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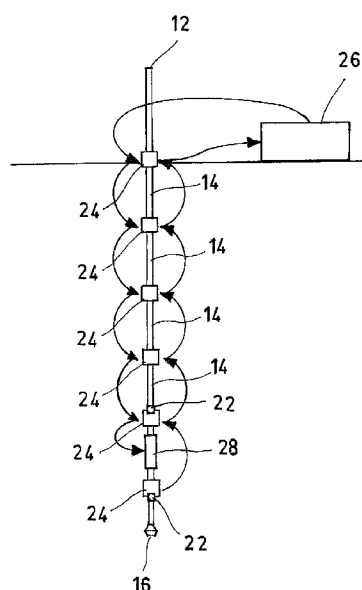


Fig.2

(57) Abstract: A system and method are described for monitoring, controlling and securing a well (10) for the extraction of formation fluids. The system comprises a set of sensors (22) for detecting the bottom hole pressure and resistivity, composition and density of the drilling mud, a series of wireless transmitters/receivers (24) for the communication of signals from and towards the bottom hole, a surface device (26) for the control and processing of the signals transmitted by the bottom hole sensors, capable of verifying the Influx conditions at the bottom hole through an appropriate analysis logic, a downhole isolation packer device (28), an electronic control/activation circulation valve, installed above the downhole isolation packer device, and an activator element of the downhole isolation packer device, which communicates with the wireless nodes of the system. The system and method allow the automatic control of potential influxes of formation fluid inside the well, significantly reducing the time necessary for recognizing said influxes and for securing the well.

SYSTEM AND METHOD FOR MONITORING, CONTROLLING AND
SECURING WELLS FOR THE EXTRACTION OF FORMATION FLUIDS

The present invention relates to a system and
5 method for monitoring, controlling and securing wells
for the extraction of formation fluids, such as, for
example, hydrocarbons. In particular, the present
invention relates to a security system and method for
reducing the probabilities of the risk of "blow-outs"
10 in a well for the extraction of formation fluids.

A well for the extraction of formation fluids can
be assimilated to a duct having a substantially
circular section or, in other words, to a long piping.
During drilling, the formation fluids are contained in
15 the pores of the subsurface rock, they are subjected to
the formation pressure and are kept in the rock by the
counter-pressure exerted on the walls of the well hole
by a drilling fluid or mud.

Should the formation fluids rise from the well
20 towards the surface uncontrollably, an eruption ("blow-
out") of said formation fluids would take place in
correspondence with the drilling rig, which is normally
on the surface of the wellhead.

Currently, there are no systems installed which are
25 capable of transmitting, by means of wireless
technologies and bidirectionally, information from and
towards the bottom of a well for the extraction of
formation fluids, nor technologies capable of
activating devices configured for reducing, limiting
30 and confining the possible influx of formation fluids
at the bottom hole, nor integrated systems which, by
using the above technologies, constitute a single

apparatus for the detection, management and control of a well and the relative drilling activities.

The current systems are normally composed of two separate sub-units. A first sub-unit is responsible for the control and bidirectional transmission of information. A second sub-unit is composed of equipment and instruments ("*downhole control systems*") for the closing and/or isolating of the so-called "annulus" in correspondence with the bottom hole. Annulus normally defines the interspace between the drill pipes and walls of the well. "*Downhole control systems*" can be used in the case of the accidental influx of the formation fluids.

With regard to the sub-unit for the control and bidirectional transmission of information, the current systems are mainly based on:

- a technology of the so-called "*mud-pulser*" type, which consists in modulating a pressure pulse generated with a defined sequence. This pressure pulse, transmitted through the drilling mud, allows data to be received from the bottom hole and/or to transmit data towards the equipment positioned at the well-bottom, controlling for example the opening or closing of pads of the automatic steering systems;
- a technology of the so-called "*wired pipe*" type, which consists in a particular type of wired drill pipes for which the electric continuity between adjacent drill pipes is guaranteed by a contact element positioned on the connection thread between said adjacent drill pipes. This contact element, however, represents a weak point of the

whole system.

As for the equipment and instruments for closing the annulus, devices known as "*downhole isolation packers*" are currently in use. These devices can be
5 activated from the surface using a modulated pressure pulse, which allows the inflation of one or more specific elastic sleeves ("*inflatable packers*") housed in the string of drill pipes. The inflation of the *packers* allows the seal-closing of the annulus to be
10 effected in correspondence with the bottom hole.

If the downhole isolation packers are not timely activated and are not adequately controlled, they have a series of critical features and technical limitations that make them unreliable and, above all, not
15 configurable as additional barriers, i.e. in addition to the so-called "*blow-out preventers*" or BOPs, for controlling and mitigating the probability of the risk of "*blow-outs*". The first and most significant limitation of an activation system of a downhole
20 isolation packer lies in the fact that the activation mode of this equipment is manual. This assumes, as a critical element, the human variable in both recognizing an effective influx of formation fluids at the bottom hole, and in the consequent choice of
25 whether or not to activate the closing procedure of the annulus by means of the downhole isolation packer.

The recognition of the presence of an influx, in fact, may not be uniquely identifiable, as it is based on the assessment of well behaviour by personnel
30 responsible for drilling and control operations. The behaviour of the well and the signals of a potential influx can however be ambiguous and confused with other

operational situations. A typical example is represented by the so-called "*ballooning*" or "*well breathing*" effect, which is a natural and non-critical event caused by alternatively activating and
5 deactivating the mud pumps causing pressure differences of said drill mud.

A consequence of these ambiguities is the delayed activation, or non-activation, of the downhole isolation packer. Another consequence is that, although
10 it is present in the drill string, the downhole isolation packer cannot be configured as a further physical barrier (in addition to BOPs) for reducing the risk of "*blow-outs*".

A second critical element of an activation system
15 of a downhole isolation packer lies in the activation mode of this apparatus. Even if the influx of formation fluids at the bottom hole has been correctly recognized, the activation is in fact normally effected by means of a technology of the "*mud-pulser*" type.
20 Although this technology is quite reliable, the exponential increase in the signals transmitted in the drilling mud, in addition to disturbances that can be generated during the drilling activities, may cause an incorrect interpretation of the activation signal sent
25 from the surface by the receiver of the apparatus.

The downhole isolation packer may therefore not be activated, whereas the operator must first identify this situation and subsequently repeat the activation procedure again, once again without the certainty that
30 the same activation procedure will be successful. The time interval necessary for effecting these operations is a critical variable and may cause a significant

delay in starting the control operations of the well should the influx be real.

A third critical element of an activation system of a downhole isolation packer lies in the operating
5 activation procedure. As there is no direct and continuous control of the well-bottom parameters and, in particular, of the pressure, the activation of the downhole isolation packer is effected by stopping the circulation of the drilling mud immediately before
10 inflation, thus avoiding accidental fracturing of the geological formation. This however leads to the loss of the ECD ("*Equivalent Circulating Density*") of the well fluids which, in the case of an influx, has the direct consequence of a further imbalance in the pressures and
15 an increase in the influx volume.

The objective of the present invention is therefore to provide a system and a method for monitoring, controlling and securing wells for the extraction of formation fluids which are capable of solving the
20 drawbacks of the known art indicated above.

More specifically, an objective of the present invention is to provide a system and a method for monitoring, controlling and securing wells for the extraction of formation fluids which allow the
25 recognition of the influx through the use of bottom sensors integrated in the activation devices of the downhole isolation packer, eliminating the human variable and exponentially reducing the response times.

Another objective of the present invention is to
30 provide a system and a method for monitoring, controlling and securing wells for the extraction of formation fluids wherein the data flow from and towards

the bottom hole, including the activation signal of the downhole isolation packer, travels through a dedicated wireless system, without overlapping other signals as, on the contrary, occurs in the technology of the "mud-
5 pulser" type.

A further objective of the present invention is to provide a system and a method for monitoring, controlling and securing wells for the extraction of formation fluids wherein the activation of the downhole
10 isolation packer takes place without necessarily having to turn off the pumps of the drilling mud circuit, as the well-bottom pressure value is constantly monitored during the activation operation. In this way, two positive effects are obtained. A first effect is due to
15 the fact that the increase in pressure, caused by the progressive closing of the annulus, generates a "choke effect" which gradually reduces the imbalance of the well-bottom pressure. Furthermore, the pump shutdown will only occur when the well-bottom pressure is close
20 to a preset safety value, lower than the value of the fracturing pressure defined.

These and other objectives according to the present invention are achieved by providing a system and a method for monitoring, controlling and securing wells
25 for the extraction of formation fluids as specified in the independent claims.

Further features of the invention are highlighted by the dependent claims, which are an integral part of the present description.

30 The characteristics and advantages of a system and a method for monitoring, controlling and securing wells for the extraction of formation fluids according to the

present invention will appear more evident from the following illustrative and non-limiting description, referring to the enclosed schematic drawings, wherein:

figure 1 is a schematic view of a generic well for the extraction of formation fluids and the relative drilling rig; and

figure 2 is a schematic view of the main components of the system for monitoring, controlling and securing a well such as that of figure 1.

With reference in particular to figure 1, this schematically shows a generic well for the extraction of formation fluids, such as, for example, hydrocarbons. The well is indicated as a whole with the reference number 10.

The well 10 is obtained through a drilling rig which typically comprises a drill string 12. The drill string 12 is composed of a plurality of hollow drill pipes 14 having a circular section, that extend from the surface to the bottom hole 10. A drill bit 16 is positioned in correspondence with the lower end of the drill string 12.

The drilling rig also comprises a circulation system 18 of a drilling fluid 30, normally consisting of mud or water. The drilling fluid 30 is circulated inside the well 10, in the interspace or annulus 20 between the drill string 12 and the wellbore wall 10 itself. The circulation of the drilling fluid 30 inside the well 10 allows the continuous removal and transportation to the surface of the drilling cuttings generated by the drill bit 16.

The drill string 12 therefore has three main functions:

- it brings the drill bit 16 to the bottom hole 10, transmitting rotation and vertical loading for performing the excavation;
- it allows the circulation of the drilling fluid 30 to the bottom hole 10; and
- it guides and controls the excavation trajectory of the well 10.

The vertical loading on the drill bit 16 is typically impressed by one or more drill pipes 14A with an increased section, called heavy weight drill pipes, more rigid and with a greater linear weight with respect to the remaining hollow drill pipes 14 of the drill string 12. The heavy weight drill pipes 14A are positioned in the lower end portion of the drill string 12, situated in correspondence with the drill bit 16 and usually called "*Bottom Hole Assembly*" (BHA).

With reference to figure 2, the system for monitoring, controlling and securing the well 10 first of all comprises a plurality of sensors 22 operatively associated with the drill string 12 in correspondence with the drill bit 16. The sensors 22, so-called MWD ("*Measurement While Drilling*"), are then positioned in correspondence with the bottom hole 10.

The MWD sensors 22 are configured for continuously detecting a plurality of parameters relating to the fluids circulating in the annulus 20 of the well 10, i.e. the drilling fluid 30 and possible formation fluid. These MWD sensors 22 can consist of:

- one or more pressure sensors, configured for continuously measuring the pressure value of the fluids inside the annulus 20 in correspondence with the bottom hole 10;

- one or more density sensors, configured for continuously measuring the density value of the drilling fluid 30;
- one or more resistivity sensors, configured for
5 continuously measuring the resistivity value of the drilling fluid 30; and
- one or more sensors capable of detecting the presence and percentage of formation fluids, typically hydrocarbons, inside the annulus 20 in correspondence
10 with the bottom hole 10.

The system for monitoring, controlling and securing the well 10 also comprises a wireless transceiver apparatus, which, in particular, uses radio waves as transmission system. The wireless transceiver apparatus
15 in turn comprises a plurality of wireless transmitter/receiver devices 24, positioned at predefined distances along the drill string 12. The wireless transmitter/receiver devices 24 are configured for transmitting signals from and towards the bottom
20 hole 10.

The wireless transceiver apparatus also comprises an electronic device 26 positioned on the surface, i.e. outside the well 10. The electronic device 26 is configured for the control and processing of the
25 parameters detected by the MWD sensors 22 at the bottom hole and transmitted by the wireless transmitter/receiver devices 24. The electronic processing and control device 26 is also configured, through an appropriate analysis logic, for verifying
30 the influx conditions of formation fluid in correspondence with the well 10 on the basis of the processing of the parameters detected by the MWD

sensors 22 at the bottom hole.

The system for monitoring, controlling and securing the well 10 also comprises at least one downhole isolation packer device 28, operatively associated with the drill string 12 in correspondence with the drill bit 16 and MWD sensors 22. The downhole isolation packer device 28 is configured for effecting the closure of the annulus 20 in correspondence with the bottom hole 10, isolating said bottom hole 10 with respect to the surface. In particular, the downhole isolation packer device 28 consists of at least one inflatable elastic sleeve which allows, through its own progressive expansion in volume, to perform the seal closure of the annulus 20.

The system for monitoring, controlling and securing the well 10 also comprises an activator element of the downhole isolation packer device 28, provided with a respective wireless receiver configured for communication with the wireless transmitter/receiver devices 24 and consequently with the electronic processing and control device 26. On the basis of the information received by the MWD sensors 22 at the bottom hole, the electronic processing and control device 26 is therefore capable of controlling the downhole isolation packer device 28 through the respective activator element.

The system for monitoring, controlling and securing the well 10 finally comprises at least one electronic control/activation circulation valve, installed on the drill string 12 above the downhole isolation packer device 28. The valve is operatively connected to the electronic processing and control device 26 through the

wireless transmitter/receiver devices 24 and is configured for controlling the circulation of the drilling fluid 30 inside the annulus 20 in relation to the operating condition of the downhole isolation packer device 28, as explained in greater detail hereunder.

The system for monitoring, controlling and securing the well 10 allows the automatic control of potential influxes of formation fluid inside the well 10. These influxes can be generated by an imbalance of the pressure of the fluids inside the annulus 20 in correspondence with the bottom hole 10. The system for monitoring, controlling and securing the well 10 therefore significantly reduces the time necessary for recognizing influxes of formation fluid and for securing the well 10, introducing a further mechanical barrier in addition to the traditional safety systems (BOPs) with which the drill string 12 is normally provided.

On the basis of the information sent by the MWD sensors 22 at the bottom hole, the electronic processing and control device 26 is capable of automatically recognizing the type, pressure and volume of the influx. In this way, times or delays associated with the human variable are avoided, leaving, however, the possibility of intervention by the drill team with the traditional control systems (BOPs) of the well 10, unaltered.

The operational steps of the system for monitoring, controlling and securing the well 10 first of all provide for the installation on the drill string 12, at a predefined distance from the drill bit 16 (and

therefore from the bottom hole 10), of a plurality of MWD sensors 22. This predefined distance can be about 20-30 meters above the drill bit 16 (and therefore above the bottom hole 10). Said predefined distance is
5 in any case selected in relation to the composition of the so-called "*bottom hole assembly*" (BHA) of the drill string 12, i.e. the lower end or excavation portion of said drill string 12.

The MWD sensors 22 are interfaced with the wireless
10 transmitter/receiver devices 24 for transmitting, at pre-established time intervals, the parameters measured. These pre-established time intervals are variable in relation to the operating conditions of the well 10, but can typically be in the order of 5-10
15 seconds. The parameters are transmitted, in the form of suitably encoded signals, through a wireless network composed of contiguous pairs of wireless transmitter/receiver devices 24 positioned on each single drill pipe 14 or on each length, the term
20 "length" meaning a set of three drill pipes 14, of the drill string 12.

The signals transmitted through the wireless network set up inside the well 10 are received and processed by the electronic processing and control
25 device 26 positioned at the surface. The electronic processing and control device 26, based on a predetermined logic, is capable of determining the presence or absence of the influx. The pairs of wireless transmitter/receiver devices 24 positioned on
30 each single drill pipe 14 ensure the necessary redundancy of the monitoring, control and securing system in the case of potential malfunctions.

Should the electronic processing and control device 26 positioned at the surface detect the presence of the influx, said electronic device 26 will simultaneously send two signals through the wireless network. A first
5 signal is sent through the driller's control console, which will lift the drill string 12 and interrupts its rotation. This operation could also be automated by interfacing the electronic processing and control device 26 with the control system of the drill string
10 12, so that the lifting and interruption operations of the rotation of said drill string 12 are automatically effected, anticipating the intervention of the operator.

A second signal is sent, through the wireless
15 network, towards the bottom hole 10. This signal, received by a specific wireless receiver coupled with the activator element of the downhole isolation packer device 28, starts the activation sequence of the downhole isolation packer device 28 itself. The
20 downhole isolation packer device 28 can typically be installed on the drill string 12 at a distance of about 30-50 meters above the drill bit 16, or in another appropriate position in relation to the drilling requirements.

25 During the activation of the downhole isolation packer device 28, the MWD sensors 22 continue to transmit, increasing the sampling, the signals relating to the well parameters to the electronic processing and control device 26 positioned at the surface. In this
30 way, the development of the influx and, in particular, the pressure increase at the bottom hole that will be generated after the reduction in the flow section

caused by the expansion of the downhole isolation packer device 28, are constantly controlled.

Once a threshold pressure value established at the beginning of the drilling step in relation to the expected fracturing pressure value, has been reached, the continuous monitoring of the well-bottom pressure by the electronic processing and control device 26 positioned at the surface, generates an activation signal of the circulation valve, installed on the drill string 12 immediately above the downhole isolation packer device 28. The circulation valve is in turn provided with an automatic activation system, managed by a signal generated by the electronic processing and control device 26 positioned at the surface and transmitted through the wireless network.

On the basis of what is specified above, it is evident that the system for monitoring, controlling and securing a well 10 allows, as a further significant advantage in addition to the aspect of automating the process, a reduction in the reaction times associated with the human variable. Furthermore, the fact that the downhole isolation packer device 28 is activated under circulation conditions of the well fluids, by reducing the flow section, a gradual increase in the well-bottom pressure is caused, consequently generating a choke effect which, by progressively reducing the differential between the so-called formation pressure (equal to the influx pressure), and the well fluids circulation pressure limits the final volume of the influx. Thanks to the continuous monitoring of the drill string 12 through the relative MWD sensors 22, these pressure variations remain under control, without

the risk of accidental fracturing of the formation.

On the basis of the signals received by the MWD sensors 22 and processed by the electronic processing and control device 26, once the well 10 is considered
5 as being once again in safety conditions, the downhole isolation packer device 28 is deactivated. The deactivation signal can be sent manually by an operator and received by the downhole isolation packer device 28 through the wireless network. An automatic or semi-
10 automatic deactivation procedure of the downhole isolation packer device 28 can be possibly provided, managed by the electronic processing and control device 26 positioned at the surface, based on the information coming from the MWD sensors 22.

15 It can thus be seen that the system and method for monitoring, controlling and securing wells for the extraction of formation fluids according to the present invention, achieve the objectives previously specified. In particular, the system and method for monitoring,
20 controlling and securing wells for the extraction of formation fluids according to the present invention can offer substantial advantages in terms of safety/risk for exploration wells characterized by high uncertainty in the estimation of gradients in the planning stage, and also for deep offshore underwater wells, where the
25 economic exposure is extremely high. The advantages of the system and method for monitoring, controlling and securing wells for the extraction of formation fluids according to the present invention can be summarized as
30 follows:

- it is a single and integrated system which automatically identifies, activates and manages

- the possible influx of formation fluids towards the surface of the well;
- it can be applied on all wells and, in particular, on deep offshore underwater wells and on wells with a high operating criticality;
 - it allows the bidirectional transmission of data from both the surface to the bottom hole, and from the bottom hole to the surface;
 - it represents a real additional security barrier, as it can be automatically activated before the intervention of BOPs and is able to put the well under safety conditions without jeopardizing its manageability;
 - it removes the human variable in recognizing the influx phenomenon from the formation as a preliminary condition for activating security procedures (activation of BOPs), without jeopardizing its subsequent intervention and with the well already in a safety condition;
 - it has more rapid activation times with respect to the activation of security/standard BOP procedures, as it guarantees recognition of the influx and the relative characteristics (type and pressure), activating the safety procedure on the basis of the parameters measured, unique and controlled by analytical logics, with detection-analysis-action times in the order of seconds;
 - it does not preclude the subsequent action of standard security systems;
 - it significantly reduces the exposure time variable to the risk of influx.
- The system and method for monitoring, controlling

and securing wells for the extraction of formation fluids of the present invention thus conceived can in any case undergo numerous modifications and variants, all included in the same inventive concept. The
5 protection scope of the invention is therefore defined by the enclosed claims.

CLAIMS

1. A system for monitoring, controlling and securing a well (10) for the extraction of formation fluids, the system being associable with a drilling rig comprising a drill string (12), made of a plurality of drill pipes (14) that extend from the surface up to the bottom hole (10), and a system (18) for the circulation of a drilling fluid (30) that is made to circulate inside the well (10) in the interspace (20) between the drill string (12) and the wellbore wall (10), the system comprising:
- a plurality of sensors (22) operatively associated with the drill string (12) and positioned at the bottom hole (10), said sensors (22) being configured for continuously detecting a plurality of parameters relating to the fluids circulating in the interspace (20) between the drill string (12) and the wellbore wall (10);
 - a wireless transceiving apparatus comprising:
 - a plurality of wireless transmitter/receiver devices (24), positioned at predefined distances along the drill string (12) and configured for the transmission of signals from and towards the bottom hole (10); and
 - an electronic device (26), configured for the control and processing of the parameters detected by the sensors (22) and transmitted by the wireless transmitter/receiver devices (24);
 - at least one downhole isolation packer device (28), operatively associated with the drill string (12) at the sensors (22) and configured for performing

- the closure, at the bottom hole (10), of the interspace (20) between the drill string (12) and
- the wellbore wall (10), so as to isolate the bottom hole (10) with respect to the surface;
 - 5 - an activator element for activating the downhole isolation packer device (28), provided with a respective wireless receiver configured for the communication with the wireless transmitter/receiver devices (24) and consequently
10 with the electronic processing and control device (26); and
 - at least one electronic control/activation circulation valve, installed on the drill string (12) above the downhole isolation packer device
15 (28) and operatively connected to the electronic processing and control device (26) through the wireless transmitter/receiver devices (24), said circulation valve being configured for controlling the circulation of the drilling fluid (30) inside
20 the interspace (20) between the drill string (12) and the wellbore wall (10) in relation to the operating condition of the downhole isolation packer device (28).
2. System according to claim 1, characterized in that
- 25 the sensors (22) are selected from the group consisting of:
 - one or more pressure sensors, configured for continuously measuring the pressure value of the fluids inside the interspace (20) between the drill
30 string (12) and the wellbore wall (10) at the bottom of said well (10);

- one or more density sensors, configured for continuously measuring the density value of the drilling fluid (30);
- one or more resistivity sensors, configured for
5 continuously measuring the resistivity value of the drilling fluid (30); and
- one or more sensors capable of detecting the presence and percentage of formation fluids inside the interspace (20) between the drill string (12)
10 and the wellbore wall (10) at the bottom of said well (10).

3. System according to claim 1 or 2, characterized in that the wireless transceiving apparatus is positioned on the surface, i.e. outside the well (10).

15 4. System according to any claims 1 to 3, characterized in that the wireless transceiving apparatus uses radio waves as transmission system.

5. System according to any claims 1 to 4, characterized in that the downhole isolation packer
20 device (28) consists of at least one inflatable elastic packer that is configured for performing the sealed closure of the interspace (20) between the drill string (12) and the wellbore wall (10) through its own progressive expansion in volume.

25 6. System according to any claims 1 to 5, characterized in that the sensors (22) are installed on the drill string (12), at a predefined distance from the bottom hole (10), said predefined distance being equal to about 20-30 metres above the bottom hole (10).

30 7. System according to any claims 1 to 5, characterized in that it comprises a pair of wireless transmitter/receiver devices (24) positioned on each

single drill pipe (14) or on each length of the drill string (12), the term "length" meaning a set of three drill pipes (14).

8. A method for monitoring, controlling and securing a well (10) for the extraction of formation fluids with the system according to any claims 1 to 7, the method comprising the following steps:

- detecting, by means of sensors (22), a plurality of parameters relating to fluids circulating in the interspace (20) between the drill string (12) and the wellbore wall (10) at the bottom hole (10);
- transmitting said parameters in the form of properly encoded signals through a wireless network composed of contiguous pairs of wireless transmitter/receiver devices (24) positioned on the drill string (12);
- receiving, by means of the electronic processing and control device (26), the signals transmitted through the wireless network and processing said signals in order to determine, on the basis of a pre-established logic, the presence or absence of a influx of formation fluids at the bottom hole (10); and
- sending, through the wireless network, by means of the electronic processing and control device (26) and if said electronic processing and control device (26) ascertains the presence of the influx, a signal adapted to activate the downhole isolation packer device (28) and to perform the closure, at the bottom hole (10), of the interspace (20) between the drill string (12) and the wellbore wall

(10), so as to isolate the bottom hole (10) with respect to the surface.

9. Method according to claim 8, characterized in that said parameters are selected from the group consisting of:

- the pressure value of the fluids inside the interspace (20) between the drill string (12) and the wellbore wall (10) at the bottom of said well (10);
- 10 - the density value of the drilling fluid (30);
- the resistivity value of the drilling fluid (30) and
- the presence and percentage of formation fluids inside the interspace (20) between the drill
- 15 string (12) and the wellbore wall (10) at the bottom hole (10).

10. Method according to claim 8 or 9, also comprising, before the step of sending a signal adapted to activate the downhole isolation packer device (28), a step of

20 sending a further signal adapted to raise the drill string (12) and to interrupt its rotation.

11. Method according to claim 10, characterized in that the raising and interruption operations of the rotation of the drill string (12) are performed manually by an

25 operator.

12. Method according to claim 10, characterized in that the raising and interruption operations of the rotation of the drill string (12) are performed automatically by interfacing the electronic processing and control

30 device (26) with the control system of said drill string (12).

13. Method according to any claims 9 to 12, also comprising, during the activation step of the downhole isolation packer device (28), a step of continuous transmission of the signals to the electronic device
5 (26), so as to constantly control the development of the flow and to continuously monitor the pressure of the bottom hole.

14. Method according to claim 13, also comprising a step of controlling, by means of the electronic
10 processing and control device (26) and of the circulation valve, the circulation of the drilling fluid (30) inside the interspace (20) between the drill string (12) and the wellbore wall (10) in relation to the operating condition of the downhole isolation
15 packer device (28).

15. Method according to any claims 8 to 14, also comprising, once the well (10) has been considered as being once again in safety conditions on the basis of the signals received by the sensors (22) and processed
20 by the electronic processing and control device (26), a step of deactivating the downhole isolation packer device (28).

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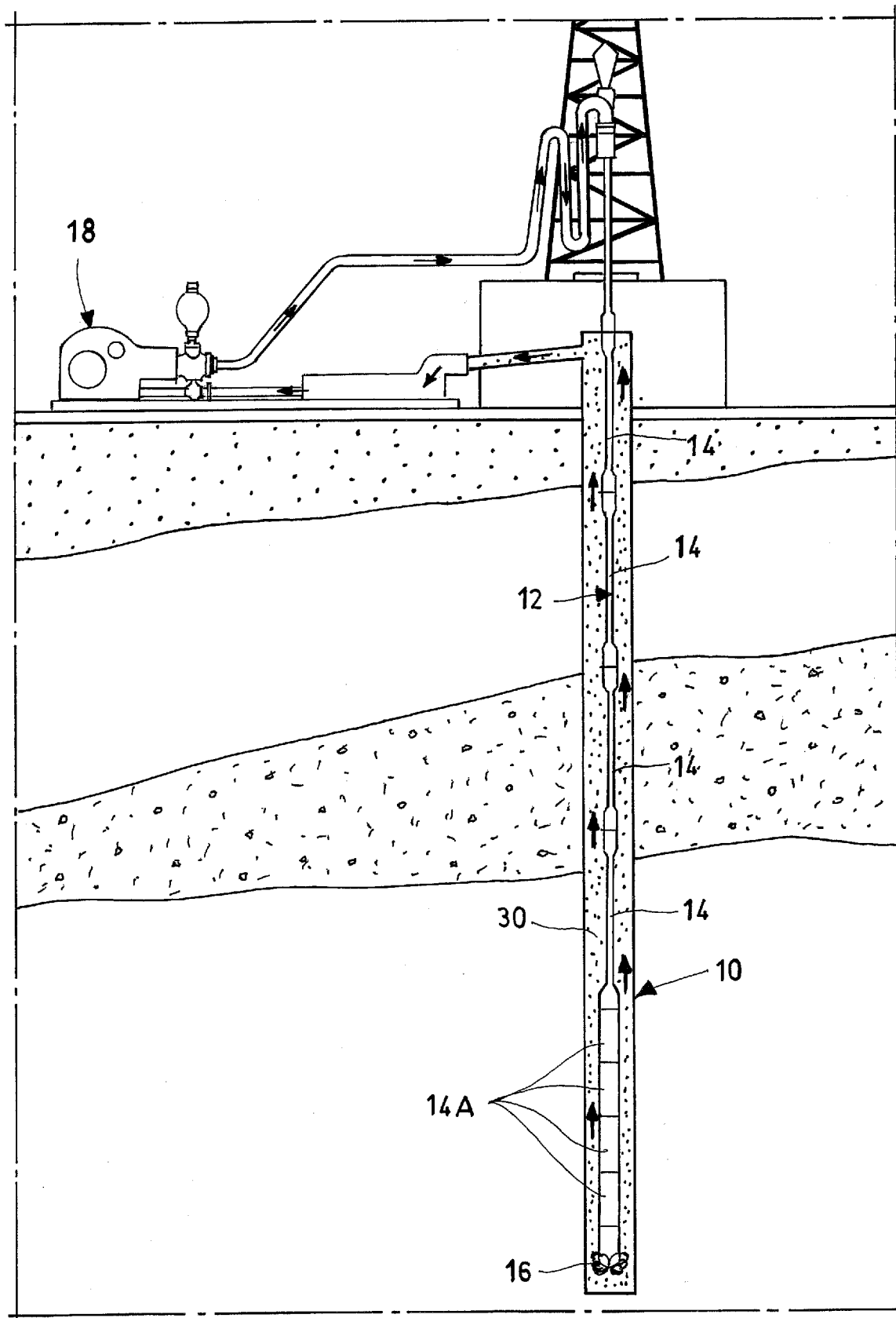


Fig.1

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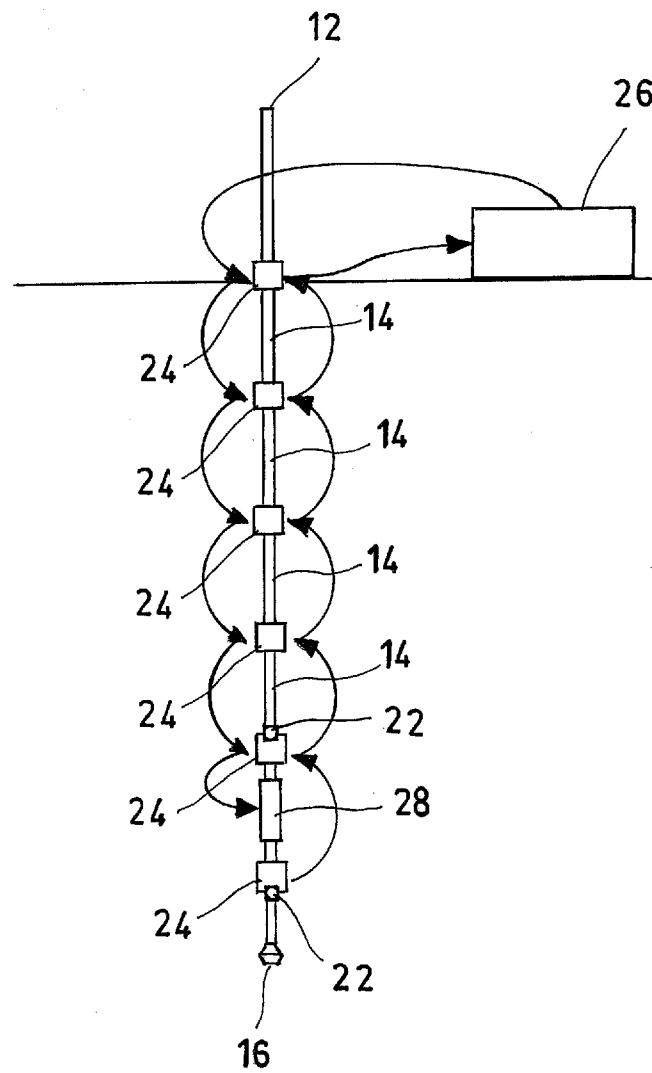


Fig.2

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/052418

A. CLASSIFICATION OF SUBJECT MATTER INV. E21B23/06 E21B47/12 E21B21/08 E21B33/12 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) E21B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012/010897 A2 (METROL TECH LTD [GB]; ROSS SHAUN COMPTON [GB]; JARVIS LESLIE DAVID [GB] 26 January 2012 (2012-01-26)	1-13,15
Y	claims 1,8,21; figure 1 -----	14
Y	WO 2008/005289 A2 (BAKER HUGHES INC [US]) 10 January 2008 (2008-01-10) figures 2,3 -----	14
A	WO 2009/093912 A1 (WELL TECHNOLOGY AS [NO]; TINNEN BAARD MARTIN [NO]; SOERTVEIT HAAVAR [N] 30 July 2009 (2009-07-30) abstract; figure 3 -----	1-15
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 16 August 2017		Date of mailing of the international search report 23/08/2017
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Dantine, Patrick

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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