AMENDED CLAIMS
received by the International Bureau, February 23, 2012
(23.02.2012)

1. A device for transferring fluid suitable for being arranged from a support (1) installed at sea, in grounded or floating manner (1-2, 1-1), between a said support and a ship (2), preferably of the methane tanker type, arranged alongside or in tandem adjacent to said support (1), said fluid transfer device comprising a plurality, n, of flexible pipes (3a-3b, 3) that are suitable for being stored on a said support (1) by means of a flexible pipe storage device (4) to which a first end (3-1) of each of said flexible pipes is suitable for being fastened, said flexible pipes being suitable for extending between said support (1) and a ship (2) arranged alongside or in tandem adjacent to said support (1), the device being characterized in that it comprises a first connection and valve device (13-1), said flexible pipes being connected together at their second ends (3-6) by said first connection and valve device (13-1), said first connection and valve device (13-1) having n preferably rigid first pipe portions (21a, 21b, 21c) held in preferably parallel fixed positions relative to one another, n being an integer not less than 3, each said first pipe portion (21a, 21b, 21c) comprising:

· at a first end, a first pipe coupling element (23-1a, 23-1b, 23-1c), preferably a male or female portion of an automatic connector);

· at its second end, a second coupling element, preferably a flange, assembled to the second end (3-6) of a said flexible pipe;

· each said first pipe portion (21a, 21b, 21c) including, between its two ends n-1 branch connections (30) enabling it to communicate with respective ones of the n-1 other said first rigid pipe portions, each said

branch connection (30) including a first communication valve (30ab, 30bc, 30ac);

· a first connection valve (22a, 22b, 22c) situated between said first coupling element (23-1a, 23-1b, 23-1c) and said branch connection (30);

· said first pipe portions preferably being held parallel by a first rigid support (24) to which they are secured; and

· said first communication valves (30ab, 30ac, 30bc) preferably being butterfly valves and said first connection valves (22a, 22b, 22c) preferably being ball valves.

2. A device according to claim 1, characterized in that it comprises a second connection and valve device (13-2) suitable for being arranged on board a said ship (2), said first connection and valve device (13-1) being connected to said second connection and valve device (13-2), said second connection and valve device (13-2) comprising:

· n preferably rigid second pipe portions (26a, 26b, 26c);

· each said second pipe portion (26a, 26b, 26c) communicating or being suitable for communicating at one of its ends with a second tank (12) inside said preferably methane tanker type ship (2), and including at its other end a first complementary pipe coupling element (23-2a, 23-2b, 23-2c), said first complementary coupling element being suitable for co-operating in reversible coupling (23) with a said first coupling element (23-1a, 23-1b, 23-1c), said first complementary coupling element preferably being a female or male automatic connector portion (23-2a, 23-2b, 23-2c), respectively;

· said second pipe portions (26a, 26b, 26c) being held in preferably parallel fixed positions relative to one another so as to enable said first complementary

coupling element (23-2a, 23-2b, 23-2c) to be coupled with said first coupling element (23-1a, 23-1b, 23-1c);

· each said second pipe portion (26a, 26b, 26c) having a second connection valve (27a, 27b, 27c) suitable for allowing or preventing fluid from flowing in said second pipe portion towards or from said first complementary coupling element when open or closed, respectively;

· said second pipe portions preferably being held parallel to one another by a second rigid support (25) to which they are secured; and

· said second connection valves (27a, 27b, 27c) preferably being ball valves.

3. A device according to claim 1 or claim 2, characterized in that it comprises:

· a said support (1) installed at sea, in grounded or floating manner (1-2, 1-1), and a said ship (2), preferably of the methane tanker type, arranged alongside or in tandem adjacent to said support (1); and

· a said flexible pipe storage and guide device (4) arranged on said support; and

· said flexible pipes that are fastened at a first end (3-1) to a said storage device (4), said flexible pipes extending between said floating support and said ship.

4. A device according to claim 2 and claim 3, characterized in that it further comprises a second said connection and valve device (13-2), arranged on board a said ship.

5. A device according to claim 2 or claim 3, characterized in that said flexible pipes comprise at least one flexible pipe, a "first" flexible pipe (3b), preferably at least two flexible pipes, "first" and "second" flexible pipes (3b, 3c), suitable for

transferring liquefied gas therein between said floating support and at least one second tank (12) of said ship (2), preferably of the methane tanker type, and of a third flexible pipe, preferably of diameter smaller than the diameter of said first and second pipes, within which gas corresponding to the gas ceiling of the second tank is suitable for being transferred from a said second tank (12) to a first tank within said floating support or to a liquefaction unit (1b) on a said support prior to being transferred to a said first tank (11).

6. A device according to any one of claims 1 to 5, characterized in that it comprises a said support (1) installed at sea, fitted on its surface with a storage and guide device (4) for storing and guiding flexible pipes (3, 3a-3b-3c) and suitable for storing and guiding a plurality of said flexible pipes, and preferably at least three of them, said storage and guide device comprising:

· a first carrier structure (5) resting on or secured to the deck (1c) of said support (1) close to a side (1d) of said support (1), preferably a longitudinal end wall of said support, said first carrier structure (5) supporting a plurality of circular turntables (4-1) arranged one above another;

· each of said turntables (4-1, 4a, 4b, 4c) being suitable for being driven in rotation in powered manner by a first motor (6) about a vertical central axis ZZ' independently of one another, preferably about the same vertical central axis ZZ', each turntable having a central orifice (4-2) surmounted by a central cylinder (4-3) against and around which a said flexible pipe (3, 3a, 3b, 3c) can be wound in concentric juxtaposed spiral turns of increasing diameter resting on the top face (4-1a) of said turntable, said central orifice (4-2) of said turntable being fitted with a rotary joint coupling (7) suitable for providing coupling between firstly a

first end (3-1) that is closest to said central cylinder of a flexible pipe wound around said flexible cylinder, said first pipe end (3-1) being suitable for being driven in rotation together with said turntable, and secondly an end (8-1) of a stationary transfer pipe (8) having its other end in communication with at least one first tank (11) within said support (1); and

a plurality of guide means (10, 10a, 10b, 10c), each said guide means being suitable for guiding the portion (3-2) of said pipe leaving a respective one of each of said turntables in continuity with the portion of pipe wound on said turntable, in such a manner that the various said pipe portions (3-2) leaving the various turntables are arranged in straight lines, being offset in different positions along a horizontal direction $Y_1Y'_1$ parallel to said side, at different heights, and capable of adopting different orientations ($\alpha 1$, $\alpha 2$, $\alpha 3$) for their vertical axial planes (P1, P2, P3) relative to said horizontal direction $Y_1Y'_1$ parallel to said side (1d).

7. A device according to claim 6, characterized in that at least one said flexible pipe (3) is wound, at least in part, against and around a said central cylinder (4-3) in concentric juxtaposed spiral turns of increasing diameters resting on said turntable (4-1), said central cylinder presenting a radius greater than the minimum radius of curvature of said flexible pipe, there being preferably at least three flexible pipes wound, at least in part, respectively on at least three said turntables, including at least one flexible pipe of diameter smaller than the others.

8. A device according to claim 6 or claim 7, characterized in that each guide means is arranged at a different height facing a respective one of each of said turntables so as to be suitable for supporting an intermediate curved pipe portion (3-3) between a

downstream portion (3-4) of said pipe in a substantially vertical position beside said side (1d) and a said upstream pipe portion leaving the turntable (3-2) in continuity with the wound pipe portion resting on a said turntable, said upstream pipe portion (3-2) leaving the turntable extending on a virtual plane P that is substantially tangential to the surface of the top face (4-1a) of said turntable on which said wound pipe portion is wound, the various downstream pipe portions (4-4) in substantially vertical positions beside said side being arranged in positions that are offset relative to one another in a said direction Y_2Y_2' parallel to said side on leaving said sheaves.

9. A device according to claim 8, characterized in that:

· each said guide means (10) comprises a sheave (10-1) mounted to revolve about a horizontal first axis of rotation Y_1Y_1', said sheave also being suitable for swiveling, preferably freely, about a vertical second axis of rotation Z_1Z_1' extending along a diameter of the sheave, said first axis of rotation about which each said sheave revolves preferably being controlled by a second motor (10-6), preferably synchronously with said first motor (6) of each said turntable (4-1);

· the various sheaves (10a, 10b, 10c) are arranged offset side by side relative to one another in said horizontal direction Y_1Y_1', parallel to said side at different heights, the top of each sheave preferably being positioned substantially level with a plane P tangential to the top face (4-1a) of a said turntable (4-1); and in that

· each sheave is supported by a second carrier structure (10-2) arranged outside said floating support and fastened to a common side (1d) at a different position in a said horizontal direction Y_1Y_1' parallel to said side, each sheave being mounted to swivel about said vertical second axis of rotation Z_1Z_1' relative to a

portion (10-4, 10-5) of its said second carrier structure fastened to said side (1d).

10. A device according to any one of claims 1 to 9, characterized in that each said turntable (4-1) includes or co-operates on its under face with wheels (4-5) suitable for co-operating with or respectively supported by elements (5a) of said carrier structure, and each said turntable including a bearing (4-4) at said central orifice, the bearing being secured to said carrier structure (5) and being suitable for enabling said turntable to rotate relative to said first carrier structure (5).

11. A device according to any one of claims 1 to 10, characterized in that at least one said turntable (4-1d) presents a top face (4-1a) that is plane and horizontal.

12. A device according to any one of claims 1 to 10, characterized in that at least one said turntable (4-1c) presents a top face of convex frustoconical shape, with an angle γ at the apex preferably lying in the range 160° to 178°.

13. A device according to any one of claims 1 to 10, characterized in that at least one said turntable (4-1b) presents a top face (4-1a) of concave frustoconical shape, with an angle γ at the apex preferably lying in the range 160° to 178°.

14. A device according to any one of claims 2 to 13, characterized in that it comprises a said support (1), a said storage device, preferably a storage and guide device, and at least two said flexible pipes (3), preferably via at least three flexible pipes (3a, 3b, 3c), extending between a said support (1) and a said ship (2), preferably of the methane tanker type, arranged

alongside or in tandem adjacent to said floating support (1), at least some of said flexible pipes (3) being stored with the help of a said storage and guide device (4), said flexible pipes being fitted with a said first connection and valve device (13-1), connected to a said second connection and valve device (13-2) arranged or suitable for being arranged on board a said ship (2).

15. A device according to claim 14, characterized in that said flexible pipes are floating pipes, floating on the surface over at least a fraction (3-5) of the distance between said support (1) and said ship (2), preferably of the methane tanker type.

16. A method of transferring a fluid, preferably a liquid or gaseous petroleum fluid, from a support (1) installed at sea, in grounded or floating manner (1-2, 1-1), preferably between a said support and a ship (2), preferably of the methane tanker type, arranged alongside or in tandem adjacent to said support (1) by means of a device according to claim 14 or claim 15, the method being characterized in that said liquid petroleum fluid, preferably liquid natural gas LNG, is transferred in two said first and second flexible pipes (3b, 3c), and then said first and second flexible pipes (3b, 3c) used for transferring the liquid product are purged by performing the following successive steps:

a. closing said first and second connection valves (22a-22b-22c, 27a-27b-27c), and disconnecting said first and second connection and valve devices (13-1, 13-2) from each other;

b. injecting gas into the first end (3-1) of a first flexible pipe (3b) from said support (1) and opening at least one said first communication valve (30bc) between said first flexible pipe (3b) and a second flexible pipe (3c) assembled to the same said first connection and

valve device (13-1), the other said first communication valves (30ac, 30ab) being closed; and then

c. closing said first communication valve (30bc) between said first and second pipes (3b, 3c) when said first pipe (3b) has been emptied sufficiently, and preferably substantially completely emptied.

17. A method according to claim 16, characterized in that after step c), said second flexible pipe (3c) is purged completely by performing the following successive steps:

d. injecting gas from the support (1) into said first end (3-1) of said second pipe (3c) and opening said first communication valve (30ac) between said second pipe (3c) and a third flexible pipe (3a) of smaller diameter than said second pipe so that the flow rate of purge gas is such that the speed of said gas is greater than 1.5 m/s, preferably greater than 3 m/s, more preferably greater than 5 m/s, said other first communication valves (30ab, 30bc) being closed; and

e. closing said first communication valve (30ac) between said second and third pipes (3c, 3a) when said second pipe (3c) has been emptied sufficiently, and preferably emptied substantially completely.

18. A method according to claim 16 or claim 17, characterized in that said storage device comprises a plurality of turntables (4-1) arranged one above another on which, when all of said flexible pipes have been purged sufficiently, said flexible pipes are rewound until the second ends (3-6) of all of said flexible pipes are above water, preferably with said first connection and valve device (13-1) coming just under the lowest of the turntables co-operating with one of said flexible pipes.

19. A method according to claim 18, characterized in that said first flexible pipe (3b) is wound on a said convex turntable as defined in claim 12.

20. A method according to claim 18 or claim 19, characterized in that at least one of said second and third pipes (3c, 3a) and preferably both of said second and third pipes (3c, 3a) used for transferring liquid, is (are) wound on a said frustoconical turntable of concave shape as defined in claim 13.

DECLARATION UNDER PCT ARTICLE 19

REPLY TO THE INTERNATIONAL SEARCH REPORT RELATING TO APPLICATION PCT/EP2011/070977
filed on November 24, 2011

In the name of SAIPEM S.A.

Entitled:
"Device for transferring fluid from a marine mounting"

Our ref.: H52 314 CAS 83 WO (MD/JP-B.12.018)
Filing number: PCT/EP2011/070977
Filing date: November 24, 2011

* * *

Please find herewith a new set of claims in which the claims have been amended as follows:

1) Claim 1:

- the term "stored or" has been deleted; and
- the term "fastened" has been replaced by the expression "suitable for being fastened".

2) In new claim 2, the following have been deleted:

- the expression "arranged or" from line 3 in order to limit the definition of the subject matter to a second connection and valve device (13-2) "suitable for being arranged on board said ship (2) ..."; and
- the expression "suitable for being connected", in order to limit the claimed subject matter to a second connection and valve device (13-2) connected to said first device.

3) In new claim 3, it is stated that said transfer device further comprises:

- a said support (1) ... and a said ship (2) ... arranged alongside or in tandem;
- a flexible pipe storage device (4) arranged on said support;
- said flexible pipes that are fastened at a first end (3-1) to a said storage device (4); and

- said flexible pipes extending between said floating support and said ship.

4) In new claim 4, it is stated that the pipe device has a second said connection and valve device (13-2) arranged on board said ship (2).

* * *

The support for these amendments is taken from initial claims 1 to 4.

New claims 5 to 8 correspond to old claims 3 to 6.

New claim 9 combines old claims 7 to 9.

Claims 10 to 20 are unchanged.

CLAIMS

1. A device for transferring fluid from a support (1) installed at sea, in grounded or floating manner (1-2, 1-1), preferably between a said support and a ship (2), preferably of the methane tanker type, arranged alongside or in tandem adjacent to said support (1), said fluid transfer device comprising a plurality, n, of flexible pipes (3a-3b, 3) that are stored or suitable for being stored on a said support (1) by means of a flexible pipe storage device (4) to which a first end (3-1) of each of said flexible pipes is fastened, said flexible pipes preferably being suitable for extending between said support (1) and a ship (2), preferably of the methane tanker type, arranged alongside or in tandem adjacent to said support (1), the device being characterized in that it comprises a first connection and valve device (13-1), said flexible pipes being connected together at their second ends (3-6) by said first connection and valve device (13-1), said first connection and valve device (13-1) having n preferably rigid first pipe portions (21a, 21b, 21c) held in preferably parallel fixed positions relative to one another, n being an integer not less than 3, each said first pipe portion (21a, 21b, 21c) comprising:

· at a first end, a first pipe coupling element (23-1a, 23-1b, 23-1c), preferably a male or female portion of an automatic connector);

· at its second end, a second coupling element, preferably a flange, assembled to the second end (3-6) of a said flexible pipe;

· each said first pipe portion (21a, 21b, 21c) including, between its two ends n-1 branch connections (30) enabling it to communicate with respective ones of the n-1 other said first rigid pipe portions, each said branch connection (30) including a first communication valve (30ab, 30bc, 30ac);

· a first connection valve (22a, 22b, 22c) situated between said first coupling element (23-1a, 23-1b, 23-1c) and said branch connection (30);

· said first pipe portions preferably being held parallel by a first rigid support (24) to which they are secured; and

· said first communication valves (30ab, 30ac, 30bc) preferably being butterfly valves and said first connection valves (22a, 22b, 22c) preferably being ball valves.

2. A device according to claim 1, characterized in that it comprises a second connection and valve device (13-2) arranged or suitable for being arranged on board a said ship (2), said first connection and valve device (13-1) being connected or suitable for being connected to said second connection and valve device (13-2), said second connection and valve device (13-2) comprising:

· n preferably rigid second pipe portions (26a, 26b, 26c);

· each said second pipe portion (26a, 26b, 26c) communicating or being suitable for communicating at one of its ends with a second tank (12) inside said preferably methane tanker type ship (2), and including at its other end a first complementary pipe coupling element (23-2a, 23-2b, 23-2c), said first complementary coupling element being suitable for co-operating in reversible coupling (23) with a said first coupling element (23-1a, 23-1b, 23-1c), said first complementary coupling element preferably being a female or male automatic connector portion (23-2a, 23-2b, 23-2c), respectively;

· said second pipe portions (26a, 26b, 26c) being held in preferably parallel fixed positions relative to one another so as to enable said first complementary coupling element (23-2a, 23-2b, 23-2c) to be coupled with said first coupling element (23-1a, 23-1b, 23-1c);

· each said second pipe portion (26a, 26b, 26c) having a second connection valve (27a, 27b, 27c) suitable for allowing or preventing fluid from flowing in said second pipe portion towards or from said first complementary coupling element when open or closed, respectively;

· said second pipe portions preferably being held parallel to one another by a second rigid support (25) to which they are secured; and

· said second connection valves (27a, 27b, 27c) preferably being ball valves.

3. A device according to claim 1 or claim 2, characterized in that said flexible pipes comprise at least one flexible pipe, a "first" flexible pipe (3b), preferably at least two flexible pipes, "first" and "second" flexible pipes (3b, 3c), suitable for transferring liquefied gas therein between said floating support and at least one second tank (12) of said ship (2), preferably of the methane tanker type, and of a third flexible pipe, preferably of diameter smaller than the diameter of said first and second pipes, within which gas corresponding to the gas ceiling of the second tank is suitable for being transferred from a said second tank (12) to a first tank within said floating support or to a liquefaction unit (1b) on a said support prior to being transferred to a said first tank (11).

4. A device according to any one of claims 1 to 3, characterized in that it comprises a said support (1) installed at sea, fitted on its surface with a storage and guide device (4) for storing and guiding flexible pipes (3, 3a-3b-3c) and suitable for storing and guiding a plurality of said flexible pipes, and preferably at least three of them, said storage and guide device comprising:

· a first carrier structure (5) resting on or secured to the deck (1c) of said support (1) close to a side (1d) of said support (1), preferably a longitudinal end wall of said support, said first carrier structure (5) supporting a plurality of circular turntables (4-1) arranged one above another;

· each of said turntables (4-1, 4a, 4b, 4c) being suitable for being driven in rotation in powered manner by a first motor (6) about a vertical central axis ZZ' independently of one another, preferably about the same vertical central axis ZZ', each turntable having a central orifice (4-2) surmounted by a central cylinder (4-3) against and around which a said flexible pipe (3, 3a, 3b, 3c) can be wound in concentric juxtaposed spiral turns of increasing diameter resting on the top face (4-1a) of said turntable, said central orifice (4-2) of said turntable being fitted with a rotary joint coupling (7) suitable for providing coupling between firstly a first end (3-1) that is closest to said central cylinder of a flexible pipe wound around said flexible cylinder, said first pipe end (3-1) being suitable for being driven in rotation together with said turntable, and secondly an end (8-1) of a stationary transfer pipe (8) having its other end in communication with at least one first tank (11) within said support (1); and

· a plurality of guide means (10, 10a, 10b, 10c), each said guide means being suitable for guiding the portion (3-2) of said pipe leaving a respective one of each of said turntables in continuity with the portion of pipe wound on said turntable, in such a manner that the various said pipe portions (3-2) leaving the various turntables are arranged in straight lines, being offset in different positions along a horizontal direction Y_1Y_1', parallel to said side, at different heights, and capable of adopting different orientations ($\alpha 1$, $\alpha 2$, $\alpha 3$) for their vertical axial planes (P1, P2, P3) relative to said horizontal direction Y_1Y_1' parallel to said side (1d).

5. A device according to claim 4, characterized in that at least one said flexible pipe (3) is wound, at least in part, against and around a said central cylinder (4-3) in concentric juxtaposed spiral turns of increasing diameters resting on said turntable (4-1), said central cylinder presenting a radius greater than the minimum radius of curvature of said flexible pipe, there being preferably at least three flexible pipes wound, at least in part, respectively on at least three said turntables, including at least one flexible pipe of diameter smaller than the others.

6. A device according to claim 4 or claim 5, characterized in that each guide means is arranged at a different height facing a respective one of each of said turntables so as to be suitable for supporting an intermediate curved pipe portion (3-3) between a downstream portion (3-4) of said pipe in a substantially vertical position beside said side (1d) and a said upstream pipe portion leaving the turntable (3-2) in continuity with the wound pipe poxtion resting on a said turntable, said upstream pipe portion (3-2) leaving the turntable extending on a virtual plane P that is substantially tangential to the surface of the top face (4-1a) of said turntable on which said wound pipe portion is wound, the various downstream pipe portions (4-4) in substantially vertical positions beside said side being arranged in positions that are offset relative to one another in a said direction Y_2Y_2' parallel to said side on leaving said sheaves.

7. A device according to claim 6, characterized in that each said guide means (10) comprises a sheave (10-1) mounted to revolve about a horizontal first axis of rotation Y_1Y_1', said sheave also being suitable for swiveling, preferably freely, about a vertical second

axis of rotation Z_1Z_1' extending along a diameter of the sheave, said first axis of rotation about which each said sheave revolves preferably being controlled by a second motor (10-6), preferably synchronously with said first motor (6) of each said turntable (4-1).

8. A device according to claim 7, characterized in that the various sheaves (10a, 10b, 10c) are arranged offset side by side relative to one another in said horizontal direction $Y_1Y'_1$ parallel to said side at different heights, the top of each sheave preferably being positioned substantially level with a plane P tangential to the top face (4-1a) of a said turntable (4-1).

9. A device according to claim 8, characterized in that each sheave is supported by a second carrier structure (10-2) arranged outside said floating support and fastened to a common side (1d) at a different position in a said horizontal direction Y_1Y_1' parallel to said side, each sheave being mounted to swivel about said vertical second axis of rotation Z_1Z_1' relative to a portion (10-4, 10-5) of its said second carrier structure fastened to said side (1d).

10. A device according to any one of claims 1 to 9, characterized in that each said turntable (4-1) includes or co-operates on its under face with wheels (4-5) suitable for co-operating with or respectively supported by elements (5a) of said carrier structure, and each said turntable including a bearing (4-4) at said central orifice, the bearing being secured to said carrier structure (5) and being suitable for enabling said turntable to rotate relative to said first carrier structure (5).

11. A device according to any one of claims 1 to 10, characterized in that at least one said turntable (4-1d) presents a top face (4-1a) that is plane and horizontal.

12. A device according to any one of claims 1 to 10, characterized in that at least one said turntable (4-1c) presents a top face of convex frustoconical shape, with an angle γ at the apex preferably lying in the range 160° to 178°.

13. A device according to any one of claims 1 to 10, characterized in that at least one said turntable (4-1b) presents a top face (4-1a) of concave frustoconical shape, with an angle γ at the apex preferably lying in the range 160° to 178°.

14. A device according to any one of claims 2 to 13, characterized in that it comprises a said support (1), a said storage device, preferably a storage and guide device, and at least two said flexible pipes (3), preferably via at least three flexible pipes (3a, 3b, 3c), extending between a said support (1) and a said ship (2), preferably of the methane tanker type, arranged alongside or in tandem adjacent to said floating support (1), at least some of said flexible pipes (3) being stored with the help of a said storage and guide device (4), said flexible pipes being fitted with a said first connection and valve device (13-1), connected to a said second connection and valve device (13-2) arranged or suitable for being arranged on board a said ship (2).

15. A device according to claim 14, characterized in that said flexible pipes are floating pipes, floating on the surface over at least a fraction (3-5) of the distance between said support (1) and said ship (2), preferably of the methane tanker type.

16. A method of transferring a fluid, preferably a liquid or gaseous petroleum fluid, from a support (1) installed at sea, in grounded or floating manner (1-2, 1-1), preferably between a said support and a ship (2), preferably of the methane tanker type, arranged alongside or in tandem adjacent to said support (1) by means of a device according to claim 14 or claim 15, the method being characterized in that said liquid petroleum fluid, preferably liquid natural gas LNG, is transferred in two said first and second flexible pipes (3b, 3c), and then said first and second flexible pipes (3b, 3c) used for transferring the liquid product are purged by performing the following successive steps:

a. closing said first and second connection valves (22a-22b-22c, 27a-27b-27c), and disconnecting said first and second connection and valve devices (13-1, 13-2) from each other;

b. injecting gas into the first end (3-1) of a first flexible pipe (3b) from said support (1) and opening at least one said first communication valve (30bc) between said first flexible pipe (3b) and a second flexible pipe (3c) assembled to the same said first connection and valve device (13-1), the other said first communication valves (30ac, 30ab) being closed; and then

c. closing said first communication valve (30bc) between said first and second pipes (3b, 3c) when said first pipe (3b) has been emptied sufficiently, and preferably substantially completely emptied.

17. A method according to claim 16, characterized in that after step c), said second flexible pipe (3c) is purged completely by performing the following successive steps:

d. injecting gas from the support (1) into said first end (3-1) of said second pipe (3c) and opening said first communication valve (30ac) between said second pipe (3c) and a third flexible pipe (3a) of smaller diameter than said second pipe so that the flow rate of purge gas

is such that the speed of said gas is greater than 1.5 m/s, preferably greater than 3 m/s, more preferably greater than 5 m/s, said other first communication valves (30ab, 30bc) being closed; and

e. closing said first communication valve (30ac) between said second and third pipes (3c, 3a) when said second pipe (3c) has been emptied sufficiently, and preferably emptied substantially completely.

18. A method according to claim 16 or claim 17, characterized in that said storage device comprises a plurality of turntables (4-1) arranged one above another on which, when all of said flexible pipes have been purged sufficiently, said flexible pipes are rewound until the second ends (3-6) of all of said flexible pipes are above water, preferably with said first connection and valve device (13-1) coming just under the lowest of the turntables co-operating with one of said flexible pipes.

19. A method according to claim 18, characterized in that said first flexible pipe (3b) is wound on a said convex turntable as defined in claim 12.

20. A method according to claim 18 or claim 19, characterized in that at least one of said second and third pipes (3c, 3a) and preferably both of said second and third pipes (3c, 3a) used for transferring liquid, is (are) wound on a said frustoconical turntable of concave shape as defined in claim 13.

CLAIMS

1. A device for transferring fluid suitable for being arranged from a support installed at sea, in grounded or floating manner, between a said support and a ship, arranged alongside or in tandem adjacent to said support, said fluid transfer device comprising a plurality, n, of flexible pipes that are suitable for being stored on a said support by means of a flexible pipe storage device to which a first end of each of said flexible pipes is suitable for being fastened, said flexible pipes being suitable for extending between said support and a ship arranged alongside or in tandem adjacent to said support, wherein the device comprises a first connection and valve device, said flexible pipes being connected together at their second ends by said first connection and valve device, said first connection and valve device having n first pipe portions held in fixed positions relative to one another, n being an integer not less than 3, each said first pipe portion comprising:

· at a first end, a first pipe coupling element, which is a male or female portion of an automatic connector;

· at its second end, a second coupling element, assembled to the second end of a said flexible pipe;

· each said first pipe portion including, between its two ends n-1 branch connections enabling it to communicate with respective ones of the n-1 other said first rigid pipe portions, each said branch connection including a first communication valve;

· a first connection valve situated between said first coupling element and said branch connection;

· said first pipe portions being held by a first rigid support to which they are secured.

2. A device according to claim 1, wherein it comprises a second connection and valve device suitable for being arranged on board of a said ship, said first connection

and valve device being connected to said second connection and valve device, said second connection and valve device comprising:

· n second pipe portions;

· each said second pipe portion communicating or being suitable for communicating at one of its ends with a second tank inside said ship, and including at its other end a first complementary pipe coupling element, said first complementary coupling element being suitable for co-operating in reversible coupling with a said first coupling element, said first complementary coupling element being a female or male automatic connector portion, respectively;

· said second pipe portions being held in fixed positions relative to one another so as to enable said first complementary coupling element to be coupled with said first coupling element;

· each said second pipe portion having a second connection valve suitable for allowing or preventing fluid from flowing in said second pipe portion towards or from said first complementary coupling element when open or closed, respectively.

3. A device according to claim 1 or claim 2, wherein it comprises:

· a said support installed at sea, in grounded or floating manner , and a said ship, , arranged alongside or in tandem adjacent to said support; and

· a said flexible pipe storage and guide device arranged on said support; and

· said flexible pipes that are fastened at a first end to a said storage device, said flexible pipes extending between said floating support and said ship.

4. A device according to claim 2 and claim 3, wherein it further comprises a second said connection and valve device, arranged on board a said ship.

5. A device according to claim 2 or claim 3, wherein said flexible pipes comprise at least one flexible pipe, a "first" flexible pipe, suitable for transferring liquefied gas therein between said floating support and at least one second tank of said ship, and of a third flexible pipe, within which gas corresponding to the gas ceiling of the second tank is suitable for being transferred from a said second tank to a first tank within said floating support or to a liquefaction unit on a said support prior to being transferred to a said first tank.

6. A device according to any one of claims 1 to 5, wherein it comprises a said support installed at sea, fitted on its surface with a storage and guide device for storing and guiding flexible pipes and suitable for storing and guiding a plurality of said flexible pipes, said storage and guide device comprising:

· a first carrier structure resting on or secured to the deck of said support close to a side of said support , said first carrier structure supporting a plurality of circular turntables arranged one above another;

· each of said turntables (being suitable for being driven in rotation in powered manner by a first motor about a vertical central axis ZZ' independently of one another, about the same vertical central axis ZZ', each turntable having a central orifice surmounted by a central cylinder against and around which a said flexible pipe can be wound in concentric juxtaposed spiral turns of increasing diameter resting on the top face of said turntable, said central orifice of said turntable being fitted with a rotary joint coupling suitable for providing coupling between firstly a first end that is closest to said central cylinder of a flexible pipe wound around said flexible cylinder, said first pipe end being

suitable for being driven in rotation together with said turntable, and secondly an end of a stationary transfer pipe having its other end in communication with at least one first tank within said support ; and

· a plurality of guide means, each said guide means being suitable for guiding the portion of said pipe leaving a respective one of each of said turntables in continuity with the portion of pipe wound on said turntable, in such a manner that the various said pipe portions leaving the various turntables are arranged in straight lines, being offset in different positions along a horizontal direction $Y_1Y'_1$ parallel to said side, at different heights, and capable of adopting different orientations ($\alpha 1$, $\alpha 2$, $\alpha 3$) for their vertical axial planes (P1, P2, P3) relative to said horizontal direction Y_1Y_1' parallel to said side.

7. A device according to claim 6, wherein at least one said flexible pipe is wound, at least in part, against and around a said central cylinder in concentric juxtaposed spiral turns of increasing diameters resting on said turntable, said central cylinder presenting a radius greater than the minimum radius of curvature of said flexible pipe, there being preferably at least three flexible pipes wound, at least in part, respectively on at least three said turntables, including at least one flexible pipe of diameter smaller than the others.

8. A device according to claim 6 or claim 7, wherein each guide means is arranged at a different height facing a respective one of each of said turntables so as to be suitable for supporting an intermediate curved pipe portion between a downstream portion of said pipe in a substantially vertical position beside said side and a said upstream pipe portion leaving the turntable in continuity with the wound pipe portion resting on a said turntable, said upstream pipe portion leaving the

turntable extending on a virtual plane P that is substantially tangential to the surface of the top face of said turntable on which said wound pipe portion is wound, the various downstream pipe portions in substantially vertical positions beside said side being arranged in positions that are offset relative to one another in a said direction Y_2Y_2' parallel to said side on leaving said sheaves.

9. A device according to claim 8, wherein:

· each said guide means comprises a sheave mounted to revolve about a horizontal first axis of rotation Y_1Y_1', said sheave also being suitable for swiveling, about a vertical second axis of rotation Z_1Z_1' extending along a diameter of the sheave, said first axis of rotation about which each said sheave revolves being controlled by a second motor, · the various sheaves are arranged offset side by side relative to one another in said horizontal direction $Y_1Y'_1$ parallel to said side at different heights, the top of each sheave being positioned substantially level with a plane P tangential to the top face of a said turntable; and in that

· each sheave is supported by a second carrier structure arranged outside said floating support and fastened to a common side at a different position in a said horizontal direction Y_1Y_1' parallel to said side, each sheave being mounted to swivel about said vertical second axis of rotation Z_1Z_1' relative to a portion of its said second carrier structure fastened to said side.

10. A device according to any one of claims 6 to 9, wherein each said turntable includes or co-operates on its under face with wheels suitable for co-operating with or respectively supported by elements of said carrier structure, and each said turntable including a bearing at said central orifice, the bearing being secured to said carrier structure and being suitable for enabling said

turntable to rotate relative to said first carrier structure.

11. A device according to any one of claims 6 to 10, wherein at least one said turntable presents a top face that is plane and horizontal.

12. A device according to any one of claims 6 to 10, wherein at least one said turntable presents a top face of convex frustoconical shape, with an angle γ at the apex lying in the range 160° to 178°.

13. A device according to any one of claims 6 to 10, wherein at least one said turntable presents a top face) of concave frustoconical shape, with an angle γ at the apex lying in the range 160° to 178°.

14. A device according to any one of claims 2 to 13, wherein it comprises a said support, a said storage device, and at least two said flexible pipes, extending between a said support and a said ship , arranged alongside or in tandem adjacent to said floating support, at least some of said flexible pipes being stored with the help of a said storage and guide device, said flexible pipes being fitted with a said first connection and valve device, connected to a said second connection and valve device arranged or suitable for being arranged on board a said ship.

15. A device according to claim 14, wherein said flexible pipes are floating pipes, floating on the surface over at least a fraction of the distance between said support and said ship.

16. A method of transferring a liquid petroleum fluid, from a support installed at sea, in grounded or floating manner, between a said support and a ship, arranged

alongside or in tandem adjacent to said support by means of a device according to claim 14 or claim 15, wherein said liquid petroleum fluid is transferred in two said first and second flexible pipes, and then said first and second flexible pipes used for transferring the liquid product are purged by performing the following successive steps:

a. closing said first and second connection valves, and disconnecting said first and second connection and valve devices from each other;

b. injecting gas into the first end of a first flexible pipe from said support and opening at least one said first communication valve between said first flexible pipe and a second flexible pipe assembled to the same said first connection and valve device, the other said first communication valves being closed; and then

c. closing said first communication valve between said first and second pipes when said first pipe has been emptied sufficiently.

17. A method according to claim 16, wherein after step c), said second flexible pipe is purged completely by performing the following successive steps:

d. injecting gas from the support into said first end of said second pipe and opening said first communication valve between said second pipe and a third flexible pipe of smaller diameter than said second pipe so that the flow rate of purge gas is such that the speed of said gas is greater than 1.5 m/s, said other first communication valves being closed; and

e. closing said first communication valve between said second and third pipes when said second pipe has been emptied sufficiently.

18. A method according to claim 16 or claim 17, wherein said storage device comprises a plurality of turntables arranged one above another on which, when all of said

flexible pipes have been purged sufficiently, said flexible pipes are rewound until the second ends of all of said flexible pipes are above water, with said first connection and valve device coming just under the lowest of the turntables co-operating with one of said flexible pipes.

19. A method according to claim 18, wherein said first flexible pipe is wound on a said convex turntable as defined in claim 12.

20. A method according to claim 18 or claim 19, wherein at least one of said second and third pipes is (are) wound on a said frustoconical turntable of concave shape as defined in claim 13.