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(54) **Filtration systems for chemical fluids**

Filtersysteme für chemikalische Flüssigkeiten

Systèmes de filtration pour liquides chimiques

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EP 2 476 860 B1

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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.

[0005] US-A-4 435 292 discloses a filtration system for filtering soil contaminants from a flushing fluid, 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 and the outlet end being connected to a second fluid flow passageway.

[0006] US-A-6 644 410 discloses the pre-characterising features of claims 1 and 6.

Summary of the invention

[0007] 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 hydraulic connector and connecting the outlet end to a second fluid flow passageway using a second hydraulic connector, wherein the well is a subsea well, the filtration system being on a subsea structure of the well, characterised in that each of said connectors is a hydraulically operated connector which is operable hydraulically to be open or closed by a remotely operated vehicle (ROV).

[0008] 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 hydraulic connector and the outlet end being connected to a second fluid flow passageway by a second hydraulic connector, wherein the filtration system is on a subsea structure of a subsea hydrocarbon extraction well, characterised in that each of said connectors is a hydraulically operated connector which is operable hydraulically to be open or closed by an ROV.

[0009] Preferably, the ROV causes hydraulic fluid to be supplied to operate said connectors via respective lines of the system from a connector portion with which the ROV engages, preferably by engaging with the connector portion in a hot stab manner.

[0010] 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.

[0011] 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.

[0012] 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 attached 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

[0013]

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.

[0014] 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

[0015] 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 (2) and an outlet end (4) and connecting the inlet end to a first fluid flow passageway (9) for the fluid using a first hydraulic connector (14) and connecting the outlet end to a second fluid flow passageway (10) using a second hydraulic connector (15), wherein the well is a subsea well, the filtration system being on a subsea structure (11) of the well, **characterised in that** each of said connectors is a hydraulically operated connector which is operable hydraulically to be open or closed by a remotely operated vehicle (ROV).

2. A method according to claim 1, wherein the ROV causes hydraulic fluid to be supplied to operate said connectors (14, 15) via respective lines (16, 17) from a connector portion (18) with which the ROV engages.

3. A method according to claim 2, wherein the ROV engages with the connector portion (18) in a hot stab manner.

4. A method according to any preceding claim, wherein said filter arrangement extends from said inlet end (2) to an apex region (3) and from the apex region to said outlet end (4).

5. A method according to claim 4 as dependent on either of claims 2 and 3, wherein said connector portion (18) is at said apex region (3).

6. A filtration system for filtering a chemical fluid used in a hydrocarbon extraction well, the system comprising a filter arrangement having an inlet end (2) and an outlet end (4), the inlet end being connected to a first fluid flow passageway (9) for the fluid by a first hydraulic connector (14) and the outlet end being connected to a second fluid flow passageway (10) by a second hydraulic connector (15), wherein the filtration system is on a subsea structure (11) of a subsea hydrocarbon extraction well, **characterised in that** each of said connectors is a hydraulically operated connector which is operable hydraulically to be open or closed by an ROV.

7. A system according to claim 6, including a connector portion (18) for engagement with an ROV for the ROV to cause hydraulic fluid to operate said connectors (14, 15) from said connector portion via respective lines (16, 17) of the system.

8. A system according to claim 6 or 7, wherein said filter arrangement extends from said inlet end (2) to an apex region (3) and from the apex region to said outlet end (4).

9. A system according to claim 8 as dependent on claim 7, wherein said connector portion (18) is at said apex region (3).

Patentansprüche

1. Verfahren zum Herstellen eines Filtrationssystems zum Filtern eines chemischen Fluids, das in einem Kohlenwasserstoff-Gewinnungsbohrloch verwendet wird, wobei das Verfahren Folgendes umfasst: Bereitstellen einer Filteranordnung mit einem Einlassende (2) und einem Auslassende (4) und Verbinden des Einlassendes mit einem ersten Fluidflussdurchgang (9) für das Fluid unter Verwendung eines ersten Hydraulikverbinders (14) und Verbinden des Auslassendes mit einem zweiten Fluidflussdurchgang (10) unter Verwendung eines zweiten Hydraulikverbinders (15), wobei es sich bei dem Bohrloch um ein Unterseebohrloch handelt und sich das Filtrationssystem an einer Unterseestruktur (11) des Bohrlochs befindet, **dadurch gekennzeichnet, dass** es sich bei den Verbindern jeweils um hydraulisch betätigte Verbinder handelt, die von einem ferngesteuerten Fahrzeug (ROV) hydraulisch betätigbar sind, um offen oder geschlossen zu sein.

2. Verfahren nach Anspruch 1, wobei das ROV bewirkt, dass Hydraulikfluid zum Betätigen der Verbinder (14, 15) überjeweilige Leitungen (16, 17) von einem Verbinderabschnitt (18) zugeführt wird, mit dem das ROV in Eingriff tritt.

3. Verfahren nach Anspruch 2, wobei das ROV auf Hot-Stab-Weise mit dem Verbinderabschnitt (18) in Eingriff tritt.

4. Verfahren nach einem der vorangehenden Ansprüche, wobei sich die Filteranordnung von dem Einlassende (2) zu einer Gipfelregion (3) und von der Gipfelregion zu dem Auslassende (4) erstreckt.

5. Verfahren nach Anspruch 4, wenn abhängig von einem der Ansprüche 2 und 3, wobei sich der Verbinderabschnitt (18) an der Gipfelregion (3) befindet.

6. Filtrationssystem zum Filtern eines chemischen Fluids, das in einem Kohlenwasserstoff-Gewinnungsbohrloch verwendet wird, wobei das System Folgendes umfasst: eine Filteranordnung mit einem Einlassende (2) und einem Auslassende (4), wobei das Einlassende durch einen ersten Hydraulikverbinder (14) mit einem ersten Fluidflussdurchgang (9) für das Fluid verbunden ist und das Auslassende durch einen zweiten Hydraulikverbinder (15) mit einem zweiten Fluidflussdurchgang (10) verbunden ist, wobei sich das Filtrationssystem an einer Unterseestruktur (11) eines Untersee-Kohlenwasserstoff-Gewinnungsbohrlochs befindet, **dadurch gekennzeichnet, dass** es sich bei den Verbindern jeweils um hydraulisch betätigte Verbinder handelt, die von einem ROV hydraulisch betätigbar sind, um offen oder geschlossen zu sein.

7. System nach Anspruch 6, umfassend einen Verbinderabschnitt (18) für den Eingriff mit einem ROV, damit das ROV bewirkt, dass Hydraulikfluid von dem Verbinderabschnitt über jeweilige Leitungen (16, 17) des Systems die Verbinder (14, 15) betätigt.

8. System nach Anspruch 6 oder 7, wobei sich die Filteranordnung von dem Einlassende (2) zu einer Gipfelregion (3) und von der Gipfelregion zu dem Auslassende (4) erstreckt.

9. System nach Anspruch 8, wenn abhängig von Anspruch 7, wobei sich der Verbinderabschnitt (18) an der Gipfelregion (3) befindet.

Revendications

1. Procédé de production d'un système de filtration pour filtrer un fluide chimique utilisé dans un puits d'extraction d'hydrocarbures, le procédé comprenant la fourniture d'un agencement de filtre ayant une extrémité d'admission (2) et une extrémité de sortie (4) et la connexion de l'extrémité d'admission à un premier passage d'écoulement de fluide (9) pour le fluide au moyen d'un premier connecteur hydraulique (14) et la connexion de l'extrémité de sortie

à un second passage d'écoulement de fluide (10) au moyen d'un second connecteur hydraulique (15), dans lequel le puits est un puits sous-marin, le système de filtration étant monté sur une structure sous-marine (11) du puits, **caractérisé en ce que** chacun desdits connecteurs est un connecteur actionné hydrauliquement exploitable hydrauliquement pour être ouvert ou fermé par un véhicule télécommandé (ROV).

2. Procédé selon la revendication 1, dans lequel le ROV fait en sorte que du fluide hydraulique soit alimenté pour actionner lesdits connecteurs (14, 15) via des conduites respectives (16, 17) depuis une partie de connecteur (18) avec laquelle le ROV s'enclenche.

3. Procédé selon la revendication 2, dans lequel le ROV s'enclenche avec la partie de connecteur (18) à la manière d'un tube de guidage (hot stab).

4. Procédé selon l'une quelconque des revendications précédentes, dans lequel ledit agencement de filtre s'étend depuis ladite extrémité d'admission (2) jusqu'à une région sommitale (3) et depuis la région sommitale jusqu'à l'extrémité de sortie (4).

5. Procédé selon la revendication 4, dépendante de la revendication 2 ou 3, dans lequel ladite partie de connecteur (18) est située au niveau de ladite région sommitale (3).

6. Système de filtration pour filtrer un fluide chimique utilisé dans un puits d'extraction d'hydrocarbures, le système comprenant un agencement de filtre ayant une extrémité d'admission (2) et une extrémité de sortie (4), l'extrémité d'admission étant connecté à un premier passage d'écoulement de fluide (9) pour le fluide par un premier connecteur hydraulique (14) et l'extrémité de sortie étant connectée à un second passage d'écoulement de fluide (10) par un second connecteur hydraulique (15), le système de filtration étant monté sur une structure sous-marine (11) d'un puits d'extraction d'hydrocarbures sous-marin, **caractérisé en ce que** chacun desdits connecteurs est un connecteur actionné hydrauliquement exploitable hydrauliquement pour être ouvert ou fermé par un ROV.

7. Système selon la revendication 6, comportant une partie de connecteur (18) destinée à s'enclencher avec un ROV pour que le ROV fasse en sorte que du fluide hydraulique actionne lesdits connecteurs (14, 15) depuis ladite partie de connecteur via des conduites respectives (16, 17) du système.

8. Système selon la revendication 6 ou 7, dans lequel ledit agencement de filtre s'étend depuis ladite extrémité d'admission (2) jusqu'à une région sommitale (3) et depuis la région sommitale jusqu'à ladite extrémité de sortie (4).

9. Système selon la revendication 8, dépendante de la revendication 7, dans lequel ladite partie de connecteur (18) est située au niveau de ladite région sommitale (3).

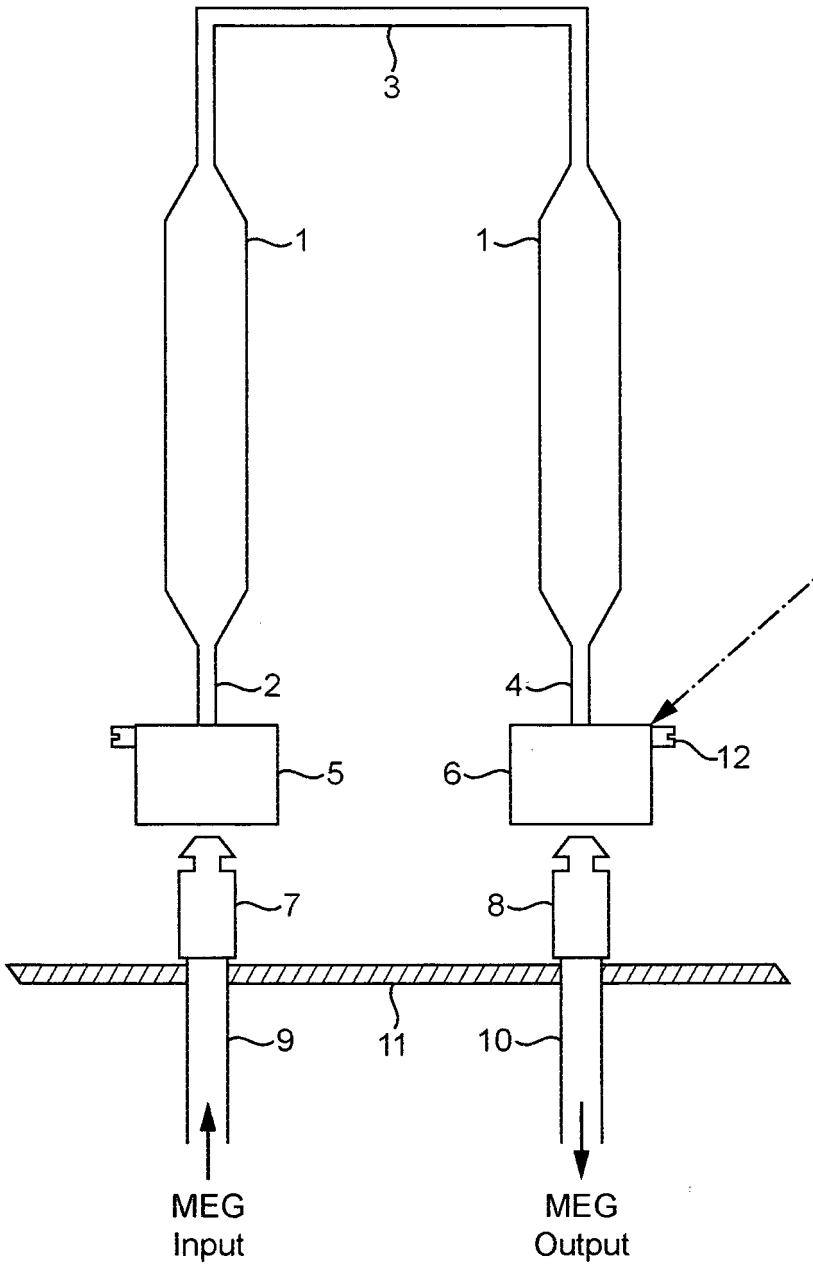


FIG. 1

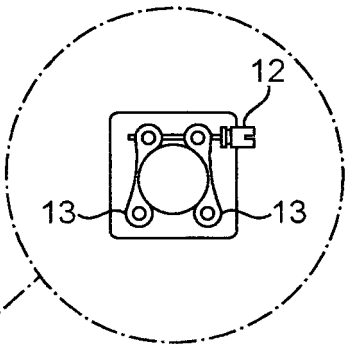


FIG. 1a

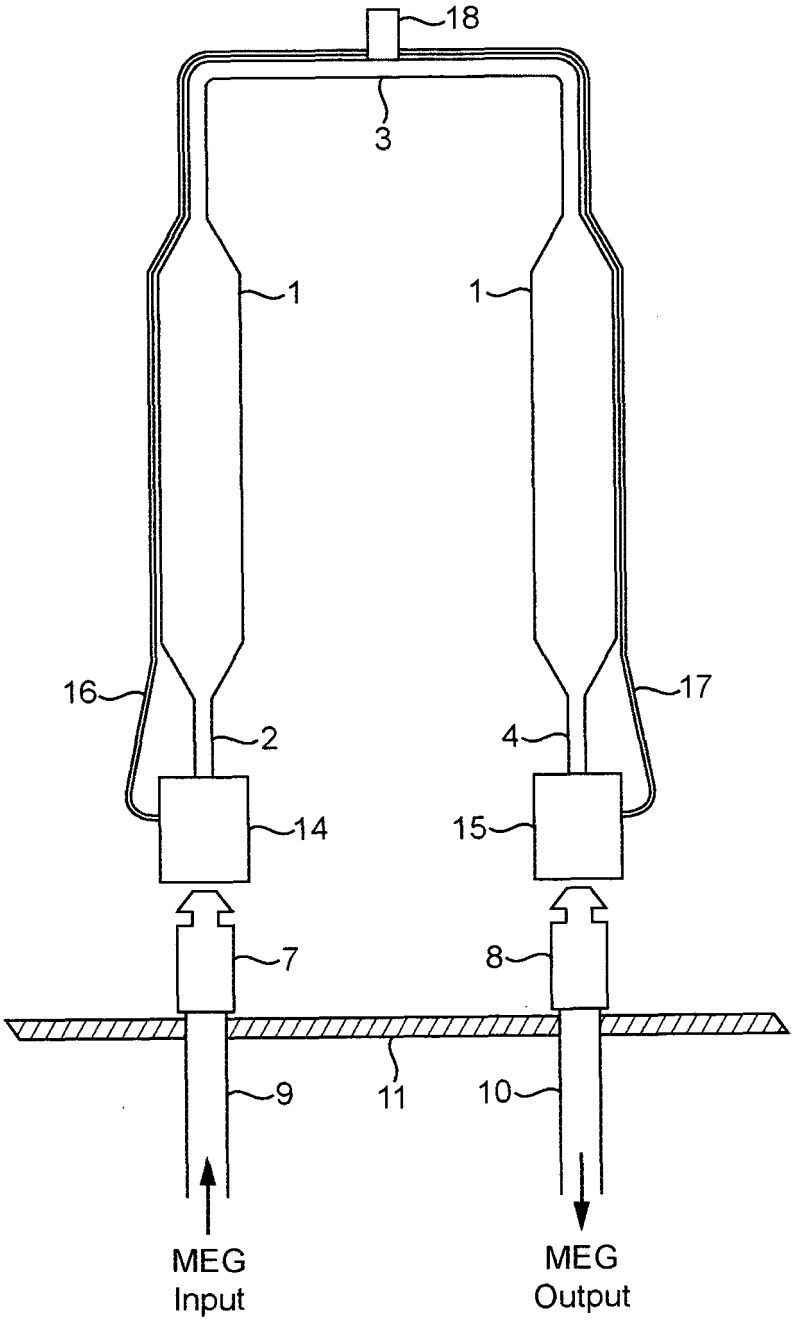


FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4435292 A **[0005]**
- US 6644410 A **[0006]**