

In addition, in order to further increase the excavation efficiency, the excavation rod generally includes a plurality of excavation rods. Therefore, in order to stably support the plurality of excavation rods, a rod support stand for supporting the plurality of excavation rods is provided. Here, the rod support stand allows the excavation rod to rotate
5 therein while not being rotated.

Meanwhile, the ground improvement is done not only in an underground level but in an underwater level. That is to say, in order to construct a bridge, a pier or a building on the underwater ground, high-strength cylindrical or rectangular piles or coffering walls for waterproofing may first be constructed in the soft underwater ground for the purpose of
10 safely supporting props of the bridge, the pier or the building, and the bridge, the pier or the building may then be constructed on the piles or coffering walls.

However, environments in water, unlike on the ground, may be contaminated during improvement of the underwater ground. That is to say, if an improvement agent is injected into the underwater ground while excavating the underwater ground, floating soil
15 having the improvement agent and earth and sand mixed therein may float in water by a predetermined thickness. Since the improvement agent and the earth and sand contained in the floating soil are not yet cured, the floating soil is broken down into small pieces to then be extensively diffused in water. Therefore, during improvement of the underwater ground, water turbidity may be noticeably lowered by the floating soil and chemical components of
20 the improvement agent are extensively diffused, thereby contaminating the underwater environments.

In particular, since the chemical components of the improvement agent adversely affect marine organisms, damages may be caused to surrounding fish nursery areas. To

avoid this, it may be necessary to install a separate board for preventing turbidity of water around construction sites of the fish nursery areas.

Further, since the floating soil as a mixture of the improvement agent and the earth and sand has a low strength and is cured, it is necessary to separately remove the floating
5 soil after the improvement of the underwater ground.

SUMMARY

The present invention provides a device for preventing turbidity from water in an underwater soil improving apparatus due to floating soil during improvement of an
10 underwater soil.

The above and other objects of the present invention will be described in or be apparent from the following description of the preferred embodiments.

According to an aspect of the present invention, there is provided a device coupled to an excavation rod of an underwater soil improving apparatus for preventing turbidity
15 from water, the device including a cover unit having a plurality of throughholes allowing the excavation rod to pass therethrough, and a cylindrical crease body coupled to the cover unit, configured to be extensible in a top-bottom direction and surrounding the excavation rod.

The cylindrical crease body may include an extensible sheath extending
20 downwardly from the cover unit and configured to be extensible in the vertical direction, and a plurality of rings installed along the periphery of the extensible sheath and spaced apart from each other.

A winch may be installed in the underwater soil improving apparatus, and a

plurality of tow rings may be installed in the cover unit to be coupled to tow wires of the winch.

According to an aspect of the present invention, there is provided a device coupled to an excavation rod of an underwater soil improving apparatus for preventing turbidity from water, the device including a first cover unit allowing the excavation rod to pass therethrough, a second cover unit installed at a lower portion of the first cover unit and having a plurality of throughholes to allow the excavation rod to pass therethrough, and a cylindrical crease body coupled to the first and second cover units, configured to be extensible in the vertical direction and surrounding the excavation rod.

The cylindrical crease body may include an extensible sheath extending downwardly from the first and second cover units and configured to be extensible in the vertical direction, and a plurality of rings installed along the periphery of the extensible sheath and spaced apart from each other.

The excavation rod may include a plurality of excavation rods, a guide pipe provided between each of the plurality of excavation rods in the same direction as the excavation rods, a first cover throughhole may be formed in the first cover unit to allow the guide pipe to pass therethrough, and a second cover throughhole may be formed in the second cover unit to allow the guide pipe to pass therethrough. A guide rail may be installed in the guide pipe in a lengthwise direction, and a guide protrusion coupled to the guide rail and guiding the guide pipe may further be formed in the first cover throughhole of the first cover unit.

As described above, one embodiment of the present invention provides a device for preventing turbidity due to floating soil from water in an underwater soil improving

apparatus. That is to say, in the present invention, since the vicinity of the excavation rod is surrounded by the water turbidity preventing device, the floating soil may not be outwardly diffused in vertical and horizontal directions. In other words, the floating soil is contained only within the body unit of the water turbidity preventing device but is not released to the
5 outside of the body unit. Therefore, water turbidity is maintained as it is and diffusion of chemical components of the improvement agent is minimized, thereby preventing underwater environments from being contaminated.

In particular, since marine organisms are not affected by the chemical components of the improvement agent, damages caused to surrounding fish nursery areas can be
10 minimized, and it is not necessary to install a separate board for preventing turbidity of water for preventing seawater contamination.

Further, since the floating soil having the improvement agent and earth and sand mixed therein is cured within a predetermined area without being diffused, the floating soil has a high strength, unlike in the conventional art. That is to say, since the strength of the
15 floating soil is similar to that of the improved underwater ground, a bridge, a pier or a building may be constructed directly on the underwater ground without separately removing the floating soil.

BRIEF DESCRIPTION OF THE DRAWINGS

20 The above and other features and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1A is a plan view of a water turbidity preventing device for an underwater soil improving apparatus according to an embodiment of the present invention, FIG. 1B is a longitudinally sectional view of the water turbidity preventing device shown in FIG. 1A, and FIG. 1C is a perspective view of the water turbidity preventing device shown in FIG.

5 1A;

FIGS. 2A to 2G are views sequentially illustrating a process of filling floating soil in the water turbidity preventing device for an underwater soil improving apparatus according to an embodiment of the present invention;

FIGS. 3A to 3J are views sequentially illustrating operations of the underwater soil improving apparatus including the water turbidity preventing device shown in FIG. 1A.

FIG. 4A is a longitudinally sectional view of a water turbidity preventing device for an underwater soil improving apparatus according to another embodiment of the present invention, FIG. 4B is a sectional view taken along the line 4b-4b of FIG. 4A, FIG. 4C is a sectional view taken along the line 4c-4c of FIG. 4A, and FIG. 4C is a perspective view of the water turbidity preventing device shown in FIG. 4A;

FIGS. 5A to 5G are views sequentially illustrating a process of filling floating soil in the water turbidity preventing device for an underwater soil improving apparatus according to another embodiment of the present invention; and

FIGS. 6A to 6J are views sequentially illustrating operations of the underwater soil improving apparatus including the water turbidity preventing device shown in FIG. 4A.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Hereinafter, an exemplary embodiment of the present invention will be described with reference to the accompanying drawings.

An exemplary embodiment will now be described more fully hereinafter with reference to the accompanying drawings; however, they may be embodied in different
5 forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey embodiments of the invention to those skilled in the art.

In the drawings, thicknesses of layers and regions may be exaggerated for clarity. Like numbers refer to like elements throughout. As used herein, the term "and/or" includes
10 any and all combinations of one or more of the associated listed items.

The terminology used herein is for the purpose of describing particular embodiments and is not intended to be limiting of the invention. As used herein, singular forms are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises," and/or "comprising,"
15 when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

It will be understood that, although the terms first, second, etc., may be used herein
20 to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another element, component, region, layer or section. Thus, a first element, component,

region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.

In addition, the term “water” used herein may mean both seawater and fresh water. Further, the terms “underwater soil improving apparatus” and “excavation rod installed
5 therein” as used herein are provided only for exemplary illustration and may include concepts used for encompassing all of underwater soil improving apparatuses and excavation rods installed therein, although not illustrated herein. Therefore, the underwater soil improving apparatus and the excavation rod installed therein should be defined as defined herein.

10 FIG. 1A is a plan view of a water turbidity preventing device (100) for an underwater soil improving apparatus according to an embodiment of the present invention, FIG. 1B is a longitudinally sectional view of the water turbidity preventing device shown in FIG. 1A, and FIG. 1C is a perspective view of the water turbidity preventing device shown in FIG. 1A.

15 As illustrated in FIGS. 1A to 1C, the water turbidity preventing device 100 includes a substantially disk-shaped cover unit 110 and a cylindrical crease body 120 coupled to the cover unit 110.

The cover unit 110 may include a plurality of throughholes 112 to allow an excavation rod (not shown) to pass therethrough and may be shaped of a substantially
20 circular plate. In an example, when the excavation rod includes 4 excavation rods, the plurality of throughholes 112 may also include 4 throughholes, but aspects of the present invention are not limited thereto. In addition, the cover unit 110 may have various polygonal-plate shapes, including a triangular plate, a tetragonal plate, a pentagonal plate, a

hexagonal plate, and the like, instead of a circular plate.

In addition, a plurality of tow loops 111 may further be installed at opposite sides of a top surface of the cover unit 110 to be coupled to tow wires (not shown) installed in the underwater soil improving apparatus.

5 The cylindrical crease body 120 includes an extensible sheath 121 and a ring 122. The extensible sheath 121 extends downwardly by a predetermined length while being connected to the circular periphery of the cover unit 110. Here, the extensible sheath 121 may be shaped of a disk-shaped cylinder roughly surrounding the exterior surface of the excavation rod. In addition, the extensible sheath 121 may have various polygonal shapes,
10 including a triangular cylinder, a tetragonal cylinder, a pentagonal cylinder, a hexagonal cylinder, and the like, instead of the disk-shaped cylinder. Further, the extensible sheath 121 may be made of a synthetic fiber, a metal fiber, and equivalents thereof, which are strong against water or seawater, but aspects of the present invention are not limited thereto. The ring 122 may include a plurality of rings spaced a predetermined distance apart from
15 each other. That is to say, the ring 122, including the plurality of rings 122 spaced a predetermined distance apart from the cover unit 110, may be installed inside or outside the extensible sheath 121. The ring 122 may be coupled to the extensible sheath 121 using an adhesive or may be coupled to the extensible sheath 121 by sewing. In the illustrated embodiment, the ring 122 including three rings is exemplified, but the present invention
20 does not limit the number of rings to three. Further, the ring 122 may have various polygonal shapes, including a circle, a triangle, a tetragon, a pentagon, a hexagon, and the like. Further, the ring 122 may be made of stainless steel, steel, and equivalents thereof, which are strong against water or seawater, but aspects of the present invention are not

limited thereto.

FIGS. 2A to 2G are views sequentially illustrating a process of filling floating soil (270) in the water turbidity preventing device (100) for an underwater soil improving apparatus according to an embodiment of the present invention.

5 As illustrated in FIG. 2A, before the floating soil 270 is filled, the water turbidity preventing device 100 is maintained at a state in which it has a minimized length or height. That is to say, the extensible sheath 121, forming the cylindrical crease body 120, is maintained at a state in which it is contracted in a length or height direction, and the plurality of rings 122 are maintained such that they are positioned closest to each other.
10 Here, the same reference numerals as those of FIGS. 1A to 1C are used.

 Meanwhile, as illustrated in FIGS. 2B to 2G, if filling of the floating soil 270 starts, the extensible sheath 121, forming the cylindrical crease body 120, extends in a length or height direction (that is, the extensible sheath 121 spreads out in a length or height direction.), and the plurality of rings 122 become distant from each other. That is to say,
15 the more the floating soil 270 filling the cylindrical crease body 120, the more the extensible sheath 121 extends or spreads out in a length or height direction and the more the plurality of rings 122 become distant from each other. Therefore, a large amount of the floating soil 270 can efficiently accumulate inside the cylindrical crease body 120.

 Referring to FIGS. 3A to 3J, operations of the underwater soil improving apparatus
20 (200) including the water turbidity preventing device (100) shown in FIG. 1A are sequentially illustrated.

 As illustrated in FIGS. 3A to 3J, the underwater soil improving apparatus 200 includes an auger machine (motor) 210, a gear box 220 coupled to the auger machine 210,

and a plurality of excavation rods 230 coupled to the gear box 220. Here, in order to increase excavation efficiency, each of the excavation rods 230 may include an excavation bit 231, excavation blades 232 and agitation blades 233. In addition, a discharge hole (not shown) is formed at a bottom portion of each of the excavation rods 230 to allow an improvement agent, such as cement glue or mortar, to be inserted into the excavation rod to then be mixed and agitated with excavated earth and sand.

In addition, the water turbidity preventing device 100 may be downwardly coupled to the excavation rod 230 through a top end of the excavation rod 230. That is to say, before the excavation rod 230 is coupled to the gear box 220, it is first coupled to the water turbidity preventing device 100, thereby connecting the water turbidity preventing device 100 to the underwater soil improving apparatus 200.

As illustrated in FIG. 3A, tow wires 260 are connected to tow loops 111 provided on the cover unit 110 of the water turbidity preventing device 100 and the tow wires 260 are coupled to a winch (not shown) provided in the underwater soil improving apparatus 200. Therefore, the water turbidity preventing device 100 may be upward elevated or downward lowered together with the underwater soil improving apparatus 200. In addition, the water turbidity preventing device 100 is initially configured to cover a bottom end of the underwater soil improving apparatus 200, that is, substantially lower portions of the excavation rods 230 and is downward lowered into underwater together with the excavation rods 230. Here, the cover units 120 of the water turbidity preventing device 100 interfere with none of components of the water turbidity preventing device 100. The excavation bit 231, the excavation blades 232 and the agitation blades 233 are positioned at an interior side of the cylindrical crease body 120 positioned under the cover unit 110. In

addition, since the water turbidity preventing device 100 is suspended on the tow wires 260, it is maintained at a state in which it is maximally extended by its own weight. That is to say, the extensible sheath 121 of the cylindrical crease body 120 is in a longest or greatest extended or spread state, and the plurality of rings 122 are in a state in which they are
5 farthest from each other. Here, the same reference numerals as those of FIGS. 1A to 1C are used.

As illustrated in FIG. 3B, bottom ends of the excavation rods 230 and the water turbidity preventing device 100 are lowered together until they reach the ground surface. If the bottom ends of the excavation rods 230 and the water turbidity preventing device 100
10 reach the ground surface, the winch lowering the water turbidity preventing device 100 stops operating. Here, after the water turbidity preventing device 100 makes contact with the ground surface, the winch stops operating when the extensible sheath 121 of the cylindrical crease body 120 is contracted most and the plurality of rings 122 become closest to each other. As described above, since the water turbidity preventing device 100
15 is suspended on the winch by the tow wires 260, the water turbidity preventing device 100 may not be reversed or overturned.

Meanwhile, if the auger machine (motor) 210 operates, a ground improvement operation may be performed by own weights of the plurality of excavation rods 230 during rotation of the plurality of excavation rods 230. That is to say, an improvement agent, such
20 as cement glue or mortar, is inserted into the underground to then be mixed and agitated with excavated earth and sand. Here, floating soil as a mixture of the improvement agent and earth and sand may be elevated. The floating soil remains only inside the water turbidity preventing device 100 according to the present invention.

As illustrated in FIGS. 3C to 3E, if the auger machine (motor) 210 continuously operates, the ground improvement operation is continuously performed by own weights of the plurality of excavation rods 230 during rotation of the plurality of excavation rods 230.

In addition, as the ground improvement operation is progressed, the floating soil
5 270 may float much more to the outside of the ground surface. However, in the present invention, since the water turbidity preventing device 100 surrounds regions around the excavation rods 230, the floating soil 270 may not be diffused in vertically and horizontally outward directions. That is to say, the floating soil 270 is accommodated only within the cover unit 110 and the cylindrical crease body 120 of the water turbidity preventing device
10 100 but is not released to the outside. Therefore, according to the present invention, since the floating soil 270 is contained within the water turbidity preventing device 100, water turbidity is maintained as it is and diffusion of chemical components of the improvement agent is minimized, thereby preventing underwater environments from being contaminated. In particular, since marine organisms are not affected by the chemical components of the
15 improvement agent, damages caused to surrounding fish nursery areas can be minimized, and it is not necessary to install a separate board for preventing turbidity of water for preventing seawater contamination.

Further, since the floating soil 270 in the water turbidity preventing device 100 is cured within a predetermined area without being diffused, the floating soil 270 has a high
20 strength, unlike in the conventional art. That is to say, since the strength of the floating soil 270 is similar to that of the improved underwater ground, a bridge, a pier or a building can be constructed directly on the underwater ground without separately removing the floating soil 270.

Meanwhile, as the result of the ground improvement operation, the floating soil 270 may increase. Accordingly, the length or height of the water turbidity preventing device 100 may naturally increase. That is to say, since the increasing floating soil 270 upwardly lifts the cover unit 110 of the water turbidity preventing device 100, the length or height of the water turbidity preventing device 100 may naturally increase as a whole. In some cases, the winch is allowed to slowly operate according to the increasing rate of the floating soil 270, thereby allowing the tow wires 260 to upwardly tow the water turbidity preventing device 100 slowly.

As illustrated in FIGS. 3F to 3I, once the excavation rods 230 are coupled to the underwater ground with the maximum depth, they are slowly elevated again while forward rotating or backward rotating. At this time, since the excavation rods 230 are slowly elevated while rotating, an agitation operation is still performed.

As illustrated in FIG. 3J, if the ground improvement operation is completed, the winch operates at the same time when the excavation rods 230 are elevated, and the water turbidity preventing device 100 is also elevated with the excavation rods 230 in a state in which it is suspended on the tow wires 260.

Accordingly, the floating soil 270 in the water turbidity preventing device 100 is finally exposed to above the underwater ground, but the ground improvement operation is completed so that external shocks are not applied to the floating soil 270, thereby minimizing environmental contamination due to the floating soil 270.

FIG. 4A is a longitudinally sectional view of a water turbidity preventing device (300) for an underwater soil improving apparatus according to another embodiment of the present invention, FIG. 4B is a sectional view taken along the line 4b-4b of FIG. 4A, FIG.

4C is a sectional view taken along the line 4c-4c of FIG. 4A, and FIG. 4C is a perspective view of the water turbidity preventing device shown in FIG. 4A.

As illustrated in FIGS. 4A to 4D, the water turbidity preventing device 300, coupled to an excavation rod of the underwater soil improving apparatus, includes a first
5 cover unit 310, a second cover unit 320 and a cylindrical crease body 330.

The first cover unit 310 includes a first cover throughhole 314 formed to allow an excavation rod (not shown) and a guide pipe 240 to pass therethrough and is shaped of a substantially circular disk. Here, a guide protrusion 313 protruding a predetermined length is further formed inside the first cover throughhole 314 so as to be coupled to a guide rail
10 250 to be described later. The first cover unit 310 may be made of stainless steel, steel, and equivalents thereof, but aspects of the present invention are not limited thereto.

The first cover unit 310 may include a circular ring 311, a frame 312 extending a predetermined length to the inside of the circular ring 311, and a guide protrusion 313 formed at an end of the frame 312. Here, a region excluding the frame 312 and the guide
15 protrusion 313 in the circular ring 311 may correspond to the first cover throughhole 314.

The second cover unit 320 includes a plurality of throughholes 322 allowing an excavation rod to pass therethrough and a second cover throughhole 324 allowing a guide pipe 240 to pass therethrough and is shaped of a substantially circular disk.

Here, the excavation rod may include a plurality of excavation rods, and a guide
20 pipe 240 may be provided between each of the plurality of excavation rods in the same direction as the excavation rods. In addition, a guide rail 250 is installed in the guide pipe 240 in a lengthwise direction. Further, a guide protrusion 313 coupled to the guide rail 250 and guiding the guide pipe 240 may further be formed in the first cover throughhole 314 of

the first cover unit 310. Stoppers 241 extending laterally may further be installed at bottom ends of the guide pipe 240, thereby preventing the first cover unit 310 from being dislodged downwardly. That is to say, the stoppers 241 installed in the guide pipe 240 interfere with the guide protrusion 313, thereby preventing the first cover unit 310 from being dislodged from the guide pipe 240 downwardly.

The cylindrical crease body 330 is coupled to the first and second cover units 310 and 320, is configured to be extensible in a top-bottom direction, and is configured to surround the excavation rod and the guide pipe 240. The cylindrical crease body 330 is substantially the same as the cylindrical crease body 120 of the previous embodiment, and a repeated description thereof will not further be given.

FIGS. 5A to 5G are views sequentially illustrating a process of filling floating soil (270) in the water turbidity preventing device (100) for an underwater soil improving apparatus according to another embodiment of the present invention.

As illustrated in FIG. 5A, before the floating soil 270 is filled, the cylindrical crease body 330 is maintained to have a minimized length. That is to say, the extensible sheath 121, forming the cylindrical crease body 330, is maintained at a state in which it is contracted in a length or height direction, and the plurality of rings 122 are maintained such that they are positioned closest to each other.

Meanwhile, as illustrated in FIGS. 5B to 5G, if filling of the floating soil 270 starts, the extensible sheath 121, forming the cylindrical crease body 330, extends in a lengthwise direction, and the plurality of rings 122 become distant from each other. That is to say, the more the floating soil 270 filling the cylindrical crease body 330, the more the extensible sheath 121 extends in the lengthwise direction and the more the plurality of rings 122

become distant from each other. Therefore, a large amount of the floating soil 270 can efficiently accumulate inside the cylindrical crease body 330.

FIGS. 6A to 6J are views sequentially illustrating operations of the underwater soil improving apparatus (200b) including the water turbidity preventing device (300) shown in
5 FIG. 4A.

As illustrated in FIGS. 6A to 6J, the underwater soil improving apparatus 200b includes an auger machine (motor) 210, a gear box 220 coupled to the auger machine 210, and a plurality of excavation rods 230 coupled to the gear box 220. Here, in order to increase excavation efficiency, each of the excavation rods 230 may include an excavation
10 bit 231, excavation blades 232 and agitation blades 233. In addition, a discharge hole (not shown) is formed at a bottom portion of each of the excavation rods 230 to allow an improvement agent, such as cement glue or mortar, to be inserted into the excavation rods 230 to then be mixed and agitated with excavated earth and sand. Further, a guide pipe 240 may be provided between each of the plurality of excavation rods 230 in the same direction
15 as the excavation rods 230. In addition, a guide rail 250 extending from the gear box 220 in the same direction as the excavation rods 230 is installed between each of the plurality of excavation rods 230, and a guide rail 250 or a guide groove is installed at an exterior side of the guide pipe 240 in a lengthwise direction.

Further, the water turbidity preventing device 300 is coupled to the excavation
20 rods 230 and the guide pipe 240.

FIGS. 6A to 6J sequentially illustrate operations of the underwater soil improving apparatus including the water turbidity preventing device (300) shown in FIG. 4A.

As illustrated in FIG. 6A, in a state in which the guide pipe 240 is coupled to the

first cover unit 310 of the water turbidity preventing device 300, the water turbidity preventing device 300 may be upward elevated or downward lowered together with the underwater soil improving apparatus 200. In addition, the water turbidity preventing device 100 is basically configured to cover a bottom end of the underwater soil improving apparatus 200, that is, substantially lower portions of the excavation rods 230 and is downward lowered into underwater together with the excavation rods 230. Here, the excavation rods 230 pass through the first and second cover units 310 and 320 of the water turbidity preventing device 300 and interfere with none of components of the water turbidity preventing device 300. The excavation bit 231, the excavation blades 232 and the agitation blades 233 are positioned at an interior side of the cylindrical crease body 330 positioned under the first and second cover units 310 and 320. Further, since the water turbidity preventing device 300 is substantially suspended to the guide pipe 240, it is maintained at a state in which it is maximally extended by its own weight. That is to say, the extensible sheath 121 of the cylindrical crease body 330 is in a longest or greatest extended or spread state, and the plurality of rings 122 are in a state in which they are farthest from each other.

Here, since the horizontally extending stoppers 241 are formed at opposite bottom ends of the guide pipe 240, it is possible to prevent the water turbidity preventing device 300 from being dislodged downwardly from the guide pipe 240.

As illustrated in FIG. 6B, bottom ends of the excavation rods 230 and the water turbidity preventing device 300 are lowered together until they reach the ground surface, and if the excavation rods 230 start excavating of the ground surface, the extensible sheath 121 of the cylindrical crease body 330 of the water turbidity preventing device 300 is in a

contracted or folded state, and the plurality of rings 122 become closest to each other (?).

If the auger machine (motor) 210 operates, a ground improvement operation may be performed by own weights of the plurality of excavation rods 230 during rotation of the plurality of excavation rods 230. That is to say, an improvement agent, such as cement glue
5 or mortar, is inserted into the underground to then be mixed and agitated with excavated earth and sand. Here, floating soil 270 as a mixture of the improvement agent and earth and sand may be elevated. The floating soil remains only inside the water turbidity preventing device 300 according to the present invention.

As illustrated in FIGS. 6C to 6E, if the auger machine (motor) 210 continuously
10 operates, the ground improvement operation is continuously performed by own weights of the plurality of excavation rods 230 during rotation of the plurality of excavation rods 230.

In addition, as the ground improvement operation is progressed, the floating soil 270 may float much more to the outside of the ground surface. However, in the present invention, since the water turbidity preventing device 300 surrounds regions around the
15 excavation rods 230, the floating soil 270 may not be diffused in vertically and horizontally outward directions. That is to say, the floating soil 270 is accommodated only within the second cover unit 320 and the cylindrical crease body 120 of the water turbidity preventing device 300 but is not released to the outside. Therefore, according to the present invention, since the floating soil 270 is contained within the water turbidity preventing device 300,
20 water turbidity is maintained as it is and diffusion of chemical components of the improvement agent is minimized, thereby preventing underwater environments from being contaminated. In particular, since marine organisms are not affected by the chemical components of the improvement agent, damages caused to surrounding fish nursery areas

can be minimized, and it is not necessary to install a separate board for preventing turbidity of water for preventing seawater contamination.

Further, since the floating soil 270 in the water turbidity preventing device 300 is cured within a predetermined area without being diffused, the floating soil 270 has a high strength, unlike in the conventional art. That is to say, since the strength of the floating soil 270 is similar to that of the improved underwater ground, a bridge, a pier or a building can be constructed directly on the underwater ground without separately removing the floating soil 270.

Meanwhile, as the result of the ground improvement operation, the floating soil 270 may increase. Accordingly, the second cover unit 320 is automatically elevated. That is to say, since the increasing floating soil 270 upwardly lifts the second cover unit 320 of the water turbidity preventing device 300, the length or height of the water turbidity preventing device 300 may naturally increase as a whole. In some cases, a winch (not shown) is allowed to slowly operate according to the increasing rate of the floating soil 270, thereby allowing winch wires (not shown) to upwardly tow the water turbidity preventing device 300 slowly.

As illustrated in FIGS. 6F to 6I, once the excavation rods 230 are coupled to the underwater ground with the maximum depth, they are slowly elevated again while rotating. At this time, since the excavation rods 230 are slowly elevated while rotating, an agitation operation is still performed.

As illustrated in FIG. 6J, if the ground improvement operation is completed, the first cover unit 310 is coupled to stoppers 241 of the guide pipe 240 at the same time when the excavation rods 230 are elevated, and the water turbidity preventing device 300 is also

elevated.

Accordingly, the floating soil 270 in the water turbidity preventing device 300 is finally exposed to above the underwater ground, but the ground improvement operation is completed so that external shocks are not applied to the floating soil 270, thereby
5 minimizing environmental contamination due to the floating soil 270.

While the water turbidity preventing device of an underwater soil improving apparatus according to the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein
10 without departing from the spirit and scope of the present invention as defined by the following claims. It is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being made to the appended claims rather than the foregoing description to indicate the scope of the invention.

15 Brief explanation of essential parts of the drawings

100: Water turbidity preventing device of underwater soil improving apparatus

110: Cover unit

111: Tow loop

112: Through-hole

120: Cylindrical crease body

121: Extensible sheath

122: Ring

20 200: Underwater soil improving apparatus

210: Auger machine

220: Gear box

230: Excavation rod

231: Excavation bit

232: Excavation blade

233: Agitation blade

	240: Guide pipe	241: Stoppers
	250: Guide rail	260: Tow wires
	270: Floating soil	
	300: Water turbidity preventing device for an underwater soil improving apparatus	
5	310: First cover unit	
	311: Circular ring	
	312: Frame	313: Guide protrusion
	314: First cover throughhole	320: Second cover unit
	322: Throughhole	324: Second cover throughhole
10	330: Cyindrical crease body	331: Extensible sheath
	332: Ring	

WHAT IS CLAIMED IS:

1. A device coupled to an excavation rod of an underwater soil improving apparatus for preventing turbidity from water, the device comprising:

- 5 a first cover unit allowing the excavation rod to pass therethrough;
- a second cover unit installed at a lower portion of the first cover unit and having a plurality of throughholes to allow the excavation rod to pass therethrough; and
- a cylindrical crease body coupled to the first and second cover units, configured to be extensible in the vertical direction and surrounding the excavation rod,
- 10 wherein the cylindrical crease body is connected to a circular periphery of the first and second cover units and extends downwardly,
- the excavation rod includes a plurality of excavation rods,
- a guide pipe provided between each of the plurality of excavation rods in the same direction as the excavation rods,
- 15 a first cover throughhole is formed in the first cover unit to allow the guide pipe to pass therethrough, and
- a second cover throughhole is formed in the second cover unit to allow the guide pipe to pass therethrough.

- 20 2. The device of claim 1, wherein the cylindrical crease body comprises:
- an extensible sheath extending downwardly from the first and second cover units and configured to be extensible in the vertical direction; and
- a plurality of rings installed along the periphery of the extensible sheath and

spaced apart from each other.

3. The device of claim 1, wherein a guide rail is installed in the guide pipe in a lengthwise direction, and a guide protrusion coupled to the guide rail and guiding the guide
5 pipe is further formed in the first cover throughhole of the first cover unit.

4. The device of claim 3, wherein a stopper laterally extending at a bottom end of the guide pipe is further installed in the guide pipe.

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ABSTRACT OF THE DISCLOSURE

Water turbidity prevention device for underwater foundation improvement apparatus

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Provided is a device for preventing turbidity due to floating soil from water, the device provided in an underwater soil improving apparatus. For this purpose, the underwater foundation improvement apparatus includes a cover unit having a plurality of throughholes allowing the excavation rod to pass therethrough, and a cylindrical crease
10 body coupled to the cover unit, configured to be extensible in a top-bottom direction and surrounding the excavation rod.