

PATENT SPECIFICATION

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- (21) Application No. 41387/71 (22) Filed 6 Sep. 1971
(31) Convention Application No. 70 101 (32) Filed 8 Sep. 1970 in
(33) United States of America (US)
(44) Complete Specification published 17 July 1974
(51) International Classification E02B 17/02 // E21B 7/04 7/12
(52) Index at acceptance
E1F 31E 44
E1H 14



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(54) PLATFORM STRUCTURE FOR CARRYING OUT DRILLING AND PRODUCTION OPERATIONS

(71) We, SHELL INTERNATIONALE RE-
SEARCH MAATSCHAPPIJ N.V., a company
organised under the laws of The Nether-
lands, of 30 Carel van Bylandtlaan, The
Hague, The Netherlands, do hereby declare
the invention, for which we pray that a
patent may be granted to us, and the
method by which it is to be performed to
be particularly described in and by the fol-
lowing statement:—

The invention relates to platform struc-
tures for carrying out drilling and produc-
tion operations, and being suitable for being
disposed on the floor of a body of water.
The invention relates further to a method of
installing such platforms.

In an attempt to locate new oil fields,
an increasing amount of well drilling has
been conducted at offshore locations.
Generally, platform structures are installed
on the ocean floor or sea floor and straight
well conductors are extended from the plat-
form structure some distance below the
ocean floor, providing guidance and support
for wells drilled into the formations below
the ocean floor.

In order to increase the lateral reach of
such well conductors, these conductors have
been slanted from the vertical, as described,
for example, in US patent No. 3,451,493
issued to J. C. Storm on 29th June, 1969.
Such conductors are usually extended
laterally beyond the perimeter of a con-
ventional platform structure at a consider-
able distance above the mudline (e.g. about
30 to 45 metres in 75-metres water depth).
This condition is undesirable since it results
in long spans of well conductors which are
unsupported or which require fabrication of
conductor guides outside of the main frame-
work of the platform structure. Such an
arrangement is both costly and complicated.
Further, if such well conductors are to per-
form as a portion of the platform structure
foundation by providing resistance to lateral

[Price 25p]

movement, the cost of the outriggered frame-
work is considerably increased.

An alternate type of arrangement in
applying such straight-slant type conductors
to deep water conditions is to keep the por-
tion of the conductor which is above the
mudline inside the framework of the plat-
form. The wellhead for each well conductor
should then be located at the top of the
platform structure on one side thereof and
the well conductor is further supported by
the structure at the mudline near the oppo-
site side of the platform structure. Such an
arrangement requires that a large part of
the deck area of the platform structure be
designed to accommodate the required slant
drilling rig since the wellheads are not
located together. Moreover, a special slant
drilling rig must be used rather than the
conventional straight rig.

Thus, the disadvantages of such prior art
arrangements for increasing horizontal reach
are conductor guides external of the plat-
form structure, possible interference of con-
ductors with the platform structure founda-
tion, non-centrally located wellheads, pos-
sibly undesirable well conductor reach pat-
terns, and the need for a special rig. These
disadvantages become especially significant
in water deeper than 60 metres.

It is an object of this invention to pro-
vide an offshore platform structure and
method for installing such platform with
well conductors having increased lateral
reach from the platform structure installed
on the floor of a body of water.

It is a further object of this invention
to provide offshore platform structures
wherein the conductors and guides are
framed inside of the main framework of the
structure.

It is a still further object of this inven-
tion to increase the lateral reach of well
conductors supported by offshore platform
structures with the ability to provide any

desired pattern with respect to the platform structure, depending upon the underground formations that are to be explored or from which a valuable product such as oil is to be produced.

It is an even further object of this invention to carry out the techniques disclosed herein without significantly altering the design or operation of conventional platform structures and drilling rigs.

In addition to the above-mentioned objects, a further object is to minimize the possibility of inadvertently drilling into a previously drilled well. The further apart the conductors are spread at the bottom of the structure, the less likelihood there is of drilling into one wellbore while drilling another well.

According to the present invention a platform structure for carrying out drilling and production operations and being suitable for being disposed on the floor of a body of water, comprises a framework and conductor guides carried by the framework, said guides being arranged for guiding at least one well conductor into a position in which said well conductor is curved over at least part of the length thereof but maintains throughout the entire length thereof a bore therethrough which does not abruptly change direction.

The conductor guides may be arranged to guide a well conductor within the enclosure of the framework between the upper end and the lower end of the structure when in the upright position.

Further, the conductor guides may be arranged to guide a well conductor in a position in which the upper part thereof extends vertically when the structure is in the upright position.

Also according to the present invention a method of installing a platform structure as defined above comprises the steps of:

placing the platform structure in the upright position on the floor of the body of water and anchoring the framework thereof to this floor, and

extending at least one well conductor from the upper end of the structure downwards through the conductor guides and into the floor, whereby the well conductor is passed through the guide means into a position in which said well conductor is curved over at least a portion of the length thereof but maintains throughout the entire length thereof a bore therethrough which does not abruptly change direction.

The well conductor may be passed through the conductor guides in a pre-curved condition.

The invention will now be described by way of example in more detail with reference to the drawing, in which:

Figure 1 is a vertical view of a platform

structure resting on the floor of a body of water and having well conductors installed thereon in accordance with the invention;

Figure 2 is a perspective view of the platform structure of Figure 1 showing well conductor guides carried by the framework of the structure for accommodating the curvature of the well conductors in accordance with the invention; and

Figure 3 is a vertical, partly graphic, view showing the advantages of the use of the invention over known offshore platforms provided with derricks with vertical axis.

Referring to both Figures 1 and 2, a platform structure 10 is shown resting on the floor 11 of a body of water 12. Structure 10 includes a generally horizontal work platform 13 thereon supported above the water surface 14 by suitable framework 15. Framework 15 includes a plurality of legs 16 interconnected by a network of cross-bracing members 17. The lower ends of legs 16 extend into the floor 11 and are anchored therein by suitable piles 18. It is to be understood that conventional well equipment, such as derricks, draw works, engines, etc., (not shown) may be installed on work platform 13.

In accordance with the invention, a plurality of well conductors are extended from platform 13 along framework 15 to the floor 11 of the body of water 12. For example, six such conductors 19 through 24 are shown in Figures 1 and 2. Conductor 22 extends substantially vertical with respect to platform structure 10 and is not visible in Figure 1. Conductors 19, 20, 21, 23 and 24 extend first vertically downwardly with respect to platform structure 10, then continually curve downwardly and outwardly in any desired pattern as illustrated in Figures 1 and 2.

Although only six such well conductors are shown extending from platform 13, obviously a plurality of such conductors may be provided, so arranged with respect to platform structure 10 as to provide an optimum lateral reach in the desired directions from the structure 10.

The curvature applied to conductors 19, 20, 21, 23 and 24 may be constant or varying; however, in either case, there is no abrupt change in direction throughout the entire extent of the conductors thereby permitting sharper curvatures than may normally be permitted when drilling into the floor 11. In this manner, the early attainment of high angles of deviation increases the lateral reach of the well conductors while retention of conventional vertical drilling techniques is permitted by having the curved conductors vertical at their top ends.

The conductors are supported at intervals along platform structure 10 by conductor guides 25 (Figure 2) connected to the frame-

work 15 of the platform structure 10 so as to accommodate the curvature of the conductors. These guides 25 have been omitted in Figure 1 for convenience of illustration.

5 As shown in Figure 2, guides 25 may take the form of ring elements or the like secured to the framework 15 of platform structure 10 at a plurality of staggered offset locations. These guides 25 provide guidance and support for the conductors. Curvature may be imparted to the conductors by preforming the conductors and/or by elastically bending the conductors during installation through the series of slightly offset guides 25. The preformed or plastically-bent conductors may be used to continue building angle below the bottom conductor guides 25 (generally at the mudline or floor 11). Conventional drilling, jetting, driving, or a combination of these techniques may be used to install the conductors through floor 11. Further, the curved well conductor provides continuous support for casing and tubing which can be conventionally drilled into communication with a subterranean reservoir from which valuable products are to be recovered, or into which drive fluids for secondary recovery processes are to be injected.

10 In Figure 3, a well 26 drilled through a curved conductor according to the invention is shown adjacent to a well 26' drilled through a conventional prior art "straight" vertical conductor and whipstocked in the seabottom 11. Both conductors are used in combination with a vertical-axis derrick (not shown) mounted on the platform structure 10. As can be seen, the lateral reach capability of the curved well conductor is greater as compared to the straight well conductor.

The techniques of the invention are particularly well suited for combined conditions of deep water (i.e. a water depth or W.D. greater than 60 metres) and shallow reservoir depth (i.e. a reservoir depth or R.D. of at most 1500 metres). When compared with known prior art techniques, as, for example, the "straight" vertical conductor of Figure 3 which is shown as having been driven to 45 metres penetration (vide level L) with the wellbore 26' deviated horizontally from that point, the curved conductor (through which the wellbore 26 is drilled) having a moderate curvature of, for example, six degrees every 30 metres, nearly doubles the acreage that can be reached by the wells (such as well 26) drilled therethrough from the platform structure 10. If desired the curvature may be chosen greater, say up to nine degrees every 30 metres.

Thus, in drilling wells in accordance with the techniques of the invention, a slant rig is not required since the wells may be drilled using conventional vertical-type

equipment. Additional deck space on platform 13 which may be necessary to move and operate a slant rig is not required nor is special designing of platform 13 to accommodate such a rig necessary. Finally, as shown in Figure 1, conventional wellhead equipment 27 through 31 may be associated with conductors 19, 20, 21, 23 and 24 (the equipment associated with conductor 22 not being visible in Figure 1) for recovering formation fluids produced from the reservoir 26 of Figure 3. This equipment may be clustered in a central location on the platform 13 of platform structure 10 of the same spacing and shape as is conventionally required for producing formation fluids from "straight" vertical conductors.

In summary, the curved conductors of the invention may be designed to nearly match or exceed (depending on water depth) the reach capability of conventional slant conductors without the inherent disadvantages of the latter, as the conductors and guides may be framed inside the platform structure. Thus, the well head equipment may be centrally located, and any desired reach pattern may be achieved. Further, the curved conductors may be installed and wells may be drilled using conventional vertical-type equipment and techniques. For deep water-shallow reservoir conditions, the curved conductor may be installed and operated without significantly altering the design or operation of the platform from that which is conventionally used for straight-vertical conductors. The curved conductors of the invention may be used in combination with straight vertical conductors to greatly increase the number of wells which can be drilled from a single platform structure.

It will be appreciated that the application of the platform structure according to the present invention is not restricted to the support of oil well installations or for carrying out drilling operations into oil reservoirs. With equal results, the structure with curved conductors may be applied for drilling and production operations in other types of reservoirs, such as gas or water reservoirs, or in formations, containing valuable solid products such as sulphur, salts or ores.

Although the conductor guides 25 as shown in the drawing consist of ring-shaped members, it will be appreciated that the application of the invention is not limited to this particular shape of the conductor guides. Any other type of guides suitable for the purpose, may be used. Thus, the guides may consist of curved tubular parts which are attached to the framework 15 of the platform structure, which framework comprises the legs 16 and the cross-bracing members 17.

Further, conductor guides may also be

arranged in the platform 13 carried by the framework 15 of the offshore structure 10.

WHAT WE CLAIM IS:—

1. Platform structure for carrying out
5 drilling and production operations and being
suitable for being disposed on the floor of
a body of water, said structure comprising
a framework and conductor guides carried
by the framework, said guides being
10 arranged for guiding at least one well con-
ductor into a position in which said well
conductor is curved over at least part of
the length thereof but maintains throughout
the entire length thereof a bore therethrough
15 which does not abruptly change direction.

2. Platform structure according to claim
1, wherein the conductor guides are
arranged to guide a well conductor within
the enclosure of the framework between the
20 upper end and the lower end of the struc-
ture when in the upright position.

3. Platform structure according to claim
1 or 2, wherein the conductor guides are
arranged to guide a well conductor in a
25 position in which the upper part thereof
extends vertically when the structure is in
the upright position.

4. Platform structure according to any
of the claim 1 - 3, wherein the guide means
30 are arranged to guide a well conductor to
curve up to nine degrees every 30 metres.

5. Method of installing the platform
structure according to any one of the claim

1 - 4, comprising the steps of:

placing the platform structure in the up- 35—
right position on the floor of the body of
water and anchoring the framework thereof
to this floor, and

extending at least one well conductor
from the upper end of the structure down- 40
wards through the conductor guides and
into the floor, whereby the well conductor
is passed through the guide means in a posi-
tion in which said well conductor is curved
over at least a portion of the length thereof 45
but maintains throughout the entire length
thereof a bore therethrough which does not
abruptly change direction.

6. The method according to claim 5,
wherein the well conductor is passed 50
through the conductor guides in a pre-
curved condition.

7. Platform structure for carrying out
drilling and production operations substan-
tially as described with reference to Figures 55
1 and 2 of the accompanying drawings.

8. Method of installing a platform struc-
ture for carrying out drilling and production
operations substantially as described with
reference to Figures 1 and 2 of the accom- 60
panying drawings.

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