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(54) DOWNHOLE PUMP WITH ANTI-GAS LOCK ORIFICE

BOHRLOCHPUMPE MIT ANTIGASVERRIEGELUNGSÖFFNUNG

POMPE DE FOND DE TROU À ORIFICE DE VERROUILLAGE ANTI-GAZ

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Description

FIELD OFTHE INVENTION

[0001] The present invention relates to downhole pumps (also known as bottom-hole pumps). More specifically, the present invention relates to downhole pumps comprising means for preventing gas lock.

BACKGROUND OF THE INVENTION

[0002] One of the most widely used methods of onshore oil extraction is known as mechanical pumping. According to this method, as widely employed in the prior art, a reciprocating pump is installed at the bottom of the well, and this pump is connected to a sucker-rod string with sufficient length so that the other end reaches the surface.

[0003] At the surface, the sucker-rod string is connected to a device known as a pumping unit, whose function is to convert the rotary motion of a conventional motor into a reciprocating motion with slow rotation to the sucker rod, which in its turn transfers it to the pump installed at the bottom of the well.

[0004] It is also known that each sample of oil consists of hundreds of different molecules in different States, from gaseous to solid in varying amounts. In oils with a larger amount of gaseous fractions, the effect known as "gas lock" occurs, which is the accumulation of gas in the space between the standing valve and the travelling valve. This accumulation of gas delays or even prevents opening of the travelling valve, limiting the flow of oil.

[0005] In the State of the art, the problem of gas blocking of downhole pumps is tackled with a manoeuvre known as "bottom checking", which consists of repositioning the travel of the pump so that at the end of the descending cycle, the piston collides with the barrel, causing maximum reduction of the dead space between piston and standing valve, which reduces the possibility of accumulation of gas and helps to ensure that the maximum amount of gas is expelled.

[0006] Another way of tackling this problem is the operation of reversed circulation, where fluid is pumped from the surface through the annular space between the casing and production pipes via the downhole pump, so that the gas is withdrawn.

[0007] The impacts caused by the bottom checking manoeuvre may damage the pump to the point that its operation becomes impracticable, as there is constant direct impact between the standing valve and the travelling valve.

[0008] None of these problems is solved satisfactorily by the prior art, see for example US3912420 and US4221551, as is also clear from the known examples described below.

[0009] Document WO2008153698A1 discloses a downhole pump for removing volumes of liquids, such as oil, gases and production water, from oil wells. The pump described in that document comprises, among other elements: a chamber for gas separation, with a standing valve; a piston with a travelling valve; and an actuator of the travelling valve. The actuator of the travelling valve consists of a pin that actuates the ball of the valve, opening the travelling valve, in order to equalize the pressure between the interior of the piston and the separating chamber, preventing blocking by gas.

[0010] However, the downhole pump disclosed in document WO2008153698A1 makes use of a pin for actuating the ball valve of the travelling chamber, so that, owing to the repeated movements of the valve, the pin is subjected to a high mechanical force, making it very susceptible to fractures.

[0011] Document US3215085A discloses a configuration of standing valve for a downhole plunger pump. This document specifically envisages that, fixed to the standing valve, a means is provided for actuating the ball of the travelling valve fixed to the piston, when the piston is at the lowest point of its travel. In the configuration presented in this document, a pin is adopted for actuating the ball of the travelling valve. Thus, it makes it possible for gas trapped in the stationary assembly (separating chamber) to be directed to the interior of the piston, preventing blocking of the pump by gas.

[0012] Similarly, the downhole pump disclosed in document LIS3215085A makes use of a pin for actuating the ball valve of the travelling chamber, so that, owing to the repeated movements of the valve, the pin is subjected to a high mechanical force, which makes it very susceptible to fractures.

[0013] Document US7909589B2 discloses a downhole pump that comprises a separating chamber, with a standing valve, and a piston, with a travelling valve, in which the piston is divided into two parts. A chamber for trapping sand is provided between the two parts of the piston, to prevent sand present in the pumped fluid entering the piston.

[0014] According to document US7909589B2, orifices are also provided between the two parts of the piston, which allow fluid communication between the interior of the piston and the separating chamber (balancing). Thus, these orifices allow the internal pressure of the piston and the pressure of the separating chamber to be equalized, thus preventing blocking of the pump by gas.

[0015] To make it possible to equalize the internal pressure of the piston and the pressure of the separating chamber, a channel is maintained between the piston and the inside wall of the separating chamber, via which a fluid (such as gas) can drain away.

[0016] However, since the oil being pumped comprises a number of impurities such as sand and mud, the channel maintained between the piston and the inside wall of the separating chamber is liable to obstruction, which could cause blocking of the pump by gas. Document US8858187B2 discloses a downhole pump that comprises a filter provided in the piston adapted for separating the interior of the piston from the separating chamber.

According to this document, the filter comprises openings that allow passage of fluid with the aim of balancing the pressure inside the piston and in the separating chamber, thus preventing blocking of the pump by gas.

[0017] In addition, it is described in US8858187B2 that to make it possible to equalize the internal pressure of the piston and the pressure of the separating chamber, a space is maintained between the piston and the inside wall of the separating chamber, through which a fluid (such as gas) can drain away, in which the space maintained is preferably of the same thickness as the openings.

[0018] However, since the oil being pumped comprises a number of impurities such as sand and mud, the channel maintained between the piston and the inside wall of the separating chamber is liable to obstruction, which could cause blocking of the pump by gas. Document US6273690B1 discloses a downhole pump that comprises a piston and a separating chamber, with standing and travelling valves, in which a channel is provided between the piston and the separating chamber so as to provide communication around the piston. According to this document, the channel is kept open when the piston is in the highest position of its travel, and is kept closed when the piston is in the lowest position of its travel. Thus, when the channel is open, the object described ensures that the infernal pressure of the piston is equalized with the pressure of the separating chamber. However, since the oil being pumped comprises a number of impurities such as sand and mud, the channel maintained between the piston and the separating chamber is liable to obstruction, which could cause blocking of the pump by gas.

[0019] Thus, it is clear that the prior art does not provide a downhole pumping system, preferably for onshore application, that is effective and free from the risk of blocking by gas.

[0020] As will be described in more detail hereunder, the present disclosure aims to solve the problems of the prior art described above in a practical and efficient manner.

SUMMARY OF THE INVENTION

[0021] The present disclosure aims to provide a downhole pump for onshore oil production capable of substantially minimizing the gas lock effect.

[0022] According to the present disclosure, there is provided a downhole pump, comprising at least one of an extension wall; a barrel that extends vertically to the interior of the extension wall; a gas separating chamber delimited by the barrel and the interior surface of the extension wall; and a piston comprising a travelling valve in its lower portion, wherein the piston is configured to slide vertically in the barrel to the interior of the separating chamber between an upper end of stroke position and a lower end of stroke position; wherein the piston comprises a plurality of venting orifices, wherein the plurality of venting offices is configured to provide communication between the interior of the piston and the gas separating chamber when the piston reaches the lower end of stroke position, wherein, in the lower end of stroke position, the plurality of venting orifices is positioned below the barrel.

[0023] Optionally, the venting orifices are located at the same horizontal position on the piston.

[0024] Optionally, the venting orifices have different dimensions.

[0025] Optionally, the at least one venting orifices provides fluid communication between the interior of the piston and the separating chamber in the uppermost region of the separating chamber

[0026] Optionally, the pump further comprises a nipple configured to be connected to a lower end of a production pipe between the barrel and the production pipe

[0027] Optionally, the pump further comprises an end-of-stroke sleeve configured to be connected to the sucker rod, wherein the nipple is adapted to interrupt the descending motion of the end-of-stroke sleeve when the piston reaches the lower end of stroke position.

[0028] Optionally, the end-of stroke sleeve is configured to be connected at an end of the sucker rod, wherein the pump further comprises a connecting rod which connects the end-of-stroke sleeve to the piston

[0029] Optionally, the end-of-stroke sleeve is configured to be adjustably connected to the sucker rod.

[0030] Optionally, the extension wall is an extension of the barrel, the interior of the extension wall having a larger diameter than the interior of the barrel.

[0031] Optionally, the gas separating chamber comprises a standing valve.

[0032] Optionally, the piston is configured to be driven by a sucker rod.

[0033] Optionally, the venting orifice is configured not to provide communication between the interior of the piston and the gas separating chamber when the piston is away from the lower end of stroke position.

BRIEF DESCRIPTION OF THE FIGURES

[0034] The detailed description presented hereunder refers to the appended figures and their respective reference numbers.

Fig. 1 illustrates a schematic view of the downhole pump with gas separator and anti-gas lock orifice according to an optional configuration of the present disclosure.

Fig. 2 illustrates a schematic view of the detail of the operation of the venting orifice of the piston illustrated in Fig. 1.

Fig. 3a illustrates a schematic view of the downhole pump with gas separator and anti-gas lock orifice from Fig. 1 in the initial position of the cycle.

Fig. 3b illustrates a schematic view of the downhole pump with gas separator and anti-gas lock orifice from Fig. 1 in an initial position of the ascending cycle.

Fig. 3c illustrates a schematic view of the downhole pump with gas separator and anti-gas lock orifice from Fig. 1 in an initial position of the descending cycle.

Fig. 3d illustrates a schematic view of the downhole pump with gas separator and anti-gas lock orifice from Fig. 1 in the final position of the cycle.

DETAILED DESCRIPTION OF THE INVENTION

[0035] Firstly, it is emphasized that the description given hereunder is based on a preferred embodiment of the disclosure. As will be obvious to a person skilled in the art, however, the invention is not limited to this particular embodiment.

[0036] The present disclosure relates to a downhole pump preferably for onshore use. As already described in earlier sections, a pump of this type is usually installed at the bottom of a production well. Such a pump can be connected to a sucker-rod string of sufficient length so that the other end reaches the surface. At the surface, the sucker-rod string can be connected to a device known as a pumping unit. The function of the pumping unit is to convert the rotary motion of a conventional motor into a reciprocating motion and slow rotation for the sucker rod. The sucker rod can in turn transfer the motion to the pump installed at the bottom of the well.

[0037] However, a very common phenomenon in this type of pump is the so-called gas lock effect, caused by the accumulation of gas in the separating chamber of the downhole pump (the space between the standing valve and the travelling valve). This accumulation of gas delays or even prevents opening of the travelling valve, literally obstructing the flow of oil, causing loss of production.

[0038] Being well known in the field of oil extraction, this phenomenon occurs through the presence of light hydrocarbon fractions, that change phase during the suction cycle of the downhole pump, so that the pressure in the separating chamber is not high enough to cause opening of the travelling valve of the piston, which prevents entry of liquid produced therein, interrupting pumping. In the case of conventional pumps, there is no separating chamber, but the effect occurs in the same way as the space between piston and barrel expands.

[0039] In one arrangement, there is provided a downhole pump as illustrated schematically in Fig. 1, which illustrates an optional configuration of the downhole pump with gas separator and anti-gas lock orifice, comprising:

a sucker rod 3 connected to a pumping unit;

a nipple 5 connected to a lower end of a production pipe 2, and comprising a barrel 6 that extends vertically to the interior of an extension wall 10 of the pump;

a chamber for gas separation 11 comprising a standing valve 9, wherein the separating chamber is delimited by the barrel 6 and the extension wall 10 of the pump; and

a piston 7 (also known as a plunger) comprising a travelling valve 8 in its lower portion, wherein the piston 7 is driven by the sucker rod 3, and adapted for sliding vertically in the barrel 6 to the interior of the separating chamber.

[0040] According to the present disclosure, there is also provided a downhole pump comprising one or more of an extension wall 10; a barrel 6 that extends vertically to the interior of the extension wall 10; a gas separating chamber 11 comprising a standing valve 9, wherein the gas separating chamber 9 is delimited by the barrel 6 and the interior surface of the extension wall 10; and a piston 7 comprising a travelling valve 8 in its lower portion, wherein the piston is configured to slide vertically in the barrel 6 to the interior of the separating chamber between an upper end of stroke position and a lower end of stroke position; wherein the piston 7 comprises a plurality of venting orifices 12, wherein the plurality of venting orifices 12 is configured to provide communication (i.e. fluid communication) between the interior of the piston and the gas separating chamber 11 when the piston reaches the lower end of stroke position, wherein, in the lower end of stroke position, the venting orifices 12 are positioned below the barrel. It will be appreciated that "upper" and "lower" are in the sense of the pump when installed at the bottom of a well. The piston 7 may be configured to be driven by a sucker rod 7.

[0041] The extension wall 10 may take the form of a cylindrical wall. The cylindrical wall may have a side portion and a bottom portion. The standing valve 9 may be disposed in the bottom portion.

[0042] As set out above, and as shown in Figure 1, the interior of the pump defines a volume formed by the interior of the barrel 6 and the extension wall 10. The barrel 6 has a smaller interior diameter than the extension wall 10. The extension wall 10 may be thought of as an extension of the barrel, with a larger interior diameter. The exterior diameters of the barrel 6 and the extension wall 10 may be substantially the same, as shown in Figure 1. A nipple 5 (also known as a seating nipple) may be provided above the barrel 6. The nipple 5 may be positioned at the top of the pump to allow a connection to a production pipe 2. The barrel 6 may be considered as part of the nipple 5, or alternatively, the barrel 6 can be considered as a separate part, with the nipple being positioned between the production pipe 2 and the barrel 6. The extension wall 10, barrel 6, and, where present, the nipple 5 may be considered to form a main body of the pump.

[0043] The gas separating chamber 11 is defined by the space between the side and bottom walls of the extension wall 10, and the boundary between the extension wall and the barrel 6. The gas separating chamber 11 may comprise a standing valve 9. The standing valve 9 may be located at the bottom of the gas separating chamber 11 (i.e. in the bottom wall of the extension wall 10).

[0044] As explained above, the oil extracted from the well consists of a mixture of molecules, some of which are in a gas phase and some of which are in a liquid phase. The separating chamber 11 promotes phase separation of the mixture extracted from the well, wherein the gas phase tends to be displaced and to accumulate in the upper portion 110 of the separating chamber 11, and the liquid phases are displaced and accumulate in the lower portion 111 of the separating chamber 11.

[0045] In order to prevent loss of production due to the gas lock effect, the piston 7 of the downhole pump of the present disclosure comprises at least one venting orifice 12. The venting orifice 12 is adapted for providing fluid communication between the interior of the piston 7 and the gas separating chamber 11 when the piston 7 reaches the lower end of stroke position. At the lower end of stroke position the venting orifice 12 is positioned below the barrel 6. In other words, the venting orifice 12 is an opening in the wall of the piston which allows gas to pass from the gas separating chamber 11 to the interior of the piston 7 when the piston 7 is at its lowest position.

[0046] It will be appreciated that, when the piston 7 is away from the lower end of stroke position, the venting orifice 12 is configured not to provide communication between the interior of the piston 7 and the gas separating chamber 11. This may be because the orifice 12 can be blocked by the inner wall of the barrel 6. This may occur because the inner diameter of the barrel 6 may be smaller than the inner diameter of the extension wall 10. The State in which the piston 7 is considered to be away from the lower end of stroke position may be, for example, when the piston 7 is in the upper 90% of its travel. Any other suitable proportion of the stroke may also be chosen.

[0047] The functioning of the feature described in the preceding paragraphs may be visualized in Fig. 2, which illustrates a schematic view of the detail of the operation of the venting orifice 12 of the piston 7 illustrated in Fig. 1. In a situation of gas lock, due to accumulation of gas in the separating chamber 11, this chamber is expected to have a pressure greater than that of the interior of the piston 7, but the pressure difference between the separating chamber 11 and the piston 7 is not sufficient to actuate (i.e. open) the travelling valve 8. This is due to the fact, in a gas lock condition, there is a large amount of gas 18 accumulated in the upper portion 110 of this chamber., Since the compressibility of gases is very high compared to liquids, the piston 7 does not exert sufficient pressure on the separating chamber 11 to actuate the travelling valve 8, which would allow the liquid phase 111 to be directed to the interior of the piston 7 through the travelling valve 8.

[0048] However, due to the presence of the venting orifice 12, when the piston 7 reaches the lower end of stroke position, in which the venting orifice 12 is positioned below the barrel 6, the venting orifice 12 now allows fluid communication between the interior of the piston 7 and the separating chamber 11. In this situation, since the pressure in the separating chamber 11 is greater than the pressure in the piston 7, the gas accumulated in the upper portion 110 of the separating chamber 11 is impelled to the interior of the piston 7.

[0049] With the expulsion of the gas from this region (i.e. the separating chamber 11), the pressure difference between the separating chamber 11 and the piston 7 is sufficient to actuate (i.e. open) the travelling valve 8. Thus, the pump operates normally again in the next pumping cycle, without any interruption of production.

[0050] Figs. 3a, 3b, 3c, and 3d illustrate, respectively, the pump from Fig. 1 in the initial position, in the ascending cycle of the piston 7, in the descending cycle of the piston 7, and in the final position. Note that the initial and final positions represent the same position of the pump, or of the piston 7, since at the end of a cycle, the pump begins a new cycle immediately. It is also emphasized that the initial position of the piston 7 represents the point where the piston 7 reaches the lower end of stroke position, i.e. the lowest position of its travel. The upper end of stroke position is the position of the piston 7 at which the piston stops ascending (as shown in in Figure 3b) and starts descending again. It will be understood that in each cycle, the piston 7 travels from the lower end of stroke position, to the upper end of stroke position, and back down to the lower end of stroke position. Although the figures show that the piston 7 comprises only one venting orifice 12, a plurality of venting orifices are provided in the piston 7. Preferably, these orifices are positioned on one and the same horizontal line. The orifices may comprise different sizes (i.e. be of different dimensions). Thus, if there is obstruction of one of the venting orifices 12, others can provide fluid communication between the interior of the piston 7 and the separating chamber 11. The varying sizes of orifices 12 may allow at least one orifice to remain clear of obstructions if the obstruction is made up of particles of a particular size, because those particles may block an orifice of a certain size, but pass through an orifice of a different size.

[0051] In general, it can be seen that during the ascending and descending motion of the piston 7, the venting orifice 12 remains obstructed by the barrel 6 of the pump, so that the venting orifice 12 is only in communication with the separating chamber 11 when the piston 7 is closer to its lower end of stroke.

[0052] Thus, in a situation of normal operation the venting orifice 12 only provides communication between the interior of the piston 7 and the separating chamber 11 in the uppermost region 110 of the separating chamber 11, which normally is only filled with the gas phase.

[0053] So as to ensure that the lower travel of the piston 7 does not exceed a tolerable limit, there is optionally provided an end-of-stroke sleeve 4 connected (or fixed) to the sucker rod 3. The nipple 5 may be adapted to interrupt the descending motion of the end-of-stroke sleeve 4 when the piston 7 reaches a lowest position of travel. In this configuration, the lowest position of travel is such that the venting orifice 12 is positioned below the barrel 6. This can allow fluid communication between the interior of the piston 7 and the separating chamber 11. It will be understood that "fixed" need not mean "permanently fixed" and that any suitable attachment or connection may be used.

[0054] Optionally the end-of-stroke sleeve 4 may be fixed at the end of the sucker rod 3, wherein a connecting rod 13 is adopted, connecting the end-of-stroke sleeve 4 to the piston 7. In other words, the pump may comprise a connecting rod 13 between the end-of-stroke sleeve 4 and the piston 7 to provide a connection between the sucker rod 3, end-of stroke sleeve 4 and piston 7. However, a connecting rod 13 need not be provided, and the end-of-stroke sleeve 4 may be directly connected to the piston or connected to the piston using an arrangement other than a connecting rod 13.

[0055] In particular configurations the end-of-stroke sleeve 4 may be connected adjustably to the sucker rod 3. In this configuration, the limit position of end of stroke defined by the position of the sleeve 4 may be adjustable.

[0056] As is known by a person skilled in the art, the standing and travelling valves 8,9 may be any that are known from the prior art, so that this feature does not limit the scope of protection of the invention.

[0057] Thus, it will be clear that the invention now described solves, in a hitherto unpublished manner, the problems of the prior art for which it is proposed, namely to provide a downhole pump for onshore oil production that overcomes problems through blocking by gas.

Claims

1. Downhole pump comprising:

an extension wall (10) having an interior;
a barrel (6) that extends vertically to the interior of the extension wall (10);
a gas separating chamber (11) delimited by the barrel (6) and the interior surface of the extension wall (10); and
a piston (7) comprising a travelling valve (8) in its lower end, wherein the piston (7) is configured to slide vertically in the barrel (6) to the interior of the separating chamber (11) between an upper end of stroke position and a lower end of stroke position;
wherein the piston comprises a plurality of venting orifices (12), wherein the plurality of venting orifices (12) is configured to provide communication between an interior of the piston and the gas separating chamber (11) when the piston (7) reaches the lower end of stroke position, wherein, in the lower end of stroke position, the plurality of venting orifices (12) is positioned below the barrel (6).

2. Downhole pump according to claim 1, wherein the venting orifices (12) are located at the same horizontal position on the piston (7).

3. Downhole pump according to claim 1 or 2, wherein the venting orifices (12) have different dimensions.

4. Downhole pump according to any one of claims 1 to 3, wherein the plurality of venting orifices (12) provides fluid communication between the interior of the piston (7) and the separating chamber (11) in the uppermost region (110) of the separating chamber (11).

5. Downhole pump according to any one of the preceding claims, further comprising a nipple (5) configured to be connected to a lower end of a production pipe (2) between the barrel (6) and the production pipe (2).

6. Downhole pump according to claim 5, further comprising an end-of-stroke sleeve (4) configured to be connected to a sucker rod (3), wherein the nipple (5) is adapted to interrupt the descending motion of the end-of-stroke sleeve (4) when the piston (7) reaches the lower end of stroke position.

7. Downhole pump according to claim 6, wherein the end-of-stroke sleeve (4) is configured to be connected at an end of the sucker rod (3), wherein the pump further comprises a connecting rod (13) which connects the end-of-stroke sleeve (4) to the piston (7).

8. Downhole pump according to claim 6 or 7, wherein the end-of-stroke sleeve (4) is configured to be adjustably connected to the sucker rod (3).

9. Downhole pump according to any preceding claim, wherein the extension wall (10) is an extension of the barrel (6), the interior of the extension wall (10) having a larger diameter than the interior of the barrel (6).

10. Downhole pump according to any preceding claim, wherein the gas separating chamber (11) comprises a standing valve (9).

11. Downhole pump according to any preceding claim, wherein the piston (7) is configured to be driven by a sucker rod (3).

12. Downhole pump according to any preceding claim, wherein the venting orifices (12) are configured not to provide communication between the interior of the piston (7) and the gas separating chamber (11) when the piston (7) is away from the lower end of stroke position.

Patentansprüche

1. Bohrlochpumpe, Folgendes umfassend:

    eine Erweiterungswand (10), die einen Innenraum aufweist;
    einen Zylinder (6), der sich vertikal in den Innenraum der Erweiterungswand (10) erstreckt;
    eine Gastrennkammer (11), die durch den Zylinder (6) und die Innenfläche der Erweiterungswand (10) begrenzt ist; und
    einen Kolben (7), der an seinem unteren Ende ein Arbeitsventil (8) umfasst, wobei der Kolben (7) ausgebildet ist, um in dem Zylinder (6) vertikal in den Innenraum der Trennkammer (11) zwischen einer oberen Endposition des Hubs und einer unteren Endposition des Hubs zu gleiten;
    wobei der Kolben eine Vielzahl von Entlüftungsöffnungen (12) umfasst, wobei die Vielzahl von Entlüftungsöffnungen (12) ausgebildet ist, um eine Verbindung zwischen einem Innenraum des Kolbens und der Gastrennkammer (11) bereitzustellen, wenn der Kolben (7) die untere Endposition des Hubes erreicht, wobei in der unteren Endposition des Hubes die Vielzahl von Entlüftungsöffnungen (12) unterhalb des Zylinders (6) positioniert ist.

2. Bohrlochpumpe nach Anspruch 1, wobei sich die Entlüftungsöffnungen (12) an dergleichen horizontalen Position am Kolben (7) befinden.

3. Bohrlochpumpe nach Anspruch 1 oder 2, wobei die Entlüftungsöffnungen (12) verschiedene Abmessungen aufweisen.

4. Bohrlochpumpe nach einem der Ansprüche 1 bis 3, wobei die Vielzahl von Entlüftungsöffnungen (12) eine Fluidverbindung zwischen dem Innenraum des Kolbens (7) und der Trennkammer (11) im obersten Bereich (110) der Trennkammer (11) bereitstellt.

5. Bohrlochpumpe nach einem der vorhergehenden Ansprüche, die ferner einen Nippel (5) umfasst, der ausgebildet ist, um mit einem unteren Ende eines Produktionsrohres (2) zwischen dem Zylinder (6) und dem Produktionsrohr (2) verbunden zu werden.

6. Bohrlochpumpe nach Anspruch 5, ferner umfassend eine Hubende-Hülse (4), die ausgebildet ist, um mit einem Saugstab (3) verbunden zu werden, wobei der Nippel (5) angepasst ist, um die Abwärtsbewegung der Hubende-Hülse (4) zu unterbrechen, wenn der Kolben (7) die untere Endposition des Hubs erreicht.

7. Bohrlochpumpe nach Anspruch 6, wobei die Hubende-Hülse (4) ausgebildet ist, um mit einem Ende des Saugstabs (3) verbunden zu werden, wobei die Pumpe ferner einen Verbindungsstab (13) umfasst, der die Hubende-Hülse (4) mit dem Kolben (7) verbindet.

8. Bohrlochpumpe nach Anspruch 6 oder 7, wobei die Hubende-Hülse (4) ausgebildet ist, um einstellbar mit dem Saugstab (3) verbunden zu werden.

9. Bohrlochpumpe nach einem der vorhergehenden Ansprüche, wobei die Erweiterungswand (10) eine Erweiterung des Zylinders (6) ist, wobei der Innenraum der Erweiterungswand (10) einen größeren Durchmesser aufweist als der Innenraum des Zylinders (6).

10. Bohrlochpumpe nach einem der vorhergehenden Ansprüche, wobei die Gastrennkammer (11) ein Fußventil (9) umfasst.

11. Bohrlochpumpe nach einem der vorhergehenden Ansprüche, wobei der Kolben (7) ausgebildet ist, um von einem Saugstab (3) angetrieben zu werden.

12. Bohrlochpumpe nach einem der vorhergehenden Ansprüche, wobei die Entlüftungsöffnungen (12) ausgebildet sind, um keine Verbindung zwischen dem Innenraum des Kolbens (7) und der Gastrennkammer (11) bereitzustellen, wenn der Kolben (7) von der unteren Endposition des Hubs entfernt ist.

Revendications

1. Pompe de fond de trou comprenant :

    une paroi d’extension (10) comportant un intérieur ;
    un fût (6) s’étendant verticalement à l’intérieur de la paroi d’extension (10) ;
    une chambre de séparation de gaz (11) délimitée par le fût (6) et la surface intérieure de la paroi d’extension (10) ; et
    un piston (7) comprenant une valve mobile (8) dans son extrémité inférieure, dans laquelle le piston (7) est configuré pour coulisser verticalement dans le fût (6) à l’intérieur de la chambre de séparation (11) entre une position de fin de course supérieure et une position de fin de course inférieure ;
    dans laquelle le piston comprend une pluralité d’orifices de ventilation (12), dans laquelle la pluralité d’orifices de ventilation (12) sont configurés pour assurer la communication entre un intérieur du piston et la chambre de séparation de gaz (11) lorsque le piston (7) atteint the la position de fin de course inférieure, dans laquelle,

dans la position de fin de course inférieure, la pluralité d'orifices de ventilation (12) sont positionnés en dessous du fût (6).

2. Pompe de fond de trou selon la revendication 1, dans laquelle les orifices de ventilation (12) sont situés dans la même position horizontale sur le piston (7).

3. Pompe de fond de trou selon la revendication 1 ou 2, dans laquelle les orifices de ventilation (12) ont des dimensions différentes.

4. Pompe de fond de trou selon l'une quelconque des revendications 1 à 3, dans laquelle la pluralité d'orifices de ventilation (12) assure une communication de fluide entre l'intérieur du piston (7) et la chambre de séparation (11) dans la région la plus haute (110) de la chambre de séparation (11).

5. Pompe de fond de trou selon l'une quelconque des revendications précédentes, comprenant en outre un mamelon (5) configuré pour être relié à une extrémité inférieure d'un tuyau de production (2) entre le fût (6) et le tuyau de production (2).

6. Pompe de fond de trou selon la revendication 5, comprenant en outre un manchon de fin de course (4) configuré pour être relié à une tige de pompage (3), dans laquelle le mamelon (5) est adapté pour interrompre le mouvement descendant du manchon de fin de course (4) lorsque le piston (7) atteint la position de fin de course inférieure.

7. Pompe de fond de trou selon la revendication 6, dans laquelle le manchon de fin de course (4) est configuré pour être relié à une extrémité de la tige de pompage (3), dans laquelle la pompe comprend en outre une tige de liaison (13) qui relie le manchon de fin de course (4) au piston (7).

8. Pompe de fond de trou selon la revendication 6 ou 7, dans laquelle le manchon de fin de course (4) est configuré pour être relié de manière réglable à la tige de pompage (3).

9. Pompe de fond de trou selon l'une quelconque des revendications précédentes, dans laquelle la paroi d'extension (10) est une extension du fût (6), l'intérieur de la paroi d'extension (10) ayant un diamètre plus grand que l'intérieur du fût (6).

10. Pompe de fond de trou selon l'une quelconque des revendications précédentes, dans laquelle la chambre de séparation de gaz (11) comprend une valve de fond (9).

11. Pompe de fond de trou selon l'une quelconque des revendications précédentes, dans laquelle le piston (7) est configuré pour être entraîné par une tige de pompage (3).

12. Pompe de fond de trou selon l'une quelconque des revendications précédentes, dans laquelle les orifices de ventilation (12) sont configurés pour ne pas assurer une communication entre l'intérieur du piston (7) et la chambre de séparation de gaz (11) lorsque le piston (7) est éloigné de la position de fin de course inférieure.

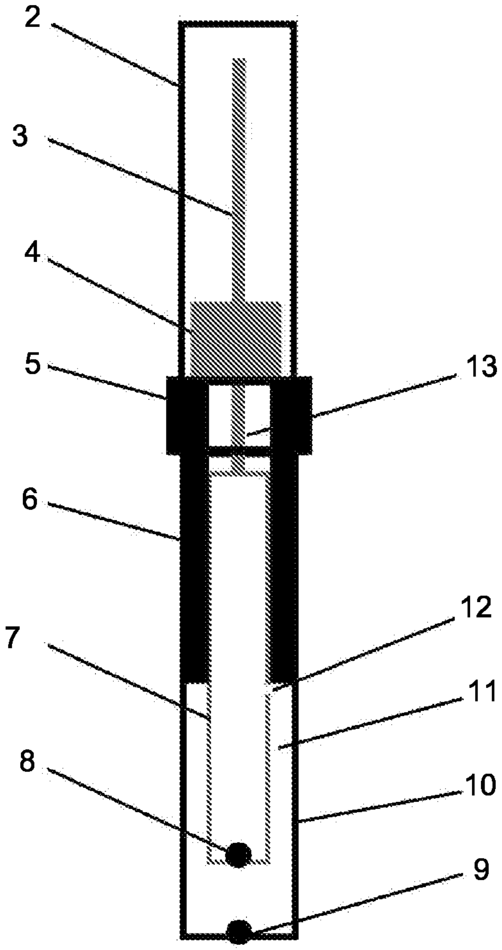

FIG. 1

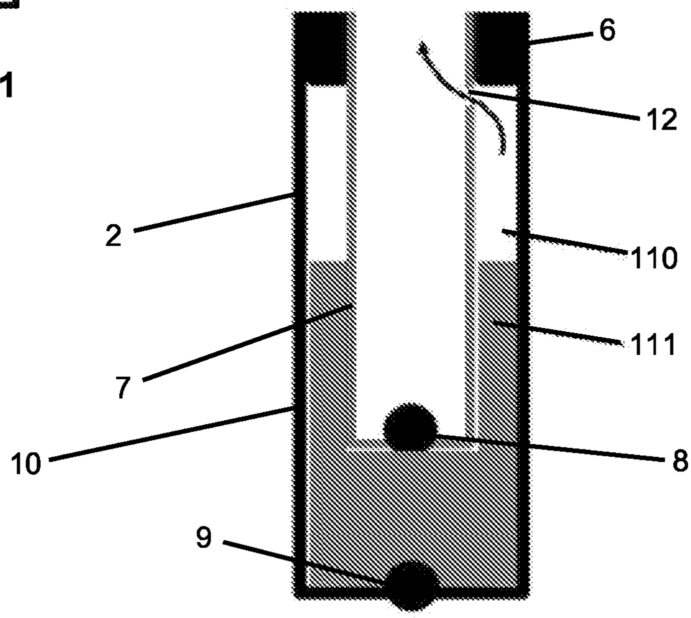

FIG. 2

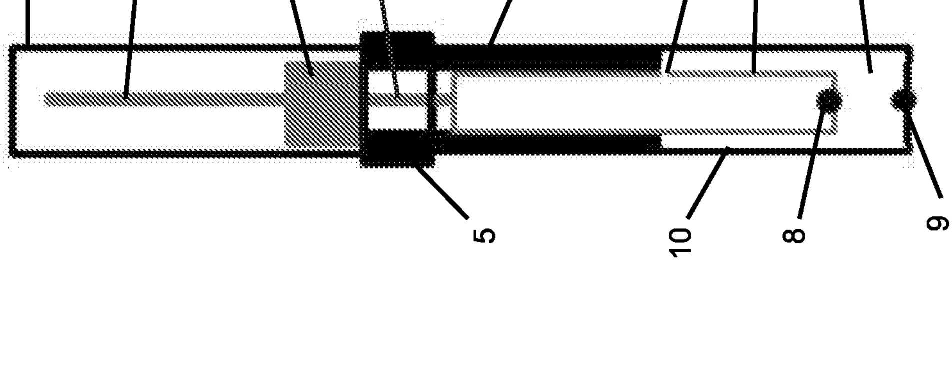

FIG. 3a

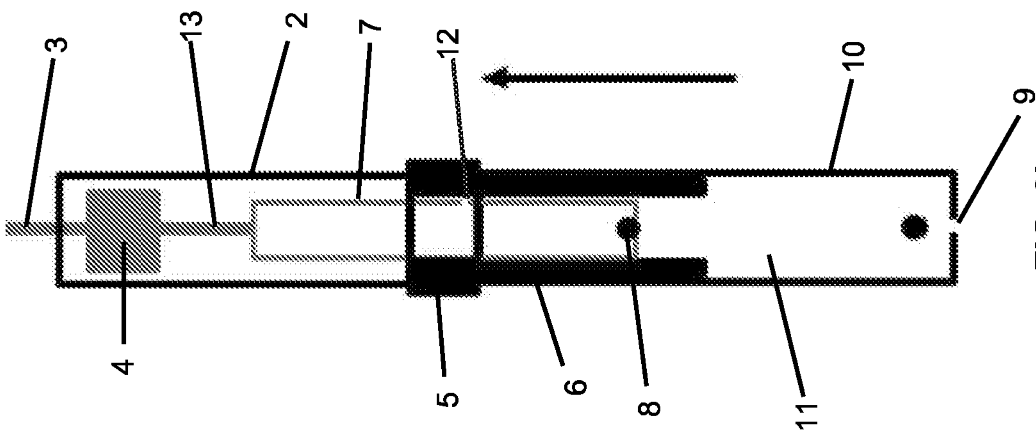

FIG. 3b

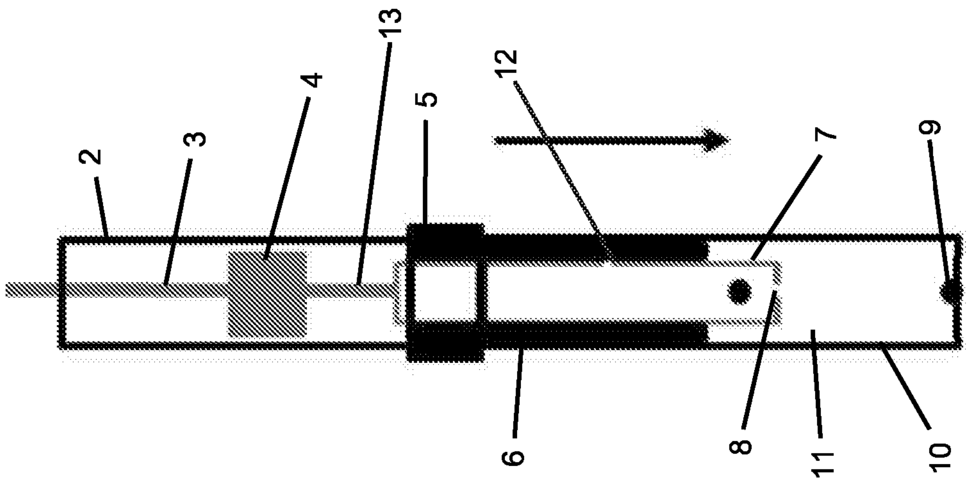

FIG. 3b

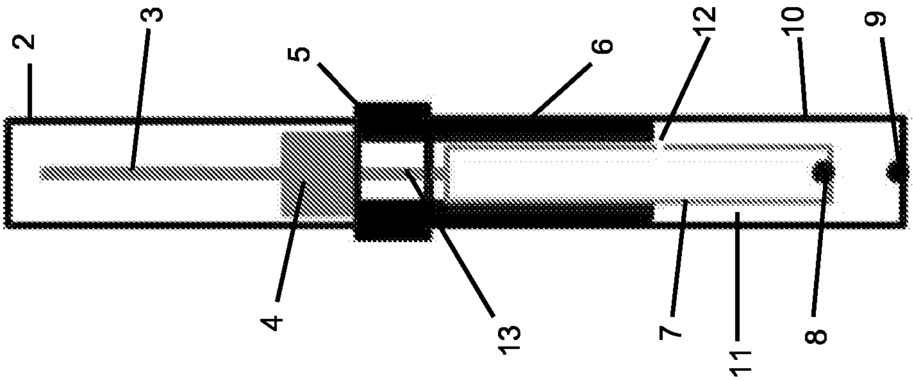

FIG. 3d

REFERENCES CITED IN THE DESCRIPTION

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