(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 220 972 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
10.12.2003 Bulletin 2003/50

(21) Application number: **00964443.6**

(22) Date of filing: **29.09.2000**

(51) Int Cl.[7]: **E21B 43/00**, E21B 21/16

(86) International application number:
PCT/GB00/03741

(87) International publication number:
WO 01/025595 (12.04.2001 Gazette 2001/15)

(54) **UNDERBALANCED PERFORATION**

PERFORATION VON BOHRLÖCHERN BEI UNTERDRUCK

PERFORATION EN SOUS-PRESSION

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **01.10.1999 GB 9923200**

(43) Date of publication of application:
10.07.2002 Bulletin 2002/28

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(56) References cited:
WO-A-99/42696
US-A- 4 175 042
US-A- 4 650 010
US-A- 5 635 636

- **SCOTT ET AL.: "Air foam improves efficieny of completion and workover operations in low-pressure gas wells" 1994 SPE MID-CONTINENT GAS SYMPOSIUM, 22 - 24 May 1994, pages 219-225, XP002156494 amarillo**

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EP 1 220 972 B1

Description

[0001] The present invention relates to the extraction of fluids, especially hydrocarbons. A method of removing these hydrocarbons, and apparatus suitable for performing the method, is described hereinafter. The invention finds particular use in the oil and gas industry during the extraction of natural gas or oil from a low pressure reservoir.

[0002] Natural reservoirs of hydrocarbons in the form of oil and gas have been exploited commercially with varying degrees of success since the mid- to late nineteenth century. However, the need for a petrochemical industry has steadily and rapidly developed since around 1900 and during this time readily accessible reservoirs at land based sites have been depleted so that currently exploitation is mainly concerned with off-shore, often deep water sites. The need often arises to re-work older sites previously considered as depleted by the technology available at the time the sites were first exploited. The natural drive of these sites may have become exhausted or so weak that though deposits of desirable hydrocarbons remain, the recovery thereof awaits a cost-effective technology.

[0003] Extracting hydrocarbons from deep wells or at these previously worked sites requires an artificial lifting system to bring the hydrocarbons to the surface. The system includes pumping means associated with a well head assembly or "tree" and a riser tubing within a well casing. Poor natural pressure reservoirs may be worked using fluid displacement systems e.g. pumping brine into a reservoir to displace hydrocarbons to surface.

[0004] Care has to be taken for environmental reasons in extracting hydrocarbons. Thus it is essential that any oil production facility can reliably control the output of each well associated therewith. Therefore, it is necessary to have complete control over pressure in the wells. Established techniques exist for countering the natural pressure of a reservoir by applying over-pressure relative to the natural reservoir pressure by means of a column of mud or completion fluid in the well.

[0005] Reservoir pressure is detectable as a fluid pressure in a borehole or well whenever an oil or gas reservoir has been intercepted by that borehole or well. As a generalisation it is lower than the hydrostatic pressure, or head of drilling fluid (commonly "mud"), and varies with depth, but reservoir pressure is affected by many factors, and may be considerably higher or lower than normal. The hydrostatic head is the pressure exerted by a column of liquid, having a given density, above a point a given distance below. If the hydrostatic column of mud is greater than the reservoir pressure then an overbalance exists. This overbalance keeps the well stable and prevents the hydrocarbon being produced into the well bore.

[0006] Consequently, for a well to operate productively, it is necessary to achieve a controllable underbalance of these pressures, i.e. selectively arrange for the reservoir pressure to be greater than the hydrostatic pressure of fluid over the reservoir. It is imperative that this underbalance is achieved in a controlled and safe manner to avoid the potential for hazardous losses of hydrocarbons with attendant risks of endangering personnel and equipment due to fire and explosions, and environmental pollution.

[0007] Generally the initial pressure encountered when a borehole first intercepts a reservoir only partly affects the ability of oil or gas to subsequently flow up the completed well: the most important factor being the drive mechanism.

[0008] This is well understood by those in the art and much has been written concerning drive mechanisms and techniques for enhancing the natural drive or applying an induced force which is needed to drive oil or gas out of a reservoir and up the well bore. The literature describes many drive mechanisms used in modern well technology including dissolved gas drive, water drive, gas cap drive, gas drive, miscible flooding and gravity drainage. Gas or water pressure is carefully controlled in a pressure maintenance program, so that pressure is just sufficient to drive the hydrocarbons to the surface. A pressure maintenance program might make use of a combination of techniques employed to sustain the natural pressure in a producing well to ensure continuous production at the required rate. Water drive and gas drive are two practical methods which are frequently used in combination with re-injection mechanisms. Water or gas is then injected through service wells.

[0009] However, known methods currently applied in the oil and gas industry for enhancing the natural drive of a reservoir or underbalancing wells include using oil base products or a full coiled tubing lift. The use of oil base fluids for this type of operation has the inherent high risks of pollution causing major problems for companies working in environmentally sensitive areas offshore. This inevitably results in production shut downs which have a severe financial impact on the earning potential of the company involved.

[0010] Conventional methods involving coiled tubing also suffer from inherent problems given the very time-consuming nature of the method. By having to feed lengths of coiled tubing the fully into the well until the reservoir depth has been reached, in some cases 4000 feet (1219.2 metres) or more, many hours of valuable production time have been lost. Added to this is the major cost of maintaining personnel and equipment on standby whilst the coiled tubing is being fed into the well which is still not in production mode as yet. In some instances, times of 36 hours constant feeding of coiled tubing to reach the reservoir depth are not unknown. Such a method is an expensive and time consuming procedure to carry out.

[0011] US-A-5,636,636 discloses a method of determining the inflow rate of solely gas or solely liquid into a well being completed in an underbalanced state and monitoring the pressure in this well after perforation. This document

describes a tubing string extending downwardly inside the bore of a well casing string which in turn extends into a formation containing fluid. The well is then conditioned to create an underbalanced state which leaves a gas f illed space above any residual liquid in the well bore. The levels of the liquid in both the bore of the tubing and the annulus formed between the casing and the tubing can be determined by testing. The casing is then perforated to permit fluid from the formation to flow into the wellbore.

[0012] Scott et al, in an article in SPE Drilling and Completion, December 1995, pp219-225 entitled "Air Foam improves efficiency of completion and workover operations in low-pressure gas wells", describe the use of portable air form units in circulating operations and the use of these units as an alternative to foamed nitrogen for both conventional and coiled tubing. The paper also states that blowing liquids out of the wellbore to create an underbalanced condition before perforating are newer uses of these units. It goes on to describe how the surfactants, inhibitors and other needed chemicals are mixed prior to injection. The document then describes how a good quality foam is produced by impinging the air and liquid streams in a high turbulence foam generator.

[0013] An object of the present invention is to obviate or mitigate at least some or all of the disadvantages of the known underbalance methods and to further improve hydrocarbon production techniques. A further object of the invention is to offer the industry an environmentally acceptable method of underbalancing a well. A still further object of the invention is to provide a tool for use in underbalancing a well which tool is of a relatively simple design, offering advantages in ease of installation and safety.

[0014] Accordingly, the present invention provides a method of initiating production as specified in claim 1.

[0015] This enables the well to be underbalanced much quicker than is possible using conventional methods and at a greatly reduced cost. A key feature recognisable in the method is that the steps required to achieve the pressure underbalance adjustments are undertaken "topside" of the well, rather than down at the reservoir depths. Furthermore, the pressure adjustments are achievable using environmentally safe methods utilising gas and fluids which are recoverable within the proposed protocols. Furthermore, the simplicity of the method is recognisable in that the invention selectively substitutes a part of the volume of the fluid standing over the hydrocarbon with a corresponding volume of gas to effect the necessary pressure adjustments. The safety inherent in the method is recognisable in that both the supplied gas, preferably an inert gas like nitrogen, and the displaced fluid, preferably an aqueous completion fluid, are recoverable without loss to ambient, and the thus underbalanced well is thereafter controllable in a manner known in the art.

[0016] The displaceable liquid to be used in the underbalance method of the invention may be a typical completion fluid or brine, containing sodium chloride or calcium chloride, for example.

[0017] The sealing step may further include cementing the casing in place by filling the annular space between the casing and the bore hole. This prevents any unwanted fluids entering the annular space.

[0018] The gaseous material used may consist of, or include nitrogen.

[0019] Thus according to the invention, there is provided a method of underbalancing a well which does not have sufficient pressure to provide flow from a reservoir to be tapped, by introduction of a gas to displace fluid from tubing forming part of the well characterised by installing in an upper part of the well tubing remote from the reservoir an underbalance tool having means for pumping fluids separately therethrough and an associated tool tubing of narrower bore than the well tubing and of a pre-selected length capable of penetrating into the well tubing to a predetermined depth to permit exchange of fluid in the well for gas, locating the tool tubing within the well tubing, operatively connecting the tool and its tubing to permit fluid flow therein, providing a controllable gas supply to said tool, operating the tool to deliver gas and displacing fluid from the well tubing by means of said gas to achieve underbalance.

[0020] Such a method is useful at the stage of completion, ideally on new wells with cemented casings or liners, but is applicable whenever the well is in a dead, killed or overbalance status. Thus the method is also applicable for minimising the risks of hydrate formation when a well has been suspended and re-entered. Where the well has been preperforated or uses slotted liners, it is possible to apply the method by utilising the tool in conjunction with a downhole plug system. The proposed method is particularly suited to low pressure reservoirs which cannot be underbalanced using a fluid medium.

[0021] The invention further provides an apparatus for use in the start up of production of hydrocarbon from a well as specified in claim 12.

[0022] Preferably, said tubing attachable to said body is provided with a foraminated bull nose distal end.

[0023] The present proposal offers a quick, technically simple and cheap opportunity for underbalancing a well with a minimum risk of environmental discharge into the sea. In addition to offering financial benefits for new installations, the invention offers a simple cost effective way of ensuring full hydra testing is carried out on wells requiring re-entry thereby minimising the risks of hydrate formation and reducing re-entry costs. The present invention is also ideally suited to low pressure reservoirs which cannot be underbalanced using a fluid medium.

Brief Description of the Drawings

[0024] Embodiments of the present invention will now be described by way of example only with reference to the following drawings, in which:

Fig. 1 is a diagrammatic representation of a reservoir section being drilled;

Fig. 2 is a diagrammatic representation of a casing and a cemented liner after insertion into the hydrocarbon well;

Fig. 3 is a diagrammatic representation of the well after completion;

Fig. 4 is a diagrammatic representation of the underbalanced well in accordance with the present invention;

Fig. 5 is a diagrammatic representation of a perforated underbalanced well in accordance with the present invention; and

Fig. 6 is a diagrammatic representation of the underbalanced well during the production phase of the well.

Detailed Description of Exemplary Embodiment

[0025] Referring to Fig 1, there is shown schematically a well borehole 10 being drilled with a conventional drill bit 20 and a drill pipe 40 to the depth of the reservoir section 20. Casing 30 is placed inside the borehole 10 as a lining to secure the hole and prevent the walls from collapsing. The casing 30 is run soon after drilling the first hundred metres or so of the hole 10. At this drilling stage, the well 10 is full of kill weight mud. This means that the hydrostatic column of mud is greater than the reservoir pressure. This is illustrated by calculating the pressures using the following formula:

$$p = 0.052\ gh,$$

[0026] Where

p is in psi;
g is in pounds per gallon; and
h is in feet.

Where the reservoir depth is 4000 feet (1219.2 metres), as indicated by point P, and the mud weight is 11 ppg (pounds per gallon) (1097.54kg/m^3) then the hydrostatic head equals:

$$0.052 \times 11 \times 4000 = 2288\text{psi}\ (15775.2\text{KN/m}^2)\text{hydrostatic}$$

As the reservoir pressure at 4000 feet (1219.2 metres) is equal to 2000 psi (13789.52KN/m^2), this equates to an overbalance of 288 psi (1985.7KN/m^2). This overbalance keeps the well 10 stable and prevents the hydrocarbon being produced into the well 10.

[0027] Sections of the casing are coupled together as with drill pipe, but they may be welded together, threaded or interlocked, and when the string reaches the required depth it is cemented in position, as shown in Fig.2. With the drill pipe in place an annulus is formed, up which drilling fluid and cuttings may travel to the surface. A deep hole will need several concentric runs of reducing diameter to make up a casing programme.

[0028] Primary cementing is the first job in a casing cementing programme, which takes place soon after the casing has been run. After the drill string has been removed cement is pumped down the inside of the casing to clear the hole of mud. A cementing plug is then inserted, followed by drilling fluid, which forces the cement to the bottom of the hole and up into the space between casing and hole, or between casings, until it reaches the surface along with any remaining mud. This is known as cementing up. When set, the cement 60 keeps the casing 50 in place and secures the hole against the ingress of unwanted fluids by filling the annular space between the casing and the bore wall. This provides an added barrier to the well over and above the mud column used in the drilling phase. The unperforated cemented casing 50 also retains the reservoir pressure at the reservoir depth. As a prelude to the production phase of operation of the well, the well bore fluid is exchanged from a relatively high density drilling mud to a lower density completion fluid 110 such as a brine containing for example sodium chloride or calcium chloride which has a weight of

10ppg (997.763kg/m^3). This is achieved using conventional clean-up techniques employing drill pipe and casing scrapers. The blade type or wire brush scrapers are used as a mechanical means to scrape the internal wall of the casing down to the bottom of the well. This process removes any mud cake, which has built up on the casing well by pumping sea water into the wellbore until the fluid returns have reached the required level of cleanliness. Once the well has been cleaned, the prefiltered completion brine is circulated into the wellbore. By reducing the weight of the fluid in this manner, the hydrostatic head is reduced further as the following calculation illustrates;

$$0.052 \times 10 \times 4000 = 2080\text{psi}\ (14341.1\text{kN/m}^2)\ \text{hydrostatic}$$

The fluid column is still overbalanced by 80psi (551.58kN/m^2) at this stage.

[0029] As shown in Fig. 3, the well 10 is completed by installing a down hole safety valve 70, a packer 80, connection tubulars 90, and a wellhead 100. After completion, the well is still overbalanced by 80psi (551.58kN/m^2).

[0030] After completion of the well has been successfully carried out, the well is in a condition which enables it to be underbalanced with a view to facilitating production. Referring to Fig. 4, it can be seen that the underbalance is achieved by running 600 feet (182.88m) of slip pipe 120 into the completion zone 130. Nitrogen 150 is then pumped under pressure into the well to remove the upper part-volume of the fluid column down to a level 160 at the end of the slim pipe 120. The pump pressure required through the system is a function of how deep the slim pipe 120 is run into the well and the density of the completion fluid 110. The pressure range is a function of the differential pressure at the drilling tool 20 and the rate at which the nitrogen is being pumped The return line 140 for the completion fluid/nitrogen to the surge tank on deck (not shown) is choked back. This ensures that a back pressure is maintained during the nitrogen pumping operation. The system can be operated from a minimum pressure of 50psi (344.74kN/m^2) to a maximum operating pressure of 5000psi (34473.8kN/m^2). The following calculation shows how the well is underbalanced;

$$4000 \times 10 \times 0.052 = 2080\text{psi}\ (14341.1\text{kN/m}^2)\ \text{hydrostatic}$$

$$600 \times 10 \times 0.052 = 312\text{psi}\ (2151.2\text{kN/m}^2)$$

this produces a hydrostatic head of 1776psi (12245.1kN/m^2).

As the reservoir pressure is equal to 2000psi (13789.5kN/m^2), this produces an underbalance of 223psi (1537.5kN/m^2). The fluid returns 140 removed by the nitrogen 150 can be monitored to ensure the correct underbalance has been achieved. The underbalance can also be verified by the pressure reading.

[0031] After the well has been cased, cemented and serviced, each productive horizon is completed by making permanent contact between it and the well bore, and installing tubing and the appropriate equipment for controlling fluid flow. Contact with each horizon may be achieved directly or by perforating the casing, as shown in Fig.5, using wireline guns 180. Completions may be single or multiple completions and separate tubings are run according to the number of productive zones. This causes the fluid level 160 to rise, offloading the well in the process.

[0032] Fig. 6 shows the well in the production phase after a production tree 190 has been fitted.

The method described eliminates the complex mechanisms and procedures utilised by existing methods. Benefit is gained from the fact that the present invention can be used to underbalance a well extremely quickly and at a far lower cost than can be achieved using existing methods.

[0033] The example described is given by way of example only, and is not intended to limit the scope of the invention which is defined by the following claims.

Claims

1. A method of initiating production of hydrocarbons from a dead or killed well including a shaft with a casing or lining (30) therein; and a flow conduit (40) located within the casing or lining (30); which well has a column of liquid to provide a hydrostatic head, which method is **characterised by** the steps of:

   inserting a tubular member (130) inside the casing or lining to a required depth in the liquid to provide a chamber (110);
   sealing the chamber (110) from the outside environment;
   causing a gaseous material to flow into the chamber (110) to create a pressure differential between the chamber (110) and the outside environment, and so cause the liquid in the well to be displaced and flow along the flow conduit (40);

collecting the liquid displaced from the well; and
perforating the casing (30) to enable the hydrocarbon to flow.

2. The method according to claim 1 wherein said gaseous material is an inert gas.

3. The method according to claim 2 wherein said inert gas is nitrogen.

4. The method according to any of the preceding claims wherein said displaced fluid is an aqueous completion fluid.

5. The method according to claim 4 wherein said completion fluid is sodium chloride, calcium chloride or brine.

6. The method according to any of the preceding claims wherein sealing the chamber includes cementing said casing or lining in place filling the annular space between the casing or lining and the bore hole.

7. The method according to any preceding claim wherein sealing the chamber includes providing a static seal at the top of the well to complete the well.

8. The use of the method in accordance with any of the preceding claims to initiate production of hydrocarbons from a new well, or a suspended well, or a re-entered well.

9. The use of the method according to claim 8 with a downhole plug system.

10. The use of the method according to claim 9 wherein the well has been pre-perforated.

11. The use of the method according to claim 9 wherein the well uses slotted liners.

12. Apparatus for use in the initiation of production of hydrocarbon from a dead or killed well having a casing (30) and which well has a hydrostatic head of liquid in the well during drilling which apparatus includes:

a tubular member (130) for insertion into the well casing (30) to provide a chamber (110) and a flow conduit (40);
gas supply means (150) to supply gas under pressure to the chamber;
fluid flow means to allow liquid displaced from the well to flow through the flow conduit (40) and be collected;
and **characterised in that** means for sealing the chamber (110) from the environment are provided and include a static seal for sealing the chamber (110) at the top of the well and further **characterised by** having means to perforate the casing (30).

13. Apparatus for use in the initiation of production of hydrocarbon from a well as claimed in claim 12 wherein the means for sealing the chamber at the top of the well is provided by ;
a tool which includes a body adapted to be removably inserted in a well and having at least two discrete fluid channel therein;
one of said fluid channels is provided at one end with a fluid tight coupling for attachment to a controllable gas supply;
one of the other, channels having a fluid tight coupling for venting fluid to a collector; wherein
said body further includes means for attaching a length of tubing for insertion into the well tubing to provide means of exchanging fluids within the well and to adjust the pressure in the well tubing.

14. Apparatus as claimed in claim 13 wherein said tubing attachable to said body is provided with a foraminated bull nose distal end.

Patentansprüche

1. Verfahren zur Aufnahme der Förderung von Kohlenwasserstoffen aus einem stillgelegten oder trockengepumpten Bohrloch mit einer Verrohrung oder einer Auskleidung (30) sowie einem Strömungskanal (40), der sich innerhalb des Ausbaus oder der Auskleidung (30) befindet, umfasst, wobei das Bohrloch eine Flüssigkeitssäule aufweist, um einen Flüssigkeitsdruck zu schaffen, wobei das Verfahren charakterisiert ist durch die Schritte:

Einbringen eines röhrenförmigen Mittels (130) in die Verrohrung oder die Auskleidung bis auf eine erforderliche

Teufe in die Flüssigkeit. um eine Kammer (110) zu schaffen,

Versiegeln der Kammer (110) gegenüber der äußeren Umgebung,

wegen gasförmigen Material, das in die Kammer (110) strömt, erzeugen eines Druckgefälles zwischen der Kammer (110) und der äußeren Umgebung, damit die Flüssigkeit in das Bohrloch verdrängt wird und in den Strömungskanal (40) strömt,

Auffangen der Flüssigkeit, die aus dem Bohrloch verdrängt wurde, und

Perforieren der Verrohrung (30), um das Zuströmen des Kohlenwasserstoffs zu ermöglichen.

2. Verfahren nach Anspruch 1, wobei das gasförmige Material ein Inertgas ist.

3. Verfahren nach Anspruch 2, wobei das Inertgas Stickstoff ist.

4. Verfahren nach einem der vorangehenden Ansprüche, wobei das verdrängte Fluid ein wässriges Ergänzungsfluid ist.

5. Verfahren nach Anspruch 4, wobei das Ergänzungsfluid Natriumchlorid, Calciumchlorid oder Sole ist.

6. Verfahren nach einem der vorangehenden Ansprüche, wobei das Abdichten der Kammer das Einzementieren der Verrohrung oder der Auskleidung umfasst wobei hierbei der Ringraum zwischen der Verrohrung oder der Auskleidung und dem Bohrloch verfüllt wird.

7. Verfahren nach einem der vorangehenden Ansprüche, wobei das Abdichten der Kammer eine statische Dichtung bis zum oberen Ende des Bohrloches umfasst, um das Bohrloch zu vervollständigen.

8. Benutzung des Verfahrens nach einem der vorangehenden Ansprüche, um die Förderung von Kohlenwasserstoffen aus einem neuen Bohrloch oder einem stillgelegten Bohrloch oder einem wiedergeöffneten Bohrloch aufzunehmen.

9. Benutzung des Verfahrens nach Anspruch 8 mit einem Bohrlochstopfensystem.

10. Benutzung des Verfahrens nach Anspruch 9, wobei das Bohrloch vorperforiert worden ist.

11. Benutzung des Verfahrens nach Anspruch 9, wobei bei dem Bohrloch Siebrohre benutzt werden.

12. Vorrichtung zur Benutzung bei der Aufnahme der Förderung von Kohlenwasserstoffen aus einem stillgelegten oder totgepumpten Bohrloch, das eine Verrohrung (30) aufweist, und wobei das Bohrloch während des Bohrens durch Flüssigkeit in dem Bohrloch einen Flüssigkeitsdruck aufweist, wobei die Vorrichtung umfasst:

ein röhrenförmiges Mittel (130) zur Einfügung in die Bohrlochverrohrung (30), um eine Kammer (110) und einen Strömungskanal (40) zu schaffen.

Gasversorgungsmittel (150), um die Kammer mit unter Druck stehendem Gas zu versorgen,

Fluidströmungsmittel, um die Flüssigkeit, die aus dem Bohrloch verdrängt wird, zu ermöglichen, durch den Strömungskanal (40) zu strömen um sie abzufördern und wobei Mittel zum Abdichten der Kammer (110) gegenüber der Umgebung bereitgestellt sind, um eine statische Dichtung zum Abdichten der Kammer (110) am oberen Ende des Bohrloches vorzusehen, wobei ferner das Aufweisen von Mitteln vorgesehen ist, um den Mantel (30) zu perforieren.

13. Vorrichtung zur Benutzung bei der Aufnahme der Förderung von Kohlenwasserstoffen aus einem Bohrloch nach Anspruch 12, wobei das Mittel zum Abdichten der Kammer am oberen Ende des Bohrloches bereitgestellt ist durch eine Vorrichtung, die einen Körper umfasst, der angepasst ist, um ihn in ein Bohrloch einzufahren, und der mindestens zwei getrennte Fluidkanäle aufweist,
wobei einer der Fluidkanäle an einem Ende mit einer fluiddichten Kupplung versehen ist zur Anfügung an eine

regulierbare Gasversorgung, und
wobei der andere Kanal eine fluiddichte Kupplung zum Absaugen von Fluid in einen Sammler aufweist, wobei der Körper ferner Mittel zum Verbinden eines Rohrleitungsabschnittes an die Bohrlochverrohrung umfasst, um Mittel zum Austauschen von Fluiden innerhalb des Bohrloches bereitzustellen und um den Druck in der Bohrlochverrohrung einzustellen.

14. Vorrichtung nach Anspruch 13, wobei die Verrohrung, die an den Körper anfügbar ist, mit einem durchlöcherten, abgerundeten fernen Ende versehen ist.

Revendications

1. Procédé de lancement de la production d'hydrocarbures à partir d'un puits perdu ou arrêté comportant un arbre avec une enveloppe ou un doublage (30) à l'intérieur ; et un conduit d'écoulement (40) situé à l'intérieur de l'enveloppe ou du doublage (30) ; lequel puits comportant une colonne de liquide pour procurer une marge hydrostatique, lequel procédé étant **caractérisé par** les étapes consistant à :

- insérer un organe tubulaire (130) à l'intérieur de l'enveloppe ou du doublage jusqu'à une profondeur requise dans le liquide pour ménager une chambre (110) ;
- sceller la chambre (110) par rapport à l'environnement extérieur ;
- faire en sorte qu'une substance gazeuse s'écoule dans la chambre (110) pour créer une différence de pression entre la chambre (110) et l'environnement extérieur et occasionner ainsi un déplacement du liquide présent à l'intérieur du puits et un écoulement de celui-ci le long du conduit d'écoulement (40) ;
- recueillir le liquide déplacé à partir du puits ; et
- perforer l'enveloppe (30) pour permettre aux hydrocarbures de s'écouler.

2. Procédé selon la revendication 1, dans lequel ladite substance gazeuse est un gaz inerte.

3. Procédé selon la revendication 2, dans lequel ledit gaz inerte est de l'azote.

4. Procédé selon une quelconque des revendications précédentes, dans lequel ledit fluide déplacé est un fluide aqueux de remplissage ou de terminaison.

5. Procédé selon la revendication 4, dans lequel ledit fluide de remplissage est du chlorure de sodium, du chlorure de calcium ou de l'eau salée.

6. Procédé selon une quelconque des revendications précédentes, dans lequel le scellement de la chambre comprend une cémentation de ladite enveloppe ou doublage en place, en remplissant l'espace annulaire compris entre l'enveloppe ou doublage et le trou de forage.

7. Procédé selon une quelconque des revendications précédentes, dans lequel le scellement de la chambre comprend l'aménagement d'un scellement statique au sommet du puits pour compléter le puits.

8. Utilisation du procédé selon une quelconque des revendications précédentes afin de lancer la production d'hydrocarbures à partir d'un nouveau puits, d'un puits en suspension ou d'un puits de ré-entrée.

9. Utilisation du procédé selon la revendication 8 avec un système de bouchon de fond de puits.

10. Utilisation du procédé selon la revendication 9, dans lequel le puits a été pré-foré.

11. Utilisation du procédé selon la revendication 9, dans lequel le puits utilise des doublages fendus.

12. Appareil susceptible d'être utilisé pour le lancement de la production d'hydrocarbures à partir d'un puits perdu ou arrêté comportant une enveloppe (30), lequel puits ayant une marge hydrostatique de liquide dans celui-ci au cours du forage, l'appareil comprenant :

- un organe tubulaire (130) pour une insertion dans l'enveloppe (30) du puits afin de ménager une chambre (110) et un conduit d'écoulement (40) ;

- des moyens d'alimentation en gaz (150) pour délivrer un gaz sous pression jusqu'à la chambre ;
- des moyens de mise en circulation de fluide pour permettre au liquide déplacé à partir du puits de s'écouler en traversant le conduit d'écoulement (40) et d'être recueilli ;

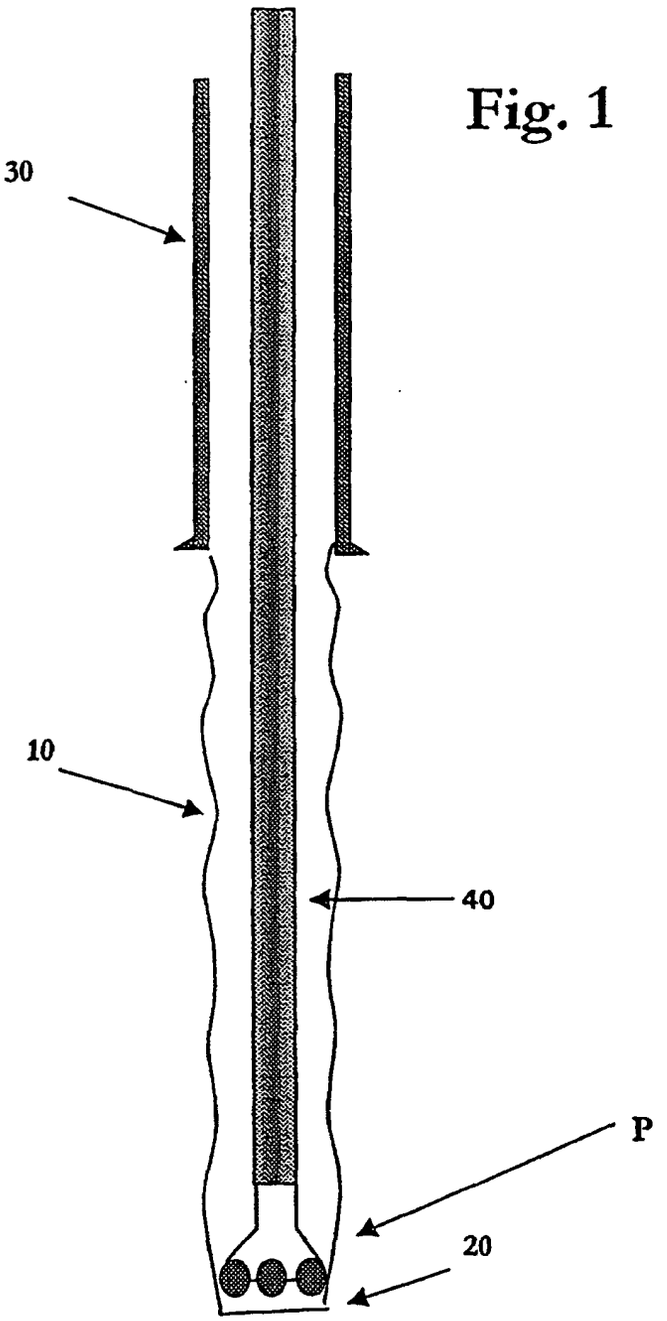
et **caractérisé en ce que** des moyens pour sceller la chambre (110) par rapport à l'environnement sont prévus et comprennent un scellement statique pour sceller la chambre au sommet du puits et, en outre, **caractérisé en ce que** des moyens sont prévus pour perforer l'enveloppe (30).

13. Appareil susceptible d'être utilisé pour le lancement de la production d'hydrocarbures à partir d'un puits selon la revendication 12, dans lequel les moyens pour sceller la chambre au sommet du puits sont constitués par :

- un outil incluant un corps adapté à être inséré, de manière amovible, dans un puits et ayant au moins deux canaux discrets de fluide dans celui-ci ;
- un desdits canaux de fluide étant pourvu à une extrémité d'un couplage étanche aux fluides pour une fixation sur une alimentation en gaz susceptible d'être contrôlée ;
- un des autres canaux comportant un couplage étanche aux fluides pour effectuer une ventilation du fluide vers un collecteur ; dans lequel
- ledit corps comprend, en outre, des moyens pour fixer une longueur de tubulure pour son insertion dans la tubulure du puits et pour ajuster la pression dans la tubulure du puits.

14. Appareil selon la revendication 13, dans lequel ladite tubulure susceptible d'être fixée audit corps est pourvue d'une extrémité distale foraminée en nez de bison.

Fig. 1



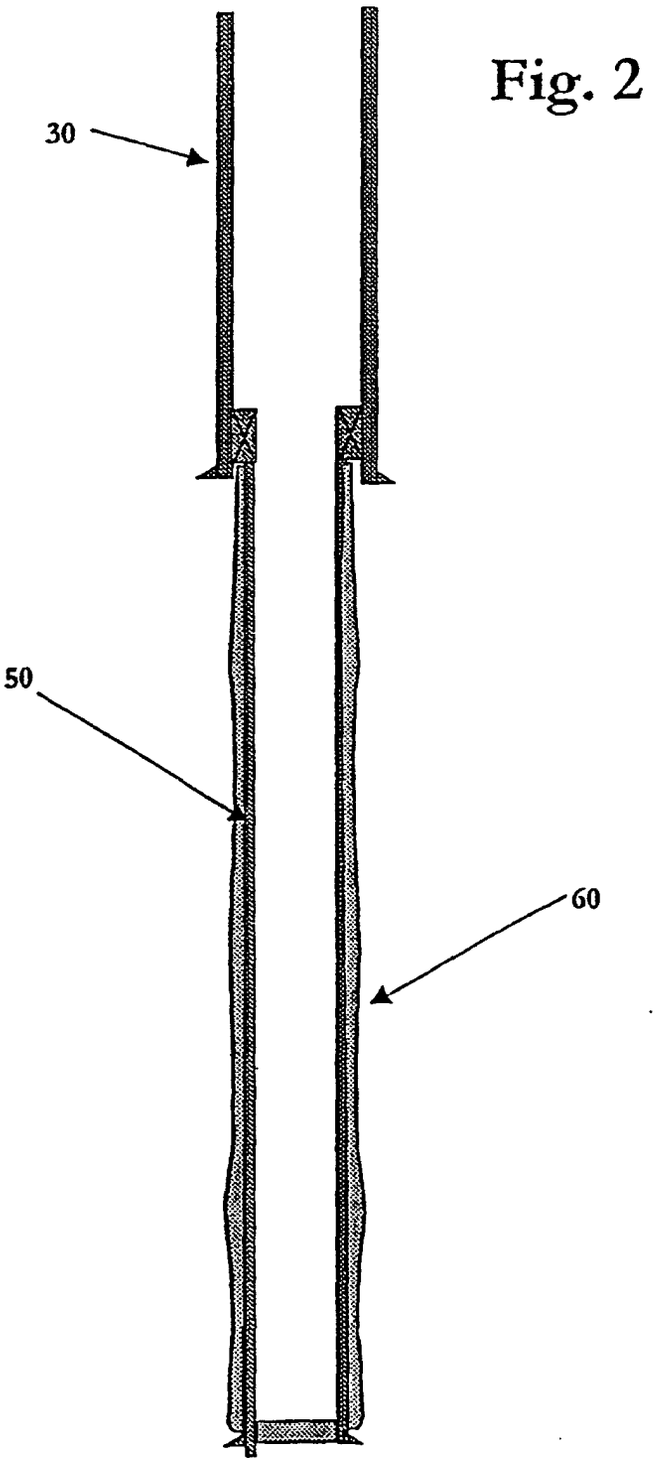


Fig. 2

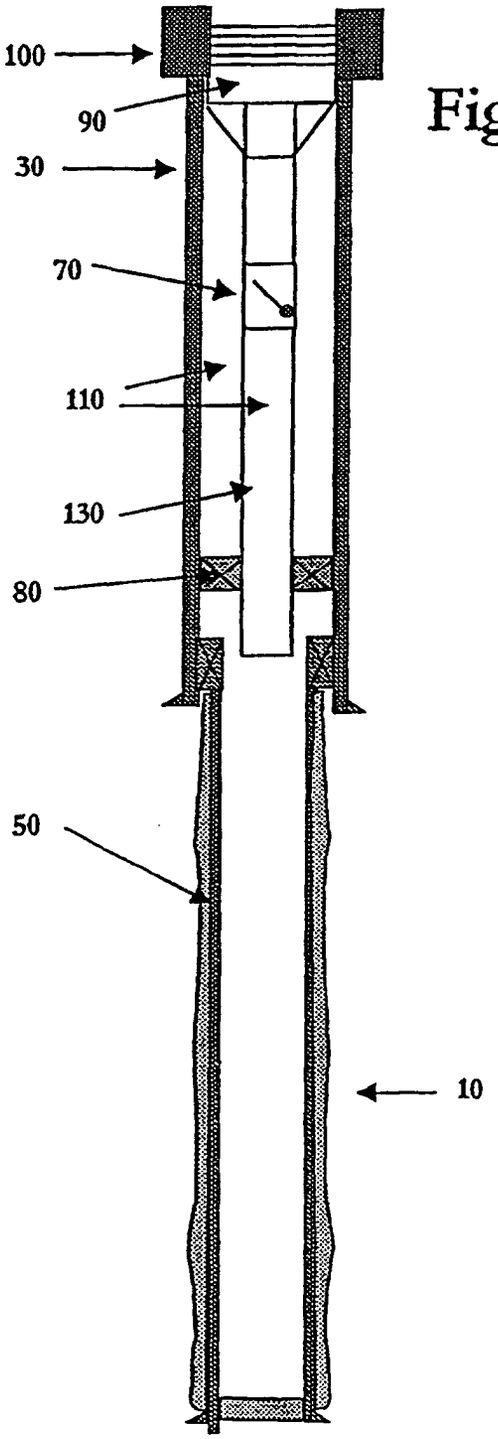


Fig. 3

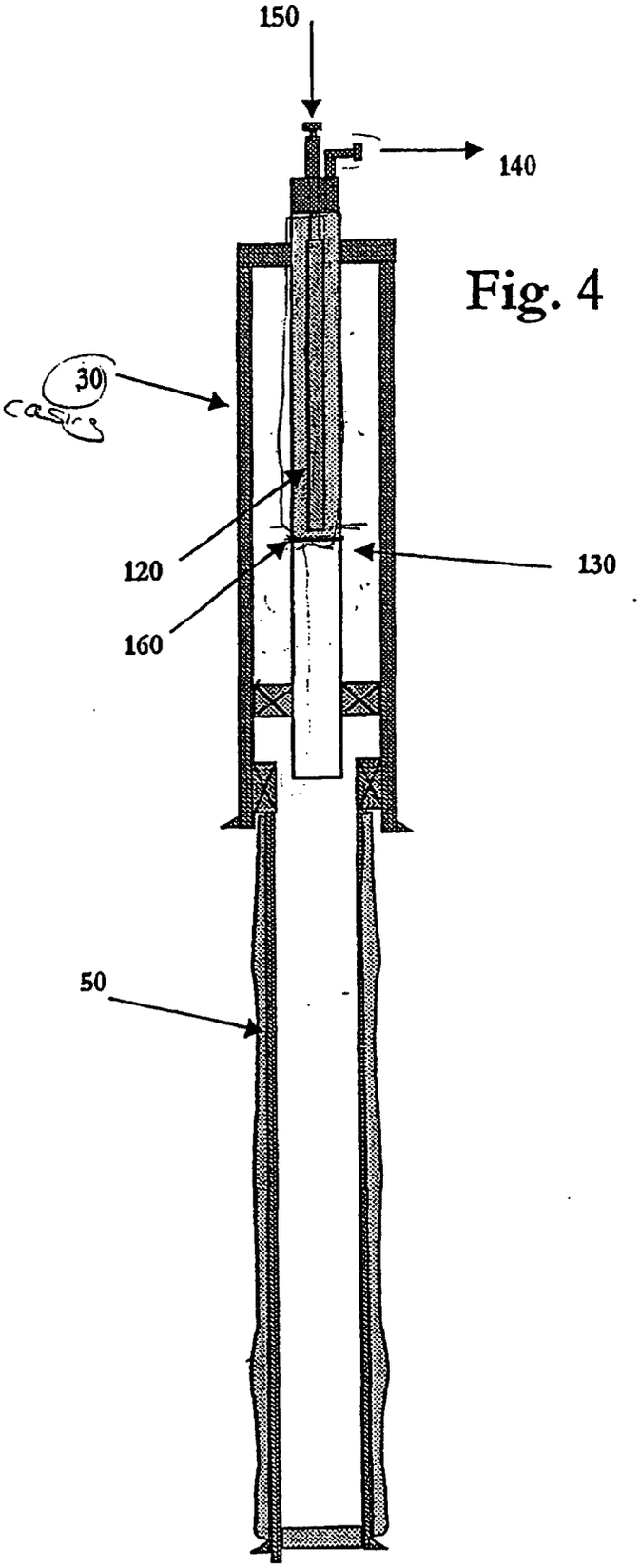
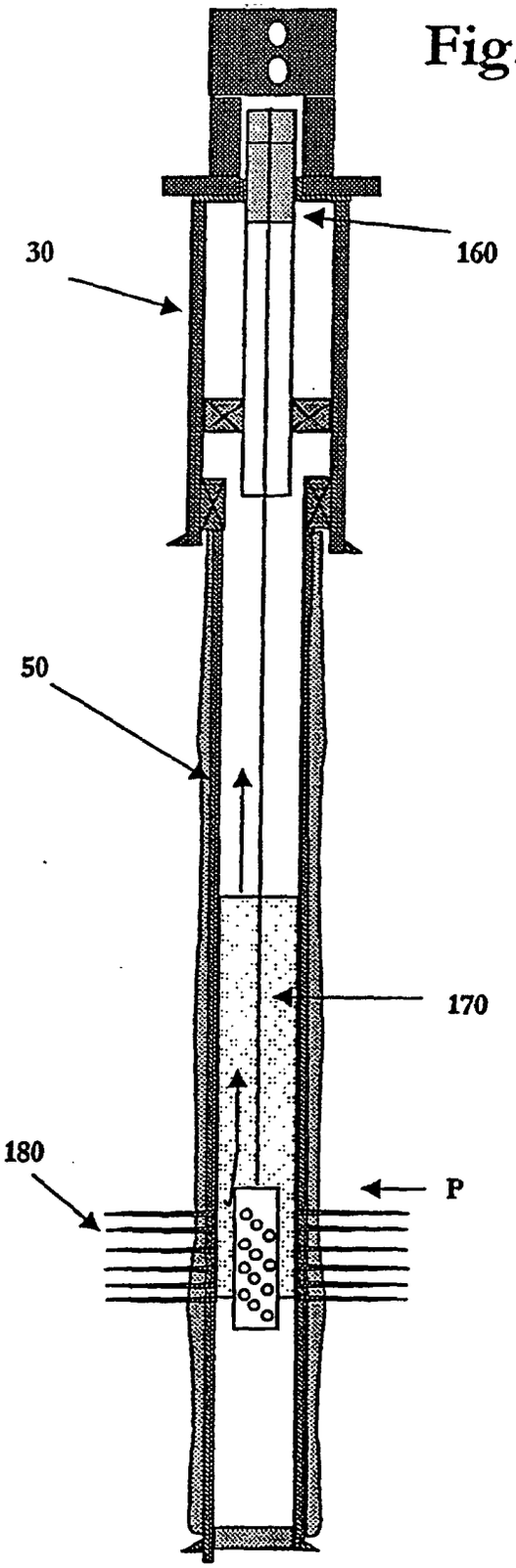


Fig. 4

Fig. 5



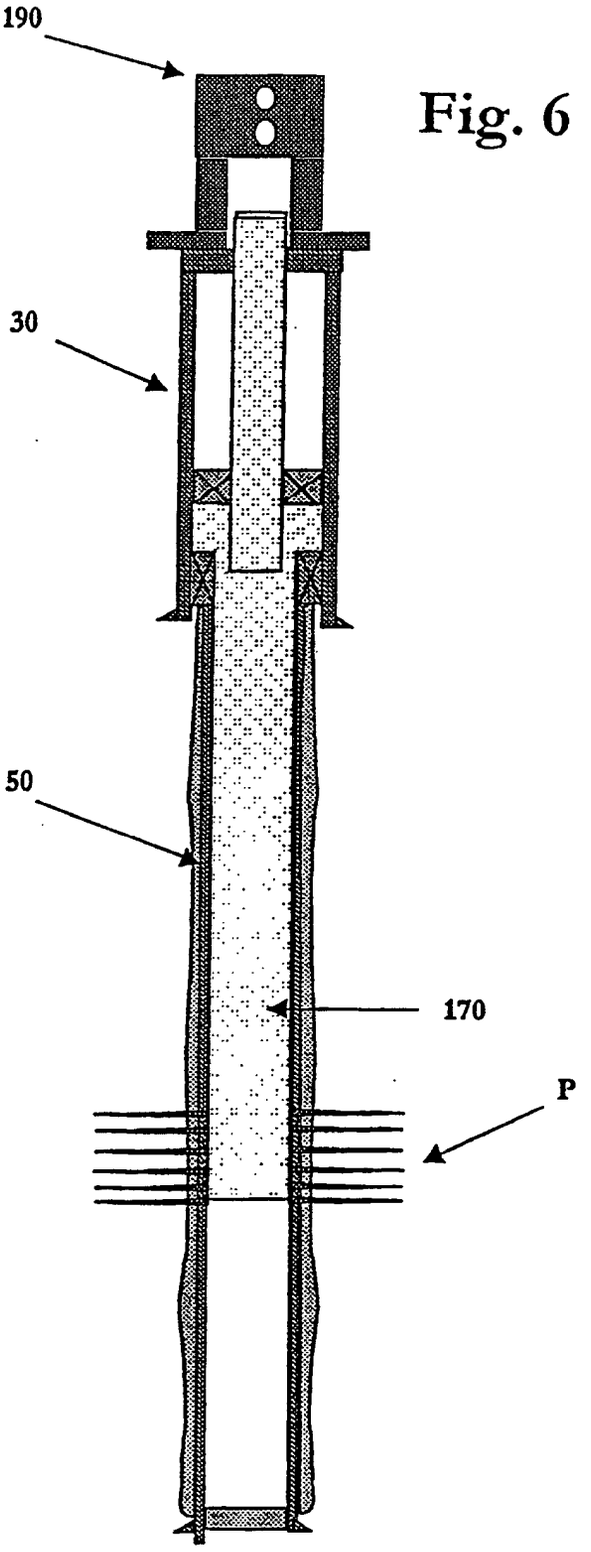


Fig. 6