

INTEGRATED BASE FOR OIL DRILLING AND PRODUCING WORK

This invention relates to an undersea structure intended to enable oil drilling, well-completing and oil-producing equipment to be installed.

This invention concerns an undersea structure known as an integrated drilling and producing base which will enable equipment intended for undersea oil drilling, well-completing and oil-producing to be installed. Fewer parts may be employed than in the conventional method, the idea being to cut down on the amount of work, movements and cost of equipment needed.

The method conventionally employed for the drilling, completing and producing work in undersea oil wells calls for two structures known as a drilling base and a producing base, which were intended to afford proper guidance for drilling tools and in the installing of the various kinds of well-completing and oil-producing equipment needed for production purposes, as for instance wet Xmas trees. A drilling base for deep water undersea wells is disclosed in Brazilian Patent Application PI 8700104.

The drilling base is a sturdy, complex piece of equipment fundamental in good drilling work. After drilling a well another specially designed base had to be put in position to enable parts involved specifically in oil-production work (pipes, valves, connectors, control devices, etc.) to be installed, and also a means had to be provided to transfer the oil drawn from the well. Special mention must be made of undersea wells and particularly of those in deep water. Those in the art skilled at dealing with them well know how much time and money is spent in installing two different bases (along with all the shifting of heavy loads) and are aware of the sturdiness required of the first base in order to bear the weight of the second base and of other equipment.

In addition to the foregoing, regard must be had for

the fact that the connections that had to be made in the second stage of the assembly of the completion base led to the risk of leaks because there are more points that require sealing.

5 To eliminate the need for two bases for drilling, completing, and producing work this invention provides a single base which deals with all these tasks and which offers not only a considerable technical advance but is also substantially cheaper and requires less labour to install.

10 Accordingly the present invention provides an integrated oil-drilling and -producing base whereby merely one such base is used, with a single guide funnel to guide installation of all drilling, completing, and producing equipment and whereby the guide funnel and supporting cradles
15 for a swivelling terminal for oil outflow piping are installed directly fitted to a high pressure head, thereby reducing any play and wandering between said high pressure head, said supporting cradles and said guide funnel, which parts are fundamental for proper positioning of a wet Xmas
20 tree.

Another important feature to be taken into account is the precision of the connections that can be made, whereby secure coupling of the wet Xmas tree to the production string hanger, and to the cradle used mainly for the oil outflow
25 piping, is achieved.

There are several further aspects to the equipment of this invention that enable the assembly of the parts needed to do the job, and the installation thereof, to be carried out with the aid of special tools, mainly by providing
30 certain temporarily adapted devices that make it easier to install and to withdraw certain parts used in the connecting of oil outflow pipes and those for control fluids.

In order that the present invention may more readily be understood the following description is given, merely by way
35 of example, with reference to the accompanying drawings, in which:-

FIGURE 1 is a schematic view of the arrangement of a two base system, used in the prior art;

FIGURE 2 is a side sectional view of the integrated drilling and completing base of this invention;

5 FIGURE 3 is a top plan view of the integrated drilling and completing base of Figure 2;

FIGURE 4 is an exploded schematic view of the arrangement of this invention for assembly upon a well head, showing necessary connections and oil-carrying lines as well as other
10 details of the arrangement; and

FIGURE 5 is a front view of an adaptor bushing intended to guide a tubing hanger installing tool.

Before starting upon a description of this invention reference is made to Figure 1 which is a sketch of a typical
15 two base system as used in the prior art. This shows a drilling base 27 and a completing and producing base 28, a tubing hanger 29, an undersea pipeline terminal 30, and a wet Xmas tree 31.

It should be pointed out that where the expression
20 "producing base" is used herein, it means equipment intended to guide properly the various kinds of equipment employed in the completing and producing stages, the latter stage being simply an extension of the former stage.

The invention will now be exemplified in terms of the
25 embodiments shown in Figures 2 to 5; however it must be assumed that other embodiments may result from use of the new technical ideas referred to herein.

Figure 2 shows the integrated drilling and producing base 1 mounted on its supporting structure 8 and standing on
30 the top of the outermost casing 10. Resting on this outermost casing 10 is the low pressure head 2, which in turn supports the high pressure head 3 and tubular conductor 9. This high pressure head 3 supports the well casing 11 and bears a guiding funnel 4, while a cradle 5 is fixed to said
35 guiding funnel 4. The casing pipes going down to various depths in the bore hole, as required by the job, are referred

to merely so that those who understand the art may imagine how the integrated base works; the gauges of the various pipes, or the extent to which they penetrate into the ground, are not factors that limit this invention.

5 A study of Figures 2, 3 and 4 reveals other important features of the integrated drilling and producing base, namely:

- 10 (a) the supporting frame 8 which is octagonal in shape in this embodiment and is coupled to the casing 10, said supporting frame 8 being nothing more than the temporary guiding base that rests on the bottom of the sea;
- 15 (b) the Y-shaped slots 12 intended for first rough guidance of the wet Xmas tree into place when installing it, this being a typical feature of the prior art and which has been retained in this invention since it is very important in guiding the coupling of the wet Xmas tree 26;
- 20 (c) the guiding funnel 4 is the only one to be used for the two operating modes of this base (drilling and producing);
- 25 (d) the cradle 5, which is the adaptor to which is fixed the pivoting terminal 16 of the oil carrying pipeline 32 leading to the oil receiving points, which said pivoting terminal receives at the same time the connector 15 of the oil carrying pipeline 14 from the wet Xmas tree 26; and
- (e) a cylindrical downcomer 6 from the funnel 4, which fits on to the high pressure well head 3 resting on the low pressure well head 2.

30 Other secondary operating features, as for instance the stiffener 7, are intended to strengthen the funnel 4 and ball levels 13, which are shown only because they are visible in the view of the embodiment illustrated but are nevertheless regarded as practically indispensable in all cases of
35 assembly of such structures.

 An important design feature is that the outside of the

guide funnel is not fully circular but is cut into by slits (Figure 3) large enough to receive the oil carrying pipeline 14 from the Xmas tree 26 and carrying the connector 15 to be connected to a hinged terminal 16 of the oil flowing pipeline 5 32 so that the line 32 may pass through it relatively easily, and easily fit into cradle 5 during assembly of the wet Xmas tree 26 (Figure 4).

It should be noted that more than one cradle 5, with its respective one of the slits 17 in the funnel 4, can be 10 provided at the integrated base 1 as a way of making the equipment more flexible. In this embodiment there are four cradles 5, with their respective slits 17 all at 90° intervals round the funnel 4, but it should be understood that this number is a mere matter of choice out of the many 15 possible alternatives and must not therefore be regarded as a factor limiting the present invention.

The position of the keyway 25 inside the high pressure well head 3, in relation to the cradle 5 chosen to bear the pivoting terminal 16, is fundamental as regards simultaneous 20 couplings of the connector 16 of the wet Xmas tree 26 to the hanger 19, and of the hinged terminal 16 to the cradle 5, which all take place when the wet Xmas tree 26 is being installed, as will be seen later on. In order to enable this positioning of the keyway 25 of the high pressure well head 25 3, and the cradle 5 chosen to bear pivoting terminal 16, to be done as accurately as possible, assembly and fitting devices are employed which are used for such kinds of assembly work and which are not described herein since they are not part of the present invention and because they are 30 widely known.

Since the position of production tubing hanger 19 is what determines the final position of the wet Xmas tree 26, and therefore the direction of the oil outflow pipeline 32, hanger 19 must be placed properly lined up with cradle 5 35 chosen to bear pivoting terminal 16.

Then, once the integrated base 1 and high pressure head 3 have been installed in their proper places, the tubing hanger 19 is fixed inside the high pressure head 3 in such a way as to take the wet Xmas tree 26. In order to enable the tubing hanger 19 to be installed in the correct direction relative to the particular cradle 5 chosen to bear the pivoting terminal 16, a bushing 20 is provided to guide fitting of the tubing hanger 19 inside the high pressure head 3. Such guide bushing 20 is shown in front view in Figure 5.

10 The guide bushing 20 consists of a hollow cylindrical body 21, cut off at its top end so that the rim thereof opens out into the shape of a pair of half helices 22 intended to direct the tubing hanger 19 when it is being put in with the help of the installing tool. This tool is not shown in the drawing, but proper fit thereof within the high pressure head 15 3 is achieved when its key 24 slides into the keyway 25 inside the high pressure head 3.

The tool used to insert the hanger 19 has a tip tongue which slides, under its own weight and that of the production 20 string being installed, along the helical face 22 of said bushing 20 to fit into the slot 23 shown in Figure 5. Thus the tubing hanger 19 is brought into its proper position to ensure it is in line with the particular cradle 5 chosen to bear the pivoting terminal 16, thereby ensuring that the oil 25 outflow pipeline 32 is pointing in the correct direction. After the tubing hanger 19 has been installed the guide bushing 20 is withdrawn, with the aid of its installing tool, from inside the blowout preventer which should be carried out after the hanger installing tool has first of all been 30 extracted.

A very important feature of this invention is that, in contrast to the conventional technique where the guide funnel is fitted to the low pressure head, the guide funnel 4 is in this case fitted directly to the high pressure head 3, 35 thereby doing away with any mechanical interfaces which would lead to play or wandering between the particular cradle 5

chosen to bear the pivoting terminal 16, and the keyway 25.

Figure 4 shows how the wet Xmas tree 26 will rest upon the integrated base, and how it will be connected to the other parts of the integrated base 1, or parts enveloped
5 thereby in operation. The dotted lines and arrows show quite clearly how the various parts will fit smoothly into place, thus ensuring an assembly that will operate securely and reliably.

Hence line 14 links the wet Xmas tree 13 laterally to
10 the connector 15 which fits into the pivoting terminal 16 for the oil outflow pipe 32. The pivoting terminal 16 is fitted to the cradle 5 when the wet Xmas tree 26 is installed. It is highly important that, when the equipment is being manufactured, the distances between the cradles 5 and the
15 centre line of the high pressure head are strictly equal, because the cradles 5 of the adaptor base have a fixed position so that when equipment is being installed the distances previously referred to must be strictly adhered to if precision of connections is to be assured.

20 To sum up, the integrated drilling and producing base 1 enables merely one kind of equipment to be used to guide the drilling, completing and producing work, giving the advantages that it is easier to fit together the parts that have to be joined, and that fewer movements are called for,
25 thereby cutting down on the number of mechanical interfaces between parts which would lead to play and to wandering, while ensuring an extremely reliable assembly and one which is simpler and considerably cheaper than those of the prior art.



CLAIMS

1. An integrated oil-drilling and -producing base whereby merely one such base is used, with a single guide
5 funnel to guide installation of all drilling, completing, and producing equipment and whereby the guide funnel and supporting cradles for a swivelling terminal for oil outflow piping are installed directly fitted to a high pressure head, thereby reducing any play and wandering between said high
10 pressure head, said supporting cradles and said guide funnel, which parts are fundamental for proper positioning of a wet Xmas tree.

2. An integrated oil-drilling and -producing base, according to claim 1, wherein said high pressure head
15 includes a keyway inside it, intended to guide a key of the body of a bushing when said bushing is installed inside said high pressure head, said bushing being responsible for guiding the tubing hanger installing tool so that said tubing hanger will match up properly with a said supporting cradle
20 chosen to bear said swivelling terminal of the oil outflow line, thereby ensuring simultaneous precision coupling of said wet Xmas tree connector to said hanger and of the swivelling terminal to said cradle which occurs when said wet Xmas tree is put in place.

25 3. An integrated oil-drilling and -producing base constructed and adapted to operate substantially as hereinbefore described with reference to, and as illustrated in, Figures 2 to 5 of the accompanying drawings.