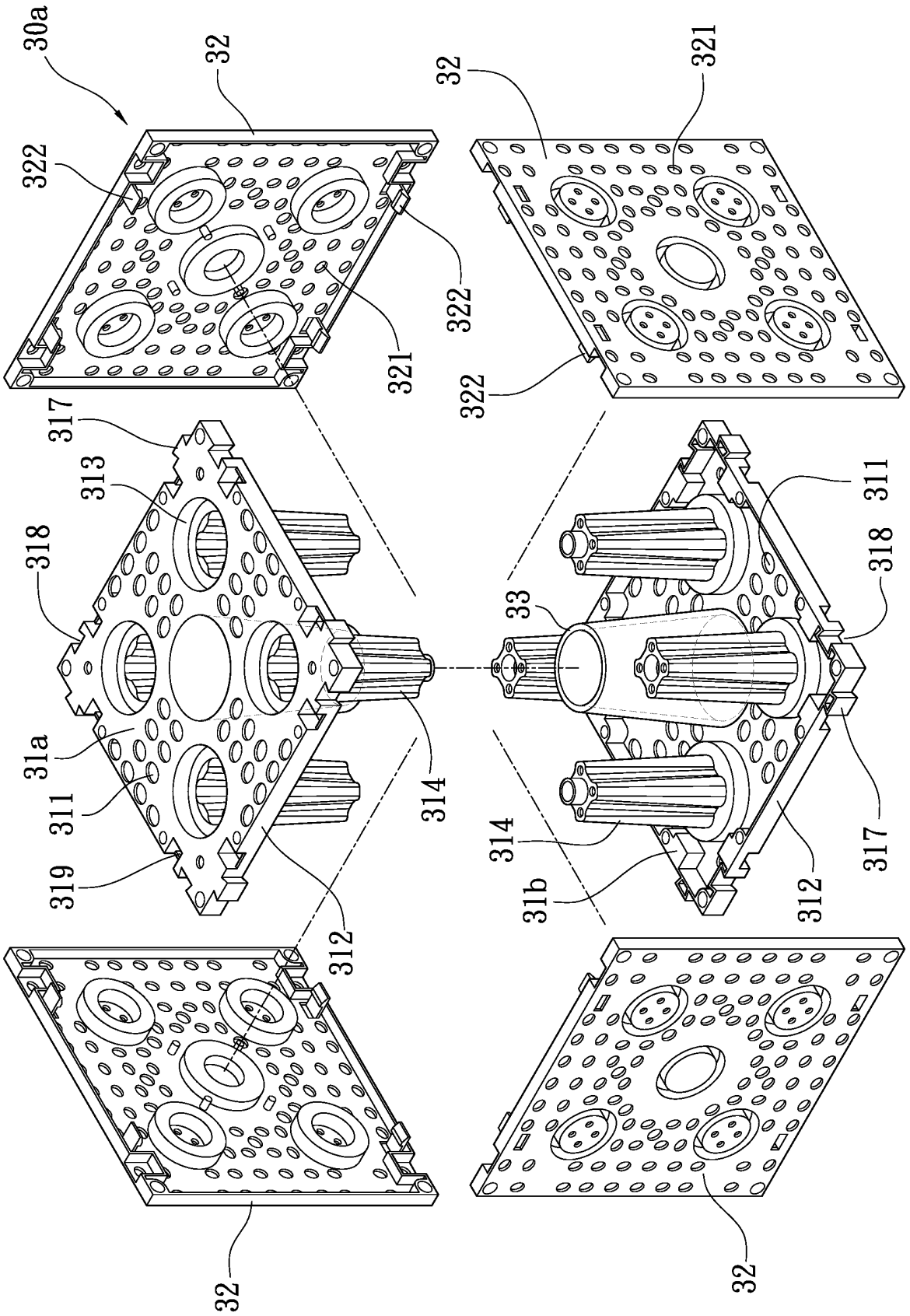

FIG. 12

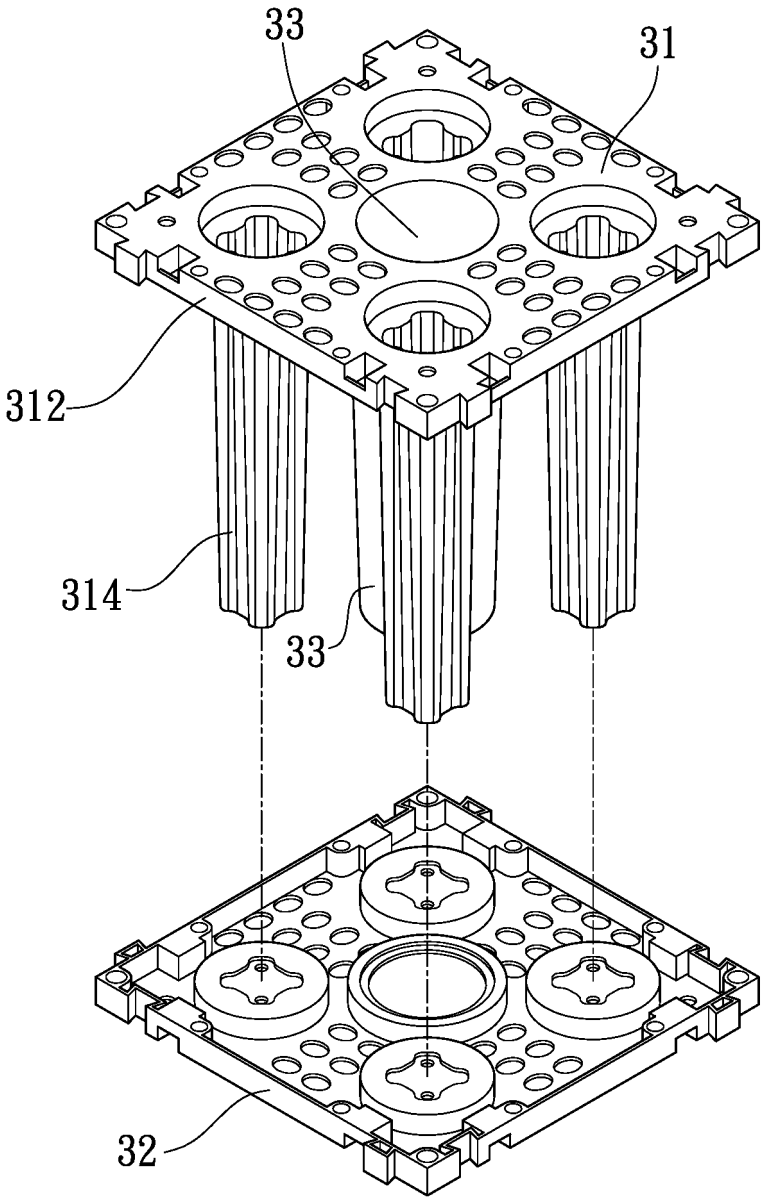

FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/091725

A. CLASSIFICATION OF SUBJECT MATTER

E03F 5/10(2006.01)i; E03B 3/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E01C, E03F, E03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT, ENTXTC, CNKI, VEN: 管, 孔, 灌浆, 灌注, 注浆, 浇筑, 浇注, 水, 雨水, 板, 顶板, 侧板, 模板, 砌块, 砖, pipe?, tube, duct, hole?, aperture, grout+, pour+, inject+, rain, rainwater, stormwater, upper, lower, bottom, lateral, side, board, plate, module, framework, brick, block

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 216787349 U (CHEN RUIWEN) 21 June 2022 (2022-06-21) description, paragraphs 29-49, and figures 1-11	1-5
E	CN 216787381 U (CHEN RUIWEN) 21 June 2022 (2022-06-21) description, paragraphs 29-40, and figures 1-12	1-5
PX	CN 215670013 U (CHEN RUIWEN) 28 January 2022 (2022-01-28) description, paragraphs 24-36, and figures 1-8	1-5
PX	TW 621567 U (CHEN RUIWEN) 21 December 2021 (2021-12-21) description, paragraphs 17-37, and figures 1-13	1-5
PX	TW 623851 U (CHEN RUIWEN) 01 March 2022 (2022-03-01) description, paragraphs 13-27, and figures 1-8	1-5
PX	TW 624383 U (CHEN RUIWEN) 11 March 2022 (2022-03-11) description, paragraphs 14-35, and figures 1-11	1-5
Y	CN 109295829 A (CHEN GUANWEI) 01 February 2019 (2019-02-01) description, paragraphs 99-129, and figures 1-27	1-5

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 July 2022	**18 July 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/091725

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 210596882 U (ANHUI XINGLUO CONSTRUCTION GROUP CO., LTD.) 22 May 2020 (2020-05-22) description, paragraphs 21 and 27-31, and figures 1-2	1-5
Y	CN 207143643 U (CHEN GUANWEI) 27 March 2018 (2018-03-27) description, paragraphs 83-107, and figures 1-27	1-5
A	TW 613344 B (CHEN GUANGZHENG) 01 February 2018 (2018-02-01) entire document	1-5
A	US 2004099414 A1 (CHEN JUIWEN) 27 May 2004 (2004-05-27) entire document	1-5
A	CN 112922084 A (ZHANG PEIRONG) 08 June 2021 (2021-06-08) entire document	1-5
A	AU 2006279239 A1 (NEW WATER PTY LTD.) 15 February 2007 (2007-02-15) entire document	1-5
A	CN 204608556 U (GLOBAL SUNSHINE INTERNAT HOLDINGS LTD.) 02 September 2015 (2015-09-02) entire document	1-5
A	CN 204608538 U (GLOBAL SUNSHINE INTERNAT HOLDINGS LTD.) 02 September 2015 (2015-09-02) entire document	1-5
A	CN 107842060 A (CHEN RUIWEN) 27 March 2018 (2018-03-27) entire document	1-5
A	CN 1851162 A (CHEN RUIWEN) 25 October 2006 (2006-10-25) entire document	1-5
A	WO 2005113900 A1 (CHEN JUIWEN) 01 December 2005 (2005-12-01) entire document	1-5

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/091725

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	216787349	U	21 June 2022	None			
CN	216787381	U	21 June 2022	None			
CN	215670013	U	28 January 2022	None			
TW	621567	U	21 December 2021	None			
TW	623851	U	01 March 2022	None			
TW	624383	U	11 March 2022	None			
CN	109295829	A	01 February 2019	None			
CN	210596882	U	22 May 2020	None			
CN	207143643	U	27 March 2018	None			
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AU	2006279239	A1	15 February 2007	None			
CN	204608556	U	02 September 2015	None			
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				US	2018080201	A1	22 March 2018
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WO	2005113900	A1	01 December 2005	None			

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