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

(57) This system consists of a mechanism with grabs (3,4), that can hold tightly a metal tube (7) from its upper part aiming at deploying it from the sea surface to the bottom in a vertical position. The grabs (3,4) hold also through a watertight seal the lower part of a flexible water tube (8) connected to the metal tube. By activating a water pump, pressurised water comes out from the lower end of the metal tube (7), washing out the sediment particles, gradually creating a narrow hole that allows the lowering of the tube (7) to the desired depth. This depth is controlled by shoes which prevent further penetration of the metal tube when they come in contact with the seabed. When the metal tube (7) reaches the desired depth a special tube release mechanism is activated and the main body of the system with the holding grabs (3,4) and the shoes as well as the flexible tube (8) are brought back to the vessel's working deck in order to be reused for a new tube implantation. The 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 and also an alternative to conventional mooring systems (e.g. concrete blocks, sandbags, embedding anchors, etc.).

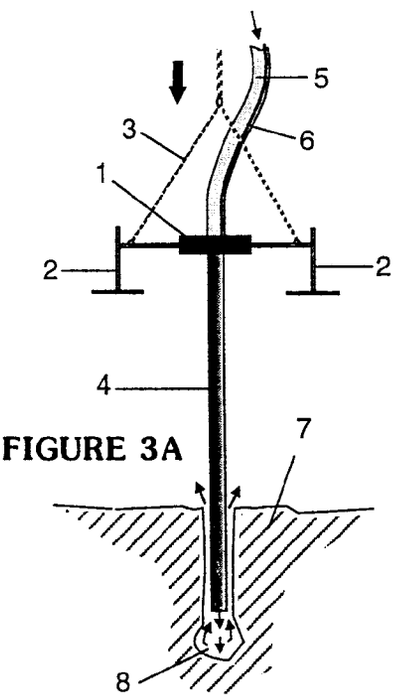

FIGURE 3A

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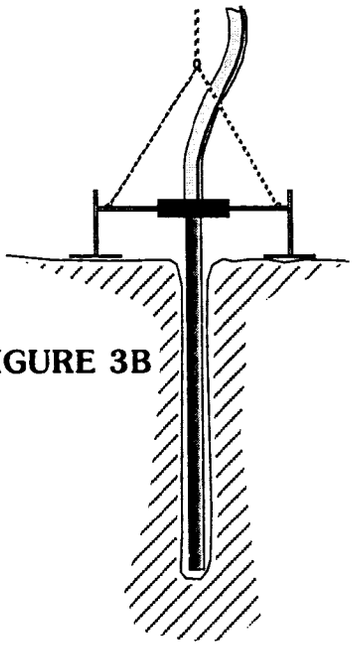


FIGURE 3B

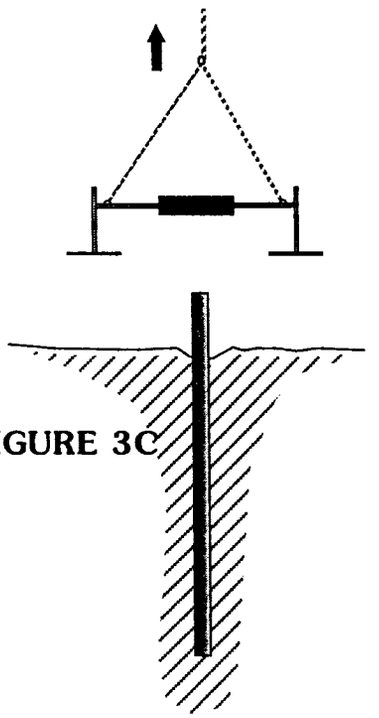


FIGURE 3C

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] 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.)

[0004] 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.

[0005] 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:

[0006] 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).

[0007] 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).

[0008] 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 (1), of which the lower surface comes in contact with the seabed, a vertical arm (2) stably connected with the shoe pad and a horizontal arm (3) that is semi-permanently connected with the vertical arm (2) and from the other side is stably connected to the external side of the metal frame of the system (4).

[0009] 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 (2) and also the metal tube (4), the flexible water tube (5) and the oil supply tube (6) to the system's hydraulic piston are depicted. The main metal frame is deployed by wire (3) from the winch of the supporting vessel. As soon as the lower part of the metal tube comes in contact with the seabed (7), a water pump located on the supporting vessel deck is activated and pressurised water is pumped through the flexible tube (5) and the metal tube (4), washing out the sediment gradually creating a narrow hole (8) that allows the lowering of the metal tube into the seabed.

[0010] 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.

[0011] 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 remains implanted in the seabed and the system including both the oil supply tube and the flexible water tube 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 that supports a hydraulic piston, pressing grabs that can hold tightly a metal tube from its upper part aiming at deploying it from the surface to the bottom in a vertical position, said grabs holding also through a watertight seal the lower end of a flexible water tube connected to a water pump supplying pressurised water through the flexible tube to the lower end of the metal tube that washes out the sediment and gradually creates a narrow hole that allows the lowering of the metal tube up to the desired penetration depth, said metal frame also supporting external arms having at their lower ends footpads which prevent further penetration of the metal tube when they come in contact with the seabed, said hydraulic grab mechanism when is deactivated allowing the opening of the grabs caused by expansion springs and finally allowing the release of the implanted metal tube into the seabed and the bringing back to the sea surface of all the system's components in order to be reused for a new tube implantation.

2. Integrated system in accordance with claim 1 wherein both grab closing and opening mechanism is supported by hydraulic pistons.

3. Integrated system in accordance with claim 1 wherein both grab holding and opening mechanism is supported by expansion springs.

FIGURE 1A

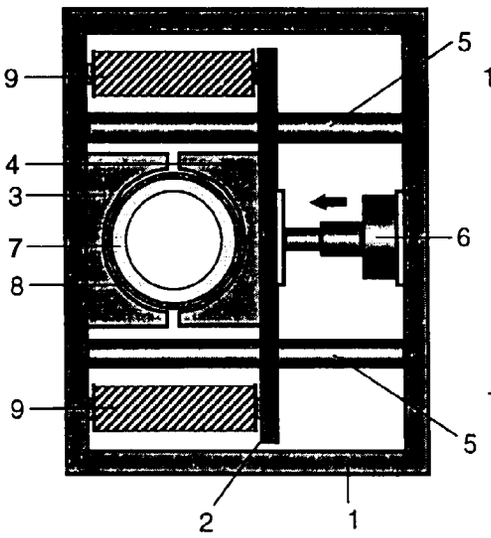
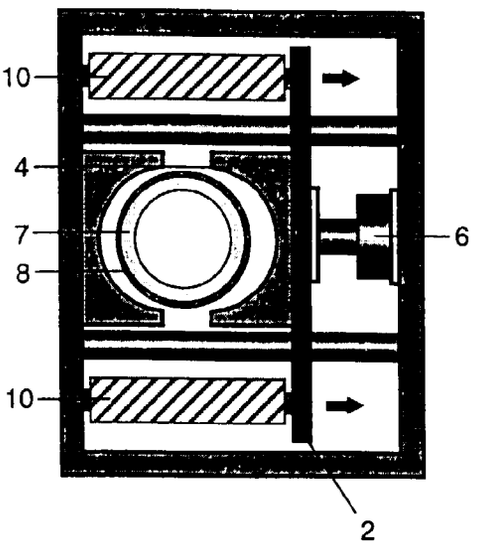


FIGURE 1B



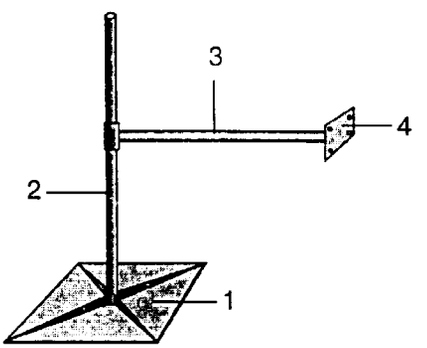


FIGURE 2

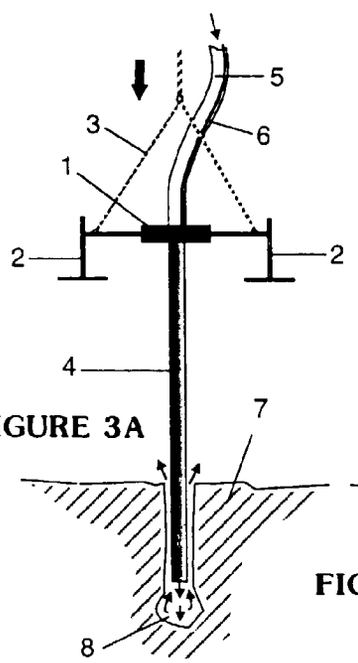


FIGURE 3A

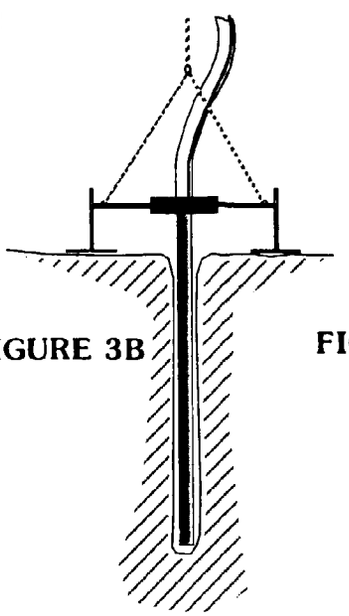


FIGURE 3B

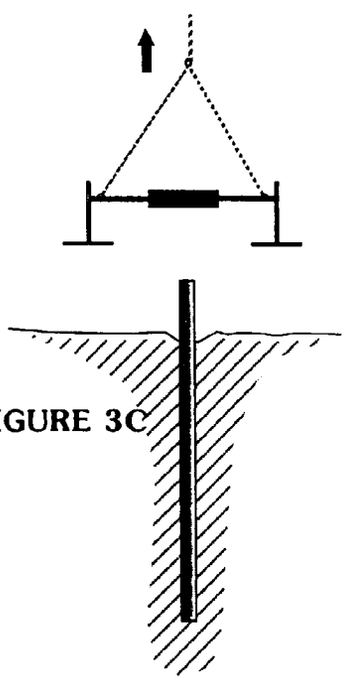


FIGURE 3C

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EUROPEAN SEARCH REPORT

Application Number
EP 98 60 0013

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	GB 2 003 532 A (STANDARD OIL CO) 14 March 1979 * page 2, line 27 - page 3, line 44; figures 1-10 *	1-3	E02D13/04 E02D7/28
A	US 3 750 609 A (CHELMINSKI S) 7 August 1973 * column 2, line 50 - column 7, line 59; figures 1-12 *	1-3	
A	US 4 102 147 A (JANSZ JOOST W) 25 July 1978 * column 2, line 11 - column 4, line 11; figures 1-4 *	1-3	
A	US 3 851 490 A (MATSUSHITA K) 3 December 1974 * column 2, line 14 - column 3, line 13; figures 1-4 *	1	
A	US 4 257 721 A (HAYNES HARVEY H) 24 March 1981 * column 2, line 46 - column 4, line 68; figures 1-8 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 November 1998	Blommaert, S

CATEGORY OF CITED DOCUMENTS

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