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(54) **APPARATUS AND METHOD FOR REDUCTION OF SONIC VIBRATIONS IN A LIQUID**

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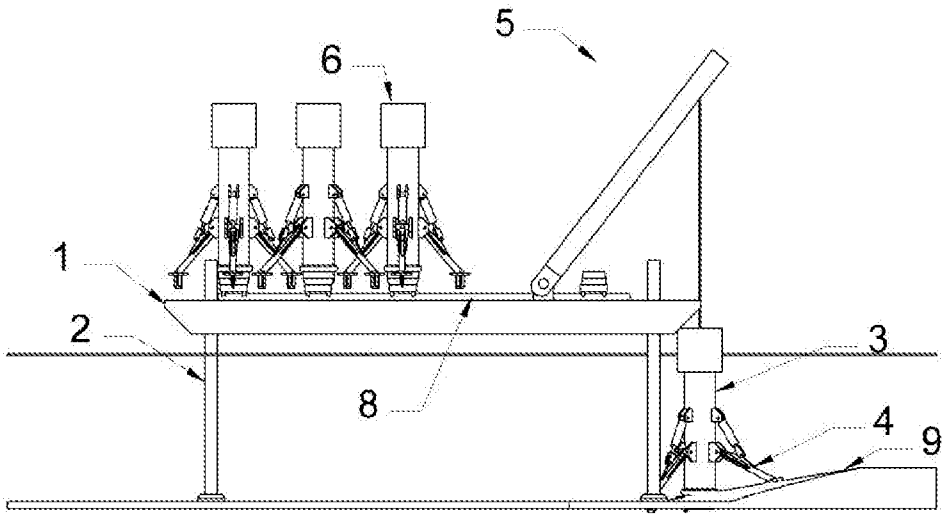
(57) **ABSTRACT**

An apparatus for reduction of sonic vibrations caused when driving a foundation member below the surface of a liquid has a tube structure which is lowered below the surface of the liquid, and which receives the foundation member. A seal is in contact with the tube structure and creates a contained volume around the foundation member, which may be pumped dry so as to minimize the communication of sonic vibrations into the liquid.



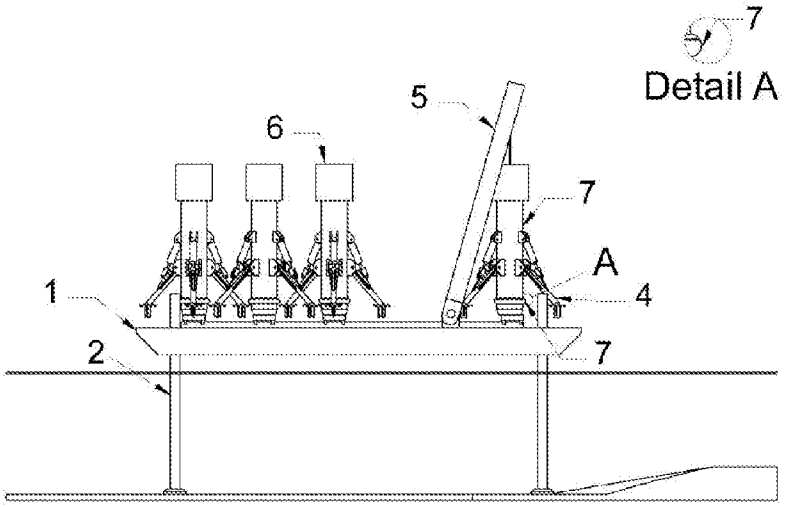


Fig 1 A

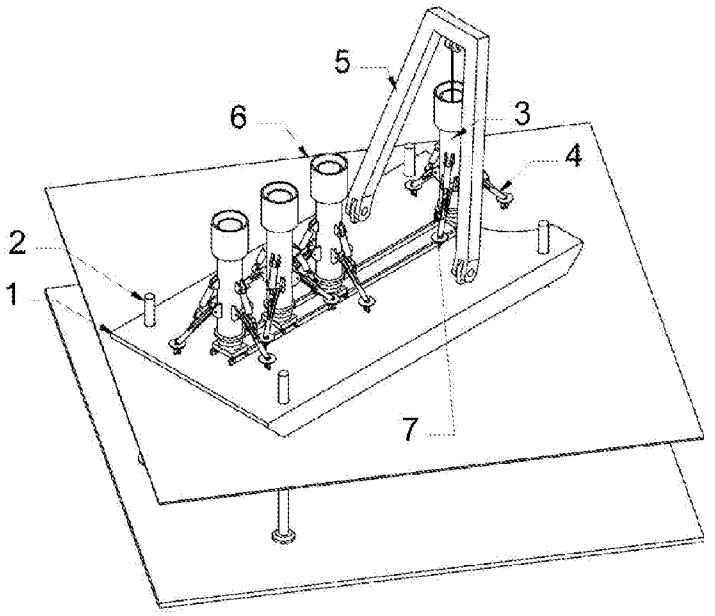


Fig 1 B

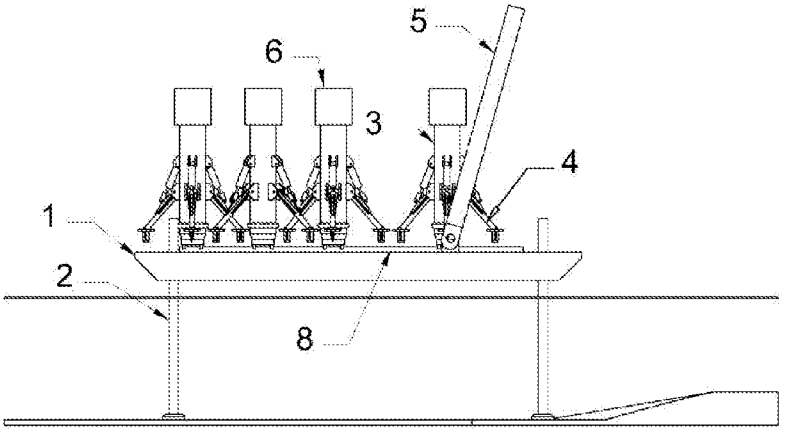


Fig 2 A

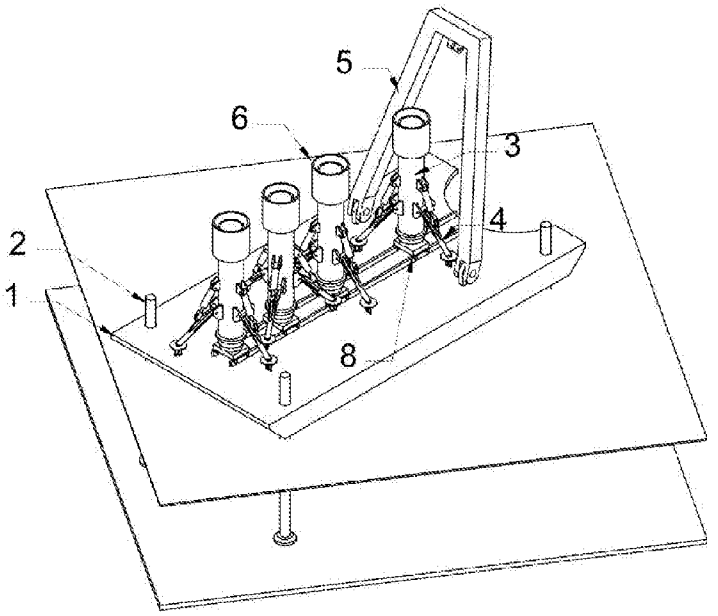


Fig 2 B

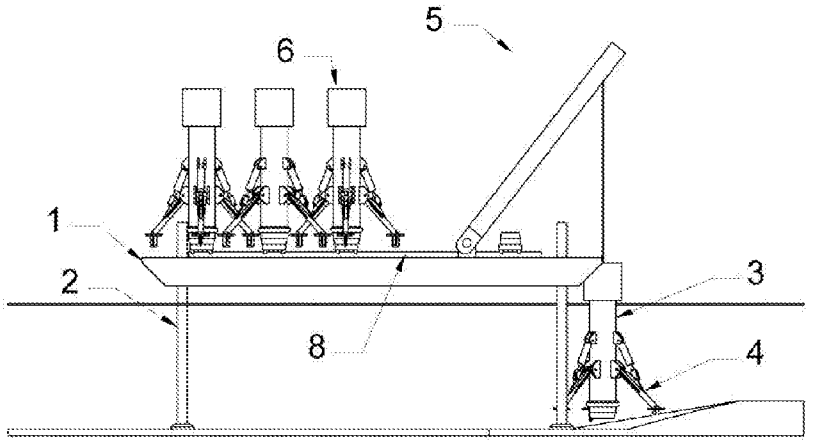


Fig 3 A

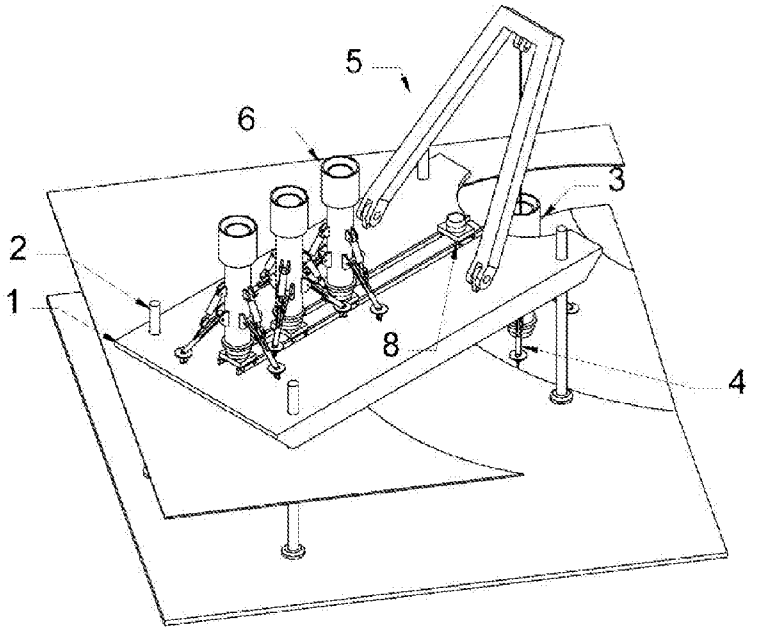


Fig 3 B

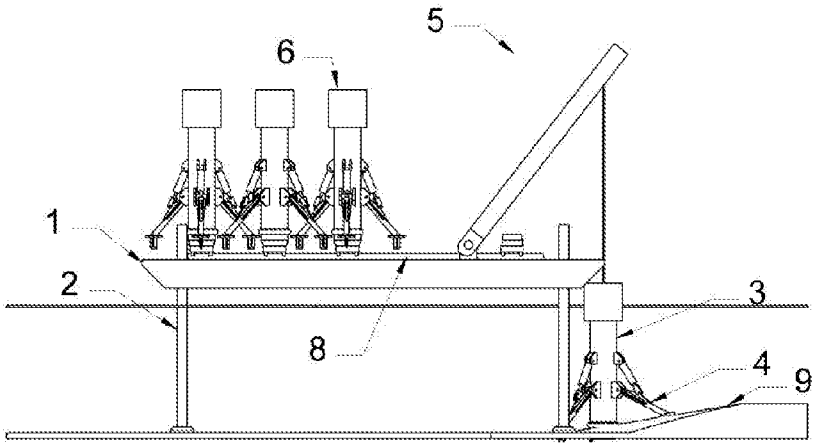


Fig 4 A

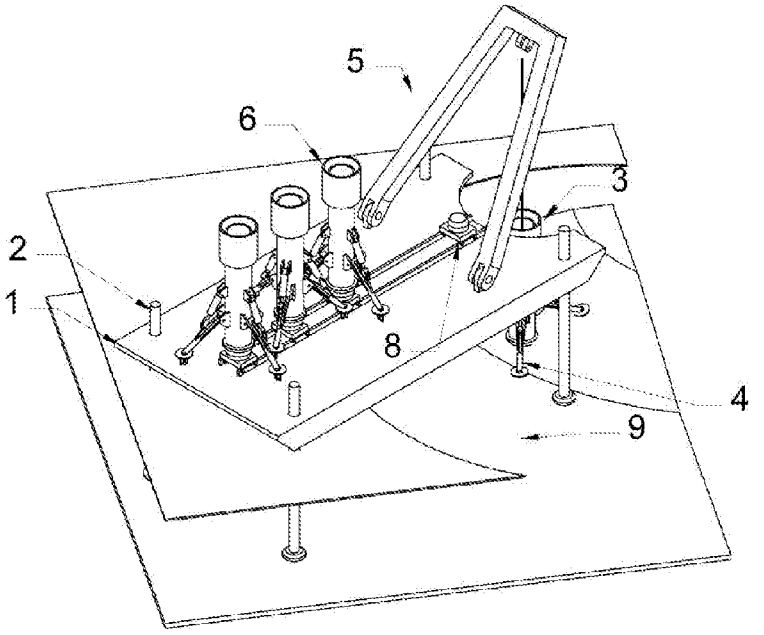


Fig 4 B

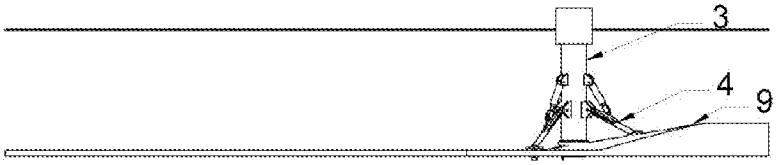


Fig 5 A

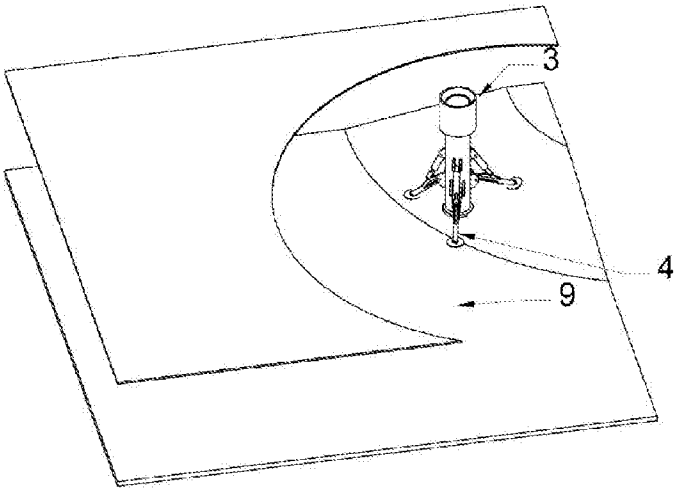


Fig 5 B

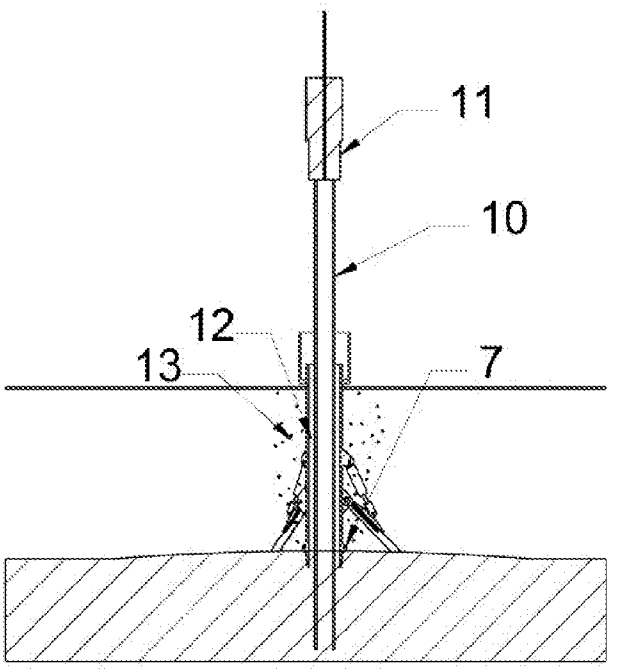


Fig 6

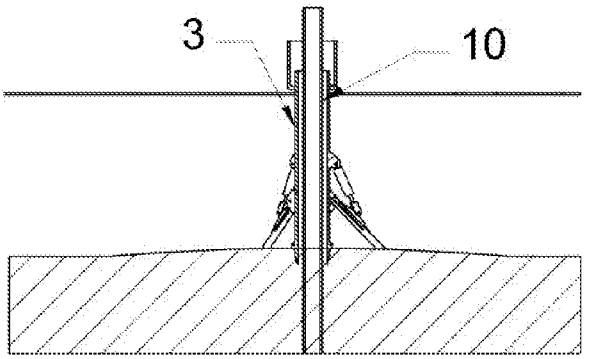


Fig 7

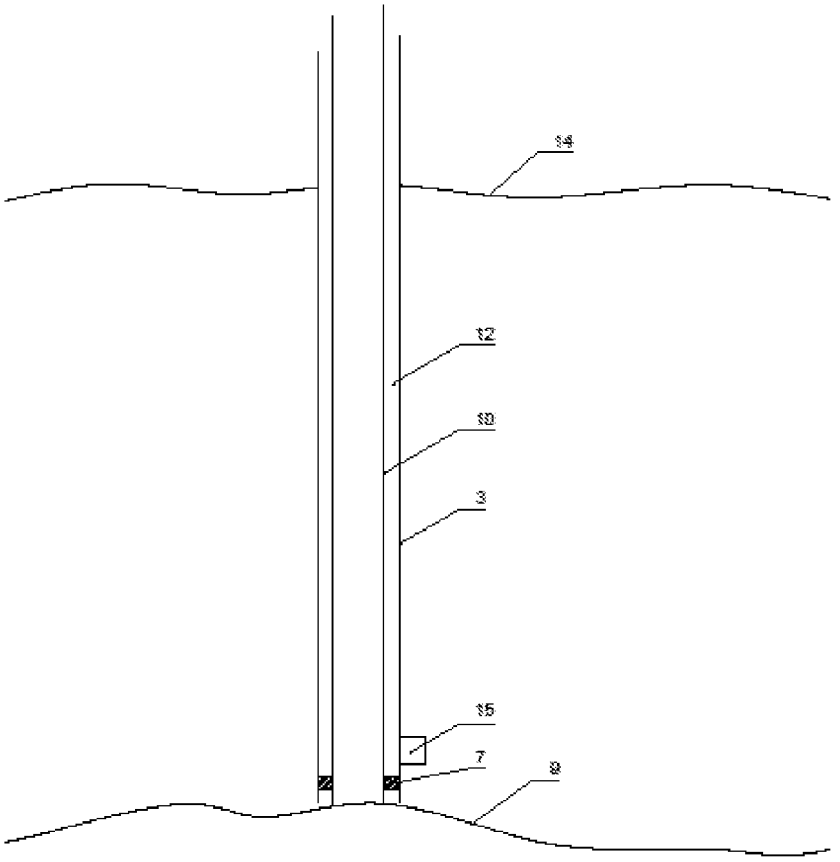


Fig. 8A

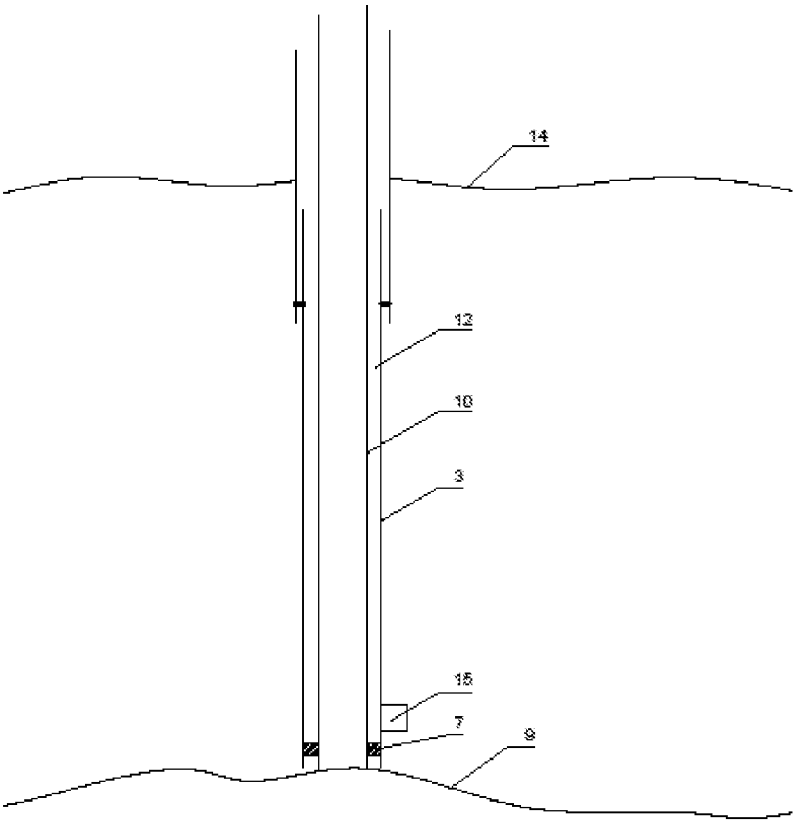


Fig. 8B

APPARATUS AND METHOD FOR REDUCTION OF SONIC VIBRATIONS IN A LIQUID

FIELD OF INVENTION

[0001] The invention relates to an apparatus for reduction of sonic vibrations in a liquid, when driving down a foundation member below the surface of the liquid so that one end is rooted in the bottom of the liquid.

BACKGROUND OF THE INVENTION

[0002] A well-known problem for driving down foundation members in an offshore environment, is the sound emission from driving down foundation members into the sea bed. Research has shown that fish and sea mammals, within a certain distance from the foundation member being driven in, are at serious health risk due to the sonic vibrations (sound emissions) in the water and from the sea bed. A number of research papers have stated said harming effect on fish and sea mammals, from noise and sonic vibrations due to foundation members, such as monopiles being driven into the sea bed, e.g.: "Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish", February 2009, Prepared for: California Department of Transportation, Contact: Jim Andrews. Prepared by: ICF Jones & Stokes, 630 K Street, Suite 400, Sacramento, Calif. 95818, Contacts: Rick Oestman, Dave Buehler And: Illingworth and Rodkin, Inc, 505 Petaluma Blvd. South, Petaluma, Calif. 94952, Contacts: James Reyff, Rich Rodkin.

[0003] JP60159218A describes an onshore sound insulator using a flexible gas filled sleeve in shape of bellows surrounding the mono pile while being driven by a pile hammer. The bellow, containing gas and water, functions as a spring and damper solution in an onshore environment, but will transfer noise emission if used in an offshore environment, surrounded by water.

[0004] DE10302219 describes an offshore solution in which the pile or post is noise insulated from the surrounding water by a large number of gas filled compartments or cells.

[0005] WO2007096132 describes an offshore solution in which the pile or post is noise insulated by a noise reduction sleeve in a cofferdam structure, as the pile is positioned in a water-free environment, while being driven into the sea bed.

SUMMARY OF THE INVENTION

[0006] Considering the prior art described above, it is an object of the present invention to provide an apparatus and a method for a fast and a cheap way of driving down foundation members in the bottom of a liquid, such as an ocean, while ensuring minimal sonic vibration in order to minimise the environmental impact.

[0007] The object can be achieved by means of an apparatus for reduction of sonic vibrations in a liquid, when driving down a foundation member below the surface of the liquid, so that one end is rooted in the bottom of the liquid comprising a tube structure adapted for lowering a section of the tube structure below the surface of the liquid and suitable for longitudinally positioning the foundation member within the tube structure; sealing means in contact with the tube structure and adapted to create a contained volume by contact between the section of the tube structure below the surface and the foundation member, when the foundation member is positioned longitudinally within the tube structure for driving down the foundation member; pumping means adapted to remove liquid from the contained volume when the foundation member is positioned longitudinally within the tube structure and the contained volume has been created.

[0008] Thus, it is possible to reduce the sonic vibrations when driving down foundation members in the bottom of a liquid, such as an ocean or a lake. Further, the invention is suitable for use off shore as it is relatively simple and cheap.

[0009] The use of sealing means reduces the amount of liquid that re-enter the contained volume after liquid has been removed. This is advantageous because it decreases energy and/or fuel consumption of the pumps.

[0010] The tube structure is a hollow longitudinal structure, preferably a cylinder; however, other shapes can also be used as long as the foundation member can be positioned longitudinally within the tube structure. The cross-sectional shape of the tube structure can, for example, be square, rectangular or hexagonal. In an embodiment, the tube structure has the same cross-sectional shape as the foundation member. The tube structure can, in an embodiment, be interpreted as a cofferdam. The tube structure can be lowered to and/or be kept at a desired height above the bottom of the liquid.

[0011] Foundation members, preferably monopiles, can be used to create a foundation for offshore structures, such as wind turbines. They can be embedded in the ground by driving them into the bottom of the liquid; the depth of the foundation members in the ground depends on the intended use of the foundation members and the geology of the site. In an embodiment, the foundation member comprises a plurality of separate sections, joined when driven down.

[0012] Contained volume can be understood as the volume between the foundation member and the tube structure in the section where they overlap and are delimited in the bottom by the sealing means. In an embodiment, the contained volume is also delimited at the top and filled with a gas, in order to reduce the sonic vibrations to a desired level.

[0013] Preferably, the contained volume is open to the atmosphere. This can be obtained by having no additional sealing means between the foundation members and the tube structure. They pressure inside the contained volume will then be approx. 1 atm and equal to the surrounding air. The sonic vibrations generated when the foundation member is being driven down, e.g. by a hammer, are then transferred to the air with in the contained volume. Substantially all these sonic vibrations are then equalised through the opening to the atmosphere and consequently not transferred to the tube structure and onwards to the liquid. In other words, the contained volume directs a substantially amount of the sonic vibrations generated when driving down the foundation member up and out into the atmosphere, hereby reducing the sonic vibrations in the liquid.

[0014] The sealing means, for example a gasket or another mechanical packing, can ensure that only small amounts of liquid enter the contained volume. By small amounts, it is to be understood, that the flow of liquid into the contained volume should not exceed the pumping capacity of the pumping means. It is preferred to make the sealing means as tight as possible, as it will save energy used by the pumping means. The pumping means can be a liquid pump, suitable for pumping the relevant liquid. It is preferred to place the pumping means below the surface of the liquid and/or near the sealing means with an inlet at the bottom of the contained volume.

[0015] The tube structure is preferably lowered into the liquid, before the foundation member is positioned within the

tube structure, preferably by lowering it into the foundation member. Alternatively, the foundation member can be positioned within the tube structure before lowering a section of it below the surface of a liquid.

[0016] In an embodiment, the apparatus further comprises a support structure comprising a plurality of pivotable legs connected to the tube structure, wherein the plurality of legs are adapted to support the tube structure by positioning the plurality of legs on the bottom of the liquid. The support structure can then be used to position itself with any desired inclination. In addition, the support structure can be designed to support itself to make it possible to leave the support structure on the bottom of the liquid, either with the foundation member inserted or for later insertion, in order to drive down the foundation members at a later time. Preferably, the support structure has three legs evenly distributed around it. The angle between the legs and the support structure can be changed in order to ensure the desired inclination.

[0017] In an embodiment, the apparatus further comprises a support structure adapted to hold the tube structure in a substantially vertical position. It is preferred to have a vertical position of the support structure, regardless of the inclination at the bottom of the liquid, as a vertical position provides the best conditions for structures using the foundation members as part of their foundation.

[0018] Preferably, the sealing means are fixed to the tube structure. The tube structure can be reused on a plurality of foundation members and the sealing means are also reusable. Hence, it is desirable that they are joined. This will result in a more simple and easy handling of the present invention.

[0019] Advantageously, the sealing means comprises an expandable section, adapted to be expanded when the foundation member is positioned longitudinally within the tube structure, hereby securing a tight seal. This is a way of ensuring that the seal is as tight as possible and at the same time makes lowering the foundation member more simple, as the expandable section can be unexpanded when lowering the foundation member and then expanded afterwards. The lowering does, consequently, not have to deal with a tight sealing member until driving down of the foundation member is initiated. This also protects the sealing means against wear.

[0020] In an embodiment, the tube structure comprises telescopic sections adapted to elongate or contract the tube structure. This will ease the handling of the tube structure and is especially desirable when the tube structure is of considerable length, such as over 10 meters. In addition, telescopic sections can ensure that the section of the tube structure that is above the surface of the liquid has the same height for a plurality of tube structures even when they are positioned at different depths.

[0021] The invention further regards a system comprising a plurality of apparatuses as described herein, wherein the plurality of apparatuses are joined by at least one distance piece to ensure a predetermined position of foundation members positioned in the tube structures in relation to each other. The distance piece or pieces can be used to join tube structures and thereby make a predefined pattern possible. If, for example, pluralities of structures are in need of a foundation with more than one foundation member, it can be an advantage to have a system of tube structures and distance pieces to form a fixed template for the foundation members. In an example, distance pieces form a square with tube structures at the corners; it is then possible to position four foundation members precisely in the correct position in relation to each other. The system can then be elevated over the foundation members and used for driving down four new foundation members.

[0022] Another aspect of the present invention regards a method for reducing sonic vibrations in a liquid when driving down a foundation member below the surface of the liquid, so that one end is rooted in the bottom of the liquid, comprising the steps of: Lowering a section of a tube structure below the surface of the liquid, inserting a foundation member into the tube structure, creating a contained volume between the foundation member and the tube structure with sealing means in contact with the foundation member and the tube structure, removing liquid from the contained volume, sequentially driving down the foundation member into the bottom of the liquid with reduced sonic vibrations.

[0023] When executing this method, the sonic vibrations connected with driving down foundation members in a liquid, is greatly reduced to the benefit of the fish and sea mammals in the vicinity.

[0024] In an embodiment, the method further comprises the step of adjusting the inclination of the tube structure. This is advantageous because it ensures that the foundation can be positioned and inclined to support any structure desired. Preferably, the adjusting of the inclination of the tube structure is performed by use of a support structure, preferably comprising a plurality of legs with one end supporting the tube structure and the other resting at the bottom of the liquid. The bottom of the liquid can have different inclinations and normally it is desired that the inclination of the foundation member is vertical. A support structure as mentioned can be used to ensure that.

[0025] Advantageously, after the foundation member has been driven down into the bottom, the following step is performed: raising the tube structure above the foundation member and thereby removing the tube structure from the foundation member. The tube member can then be used when driving down another foundation member.

[0026] Preferably, the tube structure is lowered to the bottom of the liquid. It can then be supported by the bottom and is then easier to control. In addition, it can be left standing on the bottom for later use.

[0027] In an embodiment, the tube structure comprises telescopic members for elongation and contraction of the tube structure. This is advantageous when the tube structure is of considerable length. Transportation to the site where it will be lowered is then made easier.

[0028] In an embodiment, lowering of a section of a tube structure below the surface of the liquid is performed from a vessel adapted to float on the liquid. This is desirable as it is a simple way to transport the apparatus to where the foundation member is to be driven down. Preferably, the vessel comprises at least one pole which is lowered to the bottom of the liquid in order to support the vessel. Preferably the vessel is raised above the surface of the liquid while standing on at least one pole. The vessel can be a jack-up rig, which gives very stable conditions for driving down foundation members offshore.

[0029] In an embodiment, a plurality of tube structures, joined together by distance pieces, are used when driving down foundation members in a predefined pattern. This enables a predefined pattern of the foundation members.

[0030] It is to be understood that the method can be adapted for use of the mentioned apparatus and vice versa.

DESCRIPTION OF THE DRAWINGS

[0031] The invention will in the following be described in greater detail with reference to the accompanying drawings:

[0032] FIG. **1**A, **1**B a schematic view of an embodiment of the invention with a tube structure ready to be lowered.

[0033] FIG. **2**A, **2**B a schematic view of an embodiment of the invention with a tube structure resting on a vessel.

[0034] FIG. **3**A, **3**B a schematic view of an embodiment of the invention with a tube structure being lowered.

[0035] FIG. **4**A, **4**B a schematic view of an embodiment of the invention with a tube structure being stabilised by the support structure.

[0036] FIG. **5**A, **5**B a schematic view of an embodiment of the invention with a free standing tube structure stabilised by a support structure.

[0037] FIG. **6** a schematic view of an embodiment of the invention with a tube structure being stabilised by a support structure and driving down a foundation member by a hammer.

[0038] FIG. **7** a schematic view of an embodiment of the invention with a tube structure supported by a support structure and a foundation member founded in the bottom.

[0039] FIG. **8**A, **8**B a schematic view of an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0040] The present invention addresses the problem of, speedily, driving down one or more foundation members, preferable monopiles, into the bottom of a liquid, to create a foundation for structures in an offshore environment, such as Wind turbines. It provides an apparatus and method of foundation in an environmentally friendly way, for example, to the installment of multiple wind generators in offshore wind farms. In an example, it can be done by a positionable, self-supporting, temporary cofferdam, by transferring, positioning, adjusting, the temporary cofferdam from a vessel to the desired position on the bottom of the ocean, enabling early placing and adjustment of cofferdam and later driving in the foundation member.

[0041] An aspect of the present invention is a method for environmentally safety as well as speedy foundation member installation for use in oceans and lakes. Preferably, including a method for transporting a temporary cofferdam structure to a construction site, transfer of these cofferdam structures to the bottom of the flooded area, where installation position and angle is adjusted by means of adjustable legs or the like, to enable a self-supporting cofferdam in the ocean or lake. A contained volume between the cofferdam structure and the foundation member is then created. Pumps then remove water from the contained volume resulting in air entering through the opening in the top. This reduces transportation of hydro acoustic effects from driving down the foundation member into the bottom of the ocean or lake, which ensures minimal amount of vibrations to the surroundings. The apparatus according to the present invention is preferably transported on and deployed from a vessel that is able to move or be moved, for example a floating transportation vessel, such as a boat or a jack-up rig.

[0042] FIG. **8**A and **8**B shows an embodiment of the present invention, a tube structure **3** has been partly lowered into a liquid. The tube structure **3** can be held in place by a jack-up rig, boat or support means with legs resting on the bottom of the liquid **9**. The tube structure **3** rests on the bottom **9**. Resting the tube structure **3** on the bottom **9** can help in stabilising the tube structure **3**. Within the tube structure **3**, a foundation member **10** has been lowered. Both the tube structure **3** and the foundation member **10** extend over the surface of the liquid **14**. The sealing means **7** are fixed to the tube member **3** and is in sealing contact with the foundation member **10**. The pump **15** can then empty the liquid initially present in the contained volume **12**. The pump **15** has an inlet connected with the contained volume **12** and outlet in the liquid. The contained volume **12** can then be kept substantially free from liquid, while the foundation member **10** is driven down into the bottom **9**, for example by a hammer. The skilled person will know, that it is very difficult the keep sealing means **7** entirely tight as the foundation member **10** is moved in relation to the sealing means when driven into the ground **9**. It is therefore necessary to keep the pumps running throughout the operation of driving down the foundation members **10**, in order to ensure a substantially liquid free contained volume **12**. The reduction of sonic vibrations in the liquid is reduced due to the liquid free section of the contained volume **12**. FIG. **8**A shows a tube structure **3** in one piece whereas **8**B shows a telescopic tube structure **3**.

[0043] FIG. **1** disclose a simplified sketch of the present invention in an embodiment comprising an offshore vessel **1**, jack-up legs **2**, tube structure **3** (also known as cofferdam structure) with adjustable legs **4**, tube structure lifting system **5**, tube structures in storage area **6** and sealing means **7**. The jack-up vessel **1** provides a stable platform for transport and placing of the tube structures **3**.

[0044] FIG. **2** shows a simplified sketch of an embodiment of the present invention with a tube structure **3** transferred from store to cofferdam structure lifting system **5** by the transfer system **8**.

[0045] FIG. **3** shows a simplified sketch of the invention at hand in an embodiment showing a tube structure **3** being lifted to the bottom **9** of the liquid by the tube structure lifting system **5**.

[0046] FIG. **4** shows a simplified sketch of the invention at hand in an embodiment showing a tube structure **3** being angular adjusted by the adjustable legs **4** on the tube structure **3**.

[0047] FIG. **5** shows a simplified sketch of the invention at hand in an embodiment showing a tube structure **3** being positioned on the sea bed **9** for later driving down of the foundation member **10**.

[0048] FIG. **6** shows a simplified cut through sketch of the invention at hand in an embodiment showing a foundation member **10** being driven into the sea bed **9** by a pile driving hammer **11**, while the contained area **12**, between the tube structure **3** and pile **10** is kept dry by means of a pump, this will reduce the sonic vibrations generated when the foundation member is driven down in the bottom **9**. In addition, an auxiliary noise reduction system is blowing out gas in to the surrounding sea water, surrounding said tube structure **3** with a gas bubble curtain **13**, which reduces the sonic vibrations from the driving down of the foundation member **10** even further. The auxiliary noise reduction system can use a pump for generating the bubble curtain, and preferably the pump is the same pump **15** as used for emptying the contained volume **12** from liquid.

[0049] FIG. **7** shows a simplified sketch of the invention at hand in an embodiment showing a foundation member **10** in final position with the tube structure **3** still enclosing it.

[0050] Afterwards the tube structure **3** is, preferably raised and removed from the foundation member **10**.

[0051] An embodiment of the invention is described in the following:

[0052] An embodiment of the invention relates to a method of establishing a temporary cofferdam structure in a flooded environment, to allow driving in the foundation for a structure on the bottom of a flooded environment in an environmentally friendly way, including the steps of transporting a cofferdam structure to the right position, lowering said cofferdam structure to proper contact with said bottom of said flooded environment, positioning said cofferdam structure in proper angle by use of said cofferdam structures self-contained adjustable structure, inserting and driving down said foundation member, after which, said cofferdam structure will be raised to ensure that it has no metal contact with said newly driven in foundation member. The cofferdam structure and the foundation member, together, when the said foundation member is installed in the cofferdam structure, enables a contained volume, enabling said foundation members outer perimeter to be kept of direct contact with the fluid of flooded environment. Said contained volume is secured by an installed seal between said cofferdam structure and said foundation member.

[0053] Preferably, said contained volume is made by emerging the cofferdam structure partly into sealing contact of said bottom of said flooded environment. Using the material of said bottom as seal.

[0054] Preferably, said cofferdam structure is made out of 2 or more telescopic parts relatively elongateable to each other, to allow for different water levels and easier lifting and or transportation of a cofferdam structure.

[0055] Preferably, said contained area is kept secured by letting said seal be of an expandable type, enabling a tight seal, even at depts.

[0056] Preferably, said contained area is kept secured by letting said seal of an expandable type be expanded by a gas, fluid or a mix of the two, to enable a chosen expandability or contraction.

[0057] Preferably, said foundation member is of a hollow type, enabling an additional contained area while said foundation member is in a sealing contact with the bottom of the flooded environment, this contained area allows adjusting of vibrational characteristics of said foundation member.

[0058] Preferably, one or more contained volume is filled, partly or fully, with gas to allow adjusting of vibrational characteristics of said foundation member.

[0059] Preferably, said one or more contained volume is emptied, partly or fully, to allow adjusting of vibrational characteristics of said foundation member.

[0060] Preferably, said one or more contained volume is filled, partly or fully, with a mixture of gas and fluid to allow adjusting of vibrational characteristics of said foundation member.

[0061] Preferably, said one or more contained volumes is used as insulation to allow adjusting of vibrational characteristics of said foundation member.

[0062] Preferably, said one or more contained volume is emptied, partly or fully, with a pump to allow adjusting of vibrational characteristics of said foundation member.

[0063] Preferably, said one or more contained volumes are filled, partly or fully, with a mixture of gas and fluid with a pump to allow adjusting of vibrational characteristics of said foundation member.

[0064] Preferably, the driver, driving down said foundation members into said bottom of said flooded environment is a Hammer or a Hammer like mechanism.

[0065] Preferably, the driver, driving down said foundation members into said bottom of said flooded environment is a vibrator.

[0066] Preferably, the method or system is installed on a vessel for transportation in a flooded environment; this might be any kind of relevant vessel.

[0067] Preferably, a gas bubble curtain being blown out, around the extendable guide, at the lower part of the extendable guide, while driving in said foundation member to reduce noise mitigation from said extendable guide and said foundation member, to the flooded environment.

[0068] The term "flooded environment" can be a saltwater-based area or a freshwater-based area or mixture hereof. The saltwater based area can be the ocean or a lake and the freshwater based area can be a lake, river, pond, or an artificially flooded area created by humans.

[0069] Preferably, said transportation unit for transportation in a flooded environment is a floating transportation unit, like a ship, a boat, a pram or other floating transportation units.

[0070] Preferably, said transportation unit for transportation in a flooded environment is a wheel based, belt driven or other rolling or driving transportation unit, like a truck, a crane or other wheel based, belt driven or other rolling or driving transportation units.

[0071] Preferably, said transportation unit for transportation in a flooded environment is a flying or hovering transportation unit, like a plane, a hovercraft, a helicopter or other flying or hovering transportation units.

[0072] Preferably, said transportation unit for transportation in a flooded environment is a jack-up type vessel.

[0073] Preferably, said foundation member is a monopile.

[0074] Preferably, said foundation member is a construction of steel, concrete, plastic, composites, ceramics, other rigid or semi-rigid material or any mixture hereof.

[0075] Preferably, said self-contained adjustable structure contains one or more legs for interacting indirectly or directly with said bottom to alter or stabilize the angle of said cofferdam structure relatively with said bottom.

[0076] Preferably, said self-contained adjustable structure contains one or more pivot able members interacting with said bottom to alter or stabilize the angle of said cofferdam structure relatively said bottom.

[0077] Preferably, said self-contained adjustable structure contains one or more elongation able members interacting with said bottom to alter or stabilize the angle and/or alter the horizontal position of said cofferdam structure relatively said bottom.

[0078] Preferably, said driving of foundation members into a bottom of a flooded environment is made by means of rotation of the foundation member relative to said cofferdam structure.

[0079] Preferably, said driving of foundation members into a bottom of a flooded environment is made by means of rotation of a fluid or stiff media inside the foundation member relative to said bottom of said flooded environment.

1. An apparatus for reduction of sonic vibrations in a liquid when driving down a foundation member below the surface of the liquid so that one end is rooted in the bottom of the liquid, said apparatus comprising,

a tube structure adapted for lowering a section of the tube structure below the surface of the liquid, said tube structure being operable for longitudinally positioning the foundation member within the tube structure,

sealing means in contact with the tube structure, said sealing means being operable to create a contained volume by contact between the section of the tube structure below the surface and the foundation member when the foundation member is positioned longitudinally within the tube structure for driving down the foundation member,

pumping means being operable to remove liquid from the contained volume when the foundation member is positioned longitudinally within the tube structure and the contained volume has been created.

2. The apparatus according to claim **1**, wherein the apparatus further comprises a support structure comprising a plurality of pivotable legs connected to the tube structure, wherein the plurality of legs are operable to support the tube structure by positioning the plurality of legs on the bottom of the liquid.

3. The apparatus according to any of the preceding claim **1**, wherein the apparatus further comprises a support structure operable to hold the tube structure in a substantially vertical position.

4. The apparatus according to claim **1**, wherein the sealing means are fixed to the tube structure.

5. The apparatus according to claim **1**, wherein the sealing means comprises an expandable section operable to be expanded when the foundation member is positioned longitudinally within the tube structure hereby securing a tight seal.

6. The apparatus according to claim **1**, wherein the tube structure comprises telescopic sections operable to elongate or contract the tube structure.

7. The apparatus according to claim **1**, wherein the contained volume is open to the atmosphere.

8. A system comprising a plurality of apparatuses according to claim **1**, wherein the plurality of apparatuses are joined by at least one distance piece so as to ensure a predetermined position of said foundation members positioned in the tube structures in relation to each other.

9. A method for reducing sonic vibrations in a liquid when driving down a foundation member below the surface of the liquid so that one end is rooted in the bottom of the liquid, said method comprising the steps of

lowering a section of a tube structure below the surface of the liquid,

inserting a foundation member into the tube structure,

creating a contained volume between the foundation member and the tube structure with sealing means in sealing contact with the foundation member and the tube structure,

removing liquid from the contained volume, sequentially driving down the foundation member into the bottom of the liquid whereby sonic vibrations are reduced.

10. The method according to claim **9**, further comprising the step of adjusting the inclination of the tube structure.

11. The method according to claim **10**, wherein the step of adjusting the inclination of the tube structure is performed by use of a support structure comprising a plurality of legs with one end supporting the tube structure and the other resting on the bottom of the liquid.

12. The method according to claim **9**, wherein after the foundation member has been driven down in the bottom, the following step is performed: raising the tube structure above the foundation member and thereby removing the tube structure from the foundation member.

13. The method according to claim **9**, wherein the tube structure is lowered to the bottom of the liquid.

14. The method according to claim **9**, wherein the tube structure comprises telescopic members for elongation and contraction of the tube structure.

15. The method according to claim **9**, wherein lowering a section of a tube structure below the surface of the liquid is performed from a vessel adapted to float on the liquid.

16. The method according to claim **15**, wherein the vessel comprises at least one pole which are lowered to the bottom of the liquid in order to support the vessel, and wherein the vessel is raised above the surface of the liquid while standing on the at least one pole.

17. The method according to claim **9**, wherein a plurality of tube structures, joined together by distance pieces, are used when driving down foundation member in a predefined pattern.

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