In the case of adding a further conventional control mechanism for devices, such as a valve, or sensor downhole; the inventors of the present invention also note limitations since, in the event of a blow-out, the ability to function these devices may be lost due to the inability to fluctuate pressure to control pressure activated devices, or due to the loss of control lines.

Thus it is difficult for a skilled person to design a further safety system which can practically add to the safety systems already provided in oil wells.

An object ~~of the present invention~~ is to mitigate problems with the prior art, and preferably to improve the safety of wells.

According to a first aspect, there is provided a well (10) comprising:
(a) a valve (25) on a drill string (20), the valve (25) comprising:
(i) an obstructing member moveable between a first position where fluid flow is permitted, and a second position where fluid flow is restricted through the drill string
(20) in order to shut the well (10) downhole;
(ii) a movement mechanism;
(iii) and a wireless receiver (360), adapted to receive a wireless signal;
wherein the movement mechanism is operable to move the obstructing member from
one of the first and second positions to the other of the first and second positions in
response to a change in the signal being received by the wireless receiver (360);
(b) sensors to detect a parameter in the well (10), in the vicinity of the valve (25); wherein a
sensor is provided above and a sensor is provided below the valve (25).

According to ~~a first aspect of the present invention~~an embodiment there is provided a safety mechanism comprising:
an obstructing member moveable between, normally from, a first position where fluid flow is permitted, and, normally to, a second position where fluid flow is restricted;
a movement mechanism;

Claims

1. A well (10) comprising:

(a) a valve (25) on a drill string (20), the valve (25) comprising:

(i) an obstructing member moveable between a first position where fluid flow is permitted, and a second position where fluid flow is restricted through the drill string (20) in order to shut the well (10) downhole;

(ii) a movement mechanism;

(iii) and a wireless receiver (360), adapted to receive a wireless signal;

wherein the movement mechanism is operable to move the obstructing member from one of the first and second positions to the other of the first and second positions in response to a change in the signal being received by the wireless receiver (360);

(b) sensors to detect a parameter in the well (10), in the vicinity of the valve (25); wherein a sensor is provided above and a sensor is provided below the valve (25).

2. A well (10) as claimed in claim 1, wherein the wireless receiver (360) is one of:

(i) an acoustic receiver and the signal is an acoustic signal;

(ii) an electromagnetic receiver and the signal is an electromagnetic signal; and

(iii) an electromagnetic receiver and an acoustic receiver and the signal is transmitted over part of its distance by the electromagnetic receiver and part of its distance by the acoustic receiver.

3. A well (10) as claimed in claim 1 or claim 2, wherein the wireless receiver (360) is a wireless transceiver (250,360).

4. A well (10) as claimed in any preceding claim, further comprising a subsurface safety valve.

5. A well (10) as claimed in any preceding claim, wherein the sensors detect pressure above and below the valve (25).

6. A well (10) as claimed in any preceding claim, wherein the information provided by the sensors is retrieved wirelessly.

7. A well (10) as claimed in any preceding claim, wherein the receiver (360) is up to 100m, optionally less than 50m, more optionally less than 20m below the top of the well (10).

8. A well (10) as claimed in any preceding claim, comprising a casing (12a,12b,12c,12d) having a casing sub (400) with the valve (25) therein, the valve (25) communicating between an inner and outer side of the casing (12a,12b,12c,12d); wherein the valve (25) is adapted to move from one of the first and second positions to the other of the first and second positions, and then back to the first of the first and second positions.

9. A well (10) as claimed in any preceding claim, further comprising a device which is in use fitted or retro-fitted to a top of the well (10), comprising a wireless transmitter and a sonar receiver; for use in an emergency situation.

10. A well (10) as claimed in claim 9, wherein the device is less than $1m^3$, less than 0.25 m^3, especially less than 0.10 m^3.

11. A well as claimed in any preceding claim, wherein the valve comprises a battery.

12. A well apparatus comprising a well (10) as claimed in any preceding claim, and a sonar receiver (360) and preferably a sonar transmitter (250).

13. A well apparatus as claimed in claim 12, wherein a satellite device is provided, the device comprising a satellite communication mechanism and configured to relay information received between the sonar receiver (360) and the sonar transmitter (250) and the satellite.

14. A method of inhibiting fluid flow from a well as claimed in any one of claims 1 to 11 or a well apparatus as claimed in claim 12 or 13 in an emergency situation, the method comprising: in the event of an emergency situation, sending a wireless signal into the well (10) to the valve (25).

15. A method as claimed in claim 14, wherein the wireless signal is sent during a phase where a BOP (30) is provided on the well (10).

16. A method as claimed in claim 14 or claim 15, wherein the wireless signal is sent from a device provided at a wellhead apparatus of the well (10) or proximate thereto.

17. A method as claimed in claim 15, wherein the wireless signal is sent from a platform, optionally with wireless repeaters provided on risers and/or downhole.

18. A method as claimed in any one of claims 14 to 15, wherein the wireless signal is sent from the seabed wellhead apparatus, after receiving sonar signals from a surface installation or an ROV.

19. A method as claimed in any one of claims 14 to 15 wherein an ROV connects to the seabed wellhead apparatus and send or receives signals via a hot-stab connection.

20. A method as claimed in claim 14 to 16, wherein the wireless signal is sent from the wellhead apparatus after receiving satellite signals from another location.

21. A method as claimed in any one of claims 14 to 20, wherein the signals are sent retroactively, after an emergency situation has occurred.

Claims

1. A well comprising:

(a) a safety mechanism, the safety mechanism comprising:

(i) an obstructing member moveable between a first position where fluid flow is permitted, and a second position where fluid flow is restricted;

(ii) a movement mechanism;

(iii) and a wireless receiver, adapted to receive a wireless signal;

wherein the movement mechanism is operable to move the obstructing member from one of the first and second positions to the other of the first and second positions in response to a change in the signal being received by the wireless receiver;

(b) sensors to detect a parameter in the well, in the vicinity of the safety mechanism ;

wherein a sensor is provided above and a sensor is provided below the safety mechanism.

2. A well as claimed in claim 1, wherein the receiver is one of:

(i) an acoustic receiver and the signal is an acoustic signal;

(ii) an electromagnetic receiver and the signal is an electromagnetic signal; and

(iii) an electromagnetic receiver and an acoustic receiver and the signal is transmitted over part of its distance by the electromagnetic receiver and part of its distance by the acoustic receiver.

3. A well as claimed in claim 1 or claim 2, wherein the wireless receiver is a wireless transceiver.

4. A well as claimed in any preceding claim, further comprising a subsurface safety valve.

5. A well as claimed in any preceding claim, wherein the sensors detect pressure above and below the safety mechanism.

6. A well as claimed in any preceding claim, wherein the information provided by the sensors is retrieved wirelessly.

7. A well as claimed in any preceding claim, wherein the receiver is up to 100m, optionally less than 50m, more optionally less than 20m below the top of the well.

8. A well as claimed in any preceding claim, comprising a casing having a casing sub with the safety mechanism in the form of a valve therein, the valve communicating between an inner and outer side of the casing; wherein the valve is adapted to move from one of the first and second positions to the other of the first and second positions, and then back to the first of the first and second positions.

9. A well as claimed in any preceding claim, further comprising a device which is in use fitted or retro-fitted to a top of the well, comprising a wireless transmitter and a sonar receiver; for use in an emergency situation.

10. A well as claimed in claim 9, wherein the device is less than $1m^3$, less than $0.25\ m^3$, especially less that $0.10\ m^3$.

11. A well apparatus comprising a well as claimed in any preceding claim, and a sonar receiver and preferably a sonar transmitter.

12. A well apparatus as claimed in claim 11, wherein a satellite device is provided, the device comprising a satellite communication mechanism and configured to relay information received between the sonar receiver and transmitter and the satellite.

13. A method of inhibiting fluid flow from a well as claimed in any one of claims 1 to 8 or a well apparatus as claimed in claim 11 or 12 in an emergency situation, the method comprising: in the event of an emergency situation, sending a wireless signal into the well to the safety mechanism.

14. A method as claimed in claim 13, wherein the wireless signal is sent during a phase where a BOP is provided on the well.

15. A method as claimed in claim 13 or claim 14, wherein the wireless signal is sent from a device provided at a wellhead apparatus of the well or proximate thereto.

16. A method as claimed in claim 14, wherein the wireless signal is sent from a platform, optionally with wireless repeaters provided on risers and/or downhole.

17. A method as claimed in any one of claims 13 to 14, wherein the wireless signal is sent from the seabed wellhead apparatus, after receiving sonar signals from a surface installation or an ROV.

18. A method as claimed in any one of claims 13 to 14 wherein an ROV connects to the seabed wellhead apparatus and send or receives signals via a hot-stab connection.

19. A method as claimed in claim 13 to 15, wherein the wireless signal is sent from the wellhead apparatus after receiving satellite signals from another location.