

Title of the invention

Fluid transfer and connection device and method

Field of the invention

5 The present invention relates to the field of fluid transfer between an opening in a metal wall of a reservoir or hydraulic network, particularly aboard a vessel, and another opening of another reservoir or another network, particularly a fluid treatment unit aboard another vessel or floating support.

10 More particularly, the present invention relates to the transfer and the treatment of ballast water. A ballast tank is a high capacity water reservoir equipping some vessels. It is designed to be filled or drained with seawater in order to optimize navigation. The draining operation, or deballasting, carried out under poor conditions can cause ecological problems.

15 Due to international maritime traffic, considerable volumes of seawater transit by this means from one continent to another. 10 billion cubic meters each year is estimated, of which 22 million are discharged along only the metropolitan French coast. These ballast waters are charged with viruses, microorganisms, phyto and
20 zoo-plancton, small molluscs and crustaceans of which some survive the voyage and manage to conquer their destination territory, thus disrupting the local ecosystem. Hundreds of invasions of exotic species have been identified, sometimes with disastrous consequences. On the global scale, 60 % of the cases of the introduction of invasive species are connected with maritime traffic, and mainly to
25 ballast water and sediments. According to the World Maritime Organization (WMO), ballast water is responsible each day for the transfer of 7,000 to 10,000 species worldwide.

30 Since the entry into force of the international convention on ballast water, all vessels crossing the planet must be equipped to treat their ballast water before discharging it. The vessels are required to manage their ballast water to eliminate or make harmless noxious aquatic organisms and pathogenic agents present in the ballast water and sediment, or to prevent them from being admitted in this water or discharged with it.

35 Container vessels, tankers, cargoships, bulk carriers, cruise ships, large fishing vessels... more than 50,000 vessels are affected by this Convention and will

have to equip themselves with means allowing the treatment of their ballast water. Several methods have been approved by the WMO and have been available commercially for a few years. The techniques used run from treating water by ultraviolet radiation, electrolysis or filtration to the introduction of chemical products or biocides. Given the volume of water to be treated by the vessels – tens of thousands of m³ per ship – the installation of such devices is expensive and complex, especially for older vessels of which the architecture is not suitable. The new regulations impose satisfying a discharge rate of ballast water either by renewing its volume, or by a treatment system, or by discharge into a port installation. The fluid networks of a vessel have, for the most part, mechanical attachment systems (flanges, attachment by cams, hydraulic jaws...) for connection with an external reservoir. But vessels are not provided with a mechanical attachment integrated at the opening in the hull to recover this untreated ballast water. In fact, the discharge to the sea of ballast water is carried out through an opening simply cut in the hull as a means of terminating this network.

The present invention concerns more generally a fluid transfer device equipped with a connection device for a fluid transfer pipe at an opening of a flat wall of a ship or of a reservoir so as to allow the fluid transfer from one said opening not equipped with a mechanical attachment system for a fluid transfer pipe. This device is designed more particularly to be carried on a floating support or a ballast water treatment barge in mobile assistance to vessels making port calls without requiring said vessels to incorporate a standardized connection.

Background of the invention

Known in WO200893812 is a device for delivering treated ballast water to a vessel via a sea-chest opening, situated below the waterline. This device does not specify the means of connection of the transfer pipe to said opening, particularly if said opening is situated at the surface.

In WO200893811, a device is described for assisting vessels by treating their ballast water. But there too it is considered that the vessel assisted has available a dedicated standardized mechanical connection at the opening concerned.

In WO2017152617, a device on a tender storing volumes of treated water is also described. But once again, no information connected with the system for connecting the transfer pipe to the hull opening concerned is provided.

Known in CN102660980 and WO201620670 are devices dealing with flexible pipes equipped at one end with an electromagnetic connection device, but these systems use permanent magnets (fixed system) and require embedding of the parts
 5 for positioning with a magnetic force by way of retention.

Object and summary of the invention

The present invention therefore has as its main goal to propose a simple and
 10 reliable universal method and device for carrying out the connection of a flexible fluid transfer pipe from one opening in a flat metal reservoir wall suitable for all openings without necessitating a mechanical connection system or other incorporation to said opening, particularly on a vessel, without necessitating that the vessel have to apply
 15 modifications at said opening.

One aim of the present invention is to thus supply port-based assistance for the treatment of ballast water that doesn't necessitate applying modifications to piping connection systems and/or installing an on-board treatment system on the assisted vessels.

20 In conformity with the invention, this goal is attained thanks to a fluid transfer device and connection comprising:

a) a flexible fluid transfer pipe, and

25 b) at least one electromagnetic connection component, preferably of toroidal shape, defining an axial opening called "connection opening", attached respectively to at least one of the longitudinal ends of said transfer pipe, said connection component being capable of being applied in a sealed manner against a flat metal wall around an opening of said metal wall called "transfer opening" to allow the
 30 transfer of a fluid through said connection opening, said transfer opening and said transfer pipe, said connection component enclosing an electromagnetic excitation coil forming an electromagnet capable of pressing a flat front face, preferably annular, of said connection component against said metal wall when said coil is supplied with electrical current by a power supply cable, said connection component
 35 comprising at least one first lifting support comprising two first and second coupling elements capable of cooperating with lifting and handling means to allow lifting and moving the connection component, at least one second lifting support being capable

of cooperating with said transfer pipe and said lifting and handling means to allow lifting and moving the transfer pipe by the same said lifting and handling means, said second lifting support having the form of a collar or tubular sleeve capable of being positioned fixedly and removably around and along said transfer pipe at a predetermined distance from said connection component, at least 3 crow's foot lifting slings suspended from a same lifting hook, said lifting slings being respectively attached to three coupling elements, whose two said first and second coupling elements integral with said connection component disposed symmetrically on the upper face of said connection component and a third coupling element integral with said collar or tubular sleeve disposed on the upper face of said collar or tubular sleeve.

The transfer device and connection according to the invention also allows an external network to be glued at will and reversibly by this electromagnet system to a flat wall independently of a mechanical connection operation carried out by humans.

This system of 3 crow's foot slings suspended at a single connection point with lifting means contributes to facilitating the relative positioning of the connection component and of the transfer pipe in order that the terminal portion of the pipe is disposed coaxially with the connection component and/or for carrying out the homogeneous distribution of forces on the connection component, avoiding curvature of the pipe in proximity to the connection component, and especially allowing an adjustment of the inclination of said flat front face of the connection component with respect to the plane of said metal wall during its application against said wall.

More particularly, this suspension system of the lifting collar or sleeve and of the connection component by 3 slings allows controlling the relative positioning of the pipe and of the connection component with the aim of:

- taking up the weight of the pipe on the flange which links it to the connection component, subjected to shear, failing which the vibrations and the general movements caused by the flow of liquid transferred could cause a loss of sealing capacity; and

- avoiding curvature of the flexible pipe too close the attachment flange, the structure of the pipe being more fragile at its ends, and

- adapting an appropriate tension on the 3 slings to adjust the orientation of the front face of the electromagnetic connection component so as to position the latter parallel to the hull of the vessel, which will not necessarily be perpendicular to the water surface.

It is understood that:

- the axis XX' to which reference is made here can correspond to a common axis of said transfer pipe, of said connection opening and of said transfer opening when said transfer pipe is disposed rectilinearly and perpendicular to the plane of said front face of the connection component, said connection opening being applied against and opposite to said transfer opening, and

- said preferably annular flat front face of the connection component has said axial connection opening passing through it.

The front face of the connection component preferably has a circumference of circular shape coaxial with the circular connection opening.

An electromagnet consists of a coil which produces a magnetic field when it is supplied with electrical current: the electrical energy being converted into magnetic energy. A polar component made of soft ferromagnetic material called a magnetic core channels the lines of the magnetic fields and allows an increase in the magnetic induction generated by the coil.

The second lifting support allows, as explained hereafter:

- avoiding excessive curvature of the transfer pipe and
- homogenizing the distribution of forces transmitted between the end of the transfer pipe and the connection component and

- facilitating the positioning of the connection component during the approach and application of the connection component against the wall of said transfer opening.

According to other advantageous features:

- said collar or tubular sleeve is capable of being positioned fixedly and removably around and along said transfer pipe at a predetermined distance (d), adaptable at will from said connection component;

5 - said collar or tubular sleeve is capable of sliding by means of ball bearings, rollers and/or sliders.

10 - said collar or tubular sleeve is capable of being positioned at a predetermined distance (d) from said connection component, allowing the transfer pipe to be retained in a coaxial position with said connection opening, at least in the portion of the pipe between said second lifting support and the connection component, by means of a crane with an articulated arm;

15 - said second lifting support comprises an articulated collar system comprising two half-shells on either side of the flexible pipe attached together allowing the second lifting support to be integrated with the pipe in a variable and removable manner.

20 It is understood that when said collar or sleeve is capable of sliding, said collar or sleeve is capable of being positioned at a predetermined but variable distance with respect to said connection component.

25 More preferably, said second lifting support has the form of a collar or tubular sleeve capable of being positioned fixedly and removably around and along said transfer pipe at a predetermined distance from said connection component, by a system of articulated collars. The positioning of said lifting support along the transfer pipe is adapted depending on the length of the pipe and the respective weight thereof and of the connection component so that its technical functions mentioned above are optimized. Alternatively, it is possible to implement a system with a lifting sleeve or collar sliding by means of ball bearings, rollers and/or sliders.

30 More particularly, a said lifting collar is able to be articulated to be disassembled.

35 More particularly, the fluid transfer and connection device according to the invention comprises at least 3 lifting slings connected to the same lifting hook, said lifting slings being attached respectively to three coupling elements, including two coupling elements integral with said connection component disposed symmetrically on the upper face of said connection component and a third coupling element

integral with said collar or tubular sleeve disposed on the upper face of said collar or tubular sleeve. This system with 3 crow's feet slings suspended at a single point of connection with the lifting means contributed to facilitating the relative positioning of the connection component and of the transfer pipe so that the terminal portion of the pipe is disposed coaxially with the connection component and/or to carry out the homogeneous distribution of the forces on the connection component, avoid curvature of the pipe near the connection component and especially allow and adjustment of the inclination of said flat front face of the connection component with respect to the plane of said metal wall during its application against said wall.

More particularly, said connection component comprises a massive toroidal component made of non-magnetic material with a rectangular axial section enclosing a toroidal cavity within which said coil is wound in coaxial turns over several layers longitudinally and radially stacked, said coil being embedded in a dielectric epoxy resin with high thermal conductivity capable of avoiding overheating the windings.

More particularly still, said connection component is indirectly attached to the end of said transfer pipe by means of a first mechanical attachment flange, said first mechanical attachment flange being directly and reversibly attached to said end of said transfer pipe. Thus it is possible to change the flexible transfer pipe which has a shorter lifetime than the connection component and than the first lifting support which can thus be retained and adapted to another transfer pipe, a longer one if necessary.

More particularly still, said connection component comprises on a rear face a notch with an axial flat annular bottom in said massive component made of ferromagnetic material comprising threaded bores attached by screws to said first mechanical connection flange.

More particularly still, said electromagnetic connection component comprises on its front face at least one flexible and compressible O-ring coaxially disposed around said connection opening of the connection component. This flexibility and compressibility of the seal making it possible to not increase the distance separating said metal wall with respect to said coil so as not to limit the electromagnetic force.

More particularly still, said transfer pipe comprises at its other end a second mechanical connection flange. It is understood that this second mechanical connection flange can cooperate with an opening of a second reservoir or network, particularly of a fluid treatment unit.

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More particularly still, the fluid transfer and connection device according to the invention comprises lifting means comprising a crane in the form of an articulated arm.

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More particularly still, the articulated arm allows the movement of a lifting hook which is suspended from it by a lifting cable and to which lifting hook are suspended several lifting slings connected to said transfer pipe and to said connection component respectively.

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Said crane can be carried aboard the vessel comprising said metal wall comprising said transfer opening or on a floating support or assistance barge, said transfer pipe providing the connection between said floating support and an assisted vessel comprising said transfer opening.

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The present invention also provides an assistance barge for the fluid transfer from a said transfer opening of a said metal wall of the plating of an assisted vessel comprising a fluid transfer and connection device according to the invention, and lifting means comprising a crane in the form of an articulated arm mounted on the deck of said assistance barge, said articulated arm supporting said fluid transfer and

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connection device.

More particularly, said transfer pipe comprises at its other end a second mechanical connection flange attached to a fluid treatment unit, preferably a ballast water treatment unit disposed aboard said assistance barge.

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The present invention also relates to a transfer method by means of a transfer and connection device comprising an electromagnetic connection component connected to a flexible transfer pipe, so as to transfer a volume of liquid between a transfer opening, particularly an opening of a fixed network of a vessel characterized

by one said transfer opening through the hull by way of termination of this network, as well as an external network upstream or downstream of the transfer opening.

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More precisely, the present invention provides a method of fluid transfer by means of a fluid transfer and connection device according to the invention or an assistance barge according to the invention, wherein the following steps are carried out:

5 a) said electromagnetic connection component and said transfer pipe are moved by means of lifting and handling means so as to apply the front face of said electromagnetic connection component against a flat metal wall around said connection opening of said metal wall, and

10 b) electrical power is supplied to said electromagnetic coil to press said connection component in a sealed manner against a flat metal wall around said transfer opening of said metal wall, and

 c) the transfer of a fluid is carried out through said transfer opening, said connection opening and said transfer pipe, then

15 d) once the fluid transfer is completed, the supply of electrical current to said coil is interrupted and said electromagnetic connection component and said transfer pipe are disengaged, by means of lifting and handling means, with respect to said flat metal wall.

20 More particularly the transfer of ballast water is carried out from a transfer opening of a metal wall of the plating of the assisted vessel to an assistance barge comprising said lifting means comprising a crane in the form of an articulated arm mounted on the deck of said assistance barge, said articulated arm supporting said fluid transfer and connection device and before, after or preferably during the transfer of the ballast water, the treatment of the ballast water is carried out by
25 means of a ballast water treatment unit aboard said assistance barge, said transfer pipe comprising at its other end a second mechanical connection flange attached to an inlet opening of said ballast water treatment unit aboard said assistance barge.

30 The treatment of the ballast water can be directly performed, either in the assistance barge to assisted vessel direction if the barge delivers treated ballast water to the vessel, or in the assisted vessel to barge direction if it is receiving ballast water to be treated. In practice, there is no storage of ballast water to be treated.

35 Brief description of the drawings

Other features and advantages of the present invention will be revealed from the description given below, with reference to the appended drawings which illustrate an exemplary embodiment free of any limiting character. In these figures:

5 - figures 1A and 1B show views of the transfer and connection device 3 according to the present invention in perspective (figure 1A) and from the side (figure 1B); and

 - figures 2A and 2B show views of the electromagnetic connection device 2 according to the present invention in axial section in perspective (figure 2A) and axisl section in side view (figure 2B); and

10 - figures 3A to 3C show views of a connection between an assistance barge 20 and an assisted vessel 23 using a transfer and connection devic 3 according to the present invention.

Detailed description of the invention

15 The transfer and connection device 3 according to the invention includes a flexible transfer pipe 1 of which one longitudinal end comprises an attachment flange 11 attached mechanically by screws 12 to an electromagnetic connection component 2 in the form of a ring. The electromagnetic connection component 2 comprises a through connection opening 2c with a circular cross section passing
20 axially through the component along an axis XX', the opening 2c having the same diameter as the diameter of a mechanical attachment flange 11 and as the transfer pipe 1 as describe hereafter.

 The transfer and connection device 3 according to the invention comprises a
25 lifting support 10 in the form of a rigid collar or tubular sleeve through which said transfer pipe 1 passes. This lifting support 10 is disposed fixedly but adaptable at will along the pipe at a distance d from the attachment flange 11 which ensures the attachment to the electromagnetic connection component 2 to the transfer pipe 1. This distance d, preferably substantially not more than 1m from the flange 11, allows
30 the transfer pipe to be held in the coaxial position with said connection opening 2c at least in the portion of the pipe 1 between the lifting support 10 and the connection component 2 by means of a crane with an articulated arm 16. This lifting support 10 allows excessive curvature of the transfer pipe to be avoided and homogenizes the distribution of forces on the attachment flange 11 and the connection component 2
35 as explained hereafter. A collar system (not shown) comprising two half-shells on either side of the flexible pipe attached to one another by a set of bolts and nuts

allowing the lifting support to be integrated to the pipe in a variable and removable manner.

The connection component 2 comprises an electromagnet of the type marketed by the Lenoir Magnetic System company (France) called a “circular electromagnet with an assembled frame” consisting of a welded frame 6 made of steel that is non-magnetic steel or has a high magnetic permeability, which frame 6 comprises a toroidal cavity with a rectangular cross section 6a enclosing an electromagnetic excitation coil 5. The frame 6 thus allows protecting the coil 5 of the electromagnet in the event of a possible violent shock during the positioning of the device. The frame 6 defines a front face 2a with a flat annular shape closing the cavity 6a of the connection component.

The frame 6 comprises on its rear face 2 a cut-out forming an indented flat annular portion 2d comprising threaded bores 13. This indented portion 2d is capable of receiving the attachment flange 11 at the end of the transfer pipe 1. This attachment flange 11 comprises bores capable of receiving screws 12 cooperating with the threaded bores 13 thus allowing the attachment flange 11 and therefore the transfer pipe 1 to be attached to the connection component 2.

The lifting support 10 and the connection component 2 are suspended from the same hook 15a by 3 slings 4a, 4b and 4c. The lifting support is suspended by one sling 4c from a lifting shackle 10a on the upper face of said collar or sleeve. The connection component 2 is suspended from 2 slings 4a and 4b at two connection points in the form of lifting shackles disposed symmetrically on the upper face of the ring or frame 6.

This system of suspension of the lifting collar or sleeve 10 and of the connection component 2 by 3 slings allows controlling the relative positioning of the pipe 1 and of the connection component 2 for the purpose of:

- carrying out a good homogeneous distribution of the pipe on the attachment flange 11 and the set of screws 12 with link them to the connection component 2. That failing, the upper screws and nuts could be subjected to shear. Moreover, vibrations or movements generally caused by the flow of transferred liquid, could increase the clearance of the boltwork if the latter were poorly tightened, and thus cause a loss of sealing capacity; and

- avoiding a curvature of the flexible pipe too close to the flange 11, the structure of the pipe being more fragile at its ends, and

- adapting an appropriate tension on the 3 slings to adjust the orientation of the front face 2a of the electromagnetic connection component in order to present the latter parallel to the wall of the hull of the vessel, which will not necessarily be perpendicular to the surface of the water.

The coil 5 is made of guimped wire disposed in adjacent coaxial turns in the axial direction XX' and in radially superimposed layers. The coil 5 is embedded in a dielectric epoxy resin with high thermal conductivity, thus avoiding overheating the windings. The structure of the frame 6 is made of non-magnetic manganese steel (12 to 14%) serving as a simple protective enclosure with qualities that do not affect the magnetic forces.

A remote control allows supplying the coil 5 with electrical current via a cable 17 connected to a connection cabinet of terminal box 7 filled with insulating resin and which allows the connection of the cable 14 to the coil 5 by means of terminals. The coil is thus capable of creating an electromagnetic field so as to press the front face 2a of the frame 6 of the connection component 2 against the ferrous wall of the hull of the vessel when it is supplied with electrical current. The electromagnetic field allows pressing the front face 2a of the frame 6 of the connection component 2 against the transfer opening with a retention force of a few kN depending on the diameter of the pipe, from 6" to 12", 13 kN for example for a transfer pipe with a diameter of 8". This force takes up the weight of the entire device 3 with the flexible pipe 1 filled with seawater as well as the repulsive force of a portion of the flow of fluid which is reflected against the metal wall 21 of the hull of the vessel 23 if the transfer 22 of the latter has a diameter less than that of the transfer pipe.

Due to protrusions at the surface of the hull against which the connection component 2 must be pressed, a gasket 8 is placed on the front face 2a of the connection component 2, coaxially with the connection opening and the transfer opening, in order to ensure effective sealing during fluid transfer. The gasket 8 is inlaid in a circular groove of the front face 2a of the connection component 2 and has sufficient flexibility and compressibility to not limit the electromagnetic force. In fact, the electromagnetic force being inversely proportional to the distance separating the ferrous wall 22 of the hull with respect to the electromagnet 5, if a

gasket 8 that is too thick and/or not compressible was used, this would thereby limit the electromagnetic force in relation to the thickness of the joint.

In figures 3A to 3C, the transfer of ballast water is shown between an assistance barge 20 equipped with a lifting crane 16 on its deck, said crane 16 supporting the transfer and connection device 3 according to the invention via a lifting cable 15 from which it is suspended for the purpose of transferring ballast water between the barge 20 and an assisted vessel 23 at a transfer opening 21 on an iron wall 22 of its hull above the waterline.

The implementation of a crane with an articulated arm allows lifting the transfer and connection device 3 including the pipe assembly 1 and the electromagnetic connection component 2 for the screw to screw positioning of the transfer opening 21 in the hull of the assisted vessel, which transfer opening can be located several meters, perhaps tens of meters above the barge.

Alternatively, it is possible to consider implementing a crane on the assisted vessel 23 or a lifting method via windlass of the assisted vessel, or on the barge, with a return system on the main deck of the assisted vessel.

The total length of the transfer pipe from its connection on the side of the barge to the connection on the side of the assisted vessel can generally reach between 5 and 40 m. It is advantageous to create the transfer pipe by the assembly of segments of 5 to 10 m length, which allows better handling when it is necessary to erect the pipe and allows changing, if necessary, only a small segment rather than the entire pipe in the event of localized wear. The advantage of a non-segmented length of 40 m is to avoid the handling of different segments, but this requires a storage drum for storing the flexible pipe 1, once the operation is completed, this type of equipment being relatively expensive. If the difference in freeboard is not too great, a pipe of length adaptable by segments will generate less head loss.

The diameter of the transfer pipe 1 can vary, for example between 6", 8" and 10" (or approximately 150 mm, 200 mm and 250 mm) depending on the flow rate of fluid to be transferred and the diameter of the opening of the vessel. The diameter of the flange 11 will thus consequently follow the standards in force, or respectively 279 mm, 300 mm and 362 mm.

Regarding the electromagnetic connection component 2, for a model of a transfer pipe with a diameter of 8" (200 mm), the outside diameter of the connection component 2 will be approximately 950 mm. for transfer pipes with diameters of 6 and 10", the outer diameters of the connection component 2 will be approximately 750 and respectively 1200 mm.

The ballast water treatment means 19 aboard the assistance barge can be of several types. The method selected will advantageously be a combination of filtration and UV treatment. This type of treatment has the advantage of:

- being able to be carried out directly without requiring retention time,
- being effective for different water qualities, and
- limiting the utilization of consumable reactants, unlike a chemical treatment by injection of chlorine for example.

The ballast water pumped or received therefore passes through a filter for a first elimination of undesirable particles. This filter carries out an automatic counterflow cleaning in order to ensure a certain effectiveness during the operation. The fluid then passes through a grid of UV lamps in order to sterilize bacteria. A system of regular cleaning of the UV lamps is advantageous in order to optimize their efficiency.

In figure 3A, the barge 20 is shown approaching along the wall 21 of the hull of an assisted vessel 23 with the crane 16 un-masted. In figure 3B, the barge is coupled, beginning the masting of the crane 16 with one mast 18 deployed and the beginning of the lift of the transfer and connection device 3. In figure 3C, the crane is masted and the connection component pressed against the hull of the assisted vessel for carrying out the fluid transfer. Once the fluid transfer is finished, the operator can again supply power to the slings 4 thanks to the lifting means 16 before cutting the power supply to the exciting coil 5.

CLAIMS

1. A fluid transfer and connection device (3) comprising a flexible fluid transfer pipe (1), and at least one electromagnetic connection component (2), preferably of toroidal shape, defining an axial opening called "connection opening" (2c), attached respectively to at least one of the longitudinal ends of said transfer pipe, said connection component being capable of being applied in a sealed manner (8) against a flat metal wall (21) around an opening (22) of said metal wall called "transfer opening" to allow the transfer of a fluid through said connection opening (2c), said transfer opening (22) and said transfer pipe (1), said connection component (2) enclosing an electromagnetic excitation coil (5) forming an electromagnet capable of pressing a flat front face (2a), preferably annular, of said connection component against said metal wall when said coil is supplied with electrical current by a power supply cable (17), said connection component (2) comprising at least one first lifting support comprising two first and second coupling elements (9a, 9b) capable of cooperating with lifting and handling means (15, 16) to allow lifting and moving the connection component, and at least one second lifting support (10) being capable of cooperating with said transfer pipe and said lifting and handling means (15, 16) to allow lifting and moving the transfer pipe by the same said lifting and handling means (15, 16), said second lifting support (10) having the form of a collar or tubular sleeve capable of being positioned around and along said transfer pipe at a predetermined distance (d) from said connection component, at least 3 crow's foot lifting slings (4, 4a, 4b) suspended from a same lifting hook (15a) being respectively attached to three coupling elements, whose two said first and second coupling elements (9a, 9b) integral with said connection component disposed symmetrically on the upper face of said connection component and a third coupling element (10a) integral with said collar or tubular sleeve disposed on the upper face of said collar or tubular sleeve.
2. The fluid transfer and connection device according to claim 1, characterized in that said collar or tubular sleeve is capable of being positioned fixedly and removably around and along said transfer pipe at a predetermined distance (d), adaptable at will from said connection component.
3. The fluid transfer and connection device according to any one of claims 1 or 2, characterized in that said collar or tubular sleeve is capable of sliding by means of ball bearings, rollers and/or sliders.

4. The fluid transfer and connection device according to any one of claims 1 to 3, characterized in that said collar or tubular sleeve is capable of being positioned at a predetermined distance (d) from said connection component, allowing the transfer pipe to be retained in a coaxial position with said connection opening (2c) at least in the portion of the pipe between said second lifting support (10) and the connection component (2) by means of a crane with an articulated arm (16).

5. The fluid transfer and connection device according to any one of claims 1 to 4, characterized in that said second lifting support (10) comprises an articulated collar system comprising two half-shells on either side of the flexible pipe attached together allowing the second lifting support to be integrated with the pipe in a variable and removable manner.

6. The fluid transfer and connection device according to any one of claims 1 to 5, characterized in that said connection component comprises a massive toroidal component made of non-magnetic material (6) with a rectangular axial section (6a) enclosing a toroidal cavity within which said coil (5) is wound in coaxial turns over several layers longitudinally and radially stacked, said coil (5) being embedded in a dielectric epoxy resin with high thermal conductivity capable of avoiding overheating the windings.

7. The fluid transfer and connection device according to any one of claims 1 to 6, characterized in that said connection component (2) is indirectly attached to the end of said transfer pipe by means of a first mechanical attachment flange (11), said first mechanical attachment flange (11) being directly and reversibly attached to said end of said transfer pipe, and said connection component (2) comprises on a rear face (2b) a notch with an axial flat annular bottom (2d) in said massive component made of ferromagnetic material (6) comprising threaded bores (13) attached by screws (12) to said first mechanical connection flange (11).

8. The fluid transfer and connection device according to any one of claims 1 to 7, characterized in that said electromagnetic connection component (2) comprises on its front face (2a) at least one flexible and compressible O-ring (8) coaxially disposed around said connection opening (2c) of the connection component.

9. The fluid transfer and connection device according to any one of claims 1 to 8, characterized in that said transfer pipe comprises at its other end a second mechanical connection flange (14).

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10. The fluid transfer and connection device according to any one of claims 1 to 9, characterized in that it comprises lifting means comprising a crane in the form of an articulated arm (16).

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11. The fluid transfer and connection device according to claim 10, characterized in that the articulated arm (16) allows the movement of a lifting hook (15a) which is suspended from it (15) and to which lifting hook are suspended several lifting slings (4) connected to said transfer pipe (1) and to said connection component (2) respectively.

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12. An assistance barge (20) for the fluid transfer from a said transfer opening (22) of a said metal wall (21) of the plating of an assisted vessel (23) comprising a fluid transfer and connection device (3) according to any one of claims 1 to 11, and lifting means comprising a crane in the form of an articulated arm (16) mounted on the deck of said assistance barge, said articulated arm supporting said fluid transfer and connection device (3).

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13. The assistance barge (20) according to claim 12, characterized in that said transfer pipe comprises at its other end a second mechanical connection flange (14) attached to a fluid treatment unit, preferably a ballast water treatment unit (19) disposed aboard said assistance barge.

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14. A method of fluid transfer by means of the fluid transfer and connection device (3) according to any one of claims 1 to 11 or an assistance barge according to one of claims 12 or 13, wherein the following steps are carried out:

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a) moving by means of lifting and handling means (15, 16) said electromagnetic connection component (2) and said transfer pipe so as to apply said front face (2a) of said electromagnetic connection component (2) against a flat metal wall (21) around said connection opening (22) of said metal wall, and

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b) supplying said electromagnetic coil with electrical current to press said connection component in a sealed manner (8) against a flat metal wall (21) around said transfer opening (22) of said metal wall, and

c) carrying out the transfer of a fluid through said transfer opening (22), said connection opening (2c) and said transfer pipe (1), then

5 d) once the fluid transfer is completed, interrupting the supply of electrical current of said coil (5) and disengaging said electromagnetic connection component (2) and said transfer pipe, by means of said lifting and handling means (15, 16), with respect to said flat metal wall (22).

10 15. The fluid transfer method according to claim 14, characterized in that the transfer of ballast water is carried out from a transfer opening (22) of a metal wall (21) of the plating of an assisted vessel (23) to an assistance barge (20) comprising said lifting means comprising a crane in the form of an articulated arm (16) mounted on the deck of said assistance barge, said articulated arm supporting said fluid transfer and connection device (3), and before, after or preferably during the transfer of the ballast water, carrying out the treatment of the ballast water by means of a
15 ballast water treatment unit (19) aboard said assistance barge, said transfer pipe comprising at its other end a second mechanical connection flange (14) attached to an inlet opening of said ballast water treatment unit (19) aboard said assistance barge.