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METHOD AND APPARATUS FOR CONTROLLABLY  
DRILLING OFF-VERTICAL HOLES

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2 Sheets-Sheet 1

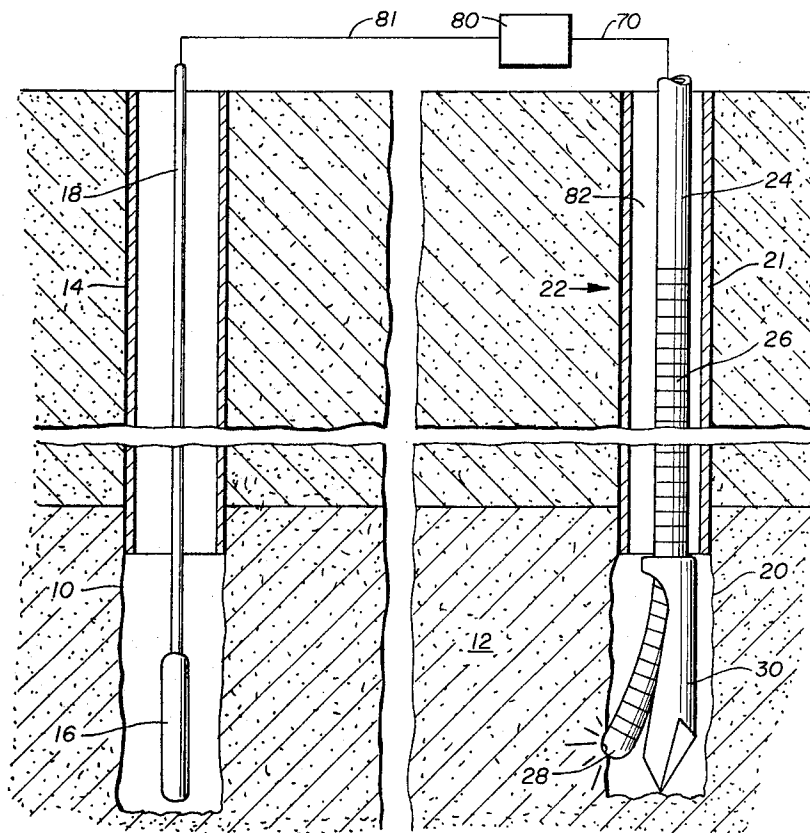


Fig. 1.

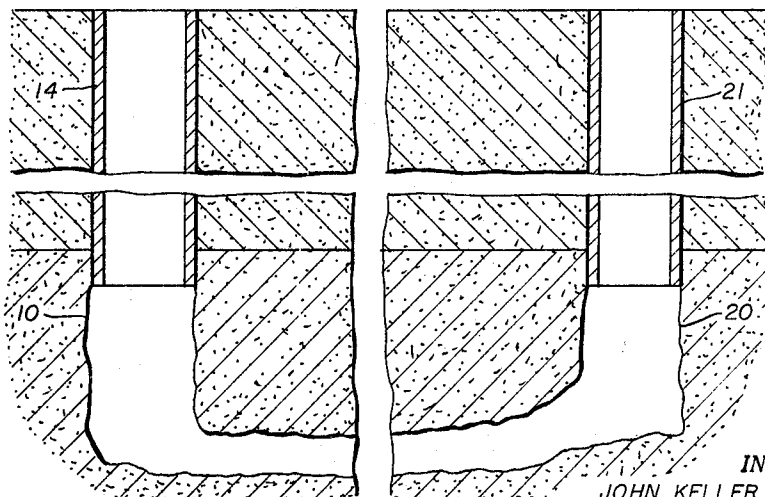


Fig. 2.

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2 Sheets-Sheet 2

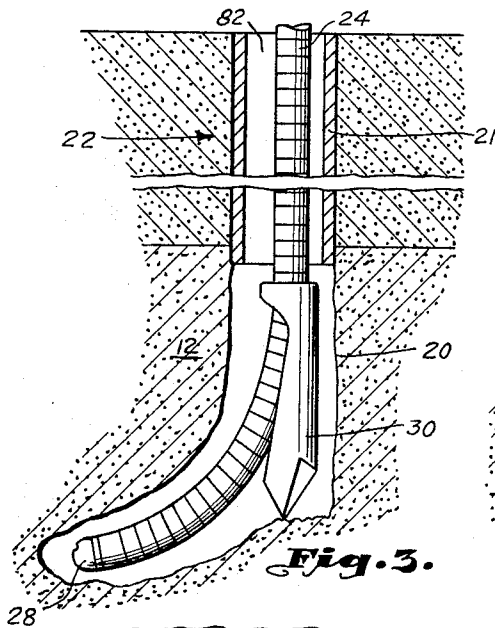


Fig. 3.

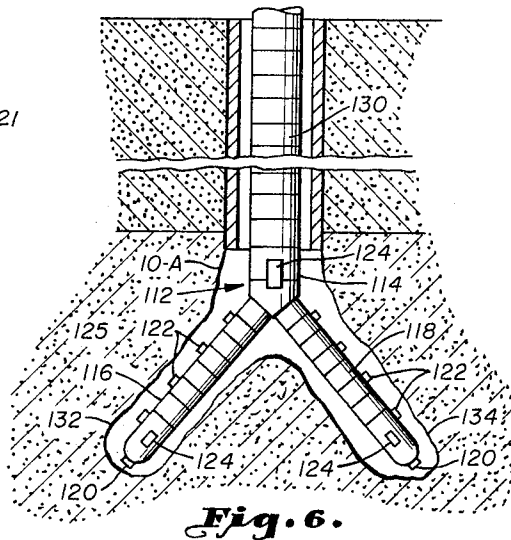


Fig. 6.

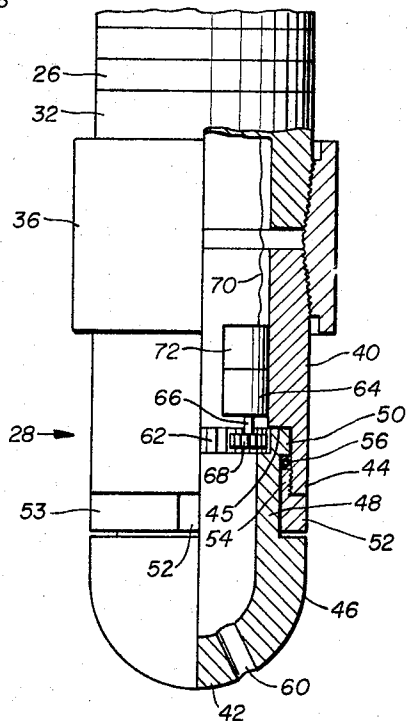


Fig. 4.

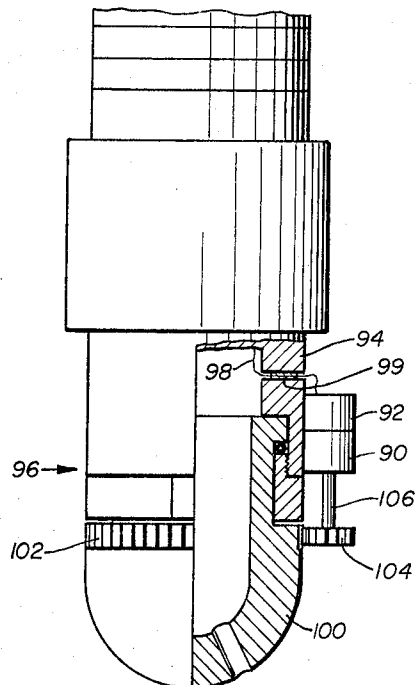


Fig. 5.

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1

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## METHOD AND APPARATUS FOR CONTROLLABLY DRILLING OFF-VERTICAL HOLES

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9 Claims. (Cl. 175-57)

This invention relates to off-vertical drilling through earth formations. More particularly this invention relates to a method and apparatus for controllably drilling off-vertical holes in mineral formations. Specifically this invention relates to a method and apparatus for controllably drilling holes through and substantially parallel to the formation, between separated wells, to assist in removing the minerals contained within the formation.

In producing the various underground minerals such as oil, sulphur or the like the more common method used today is to drill a substantially vertical hole from the surface of the earth downwardly into the formation containing the mineral and then removing the mineral from the formation as by pumping when the mineral is in liquid form or solution mining when it is a soluble solid. In the case of production of oil the oil is either produced through the drilled well by its own pressure, by pumping, by one or more conventional secondary recovering methods or other methods known to the industry. In the case of producing sulphur, salt or similar naturally occurring solid or semi-solid minerals the mineral is commonly leached from the formation by pumping water down a string of well tubing and producing the mineral laden water up the annulus space between the tubing and the well casing.

It has long been recognized that improved mining results can be obtained by increasing the area of the mineral formation exposed to the mining operation. For instance, in producing oil and/or gas through substantially vertical wells, the area open to flow from the formation into the well is the relatively small circumferential area of that portion of the borehole that extends through the production formation. As this area of flow of oil from the formation to the well increases so does the rate of production.

Likewise, in solution mining of soluble solid minerals, such as sulphur or salt, the greater the area of the mineral formation exposed to the leaching action of the solution water the more rapid the mining and the better the results.

Therefore, the use of multiple well completion systems is now prevalent in the mineral mining industries and is especially useful in the solution mining of subterranean minerals. The common application is to drill two or more wells into the mineral containing formation, at spaced intervals. These wells are then connected together through the mineral bearing formation as, for instance, by hydraulically fracturing the mineral formation from one well to the other. The effect of these horizontally extending fractures is to extend the bottom of each well into the mineral formation thereby greatly increasing the area of the formation exposed to the mining operation. Solution water is then injected down one well, forced through the fractures in the mineral formation and produced from the other well with greatly increased productivity.

Therefore, it has long been the goal of the subterranean mineral mining industries to develop a method and/or apparatus for connecting together two or more relatively widely separated wells by means of one or more passages, bores fractures or the like through the mineral bearing formation, thereby to increase the area of the formation subjected to the mining operation. However,

2

until now relatively little success has been gained in this field.

Therefore, it is an object of this invention to provide a method and apparatus for drilling off-vertical holes in a subterranean formation.

Another object of this invention is to provide a method and apparatus for controllably drilling one or more off-vertical extensions from a substantially vertical hole.

Still another object of this invention is to provide a method and apparatus for drilling a substantially horizontal hole through a mineral bearing formation to connect two or more wells to assist in mineral mining operations.

A further object of this invention is to provide a method and apparatus for connecting together two spaced apart wells by means of a subterranean hole of relatively large diameter through which a fluid can be flowed, between the wells, under a relatively low pressure differential.

Still another object of this invention is to provide a method and apparatus for drilling one or more off-vertical extensions from at or near the bottom of a working well through a mineral bearing formation, the extensions being substantially parallel to the formation, into communication with a target well spaced horizontally from the working well.

Still a further object of this invention is to provide a method and apparatus for drilling off-vertical extensions from a substantially vertical borehole to connect the borehole with a distantly spaced target well, the apparatus including means for controlling the direction of drilling whereby the extension can be drilled directly to the target well.

Yet a further object of this invention is to provide a method and apparatus for drilling an off-vertical hole through a subterranean stratum, from a working well to a laterally spaced target well, to connect the working well and the target well, the apparatus including a signal sending device positioned in one of the two wells and a signal receiving device positioned in the other of the two wells, the device that is positioned in the working well being attached to the off-vertical hole drilling device which drilling device is provided with means for controlling the direction of drilling of the off-vertical hole thereby to bring the signal sending and receiving devices together.

Another object of this invention is to provide a method and apparatus for drilling an off-vertical hole as above described wherein the signal received by the receiving device will increase in intensity as the signal receiving and sending devices near each other and including surface means for indicating the signal received by the receiving device so that the drilling operator can control the direction of drilling of the off-vertical hole to bring the signal sending and receiving devices together in the target well.

Further objects and advantages of this invention will be apparent from the following description and appended claims, reference being made to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

FIGURE 1 is a cross-sectional view taken through a working well and a target well that are equipped with the apparatus of this invention.

FIGURE 2 is a cross-sectional view through a working well and a target well that have been connected near their respective bottom ends by an off-vertical hole produced with the apparatus of this invention.

FIGURE 3 is a cross-sectional view through the working well with the drilling portion of the apparatus of this

3

invention positioned therein as it is advancing laterally toward the target well.

FIGURE 4 is a cross-sectional view of the drilling portion of the apparatus of this invention.

FIGURE 5 is a cross-sectional view of an alternate embodiment of the drilling portion of the apparatus of this invention.

FIGURE 6 is a cross-sectional view of a target well equipped with an alternate embodiment of the signal receiving portion of the apparatus of this invention.

#### General description

In general the invention consists of supporting a drilling device in a working well, at the bottom end a drill string including a bottom section of flexible drill pipe; attaching a signal generating device to the drilling device in the working well; positioning a signal receiving device in a target well, spaced from the working well, with means for conducting the signal received by the receiving device to a surface located control panel; associating a means with the drilling device to control direction of drilling thereby to bring the signal generating device and signal receiving device together at or near the bottom of the target well.

#### Specific description

For a more specific description of the method and apparatus of this invention reference is now made to the figures in general and more particularly to FIGURE 1. As is seen in FIGURE 1, a first well, designated hereinafter as target well 10, is drilled substantially vertically through the upper strata of the earth's crust, to a point within the mineral producing formation 12, preferably near the bottom thereof. A string of casing 14 is positioned within target well 10. Casing 14 is preferably "bottomed" within target well 10 such that the bottom few feet of the target well remain open. A signal receiving device 16 of conventional construction and operation is then lowered into the open bottom end of the target well 10 on the bottom end of a conventional wire line 18. Wire line 18 is provided with one or more electrical connectors (not shown) for conducting the signal received by device 16 to the surface of the well.

A second well, hereinafter referred to as the working well 20, is drilled substantially vertically through the upper strata of the earth's formation and is "bottomed" in the mineral formation 12. Working well 20, like target well 10, is preferably provided with a casing string 21 that extends downwardly to within a few feet of the bottom of the well.

It should be understood that the amount of open hole left at the bottom of the target well 10 and working well 20 will depend upon several factors including the vertical thickness of the mineral formation, and the desired location of the off-vertical hole in the mineral formation near the top or bottom thereof.

A drill string 22 consisting of an upper non-flexible section 24, a lower flexible section 26 and a drill head 28, of design to be described hereinafter, are operably positioned in working well 20. Drill string 22 is operably supported within well 20 by a conventional drilling derrick (not shown) located at the surface above well 20.

A conventional whipstock 30 is positioned in the bottom of working well 20 in a predetermined oriented position such that the bottom of the flexible drill string section 26 and its associated drill head 28 are deflected laterally into a predetermined off-vertical direction toward the target well 10. Therefore, when drilling is commenced, in a manner to be described hereinafter, the drill head 28 will tend to advance laterally toward target well 10 in the manner shown in FIGURE 3.

Referring now to FIGURE 4 there is shown the drill head 28 of the apparatus of this invention. Head 28 is connected in depending relation to the metallic collar 32 provided on the bottom end of flexible drill string section 26 by connecting nipple 36. Drill head 28 consists of a

4

tubular body 40 having rotatably attached to the bottom end thereof a drill bit 42. Body 40 is provided on the bottom end thereof with an axially depending skirt portion 44. Skirt 44 has a greater internal diameter than body 40 therefore an internal downwardly presented shoulder 45 is formed by the junction of skirt 44 and body 40.

Drill bit 42 consists of a rounded leading end portion 46 and a reduced external diameter upper tubular extension 48. The upper end of extension 48 is provided with a radially extending annular flange 50 having an external diameter slightly less than the internal diameter of skirt portion 44 thereby to allow tubular extension 48 to be telescopically received within skirt portion 44.

Drill bit 42 is rotatably connected to the bottom end of body 40 by connecting ring 52. Ring 52 is preferably split longitudinally into two symmetrical semicircular halves 52 and 53 so that it can be fitted about extension 48 prior to telescoping extension 48 within skirt 44. Ring 52 is provided with an externally reduced upper end portion 54 that extends upwardly into the annular space between extension 48 and skirt 44. End portion 54 is externally threaded for attachment with the internally threaded bottom end portion of skirt 44, thereby preventing the withdrawal of extension 48 from within skirt 44.

It should be noted that conventional bearings (not shown) can be provided at one or more of the points of contact of drill bit 42 with body 40 and ring 52 to facilitate rotation of bit 42 relative to the body and locking ring.

One or more sealing elements, such as o-ring 56, is positioned within the annular space between the upper end of the locking ring 52 and the bottom surface of the flange 50 to provide a seal between the drill bit 42 and the cylindrical body 40 to prevent leakage of drilling fluid.

One or more forwardly directed fluid jets 60 are provided through the frontal portion of bit 42 through which drilling fluid can be jetted against the mineral formation during the drilling operation. The fluid jet 60 is preferably oriented at an angle to the longitudinal axis of the drilling head 28 for reasons to be more fully described hereinafter.

A motor 64 is located internally of the cylindrical body 40, slightly above the shoulder and is attached to body 40, as by welding. The drive shaft 66 of motor 64 depends downwardly therefrom and is provided on its bottom end with gear 68 the teeth of which mesh with an annular row of gear teeth 62 cut into or otherwise provided within the interior surface of the upper end of extension 48 of bit 42. Motor 64 is operable from the surface of the working well 20 to cause rotation of drill bit 42 relative to the cylindrical body 40.

It is contemplated that motor 64 can be of any of the variety of types commercially available. However, it is important to the operation of this invention that motor 64 be of a type that will not be damaged by jarring or by continuous exposure to the fluids encountered in mineral mining operations. Furthermore, it is contemplated that motor 64 can be an electrically operated motor with its power source (not shown) either located adjacent to it within the drill head, as for instance, one or more storage batteries, or its power source located at the surface of the earth and connected thereto by means of an electrical conductor 70. Alternatively, motor 64 can be of the type that is operable by the passage of fluid, preferably drilling fluid, therethrough.

A signal generating device 72 is also positioned internally of the cylindrical housing 40, preferably adjacent and attached to motor 64. Signal generating device 72 can also be any one of the variety of devices commercially available provided the device 72 that is used be capable of producing a signal strong enough to penetrate the mineral bearing formation a distance at least equal to the spacing of the working and target wells 20 and 10, respectively. Signal generating device 72 is preferably

5

electrically operated with the electrical power delivered thereto through conductor 70.

A central control instrument panel 80 is located at the surface, preferably adjacent the controls of the drilling derrick (not shown) positioned over working well 20. A surface located conductor 81 carries the signal from signal receiving device 16 to panel 80. Also, conductor 70 extends upwardly from motor 64 and signal generating device 72 into connection with panel 80. Panel 80 is provided with at least one instrument for visually displaying variations in the intensity of signal received by device 16.

#### Operation

In the operation of this invention the target well 10 and working well 20 are drilled into the producing formation 12 and are cased as above described. The signal receiving device 16 is then suspended in the target well 10 and the electrical conductor 81 is connected to control panel 80. Drill string 22, with whipstock 30 attached thereto, is then positioned in the working well 20 in the manner shown in FIGURE 1.

Whipstock 30 is oriented so as to deflect drilling head 28 laterally in the general direction of target well 10.

Water, preferably fresh water from a source (not shown), is then pumped down the drill string 22 and jetted out water jet 60 in the drill bit 42 against the side of borehole 20, near the bottom end thereof. The water contacts the mineral producing formation 12, leaching therefrom the mineral to be produced. The mineral laden water then flows through the annular space 82 between the drill string 22 and the well casing 21 to the surface of the well. The mineral laden water is then conducted from well 20 through appropriate piping or the like (not shown) to a plant of conventional design where the mineral is removed from the water and the water then recirculated through working well 20. Alternatively, the water, can be simply disposed of in a manner known to the art.

The signal generating device 72 is operated either continuously or at predetermined intervals. The signal produced by this device traverses the mineral formation 12 to the target well 10 where it is received by the signal receiving device 16. The signal is then carried up the electrical conductor in wire line 18, through the surface conductor 81 to the control panel 80.

Directional drilling of off-vertical holes according to the method of this invention is achieved primarily by triangulation (as will be described hereinafter) or through the use of a signal receiving device 16 that is sensitive to the direction of the origin of the signal. When using such a direction sensitive signal receiving device 16, the direction of the origin of the signal (signal generating device 72) will be indicated on an indicator device (not shown) on panel 80, thereby enabling the driller to change the direction of drilling to insure communication of the hole with the target well 10.

Alternately, the signal receiving device 16 can be of a type that measures variations in the signal, such as variations in the intensity of the signal received. Therefore, as the signal source (generating device 72) approaches the receiving device 16 the intensity of the signal received increases, as indicated on appropriate instruments on panel 80.

If it is observed by the driller that the drilling head 28 is moving away from target well 10, the motor 64 will be operated from the control panel 80 to cause rotation of the drive shaft 66 and gear 68 thereby rotating the drill bit 42 to change the direction of jet 60 in bit 42. Preferably, the drill bit 42 is rotated relative to body 40 a relatively small incremental amount, for instance, 30 degrees. Drilling is continued and observations of the panel made to determine if the adjustment made was sufficient to cause the drilling head 28 to move toward target well 10. This operation is continued until a position is attained by the drill bit 42 such that continued drilling ad-

6

vances the drill head 28 laterally toward the target well 10.

In this regard it should be noted that the drilling will progress in the same direction as the orientation of jet 60, since it is the jetting action of drilling fluid through jet 60 that produces the hole.

As the drilling head 28 nears target well 10 slight variations in the direction of drilling will become more evident since the amount of mineral producing formation 12 between the drilling head 28 and the signal receiving device 16 is reduced to a minimum and interference to the movement of the signal is likewise reduced to a minimum. Therefore fine adjustments can be made in the direction of drilling at this time to assure penetration of the drilling head 28 into the bottom end of target well 10.

Referring now to FIGURE 5 is shown an alternate embodiment of the drilling head of the apparatus of this invention in which the motor 90 and signal generating device 92 are positioned externally of the cylindrical body portion 94 of the drilling head 96. The electrical cable 98 carrying power to the motor and signal generating device 90 and 92, respectively, extends upwardly, either interiorly as shown in FIGURE 5 or externally of the drill string into connection with the control panel 80 on the surface.

When the cable 98 is located interiorly of the drill string it is necessary that it pass outwardly through a passage 99 in the body 94 for connection to motor 90 and signal generating device 92. It is preferred that passage 99 be sealed to prevent leakage of drilling fluid therethrough.

Drill bit 100 is provided on its upper end portion with exteriorly exposed annular gear teeth 102 for engagement with the gear 104 attached to the bottom end of motor drive shaft 106. Drill bit 100 is rotatably attached to the bottom end of the cylindrical body 94 in the manner above described with reference to FIGURE 4.

The operation of the alternate embodiment shown in FIGURE 5 is substantially the same as that shown in FIGURE 4 and will not be further described herein.

Referring now to FIGURE 6, there is shown an alternate embodiment of the signal receiving device of this invention. Signal receiving device 112 consists of an upper preferably rigid section 114 having depending therefrom two equal length flexible legs 116 and 118. Legs 116 and 118 are normally biased outwardly away from each other so that device 112 will normally assume the inverted Y shape shown in FIGURE 6. Rigid section 114 and legs 116 and 118 are hollow so that drilling fluid will flow therethrough.

At least one downwardly opening jet 120 is provided on the bottom-most end of each of the legs 116 and 118 through which drilling fluid can be jetted. Additional jets 112 may be provided over the length of each leg 116 and 118, preferably opening in the direction towards which legs 116 and 118, respectively, are biased.

Three separate signal receiving devices 124 are included in tool 112, one being attached to rigid portion 114 of tool 112 and the other two being attached one each to the bottom ends of legs 116 and 118, respectively. Signal receiving devices 124 are of a conventional design capable of receiving the signal produced by signal generating device 72 and 92. The signals received by these separate receiving devices 124 are separately conducted up the target well 10-A by a multi-conductor cable (not shown) to the control panel (also not shown), as above where they are displayed on separate meters or similar recording instruments.

In operation, tool 112 is attached to the bottom end of a tubing string 130, legs 116 and 118 are collapsed together and tool 112 is lowered into the cased target well 10-A. Legs 116 and 118 are maintained in their collapsed position by contact with the cased well 10-A or are releasably locked together in a manner well known to the art. When the tool 112 reaches the bottom of the well 10-A, fluid such as fresh water is pumped down the tub-

ing string 130, through legs 116 and 118 and is jetted out fluid jets 120 and 122. When tool 112 is to be used in solution mining, the streams of fresh water issuing from jets 120 and 122 against the face of the borehole 10-A will leach away the mineral content of formation 125 thereby forming two diverging holes 132 and 134. As holes 132 and 134 progress downwardly and outwardly, tool 112 is lowered and legs 116 and 118 extend into holes 132 and 134, respectively. Since legs 116 and 118 are biased outwardly holes 132 and 134 tend to diverge outwardly as shown. When holes 132 and 134 are long enough that legs 116 and 118, respectively, can extend their entire length therein the operation is stopped.

Clearly, when the plane of tool 112 is substantially perpendicular to the direction of drilling of the lateral extension the signal receiving devices 124 are located at three relatively widely separated points with respect to the drilling head 28. Therefore, by applying known theories of triangulation direction finding to the signals received and recorded by separate devices 124, a more precise location of drilling head 28 can be determined and a more precise underground connection of target well 10-A and working well 20 is possible.

The method and apparatus of this invention is especially useful in the solution mining of subterranean minerals and has been described with reference thereto. However, it is contemplated that this invention can be used with equal utility in the production of petroleum from subterranean deposits. When utilizing the method and apparatus of this invention in the mining of petroleum, the drilling of the lateral off-vertical hole or holes is accomplished by the erosion of the formation resulting from the jetting of drilling fluid, with or without abrasives entrained therein, against the formation face at the bottom of the hole. Furthermore, the location of the off-vertical hole with respect to the upper and lower boundaries of the producing formation will be primarily determined by consideration of possible water encroachment problems at the bottom of the formation, and possible gas cap problems at the top of the formation.

At any rate, it is contemplated that off-vertical holes can be drilled with the apparatus of this invention at any level within a desired formation according to the preference of the operator and necessities of the field conditions.

It should be noted that the signal producing device 72 may be alternatively located within the target well 10 and the signal receiving device may be located within the working well 20 and attached to drilling head 28. With this alternative arrangement it will be necessary to use a signal receiving device that will not be affected by the vibrations set up in the drill string 22. Also, it is contemplated that the vibrations produced by the jetting of water or drilling fluid through jet 60 in drill bit 42 can function as the signal that guides drill head 28 to target well 10. In such case the separate signal generating device can be omitted.

It must be understood that a plurality of laterally extending off-vertical holes can be drilled from a single well at a variety of elevations within that well by simply resetting the whipstock 30 at the desired elevation and orienting the whipstock such that it will deflect the drilling head 28 in the desired direction for each hole.

The invention has been described by reference to specific and preferred embodiments. It will be apparent, however, that many modifications can be made without departing from the spirit and scope of the invention. Accordingly, this invention should be construed not to be limited to the embodiment herein described but should be limited only by the scope of the appended claims.

What is claimed:

1. A method of drilling a laterally extending hole from a first well into communication with a second well spaced from said first well, said method comprising the steps of:

drilling laterally from said first well with a drilling device;

emitting a signal from adjacent said drilling device during the drilling of said laterally extending hole;

receiving said emitted signal at a point in said second well where communication between said first well and said second well is desired;

indicating said received emitted signal at the surface; changing the direction of drilling with said drilling device until said drilling device is advancing toward said second well as indicated by the signal received in said second well; and

continuing drilling of said hole until said hole enters said second well.

2. A method of drilling a hole in at least one non-vertical subterranean formation, substantially parallel to said formation, said method comprising the steps of:

drilling a first substantially vertical well into said formation;

drilling a second substantially vertical well into said formation;

drilling an off-vertical hole laterally from said first well into said formation;

emitting a signal from a point near the leading extremity of said lateral hole during drilling of said hole;

receiving said emitted signal at a point in said second well adjacent said formation;

indicating said received emitted signal at the surface;

changing the direction of drilling of said lateral hole until said hole is being drilled toward said second well as indicated by the signal received in said second well; and

continuing drilling of said lateral hole until said hole enters said second well.

3. An apparatus for controllably drilling a hole from a first subterranean point to a second subterranean point, each of the subterranean points having communication with the earth's surface through a substantially vertical bore hole, said apparatus comprising:

a directionally controllable hole drilling device positioned initially at said first point;

means for advancing said drilling device to drill a substantially horizontal hole;

a signal generating means positioned at one of said first and said second points;

a signal receiving means positioned at the other of said first and said second points with the one of said signal generating and said signal receiving means that is positioned at said first point being attached to said drilling device for advancement with said drilling device as a horizontal hole is drilled;

indicator means for indicating variations in the signal received by said receiving means from said signal generating means; and

means for changing the direction of drilling of said drilling device to bring said signal generating device and said signal receiving device together.

4. An apparatus for controllably drilling a laterally extending hole from a first well into connection with a second well, said apparatus comprising:

a drilling device located in said first well;

a signal generating means located in one of said first and said second wells;

a signal receiving means located in the other of said first and said second wells, with the one of said signal generating means and said signal receiving means that is located in said first well being attached to said drilling device; and

means associated with said drilling device for changing the direction of drilling of said hole drilling device to bring said signal generating means and said signal receiving means together,

5. An apparatus for controllably drilling a laterally

extending hole from a first well into communication with a second well, said apparatus comprising:

- a string of tubular drill pipe suspended in said first well, the bottom portion of said drill pipe being flexible, said flexible drill pipe portion being at least as long as the distance between said first well and said second well;
- a drilling device suspended from the bottom end of said drill pipe, said drilling device having a tubular body portion and a drill bit portion rotatably attached to the bottom end of said body portion;
- a signal generating means located in one of said first and said second wells;
- a signal receiving means located in the other of said first and said second wells, with the one of said signal generating means and said signal receiving means that is located in said first well being attached to said drilling device;
- indicator means located at the surface of the earth and electrically connected to said signal receiving means to indicate variations of the signal received by said signal receiving means from said signal generating means; and
- means associated with said drilling device for changing the direction of drilling of said hole drilling device to bring said signal generating means and said signal receiving means together.

6. An apparatus for controllably drilling a laterally extending hole through a subterranean formation from a first well into communication with a second well spaced from said first well, said apparatus comprising:

- a string of tubular drill pipe operably suspended in said first well, the bottom end portion of said drill pipe being flexible, said flexible drill pipe portion being at least as long as the spacing between said first well and said second well;
- a drilling device suspended from the bottom end of said drill pipe, said drilling device having a tubular body portion and a drill bit portion rotatably attached to the bottom end of said body portion, with at least one fluid jet extending through the leading portion of said drill bit portion directed forwardly of said drill bit portion at an angle to the longitudinal axis of said body portion;
- a signal generating means attached to said drilling device;
- a signal receiving means located in said second well at the point where communication between said first and said second wells is desired, said signal receiving means being of the type that will receive the signal produced by said signal generating means;
- indicator means located at the surface of the earth and electrically connected to said signal receiving means to indicate variations in intensity of the signal received by said signal receiving means; and
- means for selectively changing the direction of drilling of said hole drilling device until said drilling device is advancing toward said second well as indicated on said indicator means by progressively increased signal strength received by said signal receiving means.

7. An apparatus for controllably drilling a laterally extending hole according to claim 6, wherein said means for selectively changing the direction of drilling of said drilling device consists of:

a motor attached to said tubular body portion of said drilling device with one end of the drive shaft of said motor depending downwardly from said motor; a gear attached to said motor drive shaft near the bottom end thereof; and

an annular row of gear teeth provided on said drill bit portion for engagement with the teeth of said gear on said drive shaft whereby operation of said motor causes rotation of said drill bit portion relative to said tubular body portion.

8. A method of drilling a hole from a first subterranean point to a second subterranean point spaced from said first point, said method comprising the steps of:

drilling a substantially vertical hole to said first point; positioning a drilling device at the earth's surface above said second point and drilling a substantially vertical hole to said second point, said drilling device having means to change the direction of drilling;

positioning a signal generating means at one of said first and said second points;

positioning a signal receiving means at the other of said first and said second points with the one of said signal generating means and said signal receiving means that is positioned at said second point being attached to said drilling device for advancement with said drilling device;

drilling with said drilling device in substantially a horizontal direction towards said first point; and

correcting the direction of drilling as indicated by the character of the signal received by said signal receiving means from said signal generating means to continually drill towards said first point until said drilling device reaches said first point.

9. A method of drilling a laterally extending hole from a first well into communication with a second well, said method comprising the steps of:

suspending a directionally controllable drilling device at the bottom end of a drill string located in said first well, at least the bottom portion of said drill string being flexible, said drilling device having one of a signal generating means and a signal receiving means affixed thereto;

positioning the other of a signal generating means and signal receiving means in said second well;

connecting a surface located signal indicator means to said signal receiving means;

incorporating means with said drilling device to change the direction of drilling of said drilling device; and directionally advancing said drilling device towards said second well in response to the signal displayed on said signal indicator means.

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