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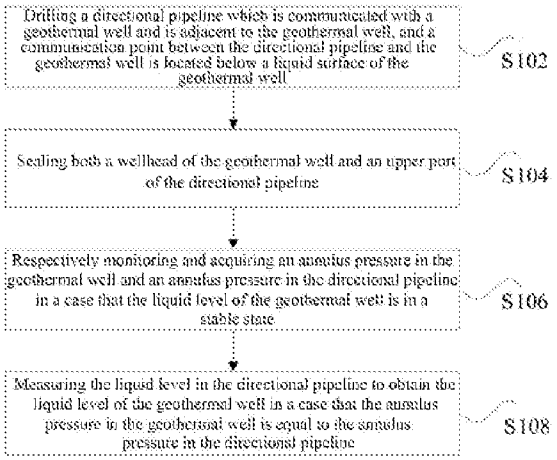
(54) METHOD AND STRUCTURE FOR MEASURING LIQUID LEVEL OF GEOTHERMAL WELL

(57) The present disclosure provides a method and a structure for measuring a liquid level of a geothermal well. The method includes: drilling a directional pipeline communicated with a geothermal well and is adjacent to the geothermal well, where a communication point between the directional pipeline and the geothermal well is located below a liquid surface of the geothermal well; sealing both a wellhead of the geothermal well and an upper port of the directional pipeline; respectively monitoring and acquiring an annulus pressure in the geothermal well and an annulus pressure in the directional pipeline in a case that the liquid level of the geothermal well is in a stable state; and measuring the liquid level in the directional pipeline to obtain the liquid level of the geothermal well in a case that the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline.



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METHOD AND STRUCTURE FOR MEASURING LIQUID LEVEL OF GEOTHERMAL WELL

TECHNICAL FIELD

[0001] The present disclosure relates to the field of geothermal measurement, and in particular, to a method for measuring a liquid level of a geothermal well and a structure for measuring a liquid level of a geothermal well.

BACKGROUND

[0002] When a geothermal well is operating in a heating season, in order to prevent air or other harmful gases from entering underground to pollute geothermal water, both a wellhead and a surface pipeline are generally in a closed connection state. In a running process of the geothermal well, an underground water level needs to be monitored frequently. In this mode, a conventional measuring line cannot be lowered to the underground and cannot acquire true data of an underground liquid level.

[0003] In order to solve the problems, two manners are mainly used for measuring the underground liquid level in solutions in the conventional art: 1) a sonic liquid-level meter is mounted at a wellhead position, sound waves are reflected at the underground liquid level through propagation of sound, and the underground liquid level is calculated by receiving reflected sound waves; this method is usually disturbed by other objects underground, and the reflected sound waves are often not reflected from the

liquid surface, resulting in distortion of the data acquired at the liquid level; 2) a small hole is formed at the wellhead position and a measuring line is lowered to measure the underground liquid level; at this moment, underground air will enter the underground to cause oxidation reactions with an underground liquid or equipment, resulting in equipment corrosion and water pollution; and in addition, there is usually a phenomenon of obstruction during the process of lowering the measuring line due to the existence of a water pumping tubular column.

SUMMARY

[0004] A main objective of the present disclosure is to provide a method for measuring a liquid level of a geothermal well and a structure for measuring a liquid level of a geothermal well to at least solve the problems of distortion of liquid level data acquired in a geothermal well liquid level measurement process in the conventional art and equipment corrosion and water pollution caused by air entering underground.

[0005] To achieve the above objective, according to a first aspect of the present disclosure, a method for measuring a liquid level of a geothermal well is provided, which includes: drilling a directional pipeline which is communicated with a geothermal well and is adjacent to the geothermal well, where a communication point between the directional pipeline and the geothermal well is located below a liquid surface of the geothermal well; sealing both a wellhead of the geothermal well and an upper port of the directional pipeline; respectively monitoring and acquiring an annulus pressure in the geothermal well and an annulus pressure in the directional pipeline in a case that the liquid level of the geothermal well is in a stable state; and measuring the liquid level in the directional pipeline to obtain the liquid level of the

geothermal well in a case that the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline.

[0006] Further, in a case that the annulus pressure in the geothermal well is not equal to the annulus pressure in the directional pipeline, the method for measuring a liquid level of a geothermal well further includes: regulating the annulus pressure in the directional pipeline through a pressure regulating device arranged in the directional pipeline; and repeatedly monitoring and acquiring the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline until the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline.

[0007] Further, in a case of monitoring and acquiring the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline the method for measuring a liquid level of a geothermal well further includes: respectively setting pressure gauges in the geothermal well and the directional pipeline; and respectively monitoring and acquiring the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline through the pressure gauges.

[0008] According to a second aspect of the present disclosure, a method for measuring a liquid level of a geothermal well is provided, which includes: drilling a directional pipeline which is communicated with a geothermal well and is adjacent to the geothermal well, a communication point between the directional pipeline and the geothermal well being located below a liquid surface of the geothermal well; sealing both a wellhead of the geothermal well and an upper port of the directional pipeline; communicating a part above the liquid surface of the geothermal well and a part above the liquid surface of the directional pipeline through a communicating pipeline formed between the geothermal well and the directional pipeline; and measuring a liquid level in the directional

pipeline to obtain the liquid level of the geothermal well.

[0009] According to a third aspect of the present disclosure, a structure for measuring a liquid level of a geothermal well is provided, which includes: a geothermal well; a directional pipeline, formed adjacent to the geothermal well, a lower end of the directional pipeline being communicated with a part below a liquid surface of the geothermal well; and a measurement part, arranged in the directional pipeline, the measurement part being used for measuring a liquid level in the directional pipeline to obtain the liquid level of the geothermal well.

[0010] Further, both a wellhead of the geothermal well and an upper port of the directional pipeline are sealed.

[0011] Further, the structure for measuring a liquid level of a geothermal well further includes: a first pressure gauge arranged in the geothermal well, the first pressure gauge being used for monitoring and acquiring an annulus pressure in the geothermal well; and a second pressure gauge arranged in the directional pipeline, the second pressure gauge being used for monitoring and acquiring the annulus pressure in the directional pipeline.

[0012] Further, the structure for measuring a liquid level of a geothermal well further includes: a pressure regulating device communicated with the directional pipeline and connected to each of the first pressure gauge and the second pressure gauge, the pressure regulating device being used for regulating the annulus pressure in the directional pipeline, so that the annulus pressure in the directional pipeline is equal to the annulus pressure in the geothermal well.

[0013] Further, the structure for measuring a liquid level of a geothermal well further includes: a communicating pipeline, formed between the geothermal well and the directional pipeline to communicate a part above the liquid surface of the geothermal well and a part above the liquid surface of the directional pipeline.

[0014] Further, the measurement part is a measuring rope.

[0015] The method for measuring a liquid level of a geothermal well in the technical solution of the present disclosure includes: drilling the directional pipeline which is communicated with the geothermal well and is adjacent to the geothermal well, where the communication point between the directional pipeline and the geothermal well is located below the liquid surface of the geothermal well; sealing both the wellhead of the geothermal well and the upper port of the directional pipeline; respectively monitoring and acquiring the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline in a case that the liquid level of the geothermal well is in a stable state; and measuring the liquid level in the directional pipeline to obtain the liquid level of the geothermal well in a case that the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline. Therefore, in a process of measuring the liquid level of the geothermal well, the directional pipeline will not affect a normal operation of measurement equipment, and the accuracy of the measured data is ensured. Meanwhile, ground air is prevented from entering the geothermal well, and equipment corrosion and water pollution are avoided. The problems of distortion of liquid level data acquired in a geothermal well liquid level measurement process in the conventional art and equipment corrosion and water pollution caused by air entering underground are solved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The specification accompanying drawings, which constitute a part of the present application, are used to provide a further understanding of the present disclosure, and exemplary embodiments of the present disclosure and the description thereof are used to explain the present disclosure, but do not constitute improper limitations to

the present disclosure. In the accompanying drawings:

[0017] FIG. 1 is a flow block diagram of an optional first method for measuring a liquid level of a geothermal well according to an embodiment of the present disclosure;

[0018] FIG. 2 is a flow block diagram of an optional second method for measuring a liquid level of a geothermal well according to an embodiment of the present disclosure;

[0019] FIG. 3 is a flow block diagram of an optional third method for measuring a liquid level of a geothermal well according to an embodiment of the present disclosure;

[0020] FIG. 4 is a schematic diagram of an optional first structure for measuring a liquid level of a geothermal well according to an embodiment of the present disclosure; and

[0021] FIG. 5 is a schematic diagram of an optional second structure for measuring a liquid level of a geothermal well according to an embodiment of the present disclosure.

[0022] The above accompanying drawings include the following reference signs:

[0023] 10, geothermal well; 20, directional pipeline; 30, measurement part; 40, first pressure gauge; 50, second pressure gauge; 60, pressure regulating device;70, communicating pipe; 80, water pumping pipeline; and 90, submersible pump.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0024] It is to be noted that embodiments in the present application and features in the embodiments may be combined without a conflict. The present disclosure is described in detail below with reference to the accompanying drawings and in combination with the embodiments.

[0025] A first embodiment of the present disclosure discloses a method for measuring a liquid level of a geothermal well, as shown in FIG. 1, which specifically includes the following steps:

[0026] S102: a directional pipeline which is communicated with a geothermal well and is adjacent to the geothermal well is drilled, and a communication point between the directional pipeline and the geothermal well is located below a liquid surface of the geothermal well;

[0027] S104: both a wellhead of the geothermal well and an upper port of the directional pipeline are sealed;

[0028] S106: an annulus pressure in the geothermal well and an annulus pressure in the directional pipeline are respectively monitored and acquired in a case that the liquid level of the geothermal well is in a stable state; and

[0029] S108: the liquid level in the directional pipeline is measured to obtain the liquid level of the geothermal well in a case that the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline.

[0030] In a process of measuring the liquid level of the geothermal well, the geothermal well is communicated with a lower end of the directional pipeline to form a communicating vessel; there is no pipeline or other obstacles in the directional pipeline, which will not affect a normal operation of measurement equipment, thereby ensuring the accuracy of the measured data; and in addition, air can be prevented from entering the geothermal well by measuring the liquid level through the directional pipeline, and equipment corrosion and water pollution are avoided. The problems of distortion of liquid level data acquired in a geothermal well liquid level measurement process in the conventional art and equipment corrosion and water pollution caused by air entering underground are solved.

[0031] In a specific implementing process, in step S102, when the directional pipeline is drilled, an upper segment of the directional pipeline is a vertical pipeline, a lower segment of the directional pipeline is an arc-shaped pipeline, and the vertical pipeline is communicated with a

position below the liquid surface of the geothermal well through the arc-shaped pipeline. The vertical pipeline of the upper segment is parallel to the geothermal well 10, so as to ensure that a measuring rope can smoothly detect the position of the liquid surface downward when the measuring rope is used for measuring the liquid level. The directional pipeline is generally a small wellbore with a small diameter that meets the requirements for measuring a water level.

[0032] In step S104, ground air can be effectively prevented from entering the geothermal well by sealing both the wellhead of the geothermal well and the upper port of the directional pipeline, so as to avoid oxidation reactions with underground liquids or equipment to cause equipment corrosion and water pollution.

[0033] In step S106, in a case of monitoring and acquiring the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline, a pressure gauge is arranged in each of the geothermal well and the directional pipeline; and the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline are respectively monitored and acquired through the pressure gauges.

[0034] In a process of pumping hot water from the geothermal well, a liquid level and a pressure inside the geothermal well will change. When the hot water is pumped to a certain extent, the liquid level of the geothermal well will be in a stable state, that is, the liquid level will not be changed up and down. In a case that the annulus pressure in the geothermal well is not equal to the annulus pressure in the directional pipeline, in order to ensure the accuracy of monitoring liquid level data, the pressure in the directional pipeline needs to be regulated, so as to balance the pressure in the geothermal well and the pressure in the directional pipeline. Specifically, after the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline

are monitored and acquired, if the annulus pressure in the geothermal well is not balanced with the annulus pressure in the directional pipeline, as shown in FIG. 2, the method for measuring a liquid level of a geothermal well of the present embodiment further includes:

[0035] S107: the annulus pressure in the directional pipeline is regulated through a pressure regulating device arranged in the directional pipeline; and the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline are repeatedly monitored and acquired until the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline.

[0036] According to a second embodiment of the present disclosure, a method for measuring a liquid level of a geothermal well is provided, as shown in FIG. 3, which specifically includes the following steps:

[0037] S202: a directional pipeline which is communicated with a geothermal well is drilled and is adjacent to the geothermal well, and a communication point between the directional pipeline and the geothermal well is located below a liquid surface of the geothermal well;

[0038] S204: both a wellhead of the geothermal well and an upper port of the directional pipeline are sealed; and

[0039] S206: a part above the liquid surface of the geothermal well is communicated with a part above the liquid surface of the directional pipeline through a communicating pipeline formed between the geothermal well and the directional pipeline, and the liquid level in the directional pipeline is measured to obtain the liquid level in the geothermal well.

[0040] The difference between the method for measuring a liquid level of a geothermal well of the present embodiment and Embodiment 1 is that the part above the liquid surface of the geothermal well is communicated with the part above the liquid surface of the directional pipeline through the communicating pipeline, so that the

pressure in the geothermal well is equal to the pressure in the directional pipeline at any time. Therefore, the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline do not need to be measured and regulated, and a measurement process is more convenient. In a process of measuring the liquid level of the geothermal well, the geothermal well is communicated with a lower end of the directional pipeline to form a communicating vessel; there is no pipeline or other obstacles in the directional pipeline, which will not affect a normal operation of measurement equipment, thereby ensuring the accuracy of the measured data; and in addition, air can be prevented from entering the geothermal well by measuring the liquid level in the directional pipeline, and equipment corrosion and water pollution are avoided. The problems of distortion of liquid level data acquired in a geothermal well liquid level measurement process in the conventional art and equipment corrosion and water pollution caused by air entering underground are solved.

[0041] According to a third aspect of the present disclosure, a structure for measuring a liquid level of a geothermal well is provided, as shown in FIG. 4, which includes: a geothermal well 10, a directional pipeline 20, and a measurement part 30; the directional pipeline 20 is formed adjacent to the geothermal well 10; a lower end of the directional pipeline 20 is communicated with a part below a liquid surface of the geothermal well 10; and the measurement part 30 is arranged in the directional pipeline 20, and the measurement part 30 is used for measuring the liquid level in the directional pipeline 20 to obtain the liquid level of the geothermal well 10.

[0042] According to the structure for measuring a liquid level of a geothermal well of the present embodiment, the directional pipeline 20 communicated with the geothermal well 10 is formed, the geothermal well 10 and the directional pipeline 20 form the communicating vessel, and

the liquid level of the directional pipeline 20 is indirectly measured to obtain the liquid level of the geothermal well 10. There is no pipeline or other obstacles in the directional pipeline, which will not affect a normal operation of the measurement equipment, thereby ensuring the accuracy of the measured data; and in addition, air can be prevented from entering the geothermal well by measuring the liquid level through the directional pipeline, and equipment corrosion and water pollution are avoided. The problems of distortion of liquid level data acquired in a geothermal well liquid level measurement process in the conventional art and equipment corrosion and water pollution caused by air entering underground are solved.

[0043] In a specific implementation process, a water pumping pipeline 80 is arranged in the geothermal well 10, and a submersible pump 90 is arranged at a lower end of the water pumping pipeline 80, thereby continuously pumping hot water to the ground. Both the wellhead of the geothermal well 10 and the upper part of the directional pipeline 20 are sealed. The geothermal well 10 is completely sealed. A sealing cover of the directional pipeline 20 may be opened or closed. A sealed environment in the directional pipeline 20 can be ensured when the upper port of the directional pipeline 20 is closed. The measurement part 30 can be lowered when the liquid level is measured in a case that the upper port of the directional pipeline 20 is opened.

[0044] In a specific implementing process, an upper segment of the directional pipeline 20 is a vertical pipeline, a lower segment of the directional pipeline is an arc-shaped pipeline, and the vertical pipeline is communicated with a position below the liquid surface of the geothermal well 10 through the arc-shaped pipeline. The vertical pipeline of the upper segment is parallel to the geothermal well 10, so as to ensure that a measuring rope can smoothly detect the position of the liquid surface downward when

the measuring rope is used for measuring the liquid level. The directional pipeline is generally a small wellbore with a small diameter that meets the requirements for measuring the water level. The structure for measuring a liquid level of a geothermal well of the present embodiment has two different structures. In a first structure for measuring a liquid level of a geothermal well, since the geothermal well 10 is not communicated with the position above the liquid surface of the directional pipeline 20, when hot water is pumped from the geothermal well 10, there will be a deviation between the annulus pressures inside the geothermal well 10 and the directional pipeline 20, resulting in a deviation in the liquid level. In order to ensure the accuracy of monitoring the liquid level, the annulus pressures of the geothermal well 10 and the directional pipeline 20 need to be kept balance. Further, the first structure for measuring a liquid level of a geothermal well further includes a first pressure gauge 40, a second pressure gauge 50, and a pressure regulating device 60. The first pressure gauge 40 is arranged in the geothermal well 10. The first pressure gauge 40 is used for monitoring and acquiring an annulus pressure in the geothermal well 10. The second pressure gauge 50 is arranged in the directional pipeline 20. The second pressure gauge 50 is used for monitoring and acquiring an annulus pressure in the directional pipeline 20. The pressure regulating device 60 is communicated with the directional pipeline 20 and is connected to each of the first pressure gauge 40 and the second pressure gauge 50. When there is a deviation between the pressures monitored by the first pressure gauge 40 and the second pressure gauge 50, and the annulus pressure in the directional pipeline 20 is regulated through the pressure regulating device 60, so that the annulus pressure in the directional pipeline 20 is equal to the annulus pressure in the geothermal well 10. At this moment, the accuracy of monitoring the liquid

level can be ensured.

[0045] As shown in FIG. 5, a second structure for measuring a liquid level of a geothermal well includes a communicating pipeline 70. The communicating pipeline 70 is formed between the geothermal well 10 and the directional pipeline 20 to communicate a part above the liquid surface of the geothermal well 10 and a part above the liquid surface of the directional pipeline 20. The annulus pressure of the geothermal well 10 and the annulus pressure of the directional pipeline 20 are kept balance all the time by the communicating pipeline 70; and the accuracy of monitoring the liquid level can be ensured.

[0046] Further, when the liquid level is measured actually, the measurement part 30 may be a measuring rope, or may also use a sonic liquid-level meter or other forms of liquid-level meters.

[0047] The above is only the preferred embodiments of the present disclosure, and is not intended to limit the present disclosure. For those skilled in the art, the present disclosure may have various modifications and changes. Any modifications, equivalent replacements, improvements and the like made within the spirit and principle of the present disclosure shall fall within the scope of protection of the present disclosure.

C O N C L U S I E S

1. Een werkwijze voor het meten van een vloeistofniveau van een geothermische put, omvattende:

het boren van een directionele pijpleiding die in verbinding staat met een geothermische put en die aangrenzend is aan de geothermische put, waarbij een verbindingspunt tussen de directionele pijpleiding en de geothermische put zich onder een vloeistofoppervlak van de geothermische put bevindt;

het afdichten van zowel een putmond van de geothermische put als een bovenste poort van de directionele pijpleiding;

het respectievelijk bewaken en vastleggen van een annulusdruk in de geothermische put en een annulusdruk in de directionele pijpleiding in het geval dat het vloeistofniveau van de geothermische put in een stabiele toestand is; en

het meten van een vloeistofniveau in de directionele pijpleiding voor het verkrijgen van het vloeistofniveau van de geothermische put in het geval dat de annulusdruk in de geothermische put gelijk is aan de annulusdruk in de directionele pijpleiding.

2. De werkwijze voor het meten van een vloeistofniveau van een geothermische put volgens conclusie 1, waarbij in het geval dat de annulusdruk in de geothermische put niet gelijk is aan de annulusdruk in de directionele pijpleiding, de werkwijze verder omvat;

het reguleren van de annulusdruk in de directionele pijpleiding door middel van een drukreguleerinrichting die is aangebracht in de directionele pijpleiding; en

het herhaaldelijk bewaken en vastleggen van de annulusdruk in de geothermische put en de annulusdruk in de

directionele pijpleiding totdat de annulusdruk in de geothermische put gelijk is aan de annulusdruk in de directionele pijpleiding.

3. De werkwijze voor het meten van een vloeistofniveau van een geothermische put volgens conclusie 1, waarbij in het geval van het bewaken en vastleggen van de annulusdruk in de geothermische put en de annulusdruk in de directionele pijpleiding, de werkwijze verder omvat:

het respectievelijk plaatsen van drukmeters in de geothermische put en de directionele pijpleiding; en

het respectievelijk bewaken en vastleggen van de annulusdruk in de geothermische put en de annulusdruk in de directionele pijpleiding via de drukmeters.

4. Een werkwijze voor het meten van een vloeistofniveau van een geothermische put, omvattend:

het boren van een directionele pijpleiding die in verbinding staat met een geothermische put en die aangrenzend is aan de geothermische put, waarbij een verbindingspunt tussen de directionele pijpleiding en de geothermische put zich onder een vloeistofoppervlak van de geothermische put bevindt;

het afdichten van zowel een putmond van de geothermische put als een bovenste poort van de directionele pijpleiding;

het verbinden van een deel boven het vloeistofoppervlak van de geothermische put en een deel boven een vloeistofoppervlak van de directionele pijpleiding door een verbindende pijpleiding die tussen de geothermische put en de directionele pijpleiding gevormd is; en

het meten van het vloeistofniveau in de directionele pijpleiding voor het verkrijgen van het vloeistofniveau van de geothermische put.

5. Een constructie voor het meten van een

vloeistofniveau van een geothermische put, omvattend:

een geothermische put (10);

een directionele pijpleiding (20) die aangrenzend gevormd is aan de geothermische put (10), waarbij een lager uiteinde van de directionele pijpleiding (20) in verbinding staat met een deel van de geothermische put (10) onder een vloeistofoppervlak; en

een meet-onderdeel (30) dat in de directionele pijpleiding (20) geplaatst is, waarbij het meet-onderdeel (30) gebruikt wordt voor het meten van een vloeistofniveau in de directionele pijpleiding (20) voor het verkrijgen van het vloeistofniveau van de geothermische put (10).

6. De constructie voor het meten van een vloeistofniveau van een geothermische put volgens conclusie 5, waarbij zowel een putmond van de geothermische put (10) als een bovenste poort van de directionele pijpleiding (20) afgedicht zijn.

7. De constructie voor het meten van een vloeistofniveau van een geothermische put volgens conclusie 6, verder omvattend:

een eerste drukmeter (40) die in de geothermische put (10) geplaatst is, waarbij de eerste drukmeter (40) gebruikt wordt voor het bewaken en vastleggen van een annulusdruk in de geothermische put (10); en

een tweede drukmeter (50) die in de directionele pijpleiding (20) geplaatst is, waarbij de tweede drukmeter (50) gebruikt wordt voor het bewaken en vastleggen van een annulusdruk in de directionele pijpleiding (20).

8. De constructie voor het meten van een vloeistofniveau van een geothermische put volgens conclusie 7, verder omvattend:

een druk-reguleer-inrichting (60) die in verbinding staat met de directionele pijpleiding (20) en die verbonden is met elke van de eerste drukmeter (40) en

de tweede drukmeter (50), waarbij de druk-reguleer-inrichting (60) gebruikt wordt voor het reguleren van de annulusdruk in de directionele pijpleiding (20), zodat de annulusdruk in de directionele pijpleiding (20) gelijk is aan de annulusdruk in de geothermische put (10).

9. De constructie voor het meten van een vloeistofniveau van een geothermische put volgens conclusie 5, verder omvattend:

een verbindende pijpleiding (70), die tussen de geothermische put (10) en de directionele pijpleiding (20) gevormd is voor het verbinden van een deel boven het vloeistofoppervlak van de geothermische put en een deel boven het vloeistofoppervlak van de directionele pijpleiding.

10. De constructie voor het meten van een vloeistofniveau van een geothermische put volgens conclusie 5, waarbij het meet-onderdeel (30) een meetkoord is.

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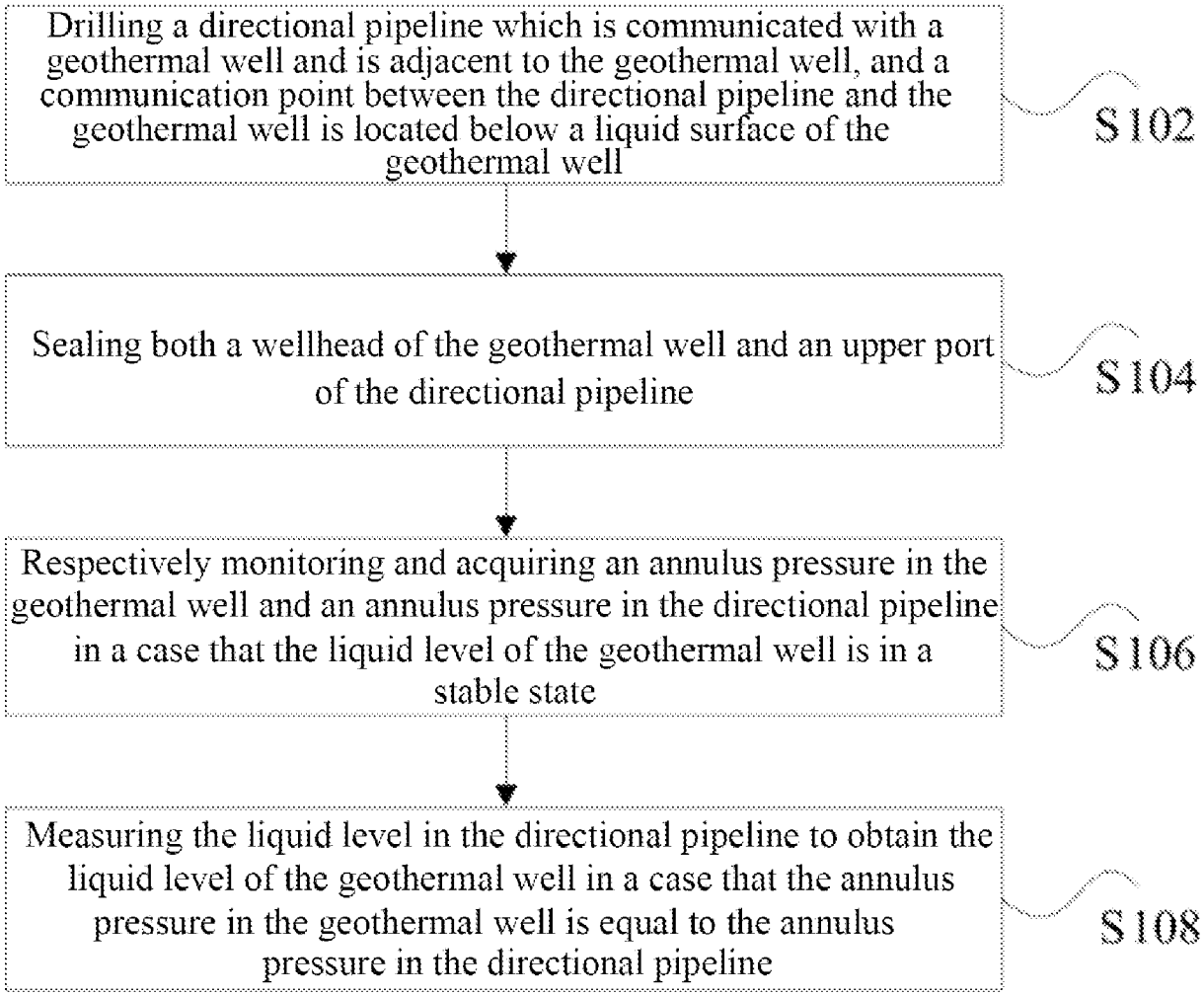
Drilling a directional pipeline which is communicated with a geothermal well and is adjacent to the geothermal well, and a communication point between the directional pipeline and the geothermal well is located below a liquid surface of the geothermal well
S102
Sealing both a wellhead of the geothermal well and an upper port of the directional pipeline
S104
Respectively monitoring and acquiring an annulus pressure in the geothermal well and an annulus pressure in the directional pipeline in a case that the liquid level of the geothermal well is in a stable state
S106
Measuring the liquid level in the directional pipeline to obtain the liquid level of the geothermal well in a case that the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline
S108

FIG. 1

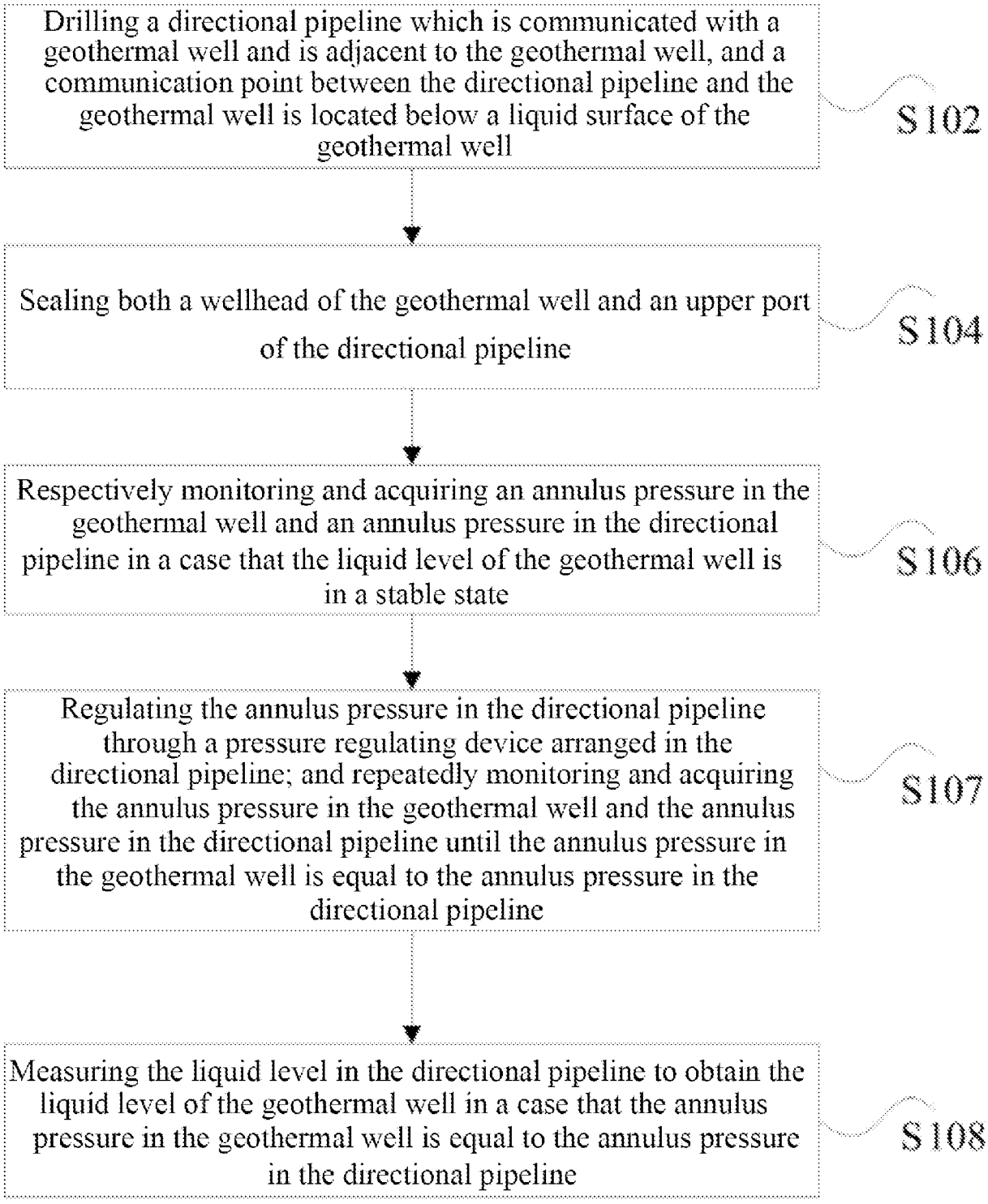
Drilling a directional pipeline which is communicated with a geothermal well and is adjacent to the geothermal well, and a communication point between the directional pipeline and the geothermal well is located below a liquid surface of the geothermal well
S102
Sealing both a wellhead of the geothermal well and an upper port of the directional pipeline
S104
Respectively monitoring and acquiring an annulus pressure in the geothermal well and an annulus pressure in the directional pipeline in a case that the liquid level of the geothermal well is in a stable state
S106
Regulating the annulus pressure in the directional pipeline through a pressure regulating device arranged in the directional pipeline; and repeatedly monitoring and acquiring the annulus pressure in the geothermal well and the annulus pressure in the directional pipeline until the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline
S107
Measuring the liquid level in the directional pipeline to obtain the liquid level of the geothermal well in a case that the annulus pressure in the geothermal well is equal to the annulus pressure in the directional pipeline
S108

FIG. 2

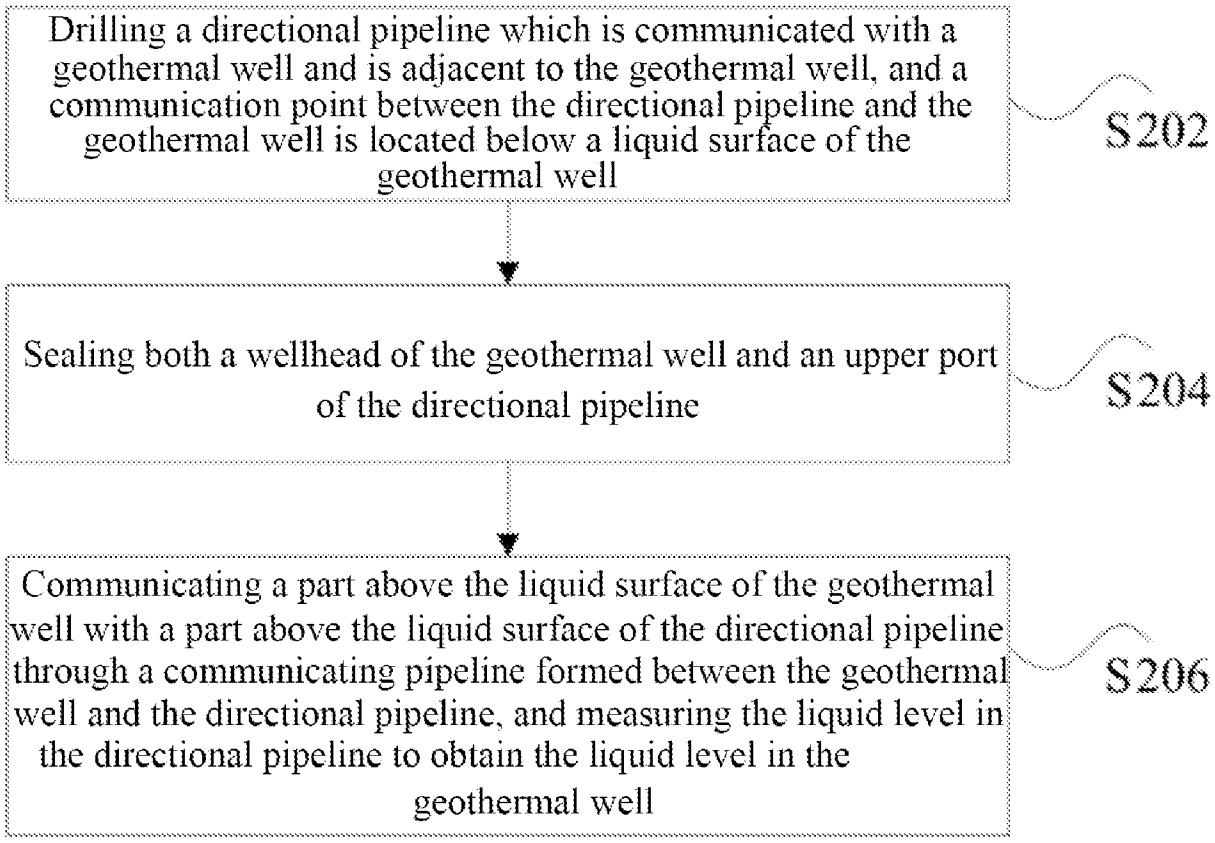
Drilling a directional pipeline which is communicated with a geothermal well and is adjacent to the geothermal well, and a communication point between the directional pipeline and the geothermal well is located below a liquid surface of the geothermal well
S202
Sealing both a wellhead of the geothermal well and an upper port of the directional pipeline
S204
Communicating a part above the liquid surface of the geothermal well with a part above the liquid surface of the directional pipeline through a communicating pipeline formed between the geothermal well and the directional pipeline, and measuring the liquid level in the directional pipeline to obtain the liquid level in the geothermal well
S206

FIG. 3

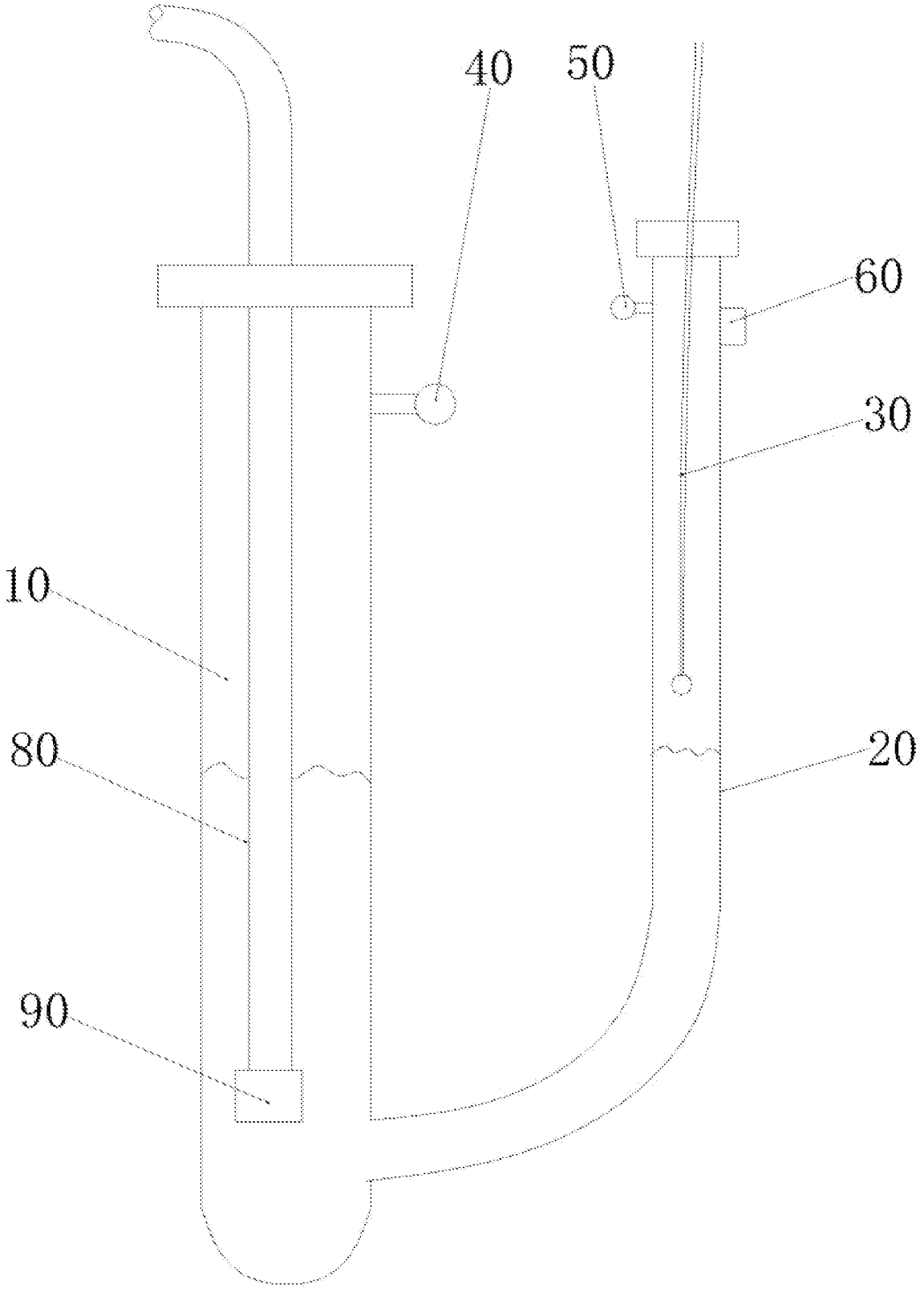

FIG. 4

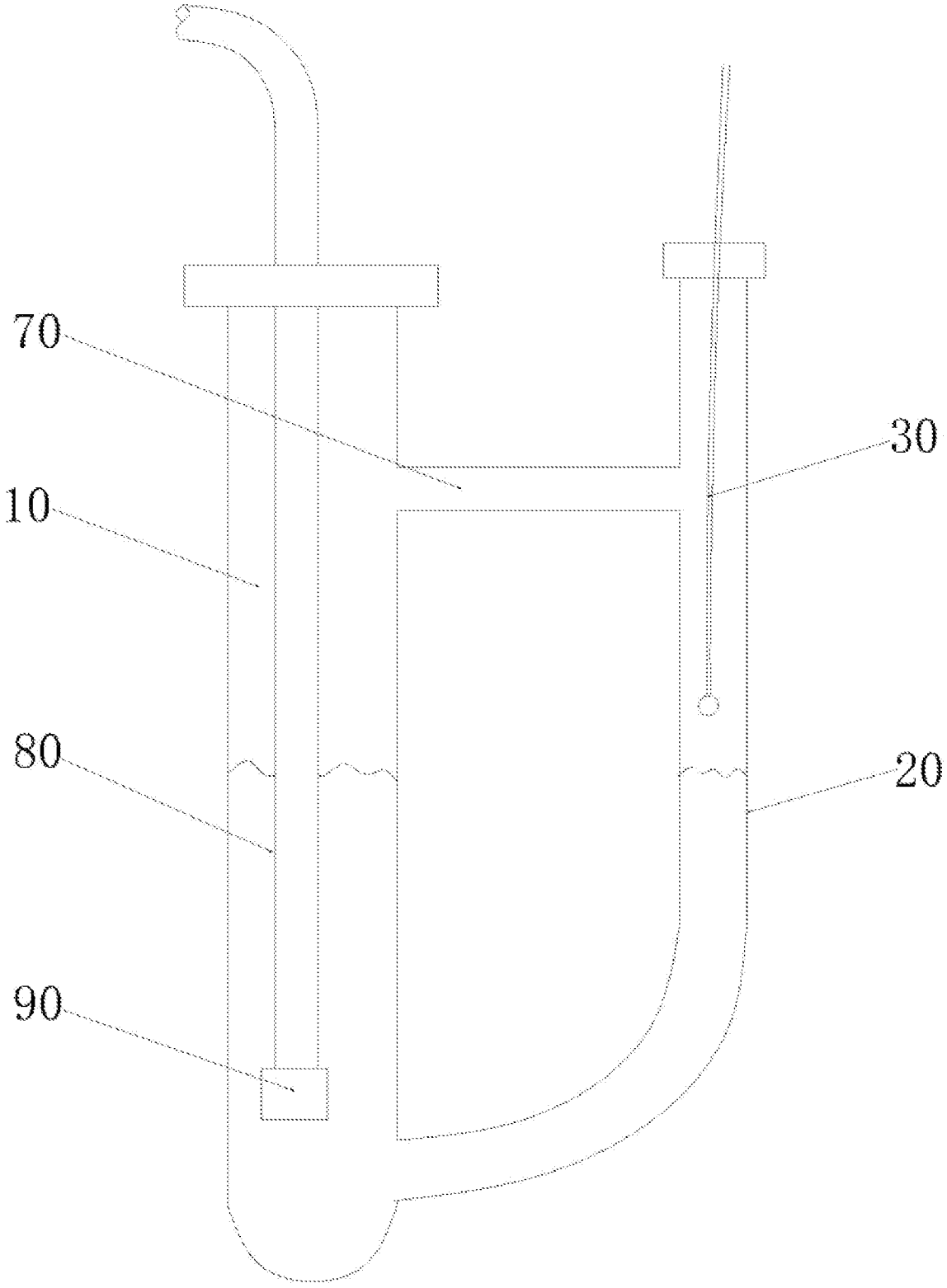

FIG. 5

Rijksdienst voor Ondernemend Nederland

OCTROOIAANVRAAG NR.:
NO 143483
NL 2035267

ONDERZOEKSRAPPORT

BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK

RELEVANTE LITERATUUR

Categorie[1]	Literatuur met, voor zover nodig, aanduiding van speciaal van belang zijnde tekstgedeelten of figuren.	Van belang voor conclusie(s) nr:	Classificatie(IPC)
X	CN 112 923 994 A (WANJIANG NEW ENERGY GROUP CO LTD) 8 juni 2021 (2021-06-08) * het gehele document *	1-10	INV. E21B47/047 E21B33/02 E21B43/30
X	JP 2018 059492 A (TAWARA SHUNICHI) 12 april 2018 (2018-04-12) * conclusies 3,7; figuren 1-5 *	1-10	E21B47/06 G01F23/04 G01F23/14
X	CN 112 502 661 A (SINOPEC GROUP CO LTD; SINOPEC STAR CO LTD ET AL.) 16 maart 2021 (2021-03-16) * conclusies 1,7; figuren 1,2 *	1-10	
A	DE 10 2014 206042 B4 (GAWRYCK HOLGER [DE]) 8 oktober 2015 (2015-10-08) * figuren 1,2 *	1-10	
A	EP 2 770 306 A1 (BODEN & GRUNDWASSER GMBH [DE]) 27 augustus 2014 (2014-08-27) * het gehele document *	1-10	

Onderzochte gebieden van de techniek

E21B
G01F
F24T

Indien gewijzigde conclusies zijn ingediend, heeft dit rapport betrekking op de conclusies ingediend op:

Plaats van onderzoek:	Datum waarop het onderzoek werd voltooid:	Bevoegd ambtenaar:
's-Gravenhage	30 april 2024	van Berlo, André

[1] NDERLINCATEGORIE VAN DE VERMELDE LITERATUUR

X: de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur
Y: de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht
A: niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft
O: niet-schriftelijke stand van de techniek
P: tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur
T: na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding
E: eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven
D: in de octrooiaanvrage vermeld
L: om andere redenen vermelde literatuur
&: lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

EOB FORM 02.83 (P0414B)

AANHANGSEL BEHORENDE BIJ HET RAPPORT BETREFFENDE HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK, UITGEVOERD IN DE OCTROOIAANVRAGE NR.

NO 143483
NL 2035267

Het aanhangsel bevat een opgave van elders gepubliceerde octrooiaanvragen of octrooien (zogenaamde leden van dezelfde octrooifamilie), die overeenkomen met octrooischriften genoemd in het rapport.
De opgave is samengesteld aan de hand van gegevens uit het computerbestand van het Europees Octrooibureau per
De juistheid en volledigheid van deze opgave wordt noch door het Europees Octrooibureau, noch door het Bureau voor de Industriële eigendom gegarandeerd;; de gegevens worden verstrekt voor informatiedoeleinden.

30-04-2024

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
CN 112923994 A	08-06-2021	GEEN	
JP 2018059492 A	12-04-2018	JP 6067173 B1	25-01-2017
		JP 2018059492 A	12-04-2018
CN 112502661 A	16-03-2021	GEEN	
DE 102014206042 B4	08-10-2015	GEEN	
EP 2770306 A1	27-08-2014	DE 102013101872 A1	28-08-2014
		EP 2770306 A1	27-08-2014

Algemene informatie over dit aanhangsel is gepubliceerd in de 'Official Journal' van het Europees Octrooibureau nr 12/82 blz 448 ev

SCHRIFTELIJKE OPINIE

DOSSIER NUMMER	INDIENINGSDATUM	VOORRANGSDATUM	AANVRAAGNUMMER
NO143483	05.07.2023	23.08.2022	NL2035267

CLASSIFICATIE
INV. E21B47/047 E21B33/02 E21B43/30 E21B47/06 G01F23/04 G01F23/14

AANVRAGER
Sinopec Green Energy Geothermal Development Co.,Ltd.

Deze schriftelijke opinie bevat een toelichting op de volgende onderdelen:

- ☒ Onderdeel I Basis van de schriftelijke opinie
- ☐ Onderdeel II Voorrang
- ☐ Onderdeel III Vaststelling nieuwheid, inventiviteit en industriële toepasbaarheid niet mogelijk
- ☐ Onderdeel IV De aanvraag heeft betrekking op meer dan één uitvinding
- ☒ Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid
- ☐ Onderdeel VI Andere geciteerde documenten
- ☐ Onderdeel VII Overige gebreken
- ☐ Onderdeel VIII Overige opmerkingen

DE BEVOEGDE AMBTENAAR
van Berlo, André

Aanvraag nr.:

SCHRIFTELIJKE OPINIE

NL2035267

Onderdeel I Basis van de Schriftelijke Opinie

1. Deze schriftelijke opinie is opgesteld op basis van de meest recente conclusies ingediend voor aanvang van het onderzoek.

2. Deze motivering is opgesteld, met betrekking tot **nucleotide- en/of aminozuursequenties** die genoemd worden in de aanvraag, op basis van een sequentielijst die:

   a. ☐ is opgenomen in de aanvraag zoals deze oorspronkelijk is ingediend

   b. ☐ aangeleverd is na de indieningsdatum ten behoeve van het onderzoek

      ☐ en vergezeld ging van een verklaring dat de sequentielijst niet meer informatie bevat dan de aanvraag zoals deze oorspronkelijk is ingediend.

3. ☐ Deze motivering is opgesteld, met betrekking tot nucleotide- en/of aminozuursequenties die genoemd worden in de aanvraag, voor zover een zinvolle motivering gevormd kon worden zonder een sequentielijst die voldeed aan WIPO standaard ST.26.

4. Overige opmerkingen:

Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid

1. Verklaring

Nieuwheid	Ja:	Conclusies	
	Nee:	Conclusies	1-10
Inventiviteit	Ja:	Conclusies	
	Nee:	Conclusies	1-10
Industriële toepasbaarheid	Ja:	Conclusies	1-10
	Nee:	Conclusies	

2. Citaties en toelichting:

   Zie aparte bladzijde

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1	CN 112 923 994 A (WANJIANG NEW ENERGY GROUP CO LTD) 8 juni 2021 (2021-06-08)
D2	JP 2018 059492 A (TAWARA SHUNICHI) 12 april 2018 (2018-04-12)
D3	CN 112 502 661 A (SINOPEC GROUP CO LTD; SINOPEC STAR CO LTD ET AL.) 16 maart 2021 (2021-03-16)

1.0 Claim 1 is **not clear**.

1.1 Claim 1 refers to:
- **een** geothermische put: twice;
- *een vloeistofniveau van een geothermische put* and *een vloeistofoppervlak van de geothermische put:* it is not clear whether this "niveau" and "oppervlak" are the same.
It is therefore not clear whether the above terms refer to the same features or not.

1.2 Claim 1 also refers to
en annulusdruk in de geothermische put en
een annulusdruk in de directionele pijpleiding;
However no annulus for the well and for the pipe has been defined; it is therefore not clear which pressure is actually meant. Herewith it is noted that an annulus typically requires a concentric inner conduit, which does not appear to be present in the claim.
The same objection applies to at least dependent claims 7 and 8.

1.3 Claim 1 refers to
het boren van een directionele pijpleiding;
The claim does not refer to *boren* before, and can therefore not be referred to with *het* as defined article.
The same objections apply for *het afdichten, het bewaken en vastleggen* and *het meten*.

1.4 For independent claim 4 similar objections as above apply.

2.0 Independent apparatus claim 5 is **not clear**.

2.1 As explained below, some of the features in the apparatus claim 5 relate to a method of using the apparatus rather than clearly defining the apparatus in terms of its technical features. The intended limitations are therefore not clear from this claim.

2.2 Claim 5 claims that "*een lager uiteinde van de directionele pijpleiding in verbinding staat met een deel van de geothermische put onder een vloeistofoppervlak*". However no liquid-surface is defined before and the claimed-subject matter does not comprise a liquid. Since the liquid does not form part of the claimed subject matter, the liquid level cannot limit the scope of the claim.

2.3 Moreover claim 5 refers twice to *een vloeistofniveau* and also once to *een vloeistofoppervlak*, whereby it is not clear whether these niveau's and/or oppervlak refer to the same level.

3.1 Furthermore, the above-mentioned lack of clarity notwithstanding, the subject-matter of claim 1 is not new, and the criteria of patentability are therefore not met.

3.2 The document D1 discloses (references to this document):
Een werkwijze voor het meten van een vloeistofniveau van een geothermische put (§1,§2), omvattende:
het boren van een directionele pijpleiding (8) die in verbinding staat met een geothermische put (2) en die aangrenzend is aan de geothermische put, waarbij een verbindingspunt tussen de directionele pijpleiding en de geothermische put zich onder een vloeistofoppervlak van de geothermische put bevindt (see fig 5,6);
het afdichten van zowel een putmond (1) van de geothermische put als een bovenste poort (9, valve) van de directionele pijpleiding;
het respectievelijk bewaken en vastleggen van een annulusdruk in de geothermische put en een annulusdruk in de directionele pijpleiding in het geval dat het vloeistofniveau van de geothermische put in een stabiele toestand is (see clarity objection above); en
het meten van een vloeistofniveau (13) in de directionele pijpleiding voor het verkrijgen van het vloeistofniveau van de geothermische put in het geval dat de annulusdruk in de geothermische put gelijk is aan de annulusdruk in de directionele pijpleiding.

4. A similar reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claim 4 and 5 as far as clear, which therefore are also considered not new.

5. Dependent claims 2,3 and 6-10 do not contain any clarifying and/or clear features which, in combination with the features of any claim to which they refer, meet the requirements of **clarity**, novelty and/or inventive step, see documents D1-D3.
5.1 For claim 2 and 3 at least the same objection as in §1.2 above applies: no annulus is defined.
5.2 For claim 6-10 at least the same objections as in §2.2 and 2.3 applies. Moreover also here no annulus is defined.
Further D1 discloses valves 7 and 9 to close off both conduits; water level rope 13; and an electric control system is fixedly installed on the top of the observation mechanism.