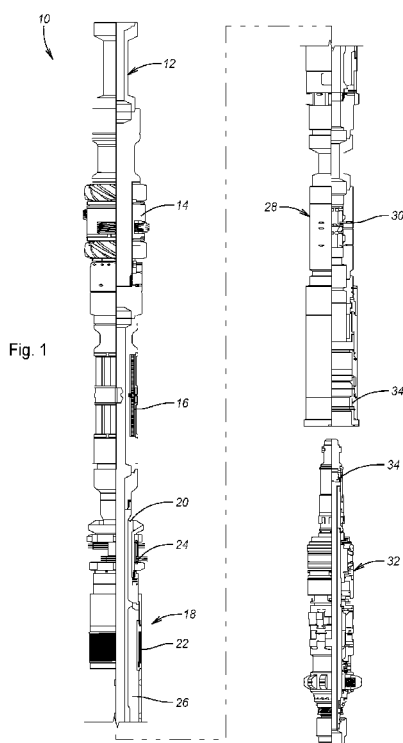




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PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
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[Continued on next page]

(54) **Title:** ONE TRIP WELLBORE CLEANUP AND SETTING A SUBTERRANEAN TOOL METHOD

(57) **Abstract:** A one trip method of cleaning a portion of the borehole and then setting a tool such as a packer or a bridge plug locates the cleanup tools above the plug with a ported sub to allow circulation of loosened debris. The debris is directed uphole from above the plug and does not have to pass around the sealing element of the plug or through bypass ports in the plug body. The plug is then positioned in the cleaned portion and set. The cleaning tools are released from the set plug and brought to the surface. These tools could be used to clean the portion of the borehole where the tool is set or clean the entire section above the tool on the trip out of the borehole. Cleaning tools can be filter, scrapers both fixed and movable, magnets, brushes and associated tools that centralize the assembly for more effective operation.



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
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— *as to the applicant's entitlement to claim the priority of
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Declarations under Rule 4.17:

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a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

ONE TRIP WELLBORE CLEANUP AND SETTING
A SUBTERRANEAN TOOL METHOD

Inventors: James L. Holloway; Samuel K. Kruger
and Christopher R. Matthews-Ewald

FIELD OF THE INVENTION

[0001] The field of the invention is one trip systems that effectively clean the borehole while delivering a tool to be set and then positioning the tool in the cleaned portion of the well for actuation which releases the running string from the tool for removal of the cleaning tool or tools.

BACKGROUND OF THE INVENTION

[0002] Residue accumulates on tubular walls in borehole from drilling mud or well fluids. This residue needs to be removed before setting tools against an existing tubular in the borehole. More often than not a separate trip is made to clean the well before running in and setting the tool in question. Using two trips takes a lot of time and costs money so a one trip approach is a logical goal of streamlining the process.

[0003] One approach to the solution has been to simply circulate the well with the tool in the hole with the hope that circulation will do a good enough job in the zone where the tool is to be set. This technique is shown in US8347968 and suffers from an inability to focus on a small portion of a wellbore where the tool is to be set and the spotty effectiveness of circulation as a technique for effectively removing debris from a specific portion of the well where such removal is most critical.

[0004] One method has combined milling and scraping but while mentioning a packer in passing to be set in a polished bore, it does not indicate that the packer is delivered in the same trip as the milling and scraping tools. That reference is US 7096950.

[0005] US6896064 illustrates a cleanup tool mounted below a packer with the purpose of cleaning the wellbore and then setting the packer in a single trip. There are several issues with this design that discloses a fixed dimension scraper immediately below the packer. One is that the loosened debris will need to be passed around the packer sealing element or through bypasses built into the mandrel body of the packer. Either way there is a serious chance that the packer will become stuck as debris tries to get around or through it even

before it is set. Debris can stick to the outside of the packer element preventing it from getting a good seal. Once the cleaning is done and the packer is set, the cleaning tools are still hanging on the underside of the packer and may later also require milling out whether still supported by the packer or even if dropped to the hole bottom in the event there is a further extension of the borehole.

[0006] The cleaning tools theoretically could also be retrieved in the event that the tool is a retrievable packer/bridge plug. However, retrieval could be extremely difficult if the tool is exposed to wellbore fluids for an extended amount of time, which could limit the ability of scrapers to expand and contract to different wellbore geometries.

[0007] The shortcomings described above are avoided with the present invention where the cleaning tools are located above the packer or plug or other tool to be set, with a disconnect in between so that the running string and the cleaning equipment can be released and removed from the borehole. By incorporating a circulation sub also above the packer and below the cleaning equipment, the loosened debris can be circulated out uphole of the packer to spare the packer or plug the issue of potential sticking with debris that has to pass by or through it as in US6896064. Those skilled in the art will have a better understanding of the invention from a review of the description of the preferred embodiment and the associated drawing while appreciating that the full scope of the invention is to be determined from the appended claims.

SUMMARY OF THE INVENTION

[0008] A one trip method of cleaning a portion of the borehole and then setting a tool such as a packer or a bridge plug locates the cleanup tools above the plug with a ported sub or a ball actuated circulation valve to allow circulation of loosened debris. The debris is directed uphole from above the plug and does not have to pass around the sealing element of the plug or through bypass ports in the plug body. The plug is then positioned in the cleaned portion and set. The cleaning tools are released from the set plug and brought to the surface. Cleaning tools can be filter, scrapers both fixed and movable, magnets, brushes and associated tools that centralize the assembly for more effective operation. In an alternative use the cleaning tools can be

activated on the trip out of the borehole either with the packer or plug if it is retrievable or without it if it is not retrievable.

BRIEF DESCRIPTION OF THE DRAWING

[0009] The Figure is a part section and part exterior view of the assembly of the plug and the cleaning equipment located uphole of the plug.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] A bottom hole assembly (BHA) **10** is supported by a string **12** at a desired location in a borehole that is not shown. A non-rotating casing scraper **14** is shown above magnets **16**. A wellbore filter assembly **18** is further downhole and it comprises an inlet **20** and a screened outlet **22**. The brushes are oriented to bypass flow for running in the hole and to line up to redirect flow into inlet **20** when the BHA **10** is pulled uphole. Chamber **26** holds the collected and diverted debris on movement uphole of the BHA **10**.

[0011] Item **28** is a schematically represented ported sub or circulation valve assembly that can be as simple as an inline valve or preferably have a selectively opened side port **30** so that in some BHAs **10** where it is desired to circulate while cleaning the borehole such circulation can take place above the bridge plug **32** and a disconnect **34** that is immediately above the bridge plug **32**.

[0012] While cleaning can take place on the trip into the wellbore the preferred method is to bring the plug **32** rapidly to beyond where it will ultimately be set. At this point the cleaning equipment that can be radially extend or otherwise manipulated into cleaning mode can be put in that mode and movement uphole can commence to cover at least the intended setting location for the plug **32**. Once that zone of the borehole is cleaned the plug **32** is positioned in the cleaned zone and set and released at disconnect **34** allowing the string **12** to take with it the cleaning equipment down to the upper part of the disconnect **34**.

[0013] Those skilled in the art will appreciate that a one trip method allows borehole cleanup for the length of an existing tubular or a part thereof with string movement in either direction with a tool to then be set later in the cleaned portion of the borehole as part of the bottom hole assembly. The loosened debris is preferably circulated out in a manner where it doesn't have to flow through or past the tool. The tool is preferably a packer or bridge plug.

A ported sub located above the tool allows debris to be circulated out at a distance from the tool to better insure that the tool operates reliably after the cleaning.

[0014] The BHA can use one or more known cleaning tools with a disconnect that can be actuated with a dropped ball on a seat with applied pressure or with string manipulation, to name a few possibilities. In that manner the BHA is removable with the tool such as a plug set in a borehole for abandonment. Other tools such as anchors for whipstocks for example can be the tool run in on a single trip. Centralizers can be integrated with the cleanup tools to enhance their performance. As an alternative the cleaning can be accomplished in a different location than where the tool is set such as setting a packer in an un-cleaned portion and releasing the cleaning tools from the set packer to clean above or uphole of the set packer or plug.

[0015] The plug or packer can be retrievable in which case the packer or plug can be removed at a later time or even with the cleaning equipment. The cleaning equipment can be operated with circulation on the trip out of the hole after the plug or packer are set.

[0016] The above description is illustrative of the preferred embodiment and many modifications may be made by those skilled in the art without departing from the invention whose scope is to be determined from the literal and equivalent scope of the claims below:

We claim:

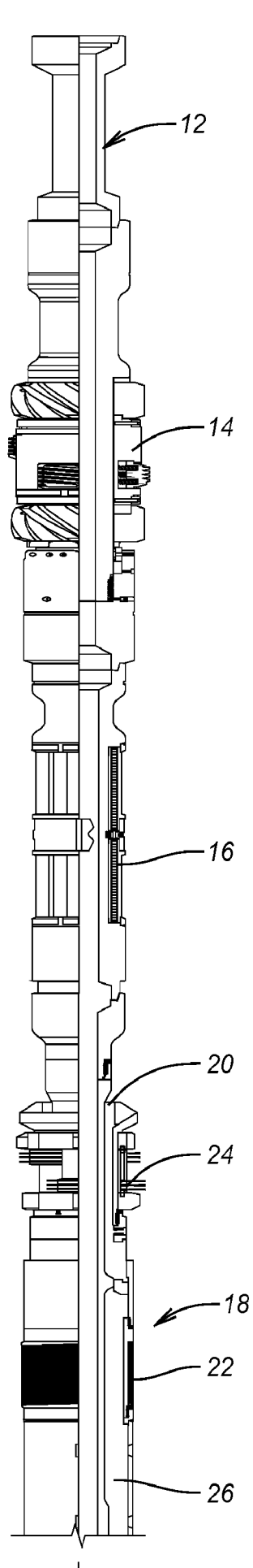
1. A completion method, **characterized by**:
running, in a single trip, a subterranean tool (32) with cleaning equipment (14,16,18, 28) for cleaning at least a portion of a borehole;
actuating said tool (32) in the location cleaned by said cleaning equipment;
removing said cleaning equipment from the borehole after said actuating.
2. The method of claim 1, comprising:
accomplishing said cleaning in a location where the tool (32) is to be actuated;
locating said cleaning equipment (14,16,18, 28) in a bottom hole assembly (10) and uphole from said tool (32).
3. The method of claim 2, comprising:
providing a disconnect (34) between said tool and said cleaning equipment to facilitate said removing.
4. The method of claim 3, comprising:
providing a circulation valve or ported sub (28) between said disconnect and said cleaning equipment for removal of debris with circulation through a string (12) that supports said tool and said cleaning equipment.
5. The method of claim 4, comprising:
avoiding flowing released debris past or through said tool when circulating fluid through said string.
6. The method of claim 5, comprising:
using a packer or plug as said tool (32).
7. The method of claim 6, comprising:
using at least one of a magnet, brush, fixed or movable scraper (14, 16) and a well filter (18) as said cleaning equipment.
8. The method of claim 1, comprising:
providing a disconnect (34) between said tool and said cleaning equipment to facilitate said removing.

9. The method of claim 8, comprising:
providing a ported sub (28) between said disconnect and said cleaning equipment for removal of debris with circulation through a string that supports said tool and said cleaning equipment.
10. The method of claim 1, comprising:
avoiding flowing released debris past or through said tool (32) when circulating fluid through a supporting string (12).
11. The method of claim 1, comprising:
using a packer or plug as said tool (32).
12. The method of claim 1, comprising:
using at least one of a magnet, brush, fixed or movable scraper (14,16) and a well filter (18) as said cleaning equipment.
13. The method of claim 11, comprising:
removing said plug or packer with said cleaning equipment (14,16,18, 28) or in a separate trip at a time after said cleaning equipment has been removed.
14. The method of claim 11, comprising:
operating said cleaning equipment (14,16,18, 28) after release from said plug or packer.

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Fig. 1

10



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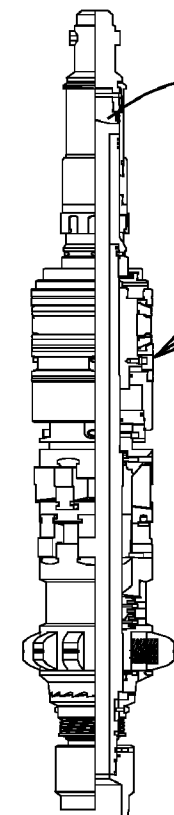
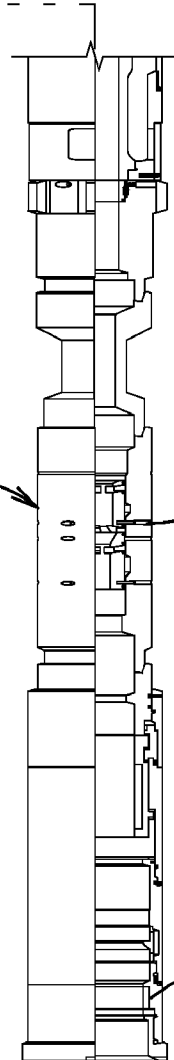
28

30

34

34

32



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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/027818**A. CLASSIFICATION OF SUBJECT MATTER****E21B 37/00(2006.01)i, E21B 33/12(2006.01)i, E21B 23/06(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)

E21B 37/00; E21B 12/06; E21B 37/02; E21B 33/13; E21B 23/00; E21B 43/10; E21B 33/12; E21B 23/06

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: clean, flow, packer, magnet, port and debris

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012-0211229 A1 (FIELDER et al.) 23 August 2012 See paragraphs [0004]–[0041], claim 1 and figures 1–2.	1–2, 8–11, 14
Y		3–7, 12–13
Y	US 2009-0272524 A1 (VOTH, RICKEY C.) 05 November 2009 See paragraphs [0037]–[0041] and figures 1–2.	3–7, 13
Y	US 2011-0168404 A1 (TELFER et al.) 14 July 2011 See paragraph [0005].	7, 12
A	US 2014-0246239 A1 (BAKER HUGHES INCORPORATED) 04 September 2014 See paragraphs [0019]–[0027] and figures 1–7.	1–14
A	US 2012-0222861 A1 (ERIKSEN, ERIK PETER) 06 September 2012 See paragraphs [0032]–[0040] and figures 1A–3C.	1–14



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 2012-0222861 A1	06/09/2012	EP 2675988 A1 EP 2675988 A4 US 8851167 B2 WO 2012-119249 A1	25/12/2013 22/04/2015 07/10/2014 13/09/2012