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(54) Benævnelse: **Olie-, vand-, gas- og faststofpartikelseparering inden for olie- og/eller gasproduktion**

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DESCRIPTION

[0001] The present invention relates to an apparatus for, and a method of, separating oil, water, gas and solid particles (usually sand) from a hydrocarbon-containing fluid produced from an oil and/or gas production facility. In particular, this invention relates to an apparatus and method for the separation of oil, water, gas and solid particles from a well or group of wells using an integrated apparatus which significantly reduces the space required on the production platform or rig and recycles produced gas to improve process efficiency while reducing cost.

[0002] Many offshore oil and gas fields are developed and produced using a multi-well platform. In general a template is placed on the seabed, which comprises slots and a well is drilled through each slot. It is not uncomment to have 10 to 20 wells drilled from a single template. Each well will be drilled to hit a particular reservoir target or targets. The trajectory of the wells can be very different but care is taken to make sure that the wells do not collided with each other. In some cases, these wells are drilled individual at some distance between them or other templates. There wells, often called satellite wells, have individual well heads that are connected into the production system via long flow-lines to a collection manifold which in turn is connected to the production platform or facility.

[0003] The production from these wells is often co-mingled and processed on a single production platform or facility. In the case of offshore field development, these production platforms can be floating, e.g., FPSO (Floating Production Storage and Offloading) or permanent platform structures. Such productions units are very expensive systems and platform space comes at a premium. As an illustration, costs can be $100,000 per tonne of payload and $25,000 per square meter of facility area. As a result, reducing the weight and size of the required process equipment is very important. In addition, consumables required for the process require storage space, which adds to their purchase price and so increases the overall cost of their use. Again, keeping these to a minimum or ideally eliminating the need for additional products will allow for a more cost effective process requiring less platform space (and load capacity).

[0004] Generally the production from a well or group of wells will comprise oil, gas, water and solid particles (usually sand). In the industry these are often referred to as different phases, that is, there are four phases in the production flow. Before oil and/or gas can be exported from a production facility to a refinery or storage facility, it must be first cleaned of any solids and water. It is also beneficial to separate the gas from the oil so that there are two independent product streams, that is, gas and oil. Water and solid particles are considered to be by-products that need to be disposed of. Usually the solids need to be cleaned of any traces of oil so that they can be disposed of without damage to the environment. Therefore the production flow is best separated into its four phases. Today this often requires a lot of equipment to carry out these separations in sequential steps. In particular, solids are removed first using one processing step followed by water removal and finally gas and oil. As a result, a large footprint or platform area is required which increases the overall cost of the system. This can significantly increase the construction cost of the production facility or platform.

[0005] US-A-6214220 discloses an apparatus for removing oil or gas from a wastewater flow stream comprising: a vessel having an interior and a vessel wall; a flow inlet for transmitting a wastewater flow stream to the vessel interior; a primary oil outlet; a secondary oil outlet; a primary inlet separation device that preliminarily separates gas and oil from wastewater that enters the vessel interior via the flow inlet; coalescing media positioned in between the primary inlet separation device and the secondary oil outlet; and a de-oiler hydrocyclone liner device that comprises one or more hydrocyclone liner positioned within the vessel interior, upstream of the secondary outlet and downstream of the coalescing media.

[0006] The present inventors have worked to establish technical solutions to the above restrictions associated with technology presently used in the industry or disclosed in the prior art.

[0007] In a first aspect of the present invention, there is provided an apparatus for separating oil, water and gas from a hydrocarbon-containing fluid produced from an oil and/or gas production facility, the apparatus comprising: a separation tank for separating a multiphase hydrocarbon-containing fluid comprising oil, water and gas into its constituent oil, water and gas phases, the separation tank including a first inlet for the hydrocarbon-containing fluid, a second inlet for gas and, connected to the second inlet, a gas fluffer for passing gas bubbles through an oil/water mixture in a reservoir of the separation tank to collect droplets of oil entrained within the water; and a first separator provided upstream of the separation tank, the first separator comprising an inflow conduit for the hydrocarbon-containing fluid, a first outlet of the first separator communicating an upper part of the first separator with the second inlet to convey gas separated from the hydrocarbon-containing fluid to the gas fluffer provided inside the separation tank, and a second outlet communicating a lower part of the first separator with the first inlet of the separation tank to convey liquid phases of the hydrocarbon-containing fluid to the separation tank.

[0008] Typically, the first separator further includes a liquid level sensor and a first control module coupled thereto for controlling the liquid level within the first separator to be within a predetermined range.

[0009] Optionally, the first separator further includes an internal gas pressure sensor and a second control module coupled thereto for controlling a gas pressure within the first separator to be within a predetermined range.

[0010] Preferably, the first separator further comprises a third outlet of the first separator, located lower on the first separator than the first outlet, communicating the upper part of the first separator with the first inlet to convey gas separated from the hydrocarbon-containing fluid to the separation tank. Typically, the first outlet, the second outlet and the third outlet are each provided with a respective independently controllable valve selectively to open or close the respective outlet and control a flow rate through the respective outlet. A controller comprising respective valve controlling modules for the respective valves may be provided.

[0011] In one embodiment, the separation tank further comprises a solids separator for separating solid particles from the multiphase hydrocarbon-containing fluid. However, alternatively the separation tank may be configured to separate only fluid phases, i.e. oil, water and gas.

[0012] Optionally, the apparatus further comprises a coarse solid particle separator upstream of the first inlet and downstream of the first separator for separating coarse particles from the multiphase hydrocarbon-containing fluid. Alternatively, a coarse solid particle separator may be located upstream of the first inflow conduit for separating coarse particles from the multiphase hydrocarbon-containing fluid.

[0013] Preferably, the apparatus of this aspect of the present invention is adapted continuously to separate oil, water, gas and solid particles from a continuous flow of a hydrocarbon-containing fluid produced from an oil and/or gas production facility. The present invention also provides an oil or gas facility incorporating the apparatus of this aspect of the present invention.

[0014] In a second aspect of the present invention, there is provided a method of separating oil, water and gas from a hydrocarbon-containing fluid produced from an oil and/or gas production facility, the method comprising the steps of:

1. (i) passing a multiphase hydrocarbon-containing fluid flow comprising oil, water and gas into a first separator through an inflow conduit of the first separator;
2. (ii) separating gas from the hydrocarbon-containing fluid in the first separator to form a separate gas ;
3. (iii) conveying liquid phases of the hydrocarbon-containing fluid from an outlet of the first separator to an inlet of a separation tank, the separation tank being adapted for separating the multiphase hydrocarbon-containing fluid comprising oil, water and gas into its constituent oil, water and gas phases;
4. (iv) conveying at least a first portion of the separated gas from the first separator through a first gas outlet of the first separator to a gas fluffer located in the separation tank; and
5. (v) bubbling gas from the gas fluffer through an oil/water mixture in the separation tank to collect droplets of oil entrained within the water.

[0015] Optionally, the method further comprises the step of conveying a second portion of the separated gas from the gas separator through a second gas outlet of the first separator into the inlet of the separation tank. Typically, the further comprises the step of controlling the flow rate of gas through the first gas outlet and the second gas outlet and controlling the flow rate of liquid phases flow through the outlet of the first separator in order to prevent the level of the liquid phases rising to the level of the first or second gas outlets.

[0016] In some embodiments of this method of the present invention, the hydrocarbon-containing fluid further comprises solid particles. In one embodiment, the method further comprises the step of separating, in the separation tank, solid particles from the oil, water and gas of the hydrocarbon-containing fluid. In another embodiment, the method further comprises the step of separating coarse solid particles from the hydrocarbon-containing fluid at a location upstream of the inlet of the separation tank and downstream of the outlet of the first separator. In a further embodiment, the method further comprises the step of separating coarse solid particles from the hydrocarbon-containing fluid at a location upstream of the inflow conduit of the first separator.

[0017] Preferably, the method of this aspect of the present invention continuously separates oil, water and gas from a continuous flow of a hydrocarbon-containing fluid produced from an oil and/or gas production facility.

[0018] The preferred embodiments of the present invention accordingly provide an apparatus for separating oil, water, gas and solid particles from a hydrocarbon-containing fluid produced from an oil and gas production facility using a compact unit where all four phases are separated. The apparatus comprises an inlet tank that is connected to the main production conduit through which the produced phases (all four phases) flow into the inlet tank and an outlet conduit that is connected to a second larger separation tank, which is at a lower pressure than the inlet tank. The inlet tank will be at a pressure that is controlled by a choke in the production conduit before the inlet tank. Preferably the inlet tank has three output conduits each of which has a valve to direct or choke the flow from the tank through each conduit to the separation tank. Ideally there are two gas exits positioned at the upper part or top of the inlet tank. One is a gas exit conduit that allows flow to be directed into the base of the separation tank through a gas fluffer/flotation device. The other gas exit allows gas to be directed into a cyclone that is built into the separation tank. The third exit from the inlet is positioned close to the bottom of the tank and allows the flow of oil, water and solid particles into the separation tank.

[0019] Preferably there is a hydrocyclone built within the separation tank and oil, water, gas and solid particles flow from the inlet tank through this hydrocyclone. Below the hydrocyclone there is a solid particles collection bucket where separated solid particles are collected and weighed. Additionally, the solid particles collection bucket is equipped with a fluidisation flushing system to remove separated solid particles from the separation tank. Preferably, the flushing unit is controlled by a controller that uses measurements of the weight of solid particles collected and directs flow of water through the fluidisation head to flush the solid particles and water mixture out of the separation tank. The solid particles can then be washed by any number of processes well known or collected and shipped to dedicated solids cleaning and disposable plant.

[0020] In addition to removing solid particles from the flow, the hydrocyclone will also remove most of the gas in the production stream. Preferably this occurs at a cyclone knocker placed within the hydrocyclone that disturbs the rotational flow within the cyclone and gas is released to exit through the top of the hydrocyclone. The remaining oil/water mixture exits the hydrocyclone and enters into the main body of the separation tank. As oil is lighter than water, the oil tends to rise to the top of the liquid column in the separation tank forming a layer floating on top of the water.

[0021] There is a gas fluffer/flotation device within the separation tank positioned along its base. This device is fed with gas leaving the inlet tank through the topmost gas exit conduit and is adapted to aid the separation of oil droplets from the water. The gas leaving the fluffer/flotation device is in the form of streaming small bubbles that "collect" small droplets of oil entrained within the water column bringing them to the surface of the liquid column and therefore improve the oil/water separation in the separation tank.

[0022] Preferably there is a coalescer or a barrier of fine mesh within the separation tank that passes from the top of the tank and down into the liquid column of oil and water. This is placed between the hydrocyclone and a baffle device. The coalescer helps to remove oil that may be carried as a very fine mist within the gas at the top of the tank. This oil will coalesce on the mesh and form droplets of oil that run down it into the liquid column below. It therefore improves the oil/gas separation in the separation tank.

[0023] Preferably a baffle is placed in the separation tank at the opposite end to the fluid inlet to the tank and the hydrocyclone. Oil that is floating on top of the water will flow over the baffle to the downstream side of the baffle. Preferably there are measurement instruments that measure the level of the oil/water column, the thickness of the oil layer floating on top of the water and the level of the oil column on the downstream side of the baffle. Preferably there are fluid exit conduits from the separation tank either side of the baffle that have valves and pumps to each that allow the control of fluid flow from each exit independently. Oil pumped from the downstream side of the baffle can be boosted in pressure using the pump to be fed into the oil production stream from the platform and water can be pump for further treatment and/or disposal.

[0024] Preferably there is a gas exit conduit on the top of the separation tank that is on the opposite (downstream) side of the coalescer to the inlet conduit into the tank and to the hydrocyclone. This gas exit conduit allows gas to leave the tank and can be flared (burnt off) or compressed to feed into the gas production stream from the platform.

[0025] Preferably all measurement instruments, valves and pumps are connected to a controller. If a gas compressor is used then it too is connected to the controller. The controller is then programmed to process the measurements and control the pumps (and compressor) to ensure that the level of the oil/water column never reaches a point where water enters the downstream side of the baffle and also ensures that the oil level on the downstream side of the baffle is always below the baffle height and cannot return to the upstream side of the baffle. The controller or controllers can also be used to ensure the level in the inlet tank is within predefine limits and that the gas pressure is also controlled within defined parameters.

[0026] Ideally there is a safety pressure relief valve in the separation tank that ensure the pressure never gets above some predefined maximum safe operating limit. If the pressure comes close to this save limit, the valve opens automatically and vents (or relieves) the high pressure gas within the tank to a safe area.

[0027] Embodiments of the present invention will now be described in more detail by way of example only with reference to the accompanying drawings, in which:

Figure 1 schematically illustrates a side view of a solid particle, water, oil and gas separation system in accordance with an embodiment of the present invention; and

Figure 2 schematically illustrates in enlarged detail the solids bucket and flushing unit of the separation system of Figure 1.

[0028] Referring to Figure 1 there is shown a schematic illustration of an oil, water, gas and solids separation system, designated generally as 100, which constitutes an apparatus for separating oil, water, gas and solid particles from a hydrocarbon-containing fluid produced from an oil and/or gas production facility in accordance with an embodiment of the present invention. The separation system 100 comprises an inlet separator tank 101 and a larger separation tank 102 downstream thereof. Oil, water, gas and solids (usually sand) enter the inlet separator tank 101 via inflow conduit 103. This inflow conduit 103 contains production flow from a production manifold, not shown, that has come from an oil well or group of oil wells. This manifold may also choke the flow so that the pressure of the mixture entering the inlet separator tank 101 is regulated.

[0029] In accordance with the preferred embodiments of the present invention as identified above, the separation tank 102 is configured to separate the hydrocarbon-containing fluid, which comprises four phases, that is oil, water, gas and solid particles, into its constituent four phases. A single separation tank separates the hydrocarbon-containing fluid into the individual four phases, each of which can provide a respective output from the separation tank.

[0030] In accordance with the present invention as identified above, the inlet separator tank 101 can separate gas from the hydrocarbon-containing fluid, which may comprises three phases, that is oil, water, gas, which is fed to the inlet separator tank 101. The oil and water phases are fed from the inlet separator tank 101 to the separation tank 102, downstream of the inlet separator tank 101, in which the oil and water phases are separated. The gas is fed from the inlet separator tank 101 to a gas fluffer 119 in the separation tank 102, the gas fluffer 119 being used to assist separation of the water and oil phases in the separation tank 102. This avoids the need for additional gas, such as nitrogen, to be provided to the gas fluffer. The hydrocarbon-containing fluid which is fed to the inlet separator tank 101 may only comprises three phases, namely oil, water and gas, and any solid phase, in the form of particles, may have been removed from the hydrocarbon-containing fluid by a solids separator upstream of the inlet separator tank 101. Alternatively, the hydrocarbon-containing fluid which is fed to the inlet separator tank 101 may comprise four phases, that is oil, water, gas and a solid phase, in the form of particles, and the liquid and solid phases are separated from the gas phase in the inlet separator tank 101 and then the separated liquid and solid phases are fed to the separation tank 102, downstream of the inlet separator tank 101, in which the oil, water and solid phases are separated.

[0031] As the production enters into the inlet separator tank 101, the solids and liquids tend to fill the inlet separator tank 101 increasing the level, which is measured using the fluid level sensor 107. In Figure 1 this sensor is shown as a float type device; however, those skilled in the art will appreciate that there are many other types readily available.

[0032] Gas that enters the inlet separator tank 101 as part of the hydrocarbon-containing fluid will tend to partially separate and fill the void above the liquid level. This gas cap will act as a pressure drive, thereby forcing the oil, water and solids mix within the inlet separator tank 101 out through conduit 106 and into a hydrocyclone 108 located within the separation tank 102. Preferably this hydrocyclone 108 is a dynamic cyclone as described in GB-A-2529729; however, any other suitable hydrocyclone could be used.

[0033] The fluid/particle mixture entering hydrocyclone 108 creates a rotation flow through the hydrocyclone 108 where the heavier particles are thrown outwards by centrifugal forces towards the cyclone wall. Here they will be slowed by frictional forces at the wall and will drop out of the liquid phase into the solids bucket 109, which is within the separation tank 102. The solids bucket 109 is pivoted on an axle 110, provided on one side thereof, and rests on a weight sensor 111, provided on an opposite side thereof. This configuration is more clearly shown in Figure 2. The weight sensor is connected to a display device 112 and can also be connected to a controller, not shown.

[0034] As the amount of solids collected increases in the solids bucket 109, the weight is recorded on display device 112 and also by the controller. Once the quantity of solids reaches some predetermined amount, they are flushed from the solids bucket 109 and out of the separation tank 102 through a solids outlet 226. This is achieved using a water fluidisation and flushing unit. Water is pumped through the conduit 113 and out from the nozzles in the fluidisation head 201, whereby the water fluidises the solids in the vicinity of the head 201. The mixture of water and solids then enters into the central conduit 202 in the head 201, and exits through the conduit 114. Both conduits 113 and 114 pass through to the exterior of the separation tank 102, as shown in Figure 1. During this operation flow of hydrocarbon fluid into the separation tank 102 may be temporarily stopped. As the solids are flushed from the separation tank 102, the weight in the solids bucket 109 decreases. Once the weight has been reduced below a predefined value, the controller switches off (or it is switched off manually) the flow of water thought conduit 113 and flushing stops. Flushing will start again once sufficiently more solids are collected, at which time another flushing cycle starts.

[0035] Returning to the description of the flow though hydrocyclone 108, the solid particles are removed as described above leaving water, oil and gas as the remaining phases.

[0036] The water and oil are collected in a first reservoir 210 in the separation tank 102 which has at a downstream end thereof with respect to the flow of oil through the separation tank 102 a baffle 124, which functions as a weir, and on the downstream side of the baffle 124 is a second reservoir 212 downstream of the first reservoir 210 which collects oil which has flowed over the top of the weir.

[0037] The gas is released from the liquids by the agitation at the cyclone knocker 115 that disturbs the rotational flow within the hydrocyclone 108, and will exit from the hydrocyclone 108 at the top exit 116. The remaining water and oil liquid mixture exits the cyclone at the bottom thereof and increases the liquid level 117 in the separation tank 102. Above this level 117 is gas and below level 117 is liquid, composed of oil and water. This fluid level 117 is measured using the ultrasonic level sensor (other types of level measurement can be used) 121 which can be connected to the controller (not shown).

[0038] In Figure 1 it is shown that the inlet separator tank 101 has three exit conduits 104, 105 and 106 that allow flow from the inlet separator tank 101 into the inlet 224 of the main separation tank 102. Each exit conduit 104, 105 and 106 has an associated valve, as shown in Figure 1. As described above, the water, oil and solids mixture will exit the inlet separator tank 101 through the lower exit 106 driven by the gas pressure in the top of the inlet separator tank 101. If the liquid level in the inlet separator tank 101 drops below a predefined value as measured by level sensor 107 then the controller may close the value of 106 and open 105 so that gas exits the inlet separator tank 101 directly into the hydrocyclone 108. It should be noted that this gas could be 'wet', that is it could contain droplets of oil and/or water.

[0039] In Figure 1 there is shown a pressure sensor 120 placed in the inlet separator tank 101 that can be connected to the controller and can be used to control the production flow into inlet separator tank 101 via conduit 103. The topmost exit 104 allows gas flow from the upper part 220 of the inlet separator tank 101 to be directed through a gas fluffer 119 which functions as an oil flotation device to cause oil droplets in the oil/water mixture to be floated upwardly by the action of rising gas bubbles from the gas fluffer 119. This gas fluffer 119 comprises perforated pipes covering the bottom section of the separation tank 101. Gas injected into it permeates through the perforations to form gas bubbles which then rise through the oil/water mix. The liquid leaving the hydrocyclone 108 is a mixture of oil and water and because of their density difference the oil will rise to the top to float on top of the water. The water level is labelled 118 and the top of the oil and water column is labelled 117. A linear resistivity sensor 122 is provided to measure where the interface between water and oil exists. As the resistivity of oil is very much higher than that of produced water, the measured resistance below the oil/water interface is low and the resistance above is much higher. Thus the position of the oil/water interface can be measured continually in real-time.

[0040] Returning to the description of the gas fluffer 119, as gas bubbles exit the perforations they rise through the oil/water liquid and will serve to enhance the separation of small droplets of oil from the water carrying them to the top of the liquid in the separation tank 102. The gas itself will leave the liquid and move above the level 117 into the top of the separation tank 102. As a result, the separation tank 102 will contain gas at its upper part 222, which is located above at least the first reservoir 210 and in the illustrated embodiment extends above both the first reservoir 210 and the second reservoir 212, and a liquid column that has two levels, namely level 118 indicating the top of water and level 117 indicating the top of oil (if there is any oil present). The linear resistance sensor 122 will provide a measurement of the thickness of the oil float on top of the water.

[0041] As discussed previously, the gas entering and leaving the hydrocyclone 108 can be wet and so can contain droplets of oil and or water. These will be very small but it is desirable to recover these liquids from the gas to improve the recovery of oil and gas. In Figure 1 there is shown a coalescer 123 that comprises a fine mesh onto which oil and/or water condenses above the level 117 and runs down into the liquid column below. The oil will float on and the water will sink below level 118. Therefore, the gas to the upstream side of the coalescer 123 (i.e. the righthand side shown in Figure 1) may be wet but the gas column to the downstream side of the coalescer 123 (i.e. the left-hand side shown in Figure 1) is dry.

[0042] The final stage of the four phase separation process is provided by the baffle 124, functioning as a weir, shown in Figure 1. As the amount of liquid in the separation tank 102 increases, oil on the top of the liquid in the first reservoir 210 will flow over the baffle 124 into the second reservoir 212 downstream of the baffle 124. Water exits the bottom of the first reservoir 210 though water outlet 228. Oil exits the bottom of the second reservoir 212 though oil outlet 230. Gas exits the upper part 222 of the separation tank 102 through gas outlet 232, which is located above the second reservoir 212 but may alternatively be located above the first reservoir 210. The level of oil in the second reservoir 212 is measured using the ultrasonic level sensor 125. This oil can be boosted by the pump 126 and directed into the main oil production line (not shown) from the production platform or it could be drained through exit conduit 127 to another storage tank, not shown. Booster pump 126 can be controlled using a control that uses the oil level as measured by sensor 125 to control the process. Also, if the water level 118 rises to a point close to the top of the baffle 124, the water pump 128 can be turned on (or its flow rate increased) to ensure that no water passes over the top of the baffle 124, i.e. to the downstream side of the baffle 124, functioning as a weir, which would contaminate the oil. A water by-pass conduit and valve assembly 129 is provided to handle very high levels of water production entering the separation tank 102.

[0043] Gas that is collected on the downstream side of the coalescer 123 can exit the separator tank 102 through the conduit 130 to be flared or collected, or it can be boosted using the compressor 131 and pumped into the main gas production line (not shown) from the platform. The gas pressure within the separator tank 102 is measured using pressure sensor 132 that can be connected to the controller. Additionally a pressure relief safety valve 133 is provide to ensure that the pressure within the separator tank can never rise above a predefined value.
Those skilled in the art will appreciate that sensors 107, 120, 121, 122, 125 and 132 can be

connected to a controller or controllers, schematically illustrated by a single controller 203, which in turn can be programmed to control the flow into the inlet separator tank 101 through conduit 103, the valves that direct flow from the inlet separator tank 101 into the separation tank 102 via the hydrocyclone 108, the pumps/boosters 126, 128 and 131 that allow oil, water and gas to exit the separation tank 102 as different phase flow streams, and the valves to the by-pass exit conduits 127, 129 and 130 that allow these flows to exit the system 100 as required. The details of such a programmed controller 214 to operate and provide the functions described above are well known to those skilled in the art. In addition, the same (or other) controller(s) can monitor the weight of solids collected in bucket 109 and can control the solids flushing process as described earlier. Again such a process is well known to those skilled in the art.

[0044] In any embodiment a coarse particle separator 216 may be located upstream of the separation tank 102, as shown schematically in Figure 1, or alternatively upstream of the inlet separator tank 101.

[0045] Using the apparatus and method of the preferred embodiment described herein, production from a well or group of wells that contains oil, water, gas and solids can be separated into streams of four phases using a separation system 100 forming a compact unit as shown in Figure 1, which optionally can be mounted on a single skid or frame. Additionally this separation unit will recycle the produced gas to improve the efficiency of oil/water separation and remove the requirement for another process product, for example, nitrogen gas. Such a system reduces the platform space required and improves the overall efficiency of the four phase separation process, thus reducing the capital and operational costs to the oil & gas operator.

[0046] The present invention may be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the concept of the invention to those skilled in the art.

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- US6214220A [0005]
- GB2529729A [0032]

Patentkrav

1. Indretning til separering af olie, vand og gas fra et carbonhydrid-indeholdende fluid produceret fra et olie- og/eller gasproduktionsanlæg, hvilken indretning omfatter:
en separationstank (102) til separering af et flerfaset carbonhydrid-indeholdende fluid, omfattende olie, vand og gas til dets indgående olie-, vand- og gasfaser, hvor separationstanken (102) indbefatter et første indløb (224) til det carbonhydrid-indeholdende fluid, et andet indløb til gas og, forbundet til det andet indløb, en gasfremkalder (119) til at lede gasbobler gennem en olie-/vandblanding i et reservoir af separationstanken (102) for at opsamle smådråber af olie, der er medbragt i vandet;
en første separator (101), der er tilvejebragt opstrøms for separationstanken (102), hvor den første separator (101) omfatter en indstrømningsledning (103) til det carbonhydrid-indeholdende fluid, et første udløb (104) af den første separator (101), som lader en øvre del (220) af den første separator (101) kommunikere med det andet indløb for at transportere gas separeret fra det carbonhydrid-indeholdende fluid til gasfremkalderen (119), som er tilvejebragt inden i separationstanken (102), og et andet udløb (106), der lader en nedre del af den første separator (101) kommunikere med det første indløb (224) af separationstanken (102) for at transportere flydende faser af det carbonhydrid-indeholdende fluid af separationstanken (102).

2. Indretning ifølge krav 1, hvor den første separator (101) yderligere indbefatter en væskeniveausensor (107) og et første styremodul, der er koblet dertil for at styre, at væskeniveauet inden i den første separator (101) er inden for et forudbestemt interval.

3. Indretning ifølge krav 1 eller krav 2, hvor den første separator (101) yderligere indbefatter en indvendig gastryksensor (120) og et andet styremodul, der er koblet dertil for at styre, at gastrykket inden i den første separator (101) er inden for et forudbestemt interval.

4. Indretning ifølge et af kravene 1 til 3, hvor den første separator (101) yderligere omfatter et tredje udløb (105) af den første separator (101), der er placeret længere nede på den første separator (101) end det første udløb (104), der lader den øvre del (220) af den første separator (101) kommunikere med det første indløb (224) for at transportere gas, der er separeret fra det carbonhydrid-indeholdende fluid til separationstanken (102), eventuelt hvor det første udløb (104), det andet udløb (106) og det tredje udløb (105) hver er forsynet med en respektiv uafhængigt styrbar ventil, der selektivt kan åbne eller lukke det respektive udløb og styre en strømningshastighed gennem det respektive udløb, yderligere eventuelt hvor indretningen yderligere omfatter en styreenhed (214), omfattende respektive ventilstyringsmoduler til de respektive ventiler.

5. Indretning ifølge et af kravene 1 til 4, hvor separationstanken (102) yderligere omfatter en faststofseparator til at separere faststofpartikler fra det flerfasede carbonhydrid-indeholdende fluid.

6. Indretning ifølge et af kravene 1 til 5, yderligere omfattende en separator til grove faststofpartikler (216) opstrøms for det første indløb (224) og nedstrøms for den første separator (101) til at separere grove partikler fra det flerfasede carbonhydrid-indeholdende fluid.

7. Indretning ifølge et af kravene 1 til 5, yderligere omfattende en separator til grove faststofpartikler opstrøms for den første indstrømningsledning (103) til at separere grove partikler fra det flerfasede carbonhydrid-indeholdende fluid.

8. Indretning ifølge et af kravene 1 til 7, som tilpasses kontinuerligt til at separere olie, vand, gas og faststofpartikler fra en kontinuerlig strøm af et carbonhydrid-indeholdende fluid produceret fra et olie- og/eller gasproduktionsanlæg.

9. Olie- eller gasanlæg, der inkorporerer indretningen ifølge et af kravene 1 til 8.

10. Fremgangsmåde til separering af olie, vand og gas fra et carbonhydrid-indeholdende fluid produceret fra et olie- og/eller gasproduktionsanlæg, hvilken fremgangsmåde omfatter trinnene med:
(i) at lede en flerfaset carbonhydrid-indeholdende fluidstrømning omfattende olie, vand og gas ind i en første separator (101) gennem en indstrømningsledning (103) af den første separator (101);

(ii) at separere gas fra det carbonhydrid-indeholdende fluid i den første separator (101) for at danne en separat gas;
(iii) at transportere flydende faser af det carbonhydrid-indeholdende fluid fra et udløb (106) af den første separator (101) til et indløb (224) af en separationstank (102), hvor separationstanken (102) er indrettet til at separere det flerfasede carbonhydrid-indeholdende fluid omfattende olie, vand og gas til dens indgående olie-, vand- og gasfaser;
(iv) at transportere mindst en første del af den separerede gas fra den første separator (101) gennem et første gasudløb (104) af den første separator (101) til en gasfremkalder (119), der er placeret i separationstanken (102); og
(v) at boble gas fra gasfremkalderen (119) via en olie-/vandblanding i separationstanken (102) for at opsamle smådråber af olie, der er medbragt i vandet.

11. Fremgangsmåde ifølge krav 10, yderligere omfattende trinnet med at transportere en anden del af det separerede gas fra gasseparatoren (101) gennem et andet gasudløb (105) af den første separator (101) ind i indløbet (224) til separationstanken (102).

12. Fremgangsmåde ifølge krav 10 eller krav 11, yderligere omfattende trinnet med at styre strømningshastigheden af gas gennem det første gasudløb (104) og det andet gasudløb (105) og at styre strømningshastigheden af væskefasestrømningen gennem udløbet (106) af den første separator (101) for at forhindre, at niveauet for væskefaserne stiger til niveauet for det første eller andet gasudløb (104, 105).

13. Fremgangsmåde ifølge et af kravene 10 til 12, hvor det carbonhydrid-indeholdende fluid yderligere omfatter faststofpartikler, eventuelt hvor fremgangsmåden yderligere omfatter trinnet med, i separationstanken (102), at separere faststofpartikler fra olien, vandet og gassen i det carbonhydrid-indeholdende fluid.

14. Fremgangsmåde ifølge krav 13, yderligere omfattende (i) trinnet med at separere grove faststofpartikler fra det carbonhydrid-indeholdende fluid på en lokation opstrøms for indløbet (224) af separationstanken (102) og nedstrøms for udløbet (106) af den første separator (101) eller (ii) trinnet med at separere grove faststofpartikler fra det carbonhydrid-indeholdende fluid på en lokation opstrøms for indstrømningsledningen (103) for den første separator (101).

15. Fremgangsmåde ifølge et af kravene 10 til 14, som kontinuerligt separerer olie, vand og gas fra en kontinuerlig strøm af et carbonhydrid-indeholdende fluid produceret fra et olie- og/eller gasproduktionsanlæg.

DRAWINGS

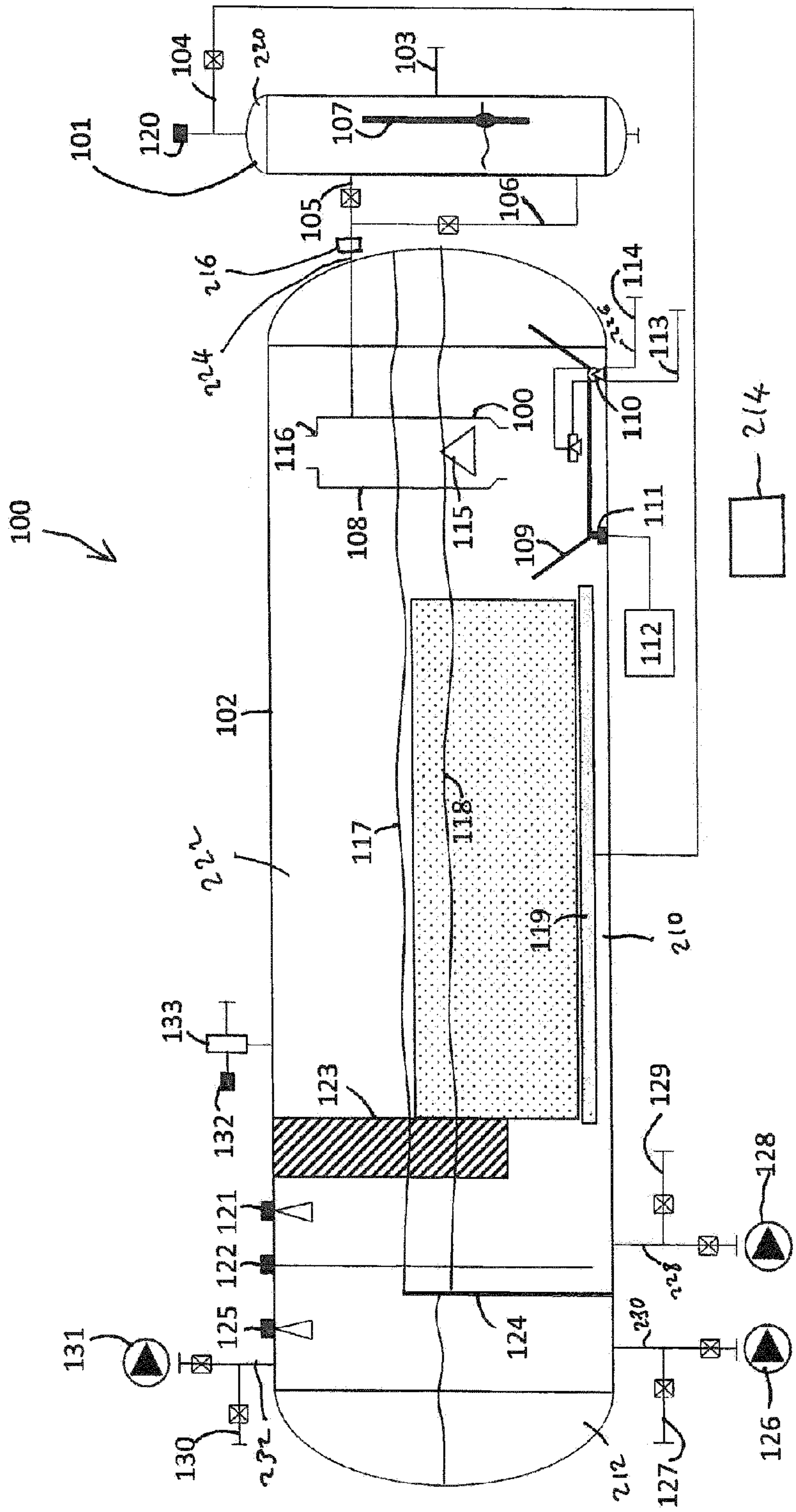

Figure 1

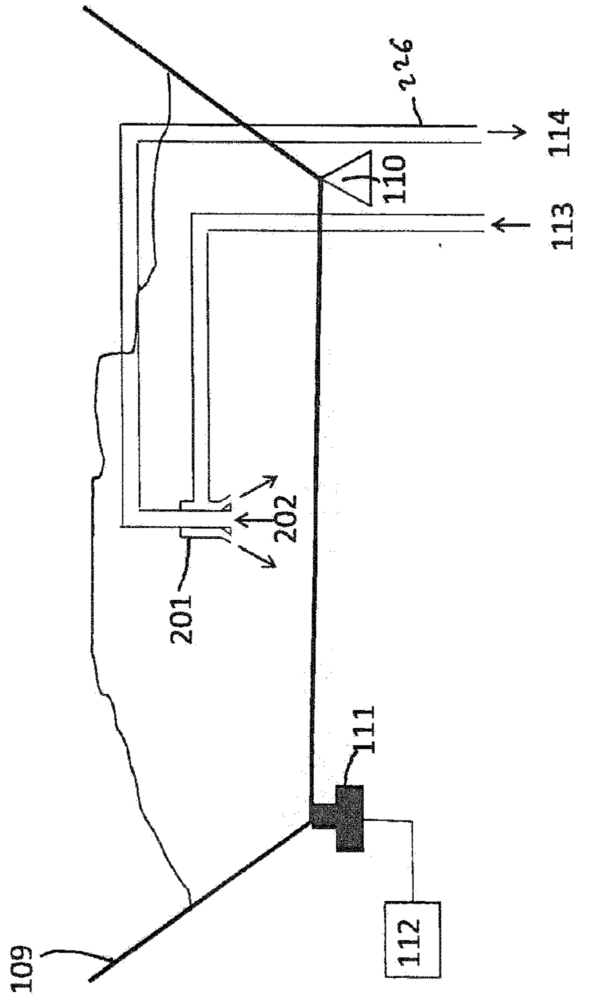

Figure 2