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(54) Filtration systems for chemical fluids

(57) A method of producing a filtration system for filtering a chemical fluid used in a hydrocarbon extraction well comprises providing a filter arrangement (1) having an inlet end (2) and an outlet end (4) and connecting the inlet end to a first fluid flow passageway (9) for the fluid using a first hydraulically operated connector (14) and connecting the outlet end to a second fluid flow passageway (10) using a second hydraulically operated connector (15).

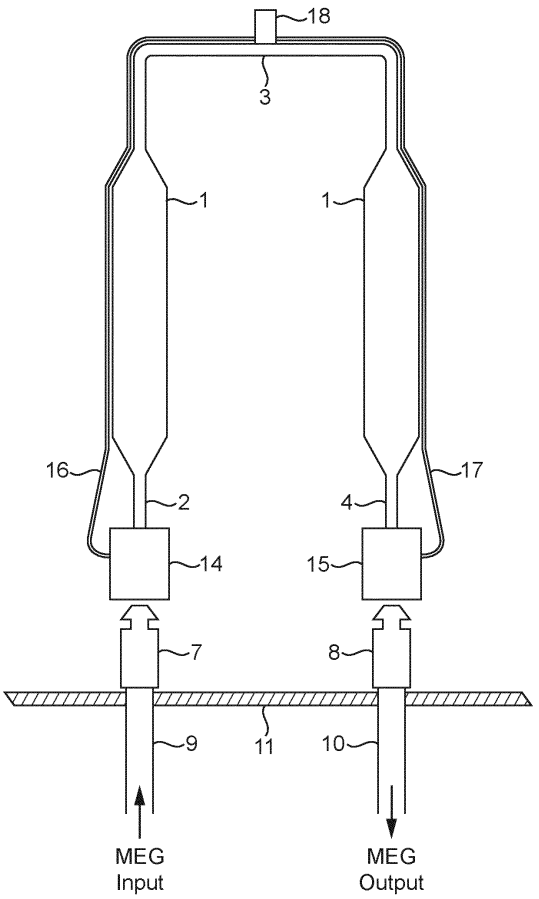

FIG. 2

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Description

Field of the Invention

[0001] The present invention relates to filtration systems for chemical fluids, in particular chemical fluids used in hydrocarbon extraction wells.

Background of the Invention

[0002] Flow lines and pipelines carrying hydrocarbons are subject to build-up of hydrates (which are crystalline in nature) which impede and may block the flow of hydrocarbons if not prevented or reduced. It is standard practice to inject mono ethylene glycol (MEG), which is a hydrate inhibitor, into such flow lines and pipelines for the prevention of hydrate formation and for the absorption of moisture. This process is normally carried out, in downtime, when production hydrocarbon fluid is not passing through the flow line or pipeline concerned. In offshore subsea control systems, the MEG is typically injected into an umbilical topside before being distributed through the subsea control system via MEG injection valves which are mounted on a suitable host structure subsea, such as one on a manifold or a Christmas tree or on the seabed, which host structure could be semi-permanent in that it is retrievable. A MEG filtration system comprising a filter module is inserted in the flow line or pipeline immediately before the MEG injection valves to clean the MEG before injection.

[0003] This filter module is required because the MEG fluid is retrieved after use and recycled in a recycling plant installed topside to remove the hydrates, pollutants from the well and water. The filter module collects contaminants suspended in the MEG and protects the inner surfaces of subsea MEG injection equipment from mechanical abrasion, resulting in expected improvement in equipment reliability and longevity. The module will require changing at intervals and therefore a method is needed of achieving this without the loss of MEG, risk of pollution and ingress of sea water.

[0004] As the MEG filter module is mounted on the host structure subsea, a remote method using an ROV is required to remove and re-install the filter module when required. As shown in Fig. 1, a typical ROV retrievable MEG filter module has a filter arrangement comprising a spool with one or more in-line filters 1 arranged in a 180 degree loop, the arrangement extending from an inlet end 2 to an apex region 3 and back to an outlet end 4. ROV actuated mechanically clamped connectors 5 and 6 respectively connect the inlet 2 and the outlet 4 to end connectors 7 and 8 of a MEG input passageway 9 and a MEG output passageway 10 which are mounted on a host structure 11, such as one on a pipeline end manifold (PLEM) or a Christmas tree. Isolation valves are placed both upstream of inlet end 2 and downstream of outlet end 4 in order to isolate the MEG flow to allow filter module replacement. Once the new filter module is latched in place, the isolation valves are returned to their open positions to re-commence the flow of MEG. Each of the connectors 5 and 6 requires an ROV to actuate its mechanical clamps and to disconnect it by rotating a clamp actuating mechanism 12 in order to remove or reinstall the filter module ··· see Fig. 1a which is a plan view of one of the connectors showing its clamps 13. Furthermore, the method of mounting the current filter module in a horizontal configuration severely restricts the access for an ROV. Thus the current process of MEG filter replacement is difficult, time consuming and therefore expensive.

Summary of the Invention

[0005] According to the present invention from one aspect, there is provided a method of producing a filtration system for filtering a chemical fluid used in a hydrocarbon extraction well, the method comprising providing a filter arrangement having an inlet end and an outlet end and connecting the inlet end to a first fluid flow passageway for the fluid using a first hydraulically operated connector and connecting the outlet end to a second fluid flow passageway using a second hydraulically operated connector.

[0006] According to the present invention from another aspect, there is provided a filtration system for filtering a chemical fluid used in a hydrocarbon extraction well, the system comprising a filter arrangement having an inlet end and an outlet end, the inlet end being connected to a first fluid flow passageway for the fluid by a first hydraulically operated connector and the outlet end being connected to a second fluid flow passageway by a second hydraulically operated connector.

[0007] Typically, the filtration system is on a subsea structure. In this case, typically, the connectors are hydraulically operated by a remotely operated vehicle (ROV). Preferably, the ROV causes hydraulic fluid to be supplied to operate said connectors via respective lines from a connector portion with which the ROV engages, preferably, by engaging with the connector portion in a hot stab manner.

[0008] Typically, said filter arrangement extends from said inlet end to an apex region and from the apex region to said outlet end, in which case such a connector portion is preferably at said apex region.

[0009] The present invention also comprises a hydrocarbon extraction well including a filtration system according to the invention.

[0010] An embodiment of the invention replaces the mechanically clamped connectors of a MEG filter module with field proven, hydraulically operated connectors operated by ROV hydraulic power by a hot stab hydraulic connection, thus enabling a quick connect/disconnect capability.

[0011] Subsea hot stab connectors, which are high pressure operated, are designed to be ROV operated. One part of such a connector, in the embodiment, is at-

tached to the filter arrangement and the ROV inserts another part into the connector so that high pressure hydraulic fluid is supplied to operate the hydraulically operated connectors.

Brief Description of the Drawings

[0012]

Fig. 1 shows a known form of filtration system;
Fig. 1 a shows part of what is shown in Fig. 1; and
Fig. 2 shows a filtration system according to an embodiment of the invention.

Description of an Embodiment of the Invention.

[0013] Fig. 2 (in which items which correspond with items in Fig. 1 have the same reference numerals as in Fig. 1) illustrates an application of the invention which includes the introduction of annulus flowline hydraulically operated connectors 14 and 15 to replace connectors 5 and 6. Each of connectors 14 and 15 is, by way of example, a Vetco Gray 2 1/16" flowline hydraulic connector part number A110312-9, to connect the MEG filter arrangement to the semi-permanent infrastructure. These connectors require hydraulic actuation, which is via hydraulic pipes 16 and 17 respectively, connected to a vertically mounted ROV hot stab connector portion 18 at the top of the 180 degree loop, that is on the apex region 3 of the filter arrangement. The hydraulic connectors 14 and 15 are self-sealing, thus preventing the ingress of seawater and the expulsion of MEG during filter arrangement change. Each connector has a latch mechanism which is hydraulically driven open and closed by the supply from the ROV hot stab on two separate circuits. A mechanism is engaged on the close stroke which mechanically latches the connector and the respective one of connectors 7 and 8 together. This means, should a hydraulic leak occur on the latch circuit, the connector will not de-latch. The system remains in stasis when the ROV hot stab is removed and until it is hydraulically driven open. The connectors 14 and 15 are latched to the end connectors 7 and 8, in each case by an annular piston within the connector body moving downwards, forcing a locking ring radially inwards by means of a surface machined on the internal diameter of the piston. Each locking ring mates with a machined profile on the respective one of end connectors 7 and 8, maintaining sufficient force to maintain the loading of a sealing gasket. The hot stab hydraulic circuit is capable of actuating both connectors 14 and 15 simultaneously. A manual over-ride is provided (not shown) should the hydraulic actuation fail whereby the ROV can mechanically separate the two parts of each hot stab connection.

Advantages of using the Invention

[0014] The main advantages of using the hot stab operated hydraulic connectors are:

improved flexibility for ROV access;

reduced time for removal and replacement of filters;

less risk of environmental pollution and sea water ingress;

reduction in cost of filter exchange; and

use of proven hydraulic connection technology.

Claims

1. A method of producing a filtration system for filtering a chemical fluid used in a hydrocarbon extraction well, the method comprising providing a filter arrangement having an inlet end and an outlet end and connecting the inlet end to a first fluid flow passageway for the fluid using a first hydraulically operated connector and connecting the outlet end to a second fluid flow passageway using a second hydraulically operated connector.

2. A method according to claim 1, wherein the well is a subsea well, the filtration system being on a subsea structure.

3. A method according to claim 2, wherein the connectors are hydraulically operated by a remotely operated vehicle (ROV).

4. A method according to claim 3, wherein the ROV causes hydraulic fluid to be supplied to operate said connectors via respective lines from a connector portion with which the ROV engages.

5. A method according to claim 4, wherein the ROV engages with the connector portion in a hot stab manner.

6. A method according to any preceding claim, wherein said filter arrangement extends from said inlet end to an apex region and from the apex region to said outlet end.

7. A method according to claim 6 as dependent on either of claims 4 and 5, wherein said connector portion is at said apex region.

8. A filtration system for filtering a chemical fluid used in a hydrocarbon extraction well, the system comprising a filter arrangement having an inlet end and an outlet end, the inlet end being connected to a first fluid flow passageway for the fluid by a first hydraulically operated connector and the outlet end being

connected to a second fluid flow passageway by a second hydraulically operated connector.

9. A system according to claim 8, wherein the filtration system is on a subsea structure of a subsea hydrocarbon extraction well.

10. A system according to claim 8 or 9, wherein said filter arrangement extends from said inlet end to an apex region and from the apex region to said outlet end.

11. A system according to claim 10 as dependent on claim 9, wherein a connector portion is at said apex region for engaging with an ROV for hydraulic operation of said connectors.

12. A hydrocarbon extraction well including a filtration system according to any of claims 8 to 11.

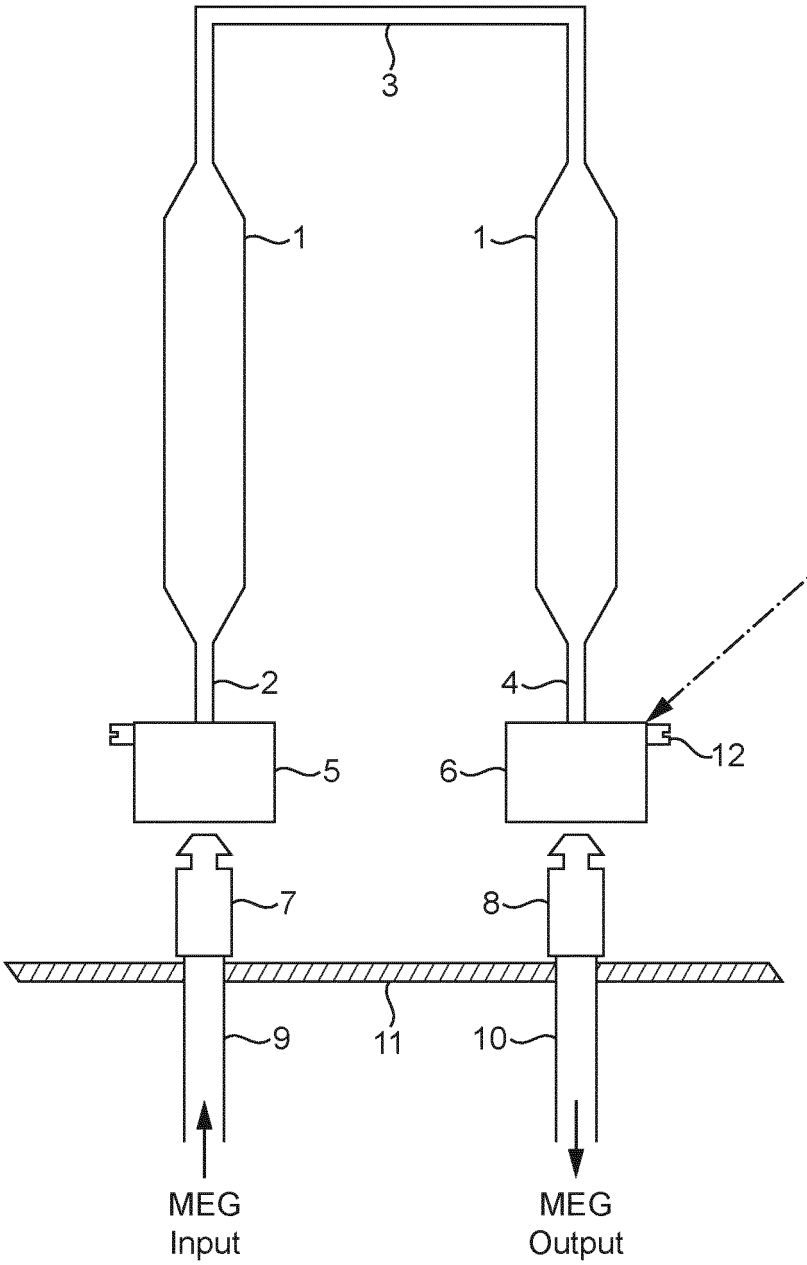

FIG. 1

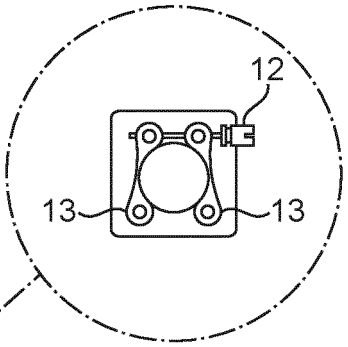

FIG. 1a

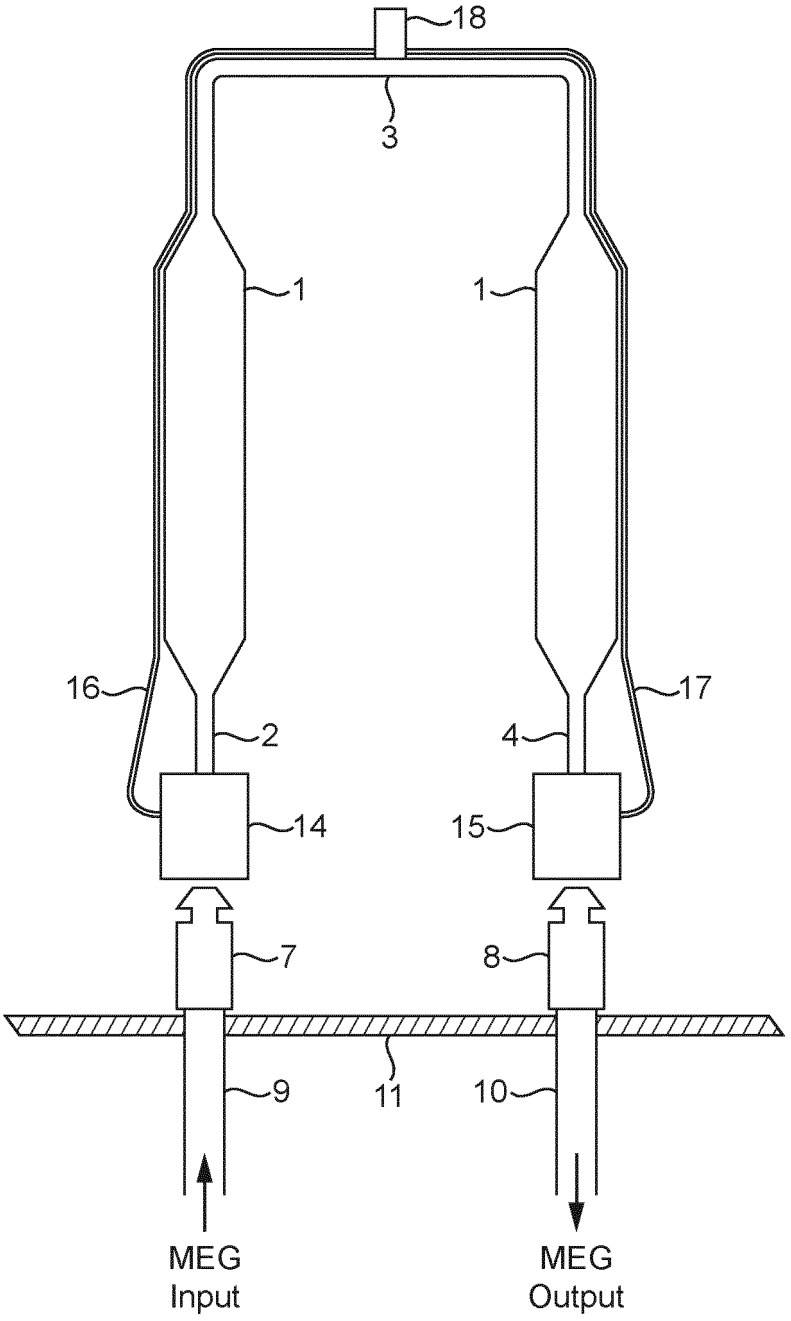

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 1156

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 4 435 292 A (KIRK JAMES L [US] ET AL) 6 March 1984 (1984-03-06) * column 5, lines 32-58; figure 1 *	1-12	INV. E21B43/00 E21B43/01
Y	US 6 644 410 B1 (LINDSEY-CURRAN CHRISTOPHER JOH [US] ET AL) 11 November 2003 (2003-11-11) * column 4, lines 28-37; figure 3 *	1-12	
Y	US 5 988 283 A (GANN DON MIKE [US]) 23 November 1999 (1999-11-23) * column 6, lines 1-8; figures 1, 2 *	1-12	
A	US 5 277 518 A (BILLINGS JEFFERY F [US] ET AL) 11 January 1994 (1994-01-11) * the whole document *	1-12	
			TECHNICAL FIELDS SEARCHED (IPC)
			E21B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 May 2011	Manolache, Iustin

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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13-05-2011

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82