

MULTIPLE BORE CHRISTMAS TREE OUTLET

Field of the Invention

This invention relates to production outlets for large bore Christmas trees.

Invention Background

Traditionally, buoyant oil markets have provided the financial justification for the development of, and production from, multiple wells. However, current market circumstances dictate that whilst production volume must be maintained, it must be done with a reduced number of wells. This has led to the development of larger bore production xmas trees.

Problem to be Solved

Large bore production xmas trees, particularly subsea trees utilising horizontal outlets, present problems with outlet diameters. Current outlet valve technology accommodates outlets of up to 7" (178mm) diameter. Any production outlet with a diameter of over 7" (178 mm) will require the development of a new subsea gate valve, with the consequent costs involved, as well as the disadvantages of increased size and weight of the new design.

Summary of the Invention

In accordance with one aspect of the present invention, there is provided a production Christmas tree comprising a substantially vertical production bore, a substantially horizontal production passage having a first end connected to the production bore and a second end extending away from the production bore, and multiple production outlets extending from the second end of the production passage, wherein in normal production mode, fluid flowing through the horizontal production passage is produced through any or all of the multiple production outlets.

The example embodiments solve the above problems by enabling the use of existing standard sized outlet valves and actuators in a large bore production tree. To that end, the example embodiments provide a production Christmas tree having multiple production outlets extending from a single production bore. Splitting one large production outlet into two or more smaller outlets allows the use of existing subsea gate valves and actuators, with each production

outlet being controlled by a separate, standard sized valve, thereby avoiding the cost of development of a new larger subsea gate valve. This example system has the further benefit that pressure drops due to reservoir depletion, and associated flow assurance problems, can be alleviated by closing one of the production outlets. Erosion problems are also reduced. Preferably each production outlet may have a different diameter. By selecting different outlets or combinations of outlets, a wide range of production flow rates can be catered for, as the reservoir pressure drops over the lifecycle of the field. In a preferred

embodiment, two outlets are provided. These may be for example a 7" (178 mm) and a 5" (127 mm) outlet. However other diameters may be used, for example to suit smaller sized valves.

- 5 An illustrative embodiment of the invention is described below with reference to the drawings.

Brief Description of the Drawings

Fig. 1 schematically shows the vertical bore and single horizontal production outlet of a
10 prior art large bore horizontal production tree, and

Fig. 2 schematically shows a dual production outlet horizontal tree embodying the invention.

Description of the Preferred Embodiment

- 15 The prior art horizontal xmas tree shown in Fig. 1 has a vertical through bore 10 and a single horizontal production outlet 12 branched off from the vertical bore 10. Annular seals 14, 16 surround the vertical bore 10 above and below the production outlet 12, to seal a tubing hanger (not shown) in the vertical bore 10, as is conventional. A gate valve 18 forming a production master valve is situated in the production outlet 18.

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The embodiment of the invention shown in Fig. 2 is similar, except that the horizontal outlet 12 from the production bore is split into two separate outlets 20, 22. One of these outlets 20 is controlled by a 5" (127 mm) subsea gate valve 24 and actuator. The other outlet 22 is controlled by a 7" (178 mm) subsea gate valve and actuator. Other multiple
25 outlet configurations will be readily apparent, for example having other diameters to suit other anticipated production flow rates, or including three or more separate outlets, each controlled by an appropriately sized valve. Although gate valves are generally preferred, other forms of valve may be suitable in particular circumstances. The xmas tree of the invention may also incorporate other features known in prior xmas trees, for example an
30 annulus and/or workover conduit, and a crossover conduit extending between the annulus/workover conduit and one or more of the production outlets. These additional conduits (shown in dotted lines in Fig. 2) will be controlled by suitable valves, as is conventional.

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CLAIMS

1. A production Christmas tree comprising a substantially vertical production bore, a substantially horizontal production passage having a first end connected to the production
5 bore and a second end extending away from the production bore, and multiple production outlets extending from the second end of the production passage, wherein in normal production mode, fluid flowing through the horizontal production passage is produced through any or all of the multiple production outlets.
- 10 2. A production Christmas tree as defined in claim 1, wherein each production outlet has a different diameter.
3. A production Christmas tree as defined in claim 1 or 2, comprising two said production outlets.
- 15 4. A production Christmas tree as defined in claim 3, wherein one of the outlets is of 7" (178 mm) diameter or smaller.
5. A production Christmas tree as defined in claim 4 wherein the other outlet is of 5"
20 (127 mm) diameter or smaller.
6. A production Christmas tree as defined in any preceding claim, being a horizontal tree.
- 25 7. A production Christmas tree as defined in any preceding claim, wherein each production outlet is provided with a respective valve.
8. A production Christmas tree substantially as described with reference to or as shown in Fig. 2 of the drawings.