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(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) **Title:** FILTRATION MEDIA FOR AN OPEN HOLE PRODUCTION SYSTEM HAVING AN EXPANDABLE OUTER SURFACE

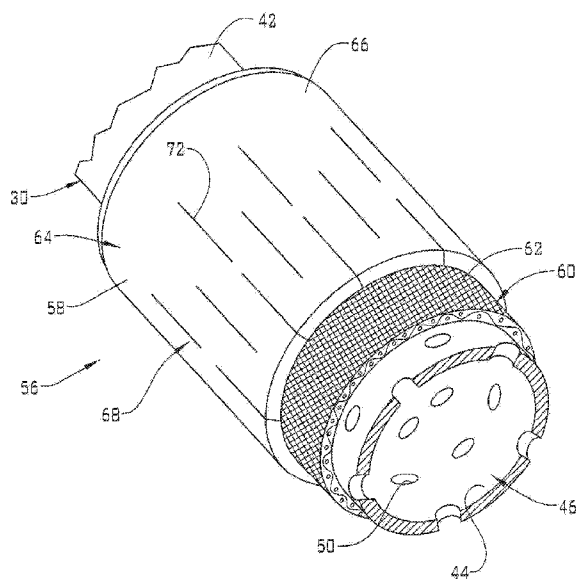


FIG. 2

(57) **Abstract:** A subsurface system includes a tubular having an opening. A filtration media is mounted about the tubular over the opening. The filtration media includes a selectively expandable outer surface positioned over the opening. The selectively expandable outer surface includes one or more selectively expandable openings. The one or more selectively expandable openings transition from a first dimension to a second dimension upon expansion of the selectively expandable outer surface.

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

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

FILTRATION MEDIA FOR AN OPEN HOLE PRODUCTION SYSTEM HAVING AN EXPANDABLE OUTER SURFACE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Application No. 16/027499, filed on July 5, 2018, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] In the resource exploration and recovery industry, the formation of boreholes for the purpose of locating and producing fluids typically involves introducing a tubular into a wellbore formed in a formation. The tubular typically includes one or more screen systems that filter produced fluids before passing into the tubular. In open hole or uncased wellbores, drilling mud is typically directed into the wellbore along with the tubular. The drilling mud supports the wellbore and reduces damage to the formation during run in.

[0003] In order to reduce clogging of the screen assembly, the drilling mud is processed to remove particles that may be larger than the screen openings. Thus, any filter cake that may form on the screen assembly during run in does not block screen openings and impede production. Processing or conditioning the drilling mud to prevent clogging of the screen assembly is a time consuming and costly process. Therefore, the art would be appreciative of alternatives to conditioning drilling mud used during run in of a production tubular.

SUMMARY

[0004] In accordance with an exemplary embodiment, a subsurface system includes a tubular having an opening. A filtration media is mounted about the tubular over the opening. The filtration media includes a selectively expandable outer surface positioned over the opening. The selectively expandable outer surface includes one or more selectively expandable openings. The one or more selectively expandable openings transition from a first dimension to a second dimension upon expansion of the selectively expandable outer surface.

[0005] In accordance with another aspect of an exemplary embodiment, a resource exploration and recovery system includes a first system, and a second system including a tubular string. The tubular string includes one or more tubulars. One of the one or more tubulars includes an opening. A filtration media is mounted about the tubular over the

opening. A selectively expandable outer surface is positioned over the filtration media. The selectively expandable outer surface includes one or more selectively expandable openings. The one or more selectively expandable openings transition from a first dimension to a second dimension upon expansion of the selectively expandable outer surface.

[0006] In accordance with yet another exemplary embodiment, a method of producing formation fluids includes introducing a tubular string supporting a filtration media into a wellbore, flowing drilling fluid into the wellbore with the tubular string, positioning the filtration media at a target depth, expanding an outer surface of the filtration media, wherein expansion of the outer surface exposes an opening formed in the tubular to formation fluids, and introducing formation fluids through the outer surface and into the tubular through the opening.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

[0008] FIG. 1 depicts a resource exploration and recovery system including a filtration media having a selectively expandable cover, in accordance with an exemplary embodiment;

[0009] FIG. 2 depicts a cross-section end view of the filtration media and selectively expandable cover in a first configuration, in accordance with an aspect of an exemplary embodiment;

[0010] FIG. 3 depicts a cross-section end view of the filtration media and selectively expandable cover in a second configuration, in accordance with an aspect of an exemplary embodiment;

[0011] FIG. 4 depicts a flow chart describing a method of producing formation fluids through the filtration media of FIG. 1, in accordance with an exemplary aspect;

[0012] FIG. 5 depicts the filtration media of FIG. 2 including a buildup of filter cake, in accordance with an exemplary aspect; and

[0013] FIG. 6 depicts the filtration media of FIG. 3 with expansion of the selectively expandable cover breaking up the filter cake, in accordance with an exemplary aspect.

DETAILED DESCRIPTION

[0014] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

[0015] A resource exploration and recovery system, in accordance with an exemplary embodiment, is indicated generally at 10, in FIG. 1. Resource exploration and recovery system 10 should be understood to include well drilling operations, completions, resource extraction and recovery, CO₂ sequestration, and the like. Resource exploration and recovery system 10 may include a first system 14 which, in some environments, may take the form of a surface system 16 operatively and fluidically connected to a second system 18 which, in some environments, may take the form of a subsurface system (not separately labeled).

[0016] First system 14 may include a control system 23 that may provide power to, monitor, communicate with, and/or activate one or more downhole operations as will be discussed herein. Surface system 16 may include additional systems such as pumps, fluid storage systems, cranes and the like (not shown). Second system 18 may include a tubular string 30 that extends into a wellbore 34 formed in a formation 36. Tubular string 30 may be formed by a series of interconnected discrete tubulars or by a single tubular that could take the form of coiled tubing. Wellbore 34 includes an annular wall 38 defining an open hole configuration.

[0017] Referring to FIG. 2, and with continued reference to FIG. 1, tubular string 30 includes an outer surface 42 and an inner surface 44 that defines a fluid passage 46. A plurality of openings 50 are provided on a selected region of tubular string 30. The plurality of openings may fluidically connect fluid passage 46 and wellbore 34. A filtration media 56 is provided on tubular string 30 and positioned over a plurality of openings 50. Filtration media 56 includes a selectively expandable outer surface 58, an intermediate layer 60 that may be defined by a mesh layer 62 that filters fluids passing between wellbore 34 and fluid passage 46. Mesh layer 62 may be defined by one or more layers (not shown) of a wire mesh material (not separately labeled). Further, each layer of the wire mesh may include openings having different sizes.

[0018] In accordance with one exemplary embodiment, selectively expandable outer surface 58 may be defined by a selectively expandable cover 64. In an embodiment, selectively expandable cover 64 may take the form of a metal sheath 66 that may be caused to increase in diameter. Of course, it should be understood that selectively expandable cover 64 may be formed from other materials. Selectively expandable cover 64 includes a plurality of

selectively expandable openings, one of which is indicated at 68. Selectively expandable openings 68 may take the form of slits 72 that extends through selectively expandable cover 64.

[0019] In further accordance with an exemplary embodiment, selectively expandable openings 68 may include a first dimension, such as shown in FIG. 2. As will be detailed herein, after expansion of selectively expandable cover 64, selectively expandable openings may increase in size so as to be defined by a second dimension that is greater than the first dimension, such as shown in FIG. 3. The first dimension may represent a closed configuration. As such, the first dimension may be about 0.0 inches (0.0 cm). The second dimension represents an open configuration. Size of the second dimension may vary.

[0020] Reference will now follow to FIG. 4 in describing a method 200 of producing formation fluids through tubular string 30. Tubular string 30 is run into formation 36 as indicated in block 202. Along with tubular string 30, drilling fluid or mud is introduced into wellbore 34 as indicated in block 204. Filtration media 56 is guided to a target depth as indicated in block 206. At this point, it should be understood that tubular string 30 may support multiple screen assemblies that are delivered to corresponding target depth. One or more screen assemblies may be separated from others of the screen assemblies by packers that form various production zones.

[0021] As tubular string 30 is run into wellbore 34, a filter cake 207, may form on filtration media 56 at slits 72 as indicated in block 208 and shown in FIG. 5. Filter cake may be formed by material in wellbore 34 and or entrained particles in the drilling fluid accumulating on filtration media 56. With slits 72 being substantially closed, only a small portion of particles forming the filter cake 207 may flow through to intermediate layer 60. Once filtration media 56 is at the target depth, selectively expandable cover 64 is radially outwardly expanded as indicated in block 209 thereby opening slits 72 allowing production fluids to pass through filtration media 54 into tubular string 30.

[0022] For example, a tool (not shown) may be introduced into filtration media 56 to expand selectively expandable cover 64. Alternatively, a release mechanism (also not shown) could be triggered to activate a component run in with tubular string 30 to radially outwardly expand selectively expandable cover 64. Radial outward expansion of selectively expandable cover 64 causes filter cake 207 to break up and be released from filtration media 54 as shown in FIG. 6.

[0023] Radial outward expansion of selectively expandable cover 64 also causes selectively expandable openings 68 to transition from the first dimension (FIG. 2) to the

second dimension (FIG. 3). In this manner, production fluids may pass through filtration media 56 into fluid passage 46 as indicted in block 210. If any filter cake remains, selectively expandable openings 68 are sized such that particles may pass through cracks or openings (not separately labeled) in filter cake 207 and then through selectively expandable cover 64. Further, production fluids may pass through any cracks or openings formed in any filter cake remaining on filtration media 56. In this manner, operators may no longer need to condition drilling fluids prior to production. That is, selectively expandable cover ensures that filter cake 207, formed by particles in the drilling fluid, is broken up allowing unimpeded flow of formation fluids into tubular string 30.

[0024] Set forth below are some embodiments of the foregoing disclosure:

[0025] Embodiment 1: A subsurface system including: a tubular including an opening; and a filtration media mounted about the tubular over the opening, the filtration media including a selectively expandable outer surface positioned over the opening, the selectively expandable outer surface including one or more selectively expandable openings, the one or more selectively expandable openings transitioning from a first dimension to a second dimension upon expansion of the selectively expandable outer surface.

[0026] Embodiment 2: The subsurface system as any prior embodiment, wherein the selectively expandable outer surface is defined by a selectively expandable cover that extends about the tubular.

[0027] Embodiment 3: The subsurface system as any prior embodiment, wherein the selectively expandable cover comprises a metal sheath

[0028] Embodiment 4: The subsurface system as any prior embodiment, wherein the first dimension is about 0.0 inches (0.0 cm)

[0029] Embodiment 5: The subsurface system as any prior embodiment, wherein the one or more selectively expandable openings comprise slits formed in the selectively expandable outer surface

[0030] Embodiment 6: A resource exploration and recovery system including: a first system; a second system including a tubular string, the tubular string including one or more tubulars, one of the one or more tubulars including an opening; a filtration media mounted about the tubular over the opening; and a selectively expandable outer surface positioned over the filtration media, the selectively expandable outer surface including one or more selectively expandable openings, the one or more selectively expandable openings transitioning from a first dimension to a second dimension upon expansion of the selectively expandable outer surface.

[0031] Embodiment 7: The resource exploration and recovery system as any prior embodiment, wherein the selectively expandable outer surface is defined by a selectively expandable cover that extends about the tubular.

[0032] Embodiment 8: The resource exploration and recovery system as any prior embodiment, wherein the selectively expandable cover comprises a metal sheath

[0033] Embodiment 9: The resource exploration and recovery system as any prior embodiment, wherein the first dimension is about 0.0 inches (0.0 cm)

[0034] Embodiment 10: The resource exploration and recovery system as any prior embodiment, wherein the one or more selectively expandable openings comprise slits formed in the selectively expandable outer surface.

[0035] Embodiment 11: A method of producing formation fluids including: introducing a tubular string supporting a filtration media into a wellbore; flowing drilling fluid into the wellbore with the tubular string; positioning the filtration media at a target depth; expanding an outer surface of the filtration media, wherein expansion of the outer surface exposes an opening formed in the tubular to formation fluids; and introducing formation fluids through the outer surface and into the tubular through the opening.

[0036] Embodiment 12: The method as any prior embodiment, wherein expanding of the outer surface forms one or more openings in a cover of the filtration media.

[0037] Embodiment 13: The method as any prior embodiment, further including: transitioning the one or more openings from a first dimension prior to expansion of the cover to a second dimension after expansion of the cover.

[0038] Embodiment 14: The method as any prior embodiment, wherein transitioning to the second dimension is defined by an increase in size.

[0039] Embodiment 15: The method as any prior embodiment, wherein transitioning from the first dimension to the second dimension includes transitioning the one or more openings from a substantially closed configuration to an open configuration after expansion of the outer surface.

[0040] Embodiment 16: The method as any prior embodiment, wherein expanding the outer surface includes introducing a tool into the tubular string.

[0041] Embodiment 17: The method as any prior embodiment, wherein expanding the outer surface includes triggering a release mechanism in the tubular string.

[0042] Embodiment 18: The method as any prior embodiment, wherein expanding the outer surface includes increasing a diameter of a metal sheath.

[0043] Embodiment 19: The method as any prior embodiment, wherein expanding the outer surface causes a filter cake adhered to the filtration media to break.

[0044] Embodiment 20: The method as any prior embodiment, further including: receiving production fluids into the tubular through cracks in the filter cake.

[0045] The terms “about” and “substantially” are intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application. For example, “about” and/or “substantially” can include a range of $\pm 8\%$ or 5% , or 2% of a given value.

[0046] The use of the terms “a” and “an” and “the” and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. Further, it should be noted that the terms “first,” “second,” and the like herein do not denote any order, quantity, or importance, but rather are used to distinguish one element from another.

[0047] The teachings of the present disclosure may be used in a variety of well operations. These operations may involve using one or more treatment agents to treat a formation, the fluids resident in a formation, a wellbore, and / or equipment in the wellbore, such as production tubing. The treatment agents may be in the form of liquids, gases, solids, semi-solids, and mixtures thereof. Illustrative treatment agents include, but are not limited to, fracturing fluids, acids, steam, water, brine, anti-corrosion agents, cement, permeability modifiers, drilling muds, emulsifiers, demulsifiers, tracers, flow improvers etc. Illustrative well operations include, but are not limited to, hydraulic fracturing, stimulation, tracer injection, cleaning, acidizing, steam injection, water flooding, cementing, etc.

[0048] While the invention has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the claims. Also, in the drawings and the description, there have been disclosed exemplary embodiments of the invention and, although specific terms may have been employed, they

are unless otherwise stated used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention therefore not being so limited.

What is claimed is:

1. A subsurface system (10) comprising:
a tubular including an opening (68); and
a filtration media (54, 56) mounted about the tubular over the opening (68), the filtration media (54, 56) including a selectively expandable outer surface (58) positioned over the opening (68), the selectively expandable outer surface (58) including one or more selectively expandable openings (68), the one or more selectively expandable openings (68) transitioning from a first dimension to a second dimension upon expansion of the selectively expandable outer surface (58).
2. The subsurface system (10) according to claim 1, wherein the selectively expandable outer surface (58) is defined by a selectively expandable cover (64) that extends about the tubular.
3. The subsurface system (10) according to claim 2, wherein the selectively expandable cover (64) comprises a metal sheath (66).
4. The subsurface system (10) according to claim 1, wherein the first dimension is about 0.0 inches (0.0 cm).
5. The subsurface system (10) according to claim 1, wherein the one or more selectively expandable openings (68) comprise slits (72) formed in the selectively expandable outer surface (58).
6. A method (200) of producing formation fluids comprising:
introducing a tubular string supporting a filtration media (54, 56) into a wellbore (34);
flowing drilling fluid into the wellbore (34) with the tubular string (30);
positioning the filtration media (54, 56) at a target depth;
expanding an outer surface (42) of the filtration media (54, 56), wherein expansion of the outer surface (42) exposes an opening (68) formed in the tubular to formation fluids; and
introducing formation fluids through the outer surface (42) and into the tubular through the opening (68).
7. The method (200) of claim 6, wherein expanding of the outer surface (42) forms one or more openings (68) in a cover of the filtration media (54, 56).
8. The method (200) of claim 7, further comprising: transitioning the one or more openings (68) from a first dimension prior to expansion of the cover (64) to a second dimension after expansion of the cover (64).
9. The method (200) of claim 8, wherein transitioning to the second dimension is defined by an increase in size.

10. The method (200) of claim 8, wherein transitioning from the first dimension to the second dimension includes transitioning the one or more openings (68) from a substantially closed configuration to an open configuration after expansion of the outer surface (42).
11. The method (200) of claim 6, wherein expanding the outer surface (42) includes introducing a tool into the tubular string (30).
12. The method (200) of claim 6, wherein expanding the outer surface (42) includes triggering a release mechanism in the tubular string (30).
13. The method (200) of claim 6, wherein expanding the outer surface includes increasing a diameter of a metal sheath.
14. The method (200) of claim 6, wherein expanding the outer surface (42) causes a filter cake (207) adhered to the filtration media (54, 56) to break.
15. The method (200) of claim 14, further comprising: receiving production fluids into the tubular through cracks in the filter cake (207).

1/6

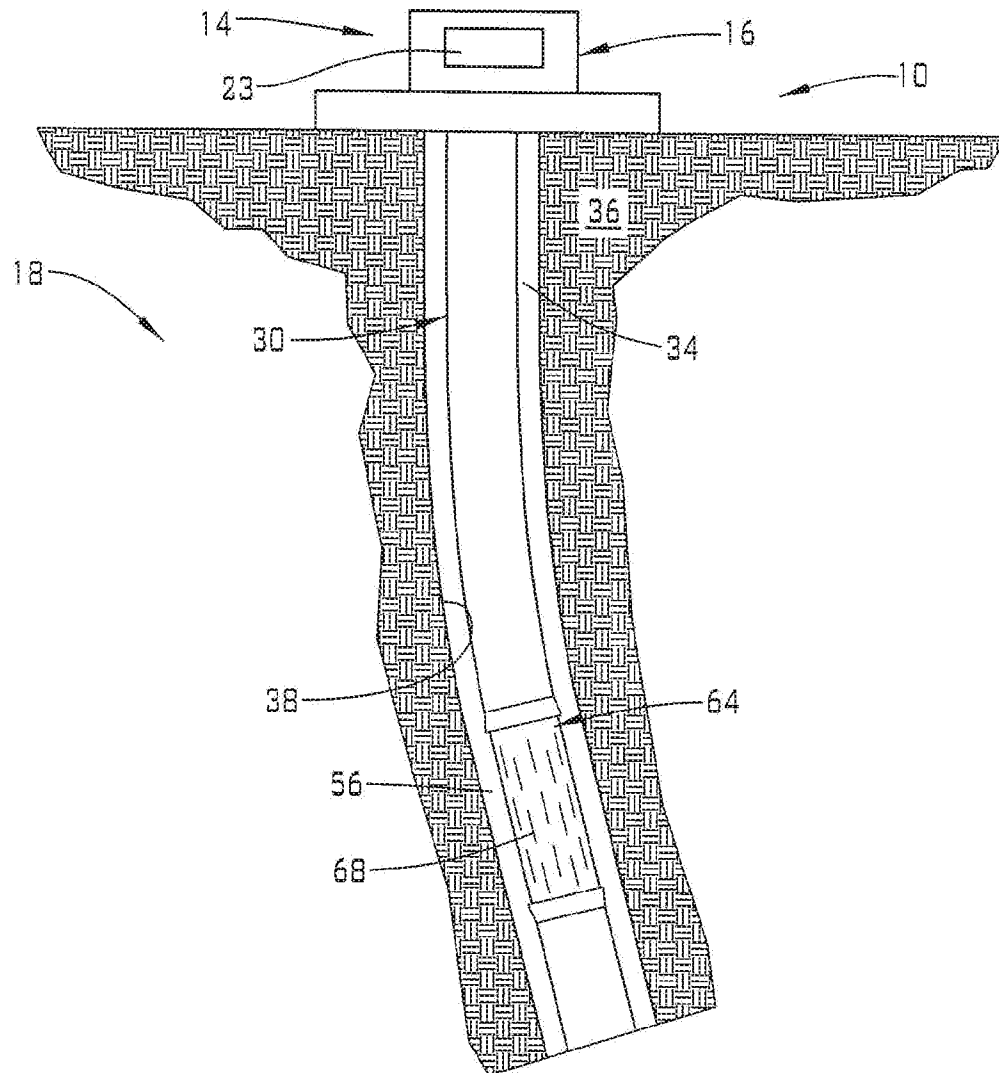


FIG. 1

2/6

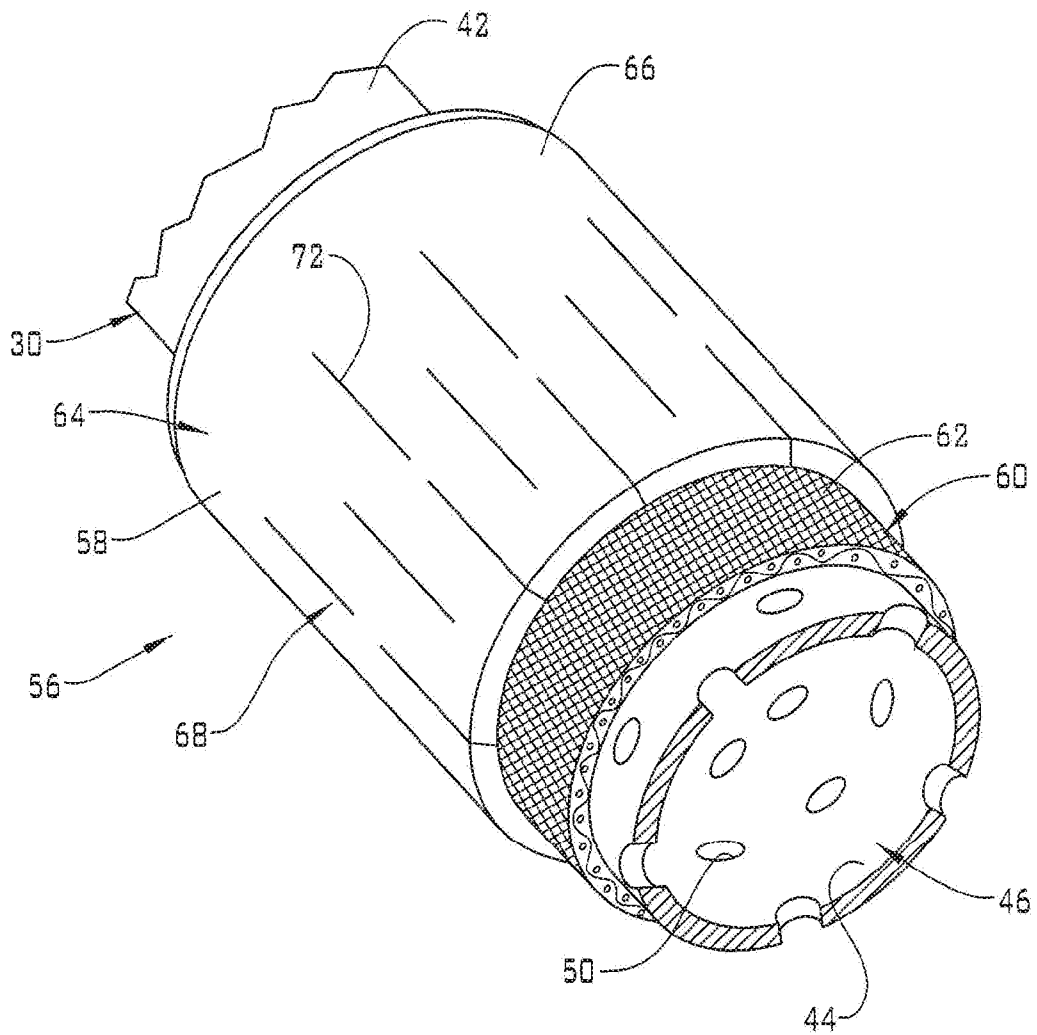


FIG. 2

3/6

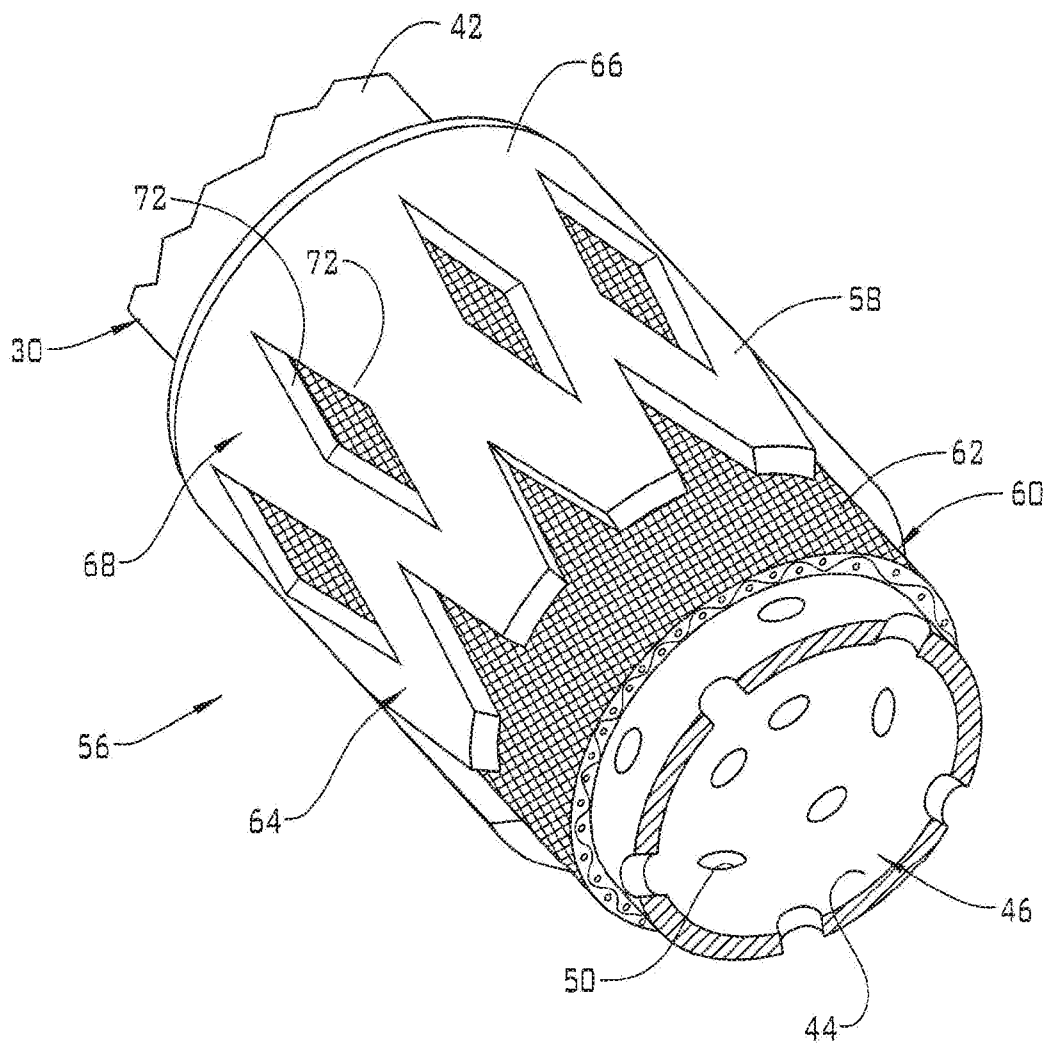
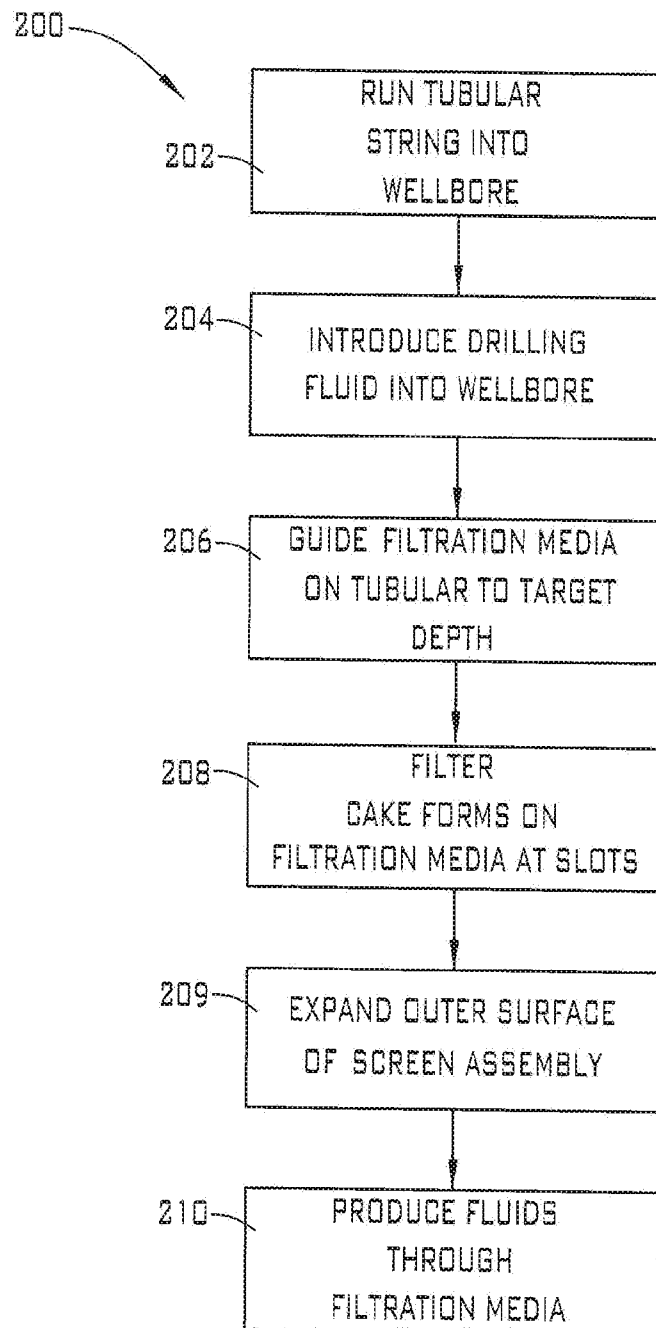


FIG. 3

4/6

**FIG. 4**

5/6

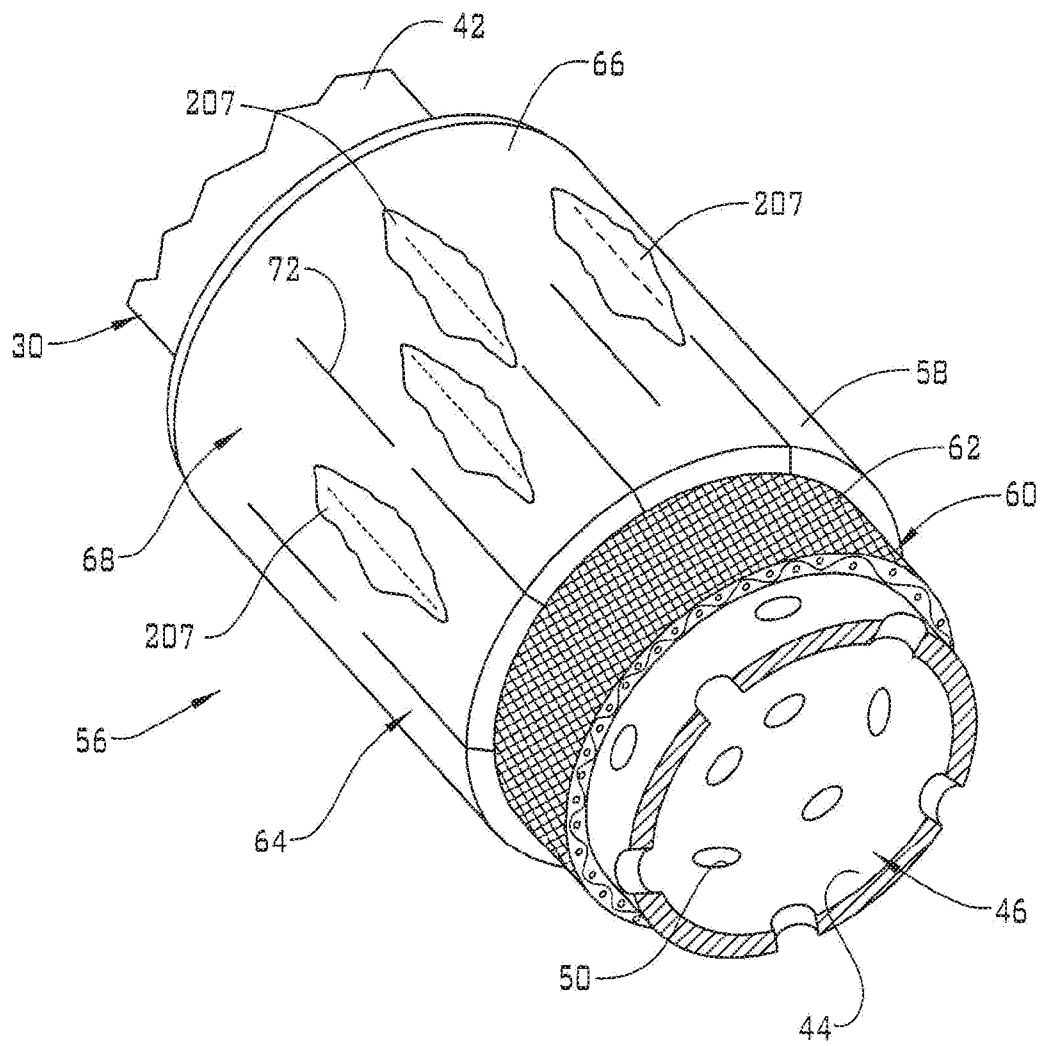


FIG. 5

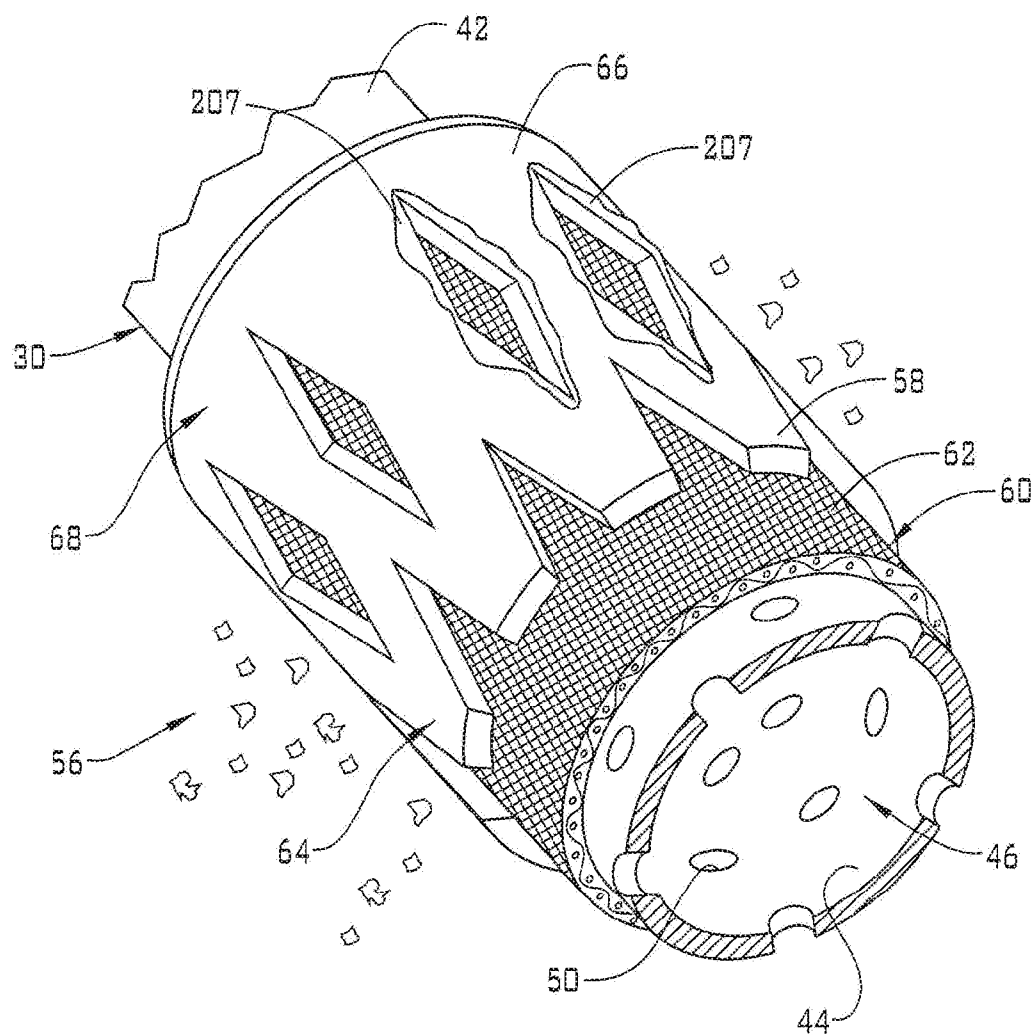


FIG. 6

A. CLASSIFICATION OF SUBJECT MATTER**E21B 43/10(2006.01)i, 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)

E21B 43/10; B32B 1/08; E21B 29/08; E21B 43/08

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: tubular string, filtration media, opening, slit, filter cake

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6523611 B1 (BAKKER et al.) 25 February 2003 See column 3, lines 8-64, column 4, lines 19-21 and figures 3-4.	1-15
Y	US 6932159 B2 (HOVEM, KNUT A.) 23 August 2005 See column 1, lines 6-9, column 2, lines 4-29 and figures 1-2.	1-15
A	US 6315040 B1 (DONNELLY, MARTIN) 13 November 2001 See column 2, line 33 - column 3, line 11 and figures 1-4D.	1-15
A	US 7134501 B2 (JOHNSON et al.) 14 November 2006 See column 4, lines 39-55 and figures 4A-4B.	1-15
A	US 7093653 B2 (METCALFE et al.) 22 August 2006 See column 6, lines 12-21 and figures 5-6.	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"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

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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

Date of the actual completion of the international search

25 September 2019 (25.09.2019)

Date of mailing of the international search report

25 September 2019 (25.09.2019)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea



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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2019/035477

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2019/035477Patent document
cited in search reportPublication
datePatent family
member(s)Publication
date

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22/01/2004