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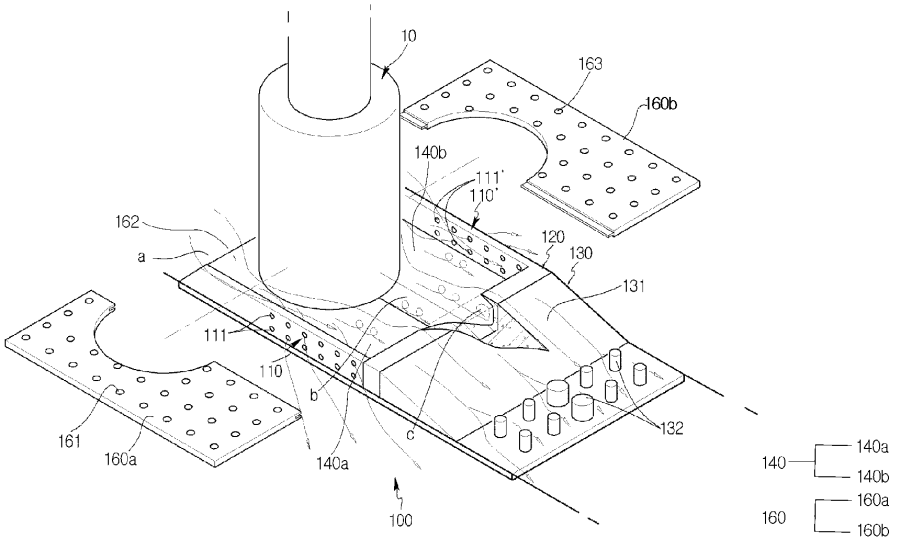
(54) **SCOUR PREVENTIVE APPARATUS FOR PIER FOUNDATION**

(57) A scour preventive apparatus for a pier foundation according to an exemplary embodiment of the present invention is the scour preventive apparatus for a pier foundation supporting load of the bridge, and may include a cover plate covering the pier foundation and formed of a plurality of holes, a first flow guide plate having a side connected to a surface of the cover plate, disposed apart from the pier foundation by a predetermined distance, and formed of a plurality of first flow holes, a second flow guide plate having a side connected to the surface of the cover plate, disposed apart from the pier foundation by the predetermined distance, and formed of a plurality of second flow holes, and a blocking plate connecting the first flow guide plate with the second flow guide plate and blocking a flow of fluid, wherein the first flow guide plate and the second flow guide plate are symmetrical to each other with respect to the pier foundation.

【Fig. 4】



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Description

[Technical Field]

[0001] The present invention relates to a scour preventive apparatus for a pier foundation.

[Background Art]

[0002] Generally, a bridge is installed at a river, a lake, and so on and means a high-level structure which vehicles or people can cross. The bridge is largely divided into an upper portion and a lower portion. The upper portion of the bridge is a part directly supporting load of the vehicles or the people, and includes an upper floor system and a mold. The lower portion of the bridge transmits the load of the upper portion to the ground, and includes an abutment, a pier, and a foundation (pile foundation, caisson foundation, and so on).

[0003] At this time, bridge scour occurs at the foundation or the pier by the flowing fluid. Scour means the phenomena that a river bed or a river bank caves in by the fluid, and occurs in a case that amount of earth and sand removed from the foundation which is the lower portion of the bridge is larger than that of earth and sand deposited around the foundation. As shown in FIG. 1 to FIG. 3, flows of the river rubbing the pier foundation can be largely divided into two flows. FIG. 1 to FIG. 3 shows occurrence of erosion and scour at the pier foundation.

[0004] The flows of the river are divided into a direct flow a directly rubbing the foundation 20 and an indirect flow b flowing around the foundation 20. The direct flow a initially rubs an exterior circumference of the foundation 20 and is separated into two flows. After that, the two flows flow symmetrically along the exterior circumference of the pier foundation and are rubbed and mixed with each other at a rear exterior circumference of the pier foundation such that vortex c occurs. At this time, small stones and pebbles lying on the ground are floated by the vortex c and hit against the foundation 20. Scour occurs by the vortex c occurring as such, and erosion occurs at the ground of the river. Strength of the foundation 20 is weakened by such phenomena, and this becomes causes of collapse of the bridge.

[0005] The above information disclosed in this Background section is only for enhancement of understanding of the background of the invention and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

[DISCLOSURE]

[Technical Problem]

[0006] An objective of the present invention is that the scour preventive apparatus is installed near the ground of a pier foundation and collects a direct flow of a river directly rubbing the pier and an indirect flow flowing around the pier as one flow such that the flow of the river is stopped at a lower portion of the pier foundation and rub between an exterior circumference of the pier and the flow of the river can be prevented.

[0007] In addition, another objective of the present invention is that flowing speed of the river is changed to zero by the scour preventive apparatus installed at the ground of the pier so as to prevent erosion of the ground of the pier foundation.

[0008] Also, other objective of the present invention is that overload that may occur in the scour preventive apparatus maintaining the flow speed to be zero is minimized.

[0009] Further, other objective of the present invention is that the flow of the river passing through a flow hole and an upper surface of a blocking plate for preventing the overload of the scour preventive apparatus quickly flows to the rear of the pier foundation.

[Technical Solution]

[0010] A scour preventive apparatus for a pier foundation according to an exemplary embodiment of the present invention is the scour preventive apparatus for a pier foundation supporting load of the bridge, and may include a cover plate covering the pier foundation and formed of a plurality of holes, a first flow guide plate having a side connected to a surface of the cover plate, disposed apart from the pier foundation by a predetermined distance, and formed of a plurality of first flow holes, a second flow guide plate having a side connected to the surface of the cover plate, disposed apart from the pier foundation by the predetermined distance, and formed of a plurality of second flow holes, and a blocking plate connecting the first flow guide plate with the second flow guide plate and blocking a flow of fluid, wherein the first flow guide plate and the second flow guide plate are symmetrical to each other with respect to the pier foundation.

[0011] In addition, the cover plate may include a first plate member and a second plate member, and the first plate member and the second plate member may be detachable from each other.

[0012] In addition, a bottom plate covering the pier foundation and having one surface laying on the ground and the other surface connected to the flow guide plates and the blocking plate may further be included.

[0013] In addition, the bottom plate may include a third plate member and a fourth plate member, and the third plate member and the fourth plate member may be detachable from each other.

[0014] An underwater barrage having one side contacting with the blocking plate may further be included, wherein thickness of the one side of the underwater barrage is larger than that of the other side of the underwater barrage.

[0015] In addition, a plurality of dispersing protrusions disposed apart from the other side of the underwater barrage by a predetermined distance may further be included.

[0016] In addition, a surface of the blocking plate where the fluid bumps may be a curved surface.

[0017] A flow separator abutting an exterior circumference of the pier foundation and having flow-separating surfaces being round and symmetrical to each other may further be included so as to prevent the fluid from rubbing the pier foundation directly.

[0018] In addition, a rubber layer may be formed on surfaces of the flow guide plates.

[Advantageous Effects]

[Description of the Drawings]

[0019]

FIG. 1 is a perspective view showing occurrence of erosion and scour at a conventional pier foundation.

FIG. 2 is a floor plan showing occurrence of scour at a conventional pier foundation.

FIG. 3 is a front view showing occurrence of scour at a conventional pier foundation.

FIG. 4 is a perspective view showing an installed state of a scour preventive apparatus according to an exemplary embodiment of the present invention at a pier foundation.

FIG. 5 is a front view showing an installed state of a scour preventive apparatus according to an exemplary embodiment of the present invention at a pier foundation.

FIG. 6 is an enlarged front view showing an installed state of a scour preventive apparatus according to an exemplary embodiment of the present invention at a pier foundation.

FIG. 7 is a perspective view showing an installed state of a scour preventive apparatus and a flow separator according to another exemplary embodiment of the present invention at a pier foundation.

FIG. 8 is a cross-sectional floor plan view showing an installed state of a scour preventive apparatus and a flow separator according to another exemplary embodiment of the present invention at a pier foundation.

FIG. 9 is a perspective view showing an installed state of a scour preventive apparatus according to another exemplary embodiment of the present invention at a pier foundation.

FIG. 10 is a cross-sectional front view showing an installed state of a scour preventive apparatus according to another exemplary embodiment of the present invention at a pier foundation.

* Description of Reference Numerals Indicating Primary Elements in the Drawings *

[0020]

10 : pier foundation	20 : foundation
100 : scour preventive apparatus	
110 : first flow guide plate	110': second flow guide plate
111 : first flow hole	111': second flow hole
112 : rubber layer	120 : blocking plate
121 : vortex-forming protrusion	130 : underwater barrage
131 : slanted surface	132 : dispersing protrusion
140 : bottom plate	140a : first plate member
140b: second plate member	150 : flow separator
151 : flow-separating surface	160 : cover plate
160a: third plate member	160b: fourth plate member
161 : through-hole	162 : inner space
a : direct flow	b : indirect flow
c : vortex	

[Mode for Invention]

[0021] Hereinafter, an exemplary embodiment of the present invention will be described in detail with reference to the attached drawings.

[0022] Firstly, it is kept in mind that the same constituent elements or components will be represented by the same reference numerals in the drawings. When explaining the present invention, a detailed description related to well-known functions or components will be omitted so as to prevent the spirit of the present invention from being obscured.

[0023] FIG. 4 is a perspective view showing an installed state of a scour preventive apparatus according to an exemplary embodiment of the present invention at a pier foundation. FIG. 5 is a front view showing an installed state of a scour preventive apparatus according to an exemplary embodiment of the present invention at a pier foundation, and FIG. 6 is an enlarged front view showing an installed state of a scour preventive apparatus according to an exemplary embodiment of the present invention at a pier foundation. In addition, FIG. 9 is a perspective view showing an installed state of a scour preventive apparatus according to another exemplary embodiment of the present invention at a pier foundation, and FIG. 10 is a cross-sectional front view showing an installed state of a scour preventive apparatus according to another exemplary embodiment of the present invention at a pier foundation.

[0024] As shown in FIG. 4 to FIG. 6, FIG 9 and FIG 10, a scour preventive apparatus 100 according to an exemplary embodiment protects a pier foundation 10 by covering the pier foundation 10.

[0025] Constituent elements of an exemplary embodiment include a cover plate 160, a first flow guide plate 110, a second flow guide plate 110', and a blocking plate 120. In addition, a bottom plate 140, an underwater barrage 130, and a dispersing protrusion 132 are further included.

[0026] Firstly, the cover plate 160 covers the pier foundation 10. At this time, the cover plate 160 includes detachable plate members 160a and 160b. The plate members 160a and 160b can be assembled by insertedly coupling a protrusion portion and an insert portion formed respectively at the plate members 160a and 160b or by welding.

[0027] This is for facilitating covering the pier foundation 10. In addition, a plurality of through-holes 163 and 161 is formed at the cover plate 160.

[0028] The first flow guide plate 110 and the second flow guide plate 110' respectively have a side connected to a surface of the cover plate 160 and are disposed apart from the pier foundation 10 by a predetermined distance. The first and second flow guide plates 110 and 110' are symmetrical to each other with respect to the pier foundation 10. At this time, first flow holes 111 and second flow holes 111' are formed respectively at the first flow guide plate 110 and the second flow guide plate 110'.

[0029] In addition, a rubber layer 112 is coated on surfaces of the first flow guide plate 110 and the second flow guide plate 110'. The rubber layer 112 protects the scour preventive apparatus 100 according to an exemplary embodiment from sand and stone swept by fluid.

[0030] The blocking plate 120 is connected to the first flow guide plate 110 and the second flow guide plate 110'. At this time, a surface of the blocking plate 120 is a curved surface.

[0031] The bottom plate 140 covers the pier foundation 10, and has one surface laying on the ground and the other surface connected to the first flow guide plate 110, the second flow guide plate 110', and the blocking plate 120. The bottom plate 140 includes detachable plate members 140a and 140b. This is for facilitating covering the pier foundation 10, too. The bottom plate 140 may not be used.

[0032] After the bottom plate 140 is disposed on the ground of the pier foundation 10, the first flow guide plate 110 and the second flow guide plate 110' are disposed vertically at both sides of the bottom plate 140 along a flowing direction of the fluid according to an exemplary scour preventive apparatus 100. The blocking plate 120 is disposed vertically at the rear of the bottom plate 140. In addition, the cover plate 160 is connected on an upper surfaces of the first flow guide plate 110, the second flow guide plate 110', and the blocking plate 120. An inner space 162 is formed among the constituent elements in the scour preventive apparatus 100 according to an exemplary embodiment where the constituent elements are connected as described above. In addition, a front portion of the bottom plate 140 is open, and the fluid flows in the inner space 162 through the front portion of the bottom plate 140.

[0033] If the fluid flows in the inner space 162, the inflow fluid stays in the inner space 162 in a state that a flowing speed thereof is zero by the blocking plate 120. At this time, as the fluid flowed in the inner space 162 is stopped, a direct flow a and an indirect flow b of a river is not generated in the inner space 162. Accordingly, the scour generated by repetitive rub of the fluid at the rear portion of the exterior circumference of the pier foundation 10 can be prevented.

[0034] In addition, the first flow hole 111, the second flow hole 111', and a plurality of holes 163 are formed respectively at the first flow guide plate 110, the second flow guide plate 110', and the cover plate 160 so as to prevent increase of hydraulic pressure in the inner space 162 by the fluid continuously flowed in the inner space 162. As a consequence that the fluid of the inner space 162 flows out through the first flow hole 111, the second flow hole 111', and the holes 163, the hydraulic pressure in the inner space 162 is controlled not to increase.

[0035] In addition, since the surface of the blocking plate 120 where the fluid bumps is a curved surface, the fluid flowed in the inner space 162 rotates along the curved surface. Thereby, the vortex c is formed in the inner space 162

and the hydraulic pressure in the inner space 162 may be reduced.

[0036] In addition, an exemplary embodiment further includes an underwater barrage 130 having a slanted surface 131 connected to the rear portion of the blocking plate 120. According to the slanted surface 131, thickness of a side contacting with a side of the blocking plate 120 is larger than that of the other side.

[0037] The underwater barrage 130 controls the fluid partly flowing out through the first flow hole 111, the second flow hole 111', and the holes 163 and the fluid flowing along the upper surface of the cover plate 160 to flow quickly toward the rear of the pier foundation 10 along the slanted surface 131 of the underwater barrage 130. This prevents hydraulic overload from being applied to the scour preventive apparatus 100. The hydraulic overload may be caused by the fluid with an inverse flow direction or with a slow flow speed.

[0038] In addition, an exemplary embodiment further includes a plurality of dispersing protrusions 132 disposed apart from the other side of the underwater barrage 130 by a predetermined distance. The plurality of protrusions 132 with multiple rows is sequentially protruded. The dispersing protrusions 132 disperse the flow of the fluid flowing along the slanted surface 131 of the underwater barrage 130. Since dispersing protrusions 132 disperse the flow of the fluid, erosion of the ground at the rear of the underwater barrage 130 can be prevented.

[0039] As described above, if the scour preventive apparatus 100 is installed at the pier foundation 10 mounted on the ground of the river, collapse of the exterior circumference of the pier foundation 10 can be prevented and the erosion of the ground near the pier foundation 10 can be prevented. This has a merit that solidity and bearing strength of the pier foundation 10 can be maintained for a very long time in spite of overflow of the river.

[0040] In addition, the flow speed near an inlet portion of the inner space 162 to which the fluid is supplied prevents occurrence of overload to the stopped fluid according to the scour preventive apparatus 100.

[0041] FIG. 7 is a perspective view showing an installed state of a scour preventive apparatus and a flow separator according to another exemplary embodiment of the present invention at a pier foundation, and FIG. 8 is a cross-sectional floor plan view showing an installed state of a scour preventive apparatus and a flow separator according to another exemplary embodiment of the present invention at a pier foundation. Constituent elements of another exemplary embodiment of the present invention are similar to those of an exemplary embodiments described above referring to FIG. 4 to FIG. 6, FIG. 9 and FIG 10, and detailed description thereof will be omitted.

[0042] As shown in FIG. 7 and FIG. 8, a flow separator 150 provided with flow-separating surfaces 151 having round shape and being symmetrical to each other is mounted at the exterior circumference of the pier foundation 10 which receives the flow of an upstream of the river so as to separate the flow of the river. Therefore, it is prevented that the flow of the upstream of the river directly rubs the pier foundation.

[0043] A scour preventive apparatus for a pier foundation according the present invention is installed near the ground of the pier foundation and collects the direct flow of the river directly rubbing the pier and the indirect flow flowing around the pier as one flow such that the flow of the river is stopped at a lower portion of the pier foundation and rub between the exterior circumference of the pier and the flow of the river can be prevented. Therefore, erosion of the pier foundation can be prevented.

[0044] In addition, according to the scour preventive apparatus for the pier foundation of the present invention, the erosion of the ground of the pier foundation can be prevented by installing the scour preventive apparatus at the ground of the pier.

[0045] Also, since the overload in the scour preventive apparatus caused by stopping the flow at the pier foundation of the present invention is minimized, bearing strength of the scour preventive apparatus can be improved.

[0046] Further, since the flow of the river passing through the first and second flow holes and the upper surface of the blocking plate and preventing the overload in the scour preventive apparatus is flowed quickly toward the rear of the pier foundation according to the scour preventive apparatus for the pier foundation of the present invention, the flow direction of the river is not changed to an inverse direction by the scour preventive apparatus.

[0047] While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

Claims

1. A scour preventive apparatus for a pier foundation supporting load of a bridge, comprising
   a cover plate covering the pier foundation and formed of a plurality of holes,
   a first flow guide plate having a side connected to a surface of the cover plate, disposed apart from the pier foundation by a predetermined distance, and formed of a plurality of first flow holes,
   a second flow guide plate having a side connected to the surface of the cover plate, disposed apart from the pier foundation by the predetermined distance, and formed of a plurality of second flow holes, and

a blocking plate connecting the first flow guide plate with the second flow guide plate and blocking a flow of fluid, wherein the first flow guide plate and the second flow guide plate are symmetrical to each other with respect to the pier foundation.

2. The scour preventive apparatus for a pier foundation of claim 1, wherein the cover plate comprises a first plate member and a second plate member, and the first plate member and the second plate member are detachable from each other.

3. The scour preventive apparatus for a pier foundation of claim 1, further comprising a bottom plate covering the pier foundation and having one surface laying on the ground and the other surface connected to the flow guide plates and the blocking plate.

4. The scour preventive apparatus for a pier foundation of claim 3, wherein the bottom plate comprises a third plate member and a fourth plate member, and the third plate member and the fourth plate member are detachable from each other.

5. The scour preventive apparatus for a pier foundation of claim 1, further comprising an underwater barrage having one side contacting with the blocking plate, wherein thickness of the one side of the underwater barrage is larger than that of the other side of the underwater barrage.

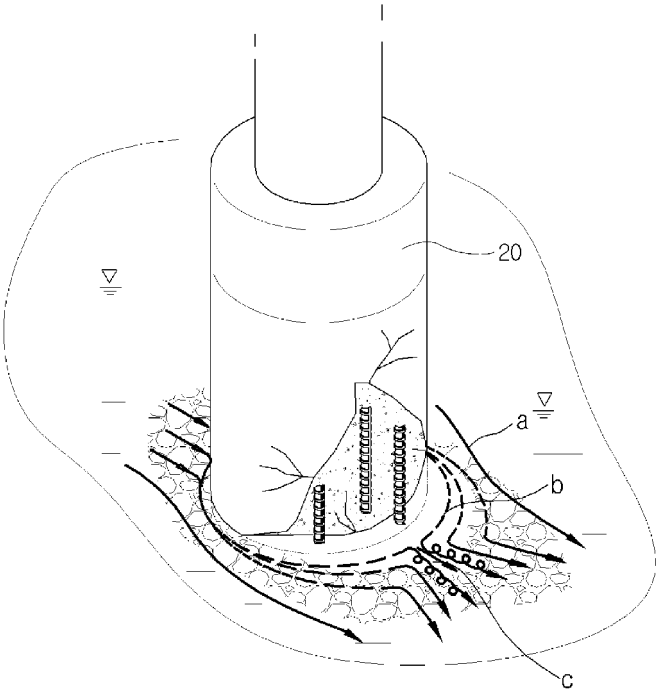
6. The scour preventive apparatus for a pier foundation of claim 5, further comprising a plurality of dispersing protrusions disposed apart from the other side of the underwater barrage by a predetermined distance.

7. The scour preventive apparatus for a pier foundation of claim 1, wherein a surface of the blocking plate where the fluid bumps is a curved surface.

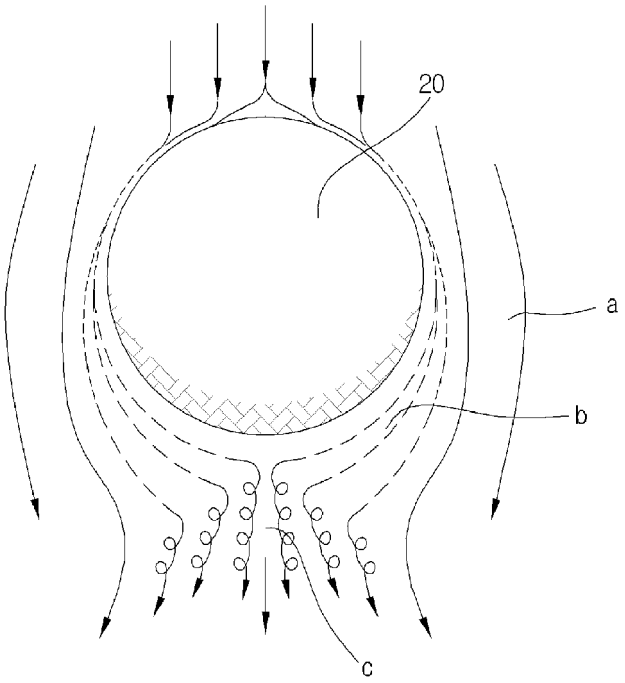
8. The scour preventive apparatus for a pier foundation of claim 1, further comprising a flow separator abutting an exterior circumference of the pier foundation and having flow-separating surfaces being round and symmetrical to each other so as to prevent the fluid from rubbing the pier foundation directly.

9. The scour preventive apparatus for a pier foundation of claim 1, wherein a rubber layer is formed on surfaces of the flow guide plates.

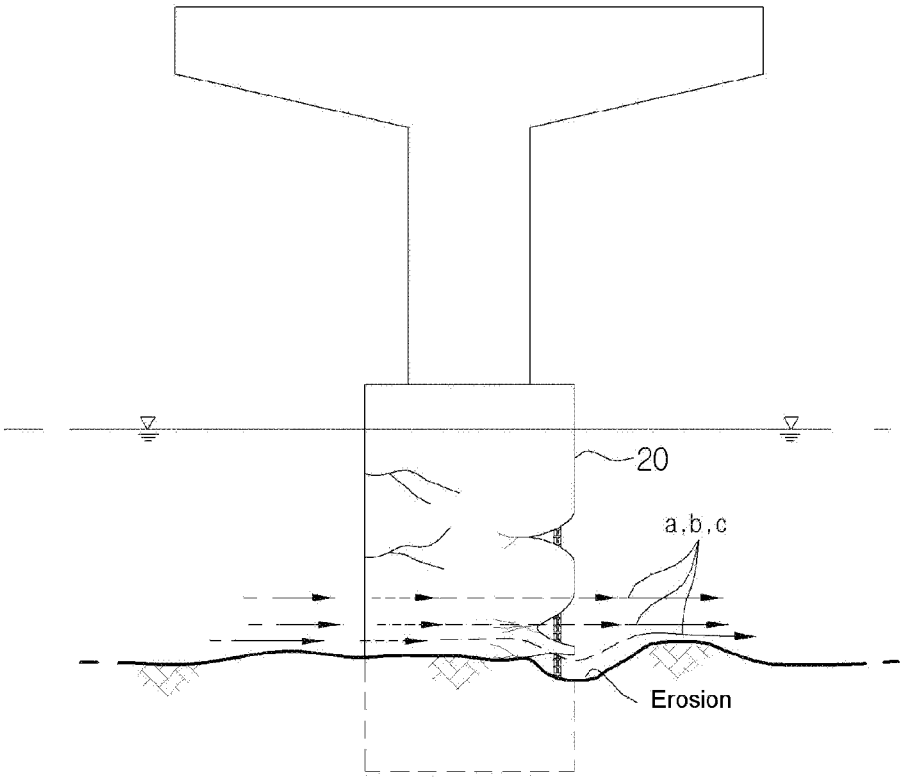
【Fig. 1】



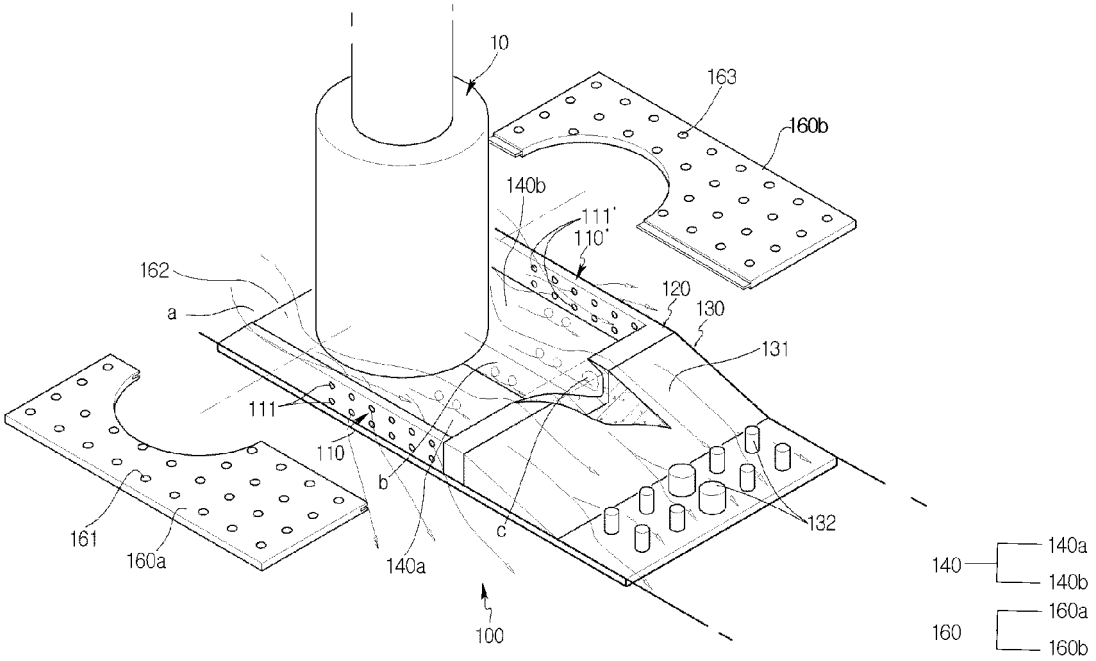
【Fig. 2】



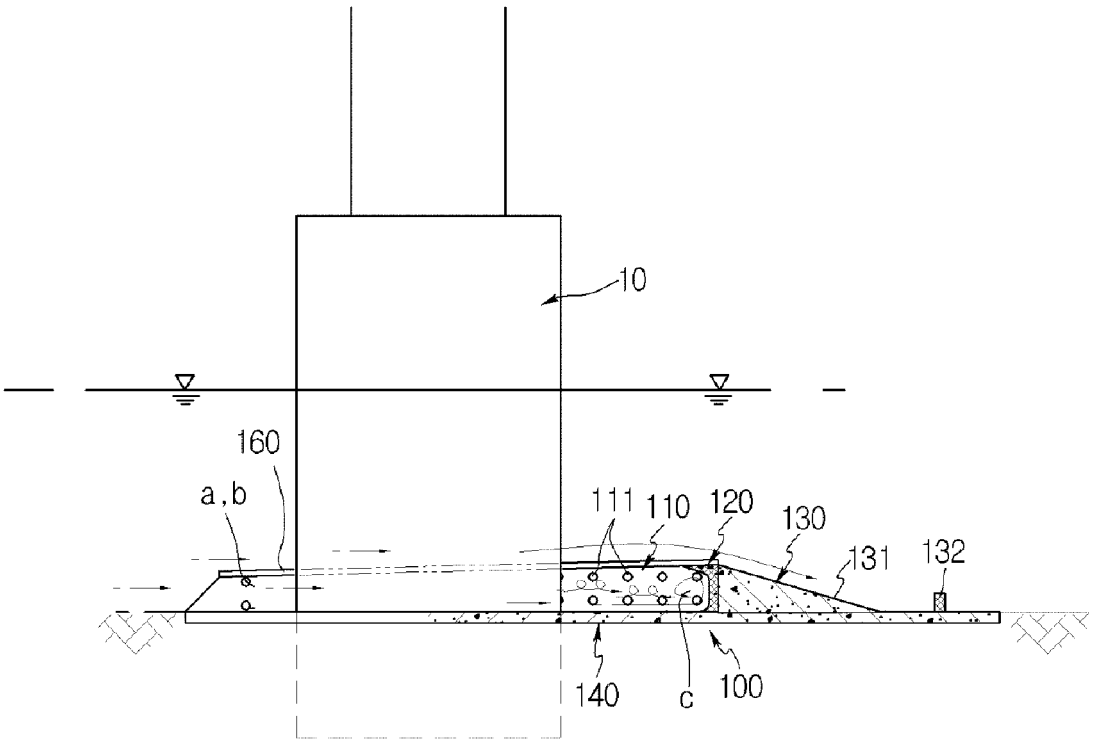
【Fig. 3】



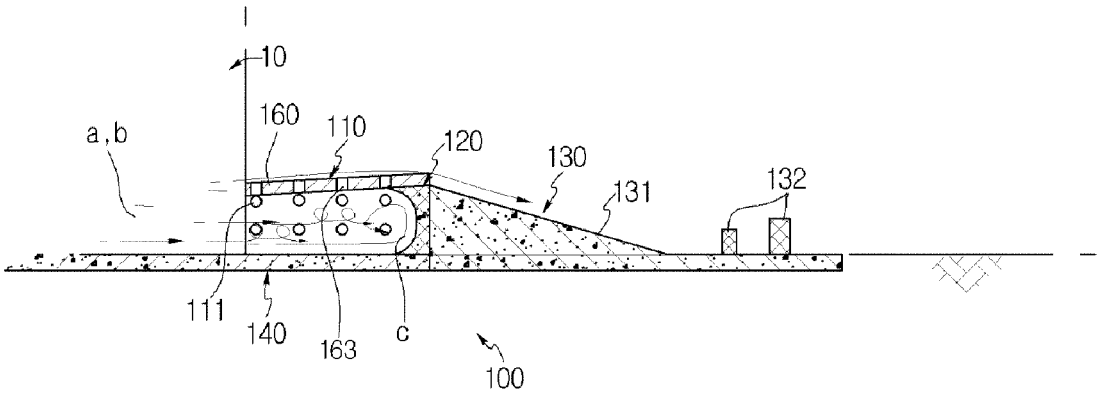
【Fig. 4】


10
163
160b
140b
111'
110'
120
130
131
162
a
111
110
b
c
132
161
160a
140a
100
140
140a
140b
160
160a
160b

【Fig. 5】


10
160
a,b
111
110
120
130
131
132
140
c
100

【Fig. 6】


10
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110
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130
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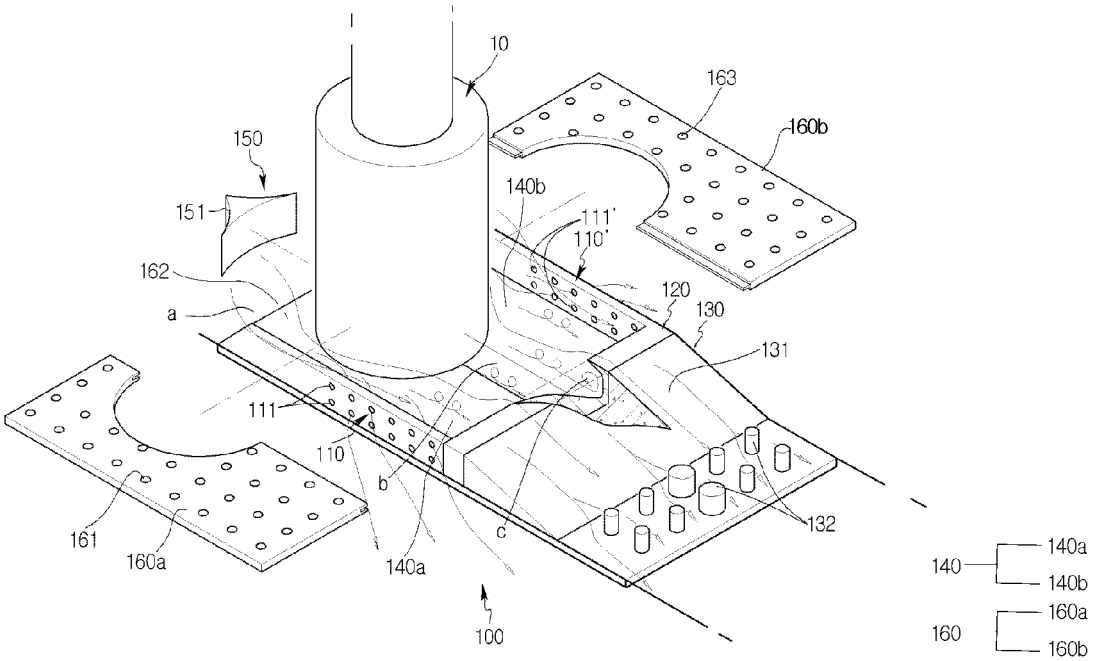
132
a, b
111
140
163
c
100

【Fig. 7】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111'
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162
a
120
130
131
111
110
b
c
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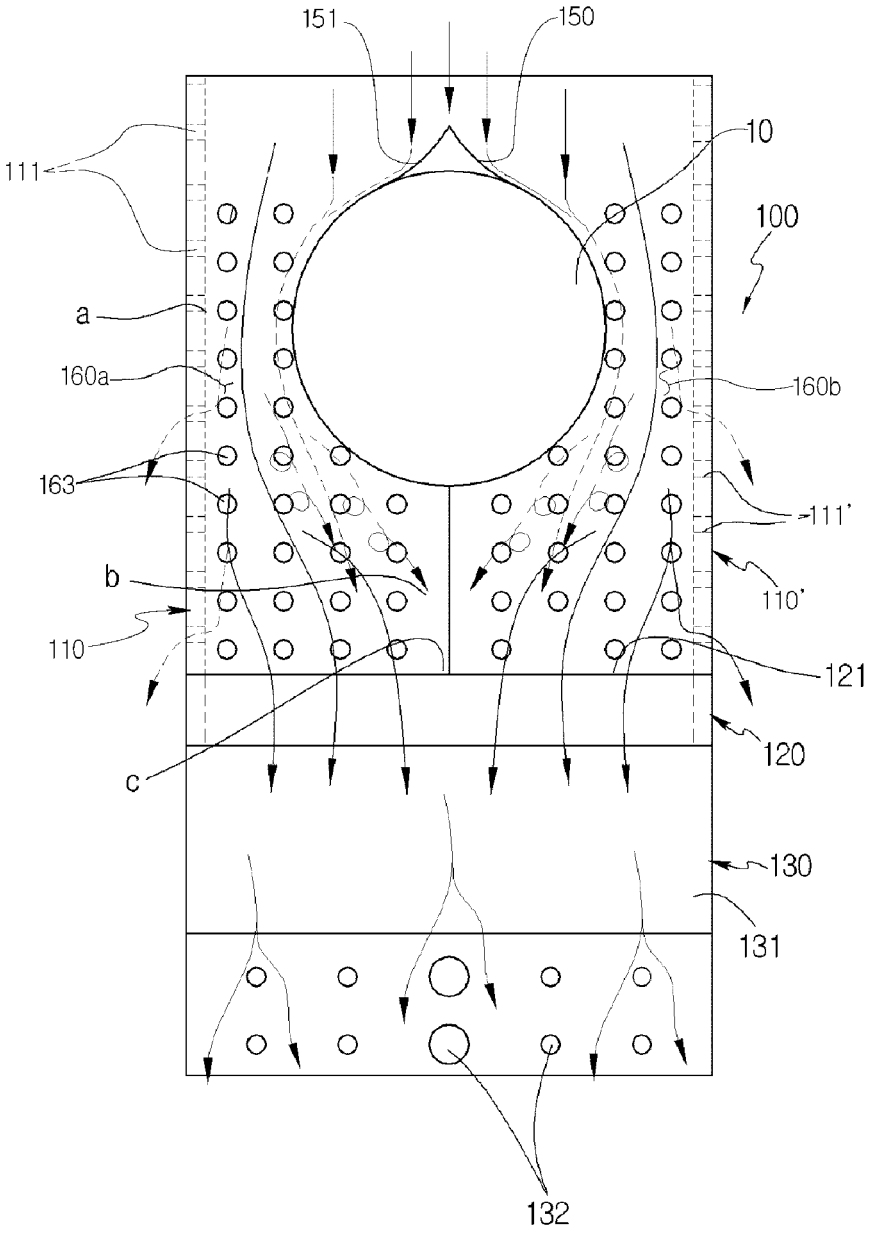
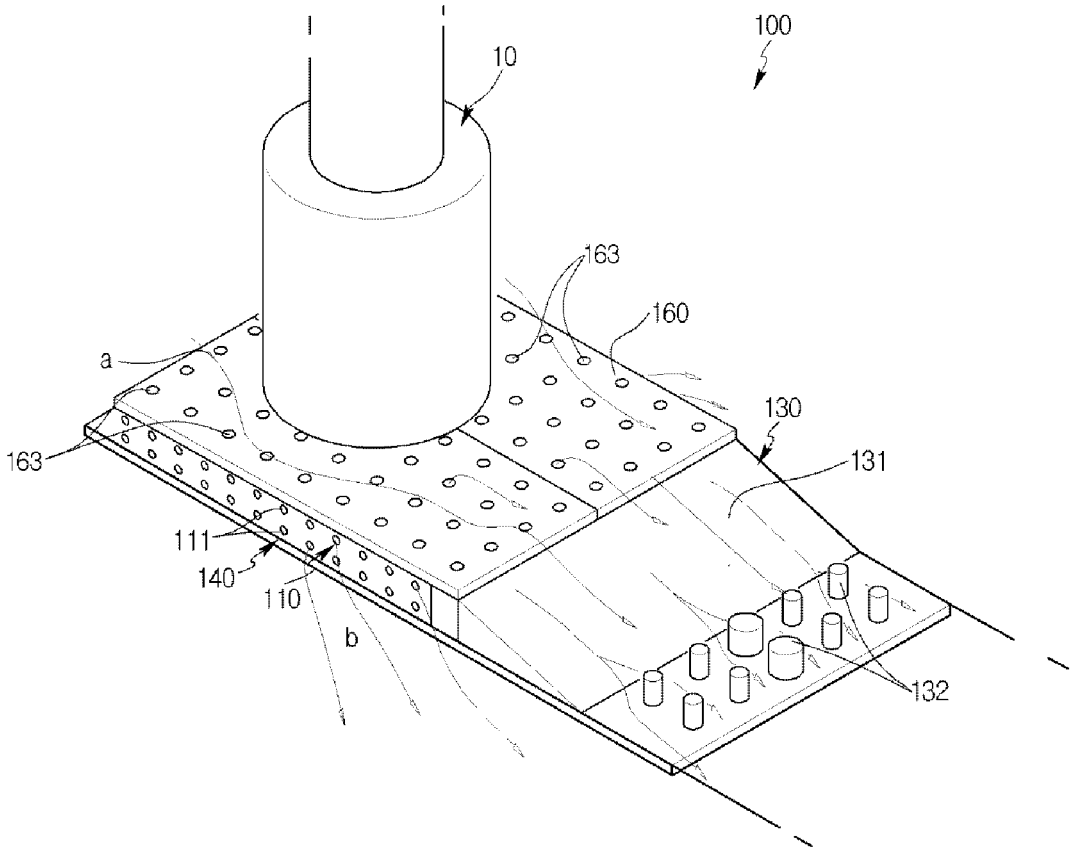
140a
132
100
140
140a
140b
160
160a
160b

【Fig. 8】


151
150
10
111
100
a
160a
160b
163
111'
b
110'
110
121
120
c
130
131
132

【Fig. 9】



【Fig. 10】