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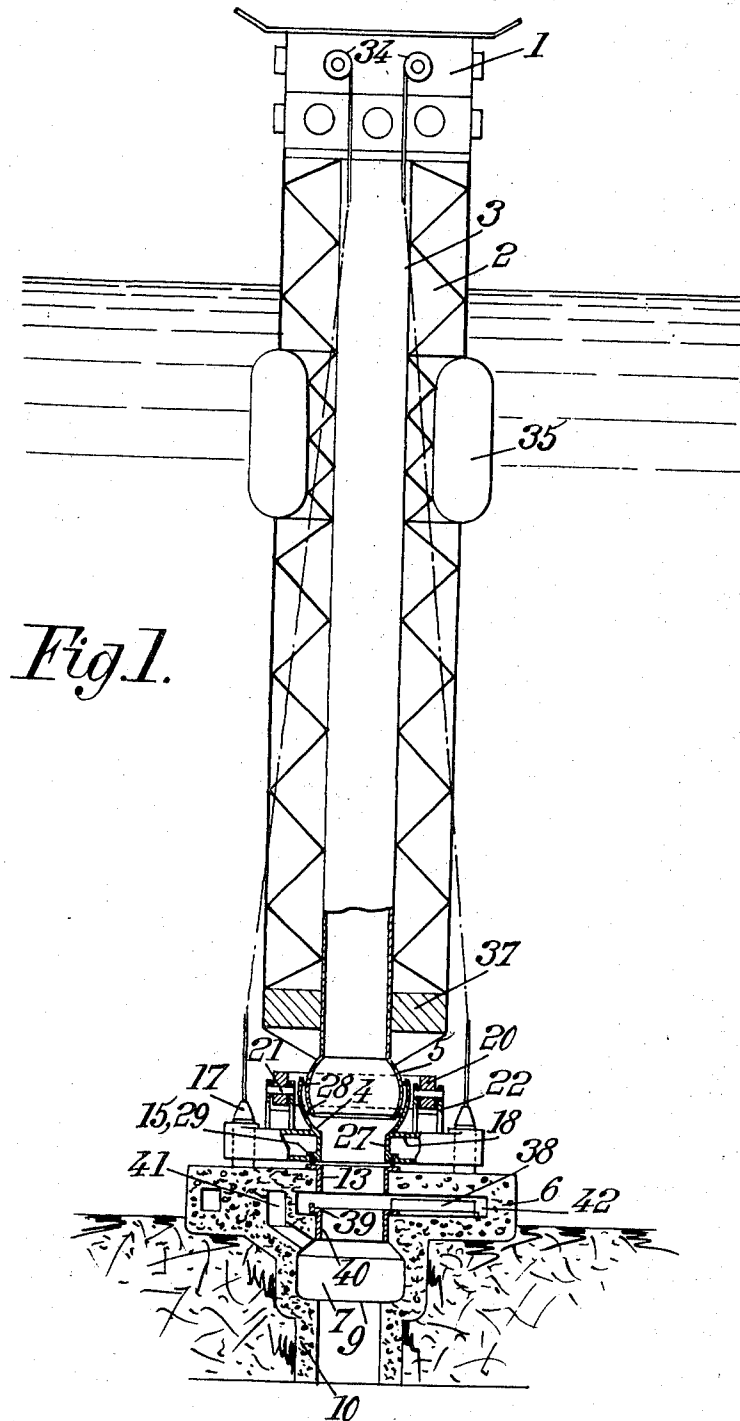
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3,522,709

MARINE PLATFORM STRUCTURE

Filed Feb. 19, 1968

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

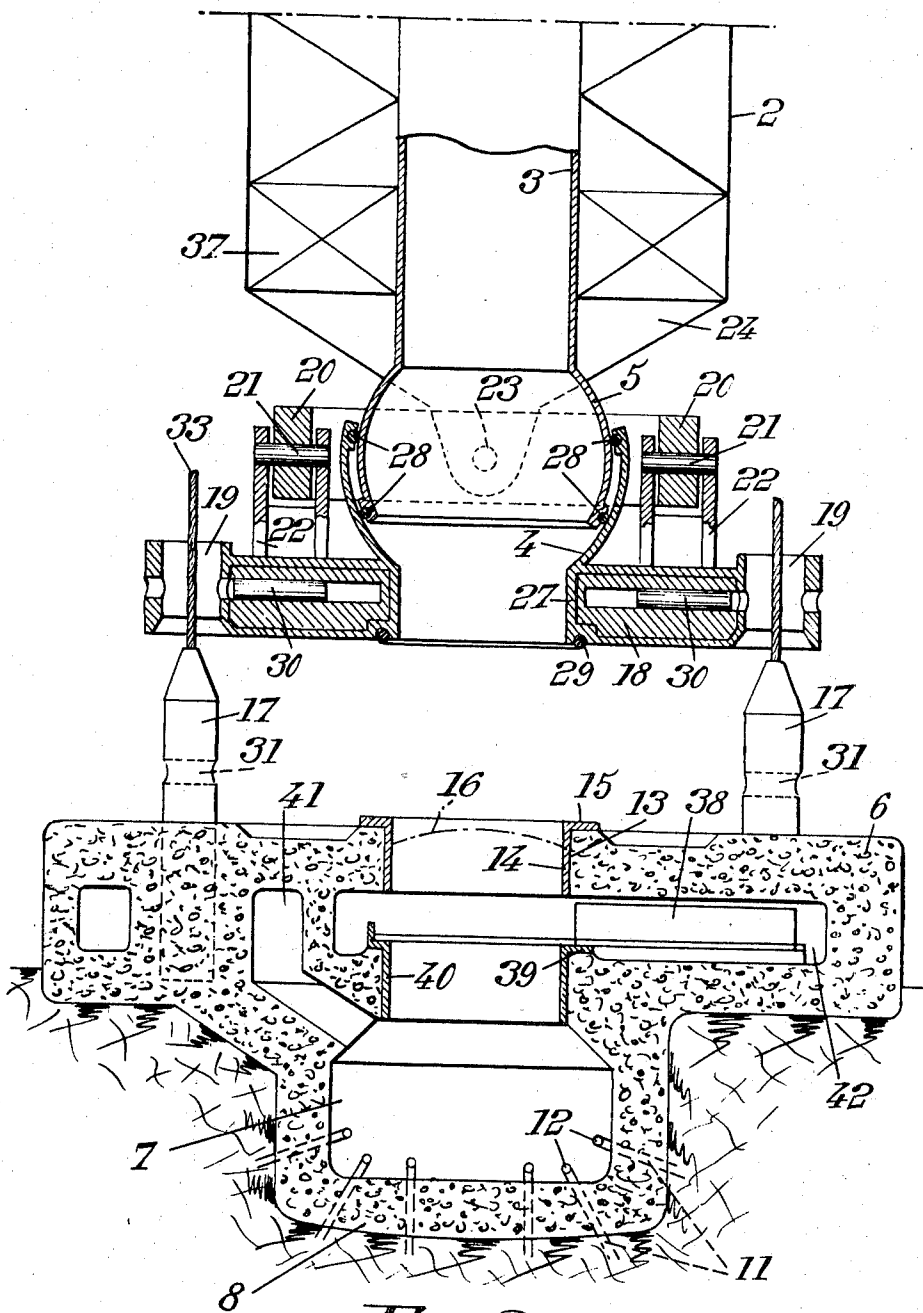


Fig. 2.

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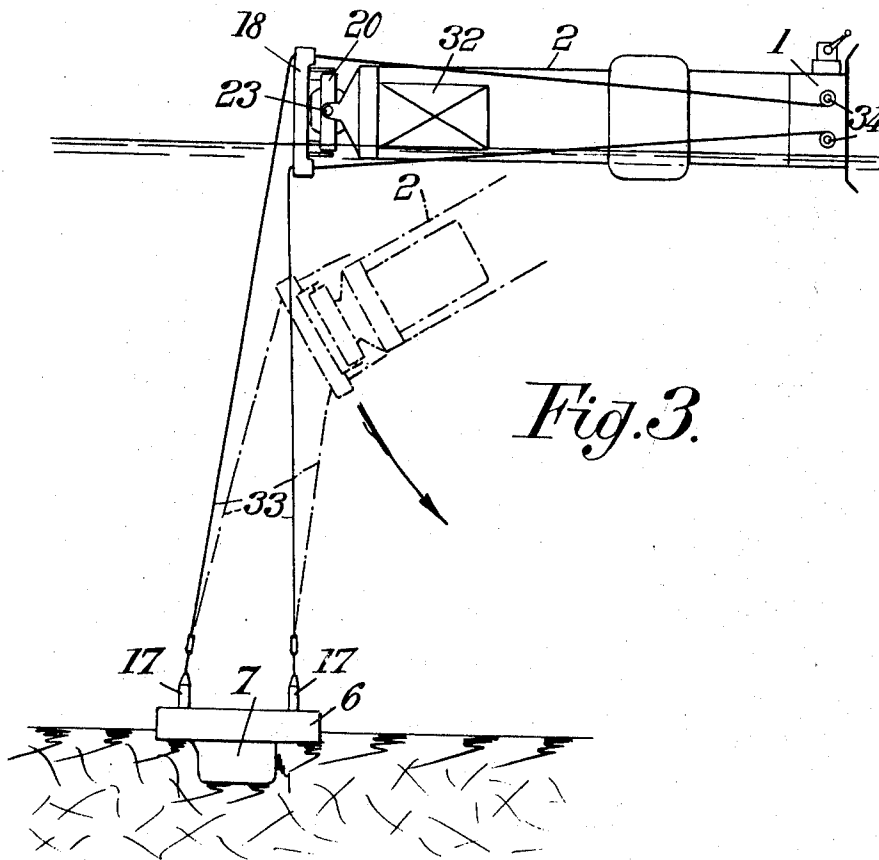
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MARINE PLATFORM STRUCTURE

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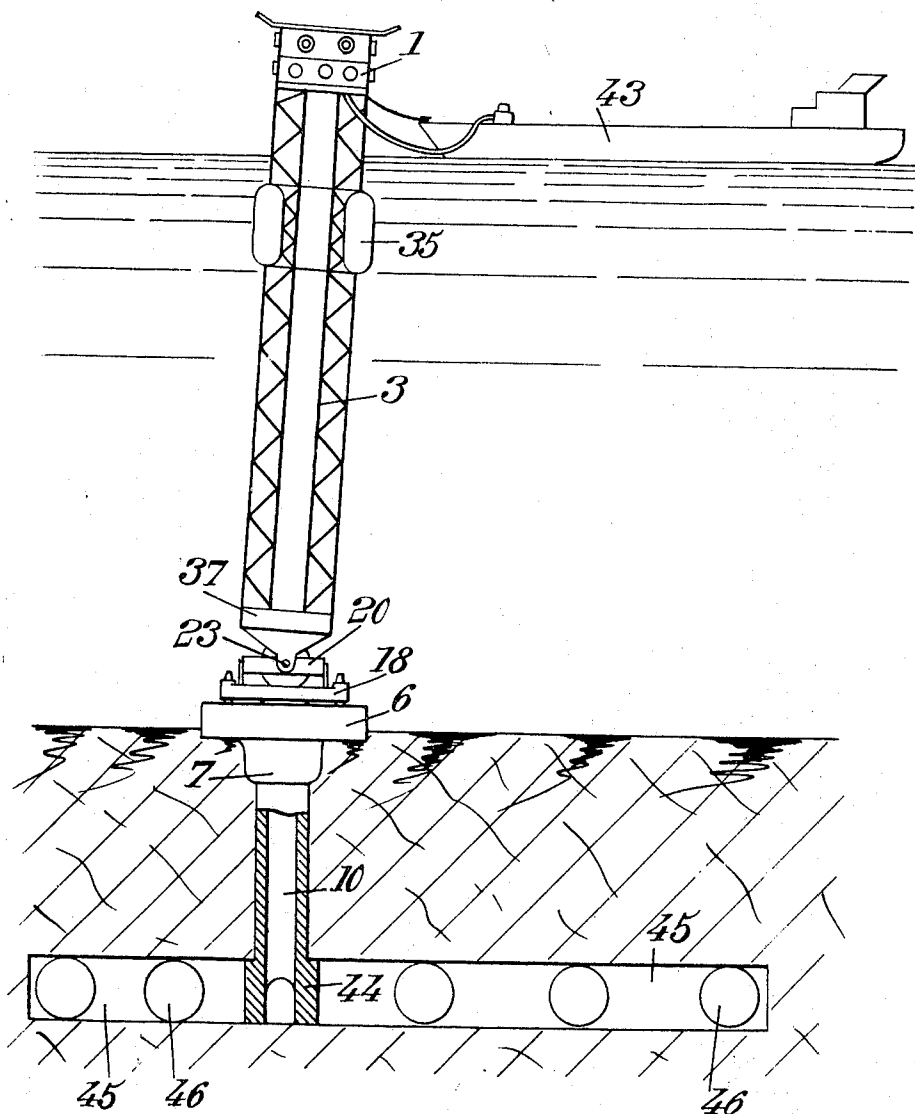
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Fig. 4.



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MARINE PLATFORM STRUCTURE

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U.S. Cl. 61—46.5

22 Claims

ABSTRACT OF THE DISCLOSURE

The marine platform structure is movably articulated at its bottom to a base, which is constructed independently and fixed first to the marine bed. The base comprises initially a water tight work chamber. The overall platform structure is combined with a plate mounted at the bottom of the structure to receive the articulation. This plate is brought into the correct position, by appropriate guiding means, above the base to be fixed to the base.

The present invention relates to marine platform structures of the type used for sub-marine works; in structures of this kind, the platform proper is carried by a support-tower movably articulated to the corresponding marine bed. In the present specification the term "marine" is used in a very general sense, and includes both salt and fresh water, seas, lakes, rivers, etc.

An object of the present invention is to provide marine platform structures that are particularly easy to mount.

According to the present invention, in order to support the articulation of these marine platform structures, a base is used, constructed independently of the structure and adapted to be fixed first to the marine bed in question, this base comprising initially a water tight work chamber, and the overall platform structure is combined with a plate mounted at the bottom of the structure to receive the articulation, which plate is brought into the correct position, by appropriate guiding means, on top of the base, to be fixed to this base.

Apart from this principal feature, the invention includes certain other features which are preferably used at the same time, namely:

A second feature according to which, in an articulated structure such as mentioned above, the structure is ballasted at its bottom and is provided with floats in the region of its upper part to assure the hydrostatic stability,

A third feature according to which the articulations of these structures are established in the form of a universal joint leaving, at the interior, a free passage of large diameter, and

A fourth feature—relating to structures of the type in question that comprise a base hollow at the lower part, in particular for the entrance of a drill-hole—according to which this base is provided with an obturator system permitting the base, and possibly also the drill-hole, to be isolated when desired.

A preferred embodiment of a marine platform structure according to the invention will now be described, merely by way of example, with reference to the accompanying drawings, in which:

FIG. 1 shows schematically in vertical section the platform structure applied to a drilling rig,

FIG. 2 shows, on a larger scale, the part of this structure intended to be fixed to the sub-marine bed,

FIG. 3 is a schematic view showing the mounting of the platform on its base, and

FIG. 4 shows the platform structure applied to a sub-marine storage installation.

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A marine platform structure according to the present invention is particularly suitable for drilling applications (sounding, drilling for oil, etc.), although these platform structures are also suitable for other applications, such as, for example, sub-marine storage of hydrocarbons, as will be seen later on.

Oscillating platforms, that is to say platforms which are articulated at their bottom, are already known, such as those described in French Pat. No. 1,418,802 and French Patent of Addition No. 86,230 of the same inventor; such platforms can, due to their articulation, oscillate freely in the swell.

According to the present invention, various means are provided which permit the articulated anchorage to the ground to be assured in a particularly simple and rapid manner. In addition, these means are arranged to permit the penetration, below the sea bottom, of wells of sufficient diameter for personnel and material to pass easily therethrough.

According to one of the principal features of the invention in particular, the structure is articulated, at its bottom, to a base constructed independently of that structure and adapted to be fixed, at the beginning of the operations, to the sea bottom, this base initially comprising a water tight work chamber to facilitate fixing the base in place.

In FIG. 1, the platform proper 1 can be seen, mounted on a metal tower structure 2 surrounding a central well 3 leading to an articulation 4, 5 (FIG. 2), in order to be fixed to the base 6, arranged for example in the manner illustrated in FIG. 2.

According to the embodiment of FIG. 2, this base 6 is constructed for example of concrete, on land, and brought to the desired region by any system of floats.

The base comprises at the interior a work chamber 7, of suitable dimensions, terminating at its bottom by a wall 8 (FIG. 2) intended subsequently, once the platform structure has been put in place, to be perforated at 9 (FIG. 1) for the passage to a well 10, visible in FIG. 1, drilled under the sea as a continuation of the well 3.

The walls of this chamber or of this base can comprise metal tubes 11 provided with appropriate obturators 12 for permitting consolidation injections to be effected in the terrain, if that proves to be necessary, before the drilling of the well 10.

At the upper part, that is to say on the side near to the platform to be fixed in an articulated manner, the base comprises at least one passage such as 13, advantageously provided with a metal casing 14 which flares outwardly at 15 to form a seal support, as indicated hereafter. During the positioning in place, this passage 13 is obturated by a provisional partition 16 fixed to the casing 14 (FIG. 2).

The base 6 is furthermore provided with centering and guiding means permitting the correct positioning in place of the lower end of the above mentioned structure, that is to say of the support for the articulation 4, 5.

These means can comprise a certain number of cylindrical pins 17 (FIG. 2), provided on the top of the base 6 and adapted to engage, during mounting, in a plate 18, which is generally of metal, provided at the bottom of the structure.

This plate 18 thus has a double function, namely, on the one hand, to assure the seating on the base 6 of the tower structure 2, for which purpose this plate 18 comprises openings 19 through which pass the pins 17, and on the other hand, to support the system of articulation, which is preferably of the universal joint type, but leaving at the interior a passage sufficient for the communication between the two wells 3 and 10, the plate 18 comprising a cased passage at 27.

In FIGS. 1 and 2, an embodiment has been shown of

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this universal joint system, which provides in particular:
On the one hand, a ring 20 articulated about aligned spindles 21 carried by supports 22 rigid with the plate 18, and

On the other hand, two other spindles at 90°, shown at 23, these spindles being carried by supports 24 of the structure and being journaled in the ring 20 (FIG. 2).

This unit, which forms a universal joint, is completed by means for assuring the tightness between the two wells 3 and 10, or between the well 3 and the interior of the base 6; these means comprise, for example, two spherical portions 4, 5 respectively rigid with the plate 18 and the well 3, these portions being one inside the other and co-acting with at least two seals or joints 28 on the sides of these portions.

The joints assure in series the tightness of the oscillating assembly between the fixed and movable parts of the well unit. One of these joints can be dismantled from the interior, the other from the exterior.

Means are provided for assuring the tightness between the base 6 and the plate 18, once this plate is in place; these means comprise, for example, a sealing joint 29 disposed at the outlet of the passage 27 and adapted to bear against the flange 15 of the passage 13, 14.

In addition, locking means are provided for maintaining the plate 18 in place, once mounted; in the present embodiment these means are bolts 30 adapted to penetrate into grooves or holes 31 of the pins 17 (FIGS. 1 and 2), these bolts being maneuverable from a distance by any appropriate apparatus, not shown.

FIG. 3 illustrates the mounting of the tower structure 2, together with the platform proper 1 and the plate 18, on the base 6. The tower structure 2 is brought to the region in question by flotation (for example with the aid of floats, some of which are shown at 35). The structure is tipped to bring the plate 18 towards the base 6, and simultaneously, guiding means are employed, comprising cables passing through the holes 19 mentioned above (or through any others) of the plate 18.

To tip the structure, water-ballasts such as shown schematically at 32 in FIG. 3 can be used.

As for the cables mentioned above, shown at 33 in FIG. 3, they are fixed at one end to the pins 17, and at the other end, after passing through the holes 19, to winches 34 carried by the platform 1. In this manner, by pulling on the cables with the aid of the winch, the exact positioning of the plate 18 on its base can be assured, the holes 19 being guided by the cables towards the pins 17.

In a preferred embodiment, the structure 2, 3 can first of all be tipped into vertical position by regulating the ballast in such a manner that the structure emerges slightly higher than in its final position, and the cables are only attached once this first operation is completed. The cables are then drawn by means of winches 34, while aiding, if necessary, the descent of the column by ballast, whereby the holes 19 are brought into engagement on the pins 17, after which the bolts 30 lock the structure in place.

The mounting in place is thus effected in the best conditions, and moreover, the water tightness is perfectly assured.

It remains to empty the ballasts such as 32, and possibly the floats 35 if they had been partially filled, as well as the central well 3. Next, the seating of the base 6 can be consolidated by injections of cement; henceforth the personnel can have free access to the base 6. The drilling of the well 10 through the bottom 8 (FIG. 2) of the chamber 7 can then be begun.

It should be noted that, in its operative position, the overall platform structure is advantageously stabilized by the fact that a ballast 37 is provided at its base, whereas, at the upper part, floats 35—or any other similar means—tend to create a thrust increasing the stability. The articulation protects against the effects of the swell.

In any case, the dissociation, which is a characteristic

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of the invention, between the heavy base 6 on the one hand, and the lighter plate 18 on the other hand (intended to support the articulation), is of a nature, not only to facilitate the transport and mounting, but to assure a more rational construction in all regards.

The base 6 is advantageously completed, according to a supplementary feature of the invention, by any safety obturator means, permitting the interior chamber 7 of the base 6 to be isolated when desired from the well 3 that the structure comprises or can comprise.

This obturator is visible at 38 in FIGS. 1 and 2, in its open position. It is slidably mounted, being intended to coact with the seat 39 of a passage 40. Such an obturator can be useful in numerous cases, in particular when at least two wells are united by a subterranean gallery; in this case, certain works can necessitate the isolation with respect to a structure 2, 3.

At 41, recesses are shown intended to balance the empty space 42 necessitated by the passage for the obturator, so that the centre of gravity of the base 6 is maintained on the axis.

From the foregoing it is clear, in particular, that the invention permits the realization of platforms provided with central wells, with the possibility of giving to this well, and consequently to the bore hole proper, very large dimensions permitting the easy passage of personnel and of material.

From this point of view, the invention lends itself not only to drilling, but also to any other installation comprising sub-marine wells.

Thus, there is shown in FIG. 4 a sub-marine storage installation using a platform according to the invention.

This platform 1, 2, 3, is mounted in an articulated manner at its bottom on a base 6 that has been superabundantly concreted, in a manner to constitute a very resistant anchoring mass. In this manner, the platform 1 can be used as an anchorage for large oil tankers such as shown at 43.

The well 10 leads to the storage installation proper, shown at 44, this installation comprising galleries 45, 46 in which the fuel can be stored.

It is known that such an installation is particularly desirable, taking into account the tendency towards a considerable increase in the tonnage of oil tankers. Such an installation would thus make it possible to avoid the entry of oil tankers into the ports.

Several solutions can be provided for the storing and the recovery of the fuel, according as the parts of the installation not filled with fuel are connected to the atmosphere or on the contrary are subjected to the hydrostatic pressure of the sea.

In the first case, the pumps for recovering the stored product will be located at the level of the bottom of the installation, for example in a lateral gallery.

In the second case, the hydrostatic pressure could be used to drive the lighter fuel upwards, whereas pumps should be provided at the level of the surface of the sea to force the fuel to enter into the reservoirs, against the action of the hydrostatic pressure.

In the supplementary case in which the fuel product is obtained under pressure from eruptive wells, the pumps can evidently be dispensed with.

Finally, if it is true that the various applications which precede comprise platform structures with a central well 3, the invention is also applicable to structures which do not comprise such a well, the invention having, even in this case, obvious advantages with respect to the anchorage on the submarine bottom by the base such as 6.

Regardless of the embodiment chosen, the present invention provides platforms whose operation is apparent from the foregoing. These platforms have numerous advantages with respect to the prior art, in particular:

The advantage of facilitating considerably both the transportation to the site in question and the assembling of the structure,

The advantage of permitting large cross-sections for the passage of personnel and material,

The advantage of lending itself to numerous different applications in which platforms are used, and

The advantage of assuring the necessary water tightness.

Although the invention has been specifically described with reference to a particular embodiment and to two applications, the invention should not be limited thereto, as various modifications to the structure and various other applications are possible, without departing from the spirit or scope of the invention.

What I claim is:

1. A marine platform structure comprising:

a supporting member adapted to be fixed in a given depth of water to a base on the marine bed,

mounting means on said supporting member for positioning said supporting member on said base, said mounting means further serving as guide means for directing said supporting member toward said base to ensure proper engagement between the supporting member and the base,

an articulation mounted on said supporting member, a tower structure mounted at one end on said articulation such that said tower structure is movably articulated to said supporting member,

at least one float mounted on said tower structure at a position to assure, when said supporting member is fixed to said base, the hydrostatic stability of said tower structure such that said tower structure orients itself generally vertically,

said tower structure being of sufficient height to project out of the water at said given depth, when said supporting member is fixed to said base.

2. A marine platform structure according to claim 1 further comprising said base, said supporting member being fixed on said base.

3. A marine platform structure according to claim 2 further comprising fastening means for fixing said supporting member to said base, said fastening means comprising upstanding pins mounted on said base and fitting into corresponding holes formed in said supporting member, and movable bolts mounted in said supporting member for penetrating into corresponding recesses formed in said pins.

4. A marine platform structure according to claim 3 wherein said holes formed in said supporting member form guides for guiding said supporting member into position on said base.

5. A marine platform structure according to claim 1 wherein said articulation which movably articulates said tower structure to said supporting member is in the form of a universal joint.

6. A marine platform structure according to claim 5 wherein said universal joint comprises a ring, said ring being rotatably mounted on two diametrically opposed first spindles mounted on said supporting member and forming a first axis of articulation, and the said one end of said tower structure being rotatably mounted on two diametrically opposed second spindles mounted on said ring and forming a second axis of articulation at right angles to said first axis.

7. A marine platform structure according to claim 1 wherein said articulation which movably articulates said tower structure to said supporting member is in the form of two co-operating spherical portions forming a ball and socket joint.

8. A marine platform comprising:

a base, constructed independently, and fixed on the marine bed,

a supporting member on said base,

means to affix said supporting member to said base, an articulation mounted on said supporting member,

a tower structure mounted at its bottom end on said articulation such that said tower structure is movably articulated to said supporting member,

said tower structure being hydrostatically stable such

that it orients itself generally vertically, and

said tower structure projecting out of the water and having a platform mounted on a part of said tower structure that projects out of the water.

9. A marine platform structure according to claim 8 wherein ballast is provided at its lower part, and floats are provided near its upper part, but below the surface of the water, to assure the hydrostatic stability.

10. A marine platform structure according to claim 8 wherein said articulation is in the form of a universal joint.

11. A marine platform structure according to claim 10 wherein said universal joint leaves at its interior a free passage of large diameter for access therethrough by personnel servicing said marine platform structure.

12. A marine platform structure according to claim 8 wherein said base comprises an interior chamber and an obturator for isolating said interior chamber.

13. A marine platform structure according to claim 8 wherein said base is provided with means for injecting cement for assuring the fastening of the base to the marine bed.

14. A marine platform structure according to claim 8 wherein said supporting member is in the form of a plate and wherein guiding means are provided for guiding said plate together with said tower structure down onto said base which is fixed on the marine bed, said guiding means comprising pins fixed to said base for fitting into holes formed in the plate.

15. A marine platform structure according to claim 14 wherein, to position the plate correctly on said pins, cables are fixed to these pins and pass through said holes in the plate, said cables being fastened to at least one winch mounted on said platform, whereby traction on the cables brings the plate into the correct position.

16. A platform structure according to claim 8 wherein said supporting member is in the form of a plate and wherein said articulation between said tower structure and said plate is in the form of a universal joint comprising a ring, said ring being rotatably mounted on two diametrically opposed first spindles mounted on said plate and forming a first axis of articulation, and the bottom end of said tower structure being rotatably mounted on two diametrically opposed second spindles mounted on said ring and forming a second axis of articulation at right angles to said first axis.

17. A platform structure according to claim 16 wherein said tower structure comprises a pipe disposed longitudinally of said tower structure, said pipe ending with a first spherical portion centred at the centre of said ring and of smaller diameter than said ring, a second, concentric, spherical portion being mounted on said plate, and one of said spherical portions being disposed inside the other with the interposition of seals between said two spherical portions, whereby said two spherical portions co-operate to permit relative articulation therebetween, said pipe and said co-operating spherical portions forming a sealed passage which is extended through said plate.

18. A marine platform structure according to claim 8 wherein sealing means in the form of packings are provided between said plate and said base.

19. A marine platform structure according to claim 8 combined with an installation for sub-marine storage.

20. A marine platform structure according to claim 8 wherein said base comprises a water-tight work chamber.

21. A marine platform structure comprising:

a supporting member adapted to be fixed in a given depth of water to a base on the marine bed,

an articulation in the form of a universal joint mounted on said supporting member,

a tower structure mounted at one end on said articulation such that said tower structure is movably articulated to said supporting member, and

at least one float mounted on said tower structure at a position to assure, when said supporting member is fixed to said base, the hydrostatic stability of said

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tower structure such that said tower structure orients itself generally vertically, said tower structure being of sufficient height to project out of the water at said given depth when said supporting member is fixed to said base.

22. A marine platform structure according to claim 21 wherein said universal joint comprises a ring, said ring being rotatably mounted on two diametrically opposed first spindles mounted on said supporting member and forming a first axis of articulation, and the said one end of said tower structure being rotatably mounted on two diametrically opposed second spindles mounted on said ring and forming a second axis of articulation at right angles to said first axis.

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