

TRIPLE-PIPE SWIVEL

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Korean Patent
5 Application No. 10-2020-0099121, filed on August 7, 2020,
the disclosure of which is incorporated herein by reference
in its entirety.

BACKGROUND

10 1. Technical Field

[0002] The present disclosure relates to a triple-pipe
swivel, and more particularly, to a triple-pipe swivel that
has a double structure consisting of an inner ring and an
outer ring, wherein in the process of rotating the inner
15 ring formed with a main through-hole, a first auxiliary
through-hole, and a second auxiliary through-hole, it is
possible to selectively supply inputs (e.g., slurry, high-
pressure water, and high-pressure air) in a manner that the
respective first and second auxiliary through-holes
20 communicate with a first horizontal through-hole and a
second horizontal through-hole formed in the outer ring
fixedly installed, and to prevent twisting of cables
required for supply of these inputs.

2. Related Art

[0003] A drilling agitator is typically used to drill and excavate the seabed ground. In general, the drilling agitator may be configured by combining individual components such as an auger machine, a support shaft, an auger shaft, an agitating blade, and a drill bit, and a component referred to a "swivel" is also applied in combination to the auger machine.

[0004] The drilling agitator performs underground excavation by rotating the drill bit during the rotation of the auger shaft. In the process of the excavation, slurry, high-pressure water (water jet), high-pressure air (air press), etc. are supplied and discharged to excavation sites through the swivel.

[0005] As illustrated in FIGS. 1 to 3, an existing swivel applied to a drilling agitator may have a structure in which a shaft 1 is formed above a body 2, a boss 3 is formed beneath the body 2 while having a fastening hole 3a allowing connection with an auger shaft, covers 4 arranged at the upper and lower ends of the body 2 and first and second bolts 11 and 12 are formed to fasten the body 2, the shaft 1, and the boss 3 to each other, a bearing 9 as well as a torque nut 5 and a snap ring 6 is interposed between the shaft 1 and the body 2, a carbon Teflon 7 and an oil ring 8 are interposed between the shaft 1 and the boss 3

for damping rotational friction, an oil ring 10 is interposed between the lower cover 4 and the boss 3, a bearing 9 is interposed between the body 2 and the boss 3, and a nipple 13 is arranged in any portion of the center of the body 2.

[0006] In addition, the existing swivel includes, as illustrated in FIG. 3, a first packing 14 and a second packing 15 which are interposed between the shaft 1 and the boss 3 to secure airtightness by blocking the inflow of seawater therebetween. Meanwhile, the existing swivel includes only a single supply line 16 as illustrated in FIG. 2.

[0007] In general, in the process of excavating the seabed using the drilling agitator, depending on the conditions of the excavation, there frequently occur situations, for example, in which only supply of slurry is required, only supply of high-pressure air is required, or only supply of water jet is required. However, since the existing swivel applied to the drilling agitator includes only the single supply line 16 as illustrated in FIG. 2, all of slurry, high-pressure air, and high-pressure water (water jet) are supplied only through the single supply line 16 at one time and discharged to excavation sites.

[0008] The situation of excavation work in the process of excavating the seabed ground may vary at each time of work

due to a variety of variables such as the strength of the ground, the depth of water, and the degree of water pressure, and the excavation work is inevitably carried out in response to such variable excavation situations.

5 Therefore, there is a need to selectively supply slurry, high-pressure water (water jet), and high-pressure air at excavation work sites according to the situation of seabed ground excavation.

[0009] However, since the existing swivel applied to the
10 drilling agitator includes only the single supply line 16, it is impossible to actively cope with the variation in the situation of excavation work. In addition, since all of slurry, high-pressure water (water jet), and high-pressure air are supplied only through the single supply line 16 at
15 one time, it is impossible to respond to such variable excavation situations. In turn, this causes a reduction in efficiency of excavation progress and a deterioration in quality of improved products to be constructed.

[0010] That is, only selective supply of slurry, high
20 pressure water (water jet), and high pressure air according to the variation in the situation of excavation work may ensure the quality of the improved products to be constructed in the future. On the other hand, only slurry may be required due to the variation in the situation of
25 excavation work. In this case, if all of slurry, high-

pressure water (water jet), and high-pressure air are supplied only through the single supply line 16 at one time, it is impossible to ensure the quality of the improved products to be constructed in the future. This eventually
5 leads to loss of trust from customers due to the deterioration in the quality of the improved products.

[0011] Meanwhile, the following patent document in the related art relates to a swivel joint capable of detecting whether a typical fluid leaks.

10 **[0012]** [Patent Document 0001] Korean Patent No. 10-1891318 (registered on August 17, 2018)

SUMMARY

[0013] Various embodiments are directed to a triple-pipe
15 swivel that enables inputs, such as slurry, high-pressure water (water jet), and high-pressure air, required for ground drilling to be selectively supplied according to situational variables of excavation work in the progress of excavating the seabed ground.

20 **[0014]** In an embodiment, there is provided a triple-pipe swivel that includes an inner ring connected to an auger shaft of a drilling agitator used to excavate the seabed ground, the inner ring being rotated together with the auger shaft, and an outer ring surrounding the inner ring
25 and coupled to an upper cover and a lower cover, the outer

ring being fixed.

[0015] The inner ring may have a main through-hole formed vertically from the top to the bottom at the center thereof.

[0016] The outer ring may have a first horizontal through-hole, formed horizontally from an upper portion on one side of an outer peripheral surface toward an inner peripheral surface thereof, and a second horizontal through-hole formed horizontally from a lower portion on the other side of the outer peripheral surface toward the inner peripheral surface thereof.

[0017] The inner ring may further have a first auxiliary through-hole and a second auxiliary through-hole formed at points spaced outward from the main through-hole formed at the center thereof, the first and second auxiliary through-holes being formed vertically from the top to the bottom of the inner ring, similarly to the main through-hole. The respective first and second auxiliary through-holes may match with any points of the first and second horizontal through-holes formed in the outer ring for communication therebetween.

[0018] At least one of inputs, such as slurry, high-pressure water, and high-pressure air, introduced into the main through-hole, the first horizontal through-hole, and the second horizontal through-hole may be selectively supplied in a manner that among the inputs, the slurry is supplied

through one of the through-holes, the high-pressure water is supplied through one of two remaining through-holes, and the high-pressure air is supplied through a remaining through-hole.

5 [0019] The inputs may be supplied through the first and second horizontal through-holes in communication with the first and second auxiliary through-holes, formed in the inner ring, during the rotation of the inner ring.

10 BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIGS. 1 to 3 are views illustrating a conventional swivel, wherein FIG. 1 is a front view illustrating an external appearance of the conventional swivel, FIG. 2 is a view for helping understanding an internal structure of the conventional swivel of FIG. 1 by cutting one side thereof, and FIG. 3 is an enlarged view illustrating portion A of the conventional swivel of FIG. 2.

[0021] FIG. 4 is a front view illustrating an external structure of a triple-pipe swivel according to an embodiment of the present disclosure.

[0022] FIG. 5 is a top view illustrating an upper structure of the triple-pipe swivel according to the embodiment of the present disclosure.

[0023] FIG. 6 is a cutaway view for helping understanding an internal structure of the triple-pipe swivel according to

the embodiment of the present disclosure.

[0024] FIG. 7 is an enlarged view illustrating portion A of the triple-pipe swivel of FIG. 6.

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DETAILED DESCRIPTION

[0025] It is noted that the drawings attached to the specification of the present disclosure are exaggerated for clarity and convenience of description. Since the embodiments described herein are nothing but one preferred
10 embodiment of the present disclosure and it does not cover all the technical ideas of the disclosure, it should be understood that various equivalents and modifications may be made at the time of filing the present application. In addition, the scope of the present disclosure is not
15 limited to the following embodiment, but should be interpreted based on the technical spirit throughout the specification in consideration of various modifications.

[0026] As illustrated in FIGS. 4 to 6, a triple-pipe swivel
100 according to an embodiment of the present disclosure
20 may include an outer ring 110, an inner ring 120 positioned inside the outer ring, an upper cover 130 provided to cover the upper ends of the outer ring and inner ring, and a lower cover 140 provided to cover the lower ends of the outer ring and inner ring.

25 [0027] In addition, a socket adapter 150 is coupled to any

portion of the outer periphery of the outer ring 110. The socket adapter 150 may be used to couple the triple-pipe swivel, connected to a support shaft and an auger shaft, to a frame structure formed in a stabilizer or a multi-auger machine.

[0028] As illustrated in FIGS. 6 and 7, intervening O-rings 160 may be interposed at regular intervals in a vertical direction between the outer ring 110 and the inner ring 120. Bearings 170 may be interposed between the outer and inner rings 110 and 120 and the upper cover 130 and between the outer and inner rings 110 and 120 and the lower cover 140, respectively.

[0029] In addition, bearing O-rings 171 may be interposed between the inner ring 120 and the upper cover 130 and between the inner ring 120 and the lower cover 140, respectively, thereby sealing the gaps therebetween in an airtight manner.

[0030] Since the intervening O-rings 160 are configured to airtightly seal the gap between the outer ring 110 and the inner ring 120, the inflow of seawater therebetween can be blocked. Since the bearing O-rings 171 seal the gap between the upper side end of the inner ring 120 and the upper cover 130 and the gap between the lower side end of the inner ring 120 and the lower cover 140 in an airtight manner, the inflow of seawater toward the bearing O-rings

171 can be blocked.

[0031] The lower end of the triple-pipe swivel is a portion that is connected to the auger shaft. Accordingly, a lower O-ring 180 and a connecting O-ring 190 may be arranged at a predetermined distance on the lower end of the inner ring 120. Since the lower O-ring 180 and the connecting O-ring 190 seal the connection portion with the auger shaft in an airtight manner, the inflow of seawater can be fundamentally blocked. A long bolt 195 may be inserted into and fastened to the inner ring 120.

[0032] The outer ring 110 is configured to surround the inner ring 120, and the respective upper and lower covers 130 and 140 may be bolted to the upper and lower ends of the outer ring 110.

[0033] Thus, the outer ring 110 may be fixedly fastened to the upper and lower covers 130 and 140, while the inner ring 120 positioned inside the outer ring 110 may be rotated.

[0034] In particular, as illustrated in FIGS. 5 and 6, the inner ring 120 may have a main through-hole CH1 vertically formed at the center thereof. The outer ring 110 surrounding the inner ring 120 may have a first horizontal through-hole CH2, which is formed horizontally from an upper point on one side of the outer peripheral surface toward the inner peripheral surface thereof, and a second

horizontal through-hole CH3 which is formed horizontally from a lower point on the other side of the outer peripheral surface toward the inner peripheral surface thereof.

- 5 **[0035]** Of course, the first horizontal through-hole CH2 may be formed at a position above the second horizontal through-hole CH3, and the first horizontal through-hole CH2 and the second horizontal through-hole CH3 may be spaced vertically from each other on the outer peripheral surface
10 of the outer ring 110. However, depending on the conditions of design, the first horizontal through-hole CH2 and the second horizontal through-hole CH3 are spaced vertically from each other on the outer peripheral surface of the outer ring 110, and for example, when the first
15 horizontal through-hole CH2 is formed at an upper point on one side of the outer peripheral surface of the outer ring 110, the second horizontal through-hole CH3 may be formed at a lower point on the other side of the outer peripheral surface of the outer ring 110.
- 20 **[0036]** On the other hand, at predetermined portions spaced outward from the main through-hole CH1 formed at the center of the inner ring 120, a first auxiliary through-hole CH2-1 and a second auxiliary through-hole CH3-1 may be formed vertically from the top to the bottom of the inner ring 120,
25 similarly to the main through-hole CH1.

[0037] The respective first and second auxiliary through-holes CH2-1 and CH3-1 formed in the inner ring 120 may match and communicate with the first and second horizontal through-holes CH2 and CH3 of the outer ring 110 fixed during the rotation of the inner ring 120. Such a communication structure makes it possible to selectively supply inputs (e.g., slurry, high-pressure water, and high-pressure air) and further to prevent twisting of cables connected for the supply of the inputs (slurry, high-pressure water, and high-pressure air).

[0038] That is, the twisting of the cables connected to the first and second horizontal through-holes CH2 and CH3 formed in the outer ring 110 is prevented since the first and second auxiliary through-holes CH2-1 and CH3-1 formed in the inner ring 120, rotated within the fixed outer ring 110, match and communicate with the first and second horizontal through-holes CH2 and CH3 for supply of inputs (slurry, high-pressure water, and high-pressure air).

[0039] Furthermore, the triple-pipe swivel of the present disclosure allows inputs (slurry, high-pressure water, high-pressure air) to be individually supplied according to the condition of excavation of the seabed ground, thereby preventing the inputs from being supplied at one time through a single supply line formed in an existing swivel. Therefore, the durability of lines for inputs can be

improved, and the quality of improved products to be constructed in the future can be enhanced as it is possible to individually or selectively supply these inputs.

[0040] In other words, in some cases, only slurry may be
5 required to be supplied to the excavation site of the excavation work due to the variable excavation situations. In this case, if high-pressure water and high-pressure air as well as slurry are supplied to the excavation site through the single supply line of the existing swivel, the
10 portions of the improved products to be constructed in the future, which do not require high-pressure water and high-pressure air, may be decreased in hardness or may be defective such as non-uniformity due to the high-pressure water and high-pressure air already supplied thereto, which
15 in turn results in a deterioration in quality of the improved products. However, the triple-pipe swivel of the present disclosure can achieve selective or individual supply of inputs so as to actively cope with the variable excavation situations, so that the quality of the improved
20 products to be constructed can be enhanced.

[0041] As apparent from the above description, the present disclosure provides the triple-pipe swivel that enables inputs, such as slurry, high-pressure water (water jet), and high-pressure air, required for drilling of the seabed
25 ground to be selectively supplied according to the

unexpected situational variables of the excavation work in the progress of excavating the seabed ground using the drilling agitator. Therefore, it is possible to improve the efficiency of the excavation work and enhance the quality of the improved products.

[0042] In addition, the present disclosure provides the triple-pipe swivel that enables inputs (slurry, water jet, and high-pressure air) required for drilling of the seabed ground to be selectively supplied. Thus, it is possible to prevent the twisting of the cables required for the supply of the inputs and to smoothly supply the inputs.

[0043] Furthermore, the present disclosure enables inputs to be selectively supplied according to the conditions of excavation on the seabed ground. Thus, it is possible to prevent inputs from being supplied to the single supply line of the existing swivel at one time, thereby improving the durability of the swivel.

[0044] While various embodiments have been described above, it will be understood to those skilled in the art that the embodiments described are by way of example only. Accordingly, the disclosure described herein should not be limited based on the described embodiments.

WHAT IS CLAIMED IS:

1. A triple-pipe swivel comprising:

an inner ring connected to an auger shaft of a
5 drilling agitator used to excavate the seabed ground, the
inner ring being rotated together with the auger shaft; and
an outer ring surrounding the inner ring and coupled
to an upper cover and a lower cover, the outer ring being
fixed.

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2. The triple-pipe swivel according to claim 1,
wherein the inner ring has a main through-hole formed
vertically from the top to the bottom at the center thereof.

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3. The triple-pipe swivel according to claim 2,
wherein the outer ring has a first horizontal through-hole,
formed horizontally from an upper portion on one side of an
outer peripheral surface toward an inner peripheral surface
thereof, and a second horizontal through-hole formed
20 horizontally from a lower portion on the other side of the
outer peripheral surface toward the inner peripheral
surface thereof.

4. The triple-pipe swivel according to claim 3,

wherein the inner ring further has a first auxiliary through-hole and a second auxiliary through-hole formed at points spaced outward from the main through-hole formed at the center thereof, the first and second auxiliary through-holes being formed vertically from the top to the bottom of the inner ring, similarly to the main through-hole, and the respective first and second auxiliary through-holes match with any points of the first and second horizontal through-holes formed in the outer ring for communication therebetween.

5. The triple-pipe swivel according to claim 4, wherein at least one of inputs, such as slurry, high-pressure water, and high-pressure air, introduced into the main through-hole, the first horizontal through-hole, and the second horizontal through-hole is selectively supplied in a manner that among the inputs, the slurry is supplied through one of the through-holes, the high-pressure water is supplied through one of two remaining through-holes, and the high-pressure air is supplied through a remaining through-hole.

6. The triple-pipe swivel according to claim 5, wherein the inputs are supplied through the first and

second horizontal through-holes in communication with the first and second auxiliary through-holes, formed in the inner ring, during the rotation of the inner ring.