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(54) **Title:** EROSION RESISTANT FILTER EMBEDDED AND SEALED IN A BASE PIPE WALL

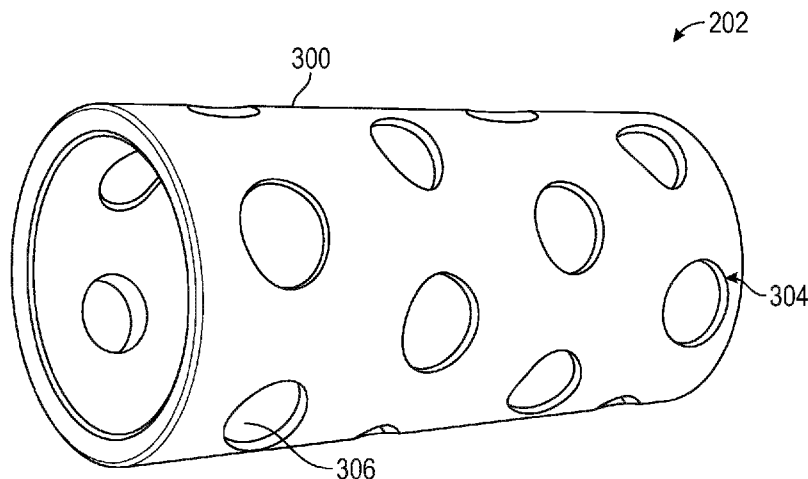


FIG. 3

(57) **Abstract:** The present disclosure generally provides systems and methods and apparatuses for filtering an inflowing formation fluid. In some embodiments, a screen assembly for use within a wellbore includes a base pipe comprising a plurality of holes disposed therein and a filter disposed within one of the plurality of holes. The filter includes a filter disk and an elastomeric seal having a circular cross-sectional area. The screen assembly further includes a plurality of axial wires disposed over the outer surface of the base pipe, and a plurality of wrap wires perpendicularly disposed over the periphery of the plurality of axial wires.



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**EROSION RESISTANT FILTER EMBEDDED AND SEALED IN A BASE PIPE
WALL**

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CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to United States Provisional Patent Application No. 63/582,018, filed September 12, 2023, the entirety of which is herein incorporated by reference.

BACKGROUND

[0002] In many oil and gas well applications, a borehole is drilled into the earth and subsequently completed with equipment, i.e., completion equipment, to facilitate production of desired fluids from a reservoir. The completion equipment may comprise various types of sand control equipment, e.g. sand screen filters, which block the inflow of sand as the oil and/or gas flow into the completion equipment.

[0003] The completion equipment may be assembled by connecting sand screen joints and deploying the sand screen joints downhole into the wellbore to a desired well zone. In a variety of applications, the wellbore may comprise multiple well zones and a plurality of sand screen joints may be disposed along each of the well zones. Within each well zone, the individual sand screen joints may comprise inflow ports through which the well fluid flows into the interior of the completion equipment for production to the surface. Each sand screen joint of the plurality of sand screen joints may be retained within a pipe wall, e.g., a retaining ring configured to maintain a pressure on the sand screen joint to prevent the sand screen joint from dislodging from the pipe wall.

[0004] Accordingly, improved systems of retaining sand screen joints within a pipe wall are needed.

SUMMARY

[0005] In an aspect, the present disclosure generally provides a method and apparatus for filtering an inflowing formation fluid.

[0006] In some embodiments, a screen assembly for use within a wellbore includes a base pipe comprising a plurality of holes disposed therein and a filter disposed within one of the

plurality of holes. The filter includes a filter disk and an elastomeric seal having a circular cross-sectional area. The screen assembly further includes a plurality of axial wires disposed over the outer surface of the base pipe, and a plurality of wrap wires perpendicularly disposed over the periphery of the plurality of axial wires.

[0007] In some embodiments, a screen assembly for use within a wellbore includes a base pipe comprising a plurality of holes disposed therein. At least one of the plurality of holes has a first thread disposed on the interior sidewall of the hole. The screen assembly further includes a filter disposed within one of the plurality of holes. The filter includes a filter disk coupled to the base pipe via a threaded connection.

[0008] In some embodiments, a method for producing formation fluids from a formation includes positioning a screen assembly within a wellbore extending through the formation. The screen assembly includes a base pipe and a plurality of filters positioned along the base pipe. The method further includes filtering an inflowing fluid stream from the wellbore via the screen assembly. At least one of the plurality of filters includes a filter disk having a cavity disposed concentrically along a lateral sidewall of the filter disk, and an elastomeric seal having a circular cross-sectional area disposed within the cavity of the filter disk.

BRIEF DESCRIPTION OF DRAWINGS

[0009] So that the manner where the above recited features may be understood in detail, a more particular description, briefly summarized above, may be had by reference to example aspects, some of which are illustrated in the appended drawings.

[0010] FIG. 1 is a schematic illustration of a well system, according to an embodiment.

[0011] FIG. 2 is a cross-sectional schematic view of a screen assembly, according to an embodiment.

[0012] FIG. 3 is an illustration of a perspective view of a base pipe, according to an embodiment.

[0013] FIG. 4A is a schematic cross-sectional view of a filter, according to an embodiment.

[0014] FIG. 4B is a schematic cross-sectional view of a filter, according to an embodiment.

[0015] FIG. 4C is a schematic cross-sectional view of a filter, according to an embodiment.

[0016] FIG. 5 is a partial cross-sectional view of a screen assembly, according to an embodiment.

[0017] FIG. 6A illustrates a side view of a screen assembly, according to an embodiment.

[0018] FIG. 6B illustrates a side view of a screen assembly, according to an embodiment.

[0019] To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to the figures. It is contemplated that elements disclosed in one embodiment may be beneficially utilized on other embodiments without specific recitation.

DETAILED DESCRIPTION

[0020] In the following description, numerous details are set forth to provide an understanding of some embodiments of the present disclosure. However, it will be understood by those of ordinary skill in the art that that embodiments of the present disclosure may be practiced without these details and that numerous variations or modifications from the described embodiments may be possible.

[0021] In the specification and appended claims: the terms “connect,” “connection,” “connected,” “in connection with,” “connecting,” “couple,” “coupled,” “coupled with,” and “coupling” are used to mean “in direct connection with” or “in connection with via another element.” As used herein, the terms “up” and “down,” “upper” and “lower,” “upwardly” and “downwardly,” “upstream” and “downstream,” “uphole” and “downhole,” “above” and “below,” and other like terms indicating relative positions above or below a given point or element are used in this description to more clearly describe some embodiments of the disclosure.

[0022] The present disclosure relates to methods of sealing erosion resistant filters in a base pipe wall. The present disclosure provides a reduced amount of force to dispose the erosion resistant material in the base pipe wall by utilizing an elastomeric seal comprising at least an arcuate surface. Moreover, the present disclosure provides enhanced stability of the erosion resistant material by providing an outer diameter of about 1 cm to about 5 cm, thereby reducing contact between adjacent erosion resistant filters of the plurality of erosion resistant filters in

the base pipe wall. The present disclosure provides reduced gaps between the erosion resistant filters and/or the base pipe wall using the elastomeric seal, a threaded seal, and/or a retention housing. The retention housing can further reduce a gap between the erosion resistant filter and the base pipe wall due to pressure exerted on the erosion resistant filter by a retention ring that is brazened to the retention housing. Additional pressure to seal the erosion resistant filter to further seal the erosion resistant material in the base pipe wall can be achieved by disposing a wrap wire and/or axial wire over the base pipe wall. Additionally, the wrap wire and/or axial wire can include a course gap and/or filtration gap to provide additional filtration of erosion materials prior to interacting with the erosion resistant filters.

[0023] FIG. 1 is a well system 100 that includes a wellbore 102 having a deviated wellbore section 104 extending into a formation 106 containing hydrocarbon fluids. Depending on the application, the wellbore 102 may comprise one or more deviated wellbore sections 104, *e.g.* horizontal wellbore sections, which may be cased or un-cased. In the example illustrated, a tubing string 108 is deployed downhole into wellbore 102 and comprises a downhole well completion 110 deployed in the deviated, *e.g.* horizontal, wellbore section 104.

[0024] The downhole well completion 110 may be constructed to facilitate production of well fluids and/or injection of fluids. By way of example, the downhole well completion 110 may comprise at least one screen assembly 112, *e.g.* a plurality of screen assemblies 112. Each screen assembly 112 may include a shroud 114 that covers a screen filter, as described in more detail below, through which fluid may enter the corresponding screen assembly 112 for production to a suitable location, *e.g.* a surface location. For example, hydrocarbon well fluids may flow from formation 106, into wellbore 102, and into the screen assemblies 112 via sand screens 114. In some embodiments, the downhole well completion 110 also may comprise a plurality of packers 116 which may be used to isolate sections or zones 118 along the wellbore 102.

[0025] FIG. 2 is a cross-sectional view of a screen assembly 112 according to one or more embodiments of the present disclosure. As described above, multiple sand screen assemblies 112 may be coupled to a tubing string, such as the tubing string 108 described above. The screen assembly 112 includes an outer wrap 200 is disposed around a base pipe 202 such that an annular space 204 is created between the primary housing 200 and the base pipe 202.

[0026] In one or more embodiments of the present disclosure, there may be ribs 206 positioned within the annular space 204 and extending between the outer wrap 200 and the base pipe 202. In one or more embodiments of the present disclosure, the outer wrap 200 may include a metallic material, such as any one or more grades of stainless steel (e.g., 316, 825, and/or 625 grades). For example, the outer wrap 200 may include wire that is wrapped around the base pipe 202, shown in FIG. 2 and described in detail with reference to FIG 5, 6A, and 6B.

[0027] FIG. 3 is a base pipe 202 according to one or more embodiments of the present disclosure. In the exemplary embodiment, the base pipe 202 includes a tubular member 300 having multiple holes 304. As shown in FIG. 3, a filter 306 is disposed within each of the holes 304. The filter 306 can be disposed within each of the holes 304 according to one or more elastomeric seals, threaded connections, adhesives, and/or retention housings, as described herein, with reference to FIGS 4A-4C.

[0028] In some embodiments, the filter 306 or component thereof may have orifices sized between about 100 microns and about 700 microns. In other embodiments, the filters may have orifices smaller than 100 microns or larger than 700 microns. In at least one embodiment, a filter 306 can include a filter disk (e.g., a filter disk 401 as described herein, with reference to FIGS 4A-4C) having a plurality of linear slots to filter particulates and/or debris from an inflowing fluid. The linear slots can include a width of less than about 5mm and a length of less than about 20 mm. In at least one embodiment, the plurality of linear slots are oriented in a parallel array. The linear slots may be disposed through the entirety of the filter disk, such that an inflowing fluid is able to traverse through the filter 306. In at least one embodiment, the linear slots include a tapered width, such that the width of the linear slot at a position on the interior of the filter disk is less than the width of the linear slot on the top, bottom, or both surfaces of the filter disk. Further, the filter 306 or component thereof may include and/or be composed of or coated with an erosion resistant material. For example, the filter 306 or component thereof may be composed of or be coated with a ceramic material, tungsten carbide, a porous powdered metal, a zirconia toughened alumina, or other similar materials.

[0029] Although the above description refers to the filter 306 disposed within the base pipe 302, the invention is not thereby limited. In one or more embodiments, the filter 306 may be used in the sand screen assemblies to at least partially prevent the intrusion of undesirable particles, such as sand and/or other debris within the wellbore, into the base pipe.

[0030] The filters can include an outer dimension having a diameter of about 1 cm to about 5 cm (as defined by the diameter of the filter), an inner dimension having a diameter of about 0.1 cm to about 5 cm (as defined by the diameter of the filter disk), a bore dimension of about 0.1 cm to about 5 cm (as defined by the thickness of the base pipe 202), an insert dimension of about 0.1 cm to about 5 cm (as defined by the thickness of the filter), and/or a thru hole of about 0.1 cm to about 5 cm (as defined by the diameter of the thru hole). In an embodiment, an insert dimension of about 1 cm to about 5 cm can allow for reduced bore dimension and base pipe wall diameters to be used downhole, thereby reducing the wellbore diameter and increasing efficiency of oil production. Moreover, an insert dimension having a diameter of about 1 cm to about 5 cm can allow for filters to implemented in a through tubing gravel pack.

[0031] FIG. 4A is an exemplary embodiment of a filter 400a, such as a filter 306 disposed within a hole 304 of the base pipe 202. The filter 400a can include a filter disk 401 having a cavity 402 disposed concentrically along a lateral sidewall 404 of the filter disk 401. The cavity 402 can include a depth 402a of about 1 mm to about 1 cm. In some embodiments, the filter disk 401 is a circular disk configured such that the cavity 402 is continually disposed along the circumference of the lateral sidewall 404. The filter disk 401 includes a plurality of filter slots 406 disposed in the filter disk 401. For example, the plurality of filter slots 406 may extend through the filter disk 401 through a cross-section of the filter disk 401. The filter 400a may also include one or more components, such as one or more seal bands 408 and/or an elastomeric seal 410 (e.g., an O-ring), disposed within the cavity 402. The components of the filter 400a illustrated in FIG. 4A may be oriented in such a manner that fluids and/or particulates/debris are prevented from bypassing the filter 306 when entering the base pipe 202. In at least one embodiment, the elastomeric seal 410 forms a friction based connection between the components of the filter 400a and the interior sidewall of a hole 304 of the base pipe 202. Without being bound by theory, a reduced magnitude of force to manufacture the friction based connection between the components of the filter 400a and the interior sidewall of a hole 304 of the base pipe may be achieved due to the elastomeric seal including an arcuate surface as described herein.

[0032] In some embodiments, the filter 400a includes one or more seal bands 408 disposed within the cavity 402. In at least one embodiment, the one or more seal bands 408 are configured to abut the top and/or bottom surface(s) of the cavity 402, as illustrated in FIG. 4A. The one or more metal bands 408 may also be configured to be disposed along the

circumference of the top and/or bottom surface(s) of the cavity 402. The one or more seal bands may be composed of any suitable elastomeric material used in a downhole tool, such as a fluoro-elastomer, nitrile butyl rubber (NBR), and/or hydrogenated nitrile butyl rubber (HNBR).

[0033] In some embodiments, the filter 400a includes an elastomeric seal 410 disposed within the cavity 402. The elastomeric seal 410 may be disposed within the cavity 402 of the filter disk 401 such that the elastomeric seal 410 is disposed along the circumference of the cavity 402. In some embodiments, the elastomeric seal 410 may be configured to include any suitable cross-sectional size and/or geometry, such that the elastomeric seal 410 occupies a portion of the volume of the cavity 402. The elastomeric seal 410 may be configured to occupy greater than about 50 % of the volume within the cavity 402, such as about 80 % to about 99.9 %. The elastomeric seal 410 may occupy a significant portion of the volume of the cavity 402 to ensure that the connection between the filter 400a and the interior sidewall of a hole 304 does not allow for the inflowing fluid to bypass the filter 306. In at least one embodiment, the elastomeric seal 410 includes at least one arcuate surface. The elastomeric seal 410 may be configured to have any suitable cross-sectional geometry, such that the elastomeric seal 410 has a cross-sectional area of occupies a significant portion of the volume of the cavity 402. In some embodiments, the elastomeric seal 410 has a rounded cross-sectional geometry, such as a circular cross-sectional geometry. The elastomeric seal 410 may configured to include a circular cross-sectional geometry having a cross-sectional diameter of about 0.5 mm to about 5 mm. The elastomeric seal 410 may be composed of any suitable elastomeric material and/or blends thereof, such as a fluoro-elastomer, nitrile butyl rubber (NBR), and/or hydrogenated nitrile butyl rubber (HNBR).

[0034] Without being bound by theory, the geometry of the elastomeric seal 410 was found to have a correlation to the force required to install the elastomeric seal into the cavity 402 and to install the filter 400a into the base pipe 202. In some instances, the materials used in the filter 400a and components thereof (e.g., the filter disk 401) are ceramic materials. As such, it is desirable for the elastomeric seal 410 installation to be conducted at a reduced force requirement, compared to conventional elastomeric seal installations, without affecting the overall performance of the elastomeric seal. Furthermore, it was determined that the geometry of the elastomeric seal 410 in combination with relative size of the filter disk 401 improves the overall structural integrity of the filter 400a when being installed into the base pipe 202 and

when in use within a well bore. Additionally, reducing the risk of fracturing the plurality of filters 400a during installation can provide improved cost-effectiveness and reduced operational downtime.

[0035] FIG. 4B is an exemplary embodiment of a filter 400b, such as a filter 306 disposed within a hole 304 of the base pipe 202. In some embodiments, the interior sidewall of the hole 304 includes a thread series disposed therein. As illustrated in FIG. 4B, the filter disk 401 may include a thread series disposed concentrically along a lateral sidewall 404 of the filter disk 401. The thread series of the filter disk 401 may be configured to couple the filter disk 401 within the base pipe 202 via the complimentary thread series disposed on the interior sidewall of the hole 304. The components of the filter 400b illustrated in FIG. 4B may be oriented in such a manner that fluids and/or particulates/debris are prevented from bypassing the filter 306 when entering the base pipe 202.

[0036] FIG. 4C is an exemplary embodiment of a filter 400c, such as a filter 306 disposed within a hole 304 of the base pipe 202. In some embodiments, the interior sidewall of the hole 304 includes a thread series disposed therein. The filter 400c may include a filter disk 401, a filter disk housing 412, and a retention ring 414. The filter disk 401 may be configured to rest within an interior portion of the filter disk housing 412. The filter disk 401 may include a one or more protrusions 416 which may contact an interior portion of the filter disk housing 412. The one or more protrusions 416 may support the filter disk 401 once introduced into the filter disk housing 412. In at least one embodiment, the filter disk 401 includes a single protrusion disposed concentrically along the circumference of a lateral sidewall 404 of the filter disk 401. The filter disk housing 412 may include a thread series disposed concentrically along a lateral sidewall 418 of the filter disk housing 412. The thread series of the filter disk housing 412 may be configured to couple the filter 400c within the base pipe 202 via the complimentary thread series disposed on the interior sidewall of the hole 304. The retention ring 414 may be configured to rest within a recess formed by introducing the filter disk 401 into the interior of the filter disk housing 412. In at least one embodiment, the retention ring 414 is configured to rest on the one or more protrusions 416 of the filter disk, as shown in FIG. 4C.

[0037] Once configured, the retention ring 414 may be adhered to the filter disk housing 412 to lock the filter disk 401 in place. The retention ring 414 may be adhered to the filter disk housing 412 via any one or more methods known to one of ordinary skill in the art, such as soldering, brazing, welding, gluing, and the like. Additionally and/or alternatively, the one or

more protrusions 416 of the filter disk 401 are in constant contact with the filter disk housing 412, the retention ring 414, or both. In at least one embodiment, the one or more protrusions 416 of the filter disk 401 are in contact with the filter disk housing 412 and the retention ring 414 such that no space exists between the filter disk housing 412, the one or more protrusions 416 of the filter disk 401, and the retention ring 414. The components of the filter 400c illustrated in FIG. 4C may be oriented in such a manner that fluids and/or particulates/debris are prevented from bypassing the filter 306 when entering the base pipe 202.

[0038] In some embodiments, the filter disk housing 412 is composed of any one or more suitable materials. In some embodiments, the retention ring 414 is composed of any one or more suitable metal materials, such as any one or more grades of stainless steel (e.g., 316, 825, and/or 625 grades) and/or other corrosion resistant alloys.

[0039] FIG. 5 is partial cross-sectional view of a screen assembly 500 (e.g., a screen assembly 112) having a filter 306 (e.g., filters 400a, 400b, and/or 400c) disposed within a base pipe 202. While FIG. 5 shows the filter 306 disposed within a hole 304 of the base pipe 202 according to a friction connection between the components of the filter 306 and the interior sidewall of the hole 304, the filter 306 may be disposed within the hole 304 of the base pipe 202 via a friction connection and/or a threaded connection between the components of the filter 306 and the interior sidewall of the hole 304. In some embodiments, it may be desirable to add an additional means of retention to keep the filter 306 within the base pipe 202, other than the friction and/or threaded connections thereto. The addition of a direct wrap “cage” may be implemented to further enhance the retention of the filter 306 within the base pipe 202. For example, the addition of the direct wrap “cage” may be implemented where an elastomeric seal is used to provide a friction based connection between the components of the filter 400a and the interior sidewall of a hole 304 of the base pipe 202. Alternatively, a direct wrap “cage” may not be implemented where a threaded seal is used to provide a threaded based connection between the components of the filter 400a and the interior sidewall of a hole 304 of the base pipe 202.

[0040] As shown in FIG. 5, a direct wrap “cage” may include a plurality of axial wires 502 (e.g., ribs 206) and wrap wires 504 disposed over the outer diameter of the base pipe 202 and over the surfaces of one or more filters 306 disposed within the one or more holes 304 throughout the base pipe 202. The axial wires 502 may be disposed directly over the outer surface of the base pipe 202 and over the surfaces of the one or more filters 306. The axial

wires 502 provide a backing for the one or more filters 306 such that any radially outward movement of the one or more filters 306 results in contact with the bottom of the axial wires 502, thereby preventing and/or eliminating radially outward movement of the one or more filters 306. Thus, the axial wires 502 enhance retention of the one or more filters 306 disposed within the one or more holes 304 throughout the base pipe 202.

[0041] In addition to the axial wires 502, a direct wrap “cage” may also include a series of wrap wires 504 perpendicularly disposed over the periphery of the axial wires 502, as shown in FIG. 5. The orientation of the wrap wires 504 may be modified to further enhance retention of the one or more filters 306 disposed within the one or more holes 304 throughout the base pipe 202 (e.g., the orientation of the wrap wires 504 illustrate in FIG. 6A), or to further increase the filtration efficiency of the screen assembly 500 by adding an extra filtration layer through which the well fluid must flow before contacting the one or more filters 306 disposed within the one or more holes 304 throughout the base pipe 202 (e.g., the orientation of the wrap wires 504 illustrate in FIG. 6B). Such orientation modifications may be made via altering the size of a gap between individual wrap wires 504 disposed around the screen assembly, as shown in Figures 6A and 6B.

[0042] FIG. 6A illustrates a side view of a screen assembly 500 according to an embodiment, in which the wrap wires 504 are oriented to further enhance retention of the one or more filters 306. That is to say that the gap between individual wrap wires 504 disposed around the screen assembly 500 does not have to be small enough to filter various particulates from the well fluid. In some embodiments, the gap between individual wrap wires 504 can be from about 0.01 cm to about 5 cm.

[0043] FIG. 6B illustrates a side view of a screen assembly 500 according to an embodiment, in which the wrap wires 504 are oriented to enhance filtration efficiency of the screen assembly 500. That is to say that the gap between individual wrap wires 504 disposed around the screen assembly 500 should be small enough to filter larger particulates from the well fluid before contacting the one or more filters 306 disposed within the one or more holes 304 throughout the base pipe 202. In some embodiments, the gap between individual wrap wires 504 can be from about 0.001 cm to about 0.05 cm.

[0044] In some embodiments, a sheath (not shown) may be disposed over the wrap wires 504 and/or the base pipe 202. For example, the sheath may be disposed over the wrap wires

504 where an elastomeric seal is used to provide a friction based connection between the components of the filter 400a and the interior sidewall of a hole 304 of the base pipe 202. Additionally, or alternatively, the sheath may be disposed over the base pipe 202 where a threaded seal is used to provide a threaded based connection between the components of the filter 400a and the interior sidewall of a hole 304 of the base pipe 202.

[0045] The sheath can be disposed perpendicular to the wrap wires 504. The sheath can be disposed offset a longitudinal angle of the wrap wires 504. The sheath can include a woven mesh, a metal mesh, a louvered shroud, a perforated shroud, or any other suitable cover to prevent a direct pass-through of erosive particles to the filter disk. In some embodiments, the sheath can include an erosion resistant coating such as a ceramic coating to enhance longevity of the sheath. In some embodiments, one or more sheaths may be overlapped over the wrap wires and/or the base pipe 202. By overlapping one or more sheaths over the wrap wires 504 and/or the base pipe 202, further filtration of erosive particles may be achieved.

[0046] In at least one embodiment, one or more screen assemblies 112 of any one or more configurations disclosed herein may be used in a downhole wellbore and/or wellbore operations. The one or more screen assemblies 112 may be used to produce formation fluids from a formation, such as a wellbore. As such, the one or more configurations of the one or more screen assemblies 112 disclosed herein may be utilized to filter an inflowing fluid stream from the wellbore. In at least one embodiment, a screen assembly 112 is configured to include one or more filters 306 disposed within the base pipe 202. The filters 306 may have any one or more configurations (e.g., 400a, 400b, and/or 400c) disclosed herein to filter particulates and/or debris from an inflowing fluid stream. Additionally and/or alternatively, the one or more screen assemblies 112 may also include the wrap wires 504 in a configuration to further enhance filtration of the inflowing fluid. In at least one embodiment, the one or more screen assemblies 112 are configured to substantially remove the particulates and/or debris from an inflowing fluid stream. As used herein, a range that includes the term between is intended to include the upper and lower limits of the range; e.g., between 50 and 150 includes both 50 and 150. Additionally, the term “approximately” includes all values within 5% of the target value; e.g., approximately 100 includes all values from 95 to 105, including 95 and 105. Further, approximately between includes all values within 5% of the target value for both the upper and lower limits; e.g., approximately between 50 and 150 includes all values from 47.5 to 157.5, including 47.5 and 157.5.

[0047] Overall, the present disclosure relates to methods of sealing erosion resistant filters in a base pipe wall. The present disclosure provides a reduced amount of force to dispose the erosion resistant material in the base pipe wall by utilizing an elastomeric seal comprising at least an arcuate surface. Moreover, the present disclosure provides enhanced stability of the erosion resistant material by providing an outer diameter of about 1 cm to about 5 cm, thereby reducing contact between adjacent erosion resistant filters of the plurality of erosion resistant filters in the base pipe wall. The present disclosure provides reduced gaps between the erosion resistant filters and/or the base pipe wall using the elastomeric seal, a threaded seal, and/or a retention housing. The retention housing can further reduce a gap between the erosion resistant filter and the base pipe wall due to pressure exerted on the erosion resistant filter by a retention ring that is brazened to the retention housing. Additional pressure to seal the erosion resistant filter to further seal the erosion resistant material in the base pipe wall can be achieved by disposing a wrap wire and/or axial wire over the base pipe wall. Additionally, the wrap wire and/or axial wire can include a course gap and/or filtration gap to provide additional filtration of erosion materials prior to interacting with the erosion resistant filters.

[0048] The phrases, unless otherwise specified, “consists essentially of” and “consisting essentially of” do not exclude the presence of other steps, elements, or materials, whether or not, specifically mentioned in this specification, so long as such steps, elements, or materials, do not affect the basic and novel characteristics of the present disclosure, additionally, they do not exclude impurities and variances normally associated with the elements and materials used.

[0049] Numerical ranges used herein include the numbers recited in the range. For example, the numerical range “from 1 wt % to 10 wt %” includes 1 wt % and 10 wt % within the recited range.

[0050] For the sake of brevity, only some ranges are explicitly disclosed herein. However, ranges from any lower limit may be combined with any upper limit to recite a range not explicitly recited, as well as, ranges from any lower limit may be combined with any other lower limit to recite a range not explicitly recited, in the same way, ranges from any upper limit may be combined with any other upper limit to recite a range not explicitly recited. Additionally, within a range includes every point or individual value between its end points even though not explicitly recited. Thus, every point or individual value may serve as its own lower or upper limit combined with any other point or individual value or any other lower or upper limit, to recite a range not explicitly recited.

[0051] All numerical values within the detailed description herein are modified by “about” the indicated value, and take into account experimental error and variations that would be expected by a person having ordinary skill in the art.

[0052] All documents described herein are incorporated by reference herein, including any priority documents and or testing procedures to the extent they are not inconsistent with this text. As is apparent from the foregoing general description and the specific embodiments, while forms of the present disclosure have been illustrated and described, various modifications can be made without departing from the spirit and scope of the present disclosure. Accordingly, it is not intended that the present disclosure be limited thereby. Likewise, the term “comprising” is considered synonymous with the term “including” for purposes of United States law. Likewise whenever a composition, an element or a group of elements is preceded with the transitional phrase “comprising,” it is understood that we also contemplate the same composition or group of elements with transitional phrases “consisting essentially of,” “consisting of,” “selected from the group of consisting of,” or “is” preceding the recitation of the composition, element, or elements and vice versa.

[0053] The specific embodiments described herein have been illustrated by way of example, and it should be understood that these embodiments may be susceptible to various modifications and alternative forms. It should be further understood that the claims are not intended to be limited to the particular forms disclosed, but rather to cover all modifications, equivalents, and alternatives falling within the spirit and scope of this disclosure.

[0054] The techniques presented and claimed herein are referenced and applied to material objects and concrete examples of a practical nature that demonstrably improve the present technical field and, as such, are not abstract, intangible or purely theoretical. Further, if any claims appended to the end of this specification contain one or more elements designated as “means for (perform)ing (a function)...” or “step for (perform)ing (a function)...”, it is intended that such elements are to be interpreted under 35 U.S.C. 112(f). However, for any claims containing elements designated in any other manner, it is intended that such elements are not to be interpreted under 35 U.S.C. 112(f).

[0055] Although a few embodiments of the disclosure have been described in detail above, those of ordinary skill in the art will readily appreciate that many modifications are possible without materially departing from the teachings of this disclosure. Accordingly, such

modifications are intended to be included within the scope of this disclosure as defined in the claims.

WHAT IS CLAIMED IS:

1. A screen assembly for use within a wellbore, the screen assembly comprising:
a base pipe comprising a plurality of holes disposed therein;
a filter disposed within one of the plurality of holes, wherein the filter comprises a filter disk and an elastomeric seal having a circular cross-sectional area;
a plurality of axial wires disposed over the outer surface of the base pipe; and
a plurality of wrap wires perpendicularly disposed over the periphery of the plurality of axial wires.
2. The screen assembly of claim 1, wherein the filter disk comprises a cavity disposed concentrically along a lateral sidewall of the filter disk, the cavity comprising a top surface, a bottom surface, and a volume.
3. The screen assembly of claim 2, wherein the cavity comprises a depth of about 1 mm to about 1 cm.
4. The screen assembly of claim 2, wherein the elastomeric seal having a circular cross-sectional area is disposed within the cavity, the elastomeric seal occupying about 80 % to about 99.9 % of the volume.
5. The screen assembly of claim 1, wherein the at least one of the plurality of axial wires is disposed over the filter.
6. The screen assembly of claim 2, wherein a surface of the elastomeric seal contacts an interior sidewall of a hole disposed in the base pipe.
7. A screen assembly for use within a wellbore, the screen assembly comprising:
a base pipe comprising a plurality of holes disposed therein, wherein at least one of the plurality of holes comprises a first thread disposed on the interior sidewall of the hole; and
a filter disposed within one of the plurality of holes, the filter comprising a filter disk coupled to the base pipe via a threaded connection.

8. The screen assembly of claim 7, wherein the filter disk comprises a second thread disposed concentrically along a lateral sidewall of the filter disk.
9. The screen assembly of claim 8, wherein the second thread of the filter disk is configured to couple the filter disk to the base pipe via the threaded connection.
10. The screen assembly of claim 7, wherein the filter disk comprises a protrusion disposed concentrically along the circumference of a lateral sidewall of the filter disk.
11. The screen assembly of claim 10, wherein the filter disk is positioned within a filter disk housing, the protrusion contacting an interior portion of the filter disk housing.
12. The screen assembly of claim 11, wherein a retention ring is positioned within a recess formed between the filter disk and the filter disk housing.
13. The screen assembly of claim 12, wherein the retention ring is coupled to the filter disk housing.
14. The screen assembly of claim 12, wherein the retention ring is configured to abut the protrusion of the filter disk.
15. The screen assembly of claim 12, wherein the protrusion is in contact with the filter disk housing, the retention ring, or a combination thereof.
16. The screen assembly of claim 14, wherein the protrusion is in contact with the filter disk housing and the retention ring.
17. The screen assembly of claim 12, wherein the screen assembly further comprises a plurality of axial wires disposed over the outer surface of the base pipe and a plurality of wrap wires perpendicularly disposed over the periphery of the plurality of axial wires.
18. A method for producing formation fluids from a formation, the method comprising:

positioning a screen assembly comprising a base pipe and a plurality of filters positioned along the base pipe within a wellbore extending through the formation; and

filtering an inflowing fluid stream from the wellbore via the screen assembly, wherein at least one of the plurality of filters comprises:

a filter disk comprising a cavity disposed concentrically along a lateral sidewall of the filter disk, and

an elastomeric seal having a circular cross-sectional area disposed within the cavity of the filter disk.

19. The method of claim 18, wherein the cavity comprises a top surface, a bottom surface, and a volume.

20. The method of claim 19, wherein the elastomeric seal occupies about 80 % to about 99.9 % of the volume.

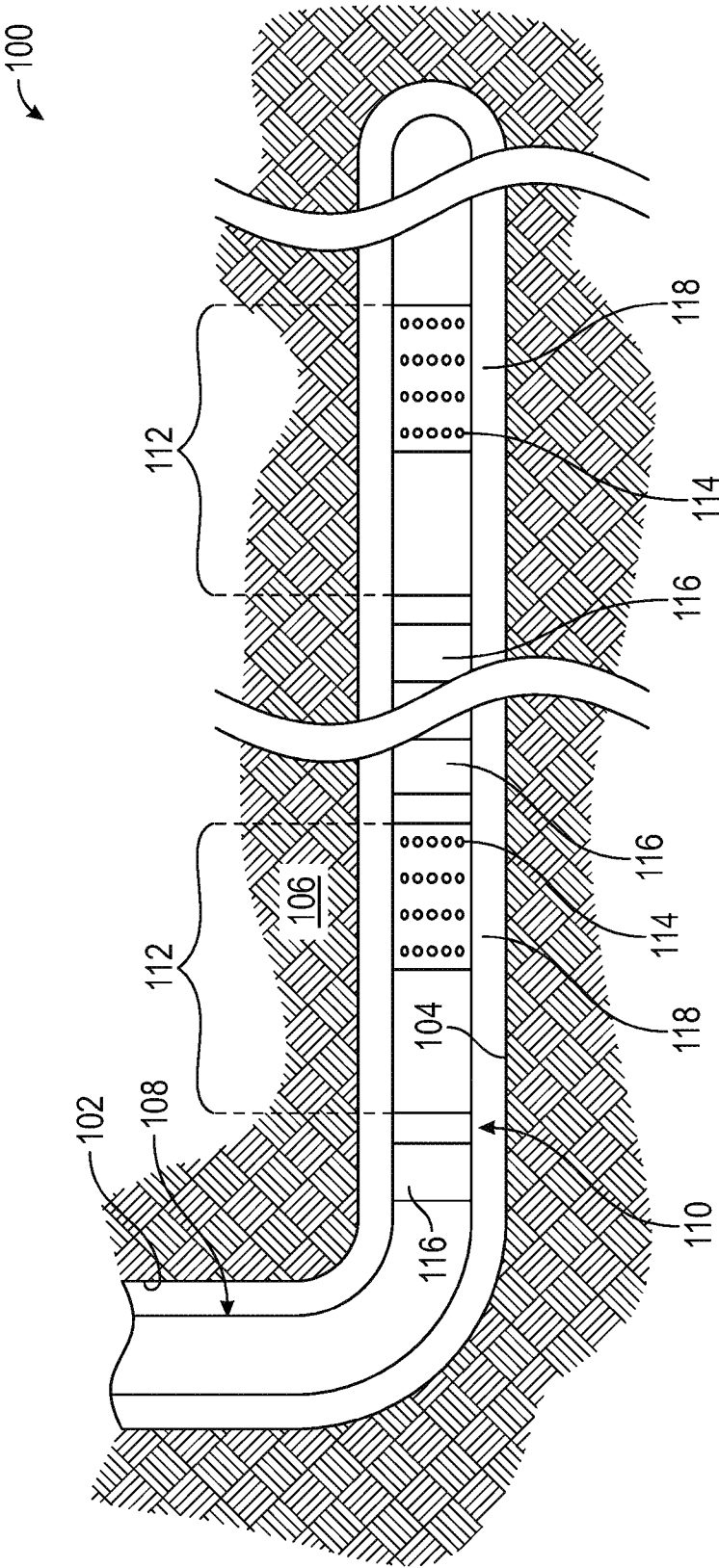


FIG. 1

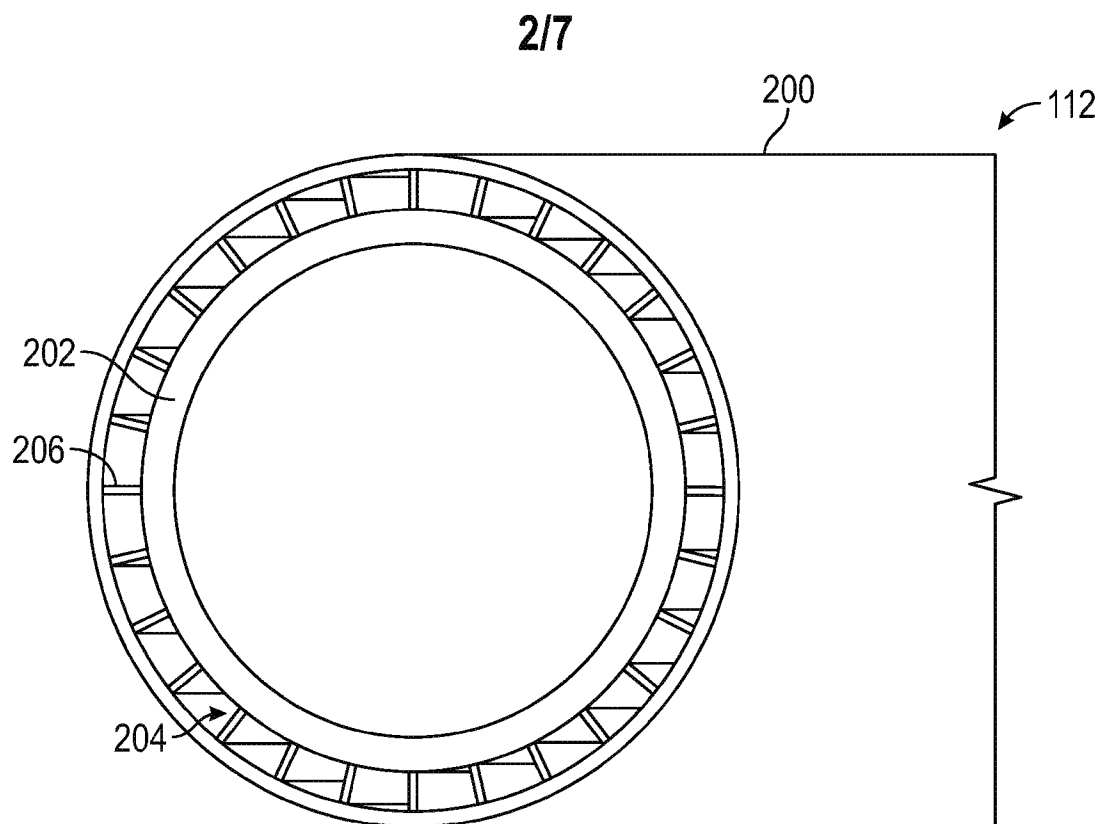


FIG. 2

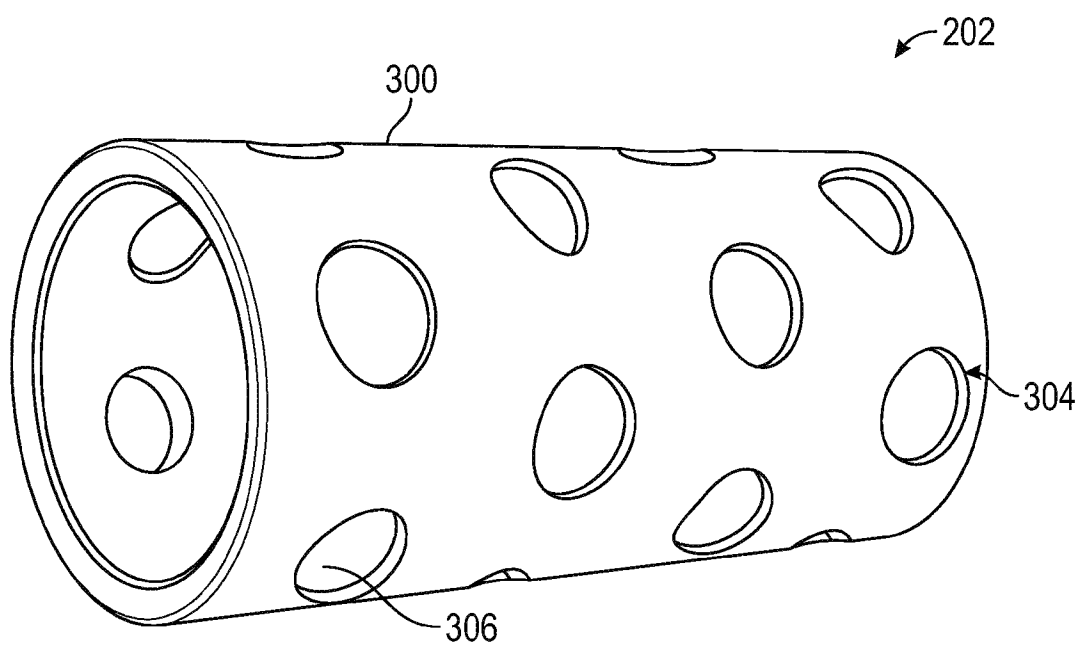
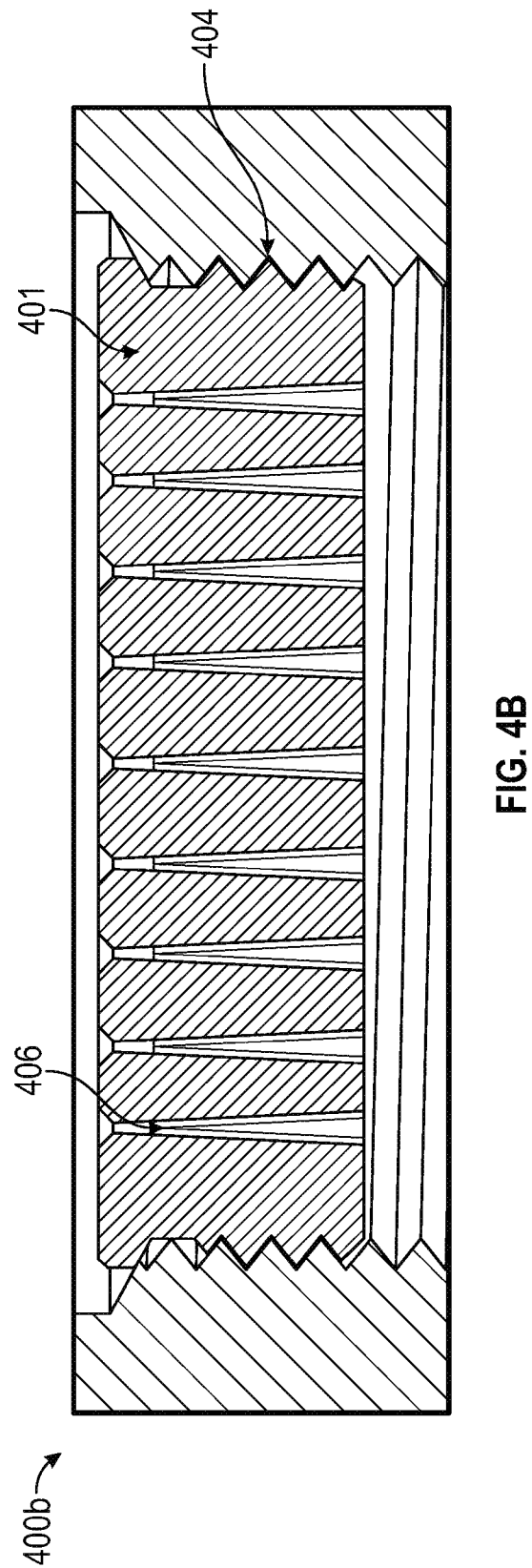
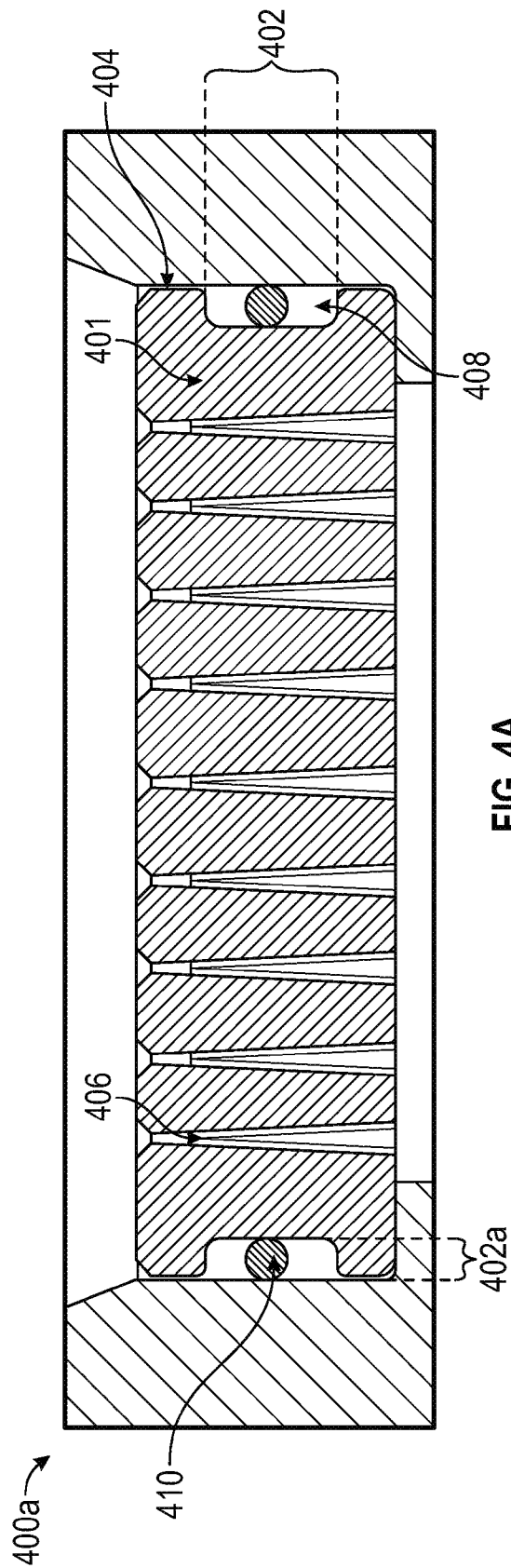


FIG. 3



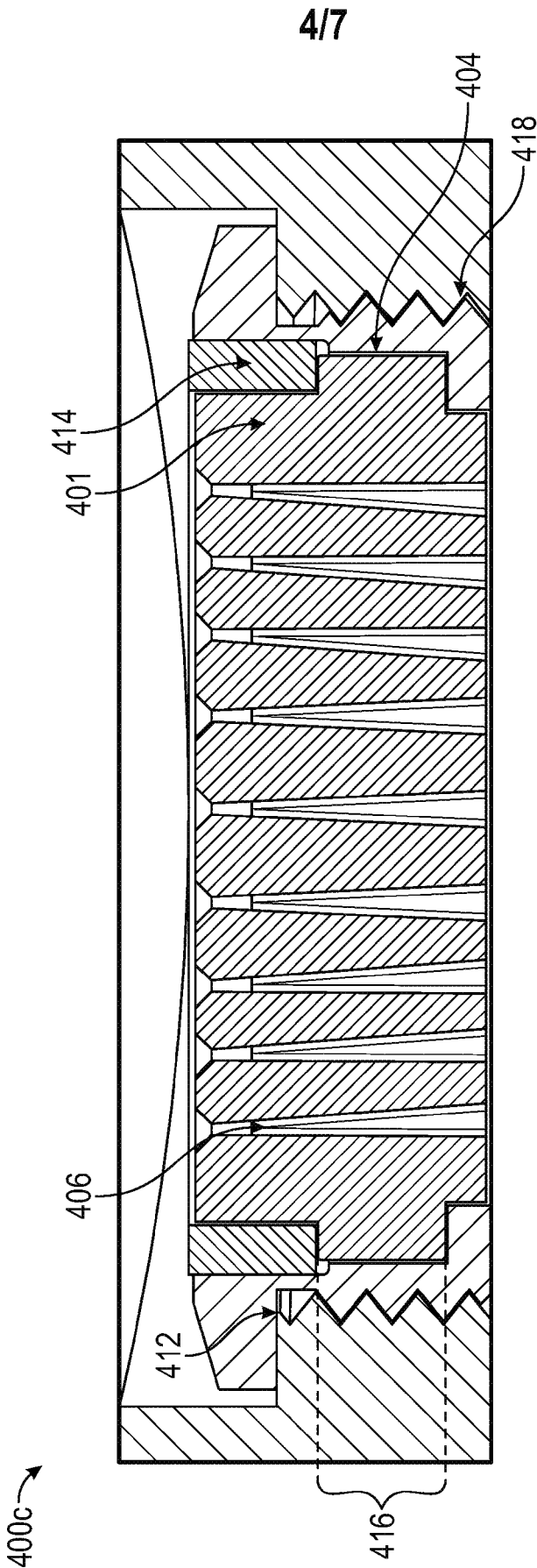


FIG. 4C

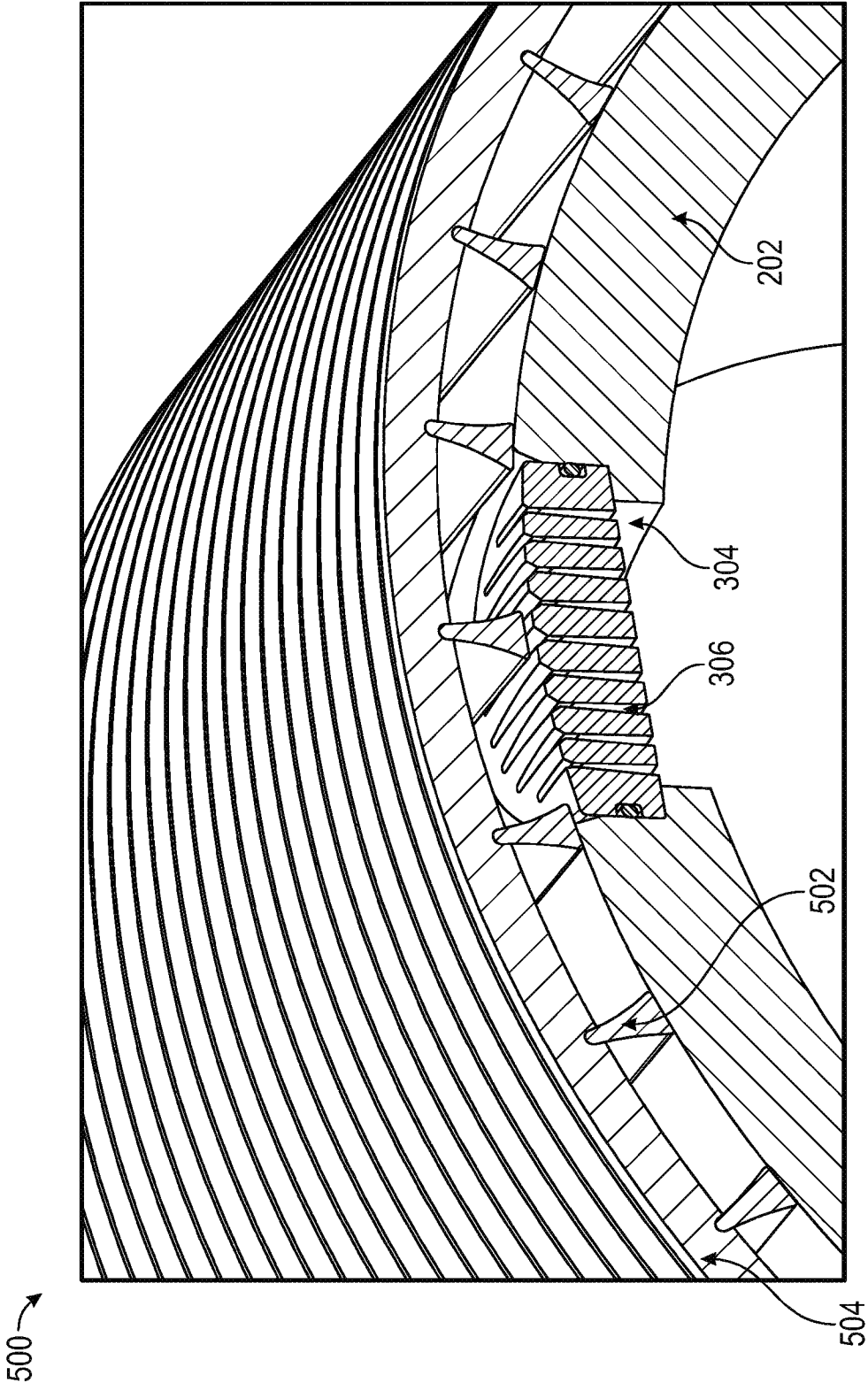
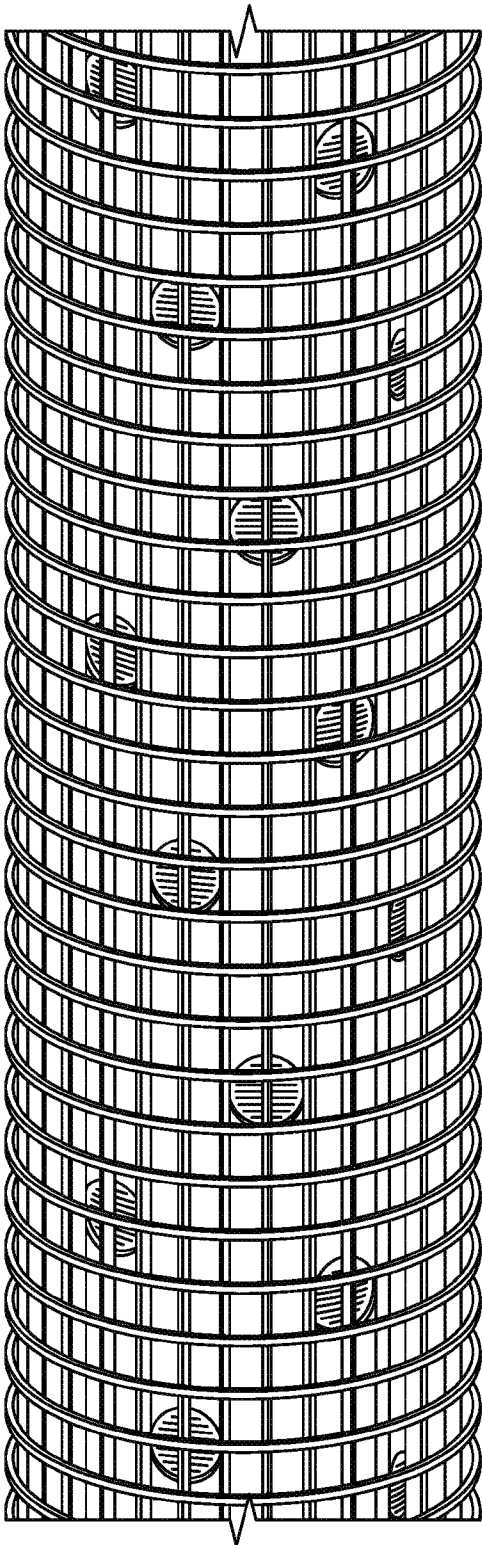


FIG. 5

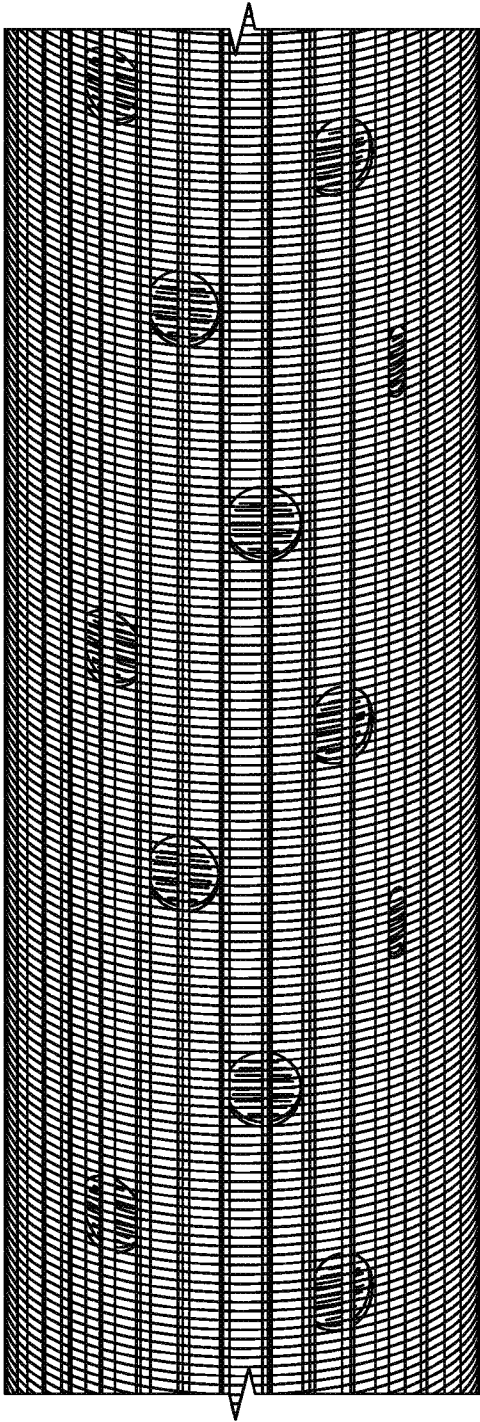
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FIG. 6A

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FIG. 6B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2024/046429

A. CLASSIFICATION OF SUBJECT MATTER E21B 43/08(2006.01)i; E21B 33/12(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 43/08(2006.01); B29C 67/06(2006.01); E21B 33/12(2006.01) 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: screen assembly, wellbore, base pipe, holes, filter, filter disk, elastomeric seal, axial wire, wrap wires		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015-0337633 A1 (LEGRAND et al.) 26 November 2015 (2015-11-26) paragraphs [0002], [0015]-[0016], [0018]-[0019] and figures 1-2	7-9,18-20
Y		1-6,10-17
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A	CN 111852413 A (PETROCHINA CO., LTD.) 30 October 2020 (2020-10-30) figure 4b	1-20
☐ 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 “D” document cited by the applicant in the international application “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 24 December 2024		Date of mailing of the international search report 26 December 2024
Name and mailing address of the ISA/KR Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon 35208, Republic of Korea Facsimile No. +82-42-481-8578		Authorized officer PARK, Tae Wook Telephone No. +82-42-481-3405

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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				WO	03-064811	A3	18 December 2003
				WO	2004-097167	A1	11 November 2004
CN	111852413	A	30 October 2020	None			