A method is disclosed for producing fluids such as oil and gas from a wellbore, typically a subsea wellbore. The method comprises linking first and second wellbores to enable reservoir fluids located in a reservoir into which the second wellbore passes to reach both wellbores in order to avoid the need for surface pipelines linking the two wells.
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METHOD OF PRODUCING FLUIDS FROM AN UNDERGROUND RESERVOIR

The present invention relates to a method of producing fluids from underground reservoirs, and particularly relates to using first and second wellbores to link such reservoirs to a production facility.

Hydrocarbon reservoirs of oil and gas which are located too far from existing or proposed hydrocarbon production facilities are typically developed by drilling wells from directly above those reservoirs, and then providing a pipeline from the wellhead to the production facility.

According to the invention there is provided a method of producing fluids from underground reservoirs, the method comprising drilling a first wellbore, drilling a second wellbore into the reservoir, and linking the two wellbores to allow fluids to flow from the reservoir to the first wellbore.

Preferably the reservoir is an oil or gas well reservoir, and most preferably an offshore reservoir.

The first wellbore is typically at least partially
deviated, so that it extends from a site of a
production platform (or similar facility) laterally
towards the reservoir for the maximum distance feasible
for horizontal or lateral drilling.

The second wellbore can optionally be drilled
subsequently so as to pass through (or close to) the
end of the first wellbore and can be vertical or
deviated as required to connect the reservoir to the
first wellbore.

The first and second wellbores can be linked by a
number of means. For example, the second wellbore can
simply pass through the first wellbore, and can be
plugged between the junction with the first wellbore
and the surface, so that fluids passing through the
second wellbore from the reservoir are diverted only
into the first wellbore. Alternatively, the first and
second wellbores can be linked by a further wellbore
drilled before or after the second wellbore, or a
series of such further bores, so that the fluids can
travel from the reservoir to the first bore through a
series of interconnected bores. The first and second
(and/or the further) bores can be drilled so as to be
separated from one another by a portion of the medium
through which they are drilled (ie they can pass close
to the ends of the previous bore but not connected
thereto to allow fluid flow) and can be linked
subsequently by controlled explosion at the ends of the
bores, by perforation by some other means, by
fracturing, by stimulation, or by drilling etc.
Indeed, in one embodiment of the invention it is an
option to generate an explosion at the end of the first
(or subsequent further) bore in order to create a
chamber of a size large enough to facilitate drilling
into the chamber when the subsequent wellbore is
drilled. Alternatively, where the formation permits, first or subsequent further wellbores can be drilled deliberately into naturally occurring voids (ie formations capable of permitting fluid flow through such formations), so as to allow easy interconnection of the chain of wellbores.

One advantage of the invention is that pipelines necessary to connect remote wellheads to production facilities can be avoided and this avoids expense in constructing, maintaining, operating and inspecting the pipeline and associated injection pipelines and control umbilicals etc. In addition to cost benefits, the invention allows a decrease in the hydrocarbon-bearing installations above land or above the seabed, thereby reducing potential environmental and safety impacts.

This invention is therefore particularly applicable in environmentally sensitive areas such as Alaska.

An embodiment of the present invention will now be described with reference to the accompanying drawings in which:-

Fig. 1 is a schematic representation of a system of wells drilled according to the present invention; and

Fig. 2 is a schematic representation of a system of wells drilled according to a second embodiment.

Referring now to the drawings, Fig. 1 shows a fixed drilling/production platform P having a vertical well connecting the platform to two hydrocarbon reservoirs R1, R2 directly below the platform P. The platform P is also drilling, by conventional, known means, a laterally deviated well W1 in the direction of a third
hydrocarbon reservoir R3 laterally displaced from the production platform P. When the limit of horizontal drilling of well W1 is reached, a second well W2 is drilled from a semi-submersible (or fixed jacket or any other drilling facility) drilling platform D1 downwards from the platform D1 in the direction of the end point of well W1. W2 can be drilled straight through a portion of W1, for example at the end thereof, or can be drilled so as to pass close to the end of W1, but not to intersect with it to allow fluid flow between W2 and W1. In the embodiment shown in Fig. 1, the well W2 has been drilled to intersect with W1 and allow fluid transfer between the wellbores.

After intersecting or passing close to W1, the second well W2 is drilled laterally as W2L towards the third hydrocarbon reservoir R3. When W2L reaches the formation of hydrocarbon reservoir R3, the drilling string extracted and the wells completed, a plug P5 can be inserted in W2 between the junction with W1 and the platform D1 so as to divert fluids flowing from reservoir R3 into W1 and therefore to the production platform P. The platform D1 is then no longer required.

The junction between W2 and W1 (Detail A) can be made during drilling by accurately drilling W2 into W1 using directional drilling techniques. W2 can be drilled subsequently to W1, or vice versa. Alternatively, W1 can be drilled into an existing and depleted hydrocarbon reservoir or other naturally occurring void from a lateral side thereof, and W2 can subsequently be drilled into the same depleted reservoir and on through it into reservoir R3. As a further alternative, the two wells can be drilled so as not to intersect but to pass within a short distance (eg a few metres) of one
another allowing perforation of the separation by eg explosives etc. at a later date when drilling has been completed. It can be seen from this embodiment that the order of drilling W1 and W2 does not matter.

Fig. 2 shows a further embodiment of the invention similar to that shown in Fig. 1 except that W2L is drilled into a natural occurring cavity (Detail B) at the limit of horizontal drilling of W2L. A third well W3 is drilled (before or after W1 and W2) to intersect with cavity (Detail B) and to extend thereto to reservoir R4. As in the first embodiment, a plug P5 can be installed upon completion of W3 to divert fluids from R4 into W2L and from there into W1. As before, the manner and timing of linkage from W3 to W2L is a matter of choice, and can be by eg explosives etc.

According to the invention, any number of wells can be linked together in order to tie distant reservoirs to existing or proposed platforms by boreholes rather than by pipelines. The same drill ship or platform D1 can be used to drill the second and further wells linking the first wellbore to the reservoir, and more than one wellbore can be drilled from any one drill ship so as to allow several branches leading back to the same first or subsequent lateral well, as shown in the dotted lines of wells W5 and W6 connecting reservoirs R5 and R6 respectively to the cavity at Detail B. Although described with specific examples relating to offshore drilling facilities, the invention is also applicable to onshore wells, and the drill ships/offshore platforms described in the examples can be replaced by onshore equivalents well known in the art.

The wellbore sizes can be varied according to
production requirements.

Should pigging facilities, chemical injection facilities etc be required then the design of the wellbores can be altered to facilitate the incorporation of such facilities eg subsurface pigging facilities from W2 to W1 and to platform P.

Modifications and improvements can be incorporated without departing from the scope of the invention. For example, although described with regard to hydrocarbon reservoirs of oil and/or gas, the invention is applicable to water and gas injection wells, and to wells for the production and recovery of other liquids, gases, or slurries.
Claims

1. A method of producing fluids from an underground reservoir, the method comprising drilling a first wellbore, drilling a second wellbore into the reservoir, and linking the two wellbores to allow fluids to flow from the reservoir to the first wellbore.

2. A method as claimed in claim 1, wherein the first wellbore is deviated.

3. A method as claimed in claim 1 or claim 2, wherein the wellbores are linked by drilling.

4. A method as claimed in any preceding claim, wherein the reservoir is of oil or gas.

5. A method as claimed in any preceding claim, wherein the wellbores are offshore or onshore wellbores.

6. A method as claimed in any preceding claim, wherein the first wellbore extends from a site of a production platform towards the reservoir for the maximum distance feasible for lateral drilling.

7. A method as claimed in any preceding claim, wherein the second wellbore is drilled after the first wellbore.

8. A method as claimed in any preceding claim, wherein the second wellbore passes through or close to the end of the first wellbore.

9. A method as claimed in any preceding claim,
wherein the second wellbore is deviated.

A method as claimed in any preceding claim, wherein the second wellbore passes through or close to the first wellbore.

A method as claimed in any one of claims 1-9, wherein the first and second bores are drilled so as to be separated from one another by a portion of the medium through which they are drilled and are linked subsequently by removal of the separating portion.

A method as claimed in claim 11, wherein the separating portion is removed by perforation, explosion, fracturing, stimulation or by drilling.

A method as claimed in any preceding claim, wherein an explosion is detonated at the end of a bore in order to create a chamber into which the successive bore can be drilled.

A method as claimed in any preceding claim, wherein a bore is drilled into naturally occurring voids in the medium, into which a successive bore is drilled.

A method as claimed in any preceding claim, wherein after the two bores are linked the second wellbore is plugged between the junction with the first wellbore and the surface so that fluids passing through the second wellbore from the reservoir are diverted into the first wellbore.

A method as claimed in any preceding claim, wherein the first and second wellbores are linked by one or more further wellbore(s) drilled before or after
the second wellbore.

17 A method as claimed in claim 16, wherein the reservoir(s) is linked to a production platform by means of a linked chain of connected wellbores.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

| IPC 6 | E21B43/30 |

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

| IPC 6 | E21B |

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>WO 98 15712 A (BAKER HUGHES INC) 16 April 1998 (1998-04-16) page 27, line 5 - line 9; figure 5</td>
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  - "Z" document member of the same patent family.

**Date of the actual completion of the international search:** 8 September 1999

**Date of mailing of the international search report:** 16/09/1999

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