

Spar-Buoy Boring Derrick and Mooring facility

The present relates to a derrick for a drilling platform, which is used for seabed geological survey or boring, or like operation.

In a sea-bottom geological survey or boring work in a relatively shallow area, piles were driven into the sea-bottom or scaffold piping was assembled onto which a deck was fastened to be used as a scaffold. Also, single column steel pipes were put straight up on the sea-bottom with their neck parts moored to anchors on the sea-bottom using mooring ropes. Another method was to lower three or more spuds onto the sea-bottom and pull a hull to the sea level to be used a scaffold. In a deep area, a steel scaffold derrick was used for a boring scaffold.

Among these methods, the method using a steel scaffold required either a lot of time and effort to move or a large scale facility in order to bore at a prescribed interval, resulting in a huge cost.

Noting the fact that the pull-in mooring type spar-buoy that has been used for navigational aids can maintain its upright stance stably with minimum slanting caused by the wind or wave and that it is relatively easy to be moved, the present invention conceives a spar-buoy boring derrick for sea-bottom drilling scaffold and its mooring facility for use in a sea-bottom geological survey.

According to the present invention there is provided derrick which comprises a column which has a platform at the top and a buoy intermediate its length, the derrick being connected to a sinker at the bottom by a mooring arrangement adapted to pull the buoy into the water so that the water level is above the buoy and the derrick stands upright in the water by buoyancy, the derrick further comprising a centre pipe through which passes a boring rod running through the buoy and column, the lower end of which centre pipe reaches the bottom of the column and is open to the water and the upper end of which centre pipe reaches higher than the

water level, wherein the column and the centre pipe form a double piping structure in which a portion inside the column and outside the centre pipe is water-tight and hollow.

It will be seen that essentially, the boring derrick or platform has a platform provided at the top of a central column, a buoy provided at an intermediate location on the column and the lower end of the column is moored to a sinker by a mooring facility; the buoy is pulled down into the water so that the water level comes somewhere along the column above the buoy and so that the buoy causes, by its buoyancy, the column to stand upright in the water, to provide a pull-in mooring type-spar buoy platform or scaffold, in which a centre pipe is provided so that it runs through the buoy and column, the lower end of the centre pipe reaching the bottom plate of the column and opening in the water, and the upper end reaching the water level at least, through which a boring rod is inserted.

The column and the centre pipe comprising a double piping structure and the periphery of the centre pipe is water-tight and hollow to increase the buoyancy of the spar-buoy boring derrick, and the inside of the centre pipe is filled with water up to the draught level.

A service platform is provided at the top of the column.

The mooring arrangement can be provided with a pair of mooring loops on both sides of the lower end of the column, and the sinker has a hole in the centre through which boring rod runs, and another pair of mooring loops are provided in the upper region of the sinker. The mooring loops are linked with a linkage that has a hollow in the centre for a boring rod to go through and is supported in two axial directions that are perpendicular to each other and horizontal to the ground level, in such a manner that the column and the sinker can tilt with respect to each another.

Instead of the linkage, a pair of linking loops at the lower end of the column and another pair of linking loops on the sinker can be linked by a pair of linking pieces to form

a linking device via an intermediate loop having supporting shafts that are perpendicular to each other and horizontal to the ground.

The derrick for boring scaffold can also have a swivel mechanism inserted in the lower end of the column.

With the configuration described above, a casing pipe, boring rod and sampler, etc., extend from the service platform established at the top of the column through the centre pipe in the centre of the mooring facility and further through the centre hole of the sinker into the sea-bottom ground to do drilling.

The spar-buoy derrick stands in the water with its own buoyancy and does not slant to interfere boring by the wind or waves.

The boring rod is inserted vertically in the centre and can slant in any direction without sagging, being constantly pulled upward by the buoyancy of the spar-buoy derrick, and therefore it can be moored safely even in the wind or wave or in the case of a collision by a ship.

Fig. 1 is an overall front view of an embodiment of the spar-buoy derrick and its mooring facility of the present invention;

Fig. 2A is a front view of an embodiment of the mooring arrangement;

Fig. 2B is a side elevation of the embodiment in Fig. 2A;

Fig. 3A is an illustration of a second embodiment of the mooring arrangement (8);

Fig. 3B illustrates two possible forms of connecting link;

Fig. 3C is a view along line A-A of Fig. 3A;

Fig. 3D shows an example of the invention in which linking pieces are eliminated for direct mooring;

Fig. 4A shows an example in which a swivel mechanism with a centre hole is inserted in the lower end of the column in order to avoid damages to the mooring facility in case an excessive torsional force arises,

Fig. 4B is a side view of the arrangement shown in Fig. 4A.

As shown in Figure 1 of the drawings, the boring derrick and mooring arrangement consists of a service platform 1, having two stages. The platform supports a boring machine 2, the whole being located at the top of a column 3 and in this embodiment, the lower stage of the service platform is mounted at the top and the upper service stage is supported by a supporting structure so that workers can have access to the boring or drilling rod (service point). A buoy 4 is located on the column and a centre pipe 5 extends through the centre of the column 3 and the buoy 4 thereby forming a double piping structure. The centre pipe 5 is joined to the bottom of the column and the interior of the centre pipe 5 is open to the water, the area between the column 3 and the central pipe 5 being watertight and hollow. A boring rod 6 or like drilling means extends through the central pipe 5 down to the seabed.

A pair of mooring loops or eyes 7 are mounted at the lower end of the column 3. Between the mooring loops or eyes 7 is a mooring assembly 8, for connected the lower end of the column 3 to a sinker 9 placed on the seabed and having a central vertical hole 10 through which the boring rod passes.

The mooring arrangement shown in Figures 2A and 2B has a mooring unit 11 which is hollow in the centre and is axially connected to the column 3 and the sinker 9 by mooring loops 7 and 7' of the sinker respectively in such a manner that it can pivot, by means of shafts 12 and 12' which are perpendicular to each other.

The mooring arrangement 8, as shown in Figures 3A to 3C comprises a mooring unit in which an intermediate connector 13 is provided with a hollow central region and incorporates supporting shafts 13' that are perpendicular to each other, the hollow central region allowing the boring rod to pass through it. Linking members 14 are provided, which may be in the form of a short length of chain in this embodiment. As

shown in Figure 3B, however, the linking member 14 can take a form of a short plate shaped member 14' or a bar-shaped linking member 14".

The length of the linking member 14 can be selected to match the depth of water.

With the configurations described above, a casing pipe, boring rod and sampler or measuring equipment can be extended from a service platform established on the boring derrick with a spar-buoy into the seabed for boring.

Tilting or slanting of the boring rod due to wind or wave action can be minimized to facilitate smooth boring.

The spar-buoy can be easily moved by lifting it a little from the seabed or ground by lifting the mooring loops provided on the sinker 9 from a service vessel, (the lifting force can be small due to the buoyancy of the spar-buoy), so providing an economical boring derrick and mooring facility.

The embodiment of the invention illustrated in Figures 4A and 4B show the provision of a mooring arrangement that allows the column 3 to swing round the mooring means, in which a swivel head 15 is located in a housing at the lower end of the column 3, the mooring unit having the perpendicularly arranged shafts which also permit the tilting movement of the column with respect to the sinker.

CLAIMS:

1. A derrick which comprises a column which has a platform at the top and a buoy intermediate its length, the derrick being connected to a sinker at the bottom by a mooring arrangement adapted to pull the buoy into the water so that the water level is above the buoy and the derrick stands upright in the water by buoyancy, the derrick further comprising a centre pipe through which passes a boring rod running through the buoy and column, the lower end of which centre pipe reaches the bottom of the column and is open to the water and the upper end of which centre pipe reaches higher than the water level, wherein the column and the centre pipe form a double piping structure in which a portion inside the column and outside the centre pipe is water-tight and hollow.

2. The derrick according to claim 1, in which a pair of mooring loops is provided on both sides of the lower end of the column and the sinker includes a central vertical through hole and a pair of mooring loops at the top of the sinker, which pairs are connected by the mooring arrangement, the mooring arrangement includes a linking element having a central vertical through hole and shafts on either side of the linkage element arranged in two mutually perpendicular directions.

3. The derrick according to claim 1, in which a pair of linkage loops at the lower end of the column and a pair of linkage loops at the top of the sinker are linked with two pairs of linking members by means of an intermediate connecting member having two pairs of horizontal mutually perpendicular supporting shafts.

4. A derrick in accordance with claim 2 or 3, in which a swivel mechanism is inserted at the lower end of the column.



5. A boring derrick substantially as hereinbefore described and with reference to Figure 1, or Figure 1, modified as shown in Figures 2A and 2B, or Figures 3A, 3B and 3C, or as shown in Figure 3D, or Figures 4A and 4B of the accompanying drawings.

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