

**DEVICE AND METHOD FOR SUPPLYING A MOVING BODY, IN
PARTICULAR A SHIP, WITH ON-SHORE POWER**

The present invention relates to the field of high power electricity
5 supply. It more particularly concerns a device and a method for supplying a
moving body when it is stationary, in particular a ship, after it has berthed.

A ship, for example a container ship or a cruise ship, when it is at berth
needs considerable electric power. This power is generally of the order of
several megawatts, typically 8 to 12 megawatts for three-phase voltages of
10 6 500 V or 11 000 V. This power is generally provided by on-board diesel
generating units. These on-board generators have low yield, use costly energy
and are highly polluting. In addition, a methane carrier which uses the gases
evaporating from its tanks as fuel is often able to produce more energy than it
consumes. It can therefore possibly export current to an on-shore network in
15 competitive manner.

It has therefore appeared of importance to design devices allowing
exchanges of electric power between a ship and the quayside, in either
direction. These exchange systems must have a universal nature and be of
great simplicity of use, since a ship must be able to use such systems in most
20 of the ports at which it may come to dock.

As illustrated by the patent applications EP 1 667 301 and JP 2006
29026, the first systems of this type are based on the adaptation of existing
technologies for manual connectors, in the most successful configurations,
with systems of motorized reels installed on the ship. The reels facilitate the
25 storage and handling of electric cables on board the ship. When the ship has
docked, the reels are unwound and the cables are extended onto the land via a
roller guide which carries them to above the quayside. On the quay, operators
take up the cables and haul them towards connection boxes to connect their
end connectors to the port power network. Mr. Ottonel Popesco gives a
30 description of this technique in a paper titled "Cavotec Alternative Maritime
Power Supply" presented at the "Clean Ship Conference" on 7-9 September
2007.

This technique has numerous drawbacks as soon as the powers involved are high, typically as soon as they exceed a few hundred kilowatts, which is generally the case. For example:

- 5 - the weight of the cables and connectors soon becomes substantial requiring the presence of heavy labour to ensure the handling thereof, whilst observing the weight limits that an operator can carry as required by regulations, typically 25 kg;
- 10 - the high electric voltages, requiring increased dimensions of the conductor insulations, not only lead to an increase in cable weight but also in their stiffness making the handling thereof more difficult and hazardous;
- 15 - for high powers, typically higher than 4 MW, it is necessary to use several systems of this type in parallel, which increases the costs, risks and the complexity of these operations accordingly;
- 20 - the cost of the cable and of the reel is high, as is the on-board space requirement, even though this equipment is only used a fraction of the time of a ship's life, which makes their amortization difficult.
- 25 - the space taken up by the cable and its reel may limit the space allocated to the ship's payload;
- since the operators are led to handling high voltage cables and connectors directly, specific procedures and qualifications are required which generate high costs and operational constraints to avoid risks for personnel; and
- in the event of an emergency, if the ship is compelled to leave its berth rapidly when the supply system is energized, there is a strong risk of the formation of an electric arc to which is added the falling of equipment onto surrounding personnel or the public, even a "whiplash" if the cables rupture.

It is the objective of the invention to propose a device and method
30 which allows the solving of the aforementioned disadvantages, and in

particular to ensure the rapid setting up of said supply in full safety, adapted to the powers required by high tonnage ships. In addition, it is one objective of the invention to limit the number, the size, the complexity and more generally the volume of the on-board components of the device.

5 According to the invention, a said device for providing a moving body, in particular a ship, with an on-shore power supply is characterized in that it comprises an on-board connector, a shuttle, means for hauling the shuttle, the shuttle comprising means to engage with an on-shore connector mating with the on-board connector, the haulage means being provided to haul the shuttle
10 and the on-shore connector when they are engaged so that the on-shore connector is brought into electric continuity with the on-board connector. The haulage means may comprise a chain and winch, a first end of the chain being connected at least in part to the shuttle, the second end of the chain being free.

 Preferably it comprises means to maintain the on-board connector
15 substantially rigidly relative to the ship's hull.

 The on-board connector can be carried by a jib mobile between a retracted position in which the on-board connector is sheltered inside the hull of the ship, and a deployed position in which the on-board connector lies distant outside the hull. This jib may advantageously comprise a nacelle, the
20 on-board connector and the winch being housed in the said nacelle, and the chain being arranged so that it can be coiled inside a compartment of the said nacelle.

 The jib may also comprise a substantially horizontal beam arranged underneath a deck of the ship, and rack means to move the beam substantially
25 horizontally.

 Advantageously, a distal end of the jib comprises a panel matching an opening in the hull so that, in the retracted position of the jib, the panel comes to close the opening, thereby ensuring the continuity of the hull.

The jib may be designed so that it is deployed substantially transversally to the ship. It can also be designed so that it is deployed substantially longitudinally to the ship, preferably at the stern of the ship.

The device may further comprise at least one cable to connect the on-board connector electrically with on-board electric equipment, and a tray
5 extending through the decks below the jib and leading via a lower end preferably into an engine room, the cable and the cable tray being arranged so that the cable beyond the lower end of the tray forms a loop, preferably a suspended loop.

10 The connectors may each comprise several connection elements in identical number, distributed around a respective axis, and respective orienting means provided to cooperate with the shuttle so that, at the time of a connection, each on-shore connector element is aligned with a corresponding element of the on-board connector.

15 In one embodiment, the connectors each comprise three connection elements, the shuttle having a triangular cross-section, and the orienting means of at least one of the connectors comprising a set of three rollers designed to engage with the triangular section of the shuttle, so that the connector and the shuttle are oriented relative to one another at a pitch of 120 degrees around the
20 respective axis. Each of the three connection elements may be provided for a respective phase of the three-phase supply. Each connector may also comprise three other connection elements, these also being distributed around the respective axis and provided for the neutral of the three-phase supply. Nonetheless, the three connection elements may also be provided both for a
25 respective phase and for neutral.

One end of the shuttle may comprise a hook provided to engage with mating hooking means of the on-shore connector.

The device may comprise a container and a chimney carried by the container, the on-shore connector being housed in the chimney, the container
30 acting as reserve for cable electrically connected to the on-shore connector,

each cable being provided so that it extends through the chimney as and when the on-shore connector is hauled towards the on-board connector. The chimney is advantageously mounted mobile in translation relative to the said container. The container may be arranged on the quayside or the device may
5 comprise a floating pontoon on which the container is installed, each cable being flexibly connected to an on-shore power supply. The floating pontoon is preferably motorized.

In another embodiment, the device may comprise floating means for the on-shore connector and preferably propelling means. Said on-shore connector
10 may further comprise ballast means adapted to sink the on-shore connector when it is not connected to an on-board connector. It may also comprise means to cause the axial sliding of the floating means relative to the connection means, so that the floating means do not mechanically interfere with an on-board part of the device when the connectors are connected
15 together.

According to the invention, a method for providing a moving body, in particular a ship, with an on-shore power supply is characterized in that an on-board connector is maintained substantially rigid relative to a hull of the ship, and a shuttle is engaged with an on-shore connector, then the shuttle and the
20 on-shore connector are hauled until the on-shore connector is in electric continuity with the on-board connector. Preferably, first the shuttle is automatically oriented relative to the on-shore connector, and then the shuttle is automatically oriented relative to the on-board connector, before the on-shore connector comes into electric continuity with the on-board connector.

25 In this document, as in the following description, by "on-board" is meant any element or part of the connection device which is part of the ship and moves together with it. In contrast, the remainder of the device and its constituent elements generally connected to a port installation are termed "on-shore". By convention, it is considered that the on-shore part of the device lies
30 upstream of its on-board part.

Several embodiments of the invention are described below as non-limiting examples, with reference to the appended drawings in which:

- 5 - Figure 1 is a schematic cross-sectional, elevation view of a device according to the invention, applied to the power supply of a ship of which a partial sectional view is shown;
- Figure 2 is a perspective view of the device in a similar position to the position in Figure 1;
- Figure 3 is a perspective overhead view of an on-shore part of the device in Figure 1, designed to be arranged on a quayside;
- 10 - Figure 4 is a perspective, partial sectional view of an on-shore connector for the device in Figure 1;
- Figure 5 is a perspective sectional view of a connection element for the on-shore connector in Figure 3;
- Figure 6 is a partial sectional view of an on-board connector for the device in Figure 1;
- 15 - Figure 7 is a sectional perspective view of a connection element for the on-shore connector in Figure 3;
- Figure 8 shows the on-shore connector of Figure 4 and on-board connector of Figure 6 connected together;
- 20 - Figure 9 is a perspective view of another embodiment of a on-shore connector adapted to float on the water, illustrated suspended from a haulage chain;
- Figure 10 is a sectional view of the on-shore connector illustrated in Figure 9, shown when resting on the surface of the water;
- 25 - Figure 11 is a similar view to the view in Figure 10, the connector being illustrated when suspended from the chain,
- Figure 12 is a perspective view of the storage and launching means for the floating connector, in storage position and,
- 30 - Figure 13 is similar view to the view in Figure 12 illustrating the launching of the floating connector.

The connection device 1, illustrated in Figures 1 and 2, comprises an on-board part 2 and an on-shore part 3. The on-shore part 3 is designed so that it is arranged on a quayside 4. The on-board part 2 is designed to equip a ship 6 whose side facing the quayside 4 is shown in the sectional view illustrated in Figure 1. The ship 6 comprises an upper deck 7, an intermediate deck 8 and a lower deck 9. The lower deck 9 forms an engine room 9.

First a general description is given of the on-board part 2 of the device 1.

The on-board part 2 of the device 1 comprises a jib 10, fixed underneath the ceiling of the upper deck 7. It is provided so that it extends transversally outside the hull 11 of the ship through an opening 12 in the hull 11. Therefore the jib is designed to be mobile between a retracted position inside the hull of the ship and a deployed position, such as illustrated in Figures 1 and 2.

The jib comprises a substantially horizontal beam 14. A distal end of the beam 14 carries a panel 13. The panel 13 is designed to close the opening 12 when the jib is retracted inside the hull 11, thereby ensuring the continuity and seal of the hull. Immediately behind the panel 13, the beam 14 carries a nacelle 15.

Three connection elements 16 (of which only two are shown in Figure 1) are arranged in the nacelle 15. Together the connection elements take part in forming an on-board connector 17. Each connection element 16 is connected to a respective electric cable 18 which extends towards inside the ship through the opening 12. Beyond the opening 12, the cables enter the upper deck 7. A duct 20 is arranged between the floor of the upper deck 7 and the floor of the intermediate deck 8 so that, beyond the upper deck 7, the cables 18 pass through the duct as far as the engine room 9. Here, the cables are hung from the ceiling of the engine room and supply an electric switchboard (not illustrated) of the ship. The cables 18 form a loop 19 in the engine room. An upstream strand of the loop 19 is suspended from pulley

means 21 in the upper deck 7, and a downstream strand of the loop is suspended from the ceiling of the engine room 9. The loop 19 forms reserve cable for the jib 10 so that when the jib 10 is in deployed position the loop is of reduced size 19A, and when the jib is retracted the loop is of larger size 19B. These two arrangements 19A, 19B of the loop 19 are illustrated together in Figure 1. The loop is arranged so that it hangs under gravity in the engine room alongside the hull 11.

The beam 14 comprises a rack 22 on which an electric motor (not illustrated in the figures) comes to engage, the said motor allowing the deployment and retracting of the jib 10.

The elements of the on-board part 2 of the connection device 1 take up little space in the ship, which means that there is little or no reduction in payload. Accordingly the beam 14 is fixed to the ceiling of the upper deck, and most of the volume taken up by the device is taken up by the nacelle 15 and the elements contained therein. Therefore, the cable travels through the upper and intermediate decks without taking up any notable space and the loop is arranged in the engine room 9 where it finds its own place whilst avoiding the presence of cumbersome reels. Provision may be made for the loop to be isolated in a specific compartment of the engine room so that it does not form a hindrance or any risk, in particular to ensure continuity of sealing with respect to water, air or fire smoke between the upper deck 7 and the engine room 9.

A description is now given of the on-shore part 3 of the device 1.

This on-shore part of the device comprises a container 25 resting on the quayside 4, and a chimney 26 which extends vertically upwards from the roof 27 of the container 25. As more particularly illustrated in Figure 2, the roof 27 of the container 25 carries a pair of longitudinal rails 28. The chimney 26 is carried by a trolley 29 able to move in horizontal translation along the rails 28. The chimney 26 is designed so that it can house an on-shore connector 30.

In Figures 1 and 2, the on-shore connector 30 is shown as it is being moved vertically for connection thereof with the on-board connector 17. The on-shore connector is drawn upwards in the direction of arrow V hung from a shuttle 40 drawn by a haulage line 41. In the illustrated example, the haulage
5 line is a chain 41. The chain 41 is moved by a winch 42 arranged and fixed inside the nacelle 15. The shuttle 40, the chain 41 and the winch 42 form part of the on-board part 2 of the device 1. The shuttle 40 is of elongate shape in the continuity of the chain 41 with a linear cross-section forming an equilateral triangle (see Figure 6).

10 The on-shore connector 30 comprises three connection elements 32, not illustrated in Figures 1 and 2 but which can be seen in Figure 4, each mating with a connection element 16 of the on-board connector 17. Each on-shore connection element 30 is connected to a respective on-shore cable 33 extending upstream of the on-shore connector through the chimney and a
15 longitudinal opening 34 in the roof 27, in the container 25, as far as an on-shore terminal. The on-shore terminal is fixed relative to the quayside 4. It cannot be seen in the figures since it is hidden by the container 25 covering it. The container acts as reserve for the on-shore cable 33 so that the cable can be deployed when the on-shore connector 32 is hauled upwards up as far as the
20 on-board connector 17, and when the on-shore connector 32 is again stored away in the chimney 26 the cable can be coiled therein.

Provision may be made for several terminals arranged further and further along each quayside of a port. A container 25 according to the invention, as per the needs of a ship intended to dock on the quayside, can be
25 brought to approximately the point where the jib 10 will be positioned. Therefore the device according to the invention allows the connectors to be positioned exactly along three axes: first longitudinally by moving the on-shore connector on the container 25, or moving the container relative to the fixed terminal, second transversally by deploying the jib 10 to a greater or

lesser extent, and finally vertically by deploying the on-shore cables 33 to a greater or lesser extent.

The chimney has an upper opening 37 which flares upwardly. As illustrated in Figure 2, the chimney 26 carries a shutter 36 in the form of a diaphragm and arranged above its upper opening 37. The shutter 36 comprises several shutter plates 38. In the illustrated example the shutter comprises three shutter plates. The role of the shutter 36 is to protect the on-shore connector 30 against bird excrements in particular, which may soil and damage the connector. The shutter additionally has the role of centring the shuttle 40 when it comes to engage with the on-shore connector 30 that has been arranged inside the chimney 26, and also the role of centring the on-shore connector when it is returned back into the chimney 26 after disconnection from the on-board connector.

When the shuttle 40 approaches the chimney to collect the on-shore connector, the shutter 36 is open so that the shutter plates 38 all form a wide opening such as illustrated in Figure 2. When the shuttle 40 lies between the plates 27 these are drawn close around the shuttle 40 to allow precise positioning thereof above the on-shore connector 30.

Figure 3 gives a magnified view of the on-shore part 3 of the device 1. The on-shore connector cannot be seen as it is stowed away in the chimney. The shutter 36 can be seen in closed position, so that it ensures the protection of the connector in the chimney. This arrangement is the arrangement of the on-shore part awaiting a ship due to berth and to set up an electrical connection.

A description is now given of the on-shore connector 30 in particular with reference to Figure 4.

As particularly illustrated in Figure 4, the on-shore connector comprises a capsule 45. The capsule comprises a cylinder 46 of revolution about an axis X30 arranged substantially vertically, and a disc 47 perpendicular to the axis X30. The disc 47 shuts off the cylinder 46 inside its upper edge. The capsule

45 is open downwardly inside a horizontal lower edge of the cylinder 48. In Figure 4 a section of the cylinder is shown to illustrate elements of the on-shore connector 30 arranged inside the capsule 45. The on-shore connector additionally comprises a structure 49, 49, 49 composed of three tubes 49 forming the edges of a regular tetrahedron. Each tube is joined to the two others by a lower end, in the vicinity of the axis X30. An upper end of each tube 49 is fixed to the lower edge 48 of the cylinder 46.

When the on-shore connector 30 enters into the chimney 26, the tubes 49 allow progressive centring of the connector 30, first between the shutter plates 38 then via the upper opening 37 of the chimney. Also, the structure 49, 49, 49 allows the on-shore cables 33 to be grouped together at the lower end of the tubes 49 so that they extend upstream of the connector 30 substantially along the axis X30 in the form of a composite cable of which each cable 33 forms a strand.

Inside the capsule, the on-shore connector comprises three connection elements 32, guide means 51, a haulage tube 52 and engaging means 53. The connection element 32 the furthest to the right is shown partly cut away to show inner components. The connection element 32 the furthest to the rear is almost entirely hidden by the haulage tube 52. The haulage tube is shown in an axial cut-away view to show the guide means 51.

The haulage tube 52 is substantially of revolution about the axis X30. It comprises a cylinder 56 whose underside is fixed to the disc 47. The haulage tube further comprises an annular plate 57 arranged at its lower end. The annular plate 57 is pierced with an axial passageway 58 for a lower end 60 of the shuttle 40 (see in particular Figure 8 in which the shuttle is shown engaged with the on-shore connector 30).

The engaging means 53 comprise two jaws 61 arranged facing one another. Each jaw 61 is fixed to the annular plate 57 by a respective clevis 62 on which the jaw is hinged about a horizontal axis. Each jaw 61 extends downwardly from its respective clevis 62. The jaws are designed to come to

engage with the lower end 60 of the shuttle 40. As particularly illustrated in Figure 6, the end 60 of the shuttle 40 comprises a narrowing which mates with a corresponding shape of the jaws. With regard to the detailed arrangement of this type of mechanism, helpful reference can be made to patent WO 83/01059
5 which describes an example thereof. The accumulated height of the haulage tube 52 and the jaws is such that the jaws, in the downward direction, do not extend beyond the lower edge 48 of the capsule 45.

The guide means 51 comprise a cylindrical guide tube 66, of axis X30. The guide tube 66 is arranged inside the haulage tube 52. It is fixed, on the
10 underside, to the disc 47. The guide tube is open over its entire section both upwardly through the disc 47 and downwardly. The guide tube 66 is therefore arranged so that the shuttle 40 is able to pass through it until it comes to engage with the jaws 61. The guide means also comprise three rollers 67. Each roller is substantially of revolution about a longitudinal axis X67. Each of the
15 two longitudinal ends of each roller is mounted in rotation in the wall of the haulage cylinder 56 about the respective axis X67. Each axis X67 is tilted by about 45 degrees relative to a plane perpendicular to the axis X30, and the rollers 67 are arranged so that the axis X567 of one can be derived from the axis X67 of the other by a rotation through 120 degrees about the axis X30.
20 Each roller 67 passes through the inner volume of the guide cylinder 66 through a respective opening 68 in the wall of the guide cylinder 66. The rollers are therefore arranged so that when seen from above i.e. along axis X30, the rollers 57 in the inner space of the cylinder 66 together leave a free section adjusted to the triangular section of the shuttle 40.

25 The connection elements 32 are each of elongate shape, substantially cylindrical about a respective axis X32. They are arranged parallel to the axis X30 of the on-shore connector 30, between the cylinder 46 of the capsule 45, and the haulage cylinder 56. They are distributed about the axis X30 at 120 degrees from each other.

A description is now given of a connection element with particular reference to Figure 5.

Figure 5 shows an isolated connection element 32. Figure 5 illustrates a waiting position in which the element 32 is not connected. The element 32 comprises a jacket 70, a piston 71, an electrically insulated push rod 72, a helical spring 73, two contacts 74 and one junction 75. One of the contacts is connected to a specific electric phase of the connection element and the second contact is connected to the neutral of the electric installation. The push rod 72 is fixed relative to the jacket 70.

The jacket is of substantially cylindrical shape. It is closed at its lower end by a bottom end 77 and at its upper end it comprises an annular rim which extends radially both towards the axis X30, to form an inner shoulder, and also moving away from the axis X30 to form an outer shoulder. A circular opening 80 is formed by the inner edge 79 of the inner shoulder. As illustrated in Figure 4, each element 32 is mounted through the disc 47 and the inner shoulder of the rim 78 forms a support for fixing the jacket onto the disc 47.

The push rod 72 extends coaxially to the jacket. A lower end of the rod 72 is fixed to the bottom end 77. The rod 72 comprises insulated conductors, one for phase and the other for neutral. These conductors are not illustrated in the figures. The rod is electrically connected to the junction 75 via the bottom end 77. The junction extends downwardly from the bottom end 77; as illustrated in Figure 4, it is designed for the connecting of a cable 33 which itself comprises a conductor for phase and another for neutral. An insulating ring 81 is provided in the bottom end 77 to insulate the bottom end 77 electrically from the rod and from the junction 75. The rod 72 extends from the bottom end 77 upwardly as far as a free end of the rod located in the vicinity of the opening 80.

The two electric contacts 74 are each in the shape of ring mounted on the rod 72 away from each other, and away from each of the ends of the rod 72. It will be noted that the rings 74 are sufficiently distanced away from each

other and from each of the ends of the connection element so that there is no possibility of the formation of an electric arc when the connector is energized. In particular, this distance is sufficient so that no arc is formed when the piston 71 is moved. The free end comprises a cylindrical disk 82. The contact rings
5 each have the same outer radius. This outer radius of the rings is substantially equal to the outer radius of the disk 82.

The piston 71 is mounted slidably inside the jacket 70. It comprises a central cylindrical passage that is sufficiently wide for the piston to be able to move along the rod 72 without being hindered by the contact rings 74. The
10 inner radius of the central passage is therefore greater than that of the rings 74; it is also smaller than that of the disk 82. The spring 73 is mounted loaded between the bottom end 77 and the piston 71. Therefore, in the waiting position illustrated in Figure 5, the piston 71 under the action of the spring 73 is held flat against the inner shoulder of the rim 78 and against the disk 82.
15 The piston 71 therefore forms a cap intended to protect the inside of the jacket against the entry of foreign bodies and humidity, and to insulate the electric contacts 74 electrically from the outside.

A description is now given of the on-board connector 17 with reference to Figure 6.

20 Figure 6 illustrates the nacelle 15 and the on-board connector 17. The on-board connector 17 is centred on a substantially vertical axis X17. It notably comprises the three on-board connection elements 16 and guide means 85 fixed to the nacelle 15. It will particularly be noted in Figure 6 that the shuttle 40 is fixed to the chain 41 via a swivel 86 so that the shuttle 40 is able
25 to assume an orientation independently of the position of the chain 41.

The guide means 85 are similar to the guide means 51 of the on-shore connector 30. They will therefore not be described in more detail.

The connection elements 16 of the on-board connector are each of elongate shape, substantially cylindrical about a respective axis X16. They are
30 arranged parallel to the axis X17 of the on-board connector 17 around guide

means 85. They are distributed at 120 degrees to each other about the axis X17. In addition, the distance between the axes X16 and axis X17 is equal to the distance between the axes X32 and axis X30.

A connection element 16 will now be described of the on-board
5 connector 17 illustrated on its own in Figure 7. Figure 7 illustrates a waiting position in which the element 16 is not connected.

The connection element 16 comprises a substantially cylindrical jacket
90 closed downwardly by an annular abutment 92 and closed in the top part by
a bottom 97. It also comprises a hollow piston 91 mounted slidingly in the
10 jacket 90. A plugging rod 94 is fixed to the piston so that it extends axially
downwards from the piston 91 through the annular abutment 92.

A spring 93 is held compressed between the piston 91 and the bottom
97. In the waiting positioning illustrated in Figure 7, the piston 91 is held flat
downwardly against the annular abutment 92, by the spring 93.

15 The connection element 16 further comprises a plunger tube 95. The
plunger tube 95 is electrically non-conductive. It comprises an annular plate
96. The connection element 16 is mounted on a lower platform 98 of the
nacelle 15 so that the platform is caught between the annular abutment 92
above and the annular plate 96 underneath. The platform 98 is not illustrated
20 in Figure 7.

The plunger tube 95 at its lower end carries an annular plug 951. The
annular plug 951 comprises a cylindrical axial passageway. The plugging rod
94, at its lowest end, comprises a stopper 941 designed to close off the axial
passageway of the plug 951 when the element 16 is in waiting position. The
25 diameter of the passageway is substantially equal to the outer diameter of the
disk 82 of the connection element 32 of the on-shore connector.

A sleeve 99 is fixedly mounted inside the plunger tube 95 so that it
extends upwardly beyond the plate 96, inside the jacket 90. The sleeve has an
inner diameter which, in the continuity of the passageway of the plug 951, is
30 substantially equal to the outer diameter of the disk 82 of element 32. This

allows the sliding therein of the push rod 72 of the connection element 32 of the on-shore connector.

The sleeve carries two contacts 100, each designed to come into contact respectively with a contact 74 associated therewith. One of the contacts 100 is
5 designed to ensure the continuity of a phase and the other to ensure the continuity of the neutral.

The contacts 100 are connected via the bottom 97 to a cable 18 belonging to the connection element 16.

Figure 8 illustrates the nacelle 15, the on-board connector 17 and the
10 on-shore connector 30 connected together. The connecting operation is now described which leads to the respective positions of the connectors 17, 30 illustrated in Figure 8.

When the ship is berthed it deploys the jib 10. The jib 10 and the chimney 26 are moved so that the on-board connector 17 lies substantially
15 directly above the chimney. The shuttle 40 is then lowered in the direction of the chimney 26. The shuttle 40 is first re-centred by the shutter 36 so that it correctly enters into the guide means 51.

As and when the shuttle 40 enters into the guide means 51 of the on-shore connector 30, its triangular section cooperates with the rollers 57 so that
20 it orients itself in a predefined position relative to the on-shore connector 30 about the axis X30. This position is defined to within 120 or 240 degrees. Once the shuttle has engaged with the jaws 61, this relative orientation is maintained.

The shuttle is then hauled upwards in direction V as illustrated in
25 Figures 1 and 2, substantially along the axis X17 of the on-board connector 17. When the shuttle 40 reaches the on-board connector it enters into the orienting means 85 and orients itself progressively into a predefined position relative to the on-board connector 17, about the axis X17. This position is defined to within 120 or 240 degrees about the axis X17. The shuttle is of
30 sufficient length so that this relative position is reached before the on-shore

connector reaches the lower level of the on-board connection elements 16. The guide means 51, 85 are designed so that once the relative positions of the shuttle 40 have been fully reached each connection element 32 of the on-shore connector 30 lies opposite a connection element 16 of the on-board connector
5 17. In other words, for each element 16 its axis X16 is aligned with the axis X32 of an element 32.

Additional hauling along V ensures the entry of each plunger tube 95 of a connection element 16 inside the jacket 70 of the connection element 32 lying opposite it, and the entry of each push rod 72 inside the sleeve 99 of the
10 corresponding connection element 16. On entering the jacket 70, the plunger tube 95 pushes the piston 71 so as to free the contacts 74, and the push rod 72 pushes the plugging rod 94 so as to free the contacts 100.

The hauling along V is continued until each rim 78 of the on-shore connector comes into contact, underneath an annular plate 96, with a
15 corresponding on-board connection element 16. The connection elements 16, 32 are designed so that, in this position, each contact 74 of the on-shore connector is in contact with a respective contact 100 of the on-board connector, thereby ensuring the electric continuity between each on-shore cable 33 and a respective on-board cable 18.

20 Between the winch and the platform 98 of the nacelle 15, the nacelle comprises a compartment 87 in which the chain is coiled, in particular when the shuttle 40 is raised inside the nacelle.

It will be noted that since the on-board connector is maintained substantially rigid relative to the ship, this provides for very easy connecting.

25 It is ascertained that a device according to the invention does not require any manual intervention for moving and connecting the connectors together. Connection is able to be made in full safety and without any effort. Said connection is particularly rapid.

The end of the chain opposite the swivel 86 is left free. Therefore, in
30 the event of an emergency when the ship must rapidly leave the quayside, all

that is needed is to unwind the chain in reverse direction to direction V until its free end is released from the winch. Under these conditions, the on-board connector returns back into the chimney without any damage and only the chain and the shuttle are abandoned on the quayside. This can be performed
5 without any manual intervention, hence without risk and within an extremely short time, therefore without hampering safety operations.

A description will now be given of another embodiment for an on-shore connector, with reference to Figures 9 to 13. This embodiment will only be described in the manner in which it differs from the previously described
10 embodiment with reference to Figures 1 to 8. It will be noted in particular that an on-shore connector 130, obtained according to this other embodiment, is designed to be compatible with the on-board connector described in particular with reference to Figure 6.

In this other embodiment, the on-shore connector 130 is designed to
15 float. This arrangement is of particular advantage for container ships. It is effectively preferable for the jib 10 of one of these ships 6 to be arranged at the stern of the ship 6 and for the jib 10 to be designed so that it extends longitudinally from the stern. On this account, the on-board connector 17 does not generally lie above a quayside but above the water. The on-shore
20 connector is therefore designed so that it can be moved by floating on the water until it comes substantially in line with the on-board connector for the mutual connection thereof.

The connector 130 comprises a capsule 45 containing the same elements as the capsule described previously with reference to the first
25 embodiment of the on-shore connector 30. It therefore particularly comprises guide elements for the shuttle 40 and connection elements 32.

The connector 130 also comprises a chimney 126 to house the capsule 45 therein. Floating means 110 are fixed to the chimney 126. In the illustrated example the floating means comprise a ring-shaped buoy 110. The buoy 110 is

formed of two semi-annular buoys that are identical and keyed onto each other.

Propelling means 111 with propellers are fixed to the chimney 126. The propelling means 111 comprise two propeller engines 111. Each engine is mounted mobile in rotation about a vertical axis XIII particular to it. Each engine 111 is mobile independently of the other.

The capsule 45 is mounted slidably in the chimney 126 equipped with a shutter 36. The connector 130 comprises sliding means sliding along axis X30 so that the capsule is slidably mounted in the chimney 126 between a bottom position and a top position. The bottom position is a waiting position, illustrated in Figure 10. The top position is illustrated in Figure 11.

In the illustrated example, the chimney 126 comprises an upper annular shoulder 112, and a lower annular shoulder 113, both extending radially towards the axis X30 of the connector 130, and the capsule 45 comprises an annular rib 114 extending radially in the direction of the chimney 126. The capsule 45 is mounted in the chimney 126 so that the rib 114 is able to slide freely parallel to the axis X30 between the two shoulders 112, 113.

In the bottom position, the rib 114 rests against the lower shoulder 113. In this position, the shutter 36 can be closed and the capsule remains protected inside the chimney waiting to be engaged by a shuttle 40.

When the shuttle 40 engages with the engaging means 53, the capsule 45 is first hauled upwards until the rib 114 reaches its top position abutting the upper shoulder 112, whilst the chimney and its floating means remain substantially immobile on the surface of the water. Additional hauling of the shuttle then allows the assembly to be driven upwards along V.

The connector is designed so that, in the top position, the annular rims 78 of the on-shore connection elements 32 lie above the other components of the on-shore connector 130, so that at the time of connection with the on-board connector 16 these other components and in particular the floating means 110 do not mechanically interfere with the on-board part 2 of the system 1.

In the example illustrated in Figures 9 to 13, the connector 130 also comprises ballast provided so that it is possible, at will, to sink the connector 130 or to leave it to float, for example when the ship is manoeuvring on arrival or departure.

5 As illustrated in Figures 12 and 13, quay storage means 120 may be provided, allowing both the launching and dry docking of the floating connector 130. In the illustrated example, these means 120 comprise a specific jib 121 motorized about a vertical axis X121, and an electric cabinet 122. These means 120 further comprise a specific shuttle 140 held on the jib by a
10 cable 141 and provided so that it engages with the connector when it is recovered for dry docking, until the next re-launching. The jib 121 carries a cover 124 arranged so that it forms a shelter for the connector 130 when it is hanging from the jib.

As particularly illustrated in Figure 12, the connector 130 is designed to
15 be stored just above the quayside 4. When it is launched as illustrated in Figure 13, the jib 121 rotates about its axis so that the connector 130 is brought above the water then the cable is unwound until the connector floats and is released from the shuttle 140. In this way, the connector 130 can be launched close to the stern 123 of a ship 6.

20 A reverse operation allows the connector 130 to be dry docked. Once dry docked above the quayside 4, the connector 130 is protected by the cover 124 away from the fenders 125 arranged along the quayside.

Evidently, the invention is not limited to the examples just described.

For example, the chain can be replaced by a cable.

25 Although only one intermediate deck is illustrated, the ship may comprise several such decks between the upper deck where the jib is installed and the engine room.

In the illustrated example, three connection elements are provided in each connector, each connection element comprising a contact for the neutral
30 and a contact for a specific phase. In another embodiment, provision may be

made for four connection elements, one for each phase and the fourth for the neutral. Provision may also be made for six connection elements, one for each phase and each of the three others for a neutral respectively derived from one of the supply cables. Said arrangements allow a considerable reduction in the
5 length of each connection element, and hence in the space requirements for the on-shore and on-board connectors.

The contacts mounted on the rods of the connection elements, instead of being rings could be replaced by lamella contacts. Said contacts are able to offset any play. Said lamella contacts are marketed in particular by Multi-
10 contact, Hesingue F-68220.

Instead of being positioned on the quayside, the container can be positioned on a floating pontoon, preferably motorized, so that it can easily come to position itself directly in line with the on-board connector.

A device according to the invention can be adapted for other types of
15 moving bodies, in particular for an aircraft, train, tramway or motor vehicle when they are stationary.

CLAIMS

1. Device (1) for providing a ship (6), with an on-shore power supply, comprising an on-board connector (17), an on-shore connector (30, 130) mating with the said on-board connector, a shuttle (40) and haulage means (41, 42) for the shuttle, the shuttle comprising means to engage with the said on-shore connector, characterised in that the haulage means are designed to haul the said shuttle and the said on-shore connector when they are engaged, so that the said on-shore connector is brought into electric continuity with the said on-board connector.

2. The device according to claim 1, characterized in that the haulage means comprise a chain (41) and a winch (42), a first end of the said chain being connected at least indirectly to the said shuttle, the second end of the said chain being free.

3. The device according to claim 1 or 2, characterized in that it comprises means (10) for maintaining the on-board connector substantially rigid relative to the hull of the ship.

4. The device according to claim 3, characterized in that the on-board connector (17) is carried by a jib (10), the said jib being designed to be mobile between a retracted position in which the on-board connector is sheltered inside a hull (11) of the ship, and a deployed position in which the on-board connector is distanced away outside the hull.

5. The device according claims 2 and 4, characterized in that the jib comprises a nacelle (15), the on-board connector and the winch being housed inside the said nacelle, and the chain being arranged coiled inside a compartment (87) of the said nacelle.

6. The device according to claim 4 or 5, characterized in that the jib comprises a substantially horizontal beam (14) arranged underneath a deck of the ship, and rack means (22) to move the said beam substantially horizontally.

5

7. The device according to claims 4 to 6, characterized in that a distal end of the jib comprises a panel (13) matching an opening (12) in the hull (11) so that, in the retracted position, the said panel comes to close the said opening and ensure the continuity of the said hull.

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8. The device according to any of claims 4 to 7, characterized in that the jib is designed to be deployed substantially transverse to the ship.

9. The device according to one of claims 4 to 7, characterized in that the jib is provided so that it is deployed substantially longitudinally to the ship, preferably at the stern of the said ship.

10. The device according to one of claims 4 to 9, characterized in that it comprises at least one cable (18) to connect electrically the on-board connector (17) with on-board electrical equipment, and a cable tray (18) extending through decks (8) below the jib and leading, via a lower end, preferably into the engine room (9), the said cable and the said tray being arranged so that the cable, beyond the said lower end, forms a loop (19) preferably a hanging loop.

25

11. The device according to one of claims 1 to 10 characterized in that the connectors (17; 30, 130) each comprise several connection elements (16, 32) in identical number distributed about a respective axis (X17, X30), and respective orienting means (51, 85) designed to cooperate with the shuttle (40) so that at the time of connection each element (32) of the on-shore

30

connector (30, 130) is aligned with a corresponding element (16) of the on-board connector (17).

12. The device according to claim 11, characterized in that the
5 connectors (17; 30, 130) each comprise three connection elements (16, 32), the shuttle (40) having a triangular cross-section and the orienting means (51, 85) of at least one of the connectors (30, 130; 17) comprising a set of three rollers (67) provided to engage with the triangular section of the said shuttle (40), so that the said connector and the said shuttle are oriented relative to one another
10 at a pitch of 120 degrees about the respective axis (X30, X17).

13. The device according to one of claims 1 to 12, characterized in that one end of the shuttle (40) comprises a hook provided to engage with mating hooking means (53) of the on-shore connector (30).

15

14. The device according to one of claims 1 to 13, characterized in that it comprises a container (25) and a chimney (26) carried by the said container (25), the on-shore connector (30) being housed in the chimney (26), the container (25) acting as reserve for cable (33) electrically connected to the
20 on-shore connector (30), each cable (33) being provided to extend through the chimney (26) as and when the on-shore connector is hauled towards the on-board connector (17).

15. The device according to claim 14, characterized in that the
25 chimney (26) is mounted mobile in translation relative to the said container.

16. The device according to claim 14 or 15, characterized in that it further comprises a floating pontoon on which the container (25) is installed, each cable (33) being connected flexibly to an on-shore electric network, the
30 said floating pontoon preferably being motorized.

17. The device according to one of claims 1 to 13, characterized in that it comprises floating means (110) for the on-shore connector (130) and preferably propelling means (111).

5 18. The device according to claim 17, characterized in that it comprises ballast means (116) adapted to sink the on-shore connector when it is not connected with an on-board connector.

10 19. The device according to claim 17 or 18 characterized in that it comprises means (112, 114) to allow axial sliding of the floating means relative to the connection means, so that the floating means do not interfere mechanically with an on-board part (2) of the device (1) when the connectors are connected together.

15 20. The device according to one of claims 17 to 19, characterized in that it comprises means (120) for dry docking and launching the connector (130) the means (120) allowing the said connector to be stored above a quayside (4), the said means preferably comprising a jib (121) mobile about a vertical axis (X121) and a shuttle (140) designed to engage with engaging
20 means (53) of the said connector (130).

 21. Onboard device (2) for providing a ship (6), with an on-shore power supply with a connecting device according one of the claims 1 to 20, comprising an on-board connector(17), a shuttle (40), haulage means(41, 42)
25 for the shuttle, the shuttle comprising means to engage with an on-shore connector (30, 130) mating with the said on-board connector, characterised in that the haulage means being designed to haul the said shuttle and the said on-shore connector when they are engaged, so that the said on-shore connector is brought into electric continuity with the said on-board connector.

22. Terrestrial device (3) for the terrestrial ground power supply of a ship (6) with a connecting device according to one of the claims 1 to 20, comprising an on-shore connector (30, 130) provided to engage with a shuttle of on-board device (2).

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23. A method for providing a moving body, in particular a ship (6), with an on-shore power supply, characterized in that an on-board connector (17) is maintained substantially rigid relative to a hull of the said ship, a shuttle (40) is engaged with an on-shore connector (30), then said shuttle and
10 said on-shore connector are hauled until the said on-shore connector is in electric continuity with the said on-board connector.

24. The method according to claim 21, characterized in that firstly said shuttle is automatically oriented relative to the on-shore connector, then
15 said shuttle is oriented automatically relative to the on-board connector, before the said on-shore connector is placed in electric continuity with the said on-board connector.