

MOBILE SUPPORT FOR EXAMINING A WALL

It is known to be important in the field of safety to constantly ensure that the walls of a tank for transporting liquefied natural gas are in a good state, and so it is important to be able to regularly inspect the state of the walls of such tanks. Specifically, it has been observed that, after a certain period of use, the metallic membranes which bound the interior of these tanks are likely to have deformations, cracks or insulation damage, in particular in top wall regions. It is thus very desirable to be able to move an inspection material to a very small distance from the wall to be inspected, and in the current state of the art the method used is unsatisfactory.

It has already been proposed, in Japanese Patent Application 58-189296, filed on 12 October 1983, to use a floating balloon encased in a protective envelope; such an envelope carries gas detectors on the outside, said gas detectors constituting the materials for inspecting the wall of a tank for transporting liquefied natural gases. The balloon is retained by tethers fixed to the floor of the tank. However, only the inspection materials fixed to the top region of the envelope can be positioned in the vicinity of the top wall; those which are on the sides of the envelope can only play their role for the inclined walls of the tank corners and provided that they are located in a meridian plane of the balloon perpendicular to the wall to be inspected, and this entails moving the tethers on the ground in order to position the balloon. Furthermore, it is necessary to multiply the number of inspection materials carried by the balloon, and this makes it necessary to increase the

size of the balloon in order to support the increased weight; and finally, the tank corner region opposite which the balloon is located when it is substantially tangential to the top wall and to an oblique wall, can never be examined. Moreover, since positioning is carried out manually by the operators, this is relatively imprecise.

The first subject of the present invention is a mobile support for an instrument for the acquisition of at least one item of information carried by an examined element independent of the support, said support comprising:

- a main cradle which is subjected to a rising or descending vertical motive force,
- a secondary cradle to which there are connected a plurality of flexible mechanical links for exerting a retention force that keeps the support balanced with respect to the vertical motive force, the lengths of the flexible mechanical links being modifiable in order to cause the support to move in a working volume, and
- an articulation connecting the main cradle to the secondary cradle.

According to one embodiment, this articulation comprises a gimbal, such that the orientation of the main cradle is kept constant with respect to the vertical direction by the vertical motive force.

In a preferred embodiment of the invention, the retention force is exerted on the secondary cradle by at least three flexible mechanical links that are each connected to a reference plane by one of their ends; the support comprises motors that are located in the

reference plane and are able to adjust the length of the flexible mechanical links in order to move the support with respect to the reference plane. When the examined element is the top wall of a tank, the reference plane may be, for example, the floor of the tank.

According to a first variant, the vertical motive force which is exerted on the primary cradle is a descending, that is to say downwardly directed, weight force generated by the mass linked to the main cradle, the secondary cradle being disposed above the main cradle; in this variant, the mass linked to the main cradle may be that of this cradle and the instruments carried thereby, but it may also be increased by an additional mass that makes it easier to maintain the orientation of the main cradle with respect to the reference plane. This variant is very particularly useful for examining and inspecting the state of a pit bottom, the secondary cradle then being suspended on its flexible mechanical links in order to retain all of the support according to the invention above the pit bottom to be examined.

In a second variant, the vertical motive force which is exerted on the main cradle is rising, that is to say upwardly directed, buoyancy generated by a hollow body connected to the main cradle, the secondary cradle being disposed beneath the main cradle. The hollow body may be a balloon, the wall of which is made for example of polyurethane or some other material, the filling gas of the balloon being helium. Such a hollow body may be spherical or cylindrical or have any other suitable shape. According to a preferred embodiment, the hollow body is connected to the main cradle by flexible

mechanical tethers that are kept in a taut state by the upwardly directed buoyancy. It may advantageously be provided for the hollow body to comprise a sphere and for the flexible mechanical tethers associated therewith to allow limited rotation of the sphere with respect to the main cradle by acting on the length of said tethers, the centre of rotation being the centre of the sphere.

It is preferred for the instrument for the acquisition of at least one item of information carried by the examined element to be loaded onto a plate fixed to the sphere associated with the main cradle, said plate being counterbalanced by a counter-plate symmetrical to the plate with respect to the centre of the sphere. The flexible mechanical tethers may be secured to the wall of the sphere by one of their ends and, by their other end, to an adjusting device that is disposed on the main cradle and acts on the length of said tethers in order to produce a rotation of the sphere through a desired angle. The counter-plate may carry batteries used for supplying power to the motors of the adjusting devices and for controlling the attitude of the main cradle. The adjusting device is advantageously able to produce a rotation of the sphere through an angle of between 0° and at least 90° in at least one meridian plane, preferably in all of the meridian planes, of said sphere.

Alternatively, an electric power supply cable can be provided between the ground and the cradle in order to ensure the electric power supply of the motors and other installed electrical units.

The connection between the main cradle and the sphere may be produced by means of at least two, for example four, flexible metallic tethers, the attachment

points of which to the sphere are located 180° or 90° apart on one and the same circle of the sphere, the plane of which is at a distance from the centre of the sphere, said circle being horizontal in a reference position of the sphere with respect to the main cradle. Advantageously, each flexible mechanical tether is associated with a guide element, the at least two guide elements being carried on the wall of the sphere and being disposed 180° or 90° apart on an equatorial circle of the sphere which is in a plane parallel to the circle in which the attachment points of the at least two flexible mechanical tethers on the sphere are located; each flexible mechanical tether, in the vicinity of its associated guide element, may be covered with a sheath that prevents friction thereof against the sphere. Each guide element may comprise at least one damping stop in order to prevent the inspected element being damaged by the support in the event of the balloon pressing against or striking said examined element.

According to embodiments, the articulation between the main cradle and the secondary cradle has a degree of pivoting freedom about a vertical axis. In this case, the support may comprise an actuator able to bring about a pivoting movement of the main cradle about the vertical axis. According to embodiments, this actuator comprises a motor mounted on the articulation or a blower mounted on the balloon.

In a preferred embodiment, the instrument for the acquisition of at least one item of information carried by the examined element comprises a video camera and/or a thermal imaging camera and/or a gas detector, for example for helium.

Another example of an instrument which may be mounted on the mobile support is a liquid-film applicator, for example for implementing a method for detecting leaks as described in FR-A-2952715.

5 According to embodiments, the mobile support further comprises an instrumentation cradle that includes:

- a main platform connected under the secondary cradle by a cable,
- a winch that is able to adjust the length of the
- 10 cable, allowing a vertical movement of the main platform with respect to the secondary cradle,
- an information acquisition instrument carried by the platform.

According to embodiments, the instrumentation cradle

15 further includes:

- a secondary platform, and
- a second articulation,

the secondary platform being connected to the bottom of the main platform by the second articulation, the

20 acquisition instrument being suspended from the secondary platform.

According to embodiments, the secondary platform further includes an actuator that is able to act on the acquisition instrument in order to adjust an orientation

25 of the acquisition instrument with respect to the secondary platform.

The second subject of the invention is the use of a support as defined above for examining and/or inspecting the state of the walls of a closed chamber or of a tank;

30 the tank examined and/or inspected may be a tank for transporting liquefied natural gas, the wall of said tank comprising a primary metallic membrane.

Finally, the third subject of the invention is the use of a support for which the vertical motive force is a downward weight force, for inspecting and/or monitoring the state of the walls of a pit.

5 One idea underlying the invention is to propose a mobile support for carrying (an) information acquisition instrument(s), said mobile support being able to be moved with respect to an examined element that is not attached to the support, both for identifying with precision the
10 position of the point observed on the examined element and also for moving the instrument(s) close enough to the examined element to make it possible to acquire information that is impossible to detect from a distance. Certain aspects of the invention proceed from the idea of
15 avoiding any risk of impact between the mobile support used and the examined element, which may be fragile. Certain aspects of the invention are based on the fact that the support is separated into two parts, one which is subjected to a vertical motive force in order to move
20 closer to the examined element and which carries the observation instrument, and the other which moves the support opposite the examined element, and that the two parts are connected by a gimbal in order to avoid repercussion by reaction between the movements imparted
25 on each of the two parts.

To explain the subject of the invention more clearly, two embodiments shown in the appended drawing will now be described by way of purely illustrative and nonlimiting example.

30 In this drawing:

- Figure 1 is a diagram showing the structure of a support according to the first variant of the invention used for inspecting the bottom of a pit;
- 5 -- Figures 2 to 9 show the structure of a support according to the second variant of the invention;
- Figure 2 schematically shows a support according to the second variant of the invention used for examining the top wall of a tank for transporting liquefied natural gas;
- 10 -- Figure 3 shows the position of the various members shown in Figure 2 when the examination of the top wall is carried out on the oblique panels by way of which the top wall is connected to the vertical walls of the tank;
- 15 -- Figure 4A shows, on a larger scale, the support used for the embodiment shown in Figures 2 and 3, said Figure 4A showing the various members in the position corresponding to the examination of the top wall of the tank;
- 20 -- Figure 4B shows the device from Figure 4A when the various members are in the position which corresponds to the examination of a vertical wall of the tank;
- 25 -- Figure 5 shows the support from Figure 4A wherein the tethers are equipped, in the vicinity of the guide element corresponding thereto, with a sheath that prevents friction of the tether against the sphere to which it is connected;
- 30 -- Figure 6 schematically shows the way of fixing the guide elements to the sphere which supports them;

- Figure 7 schematically shows a section along VII-VII in Figure 6;
- Figure 8 schematically shows a second embodiment of the support according to the second variant of the invention;
- Figure 9 schematically shows a third embodiment of the support according to the second variant of the invention.

With reference to Figure 1, it can be seen that the support consists of a main cradle 1 and a secondary cradle 2, the two cradles being connected together by an articulation of the gimbal type, which may be produced for example by a universal ball joint 3. The secondary cradle 2 is disposed above the main cradle 1. The main cradle 1 carries a video camera 4 on its lower surface and it carries a mass 5 placed on its upper surface in the vicinity of the attachment of the connection between the two cradles.

The secondary cradle 2 is connected to a frame 6 by means of four flexible mechanical links 7; each flexible link 7 has one end connected to the secondary cradle 2 and its other end connected to a winch motor 8. By acting on the winch motors 8, it is possible to move the support formed by the two cradles parallel to a reference plane, which, in the example described, is the bottom 9 of a pit.

It can thus be understood that the support which has just been described can be moved with respect to the bottom 9 by acting on the length of the flexible mechanical links 7 by means of the winches 8; in this way, the region of the bottom 9, which is observed by the video camera 4, can be identified perfectly and

positioned on the bottom; the effect of the total mass of the main cradle 1 including the additional mass 5 makes it possible to maintain the orientation of this cradle 1 with respect to the secondary cradle 2 and thus to maintain the observation distance from the bottom 9 at the desired value.

Figures 2 to 9 show the second variant embodiment in which the mobile support comprises a main cradle 11 which is connected to a secondary cradle 12 by a gimbal-type connection produced by means of a universal ball joint 13. The main cradle 11 is disposed above the secondary cradle 12 and is connected by flexible mechanical tethers 15 to a spherical balloon which has the general reference 14. The balloon 14 consists of a polyurethane wall; the filling gas of the balloon is helium. Given the relative densities of helium and air, the balloon 14 exerts vertically upwardly directed buoyancy on the main cradle 11, said buoyancy constituting a vertical motive force to which the main cradle 11 is subjected. The secondary cradle 12 is retained by four flexible mechanical links 17, the ends of which opposite the cradle are each connected to a winch motor 18.

The mobile support which has just been quickly described is intended to be set up to examine the walls of a tank for transporting liquefied natural gas and the winches 18 are fixed to the bottom part of the vertical walls of the tank. The spherical balloon 14 is equipped with a plate 16 which is at a tangent to the sphere and is kept thereon by four attachments which are disposed at angles to the plate and the ends of which are adhesively bonded to the spherical wall. The balloon 14 also comprises a counter-plate 19 symmetrical to the plate 16

with respect to the centre of the spherical balloon 14, this counter-plate being intended to counterbalance the plate 16 in order to make it easier to rotate the sphere 14 that forms the balloon about itself.

5 The mechanical connection between the sphere 14 and the main cradle 11 is carried out by virtue of four tethers 15 which are each connected by one of their ends to the main cradle 11 and by their other end to the wall of the sphere 14. The attachment points of the tethers 15
10 to the sphere 14 are distributed at 90° intervals around a circle of the sphere, said circle being located at a certain distance from the centre of said sphere; the attachment points of the tethers 15 have the reference 20. Each tether 15 is connected by its end, which is not
15 secured to the wall of the sphere 14, to an adjusting device 15a disposed on the main cradle 11; this adjusting device acts on the length of the tethers 15 in order to produce a rotation of the sphere about the angle that is
20 desired. In Figure 4A, it can be seen that the plate 16, which carries a video camera 21, is located close to the top wall 22 of the tank where the support according to the invention is operational; the counter-plate 19 is
25 connected to the wall of the sphere 14 in the same way as the plate 16 and it carries batteries 23 which allow the adjusting devices that act on the length of the tethers 15 to function.

When the circle of attachment points 20 is in a plane parallel to the top wall of the tank, the tethers are in the position shown in Figure 4A. By contrast, if
30 it is desired to turn the sphere 14 about its centre, as shown in Figure 3, in this case, one tether is shortened and the diametrically opposite tether is lengthened,

thereby causing the plate 16 to be positioned opposite the oblique panel 24 of the tank to be examined, said oblique panel 24 connecting the top wall of the tank to a vertical wall. This possibility of rotating the sphere 14 makes it possible to place the instruments carried by the plate 16 opposite any desired point on the wall of the tank, not just the top wall 22 and the oblique panel 24, but also the vertical walls of the tank, as is shown in Figure 4B.

It is clear that, in order to come into the position shown in Figure 4B, at least one tether 15 has changed position with respect to the wall of the sphere 14. Guide elements having the general reference 25 are provided in the equatorial plane of the sphere 14. In Figures 4A and 4B, it can be seen that the equatorial plane, where the guide elements 25 are distributed at 90° intervals, has turned through 90° about a horizontal axis that passes through the centre of the sphere 14. The design of the guide elements 25 is shown in detail in Figures 6 and 7. Each guide element is carried by a sheet 26 which is fixed to the wall of the spherical balloon 14; each sheet 26 is fixed by four attachments 27, the ends 27a of which are secured to the wall of the balloon 14; this type of fixation is the same as that used for fixing the plate 16 and the counter-plate 19. Each guide element 25 consists of two parts between which the tether 15 can slide freely while being retained at the sheet 26.

With reference to Figure 5, it can be seen that the tethers 15 will rub, in the vicinity of the guide elements 25, against the spherical wall of the balloon 14; in order to avoid damage to the material during the rotation of the spherical balloon 14, a sheath 28 that

acts as a bearing and prevents damage to the spherical wall has been provided for each tether 15, in the vicinity of its associated guide element 25.

5 In the embodiments in Figures 8 and 9, the same reference signs are used for elements similar or identical to those in Figures 2 to 7.

10 In the embodiment in Figure 8, the articulation between the main cradle 11 and the secondary cradle 12 has only one degree of pivoting freedom about a vertical axis, obtained by means of a pivot connection 20 which replaces the abovementioned ball joint 13. The pivot 30 can be equipped with an actuator, for example an electric motor having a notched wheel, making it possible to bring about at will a relative pivoting movement of the main
15 cradle 11 connected to the balloon 14 with respect to the secondary cradle 12 retained by the flexible links 17.

In the embodiment in Figure 9, the vertical pivot 130 is a passive pivot which is not motorized. The rotation of the balloon 14 and of the main cradle 11 is
20 obtained by actuating blowers 31 fixed to the periphery of the balloon 14 so as to create a tangential force.

By virtue of the degree of freedom of the balloon 14 about the vertical axis, it is possible to simplify the degrees of freedom between the balloon 14 and the main
25 cradle 11. In particular, it is sufficient to provide adjustable inclination of the balloon in a single meridian plane, by actuating only two diametrically opposite tethers 15. It is also possible to combine all of the abovementioned degrees of freedom, for example in
30 order to allow a highly directional measuring instrument to be aimed very precisely.

In the embodiment in Figure 8, it is possible also to provide the ball joint 13 between the cradles 11 and 12 in order to maintain the attitude of the main cradle 11. In the embodiment in Figure 9, the secondary cradle consists of a small ring (not shown) to which the links 17 are connected. In this case, the stability of the main cradle 11 results from the fact that the ring acting as the attachment point for the links 17 exerts no substantial tipping moment on account of its small size. Furthermore, the vertical pivot prevents tangling of the links.

As was indicated above, the mobile support shown in Figures 2 to 9 allows the walls of a tank for transporting liquid natural gas to be examined with precise positioning of each observed region on the wall and no matter which wall region is being subjected to the inspection. It is possible in particular to examine the upper corners of the tank in order to detect, as the case may be, localized deformations in the primary metallic membrane of the tank or cracks, even those which are scarcely visible, since the observation instruments can be moved, in a stable manner, very close to the wall of the tank.

The mobile support is driven in the tank by virtue of motors that control the length of the links 17. There are N of these motors, N being an integer greater than or equal to 3, and they are disposed at fixed locations in the tank, for example at the corners of the bottom wall. During the movement of the mobile support, 3 motors are drivers (active) and $N-3$ motors are followers (passive). The reference plane in this case designates the plane of the 3 driver motors.

Given that the position of the N motors is known, these motors can be driven by digital control, in a preprogrammed manner, for example in order to carry out a systematic scan or to follow a predetermined path. It is also possible for this driving to be carried out under the manual control of an operator and/or to influence driving by dynamically taking into account information acquired during the movement, for example in order to carry out profile tracking by image recognition, to follow a measured concentration gradient, etc.

The embodiments shown in Figures 2 to 9 allow an inspection of the top part of the tank. On account of the way in which the mobile support functions, certain bottom parts of the tank can remain inaccessible for inspection. This problem is due to the fact that the winches 18 are located beneath the balloon, at such a distance that the maintaining forces in the cables risk becoming too high when the balloon moves towards the level of the winches 18. This force when the balloon is equidistant from the four motors is equal to $F/(4 \cdot \tan(\alpha))$, F being the lift of the balloon and alpha the angle produced by the cables with respect to the horizontal. Thus, with the above embodiments, the bottom part of the tank can only be inspected manually by one or more operators.

Since automatic inspection is quicker and more reliable than manual inspection, an automated solution for inspecting the floor of the tank is advantageous. The embodiment in Figures 10 and 11 proposes automating the complete inspection of the top part and bottom part of a tank simultaneously, while resolving the limitation introduced by the maximum force absorbable by the pulleys.

In the embodiment in Figures 10 and 11, the same reference signs are used for elements similar or identical to those in Figures 2 to 9.

5 With reference to Figure 10, the system for inspecting the top part of a tank 22 is supplemented by a system for inspecting the bottom part.

10 The principle is that of suspending an inspection cradle having the general reference 100 from the secondary cradle 112. This secondary cradle 112 includes the features of the secondary cradle 12, to which have been added the features connected with the suspension. This inspection cradle 100 is intended to carry out the inspection of the bottom part of the tank. This inspection cradle 100 can be equipped with sensors and
15 measuring instruments in the same way as the balloon. The inspection cradle 100, subjected to the effects of gravity, is positioned in a manner vertically aligned with the balloon 14. The inspection cradle 100 follows the movements of the balloon 14 in the horizontal space
20 of the tank. Furthermore, the inspection cradle 100 is driven along the vertical axis, independently of the driving of the balloon 14.

25 The inspection cradle 100 includes a primary platform 106, a secondary platform 102, a gimbal 101, and gas detectors 104. The inspection cradle 100 also includes stays 105.

30 The primary platform 106 is kept vertically aligned with the balloon by a flexible cable 103 that makes it possible to adjust the height of the primary platform 106 between the balloon and the floor of the tank 22. The secondary platform 102 is connected to the bottom of this primary platform 106 with the aid of an articulation of

the gimbal type 101, which can be realized for example by a universal ball joint. The instrumentation platform is connected to the secondary platform 102 (shown in Figure 11) by the stays 105.

5 This arrangement makes it possible to inspect a bottom part comprising horizontal planes and oblique planes.

10 The gimbal 101 makes it possible to decouple the main platform 106 from the secondary platform 102, in order to ensure the stability of the secondary platform 102. Thus, any orientation disturbances caused by the movements of the balloon and propagated by the cable 103, or those of the main platform 106, are damped. This limits the undesirable movements of the instruments
15 during measurements. In addition, the secondary platform 102 weighs in a balanced manner on the main platform 106. This reduces disturbances by the inspection cradle 100 on the balloon.

20 The way in which the inspection cradle 100 functions will be understood better from studying Figure 11. It can be seen therein that the inspection cradle 100 is suspended from the secondary cradle 112 by the cable 103. The secondary cradle 112 includes pulleys 114. Furthermore, the primary platform 106 includes pulleys
25 110 and a motor 111. As in the previous embodiments, the balloon is maintained by the flexible mechanical links 17 and the primary cradle 11 is tied to the balloon 14 by the tethers 15.

30 In order to inspect the bevels and vertical walls on the one hand and to take better advantage of this solution on the other hand, the height of the inspection cradle 100 is controlled by adjusting the length of the

cable 103 which connects the primary platform 106 to the secondary platform 112 of the balloon 14. By driving a motor 111, the inspection cradle 100 rises or descends just like the cabin of an elevator. The motor 111 setting a winch into motion acts on the length of the cable 103 which passes through the pulleys 110 and 114. This embodiment makes it possible in particular to correctly position the inspection cradle 100 while limiting the rotation thereof about the vertical axis on the one hand but also about its fixing point on the other hand.

The instrumentation platform 113 includes a frame 114 and, at the end of rods 115, the detectors 104. The detectors 104 are positioned in the plane of the instrumentation platform 113, on two rods 115 which cross one another perpendicularly. A fifth detector 104 is disposed at the intersection of the two rods at right angles to the plane formed by the two rods 115, in the opposite direction to that of the balloon 14.

According to an alternative embodiment, the secondary platform 102 includes means for adjusting the length of the four stays 105 in order to position the instrumentation platform 113 vertically. In this embodiment, the adjusting means make it possible to position the instrumentation platform 113 as desired at one of the four anchoring points of the four stays 105. These adjusting means may be for example motors having pulleys, cylinders, or the like.

The embodiment in Figure 10 has the advantage of being able to inspect the bottom part of the vertical walls, while the equipment present on the balloon 14 inspects the top part.

The descending mobile support shown in Figure 1 and the ascending mobile support shown in Figure 2 are based on similar operating principles, the difference between them being mainly an inversion in the sense of the vertical direction. Elements which have been described with reference to one of the two cases are also generally applicable to the other case.

The mobile support can be used furthermore in different fields, for example for monitoring the external structure of a bridge or of a building, the inspection of glazing or the inspection of a ceiling of a theatre. Depending on the situation, a greater or smaller number of links and motors can be necessary. For example, the inspection of a vertical wall could be carried out with only two links and two motors positioned at the top or bottom of the wall.

CLAIMS

1. Mobile support for an information acquisition instrument (21), said support comprising:

- a main cradle (11) which is subjected to a rising vertical motive force,

5 - a secondary cradle (12) to which there are connected a plurality of flexible mechanical links (17) for exerting a retention force that keeps the support balanced with respect to the vertical motive force, the lengths of the flexible
10 mechanical links being modifiable in order to cause the support to move in a working volume, and
 - an articulation (13) connecting the main cradle (11) to the secondary cradle (12),

characterized in that the rising vertical motive force is
15 buoyancy generated by a hollow body (14) connected to the main cradle (11) by flexible mechanical tethers (15) that are kept in a taut state by said buoyancy, the secondary cradle (12) being disposed beneath the main cradle (11) and the flexible mechanical tethers (15) allowing limited
20 rotation of the hollow body (14) with respect to the main cradle (11) by action on the length of said tethers (15), the centre of said rotation being the centre of the hollow body (14).

2. Support according to Claim 1, characterized in
25 that the articulation (13) comprises a gimbal in order that the orientation of the main cradle is kept constant with respect to the vertical direction by the vertical motive force.

3. Support according to either of Claims 1 and 2,
30 characterized in that the articulation between the main

cradle (11) and the secondary cradle (12) has a degree of pivoting freedom about a vertical axis.

4. Support according to Claim 3, characterized in that it comprises an actuator able to bring about a pivoting movement of the main cradle about the vertical axis.

5. Support according to one of Claims 1 to 4, characterized in that the retention force is exerted on the secondary cradle (12) by at least three flexible mechanical links (17) that are each connected to a reference plane by one of their ends.

6. Support according to Claim 5, characterized in that it comprises motors (18) that are located in the reference plane and are able to adjust the length of the flexible mechanical links (17) in order to move the support with respect to the reference plane.

7. Support according to one of Claims 1 to 6, characterized in that the hollow body (14) is a balloon, the filling gas of which is helium.

8. Support according to one of Claims 1 to 7, characterized in that the information acquisition instrument (21) is loaded onto a plate (16) fixed to the hollow body (14) associated with the main cradle (11), said plate (16) being counterbalanced by a counter-plate (19) symmetrical to the plate (16) with respect to the centre of the hollow body (14).

9. Support according to one of Claims 1 to 8, characterized in that the flexible mechanical tethers (15) are secured to the wall of the hollow body (14) by one of their ends and, by their other end, to an adjusting device (15a) that is disposed on the main cradle (11) and acts on the length of said tethers (15)

in order to produce a rotation of the hollow body (14) through a desired angle.

10. Support according to Claim 9, characterized in that the adjusting device (15a) is able to produce a
5 rotation of the hollow body (14) through an angle of between 0° and at least 90° in at least one meridian plane of the sphere.

11. Support according to one of Claims 1 to 10, characterized in that the connection between the main
10 cradle (11) and the hollow body (14) is produced by means of at least two flexible mechanical tethers (15), the attachment points (20) of which to the hollow body (14) are located 180° apart on one and the same circle of the hollow body (14), the plane of which is at a distance
15 from the centre of said hollow body (14), said circle being horizontal in a reference position of the hollow body (14) with respect to the main cradle (11).

12. Support according to Claim 11, characterized in that each flexible mechanical tether (15) is associated
20 with a guide element (25), the guide elements being carried on the wall of the hollow body (14) and being disposed on an equatorial circle of said hollow body which is in a plane parallel to the circle in which the attachment points (20) of the at least two flexible
25 mechanical tethers (15) on the hollow body (14) are located.

13. Support according to Claim 12, characterized in that each flexible mechanical tether (15), in the vicinity of its associated guide element (25), is covered
30 with a sheath (28) that prevents friction of the tether (15) against the hollow body (14).

14. Support according to either of Claims 12 and 13, characterized in that each guide element (25) comprises at least one damping stop in order to prevent the inspected element being damaged by the support in the event of the hollow body (14) pressing against or striking said examined element.

15. Support according to one of Claims 1 to 14, further comprising an instrumentation cradle that includes:

- a main platform (106) connected under the secondary cradle (112) by a cable (103),
- a winch (111) that is able to adjust the length of the cable (103), allowing a vertical movement of the main platform (106) with respect to the secondary cradle (112),
- an information acquisition instrument (21) carried by the platform.

16. Support according to Claim 15, further including:

- a secondary platform (102), and
- a second articulation (101),

the secondary platform (102) being connected to the bottom of the main platform (106) by the second articulation (101), the acquisition instrument being suspended from the secondary platform (102).

17. Support according to Claim 16, in which the secondary platform (102) further includes an actuator that is able to act on the acquisition instrument (104) in order to adjust an orientation of the acquisition instrument (104) with respect to the secondary platform (102).

18. Support according to one of Claims 1 to 17, in which the information acquisition instrument (21) comprises at least one instrument selected from the group formed by a video camera, a thermal imaging camera, a gas
5 detector and a dimensional measurement sensor.

19. Support according to one of Claims 1 to 18, in which the hollow body is spherical or cylindrical.

20. Use of a support according to one of Claims 1 to 19 for examining and/or inspecting the state of the
10 walls of a closed chamber or of a tank.

21. Use according to Claim 20, characterized in that the tank examined and/or inspected is a tank for transporting liquefied natural gas, the wall of said tank comprising a primary metallic membrane.