



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
16.05.2012 Bulletin 2012/20

(51) Int Cl.:
E21B 34/14 (2006.01) E21B 43/00 (2006.01)

(21) Application number: **10797365.3**

(86) International application number:
PCT/RU2010/000294

(22) Date of filing: **07.06.2010**

(87) International publication number:
WO 2011/005144 (13.01.2011 Gazette 2011/02)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(72) Inventors:
• **ALEKSANDROV, Dmitry Ivanovich**
St. Petersburg, 192283 (RU)
• **ALEKSANDROV, Pavel Dmitrievich**
St. Petersburg, 198184 (RU)

(30) Priority: **10.07.2009 RU 2009126485**

(74) Representative: **Westendorp | Sommer**
Uhlandstraße 2
80336 München (DE)

(71) Applicants:
• **Aleksandrov, Dmitriy Ivanovich**
St.Petersburg 192283 (RU)
• **Aleksandrov, Pavel Dmitrievich**
St. Petersburg 198184 (RU)

(54) **DOWNHOLE DEVICE**

(57) The device is used in technical operations during well completion. The device acts as a sealing device by using a seal (5). The seal (5) divides the well into an upper cavity (16) and a lower cavity (17). The seal (5) includes a collet (7) that comprises segments (8), a liner (10), springs (11) and a casing (6). The segments (8) are capable of separating upon interaction with the well equipment (drilling column (19)) and are provided with additional seals (9). The casing (6) is situated in the lower portion of the collet (7) and enables the movement of the segments (8) upon the separation thereof. The seal (5) is situated in a threaded (2, 3) housing (1). The housing (1) is secured in a roller bearing (4). The device further includes an adjustment insert (12) that is capable of interacting with the well equipment upon the installation thereof and of moving the same so as to open the channel of a hydraulic connection (13) between the well opening, the upper cavity, the lower cavity and the producing formation. This technical solution makes it possible to carry out any well completion operation, prevent the inflow of formation fluids and increase the yield of the well, well completion being carried out without the generation of overbalance on the formation. 3 dependent claims, 7 figures.

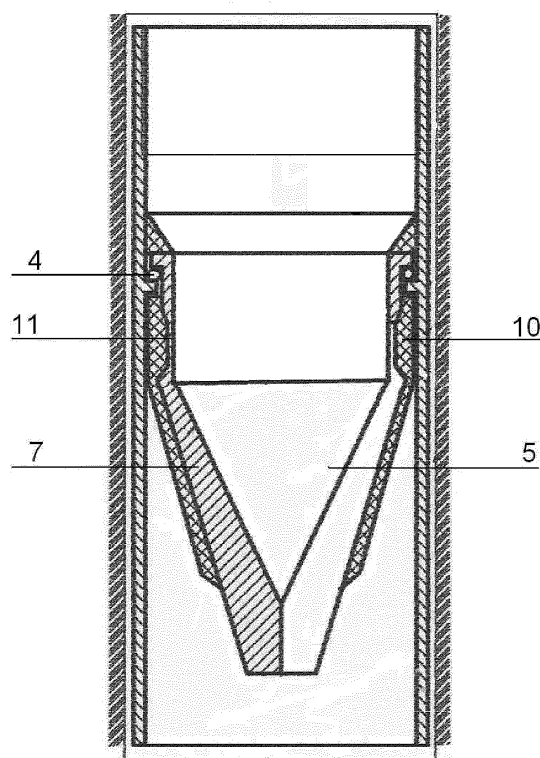


Fig. 2

Description

TECHNICAL FIELD

[0001] The invention pertains to the oil and gas industry and can be used in technical operations relating to well completion.

PRIOR ART

[0002] Known are the safety valves intended for leak-free shutoff of the well bore during the oil and gas wells operation RU No. 2312203 C2, E21B34/06, 10.12.2007; RU No. 2311526 C2, E21B34/06, 27.11.2007; RU No. 2293839 C1, E21B34/06, 20.02.2007; RU No. 2234595 C1, E21B34/10, 20.08.2004; RU No. 2224087 C2, E21B34/06, 20.02.2004; RU No. 2172815 C1, E21B34/06, 27.08.2001; RU No. 2169829 C1, E21B34/06, 27.06.2001; RU No. 2160357 C2, E21B34/06, 10.12.2000; RU No. 2145024 C1, E21B34/08, 27.01.2000; RU No. 2112863 C1, E21B34/06, 10.06.1998; RU No. 2107152 C1, E21B34/06, 20.03.1998; RU No. 2094593 C1, E21B34/06, 27.10.1997; RU No. 2021490 C1, E21B34/06, 15.10.1994; RU No. 2011797 C1, E21B34/06, 30.04.1994; RU No. 32183 U1, E21B34/06, 10.09.2003; RU No. 25527 U1, E21B34/06, 10.10.2002; RU No. 22174 U1, E21B34/06, 10.03.2002.

[0003] The known downhole shutoff devices are characterized by the significant reduction of flow channel diameter compared to the producing well diameter.

[0004] Also known is a preventer containing the housing, sealing elements equipped with hydraulic drives RU No. 2304693 C2, E21B33/06, 20.08.2007; RU No. 2125643 C1, E21B33/06, 27.01.1999; RU No. 37762 U1, E21B34/06, 10.05.2004.

[0005] Known is a rotating preventer containing the housing, rotating shaft with a sealing element, rotating assembly and a chevron seal RU No. 2027847 C1, E21B33/06, 27.01.1995; RU No. 76961 U1, E21B33/06, 10.10.2008.

[0006] Known is the rotating universal hydraulic preventer containing a housing with a cavity and a central opening, a cover with an opening, bearings, a shell, a sealing element located in the shell RU No. 2208126 C2, E21B33/06, 10.07.2003; RU No. 2013519 C1, E21B33/06, 30.05.1994; RU No. 45770 U1, E21B33/06, 27.05.2005.

[0007] The known rotating preventers, which are installed on the well opening, have overall dimensions significantly exceeding the well diameter; they do not completely overlap the cross-section.

[0008] Known is a rotating preventer containing a housing, a bearing assembly, a shaft rotating in the bearing assembly and a sealing device connected with the well equipment, RU No. 2341643 C1, E21B33/06, 20.12.2008.

[0009] This technical solution is accepted as the "closest analog" of the present invention.

est analog" of the present invention.

[0010] The sealing device of the "closest analog" preventer is made in the form of a spacer ring with a groove on the inner surface and is located on the coupling connecting the drill string and the kelly stem. The groove in the spacer ring is connected with the inner cavity of the coupling. The drill string together with the coupling is lowered into the well and the drill pump is switched on; at that, the sealing device, under action of drill fluid pressure, is expanded and retained against the shaft, thus creating a reliable sealing of the annulus.

[0011] However, the sealing device of the "closest analog" preventer seals the well opening during drilling operations and such sealing is possible only under action of drill fluid, which limits execution of other process operations.

[0012] The "closest analog" preventer belongs to devices that seal the well opening during drilling.

Summary of the invention

[0013] The invention solves the problem of expanding execution of process operations, provide conditions for any operations on well completion without loss of flow channel diameter by more than the normative value, prevent inflow of formation fluids and increase the well productivity.

[0014] According to the invention this problem is solved by using a borehole device containing a housing; a bearing assembly; and a sealing device connected with the borehole equipment.

[0015] The device acts as a sealing device by using a seal.

[0016] The seal separates the well into the upper and lower cavity with the presence of hydraulic connection between the well opening and the upper cavity and between the lower cavity and the producing formation respectively.

[0017] The seal has a collet with segments in the lower part and is made capable of separating at interaction with the well equipment, is equipped with additional seals on lateral surfaces, a liner on external surfaces, springs and casing located in the lower part and providing arrangement of segments during their separation.

[0018] The seal is located in the housing provided with the upper thread and fastened in the bearing assembly.

[0019] The device further includes an adjustment insert that is capable of interacting with the well equipment upon the installation thereof and of moving same so as to open the channel of a hydraulic connection between the well opening, the upper cavity, the lower cavity and the producing formation.

[0020] The invention is characterized by a number of optional features, namely:

- bearing assembly contains an oil-filled sealed bearing;

- liner is made of a strong flexible material;
- lower thread is additionally made on the housing.

[0021] The applicant has not identified any sources of information which contain data on technical solutions identical to the device described herein.

[0022] Thus, in the applicant's opinion, the invention meets the "novelty" (N) criterion.

[0023] The immediate technical result is implementation of technical operations on well completion without creation of overbalance on the productive deposits by the washer fluid column, with the help of the suggested device made as a sealing device by means of the seal separating the well into the upper and lower cavities, containing the collet with segments in the lower part capable of separating at interaction with the well equipment and located in the housing fastened in the bearing assembly.

[0024] This technical result does not come from the known properties, which, in the applicant's opinion, means that the technical solution applied for meets the the "inventive step" (IS) criterion.

[0025] Implementation of the technical solution applied for is confirmed by the research, development and testing of experimental batches; in the downhole device the use is made of parts and assemblies which are widely used in the oil and gas producing industry; therefore, in the applicant's opinion, it meets the "industrial applicability" (IA) criterion.

Brief description of the drawings

[0026] Further on the technical solution applied for shall be explained by description of an example of its implementation with references to the attached drawings, where

- in Fig. 1 - Downhole device, general view;
- in Fig. 2 - Downhole device, section;
- in Fig. 3 - Collet segments, section;
- in Fig. 4 - Downhole device in setting position, section;
- in Fig. 5 - Well in operating position, schematically;
- in Fig. 6 - Section A-A on fig. 5;
- in Fig. 7 - Well with downhole device, schematically.

Best embodiment of the invention

[0027] The downhole device contains:

- Housing - 1,
- upper thread (on housing 1) - 2,
- lower thread (on housing 1) - 3,
- Oil-filled sealed bearing - 4.
- Seal (in housing 1) - 5.
- Encasing (of housing 1) - 6.
- Collet (of seal 5) - 7,
- segments (of collet 7) - 8.

- additional seals (on lateral surfaces of segments 8) - 9,
- liner (on external surface of collet 7) - 10,
- springs (of collet 7) - 11.
- Locating insert - 12,
- channels of hydraulic connection - 13.
- Drill-through cover - 14.

[0028] Installation and operation of the device is provided by:

- Well-15,
- upper cavity (well 15) - 16,
- lower cavity (well 15) - 17.
- Casing string - 18.
- Drill string - 19,
- drillbit - 20.

[0029] The borehole device contains a housing (1), bearing assembly (4) and seal (5).

[0030] The device acts as a sealing device by using a seal (5).

[0031] The seal (5) separates the well into the upper (16) and the lower (17) cavity with the presence of hydraulic connection between the well opening and the upper cavity and between the lower cavity and the producing formation respectively.

[0032] The seal (5) contains a funnel-shaped collet (7). The collet (7) in the encasing (6) in the lower part contains segments (8) closely fitting to each other, capable of separating and equipped with the additional seals (9) on the lateral surfaces. The collet (7) contains a liner (10) on its external surfaces. The liner (10) is made of a strong flexible material. The collet (7) contains springs (11). The encasing (6) is located in the lower part of the collet (7) providing arrangement of segments (8) during their separation. The space between the seal (5) and the encasing (6) is filled with grease.

[0033] The seal (5) is located in the housing (1) provided with the upper thread (2) and fastened in the bearing assembly. The bearing assembly contains the oil-filled sealed bearing (4). The lower thread (3) is made on the housing (1) for installation of the device between the pipes of the casing string (18), if necessary.

[0034] The device further includes an adjustment insert (12). The adjustment insert (12) is capable of interacting with the well equipment during its installation, for example, with the drill string (19), and of moving the same so as to open the channel of a hydraulic connection (13) between the well opening, the upper cavity, the lower cavity and the producing formation.

[0035] The device is additionally equipped with the drill-through cover (14). The drill-through cover (14) is

made of easily drillable material, for example, Δ 16.

[0036] Process operations on well completion are executed using the device as follows.

[0037] The locating insert (12) is installed in the seal

(5). The space between the seal (5) and the encasing (6) is filled with grease to prevent crushing of the encasing (6) under external pressure during lowering of the device into the well (15).

[0038] The housing (1) of the device is connected by means of the upper thread (2) and the lower thread (3) with the pipe of the string (18) located below. The casing string (18) together with the device is lowered into the well.

[0039] Process operations on the well (15) fastening are then performed.

[0040] The drill string (19) is lowered down to the device and the locating insert (12) is pushed out by subsequent pressing, thus breaking the drill-through cover (14).

[0041] Segments (8) of the collet (7) are separated and the channels of the hydraulic connection (13) between the well opening, the upper cavity, the lower cavity and the producing formation open. The encasing (6) provides the guaranteed space for location of the separated segments (8).

[0042] The drill string (19) is lowered down to the productive deposits.

[0043] After execution of process operations on the well (15) deepening according to the project the drill string (19) is removed from the well (15).

[0044] After the drillbit (20) comes out of the seal (5) the collet (7) takes up the "closed" position under action of the own potential energy, as well as under action of springs (11) and liner (10), thus shutting off the channels of the hydraulic connection (13) and separating the upper (16) and the lower (17) cavities of the well (15).

[0045] If it is necessary to continue operations on the well (15) deepening, the drill string (19) is lowered in the similar way through the device.

[0046] If other process operations are executed, for example, lowering of the tail pipe (not shown) or other equipment, the device supports their installation and operation in the required modes.

[0047] Completion of the device with the housing, the bearing assembly and the seal makes it possible to lower it together with the casing string, to locate it inside the well and to perform any process operations on the well completion without any diameter loss.

[0048] Installation of the device in the well over the productive deposits, which operates on the "normally closed" principle and is opened by external actuation to let the well equipment pass through, is a necessary step to complete the well, if development of the productive deposits is carried out without creation of the overbalance.

[0049] Availability of the collet in the seal, which provides interaction with the well equipment and opening of the channel of the hydraulic connection between the well opening, the upper cavity, the lower cavity and the producing formation prevents inflow of formation fluids, when necessary.

Industrial applicability

[0050] The suggested downhole device can be used during execution of the process operations on the well completion without loss of flow channel diameter by more than the normative value, during prevention of the formation fluids inflow and during application of the known parts and assemblies manufactured industrially and widely used in the oil and gas producing industry, and the research, development and testing of the experimental batches confirms, in the applicant's opinion, its compliance with the "industrial applicability" (IA) criterion.

15 Claims

1. Downhole device comprising: a housing; a bearing assembly; and a seal connected with the well equipment, where the sealing feature of the device is provided by means of a seal separating the well into the upper and lower cavities, with the presence of hydraulic connection between the well opening and the upper cavity and between the lower cavity and the producing formation, correspondingly, containing the collet with segments in the lower part capable of separating at interaction with the well equipment and provided with the additional seals on the lateral surfaces, with the liner on the external surfaces, springs and encasing located in the lower part and providing arrangement of segments at their separation, and located in the housing having the upper thread and fastened in the bearing assembly; at that, the device is additionally equipped with the locating insert capable of interacting with the well equipment during its installation and of moving the same so as to open the channel of a hydraulic connection between the well opening, the upper cavity, the lower cavity and the producing formation.
2. The device as per Claim 1, where the bearing assembly comprises an oil-filled sealed bearing.
3. The device as per Claim 1, where the liner is made of a strong flexible material.
4. The device as per Claim, where a lower thread is additionally provided on the housing.

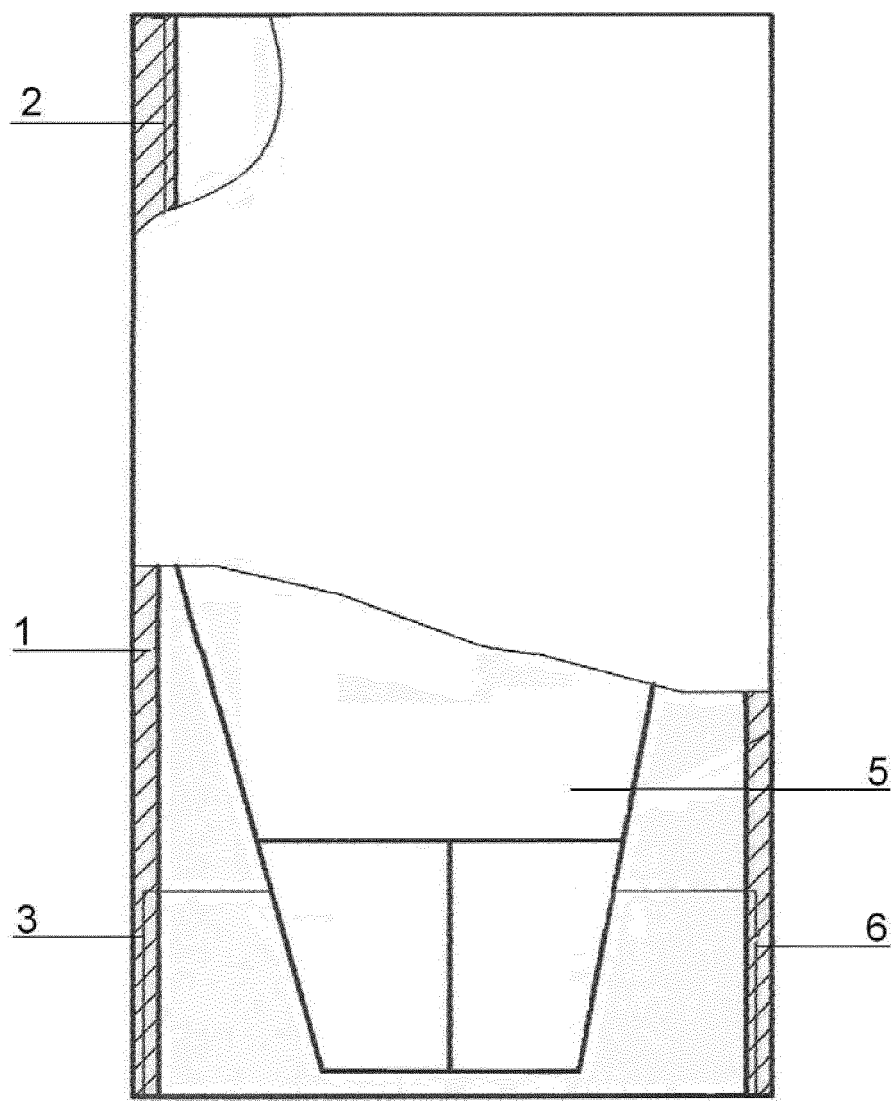


Fig. 1

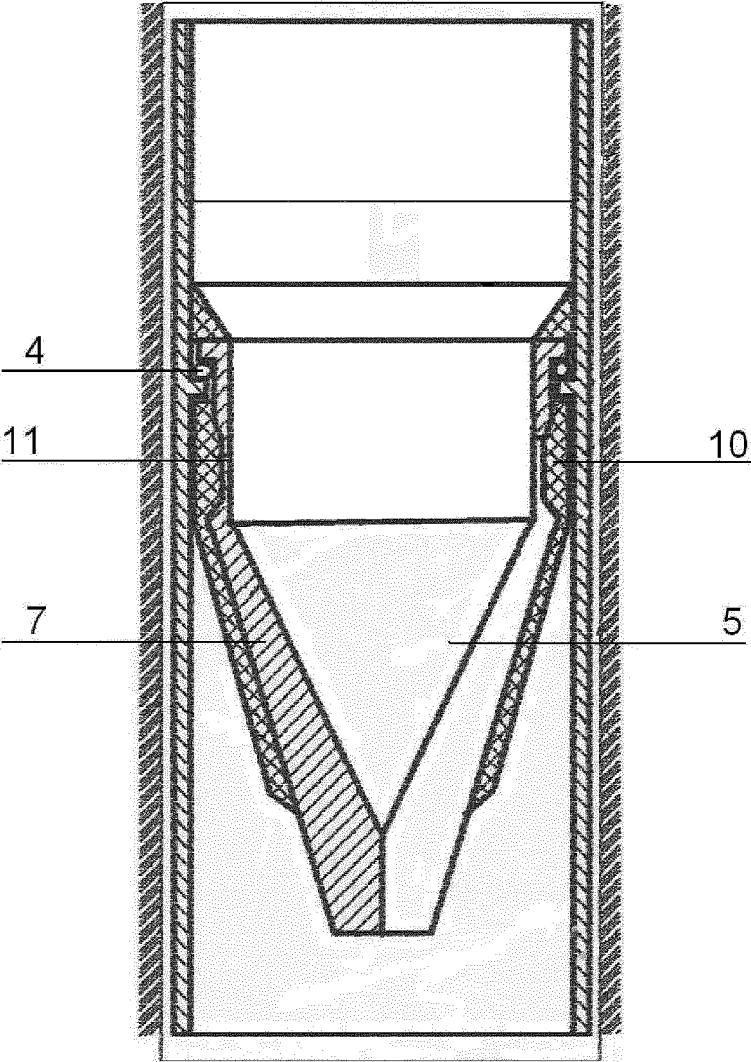


Fig. 2

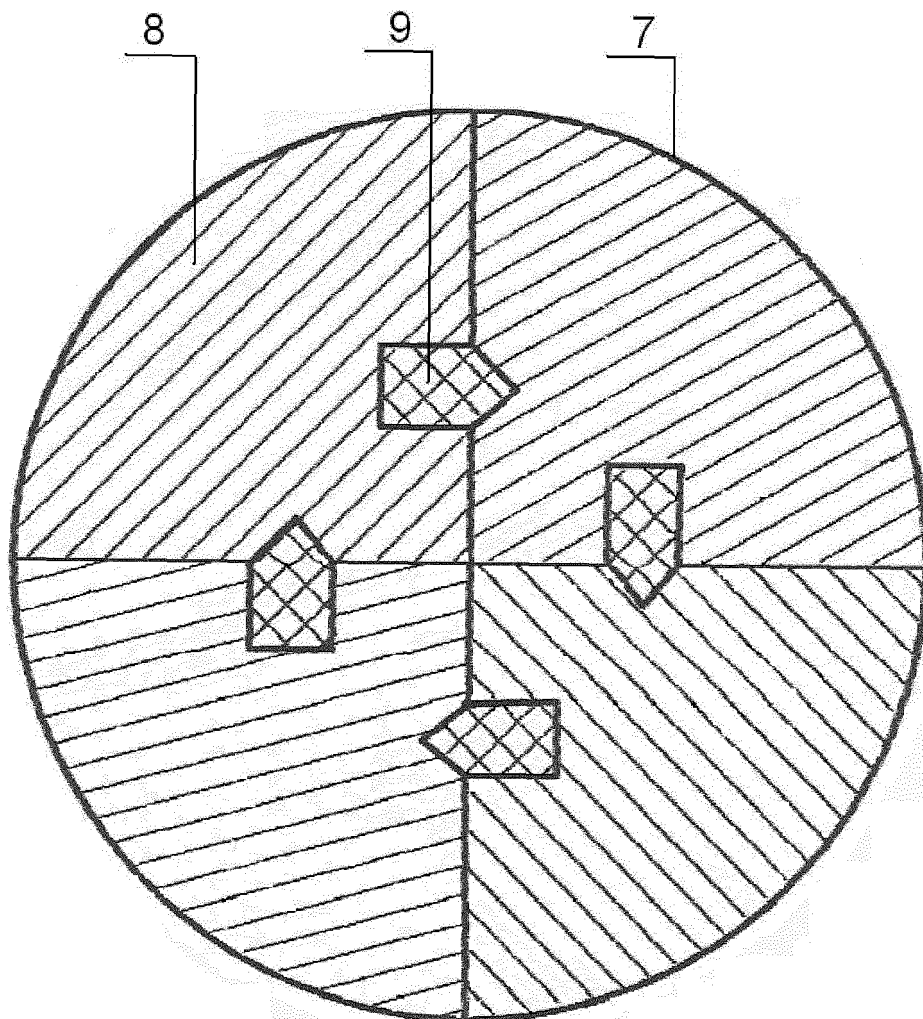


Fig. 3

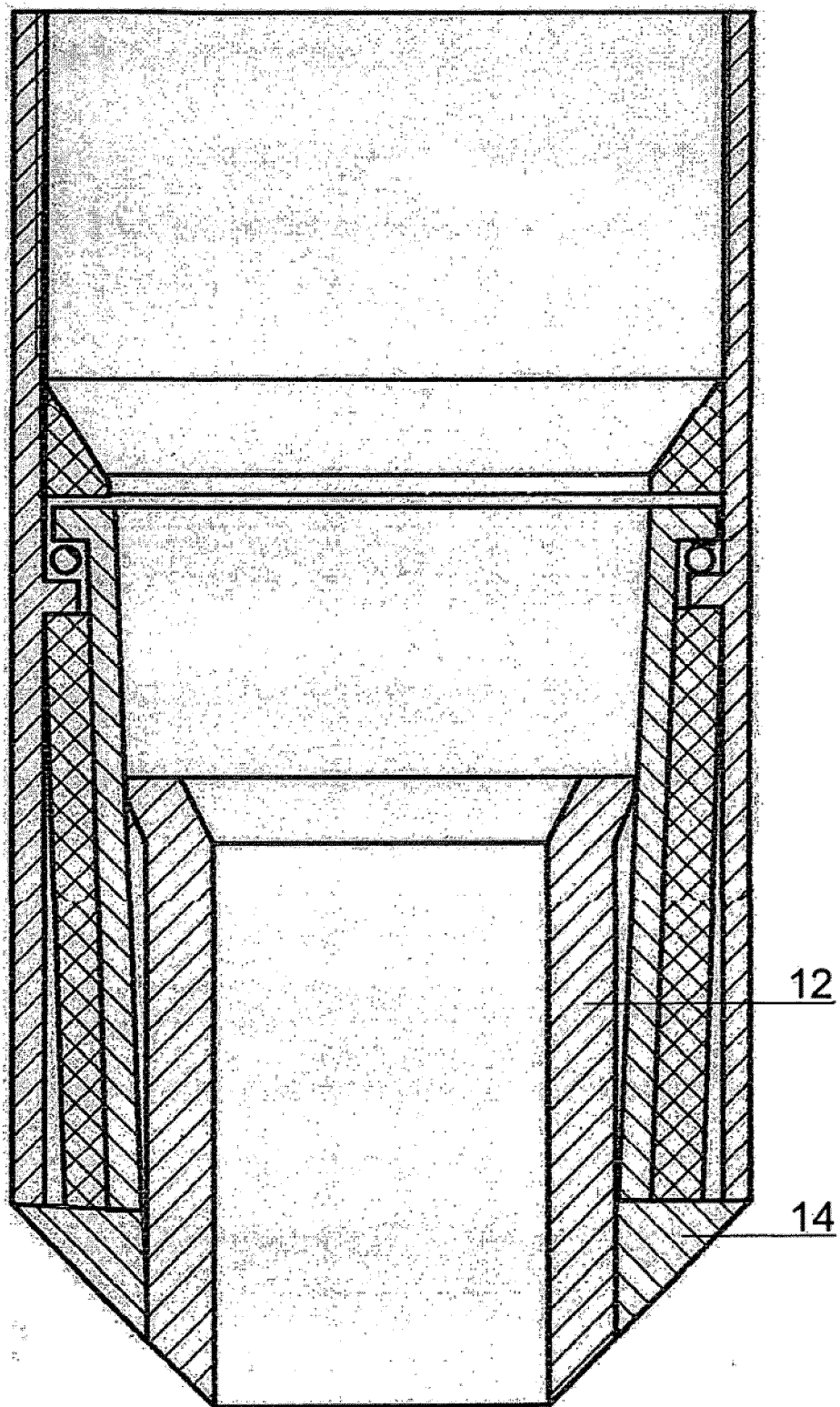


Fig. 4

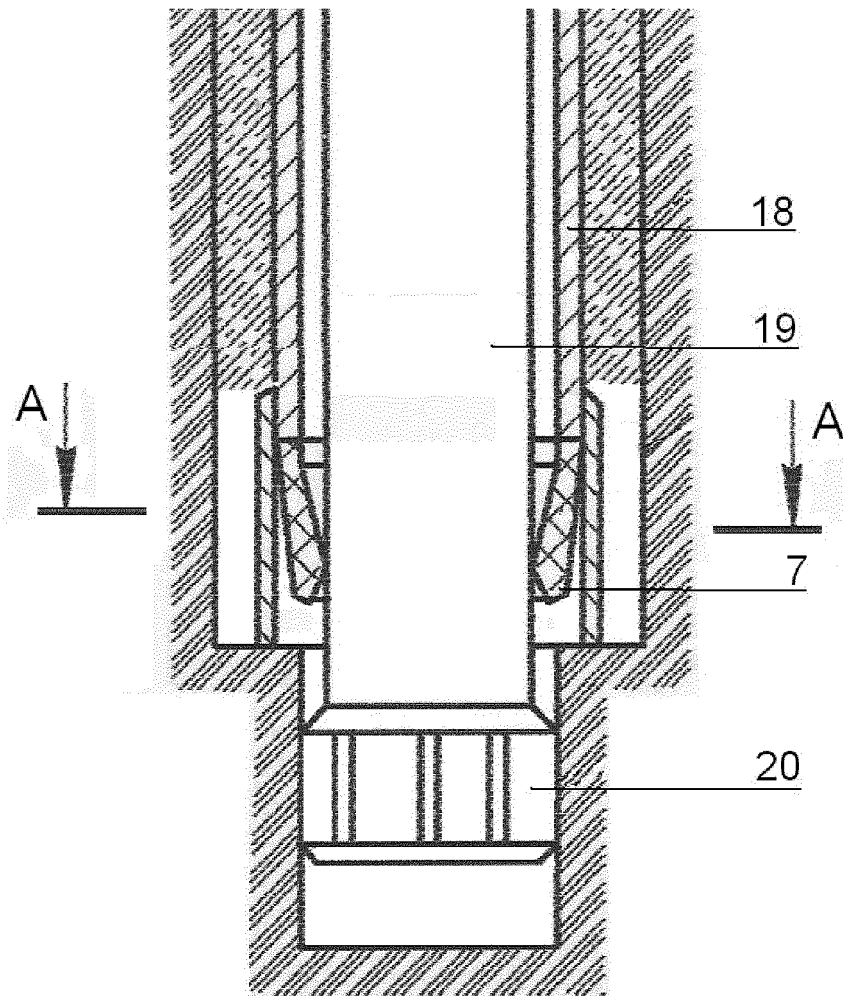


Fig. 5

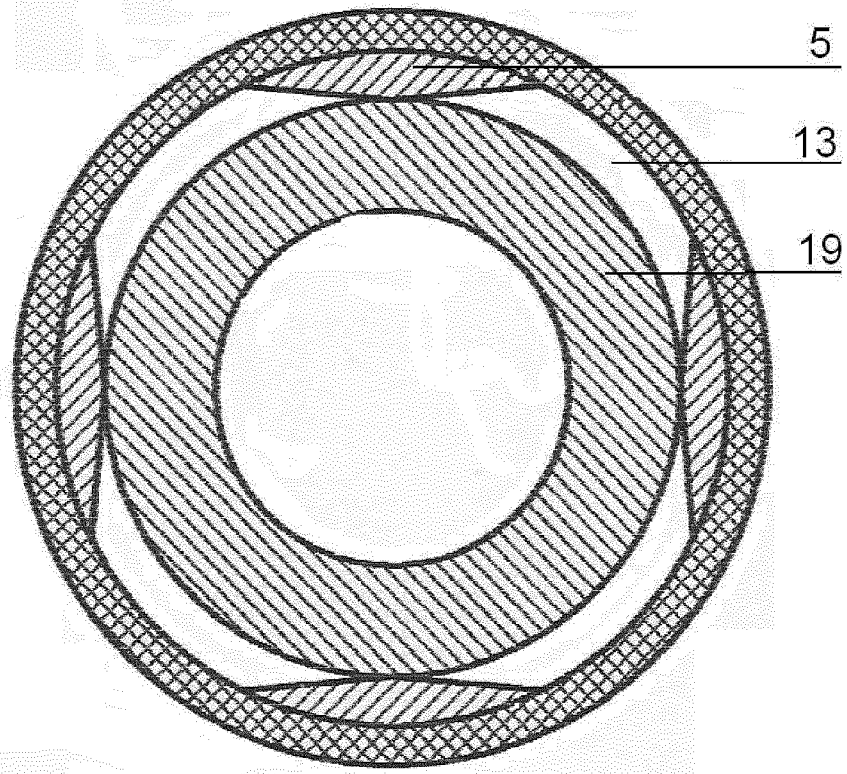


Fig. 6

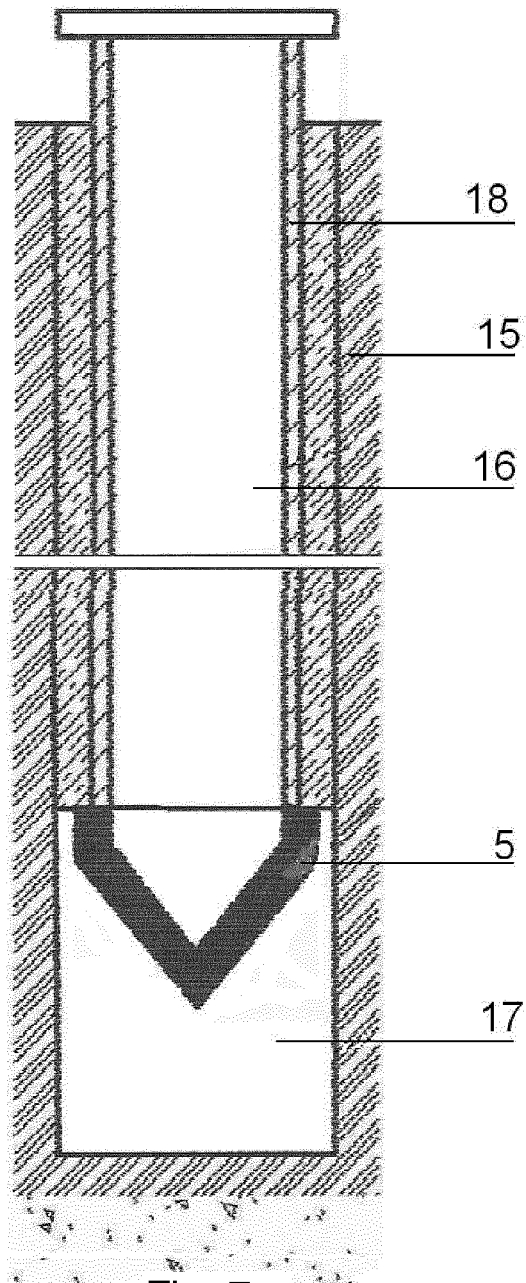


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2010/000294

A. CLASSIFICATION OF SUBJECT MATTER		E21B 34/14 (2006.01) E21B 43/00 (2006.01)
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)		
E21B 21/00, 21/08, 21/10, 33/00, 33/10, 34/00, 34/06, 34/08, 34/12, 34/14, 43/00		
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)		
EAPATIS, Esp@cenet, RUPTO, PatSearch		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	RU 2250354 C2 (OTKRYTOE AKTSIONERNOE OBSHESTVO "NAUCHNO-PROIZVODSTVENNOE OBEDINENIE "BURENIE" et al.) 20.04.2005	1-4
A	SU 874993 A (OSOBOE KONSTRUKTORSKOE BYURO PO PROEKTIROVANIYU NEFTEG AZODOBYVAYUSCHIK MASHIN I OBORUDOVANIYA MINISTERSTVA KHIMICHESKOGO I NEFTYANOGO MASHINOSTROENIYA) 26.10.1981	1-4
A	RU 2311526 C2 (OTKRYTOE AKTSIONERNOE OBSHESTVO "NAUCHNO-PROIZVODSTVENNOE OBEDINENIE "BURENIE") 27.11.2007	1-4
A	US 2009/0065257 A1 (JOE NOSKE et al.) 12.03.2009	1-4
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "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 "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) "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 "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 "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 "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 "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
13 September 2010 (13.09.2010)		30 September 2010 (30.09.2010)
Name and mailing address of the ISA/		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- RU 2312203 C2 [0002]
- RU 2311526 C2 [0002]
- RU 2293839 C1 [0002]
- RU 2234595 C1 [0002]
- RU 2224087 C2 [0002]
- RU 2172815 C1 [0002]
- RU 2169829 C1 [0002]
- RU 2160357 C2 [0002]
- RU 2145024 C1 [0002]
- RU 2112863 C1 [0002]
- RU 2107152 C1 [0002]
- RU 2094593 C1 [0002]
- RU 2021490 C1 [0002]
- RU 2011797 C1 [0002]
- RU 32183 U1 [0002]
- RU 25527 U1 [0002]
- RU 22174 U1 [0002]
- RU 2304693 C2 [0004]
- RU 2125643 C1 [0004]
- RU 37762 U1 [0004]
- RU 2027847 C1 [0005]
- RU 76961 U1 [0005]
- RU 2208126 C2 [0006]
- RU 2013519 C1 [0006]
- RU 45770 U1 [0006]
- RU 2341643 C1 [0008]