

PATENT APPLICATION



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TITLE OF THE INVENTION

5 "ARTICULATED MULTIPLE BUOY MARINE PLATFORM APPARATUS
AND METHOD OF INSTALLING SAME"

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CROSS-REFERENCE TO RELATED APPLICATIONS

10 Priority is hereby claimed to US Patent Application Serial No. 09/727,343, filed
29 November 2000, which is incorporated herein by reference.

Priority is hereby claimed to US Patent Application Serial No. 09/704,998, filed
2 November 2000, which is incorporated herein by reference.

Priority is hereby claimed to US Patent Application Serial No. 09/693,470, filed
20 October 2000, which is incorporated herein by reference.

15 STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR
DEVELOPMENT

Not applicable

REFERENCE TO A "MICROFICHE APPENDIX"

Not applicable



159159

20 BACKGROUND

The present invention relates to floating marine platforms in deep water
environments (e.g., over 1500 feet or 450 meters) and methods of installing same. More
particularly, the present invention relates to a novel multiple buoy platform that supports
a platform with a plurality of buoys and method of installing same.

25 In an alternate embodiment the present invention relates to a method wherein
multiple buoys can be used as part of an installation method to place a marine platform
upon a single spar support.

In an alternate embodiment the present invention relates to a novel specially
configured multiple device support enabling replacement of one device while the other
30 supports the platform.

Many types of marine platforms have been designed, patented and used

commercially. Marine platforms typically take the form of either fixed platforms that include a large underwater support structure or "jacket" or a floating platform having a submersible support. Sometimes these platforms are called semi-submersible rigs.

Jack-up barges are another type of platform that can be used in an offshore marine environment for drilling/production. Jack-up barges have a barge with long legs that can be powered up for travel and powered down to elevate the barge above the water.

Other types of platforms for deep water (1500 feet or 450 meters or deeper) have been patented. The September 2000 issue of Offshore Magazine shows many floating offshore platforms for use in deep water drilling and/or production. Some of the following patents relate to offshore platforms, some of which are buoy type offshore platforms, all of which are hereby incorporated herein by reference. Other patents have issued that relate in general to floating structures, and include some patents disclosing structures that would not be suitable for use in oil and gas well drilling and/or production.

15	PATENT #	ISSUE DATE	TITLE
	2,952,234	13 September 1960	Sectional Floating Marine Platform
	3,540,396	17 November 1970	Offshore Well Apparatus and System
	3,982,492	28 September 1976	Floating Structure
	4,286,538	01 September 1981	Multipurpose Floating Structure
20	4,297,965	03 November 1981	Tension leg Structure for Tension Leg Platform
	4,620,820	04 November 1986	Tension Leg Platform Anchoring Method and Apparatus
	5,197,825	30 March 1993	Tendon for Anchoring a Semisubmersible
25	5,423,632	13 June 1995	Compliant Platform With Slide Connection Docking to Auxiliary Vessel Platform
	5,439,060	08 August 1995	Tensioned Riser Deepwater Tower
	5,558,467	24 September 1996	Deep Water offshore Apparatus
30	5,706,897	13 January 1998	Drilling, Production, Test, and Oil Storage Caisson

	5,722,797	03 March 1998	Floating Caisson for Offshore Production and Drilling
	5,799,603	01 September 1998	Shock-Absorbing System for Floating Platform
5	5,873,416	23 February 1999	Drilling, Production, Test, and Oil Storage Caisson
	5,931,602	03 August 1999	Device for Oil Production at Great Depths at Sea Storage Caisson
10	5,924,822	20 July 1999	Method for Deck Installation on an Offshore Substructure
	6,012,873	11 January 2000	Buoyant Leg Platform With Retractable Gravity Base and Method of Anchoring and Relocating the Same
15	6,027,286	22 February 2000	Offshore Spar Production System and Method for Creating a Controlled Tilt of the Caisson Axis
	GB 2 092 664		Ball-and-Socket Coupling for Use in Anchorage of Floating Bodies

20 One of the problems with single floater type marine platform constructions is that the single floater must be enormous, and thus very expensive to manufacture, transport, and install. In a marine environment, such a structure must support an oil and gas well drilling rig or production platform weighing between 5,000 and 40,000 tons (5,080,250kg and 40,642,000 kg), for example (or even a package of between 500-100,000 tons)

25 (508,025 kg - 101,605,000 kg).

BRIEF SUMMARY OF THE INVENTION

 The present invention provides an improved offshore marine platform (and method of installation) that can be used for drilling for oil and/or gas or in the production of oil and gas from an offshore environment. Such drilling and/or production facilities

30 typically weigh between 500 - 100,000 tons (508,025 kg - 101,605,000 kg), more commonly between 3,000 - 50,000 tons (508,025 kg - 50,802,500 kg).

The apparatus of the present invention thus provides a marine platform that is comprised of a plurality of spaced apart buoys and a superstructure having a periphery that includes a plurality of attachment positions, one attachment position for each buoy. An articulating connection joins each buoy to the platform superstructure.

5 The apparatus of the present invention uses articulating connections between the submerged portion of each buoy and the superstructure to minimize or reduce topside, wave induced motions during the structural life of the apparatus.

Each of the buoys will move due to current and/or wind and/or wave action or due to other dynamic marine environmental factors. "Articulating connection" as used herein
10 should be understood to mean any connection or joint that connects a buoy to the superstructure, transmits axial and shear forces, and allows the support buoy(s) to move relative to the superstructure without separation, and wherein the bending moment transferred to the superstructure from one of the so connected buoys or from multiple of the so connected buoys is reduced, minimized or substantially eliminated. "Articulating
15 connection" can also be a joint movably connecting a buoy to a superstructure wherein axial and tangential forces are substantially transmitted, however, transfer of bending moment is substantially reduced or minimized through the joint allowing relative movement between the buoy and the superstructure.

A connection (which can be an articulating connection) connects each buoy to the
20 platform at a respective attachment position, the connection allowing for sea state induced buoy motions while minimizing effects on the platform.

The apparatus of the present invention provides a marine platform that can further comprise a mooring extending from a plurality of the buoys for holding the platform and buoys to a desired location.

25 In one embodiment, the present invention provides a marine platform wherein each of the articulating connections includes corresponding concave and convex engaging portions. In an alternative embodiment, a universal type joint is disclosed.

In another embodiment a marine platform has buoys with convex articulating portions and the platform has correspondingly shaped concave articulating portions.

30 In another embodiment, each buoy can be provided with a concave articulating portion and the platform with a convex articulating portion.

In another embodiment, each buoy has a height and a diameter. In another

embodiment, the height is much greater than the diameter for each of the buoys.

In another embodiment, each buoy is preferably between about 25 and 100 feet in diameter (7.62m and 30.48m).

The apparatus of the present invention preferably provides a plurality of buoys,
5 wherein each buoy is between about 100 and 500 feet in height (30.48m and 152.4m).

The buoys can be of a generally uniform diameter along a majority of the buoy. However, in an alternative embodiment each buoy can have a variable diameter.

In a preferred embodiment, each buoy is generally cylindrically shaped. However, in an alternative embodiment each buoy can be provided with simply an upper end
10 portion that is generally cylindrically shaped.

In a preferred embodiment, there are at least three buoys and at least three attachment positions, preferably four buoys and four attachment positions.

In a preferred embodiment, each articulated connection is preferably hemispherically shaped for the upper end portion of each buoy and there is a
15 correspondingly concavely shaped receptacle on the platform that fits the surface of each hemispherically shaped upper end portion.

In an alternative embodiment the connection can also be in the form of a universal joint. In an additional embodiment, the connection can be in the form of first and second devices that provide "backup" or redundancy enabling one device to be serviced while
20 the other supports the platform. In this additional embodiment, a first universal joint preferably carries load between the platform and each buoy over the long period of time. In the event that the first device must be replaced or serviced, a jacking arrangement loads the other device so that the first device does not carry load and can be removed. The devices can include an inner device and an outer device. The "devices" can be articulating
25 devices such as universal joints.

In a preferred embodiment, the platform is comprised of a trussed deck. The trussed deck preferably has lower horizontal members, upper horizontal members and a plurality of inclined members spanning between the upper and lower horizontal members, and wherein the attachment positions are next to the lower horizontal member.

30 In a preferred embodiment, the apparatus supports an oil and gas well drilling and/or production platform weighing between 500 and 100,000 tons (508,025 kg and 101,605,000 kg), more particularly, weighing between 3,000 tons and 50,000(3,048,150

kg and 50,802,500 kg).

An advantage of the present invention is that it enables smaller, multiple hull components to be used to support the superstructure when compared to a single column or single buoy floater.

5 An advantage of the present invention is that topside angular motion can be reduced when compared to the topside angular motion of a single column floater of comparable weight.

10 With the present invention, there is substantially no bending moment or minimum bending moment transferred between each buoy and the structure being supported. The present invention thus minimizes or substantially eliminates moment transfer at the articulating connection that is formed between each buoy and the structure being supported. The buoys are thus substantially free to move in any direction relative to the supported structure or load excepting motion that would separate a buoy from the supported structure.

15 The present invention has particular utility in the supporting of oil and gas well drilling facilities and oil and gas well drilling production facilities. The apparatus of the present invention has particular utility in very deep water, for example, in excess of 1500 feet (4572m).

20 The present invention also has particular utility in tropical environments (for example West Africa and Brazil) wherein the environment produces long period swell action.

25 In an alternative embodiment of the present invention includes a method of installing an oil and gas well facility such as a drilling facility or a production facility on a platform in an offshore deepwater marine environment is provided. The term "deepwater" as used herein means water depths of in excess of 1500 feet (4572m).

30 The method of the present invention contemplates the placement of a plurality of buoys at a selected offshore location, a portion of each of the buoys being underwater. A superstructure extends above water and includes a platform having an oil and gas well facility. Such a facility can include oil well drilling, oil well production, or a combination of oil well drilling and production. The platform and its facility can be floated to a selected location. The platform includes a peripheral portion having a plurality of attachment positions, one attachment position for each buoy.

When the buoys and platform are located at a desired position, the platform is ballasted relative to the buoys until the buoys connect with the platform. This connection can be achieved by either ballasting the platform downwardly (such as for example, using a ballasted transport barge), or by ballasting the buoys to a higher position so that they engage the supported platform.

In a preferred embodiment, the buoys can be elongated, cylindrically shaped buoys, each having a diameter of for example, 25 - 100 feet (7.62m - 30.48m) and a height of preferably between about 100 and 500 feet (30.48m and 152.4m). Each of the buoys can have an upper, smaller diameter portion that includes a connector. In one embodiment, the connector can be convex in shape and articulate with a correspondingly shaped concave connector on the platform.

The platform can include a trussed deck that carries at or near its periphery or corners, connectors that enable a connection to be formed with the upper end portion of each buoy. As an example, there can be provided four buoys and four connectors on the trussed deck or platform.

If a trussed deck is employed, an oil well production facility (drilling or production or a combination) can be supported upon the trussed deck. The connector at the top of each buoy can be any type of an articulating connection that forms an articulation with the trussed deck or a connector on the trussed deck. Examples include the ball and socket or concave/convex arrangement shown in the drawings (Figures 1-12). Another example includes the universal joint shown in the drawings (see Figures 13-14).

In an alternate method, the multiple buoys can be used as part of an installation method to place the marine platform upon a single spar support.

BRIEF DESCRIPTION OF THE DRAWINGS

For a further understanding of the nature, objects, and advantages of the present invention, reference should be had to the following detailed description, read in conjunction with the following drawings, wherein like reference numerals denote like elements and wherein:

Figure 1 is an elevation view of a preferred embodiment of the apparatus of the present invention;

Figure 2 is a plan view of a preferred embodiment of the apparatus of the present

invention;

Figure 3 is an elevation view of a preferred embodiment of the apparatus of the present invention;

5 Figure 4 is another elevation view of a preferred embodiment of the apparatus of the present invention;

Figures 5-6 are fragmentary perspective views of a preferred embodiment of the apparatus of the present invention illustrating the articulating connection between a buoy and the platform; and

10 Figures 7-8 show alternate mooring arrangements for the apparatus of the present invention;

Figure 9 is a partial elevation view of an alternate embodiment of the apparatus of the present invention that features buoys of variable diameter;

Figure 10 is a sectional view taken along lines 10-10 of Figure 9;

15 Figure 10A is a sectional view taken along lines 10-10 of Figure 9 and showing a buoy lower end portion that is square;

Figure 11 is a partial elevation view of a third embodiment of the apparatus of the present invention showing an alternate buoy construction;

Figure 12 is a perspective elevation view of a third embodiment of the apparatus of the present invention showing an alternate buoy construction;

20 Figures 13-14 are elevation views of a fourth embodiment of the apparatus of the present invention showing an alternate articulating connection between each buoy and the platform. Figure 14 is rotated 90 degrees from Figure 13 around the longitudinal axis of the buoy;

25 Figure 15 is a schematic elevation view of a fifth embodiment of the apparatus of the present invention;

Figure 16 is a partial elevation view of the fifth embodiment of the apparatus of the present invention;

Figure 17 is a side elevation view taken along lines 17-17 of Figure 16;

30 Figure 18 is a partially cut away elevation view of the fifth embodiment of the apparatus of the present invention;

Figure 19 is a partially cut away elevation view of the fifth embodiment of the apparatus of the present invention;

Figure 20 is an elevation view of the fifth embodiment of the apparatus of the present invention showing an angled position of the platform relative to the buoys;

Figure 21 is an elevation view of the fifth embodiment of the apparatus of the present invention showing an angled position of the platform relative to the buoys;

5 Figure 22 is a partial elevation view of the fifth embodiment of the apparatus of the present invention illustrating removal of the pin for servicing the internal universal joints;

Figure 23 is another partial elevation view of the fifth embodiment of the apparatus of the present invention showing removal of the internal universal joint.

10 Figure 24 is a partial perspective, exploded view of the fifth embodiment of the apparatus of the present invention illustrating the internal universal joint; and

Figure 25 is a partial perspective, exploded view of the fifth embodiment of the apparatus of the present invention showing the external universal joint.

15 Figure 26 is an elevation view illustrating the method of the present invention, specifically the first step of floating the marine platform to a desired location next to a plurality of buoys that will support the platform;

Figure 27 is an elevation view illustrating the method of the present invention, specifically the step of ballasting the buoys relative to the barge during a connection of the buoys to the oil and gas well drilling and/or production facility to be supported;

20 Figure 28 is an elevation view illustrating the method of the present invention including the final step of ballasting the combination of structure and plurality of buoys until a desired elevational position is achieved;

Figure 29 is a perspective view illustrating the first step of the method of the present invention;

25 Figure 30 is a perspective view illustrating the second step of the method of the present invention;

Figure 31 is a perspective view illustrating an alternate method of the present invention wherein the apparatus of the present invention is used to place a marine platform upon a single spar support;

30 Figure 32 is a perspective view illustrating an alternate method of the present invention wherein the apparatus of the present invention is used to place a marine platform upon a single spar support;

Figure 33 is an elevation view illustrating an alternate method of the present invention wherein the apparatus of the present invention is used to place a marine platform upon a single spar support;

Figure 34 is an elevation view illustrating an alternate method of the present invention wherein the apparatus of the present invention is used to place a marine platform upon a single spar support;

Figure 35 is an elevation view illustrating an alternate method of the present invention, showing the platform after placement upon a single spar and removal of all supporting buoys.

10 DETAILED DESCRIPTION OF THE INVENTION

Figures 1-6 show a preferred embodiment of the apparatus of the present invention designated generally by the numeral 10 in Figures 1-4. In Figures 1-4, floating marine platform apparatus 10 is shown in a marine environment or ocean 12 having a water surface 11. The apparatus 10 includes a plurality of buoys 13-16, preferably four (optionally between three (3) and eight (8)), that support a superstructure defined by the combination of platform 17 and drilling and/or producing facilities 53. Oil and gas well producing facility as used herein shall include a facility used for oil and gas well drilling or production, or a combination of drilling and production.

Buoys 13-16 can be any desired shape, including the alternate buoys shown in the drawings or buoys with configurations like those in the September 2000 issue of Offshore Magazine. Platform 17 can be any desired platform or rig, such as a trussed deck constructed of a plurality of upper horizontal members 18, a plurality of lower horizontal members 19, a plurality of vertical members 20 and a plurality of diagonal members 21 to define a trussed deck or platform 17. As shown in Figure 1, platform 17 can include any desired oil and gas drilling and/or production facility 53, such facilities (in combination with platform 17) defining a superstructure weighing between about 500 - 100,000 tons(508,025 kg - 101,605,000 kg), or between about 3,000 - 50,000 tons (3,048,150 kg - 50,802,500 kg). (See Figures 3 and 8).

Each buoy 13-16 has an upper end portion 22 that can be conically shaped at 23 (see Figures 5-6). An attachment portion 24 provides a convex upper surface 25 that receives a correspondingly shaped concave surface 26 of connecting portion 27 of

platform 17. The concave surface 26 can be generally hemispherically shaped. However, the concave surface 26 is curved to articulate upon the surface 25. Surface 26 is preferably smaller than a full hemispherical surface, sized to articulate upon surface 25 even wherein there is an angular variation that can be as much as 30 degrees (or more) between the central longitudinal axis 28 of buoy 13 and a pure horizontal plane 29. To address wear, conventionally available bearing materials may be used in the articulating connections. A preferred bearing material would be a graphite impregnated brass or bronze bushing.

The following equations can be used in sizing the buoys:

10 Heave Period $T(\text{heave}) = 2\pi\sqrt{(M/K)}$

Where M = total heave mass;

K = heave stiffness;

Heave Stiffness $K = 1/4\pi D^2 G$

Where D = the diameter of the section of the buoy passing through the water plane;

15 G = the unit weight of water (approximately 65 pounds per cubic foot)(1,041.2 kilograms per cubic meter);

Heave Mass $M = (\text{Dry buoy mass}) + (\text{entrapped fluid mass}) + (\text{permanent solid ballast mass}) + (\text{added virtual fluid mass})$

20 The buoys may be constructed of stiffened steel plate, or continuously cast (slip formed) concrete or through other conventional construction techniques. Typically, a number of internal stiffeners are included to provide the required overall structural strength.

The attachment portion 24 at the upper end of each buoy 13-16 can be reinforced with a plurality of vertical plates 30 as shown in Figure 6. Likewise, the connection portion 27 of platform 17 can be provided with a plurality of internal reinforcing plates 35. The plates 35 extend between upper curved plate 36 and lower curved plate 37. A conical plate 38 can be attached to (or can be integral with) upper curved plate 36 as shown in Figure 6. A square harness articulating connection (not shown) going around the primary articulating connection may also be used.

30 Platform apparatus 10 can be secured to the sea bed 51 using piling or anchors 52 and mooring lines 32, 41 (Figures 1-4, 8). In a preferred embodiment (Figures 1-4), one

or more mooring lines 32 extend from each buoy 13-16 at an upper padeye 31 to the sea bed 51. The mooring lines in Figures 1, 2, 3 and 4 extend between padeyes 31 and anchors 52 at sea bed 51.

5 In a preferred embodiment, a plurality of horizontal mooring lines 34 extend between lower padeyes 33 on two buoys 13, 14 as shown in Figure 1. While the lower horizontal mooring lines 34 are shown connecting to buoys 13, 14, it should be understood that each pair of buoys (14-15, 15-16, 16-13) has a horizontal line 34 extending there between in the same configuration shown in Figure 1.

10 Figure 7 shows a first alternate embodiment of the present invention, utilizing tensioned mooring lines 39 that extend between connection points (for example, padeyes) 40 on each of the buoys 13-16 and anchors (such as 52) embedded in the sea bed 51. In the embodiment of Figure 7, horizontal mooring lines 34 could optionally be provided between each pair of buoys such as 13 and 14, or 14 and 15, or 15 and 16, or 16 and 13.

15 Figure 8 shows an alternate arrangement wherein catenary mooring lines 41 extend between padeyes 31 and the anchors 52 that are anchored to the sea bed 51. In this embodiment, there are no horizontal lines connecting the buoys.

The plan view of Figure 2 shows various orientations that could be used for either mooring lines 32 or mooring lines 41. One arrangement provides a plurality of three
20 mooring lines 32 or 41 attached to each buoy 13-16, the mooring lines 32 or 41 being spaced about 120 degrees apart as shown in hard lines. In phantom lines in Figure 2, another geometry for the mooring lines 32, 41 is shown, wherein there are two mooring lines for each buoy that are about 90 degrees apart.

25 The platform 17 is constructed of upper and lower sets of horizontal members 18, 19; vertical members 20; and diagonal members 21.

Figures 9, 10 and 10A show an alternate construction for each of the buoys. It should be understood that a buoy such as one of those shown in Figures 9, 10 or 10A could be used to replace any one or all of the buoys 13-16 shown in Figures 1-4 and 5-6.

30 Buoy 42 can be provided with a variable diameter having a smaller diameter cylindrical middle section 43, and a larger diameter lower section 44 which can be for example, either cylindrical (see Figure 10) or squared (see Figure 10A). The cylindrical lower section 44 is shown in Figures 9 and 10, and the squared lower section 45 shown

in Figure 10A.

Another buoy construction is shown in Figures 11 and 12. It should be understood that the buoy shown in Figures 11 and 12 could be used to replace any one or all of the plurality of buoys 13-16 of Figures 1-6. In Figures 11 and 12, the buoy 46 has a
5 cylindrical middle section 47, a conical upper section 48, and a trussed lower section 49. Padeyes 50 on the upper end portion of trussed lower section 49 can be used to support any of the earlier described mooring lines such as 32, 39, or 41. In the embodiment of Figures 11 and 12, each of the buoys 46 can have a similar construction and configuration at the upper end portion to that of a preferred embodiment shown in Figures 1-6,
10 providing a conical upper section 48 and an attachment portion 24.

In Figures 13 and 14, there can be seen an alternate articulating connection between platform 17 and a selected buoy 13 (or 14-16 or 42, or 46). A gimble or universal joint 62 arrangement is shown in Figures 13 and 14, providing a first pinned connection at 54 and a second pinned connection at 55. The first pin 56 can be of a larger
15 diameter, having a central opening 58 through which the second, smaller diameter pin 57 passes as shown. The central longitudinal axes of the pins 54, 55 preferably intersect. Arrow 59 in Figures 13-14 shows that a buoy can optionally be made to rotate relative to the gimbal connection shown. Bearing plates 60, 61 can rotate relative to one another. To minimize frictional force transference and wear, both pins 56,57 can be mounted in
20 bearings.

Figures 15-25 show a fifth embodiment of the apparatus of the present invention, designated generally by the numeral 63 in Figure 15. Floating marine platform apparatus 63 is shown in Figure 15 as including a platform 17 that can include a structural deck, package, platform, trussed deck or the like which has been shown in phantom lines. It
25 should be understood that platform 17 shown in Figure 15 can include a structural deck 64 or any other structural frame that is known in the art for supporting an offshore oil and gas well drilling platform, and oil and gas well production facility, or an oil and gas well drilling and production facility 67.

Platform 17 can include a structural deck which is schematically illustrated using
30 the numeral 64 in Figures 15-25 including a superstructure (e.g. with an oil drilling platform, oil production platform, crew quarters, heliport, vessels, and the like). A plurality of connections are shown, a connection interfacing between each buoy 13, 14,

15, 16 and the platform 17 to be supported.

In the embodiment of Figures 15-25, the connection that is positioned in between each buoy such as buoy 13 and platform 17 is preferably a connection that includes first and second connection devices and a load transfer mechanism that can transfer at least
5 some of the platform load from one of the devices to the other device.

In the fifth embodiment, these devices preferably include an internal device 65 (see Figure 24) and an external device 66 (see Figure 25). In the embodiment of Figures 15-25, the internal 65 and external 66 devices are preferably articulating connections. In the embodiment of Figures 15-25, the devices 65, 66 are preferably each universal joint
10 connections.

In the embodiment of Figures 15-25, a load transfer mechanism enables load to be transferred from one of the devices 65 or 66 to the other device 65 or 66. This load transfer mechanism is preferably a jacking system such as the plurality of hydraulic jacks
119 that are shown in the drawings.

In Figure 25, a deck opening 68 is shown through which the internal device 65 can be removed for servicing. The internal device 65 can be the device that typically carries a portion of the platform load for a majority of the time and transfers that load to its buoy such as buoy 13. At deck opening 68, padeyes 69 are provided each having an opening 70 as shown in Figure 25.
15

The details of construction of the internal device 65 are shown in Figure 24. The internal device 65 includes a lower section 71, and upper section 82, and pins 77, 90. The lower section 71 has a bottom 72 that transfers load to the upper surface 124 of buoy 13. When load is to be transferred to the second device 66 of Figure 25, a jacking mechanism such as the plurality of hydraulic jacks 119 lift the lower section 71 from upper surface
20 124 of buoy 13, as shown in figure 22. A gap 123 is then present in between the upper surface 124 of buoy 13 and the bottom 72 of lower section 71. In such a position (shown in Figure 22), pin 120 can be removed and the internal device 65 can be lifted upwardly and withdrawn through opening 68 in structural deck 64.

Lower section 71 has sides 73, a top 74 and a pair of padeyes 75 that are spaced
30 apart and which extend from the top 74. Each padeye 75 has pin opening 76. A smaller pin 77 has enlarged head 78 and externally threaded section 79. Nut 80 provides an internally threaded section 81 that enables the nut 80 to be threadably engaged to the pin

77 at threads 79. Upper section 82 of internal device 65 provides sides 83 and payeyes 84 that extend downwardly as shown in Figure 24, each padeye 84 providing a pin opening 85.

5 Upper section 82 provides a pair of spaced apart beams 86, each having end portions 87, 88. Each end portion 87, 88 provides a pin opening 97. A larger pin 90 fits through openings 85 as indicated schematically by arrow 126 in Figure 24. Pin 90 has enlarged head 91, and externally threaded section 92. Larger pin 90 also provides an opening 93 that is positioned in between externally threaded section 92 and head 91 as shown in Figure 24.

10 Nut 94 has internally threaded section 95 that enables the nut to be threadably engaged with the larger pin 90. A gap 96 is provided in between the beams 86 so that padeyes 69 on structural deck 64 fit in between the spaced apart beams 86 in gap 96 as shown in the drawings (see Figures 16 and 18). In this position, the openings 70 of padeyes 69 align with the openings 97 of beams 86. Pins 120 can then be placed through
15 the aligned openings 70, 97. Upon assembly of the device 65, larger pin 90 is first passed through openings 85 of padeyes 84. Nut 94 is then threadably engaged with pin 90 at correspondingly engaging threaded portions 92, 95. The pin 77 is then placed through one of the openings 76 of padeye 75, and then through opening 93 of larger pin 90 and then through the opposite opening 76 of padeye 75. Nut 80 then retains smaller pin 77 by
20 engaging the threaded portions 79, 81. In this position, the internal device 65 defines a first universal joint (see Figure 23) that can be removed as shown by arrow 128 in figure 23 for servicing.

The devices 65, 66 can be universal joints as shown. Each of the universal joints each have multiple pins 77,90 (for device 65) and 110 (for device 66) with central
25 longitudinal axes, the central axes of the pins 77, 90 and 110 of both universal joints occupying a common plane during use.

When the internal device 65 is removed for servicing, the external device 66 carries a portion of the platform load between structural deck 64 and buoy 13. The external device 66 is shown more particularly in Figure 25. External device 66 includes
30 a pair of spaced apart lower supports 98, each having a pair of spaced apart padeyes 99, each of the padeyes 99 providing a pin opening 100.

A pair of lower beams 101 are provided, a beam 101 being pivotally attached to

each lower support 98 as shown in Figure 25. Each lower beam 101 provides end portions 102, 103, each of the end portions 102, 103 providing an upper surface 104 that carries a hydraulic jack 119. Each of the lower beams 101 provides a beam opening 105 that receives a pin 110 when the opening 105 aligns with openings 100 of padeyes 99.

5 The external device 66 includes a pair of spaced apart supports 115 that are connected (eg. welded or bolted) to the underside of structural deck 64 for transferring load from the external device 66 to structural deck 64. Upper beams 106 are pivotally attached to upper supports 115 using pins 110. Each of the upper supports 115 has a pair of spaced apart padeyes 116, each padeye 116 having an opening 117 for receiving a pin
10 110. Each upper beam 106 provides end portions 107, 108 having a lower surface 109 that is engaged by an elevating portion 129 of hydraulic jack 119 when load is to be carried by the external device 66. It should be understood that the hydraulic jacks 119 are commercially available such as from Enerpac.

Each pin 110 has an enlarged head 111 and an externally threaded section 112.
15 Pins 110 are retained in position using nuts 113. Each nut 113 has an internally threaded section 114 that engages the externally threaded section 112 of pin 110. Each of the upper beams 106 has a beam opening 118 that receives pin 110. In order to effect the pivotal connection between upper supports 115 and upper beams 106, pins 110 are passed through the openings 117 of padeyes 116 and the beam openings 118. The pins 110 are
20 then secured by fastening a nut 113 to threaded section 112.

In the embodiment of Figures 15-25, it is preferable that the internal device 65 carry load between a buoy (for example 13), and structural deck 64 a majority of the time. Therefore, there is typically a small gap between the elevating portion 129 of each jack 119 and the undersurface 109 of beam ends 107, 108. In such a situation, the bottom 72
25 of lower section 71 of internal device 65 bears against the upper surface 124 of buoy 13. In order to service the internal device 65 (or to replace it), the hydraulic jacks 119 are actuated so that elevating portion 129 elevates until the elevating portion 129 engages lower surface 109 of each beam end 107, 108. Continued elevation of the jack 119 elevating portions 129 causes upper beams 106 to move away from lower beams 101.
30 Such elevating of the jacks 119 increases the distance between structural deck 64 and the upper surface 124 of each buoy 13, 14, 15, 16. Eventually, the lower surface 72 of the lower section 71 rises above upper surface 124 of buoy 113 (see Figure 22) thus

removing platform load from the internal device 65. Pin 120 is then removed by disassembly of retainer nut 122 from pin 120 as schematically indicated by arrow 89 in Figure 22. A gap 123 between lower section 71 and buoy 13 is shown in Figure 22. Arrow 128 in Figure 23 schematically illustrates the lifting of internal device 65 upwardly for removal and servicing. The external device 66 in Figure 23 now carries load between structural deck 64 and buoy 13.

In Figures 26-28 and 29-30, a method of the present invention is disclosed. In Figure 29, arrow 153 designates travel of a transport barge 163 toward a plurality of buoys 13, 14, 15, 16 that have been positioned at a desired location. Buoys 13, 14, 15, 16 are held in that position using for example, a plurality of anchor lines 32 as shown in Figures 26-30.

Transport barge 163 provides an upper deck 164, a bottom 165, a port side 166 and a starboard side 167. The barge 163 also has end portions 154, 155. Transport barge 163 can be any suitable barge having a length, width, and depth that are suitable for transporting a multi-ton superstructure to a job site. Typically, such a superstructure mounted upon platform 17 will be a multi-ton structure that is capable of performing oil and gas well drilling activities and/or oil and gas well production activities.

In Figure 30, barge 163 has been positioned next to the plurality of buoys 13, 14, 15, 16. As an example, Figures 29-30, the transport barge 163 has been positioned so that the buoys 13, 16 are on the starboard side 167 of transport barge 163. The buoys 14, 15 are positioned on the port side 166 of transport barge 163 as shown in Figures 26-28 and 30.

Once in the position shown in Figures 26 and 30, a ballasting operation moves the buoys 13, 14, 15, 16 into contact with the platform 17 so that a connection is perfected. More specifically, the attachment portions 24 of the respective buoys 13, 14, 15, 16 engage and form an articulating connection with the corresponding connecting portions 27 of platform 17 as shown in Figures 26-28 and in Figures 1-8 and 13-14.

Ballasting can be achieved by initially adding water to the buoys 13, 14, 15, 16 so that they are at a lower position in the water as shown in Figures 26 and 29-30. The water can then be pumped from the interior of each of the buoys 13, 14, 15, 16 as indicated schematically by the numeral 60 in Figure 27. As water is removed from the interior of each of the buoys 13-16, the water level 151 in each of the buoys 13-16 will

drop and each of the buoys 13-16 will rise as indicated schematically by arrows 170 in Figure 27.

Each of the buoys 13, 14, 15, 16 will be ballasted upwardly in the direction of arrows 170 until its attachment portion 24 forms a connection with the connecting portion 27 of platform 17. Alternatively, the barge 163 can be positioned as shown in Figures 26 and 30. The barge 163 can then be lowered so that the barge 163, platform 17 and drilling/production facility 53 lower with it until the connection portions 27 of platform 17 rest upon the attachment portions 24 of the buoys 13-16.

As still a further alternative, a combination of ballasting of barge 163 and buoys 13, 14, 15, 16 can be used to connect each of the attachment portions 24 of buoy 13, 14, 15, 16 to platform 17 so that the attachments shown in Figures 1, 2, 3, 4, 7, 8 are achieved. For example, barge 163 can be lowered using ballasting while buoys 13, 14, 15, 16 are simultaneously elevated using ballasting.

For the embodiment of Figures 13 and 14, a similar ballasting arrangement can be provided wherein the pinned connections 54, 55 are added after the platform 17 and buoys 13, 14, 15, 16 are at the proper elevational positions relative to one another.

Once the superstructure that includes platform 17 and facility 53 is supported as shown in Figure 28, the superstructure (platform 17 and facility 53) can be placed upon a single spar support 156 if desired using the apparatus 10 of the present invention as a transfer apparatus.

After removal of barge 163 (see Figures 26-30), tow boats 159 can be used to tow each buoy 13, 14, 15, 16 to spar 156. For example, each boat 159 can provide a tow line 160 attached to a buoy 13, 14, 15 or 16, or to deck 17 at a provided attachment 161.

In Figures 31, 32, and 33, the boats 159 pull buoys 13, 14, 15, 16 to a position as shown that overlays platform 17 with upper end portion 157 of spar 156. Ballasting can then be used to either elevate spar 156 or lower buoys 13, 14, 15, 16 (or a combination of such ballasting can be used) to engage spar 156 upper end portion 157 with platform 17 as indicated by arrow 162 in Figure 34.

Additional ballasting separates each buoy 13, 14, 15, 16 from platform 17 so that spar 156 alone supports platform 17 and its facility 53 (see Figure 35).

PARTS LIST

	PART NUMBER	DESCRIPTION
	10	floating marine platform apparatus
	11	water surface
	12	ocean
5	13	buoy
	14	buoy
	15	buoy
	16	buoy
	17	platform
10	18	upper horizontal member
	19	lower horizontal member
	20	vertical member
	21	diagonal member
	22	upper end portion
15	23	conical shape
	24	attachment portion
	25	convex surface
	26	concave surface
	27	connecting portion
20	28	central longitudinal axis
	29	plane
	30	internal reinforcing plate
	31	upper padeye
	32	mooring line
25	33	lower padeye
	34	horizontal mooring line
	35	internal reinforcing plate
	36	upper curved plate
	37	lower curved plate
30	38	conical plate
	39	tensioned mooring line
	40	padeye

	41	catenary mooring line
	42	buoy
	43	cylindrical middle section
	44	cylindrical lower section
5	45	square lower section
	46	buoy
	47	cylindrical middle section
	48	conical upper section
	49	trussed lower section
10	50	padeye
	51	sea bed
	52	anchor
	53	drilling/production facility
	54	first pinned connection
15	55	second pinned connection
	56	pin
	57	pin
	58	opening
	59	arrow
20	60	bearing plate
	61	bearing plate
	62	universal joint
	63	floating marine platform apparatus
	64	structural deck
25	65	internal device
	66	external device
	67	facility
	68	deck opening
	69	padeye
30	70	opening
	71	lower section
	72	bottom

	73	side
	74	top
	75	padeye
	76	pin opening
5	77	smaller pin
	78	enlarged head
	79	externally threaded section
	80	nut
	81	internally threaded section
10	82	upper section
	83	side
	84	padeye
	85	pin opening
	86	beam
15	87	end portion
	88	end portion
	89	arrow
	90	larger pin
	91	enlarged head
20	92	externally threaded section
	93	opening
	94	nut
	95	internally threaded section
	96	gap
25	97	pin opening
	98	lower support
	99	padeye
	100	pin opening
	101	lower beam
30	102	end
	103	end
	104	upper surface

	105	beam opening
	106	upper beam
	107	end
	108	end
5	109	lower surface
	110	pin
	111	enlarged head
	112	externally threaded section
	113	nut
10	114	internally threaded section
	115	upper support
	116	padeye
	117	pin opening
	118	beam opening
15	119	jack
	120	pin
	121	enlarged head
	122	retainer nut
	123	gap
20	124	top of buoy
	125	arrow
	126	arrow
	127	arrow
	128	arrow
25	129	elevating portion
	150	water discharge
	151	water level
	152	buoy interior
	153	arrow
30	154	end portion
	155	end portion

	156	spar
	157	upper end portion
	158	arrow
	159	tow boat
5	160	tow line
	161	attachment
	162	arrow
	163	barge
	164	barge deck
10	165	bottom
	166	port side
	167	starboard side
	168	bearing plate
	169	bearing plate
15	170	directional arrows

The foregoing embodiments are presented by way of example only; the scope of the present invention is to be limited only by the following claims.

CLAIMS

- 1 1. A marine platform, comprising:
2 a) a plurality of buoys;
3 b) a platform having an oil and gas well producing facility and a peripheral
4 portion that includes a plurality of connecting positions, one connecting position for each
5 buoy; and
6 c) an articulating connection that connects each buoy to the platform at a
7 respective connecting position, the plurality of articulating connections allowing for buoy
8 motions induced by sea movement while reducing sea movement effect on the platform.
- 1 2. The marine platform of claim 1 further comprising a mooring extending
2 from a plurality of the buoys for holding the platform and buoys to a desired location.
- 1 3. The marine platform of claim 1 wherein the articulating connections are
2 universal joints.
- 1 4. The marine platform of claim 1 wherein each of the articulating
2 connections includes correspondingly concave and convex engaging portions.
- 1 5. The marine platform of claim 4 wherein the buoy has a convex articulating
2 portion and the platform has a concave articulating portion.
- 1 6. The marine platform of claim 4 wherein the buoy has a concave
2 articulating portion and the platform has a convex articulating portion.
- 1 7. The marine platform of claim 1 wherein each buoy has a height and a
2 diameter, the height being greater than the diameter.
- 1 8. The marine platform of claim 1 wherein there are at least three buoys and
2 at least three attachment positions.
- 1 9. The marine platform of claim 1 wherein there are at least four buoys and

2 at least four attachment positions.

1 10. The marine platform of claim 1 wherein there are between 3 and 8
2 attachment positions.

1 11. The marine platform of claim 1 wherein the platform is comprised of a
2 trussed deck.

1 12. The marine platform of claim 1 wherein the trussed deck has lower
2 horizontal members, upper horizontal members, and a plurality of inclined members
3 spanning between the upper and lower horizontal members, and wherein the attachment
4 positions are next to the lower horizontal members.

1 13. The marine platform of claim 1 wherein each buoy is between 100 and
2 500 feet in height.

1 14. The marine platform of claim 1 wherein each buoy is between about 25
2 and 100 feet in diameter.

1 15. The marine platform of claim 1 wherein each buoy has a generally uniform
2 diameter over a majority of its length.

1 16. The marine platform of claim 1 wherein each buoy has an upper end
2 portion that is generally cylindrically shaped.

1 17. The marine platform of claim 1 wherein the articulated connection is a
2 hemispherically shaped upper end of each buoy and a correspondingly shaped concave
3 receptacle on the platform that fits each hemispherically shaped upper end.

1 18. The marine platform of claim 1 wherein the buoys support a platform that
2 weighs between 500,000 and 105,000,000 kilograms.

1 19. A marine platform, comprising:

2 a) a plurality of buoys;

3 b) a platform having an oil and gas well producing facility weighing between
4 500,000 kilograms and 105,000,000 kilograms and a peripheral portion that includes a
5 plurality of connecting positions, one connecting position for each buoy; and

6 c) an articulating connection that connects each buoy to the platform at a
7 respective connecting position, the plurality of articulating connections allowing for buoy
8 motions induced by sea movement while reducing sea movement effect on the platform.

1 20. The marine platform of claim 18 further comprising a mooring extending
2 from a plurality of the buoys for holding the platform and buoys to a desired location.

1 21. The marine platform of claim 19 wherein the articulating connections are
2 universal joints.

1 22. The marine platform of claim 19 wherein each of the articulating
2 connections includes correspondingly concave and convex engaging portions.

1 23. The marine platform of claim 19 wherein the buoy has a convex
2 articulating portion and the platform has a concave articulating portion.

1 24. The marine platform of claim 19 wherein the buoy has a concave
2 articulating portion and the platform has a convex articulating portion.

1 25. The marine platform of claim 19 wherein each buoy has a height and a
2 diameter, the height being greater than the diameter.

1 26. The marine platform of claim 19 wherein there are at least three buoys and
2 at least three attachment positions.

1 27. The marine platform of claim 19 wherein there are at least four buoys and
2 at least four attachment positions.

1 28. The marine platform of claim 19 wherein the platform is comprised of a
2 trussed deck.

1 29. The marine platform of claim 19 wherein the trussed deck has lower
2 horizontal members, upper horizontal members, and a plurality of inclined members
3 spanning between the upper and lower horizontal members, and wherein the attachment
4 positions are next to the lower horizontal members.

1 30. The marine platform of claim 19 wherein each buoy is between 30 and
2 155 meters in height.

1 31. The marine platform of claim 19 wherein each buoy is between about 5
2 and 35 meters in diameter.

1 32. The marine platform of claim 19 wherein each buoy has a generally
2 uniform diameter over a majority of its length.

1 33. The marine platform of claim 19 wherein each buoy has an upper end
2 portion that is generally cylindrically shaped.

1 34. The marine platform of claim 19 wherein the articulated connection is a
2 hemispherically shaped upper end of each buoy and a correspondingly shaped concave
3 receptacle on the platform that fits each hemispherically shaped upper end.

 35. A marine platform, comprising:
 a) a plurality of buoys;
 b) a platform having an oil and gas well producing facility and a peripheral
 portion that includes a plurality of connecting positions, one connecting position for each
 buoy; and
 c) a connection that connects each buoy to the platform at a respective
 connecting positions, the plurality of connections allowing for buoy motions induced by

sea movement while reducing sea movement effect on the platform; and

d) the connection including first and second connection devices that enable removal of one of the connection devices for servicing, the other device connecting the buoy to the platform during such servicing.

1 36. The marine platform of claim 35 further comprising a mooring extending
2 from a plurality of the buoys for holding the platform and buoys to a desired location.

1 37. The marine platform of claim 35 wherein the connections include
2 universal joints.

1 38. The marine platform of claim 35 wherein each of the devices is a universal
2 joint.

1 39. The marine platform of claim 35 wherein the devices include an internal
2 device and an external device.

1 40. The marine platform of claim 35 wherein the devices include an internal
2 universal joint and an external universal joint.

1 41. The marine platform of claim 35 wherein each buoy has a height and a
2 diameter, the height being greater than the diameter.

1 42. The marine platform of claim 35 wherein there are at least three buoys and
2 at least three attachment positions.

1 43. The marine platform of claim 35 wherein there are at least four buoys and
2 at least four attachment positions.

1 44. The marine platform of claim 35 wherein there are between 3 and 8
2 attachment positions.

1 45. The marine platform of claim 35 wherein the platform is comprised of a
2 trussed deck.

1 46. The marine platform of claim 35 wherein the trussed deck has lower
2 horizontal members, upper horizontal members, and a plurality of inclined members
3 spanning between the upper and lower horizontal members.

1 47. The marine platform of claim 35 wherein each buoy is between 30 and
2 155 meters in height.

1 48. The marine platform of claim 35 wherein each buoy is between about 5
2 and 35 meters in diameter.

1 49. The marine platform of claim 35 wherein each buoy has a generally
2 uniform diameter over a majority of its length.

1 50. The marine platform of claim 35 wherein each buoy has an upper end
2 portion that is generally cylindrically shaped.

1 51. The marine platform of claim 35 further comprising a device load transfer
2 mechanism, wherein one of the devices can be loaded with the load transfer mechanism
3 so that the other device is unloaded.

1 52. The marine platform of claim 35 wherein the buoys support a platform that
2 weighs between 500,000 and 105,000,000 kilograms.

1 53. A marine platform, comprising:

2 a) a plurality of buoys;

3 b) a platform having an oil and gas well producing facility weighing between
4 500,000 kilograms and 105,000,000 kilograms and a peripheral portion that includes a
5 plurality of connecting positions, one connecting position for each buoy; and

6 c) a connection that connects each buoy to the platform at a respective

7 connecting position, the plurality of connections allowing for buoy motions induced by
8 sea movement while reducing sea movement effect on the platform;

9 d) the connection between each buoy and the platform including first and
10 second articulating devices and a load transfer mechanism that enables at least some of
11 the platform load to be transferred from one device to the other device.

1 54. The marine platform of claim 53 further comprising a mooring extending
2 from a plurality of the buoys for holding the platform and buoys to a desired location.

1 55. The marine platform of claim 53 wherein the connection devices are
2 universal joints.

1 56. The marine platform of claim 53 wherein each of the connections includes
2 an inner device surrounded by an external device.

1 57. The marine platform of claim 56 wherein the inner device is an
2 articulating portion.

1 58. The marine platform of claim 53 wherein the outer device is an
2 articulating portion.

1 59. The marine platform of claim 53 wherein each buoy has a height and a
2 diameter, the height being greater than the diameter.

1 60. The marine platform of claim 53 wherein there are at least three buoys and
2 at least three attachment positions.

1 61. The marine platform of claim 53 wherein there are at least four buoys and
2 at least four attachment positions.

1 62. The marine platform of claim 53 wherein the platform is comprised of a
2 trussed deck.

1 63. The marine platform of claim 53 wherein the trussed deck has lower
2 horizontal members, upper horizontal members, and a plurality of inclined members
3 spanning between the upper and lower horizontal members.

1 64. The marine platform of claim 53 wherein each buoy is between 30 and
2 155 meters in height.

1 65. The marine platform of claim 53 wherein each buoy is between about 5
2 and 35 meters in diameter.

1 66. The marine platform of claim 53 wherein each buoy has a generally
2 uniform diameter over a majority of its length.

1 67. A marine platform, comprising:

2 a) a plurality of buoys;

3 b) a platform having an oil and gas well producing facility and a peripheral
4 portion that includes a plurality of connecting positions, one connecting position for each
5 buoy; and

6 c) a connection that connects each buoy to the platform at a respective
7 connecting positions, the plurality of connections allowing for buoy motions induced by
8 sea movement while reducing sea movement effect on the platform; and

9 d) the connection having means for enabling a transfer of at least a portion
10 of the platform load from a first portion of the connection to a second portion of the
11 connection.

1 68. The marine platform of claim 67 wherein the means for enabling includes
2 a first connection device, a second connection device and a mechanism that transfers load
3 between the first and second devices.

1 69. The marine platform of claim 68 wherein the first connection device is a
2 universal joint.

1 70. The marine platform of claim 68 wherein the first connection device is an
2 articulating connection device.

1 71. The marine platform of claim 68 wherein the second connection device
2 is a universal joint.

1 72. The marine platform of claim 68 wherein the second connection device
2 is an articulating connection device.

1 73. The marine platform of claim 67 wherein the connections include
2 universal joints.

1 74. The marine platform of claim 67 wherein each buoy is between 100 and
2 500 feet in height.

1 75. The marine platform of claim 67 wherein each buoy is between about 25
2 and 100 feet in diameter.

76. The marine platform of claim 73 wherein the universal joints each have multiple pins with central longitudinal axes, the central axes of the pins of both universal joints occupying a common plane during use.

77. A method of installing an oil and gas well drilling or production platform in an offshore deep water marine environment, comprising the steps of:

- a) placing a plurality of buoys;
- b) floating a platform in the marine environment having an oil and gas well drilling or production facility to the location of the buoys, the platform including a peripheral portion that includes a plurality of connecting positions, one connecting position for each buoy; and
- c) ballasting the platform and buoys relative to one another until each buoy connects with the platform and substantially all of the weight of the platform is supported by the buoys.

1 78. The method of claim 77 further comprising the step of making articulating
2 connections that connect each buoy to the platform at respective connecting positions, the
3 plurality of articulating connections allowing for buoy motions induced by sea movement
4 while reducing sea movement effect on the platform.

1 79. The method of claim 77 further comprising the step of mooring each buoy
2 with an anchor line.

1 80. The method of claim 77 wherein each of the articulating connections
2 includes correspondingly concave and convex engaging portions.

1 81. The marine platform of claim 77 wherein the buoy has a convex
2 articulating portion and the platform has a concave articulating portion and in step "c" the
3 barge and buoys are ballasted until concave and convex portions engage for each buoy
4 and the platform.

1 82. The marine platform of claim 78 wherein the buoy has a concave
2 articulating portion and the platform has a convex articulating portion.

1 83. The method of claim 77 wherein each buoy has a height and a diameter,
2 the height being greater than the diameter, and further comprising the step of positioning
3 the barge in between at least two buoys.

1 84. The method of claim 77 wherein there are at least three buoys and at least
2 three attachment positions.

1 85. The method of claim 77 wherein there are at least four buoys.

1 86. The method of claim 77 wherein the platform is comprised of a trussed
2 deck and wherein steps "b" and "c" include connecting each buoy to the trussed deck.

1 87. The method of claim 77 further comprising the steps of providing a single
2 spar and transferring the platform from the buoys to the single spar.

1 88. A method of installing an oil and gas well production platform in an
2 offshore deep water marine environment, comprising the steps of:

3 a) floating a multi-ton package to a selected offshore location, the package
4 having a plurality of connectors and wherein the connectors are preliminarily positioned
5 at a higher elevational position;

6 b) positioning a plurality of floating buoys at a selected offshore location,
7 each buoy having a buoy connector portion at its upper end;

8 c) preliminarily positioning the buoy connectors at a selected elevational
9 position;

10 d) ballasting the floating package and buoys relative to one another so that
11 the package connectors and the buoy connectors engage to define a plurality of
12 articulating connections and where substantially all of the weight of the platform is
13 supported by the buoys.

1 89. The method of claim 88 wherein step "a" comprises floating a multi-ton
2 package to a selected offshore location, the package having an oil and gas well drilling
3 facility thereon and a plurality of connectors, and wherein the connectors are
4 preliminarily positioned at a higher elevational position.

1 90. The method of claim 88 wherein in step "d", the floating package is
2 ballasted from a higher elevational position to a lower elevational position that engages
3 the connectors of the package with the buoy connectors.

1 91. The method of claim 88 wherein in step "d" the buoys are ballasted from
2 a lower position to a higher position that engages the plurality of package connectors and
3 plurality of buoy connectors.

1 92. The method of claim 88 wherein in step "a" there is provided a barge
2 having a deck that supports the multi-ton package and step "a" includes floating the

3 multi-ton package and barge to a selected offshore location.

1 93. The method of claim 88 wherein in step "d", the articulating connections
2 each include correspondingly shaped concave and convex portions.

1 94. The method of claim 88 wherein the articulating connections include
2 universal joint connections.

1 95. The method of claim 88 wherein in steps "a" through "c", the floating
2 package is positioned in between first and second pairs of the buoys.

1 96. The method of claim 88 wherein steps "a" through "c" include positioning
2 the package in between first and second pairs of the buoys and wherein the buoys have
3 submerged portions that do not make contact with the floating package.

1 97. A method of installing an oil and gas well production platform in an
2 offshore deep water marine environment, comprising the steps of:

3 a) floating a multi-ton package to a selected offshore location, the package
4 having a plurality of connectors and wherein the connectors are preliminarily positioned
5 at a higher elevational position;

6 b) positioning a plurality of floating buoys at a selected offshore location,
7 each buoy having a buoy connector portion at its upper end;

8 c) preliminarily positioning the buoy connectors at a selected elevational
9 position;

10 d) ballasting the floating package and buoys relative to one another so that
11 the package connectors and the buoy connectors engage to define a plurality of
12 articulating connectors, including at least one articulating connector for each floating
13 buoy.

1 98. The method of claim 97 further comprising the steps of providing a single
2 spar and transferring the platform from the buoys to the single spar.

1 99. The method of claim 98 further comprising the step of ballasting the buoys
2 and spar relative to one another during the transfer.

1 100. The method of claim 97 further comprising the step of making articulating
2 connections that connect each buoy to the platform at respective connecting positions, the
3 plurality of articulating connections allowing for buoy motions induced by sea movement
4 while reducing sea movement effect on the platform.

1 101. The method of claim 97 wherein each of the articulating connections
2 includes correspondingly concave and convex engaging portions.

1 102. The marine platform of claim 97 wherein the buoy has a convex
2 articulating portion and the platform has a concave articulating portion and in step "c" the
3 barge and buoys are ballasted until concave and convex portions engage for each buoy
4 and the platform.

1 103. The marine platform of claim 97 wherein the buoy has a concave
2 articulating portion and the platform has a convex articulating portion.

1 104. The method of claim 97 wherein each buoy has a height and a diameter,
2 the height being greater than the diameter, and further comprising the step of positioning
3 the barge in between at least two buoys.

1 105. The method of claim 97 wherein the platform is comprised of a trussed
2 deck and wherein steps "b" and "c" include connecting each buoy to the trussed deck.

1 106. A method of installing an oil and gas well production platform in an
2 offshore deep water marine environment, comprising the steps of:

3 a) floating a multi-ton package to a selected offshore location, the package
4 having a plurality of connectors and wherein the connectors are preliminarily positioned
5 at a higher elevational position;

6 b) positioning a plurality of floating buoys at a selected offshore location,

7 each buoy having a buoy connector portion at its upper end;

8 c) preliminarily positioning the buoy connectors at a selected elevational
9 position;

10 d) positioning a floating spar next to the combination of buoys and multi-ton
11 package; and

12 e) transferring the package from the buoys to the spar by laterally moving the
13 spar relative to the combination of buoys and package until they are generally vertically
14 aligned and then lowering the package to the spar.