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(54) **Integrated system for the automatic implantation of metal tubes in sedimentary seabeds**

Vorrichtung zum Einbringen von Metallrohren in marines Sediment am Meeresboden

Système automatique pour l'implantation de tubes métalliques dans des fonds de mer sédimentaires

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Description

[0001] The invention refers to an integrated system for the implantation of metal tubes from the surface of the sea to marine sedimentary seabed. The system consists of a mechanism with grabs, that can hold tightly the metal tube from its upper part aiming at deploying it from the surface to the bottom in a vertical position. The support vessel winch is used for the deployment. The grabs hold the metal tube through a watertight seal to the lower part of a flexible water tube which is connected to top of the metal tube. The other end of the flexible tube is connected to an autonomous water pump on the working deck of the support vessel. By activating the pump, pressurised water comes out from the lower end of the metal tube, washing out the sediment particles, gradually creating a narrow hole that allows the lowering of the tube to the desired depth. The final penetration depth is controlled by special shoes attached to the main body of the mechanism which prevent further penetration of the metal tube when they come in contact with the seabed. When the metal tube reaches the desired depth into the sediment the operation of the pump is interrupted and a special tube release on the grab holding mechanism is activated Finally, the main body of the system with the holding grabs and the shoes as well as the flexible tube are brought back to the vessel's working deck in order to be reused for a new tube implantation.

[0002] The invention aims to protect fishing grounds and marine sensitive habitats from the illegal use of towed fishing gears (bottom trawling). The adverse effects of trawling activities upon the marine organisms and the biota have been well studied and documented scientifically. According to recent decision of the European Union in the frame of the Common Fisheries Policy (Council Regulation No 1626/94 of 27 June 1994) the use of bottom trawls within the three nautical miles from the coast (or up to the 50 metres contour depth) and also above sea grass meadows *(Posidonia oceanica* beds) shall be prohibited (article 3). Unfortunately, the implementation of effective controls is not always possible and as a result in many areas, vessels at sea are not controlled throughout the fishing period The use of illegal bottom trawling causes a continuous and severe deterioration of valuable natural marine habitats as well as overexploitation of marine living resources. In many Mediterranean countries, artificial reefs known in the literature also as antitrawling reefs, are used as simple mechanical obstacles to prevent illegal trawling in marine protected zones. Unfortunately, it seems that the use of artificial reefs i.e. massive structures from concrete, for the creation of protected marine zones presents a series of disadvantages. Considering the proven enhancement and aggregating role of artificial reefs in the absence of proper control measures on fishery operations, their deployment may have the effect of concentrating fishery activity and consequently further exacerbating over-fishing. Among other disadvantages the long term bureaucratic implications and high cost of artificial reef construction, including potential requirements for removal are also included.

[0003] Prior art known to the applicant includes U.S. patent 4,102,147 (JANSZ) describing a submersible pile driving apparatus. This invention comprises a frame assembly defining a guide passage for a pile and aiming at keeping the said pile at a vertical position or at a predefined slight angle to the vertical position. However, the present invention shows various structural and functional features beyond the state of the art. The main frame of the system bears grabs that hold tightly the metal tube from its upper part throughout the implantation operation. On the contrary in the pile driving apparatus, the outer ends of the rods of all cylinders act only as guides thus allowing the pile to move freely as it is driven into the ground The pile driving apparatus starts being in operation mode only when its footpads are in contact with the seabed, while the tube implantation system stops being operational when it reaches the seabed Finally, the construction of the pile-driving apparatus is exclusively adapted in supporting a pile-driving hammer operation.

[0004] The integrated system for the automatic implantation of metal tubes in soft bottom substrates can offer a high level of protection to marine seagrass beds and nursery grounds from illegal trawling. The method can be used as a cost effective alternative to the deployment of antitrawling artificial reefs in areas where urgent action has to be taken. Also, it is by far more economic, is reversible, allows the protection of extensive areas, does not aggregate fish and does not affect passive fishing gears, furthermore it is simple and does not require long term construction implications. The metal tubes will be implanted in such a way that their major part will be buried in the sediment and only the upper part of the tube will remain protruding above the seabed. The distance between the metal tubes is in the order of tens to hundreds metres, depending on the surface of the area that is preselected for protection. When a towed fishing gear comes in contact with the metal tube there are two possibilities: either the gear is stopped, or the ground rope of the trawl passes over the metal tube and consequently the trawling net is seriously damaged. Another application of the invention is the use of the implanted metal tubes as an alternative to conventional mooring systems in marine and freshwater environments (e.g. concrete blocks, sandbags, embedding anchors, etc.)

[0005] For the automatic implantation of the metal tubes, a working platform (e.g. vessel) equipped with a hydraulic winch and a crane is needed. The main body of the implantation system consists of a metal frame that supports a pair of grabs that could hold tightly a metal tube (e..g. standard 6 metre long galvanised iron or steel tubes) from its upper part aiming at deploying it from the surface to the bottom in a vertical position. The vessel's winch wire connected to the system's metal frame and the crane will be used for the metal tube deployment.

The grabs hold the metal tube through a watertight seal to the lower part of a flexible water tube which is connected to top of the metal tube. The other end of the flexible water tube is connected with a water pump located on the working deck. The holding mechanism of the grabs could be hydraulic, or simple mechanic (e.g. return springs) or a mixed type. When the lower part of the metal tube comes in contact with the seabed the water pump is activated and as a result pressurised water comes out from the lower end of the metal tube, washing out the sediment particles and thus gradually creating a narrow hole in the seabed This procedure allows the lowering of the metal tube to the desired depth controlled by special metal shoes attached to the main metal frame of the system that prevent further tube penetration when they come in contact with the seabed. The attachment of these shoes to the main metal frame of the system can be regulated according to the desired penetration depth. As a result the upper part of the implanted tube protrudes a predefined distance above the seabed Finally, the tube holding mechanism (hydraulic and/or mechanic) is decoupled and as a result the system minus the tube can be brought back to the vessel's deck in order to be reused for a new tube implantation.

[0006] In order for the reader to gain a complete understanding of the present invention, example of one preferred embodiment follow, with reference to the accompanying figures:

[0007] Figure 1A shows a bird's-eye view of the system's main body with the two grabs (3 and 4) that are stably connected, the first (3,) to the main metal frame of the system (1) and the second (4) to a metal plate that can reciprocate freely on cylindrical guides (5), connected stably to the internal sides of the main metal frame (1). A hydraulic piston (6) which is fed by an oil pump located on the support vessel, when activated, moves the metal plate (2) and consequently the grab (4) that is stably connected to it Both grabs hold tightly the upper part of the metal tube (7) and at the same time the lower part of a flexible water tube (8) which by having slightly larger diameter surrounds as external casing the upper part of the metal tube. The movement of the metal plate (2) towards the grab (3) creates the hold and seal on both tubes (7, 8) and also compresses the two return spiral springs (9). The arrow indicates the direction of the movement of the hydraulic piston (6).

[0008] In figure 1B the arrow shows the removal direction of the metal plate (2) towards the side of the frame that bears the hydraulic piston (6). This removal is caused by the expansion of the two springs (10) when the hydraulic piston (6) is deactivated. The dynamic energy of the two springs move backwards the metal plate (2) and consequently the grab (4), finally releasing both the metal and the flexible tubes (7, 8).

[0009] In figure 2 an enlarged elevated side view of one of the two shoes that are stably attached to the external sides of the main metal frame of the system is shown. It consists of the shoe pad (11), of which the lower surface comes in contact with the seabed, a vertical arm (12) stably connected with the shoe pad and a horizontal arm (13) that is semi-permanently connected with the vertical arm (12) and from the other side is stably connected to the external side of the metal frame of the system (14).

[0010] In Figures 3A, 3B and 3C a diagrammatic presentation of three successive operational phases of a tube implantation is given. In figure 3A a side view of the metal frame (1) and the two shoes of the system (11) and also the metal tube (7), the flexible water tube (8) and the oil supply tube (16) to the system's hydraulic piston are depicted The main metal frame is deployed by wire (15) from the winch of the supporting vessel. As soon as the lower part of the metal tube comes in contact with the seabed (17), a water pump located on the supporting vessel deck is activated and pressurised water is pumped through the flexible tube (8) and the metal tube (7), washing out the sediment gradually creating a narrow hole (18) that allows the lowering of the metal tube into the seabed

[0011] In figure 3B the major part of the metal tube is already burried into the seabed and its further deployment is prevented by the two shoes of the system. The supply of pressurised water is stopped and the narrow hole has started to be filled in with sediment.

[0012] In figure 3C the supply of oil by the hydraulic pump has stopped, resulting in the realease of the system from the tube. The metal tube (7) remains implanted in the seabed and the system including both the oil supply tube and the flexible water tube (not shown) are removed back onto the deck in order to be reused for a new implantation.

Claims

1. Integrated system for the automatic implantation of metal tubes from the surface of the sea to marine sedimentary seabed comprising a metal frame (1) supporting a hydraulic piston, pressing grabs (3, 4) that can tightly hold the upper part of a metal tube (7) to be lowered in a vertical position to the marine seabed, the hydraulic piston (6), when deactivated, allowing the opening of the pressing grabs (3, 4) caused by expansion springs (10) in order to release the metal tube (7), said pressing grabs (3, 4) further holding through a watertight seal the lower end of a flexible water tube (8) which is adapted to supply pressurised water to the metal tube (7) so as to wash out the sediment thereby creating a narrow hole that allows the lowering of the metal tube (7) up to the desired penetration depth, said metal frame (1) also supporting external arms (12, 13) with footpads (11) at their lower ends which footpads are adapted to prevent further penetration of the metal tube (7) above the desired depth once they come in contact with the marine seabed.

2. Integrated system in accordance with claim 1 wherein both grab dosing and opening mechanism is assisted hydraulic piston(6).

3. Integrated system in accordance with claim 1 wherein both grab holding and opening mechanism is assisted by expansion springs (9,10) .

Revendications

1. Système intégré pour la mise en oeuvre automatique de tubes métalliques de la surface de la mer au fond marin de sédimentation comprenant un cadre métallique (1) supportant un piston hydraulique, des pinces de pression (3, 4) qui peuvent maintenir fermement la partie supérieure d'un tube métallique (7) qui doit être baissé dans une position verticale vers le fond marin, le piston hydraulique (6), lorsque désactivé, permettant l'ouverture des pinces de pression (3, 4) causée par des ressorts d'expansion (10) afin de libérer le tube métallique (7), les dites pinces de pression (3, 4) maintenant en outre à travers un joint d'étanchéité à l'eau l'extrémité inférieure d'un tube à eau flexible (8) qui est adapté pour fournir de l'eau sous pression au tube métallique (7) afin de laver les sédiments, créant ainsi un trou étroit qui permet l'abaissement du tube métallique (7) jusqu'à une profondeur de pénétration désirée, ledit cadre métallique (1) supportant également des bras externes (12, 13) comprenant des pieds (11) à leurs extrémités inférieures, lesquels pieds sont adaptés pour empêcher une pénétration supplémentaire du tube métallique (7) au delà de la profondeur désirée, une fois qu'ils sont venus en contact avec le fond marin.

2. Système intégré selon la revendication 1, dans lequel le mécanisme d'ouverture et de fermeture des pinces est assisté par le piston hydraulique (6).

3. Système Intégré selon la revendication 1, dans lequel le mécanisme d'ouverture et de maintien des pinces est assisté par des ressorts d'expansion (9, 10).

Patentansprüche

1. Integriertes System für das automatische Einbringen von Metallrohren von der Wasseroberfläche aus in marines Sediment am Meeresboden, enthaltend einen Metallrahmen (1), der einen hydraulischen Kolben hält, Preßgrelfer (3, 4), die den oberen Teil eines In vertikaler Position zum Meeresboden abzusenkenden Metallrohres (7) fest halten kann, wobei der hydraulische Kolben (6) Im entaktivierten Zustand das Öffnen der preßgreifer (3, 4), hervorgerufen durch Ausdehnungsfedern (10), ermöglicht, um das Metallrohr (7) freizugeben, die Preßgreifer (3, 4) weiterhin durch eine wasserdichte Dichtung das untere Ende eines flexiblen Wasserschlauches (8) halten, der dazu eingerichtet Ist, dem Metallrohr (7) unter Druck stehendes Wasser zuzuführen, um das Sediment auszuwaschen, um dadurch ein enges Loch zu schaffen, das das Absenken des Metallrohres (7) bis zur gewünschten Eindrinptiefe ermöglicht. und der Metallrahmen (1) auch äußere Arme (12, 13) mit Fußplatten (11) an Ihren unteren Enden trägt, die dazu dienen, ein weiteres Eindringen des Metallrohrs (7) über die gewünschte Tlefe hinaus zu verhindern, sobald sie mit dem Meeresboden In Berührung gelangen.

2. Integriertes System nach Anspruch 1, bei dem der Mechanismus zum Öffnen und zum Schließen der Greifer durch einen hydraulischen Kolben (6) unterstützt ist.

3. Integriertes System nach Anspruch 1, bei dem der Mechanismus zum Halten und zum Offnen der Greifer durch Ausdehnungsfedem (9, 10) unterstützt ist.

FIGURE 1A

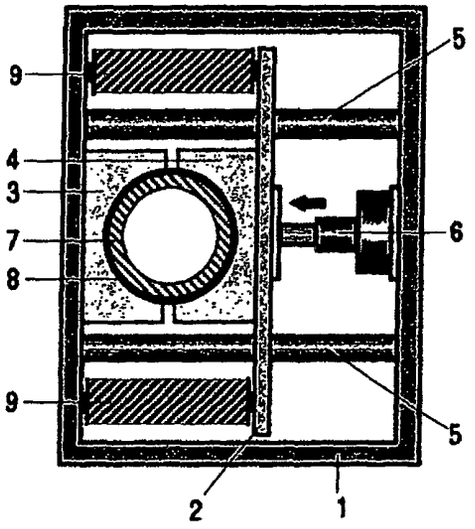
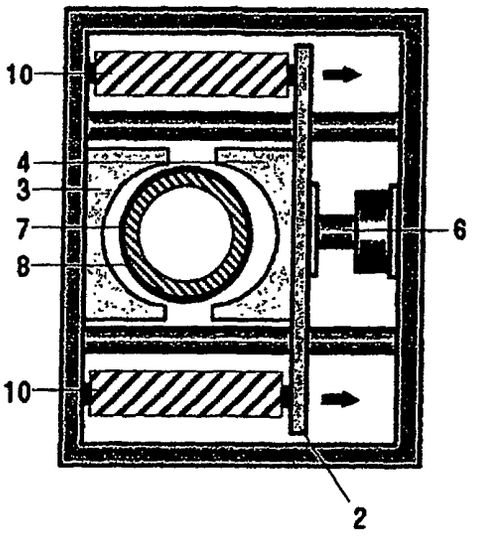


FIGURE 1B



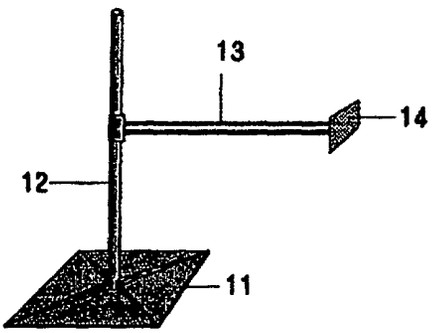


FIGURE 2

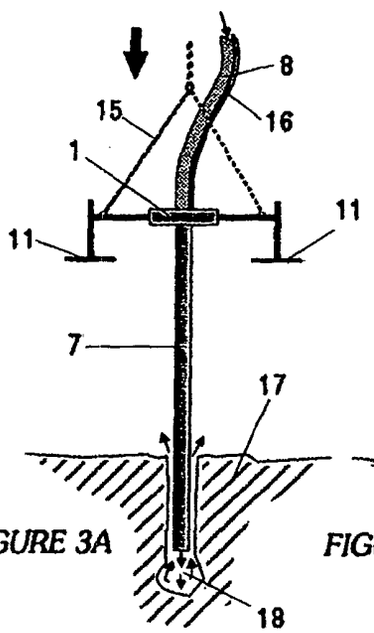


FIGURE 3A

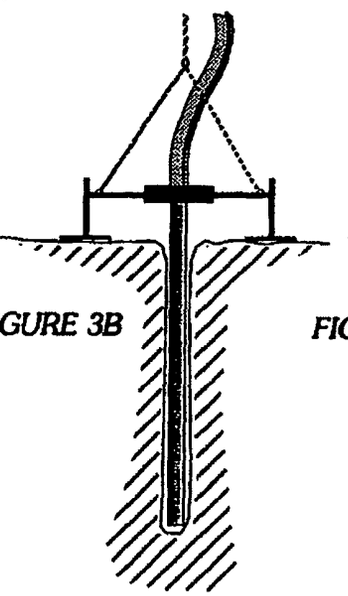


FIGURE 3B

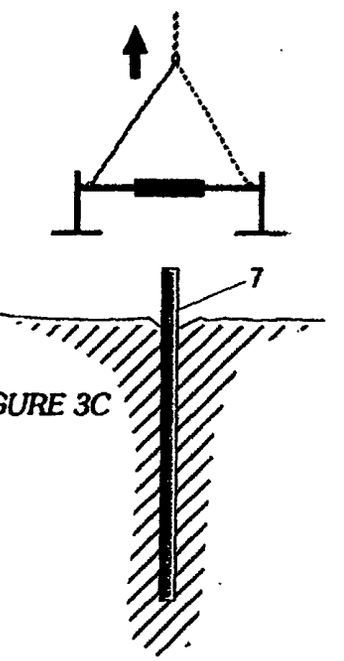


FIGURE 3C