

Claims

1. A well comprising a borehole and wellhead apparatus, and a communication box at or proximate to the wellhead apparatus,
 the well comprising a plurality of sensors coupled to wireless transmitters which are adapted to transmit information from the sensors to the communication box;
 the sensors comprising at least one pressure sensor;
 and the well comprising a first memory device spaced apart from the communication box,
 the first memory device configured to store information from the sensors,
 wherein the communication box comprises a receiver adapted to receive signals from the transmitters, and at least one of a transmission device and a second memory device to transmit and/or store data received from the transmitters.

2. A well as claimed in claim 1, wherein the sensors comprise of at least one temperature sensor, and wherein a plurality of the same type of sensor is provided in the well spaced apart from each other, and wherein the transmitter is an electromagnetic transmitter and the signal is an electromagnetic signal.

32. A well as claimed in claim 1 or claim 2, wherein the communication box has a survivability shock rating of least 50Gs for at least 5ms, all axes, optionally more than 100Gs for at least 5ms, all axes; and more optionally more than 500Gs for at least 5ms, all axes.

43. A well as claimed in either any preceding claim, wherein the transmitter is part of a transceiver which also comprises a receiver; and wherein the receiver of the communication box is a second transceiver which also comprises a transmitter.

54. A well as claimed in any preceding claim, wherein the first memory device is configured to store information for at least one minute, preferably at least one day, more preferably at least one year.

65. A well as claimed in any preceding claim, wherein the communication box comprises a second memory device which is configured to store information for at least one minute, preferably at least one day, more preferably at least one year.

76. A well as claimed in any one of preceding-claims 1, 3 to 6, wherein the transmitter is an acoustic transmitter and the signal is an acoustic signal.

~~7.~~ A well as claimed claim 6, wherein the acoustic signal is adapted to travel through at least one of elongate members and well fluid.

~~8.~~ A well as claimed claim 6 or claim 7, wherein the acoustic communications include Frequency Shift Keying ((FSK) and/or Phase Shift Keying (PSK) modulation methods.

~~9.~~ A well as claimed in claim 8, including Quadrature Phase Shift Keying (QPSK) or Quadrature Amplitude Modulation (QAM) normally incorporating Spread Spectrum Techniques.

840. A well as claimed in any preceding claim, wherein the communication box is within 50m preferably 20m of the wellhead apparatus.

911. A well as claimed in any preceding claim, wherein the communication box is subsurface, that is more than 2m under the surface, optionally more than 5m or more than 10m subsurface.

102. A well as claimed in any preceding claim, wherein the communication box is situated within the borehole.

~~13. A well as claimed in anyone of claims 1 to 11, wherein the wellhead apparatus includes the communication box.~~

114. A well as claimed in any preceding claim, wherein at least one of the sensors comprises the first memory device.

125. A well as claimed in any preceding claim, wherein the transmitter is configured to transmit data in real time.

136. A well as claimed in any preceding claim, wherein the transmitter is configured to transmit historical data.

~~17. A well as claimed in any preceding claim, wherein the borehole includes the sensors.~~

~~18. A well as claimed in any preceding claim, wherein the communication box includes a memory device.~~

149. A well as claimed in any preceding claim, wherein a sensor is provided above and below an obstruction

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~~20.~~ A well as claimed in claim 19, wherein the obstruction is an expanded packer, or a well plug.

~~15~~24. A well as claimed in any preceding claim, wherein a plurality of the same type of sensor are provided in the well spaced apart from each other.

~~16~~22. A well as claimed in any preceding claim, wherein the sensors comprise at least one temperature sensor.

~~17~~23. A well as claimed in any preceding claim, wherein there is at least one sensor in a casing annuli and at least one sensor in a production tubing.

~~18~~24. A well as claimed in any preceding claim, wherein there is at least one sensor in a first casing annuli and at least one sensor in a second casing annuli.

~~19~~25. A well as claimed in any preceding claim, wherein there are more than two different types of sensor.

~~20~~26. A well as claimed in any preceding claim, wherein the sensors are incorporated directly in the equipment comprising the transmitters.

~~21~~27. A well as claimed in any preceding claim, wherein the sensors transfer data to said wireless transmitter using cables or short-range wireless communication techniques.

~~22~~28. A well as claimed in any preceding claim, wherein the transmitter is up to 100m, sometimes less than 50m, or less than 20m below the top of the well.

239. A well as claimed in any preceding claim, which is a subsea well.

~~30. A well as claimed in any preceding claim, comprising a BOP.~~

~~31. A well as claimed in anyone of claims 1 to 29, comprising a tree.~~

2432. A well as claimed in any preceding claim, wherein the communication box comprises a sonar transmitter.

2533. A well as claimed in any preceding claim, wherein at least one sensor is provided at the wellhead apparatus.

2634. A method of monitoring a well as claimed in any preceding claim, the method comprising sending signals between a surface facility and the communication box.

2735. A method as claimed in claim 2634, wherein the signals are sent via wireless repeaters provided on risers.

2836. A method as claimed in claim 2634, wherein the communication box comprises a sonar transmitter, and the signals are sent between the surface facility or an ROV and the communication box by sonar.

2937. A method as claimed in claim 2634 wherein an ROV connects to the communication box and send or receives signals via a hot-stab connection therewith.

3038. A method as claimed in claim 2634 to 2937, wherein signals from the communication box are stored at the surface facility, and onwardly transmitted by satellite communications.