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(72) Inventors:
• **PEI, Bailin**
Beijing 102200 (CN)
• **LI, Shusheng**
Beijing 100102 (CN)

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(71) Applicant: **Beijing Hinen-Hitech Petroleum Technology Co., Ltd**
Beijing 102200 (CN)

(74) Representative: **Bergheim, Olav**
Zacco Norway AS
Haakon VII's gt. 2
P.O. Box 2003 Vika
0125 Oslo (NO)

(54) **FLOW CONTROL SCREEN TUBE FOR USE IN OIL RECOVERY PROCESS**

(57) A flow control screen for use in oilfield exploitation comprises: a base pipe (1) provided with a base pipe inlet (11) thereon; a filter pipe (2) sleeved over the base pipe (1); a flow guide layer (3) formed between the base pipe and the filter pipe; and a flow control device (4) including an inlet (41) of the flow control device, a flow

control channel (42) and an outlet (43) of the flow control device, wherein the inlet of the flow control device is in fluid communication with the flow guide layer, and the outlet of the flow control device is in fluid communication with the base pipe inlet. The pipe is simply structured and cost-effective, and effectively meets the requirements in oil production.

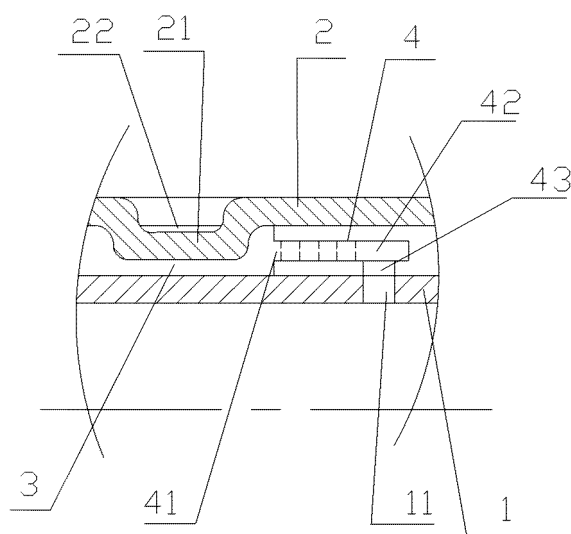


Figure 1

Description

Technical Field

[0001] The present invention relates to a flow control screen for use in oilfield exploitation.

Background Art

[0002] It is known to those skilled in the art that in petroleum exploitation, flow control screens are generally used for flow control, sand control or filtering of manually filled particles, etc. in an oil well, a gas well, a horizontal well, a vertical well and a directional well. Such a screen comprises a base pipe, a through-bore being formed on the base pipe as the inlet of the base pipe, a filter pipe being sleeved over the base pipe, and an annular gap between the base pipe and the filter pipe acting as a flow guide layer.

[0003] Due to the factors such as the viscosity of water being much less than that of oil and formation heterogeneity, the problem of water production in the oil well is very severe in oil production, which seriously influences the economic efficiency of oil field.

[0004] A flow control screen provided with an axial seal for an oil field is an effective solution to the problem of huge water production caused by reasons like high oil water viscosity ratio in oil reservoir. For instance, an effective flow control screen has been provided, wherein a flow control device is arranged in the screen, the inlet of the flow control device being in communication with the flow guide layer, and the outlet of the flow control device being in communication with the inlet of the base pipe. When in use, the filter pipe is isolated from the exterior at both ends by the end rings of the screen, such that the fluid can enter the flow guide layer through the filter pipe only. Since the flow guide layer is in communication with the inlet of the flow control device and the outlet of the flow control device is in communication with the inlet of the base pipe, the fluid sequentially passes through the filter pipe, the flow guide layer, the inlet of the flow control device, the flow control channel of the flow control device, the outlet of the flow control device, the inlet of the base pipe, and finally the base pipe in the oil production process. This is the only path, and except for it, there is no other path for the fluid to flow into the base pipe from outside of the screen.

[0005] This type of flow control screens function to reduce the flow difference per meter to some extent, thereby achieving the purpose of flow control. It can solve the problem of huge water production caused by reasons like high oil water viscosity ratio in oil reservoir, and non-uniformity of the flow per meter along the well bore during the process of water injection, the process of chemical injection, and so on.

[0006] The gap of the flow guide layers in the screen is very small, which is usually about 1 to 10mm, and however, the flowing length of the crude oil in the flow guide

layer during oil recovery can be up to 4 to 9 meters and the flowing resistance of the crude oil in the flow guide layer is relatively greater. Whether the flow guide layer is unobstructed or not directly influences the oil production.

[0007] To ensure an unobstructed flow guide layer such that the flow guide layer is not closed due to the increased pressure around the screen in the formation, a method of evenly disposing longitudinal ribs in the flow guide layer is commonly used in the prior art. When the filter pipe is pressed under external pressure, the longitudinal ribs exert supporting function to prevent the flow guide layer from closing, thereby keeping the flow guide layer unobstructed.

[0008] For such solutions as evenly distributing the longitudinal ribs in the flow guide layer, the filter pipe has two forms: one is to evenly distribute the longitudinal ribs on the external surface of the base pipe, and then wrap wires externally around the base pipe to form the filter pipe, which requires a dedicated precise wrapping machine which is costly; the other is to use a metal mesh jacket as the filter pipe, wherein the metal mesh jacket is lined with an inner protection sleeve with a plurality of holes, and the metal mesh jacket and the inner protection sleeve are sleeved over the base pipe with longitudinal ribs. On one hand, this method uses more materials. On the other hand, the speed of mounting ribs is slow, and the size of mounting ribs is not standard and has large errors, which results in a large error about the outer diameter of the base pipe with longitudinal ribs and increases difficulty in sleeving the filter pipe.

Summary of the Invention

[0009] An object of the present invention is to overcome at least one defect of a flow control screen in the prior art and to provide a flow control screen with fixed-supports on the inner wall of a filter pipe. A further object of the present invention is to make the flow control screen simply structured and cost-effective, greatly simplify the manufacturing process and facilitate control of the quality in machining, and the flow guide layer is not closed due to the increased pressure around the screen in the formation to be kept unobstructed, and the problem of huge water production caused by reasons like high oil water viscosity ratio in oil reservoir during oil exploitation can be solved, thereby meeting actual requirements in oil production.

[0010] In this regard, the present invention provides a flow control screen used in oilfield exploitation, comprising:

- a base pipe provided with a base pipe inlet thereon;
- a filter pipe sleeved over the base pipe such that an annular gap between the base pipe and the filter pipe forms a flow guide layer in which fluid is allowed to flow; and
- a flow control device including an inlet of the flow

control device, a flow control channel and an outlet of the flow control device, the inlet of the flow control device being in fluid communication with the flow guide layer, and the outlet of the flow control device being in fluid communication with the base pipe inlet; wherein the filter pipe is configured as a metal pipe provided with a plurality of filter slots on the wall thereof, the metal pipe is made of a metal plate, at least one inwardly protruding fixed-support is provided on the inner wall of the filter pipe such that the flow guide layer in communication with at least one portion of the plurality of slots is not closed under external pressure around the screen in the formation. Preferably, it may be ensured that the flow guide layer can still be kept unobstructed under external pressure around the screen in the formation.

[0011] Preferably, the at least one fixed-support comprises a plurality of fixed-supports, and the plurality of fixed-supports are substantially uniformly distributed on the inner wall of the filter pipe (or on one side of the metal pipe). It shall be appreciated by those skilled in the art that since the filter pipe is made of the metal plate and the fixed-supports are usually not disposed adjacent to the boundary of the metal plate, there are no fixed-supports in proximity of the joint on the wall of the filter pipe after formation of the filter pipe using such a metal plate. Hence, the terms "substantially uniformly distributed" or "evenly distributed" used for describing the distribution of "fixed-supports" or "slots" herein are adopted without considering the influence of the boundary of the metal plate or the joint on the wall of the filter pipe, which can be readily understood by those skilled in the art.

[0012] Preferably, each of the fixed-supports is a protruding part fixed to the inner wall of the filter pipe, and the height of each of the protruding parts is set to ensure that the flow guide layer is not closed under the external pressure around the screen in the formation.

[0013] Preferably, each of the fixed-supports is a protruding part inwardly punched on the wall of the filter pipe, and the punching depth of each of the protruding parts is greater than the thickness of the wall of the filter pipe so that the slots are formed in the form of sidewise-slots between portions of the periphery of the top surface of each of the protruding parts and the shearing planes of the unpunched portions of the wall of the filter pipe.

[0014] Preferably, the top surface of each of the fixed-supports is substantially in the shape of quadrangle. More preferably, the top surface of each of the fixed-supports is substantially in the shape of square or rectangle.

[0015] Preferably, the top surface of each of the fixed-supports is substantially in the shape of square or rectangle, and the slots are formed in the form of sidewise-slots between two opposite side edges of the top surface of each of the fixed-supports and the shearing planes of the unpunched portions of the wall of the metal pipe.

[0016] Preferably, each of the slots is configured to

extend parallel to the longitudinal axis of the filter pipe, or each of the slots is configured to extend at an angle with respect to the longitudinal axis of the filter pipe, the angle being greater than 0 degree but not more than 90 degrees.

[0017] Preferably, the plurality of slots comprise a plurality of groups of slots, the distribution pattern of which is made such that the slots in each group are equidistantly distributed in the circumferential direction of the filter pipe, and the groups of slots are equidistantly distributed in the longitudinal direction of the filter pipe; or the slots in each group are equidistantly distributed in a spiral direction on the wall of the filter pipe, and the groups of the slots are equidistantly distributed in the circumferential direction of the filter pipe.

[0018] Preferably, the filter pipe is a metal pipe formed by welding a spirally wound elongated metal plate pre-formed with the fixed-supports.

[0019] The flow control screen of the present invention is simple in manufacturing process and cost-effective, wherein the fixed-supports are disposed on the inner wall of the metal filter pipe which is provided with the slots, the fixed-supports can be formed by means of punching on the metal plate, or directly disposed on the metal plate by means such as welding or adhesion. Generally, the fixed-supports are arranged on a piece of elongated metal plate, and the filter pipe is formed by wrapping inwardly and spirally the face of the metal plate with the fixed-supports and then welding the resultant face into a cylinder. After the filter pipe is sleeved over the base pipe, the inwardly protruding fixed-supports function as longitudinal ribs in the flow guide layer between the filter pipe and the base pipe. When the filter pipe is pressed under external pressure, the fixed-supports exert a supporting function such that the flow guide layer is not closed with the increased external pressure, thereby keeping the flow guide layer unobstructed. The slots are configured to meet the requirements on filtering precision of the screen. Since the filter pipe is made of the metal plate, such a filter pipe has a superb overall strength and anti-deformation capacity. The supporting function of the inwardly protruding fixed-supports makes the flow guide layer unobstructed, reduces the flow resistance of the crude oil in the flow guide layer, and is in favor of increase in oil production.

[0020] Moreover, the present invention is simply structured and cost-effective, greatly simplifies the manufacturing process and facilitates control of the quality in machining, which ensures a high-efficiency and low cost mass production.

Brief Description of the Drawings

[0021]

Fig. 1 is a schematic partial sectional side view of a flow control screen according to a preferred embodiment of the present invention, wherein a fixed-sup-

port and a slot are shown.

Fig. 2 is a schematic partial sectional side view of a flow control screen according to a preferred embodiment of the present invention, wherein a plurality of fixed-supports and a plurality of slots are shown.

Fig. 3 is a schematic cross-sectional view of the flow control screen according to a preferred embodiment of the present invention.

Detailed Description of the Preferred Embodiments

[0022] In order to make clearer the object, the technical solution and the advantages of the present invention, the preferred embodiments of the present invention will be described in detail in conjunction with the drawings.

[0023] As shown in Fig. 1, the flow control screen used in oilfield exploitation according to the present invention generally comprises: a base pipe 1 provided with a base pipe inlet 11 thereon; a filter pipe 2 sleeved over the base pipe 1 such that the annular gap between the base pipe 1 and the filter pipe 2 forms a flow guide layer 3 in which fluid is allowed to flow; and a flow control device 4 including an inlet 41 of the flow control device, a flow control channel 42 and an outlet 43 of the flow control device, the inlet 41 of the flow control device being in fluid communication with the flow guide layer 3, and the outlet 43 of the flow control device being in fluid communication with the base pipe inlet 11. In the flow control screen, the filter pipe 1 is configured as a metal pipe provided with a plurality of filter slots 22 on the wall thereof, the metal pipe is made of a metal plate, and at least one inwardly protruding fixed-support 21 is provided on the inner wall of the filter pipe 1 such that the flow guide layer 3 in communication with at least one portion of the plurality of slots 22 is not closed under external pressure around the screen in the formation. Preferably, the flow guide layer is kept unobstructed.

[0024] Preferably, the at least one fixed-support 21 comprises a plurality of fixed-supports 21 which are substantially uniformly distributed on the inner wall of the filter pipe 2 or are substantially uniformly distributed on the metal plate (as stated above, it does not consider the influence of the boundary or the joint).

[0025] Preferably, each of the fixed-supports 21 is a protruding part fixed to the inner wall of the filter pipe 2, and the height of each of the protruding parts is set to ensure that the flow guide layer is not closed under the external pressure around the screen in the formation, preferably to keep the flow guide layer unobstructed.

[0026] Or, preferably, each of the fixed-supports 21 is a protruding part inwardly punched on the wall of the filter pipe 2, and the punching depth of each of the protruding parts is greater than the thickness of the wall of the filter pipe so that the slots 22 are formed in the form of side-wise-slots between portions of the periphery of the top surface of each of the protruding parts and the shearing planes of the unpunched portions of the wall of the filter pipe.

[0027] Preferably, the top surface of each of the fixed-supports 21 is substantially in the shape of quadrangle, and more preferably, in the shape of square or rectangle. Of course, those skilled in the art will realize that the fixed-supports with the top surfaces in other shape may be also possible.

[0028] In a preferred embodiment, the top surface of each of the fixed-supports 21 is substantially in the shape of square or rectangle. Moreover, the slots 22 are formed in the form of sidewise-slots between two opposite side edges of the top surface of each of the fixed-supports 21 and the shearing planes of the unpunched portions of the wall of the metal pipe.

[0029] Each of the slots 22 is preferably configured to extend parallel to the longitudinal axis of the filter pipe 2, or alternatively, each of the slots 22 may also be configured to extend at an angle with respect to the longitudinal axis of the filter pipe, and the angle is greater than 0 degree but not more than 90 degrees.

[0030] To facilitate discussion of the distribution pattern of the slots herein, the plurality of slots 22 may be divided into a plurality of groups of slots, i.e., the plurality of slots 22 comprise the plurality of groups of slots. In a preferred embodiment, the distribution pattern of the plurality of slots 22 is made such that the slots in each group are equidistantly distributed in the circumferential direction of the filter pipe 2, and the groups of slots are equidistantly distributed in the longitudinal direction of the filter pipe 2; or the slots in each group are equidistantly distributed in a spiral direction on the wall of the filter pipe, and the groups of the slots are equidistantly distributed in the circumferential direction of the filter pipe.

[0031] Furthermore, in the present invention, the filter pipe 2 is preferably formed by welding a spirally wound elongated metal plate preformed with the fixed-supports.

[0032] The inwardly protruding fixed-supports function as longitudinal ribs in the flow guide layer between the filter pipe and the base pipe. When the filter pipe is pressed under external pressure, the fixed-supports exert a supporting function such that the flow guide layer is not closed with the increased external pressure, thereby keeping the flow guide layer unobstructed. The filter slots in the form of sidewise-slots are punched at uniform slot width, so as to meet the requirements on filtering precision of the screen. In particular, since the filter pipe of the present invention is formed of the metal plate, the resultant filter pipe has a superb overall strength and anti-deformation capacity. The supporting function of the inwardly protruding fixed-supports makes the flow guide layer unobstructed, reduces the flow resistance of the crude oil in the flow guide layer, and is in favor of increase in oil production. Meanwhile, the flow control device can effectively solve the problem of huge water production caused by reasons like high oil water viscosity ratio in oil reservoir during the process of oil exploitation.

[0033] The present invention has a simple structure, greatly simplifies the manufacturing process, facilitates control of the quality in machining and is cost-effective,

which ensures a high-efficiency, low cost mass production.

[0034] The above description is simply the preferred embodiments of the present invention, and is not intended to limit the invention. Any modification, equivalent substitution and improvements within the spirit and principle of the present invention will fall into the protection scope of the present invention.

Claims

1. A flow control screen for use in oilfield exploitation, comprising:

a base pipe provided with a base pipe inlet thereon;

a filter pipe sleeved over the base pipe such that an annular gap between the base pipe and the filter pipe forms a flow guide layer in which fluid is allowed to flow; and

a flow control device including an inlet of the flow control device, a flow control channel and an outlet of the flow control device, the inlet of the flow control device being in fluid communication with the flow guide layer, and the outlet of the flow control device being in fluid communication with the base pipe inlet;

wherein the filter pipe is configured as a metal pipe provided with a plurality of filter slots on the wall thereof, the metal pipe is made of a metal plate, and at least one inwardly protruding fixed-support is provided on the inner wall of the filter pipe such that the flow guide layer in communication with at least one portion of the plurality of slots is not closed under external pressure around the screen in a formation.

2. The flow control screen according to claim 1, wherein the at least one fixed-support comprises a plurality of fixed-supports, and the plurality of fixed-supports are substantially uniformly distributed on the inner wall of the filter pipe.

3. The flow control screen according to claim 1 or 2, wherein each of the fixed-supports is a protruding part fixed to the inner wall of the filter pipe, and the height of each of the protruding parts is set to ensure that the flow guide layer is not closed under the external pressure around the screen in the formation.

4. The flow control screen according to claim 1 or 2, wherein each of the fixed-supports is a protruding part inwardly punched on the wall of the filter pipe, and the punching depth of each of the protruding parts is greater than the thickness of the wall of the filter pipe so that the slots are formed in the form of sidewise-slots between portions of the periphery of

the top surface of each of the protruding parts and the shearing planes of the unpunched portions of the wall of the filter pipe.

5. The flow control screen according to any one of the preceding claims, wherein the top surface of each of the fixed-supports is substantially in the shape of quadrangle.

6. The flow control screen according to claim 5, wherein the top surface of each of the fixed-supports is substantially in the shape of square or rectangle.

7. The flow control screen according to claim 4, wherein the top surface of each of the fixed-supports is substantially in the shape of square or rectangle, and the slots are formed in the form of sidewise-slots between two opposite side edges of the top surface of each of the fixed-supports and the shearing planes of the unpunched portions of the wall of the metal pipe.

8. The flow control screen according to any one of the preceding claims, wherein each of the slots is configured to extend parallel to the longitudinal axis of the filter pipe.

9. The flow control screen according to any one of the preceding claims, wherein each of the slots is configured to extend at an angle with respect to the longitudinal axis of the filter pipe, and the angle is greater than 0 degree but not more than 90 degrees.

10. The flow control screen according to any one of the preceding claims, wherein the plurality of slots comprise a plurality of groups of slots, the distribution pattern of which is made such that the slots in each group are equidistantly distributed in the circumferential direction of the filter pipe, and the groups of slots are equidistantly distributed in the longitudinal direction of the filter pipe; or the slots in each group are equidistantly distributed in a spiral direction on the wall of the filter pipe, and the groups of the slots are equidistantly distributed in the circumferential direction of the filter pipe.

11. The flow control screen according to any one of the preceding claims, wherein the filter pipe is a metal pipe formed by welding a spirally wound elongated metal plate preformed with the fixed-supports.

12. The flow control screen according to any one of the preceding claims, wherein the fixed-supports disposed on the inner wall of the filter pipe are configured so as to ensure that the flow guide layer is still unobstructed under the external pressure around the screen in the formation.

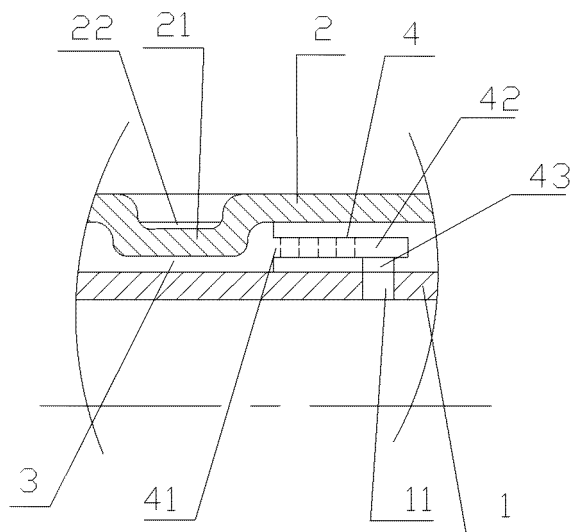


Figure 1

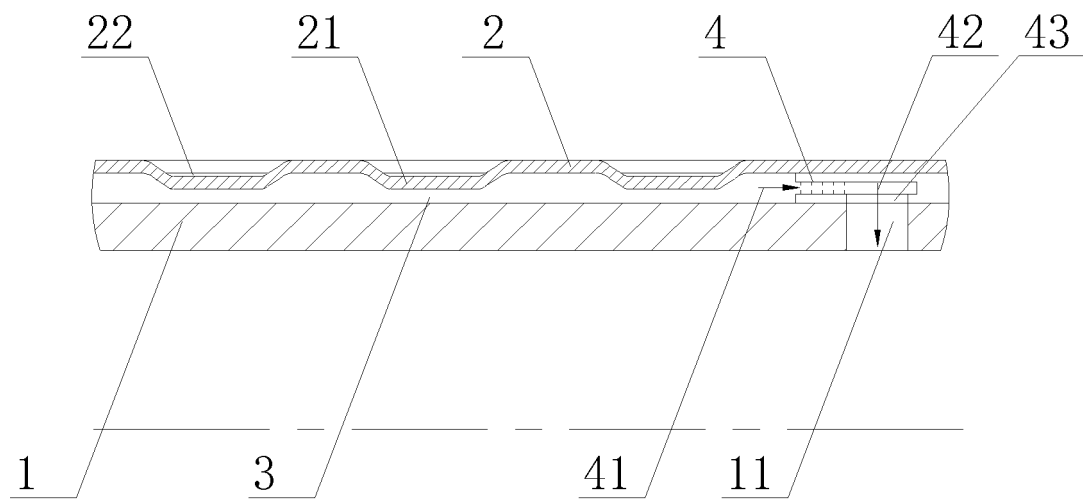


Figure 2

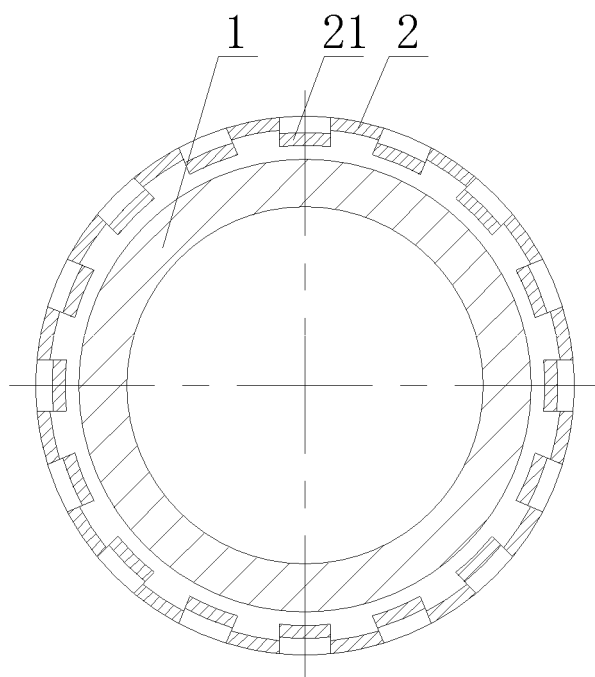


Figure 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2010/001089

A. CLASSIFICATION OF SUBJECT MATTER

E21B 43/08(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, CNPAT, CNKI: control+,flow,sieve/screen w tube,filter w tube, protrud+, fixed? supporting?

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN201486537U (ANTON OILFIELD SERV GROUP LTD) 26 May 2010 (26.05.2010) page 2, lines 3-33	1-12
PX	CN201318155Y (ANTON OILFIELD SERV GROUP LTD) 30 Sep.2009 (30.09.2009) claims 1-9 and fig.1	1-12
PX	CN101748999A (ANTON OILFIELD SERV GROUP LTD) 23 Jun.2010 (23.06.2010) claims 1-11 and fig.1	1-12
A	CN101463719A (ANTON OILFIELD SERV GROUP LTD) 24 Jun.2009	1-12

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search 10 Oct.2010 (10.10.2010)	Date of mailing of the international search report 11 Nov. 2010 (11.11.2010)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer LI, Jin Telephone No. (86-10)62085527

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2010/001089

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	(24.06.2009) page 6, lines 3-10 CN1510248A(HAINENG HAITE PETROLEUM SCI & TECHNOLOGY)07 Jul.2004	1-12
A	(07.07.2004) the whole document US2003188874 A1 (BAKER HUGHES INC) 09 Oct.2003 (09.10.2003) the whole document	1-12

Form PCT/ISA /210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2010/001089

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN201486537U	26.05.2010	none	
CN201318155Y	30.09.2009	none	
CN101748999A	23.06.2010	none	
CN101463719A	24.06.2009	none	
CN1510248A	07.07.2004	none	
US2003188874 A1	09.10.2003	CA2481913 AC	23.10.2003
		WO03087533 A	23.10.2003
		AU2003221795 A	27.10.2003
		NO20044558 A	08.11.2004
		GB2403496 AB	05.01.2005

Form PCT/ISA /210 (patent family annex) (July 2009)