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[11] **3,768,268**

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[54] **DRILLING OR PRODUCTION PLATFORM FOR WORK AT SEA**

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[51] **Int. Cl.** **E02b 17/00**, E02d 27/04

[58] **Field of Search** 61/46.5; 75/7, 8; 9/8

[56] **References Cited**

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[57] **ABSTRACT**

A platform for drilling or production operations at sea, consisting of a working platform **3** above sea-level, carried by a column **4** which is buoyant, containing tanks **5** and **6** for ballasting, and equipped with a jointed coupling **7** capable of swinging movement in two relatively transverse planes, connecting this first column to the upper end **9** of a second column **12**, the other end of which, possibly equipped with another jointed coupling **13** with two degrees of play, is attached to a base **15** with high non-buoyancy, designed to rest on the sea-bed.

9 Claims, 5 Drawing Figures

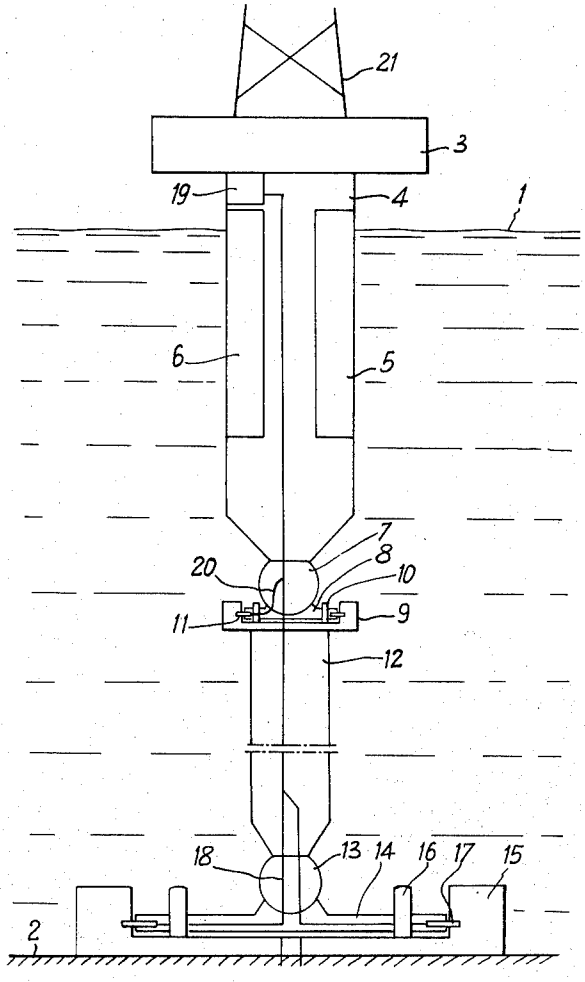


Fig. 1

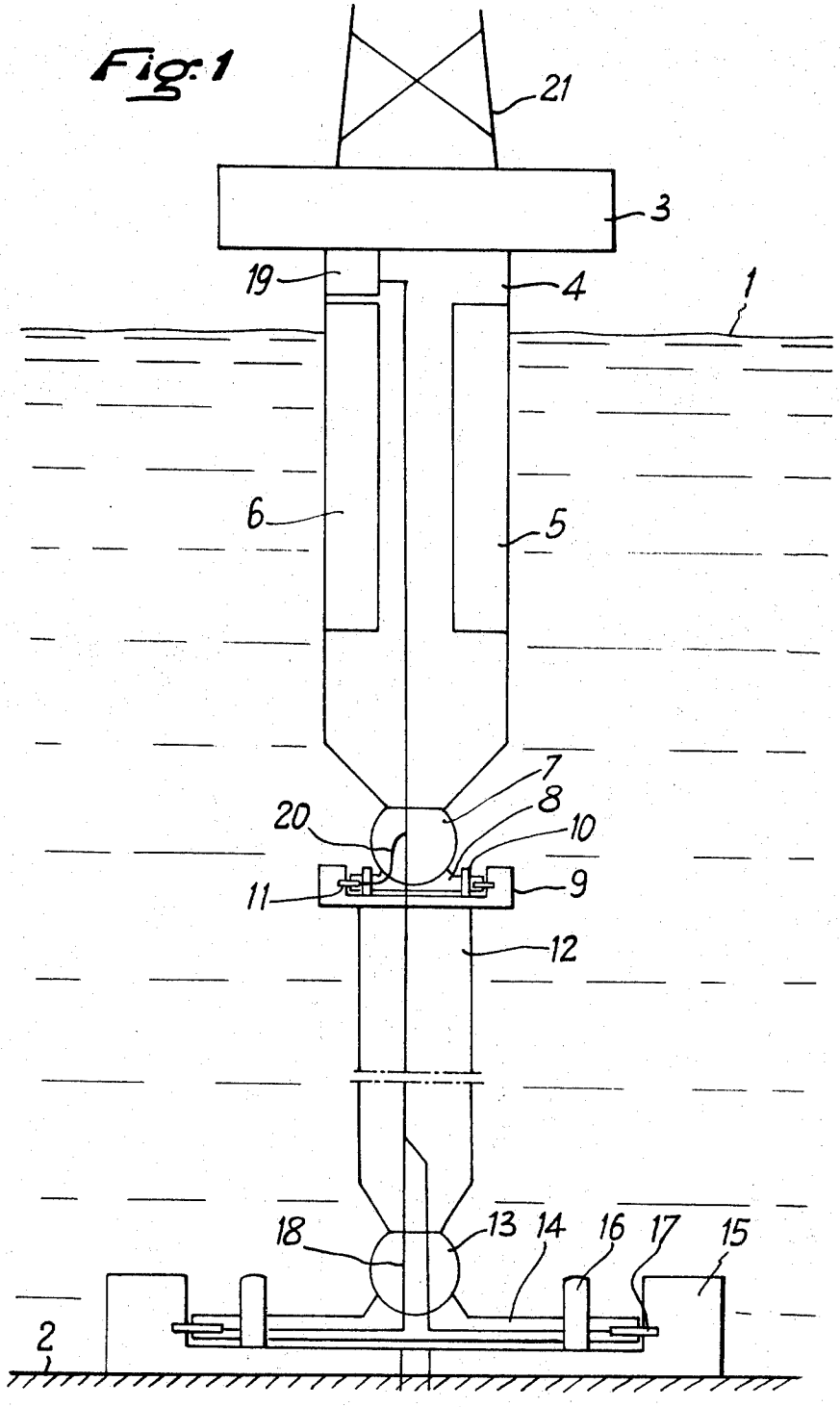


Fig: 2

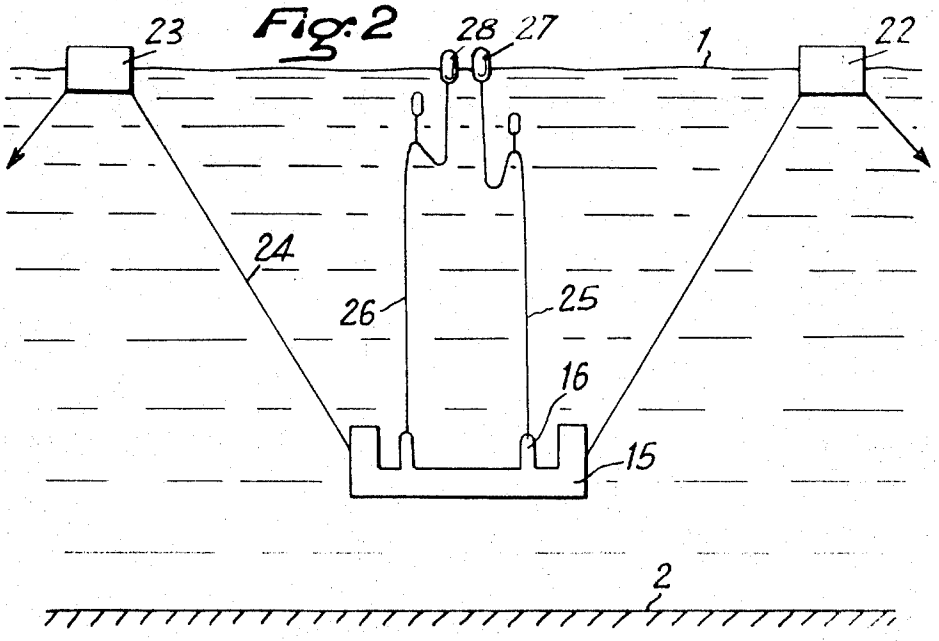

23
28
27
1
22
24
26
25
16
15
2

Fig: 3

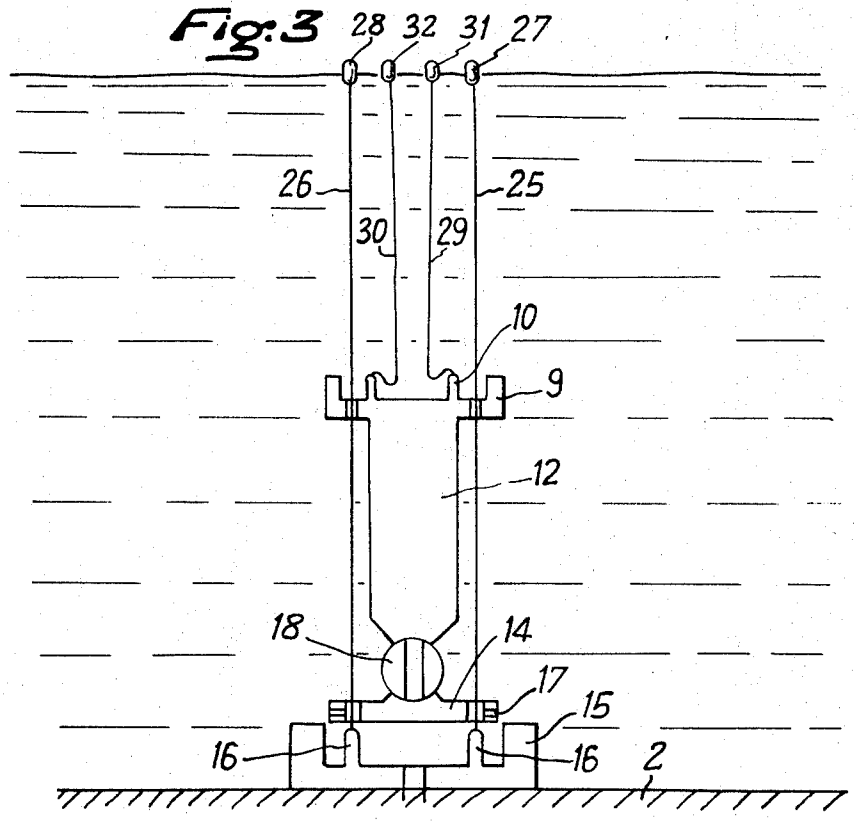

28
32
31
27
26
25
30
29
10
9
12
18
14
17
15
16
16
2

Fig: 4

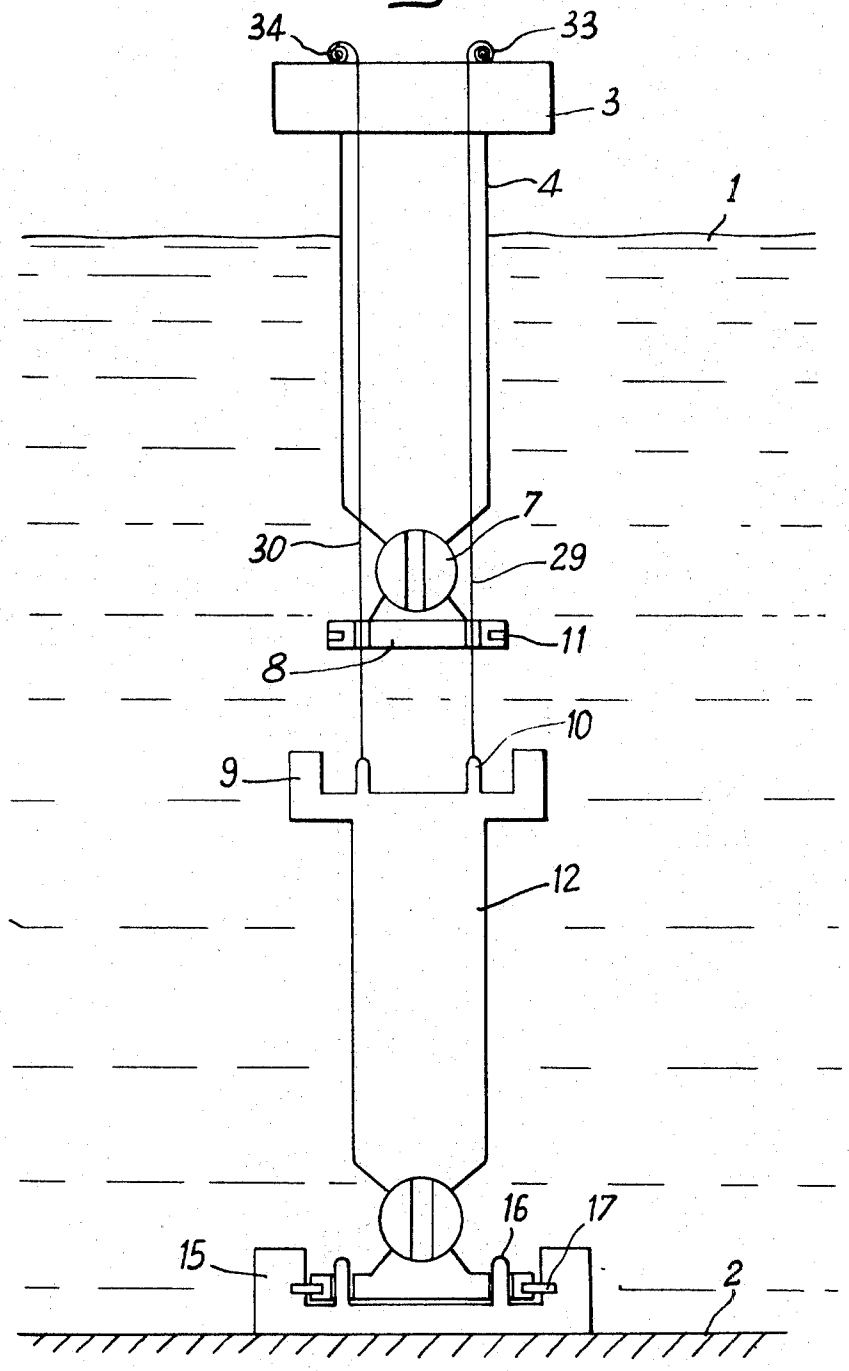
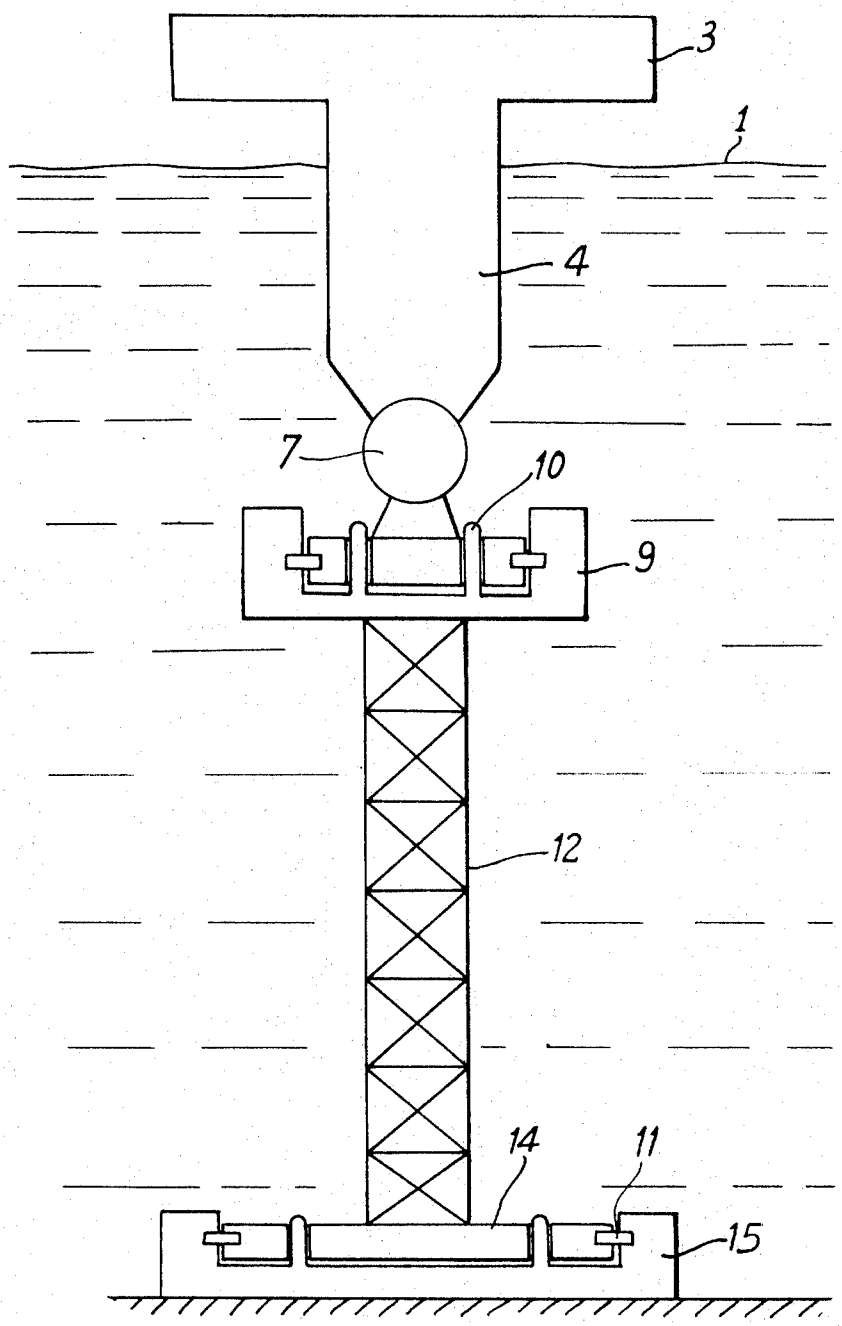


Fig. 5



DRILLING OR PRODUCTION PLATFORM FOR WORK AT SEA

The present invention concerns a platform for drilling or production operations at sea, in which a platform above sea-level, with high buoyancy, is connected with the sea-bed, by a set of columns containing at least one intermediate jointed connection.

Models already exist in which the platform is carried on a buoyant column, connected to a base of high apparent weight by means of a universal joint or swivel joint, enabling the column to rotate round the joint. This base forms a fixed point, and either rests on the sea-bed or remains between the surface and the sea-bed, to which it is anchored rigidly.

Such models are satisfactory where the distance between the jointed connection and surface of the sea does not exceed about 1,000 feet. At greater depths, the design and installation of a rigid shaft involve serious technological difficulties.

The present invention overcomes this difficulty by making use of a system involving more than one column. It is straightforward to construct and simple to instal, since the base rests on the sea-bed.

The platform for drilling or production operations at sea according to the present invention consists of a working platform above sea-level, carried on a buoyant column containing tanks for ballasting, and equipped with a jointed coupling at the lower end, which connects this first column to the upper end of a second column, also buoyant, the other end of which is attached to a highly non-buoyant base, designed to rest on the sea-bed.

In one embodiment of the invention, a jointed connection is interposed between the lower end of the second column and the non-buoyant base.

In another embodiment of the invention, the jointed connection on the first column includes a socket which fits into a base provided at the upper end of the second column.

The second column is connected with the non-buoyant base preferably by means of a socket at the lower end of the column, which fits into the base.

To allow the sockets to be positioned accurately on the bases, these bases contain guide-pins which fit into slots in the corresponding sockets.

The sockets are locked to the bases in some suitable way, such as by hydraulic devices controlled from the surface.

The invention will be made clearer by the following description of one form of embodiment of the platform, illustrated by the accompanying figures.

FIG. 1 shows a general view of the drilling platform, with two jointed connections.

FIG. 2 illustrates the installation of the base.

FIG. 3 illustrates the installation of the lower column.

FIG. 4 illustrates the installation of the upper part of the platform.

FIG. 5 shows a platform with one intermediate jointed connection.

FIG. 1 shows the surface of the sea **1** and the sea-bed **2**, with a drilling platform **3** carrying a drilling rig **21**. This platform is attached to a column **4**, inside which are tanks **5** and **6**, which may be filled with water or kept empty, allowing the buoyancy of the column to be regulated as desired. At the bottom of this column is a jointed connection **7**, capable of swinging movement in two relatively transverse planes. This jointed connection rests on a socket **8**, to which it is attached, and which in turn fits into a base **9**, attached to the second column **12**. Guide-pins **10** attached to the base **9** allow the socket **8** to be positioned correctly. When the socket has been thus positioned on the base **9**, it is locked to it by means of devices controlled from the surface. These devices **11**, which may operated hydraulically, for instance, fit into slots provided for them in the base.

This base **9** is at the top of a second column **12**, which has a jointed connection **13**, with two degrees of play, at the lower end. This connection rests on a socket **14** which fits into a base **15**. This base is extremely non-buoyant, and rests on the sea-bed. The socket **14** is positioned on the base **15** by means of guide-pines **16**, and locked in position by devices **17**, possibly operated by a hydraulic system **18** and **20** controlled from an operating post **19** on the surface.

FIG. 2 illustrates the installation of the base **15** on the sea-bed **2**. The base is floated out to the point of submersion, and connected with cables or chain-cables **24** to stabilizing buoys **22** and **23**, which are themselves anchored. The length of the mooring cables **24** depends on the depth of submersion. Cables of sufficient length **25** and **26** are attached to the guide-pins **16** on the base **15**. Floats **27** and **28** are attached to the other ends of these cables. The base is made slightly non-buoyant, in other words of low apparent weight, so that it submerges and begins to sink. Simultaneously, the buoys **22** and **23** approach the point of submersion, providing a braking force. The figure shows two such buoys, but during actual submersion there are usually four of them, in two planes at right angles to each other, to stabilize the base and ensure its correct positioning. The downward movement continues until the base reaches the sea-bed. The speed of submersion can be regulated by adjusting the apparent weight of the base.

FIG. 3 illustrates the installation of the lower column, after the base **15** has been placed in position and made completely non-buoyant, to ensure that it will remain stable on the sea-bed.

This lower column **12** may take the form of a hollow cylindrical shaft or of a metal framework, with two tanks for ballasting near the ends.

The column is floated to the point of submersion in a horizontal position, with both tanks empty. First, the cables connected to the base **25** and **26** are threaded through the slots in the socket **14**, so as to guide it during submersion. The lower end of the column is then ballasted, so that it tips over into an upright position. Ballasting is done in such a way as to leave the column as a whole still buoyant, so that on completion of the operation the upper end is still above water. Using the cables **25** and **26**, the column is then positioned over the site of the base **15**, and next made slightly non-buoyant, so that it sinks. Completion of submersion may be supervised accurately by means of the cables **29** and **30**, and buoys **31** and **32**. The socket **14** is guided by the cables, and on completion of submersion fits into the base **15**, positioning being ensured by the guide-pins **16**. When the socket is in place, it is locked to the base **15** by means of suitable devices **17**. The column is then made highly buoyant, possibly by emptying the upper tanks. It takes up a roughly upright position, with the second base **9** at the upper end. The cables **25** and **26** can be removed.

FIG. 4 illustrates the installation of the upper column, which is carried out in the same way as for the lower column. It is towed to the submersion point in a horizontal position, then the lower end is ballasted, so that it tips over into a roughly upright position, and, as buoyancy decreases, begins to sink, guided by the cables **29** and **30**. The socket **8** on this column fits into the base **9** on the lower column, positioning being ensured by the guide-pins **10**. When the socket is in place, it is locked to the base **9**, for instance by applying hydraulic pressure to locking devices **11**, which attach the two parts together. The column **4** is then made highly buoyant again, and the cables **29** and **30** are removed. The platform is now in the position for operations.

The jointed coupling **7** allows the column **4** to move in accordance with the waves. The column is generally 300 to 600 feet long, since it has been found that below this depth the swell has relatively little effect.

The other column **12** can be much longer, since it is fairly stable, being subject only to the effects of deep-water currents.

FIG. **5** shows an alternative form of platform, in which the column below **12**, in the form of a framework, is held rigidly by the socket **14**, which fits into the base **15**, being locked to it by means of locking devices **11**, which may or may not be hydraulically operated.

What is claimed is:

1. A platform for drilling or production operations at sea, comprising:

a non-buoyant base, resting on the sea bed,

a single lower buoyant column, comprising internal ballasting means, said column having its lower end attached to the base and its upper end provided with a supporting member,

a single upper buoyant column comprising internal ballasting means and having at its lower end a jointed coupling pivotally attaching said column to said supporting member for movement in a plurality of planes relative to said supporting member, said upper column being provided, at its upper end, with a working platform projecting above the sea level, and constituting the sole support for said platform.

2. A platform according to claim **1**, in which a jointed coupling is interposed between the lower end of the lower column and the non-buoyant base.

3. A platform according to claim **1**, in which the lower end of the lower column, carries a jointed coupling which is attached to a socket which fits into the non-buoyant base.

4. A platform as claimed in claim **1** in which said supporting member is provided with upwardly projecting pins and said jointed coupling comprises a socket member having slots therein positioned to receive said pins.

5. A platform according to claim **3**, in which the base carries guide-pins which fit into slots provided in the corresponding socket, to ensure accurate positioning of the said socket on the said base.

6. A platform according to claim **4**, comprising means for locking the socket to the corresponding supporting member.

7. A platform according to claim **3**, comprising means for locking the socket to the corresponding base.

8. A platform according to claim **6**, in which the locking means consists of hydraulic piston devices fitted to the socket and controlled from the surface, with the pistons of said devices fitting into slots provided in the supporting member.

9. A platform according to claim **7**, in which the locking means consists of hydraulic piston devices fitted to the socket and controlled from the surface, with the pistons of said devices fitting into slots provided in the base.

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