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(54) **FLOW RESTRICTION APPARATUS AND METHODS**

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(75) Inventors: **Daniel J. Turick**, Houston, TX (US); **Francisco A. Pineda**, Houston, TX (US)

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Correspondence Address:
JONES & SMITH, LLP
2777 ALLEN PARKWAY, SUITE 800
HOUSTON, TX 77019 (US)

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(73) Assignee: **BJ Services Company**

(57) **ABSTRACT**

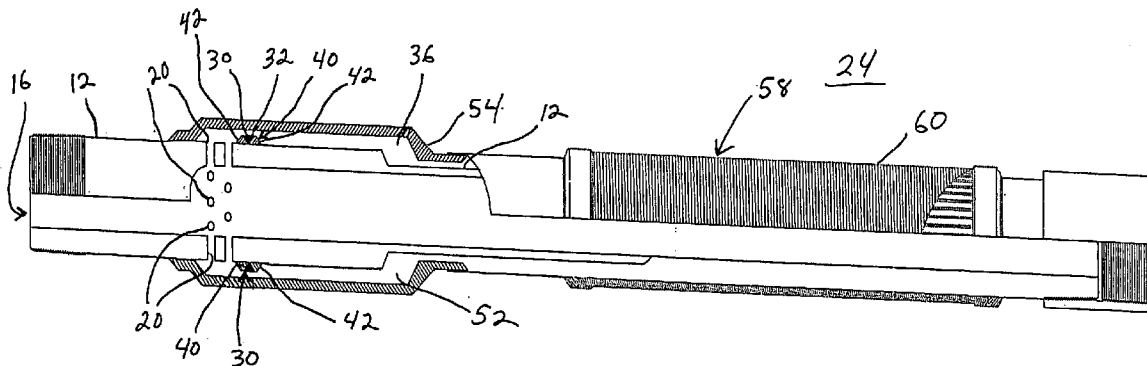
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In some embodiments, apparatus for restricting the flow of fluid from an earthen formation into at least one interior space of a tubular member includes a passageway fluidly connecting the earthen formation and the at least one interior space of the tubular member. At least one swellable member is expandable into the passageway between the interior space of the tubular member and the earthen formation.

Related U.S. Application Data

(60) Provisional application No. 60/873,245, filed on Dec. 6, 2006.



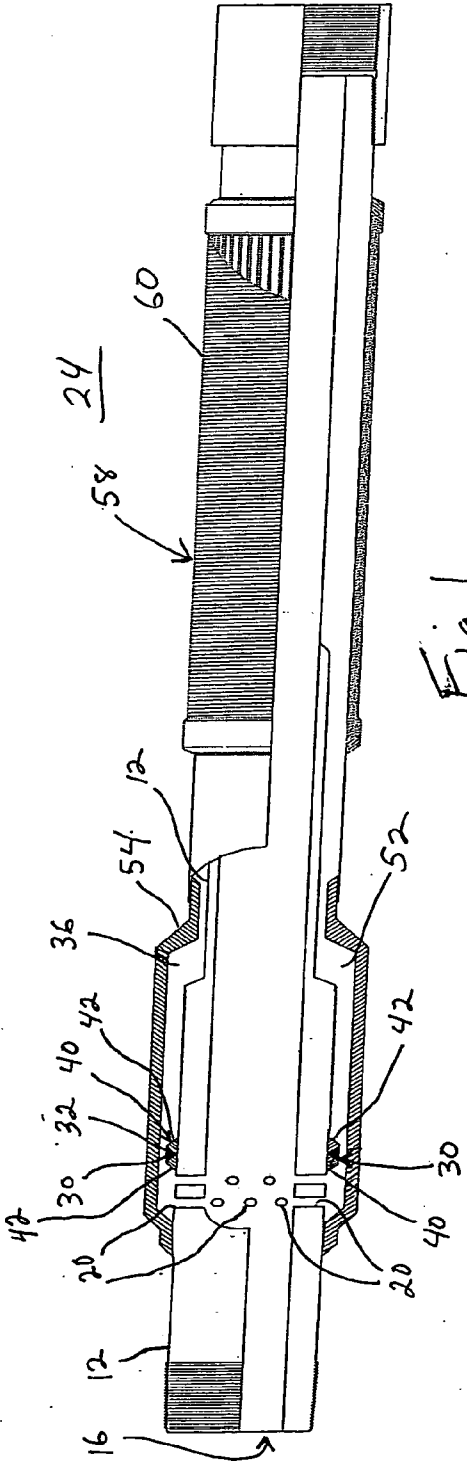


Fig. 1

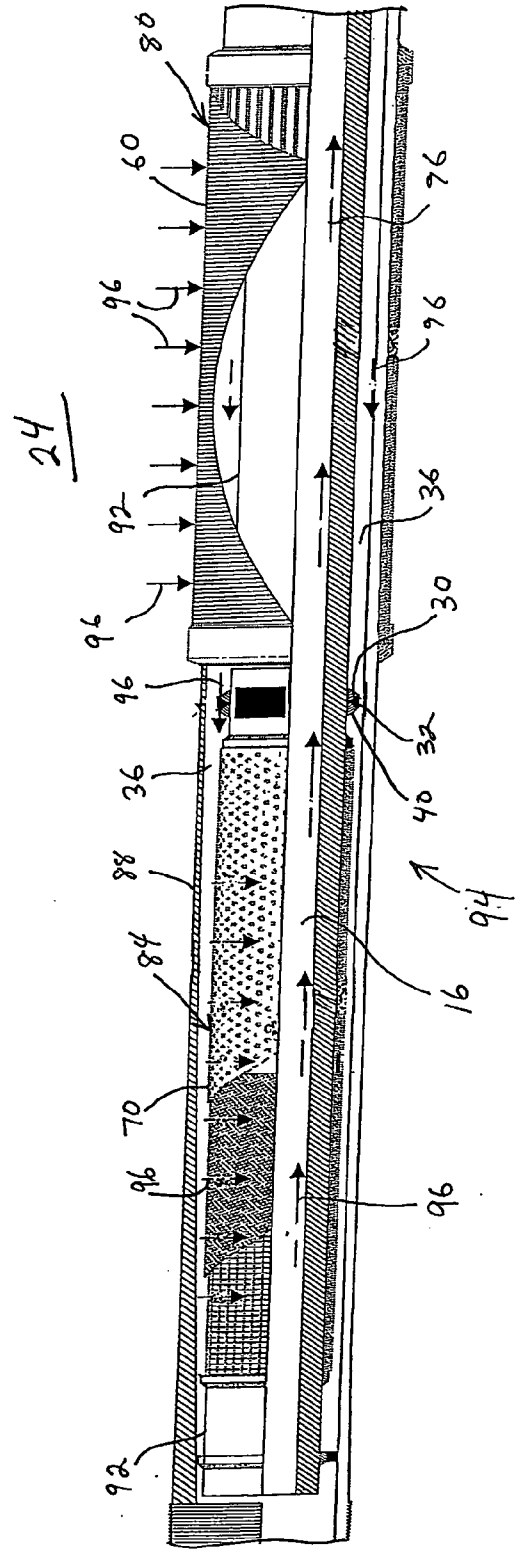


Fig. 6

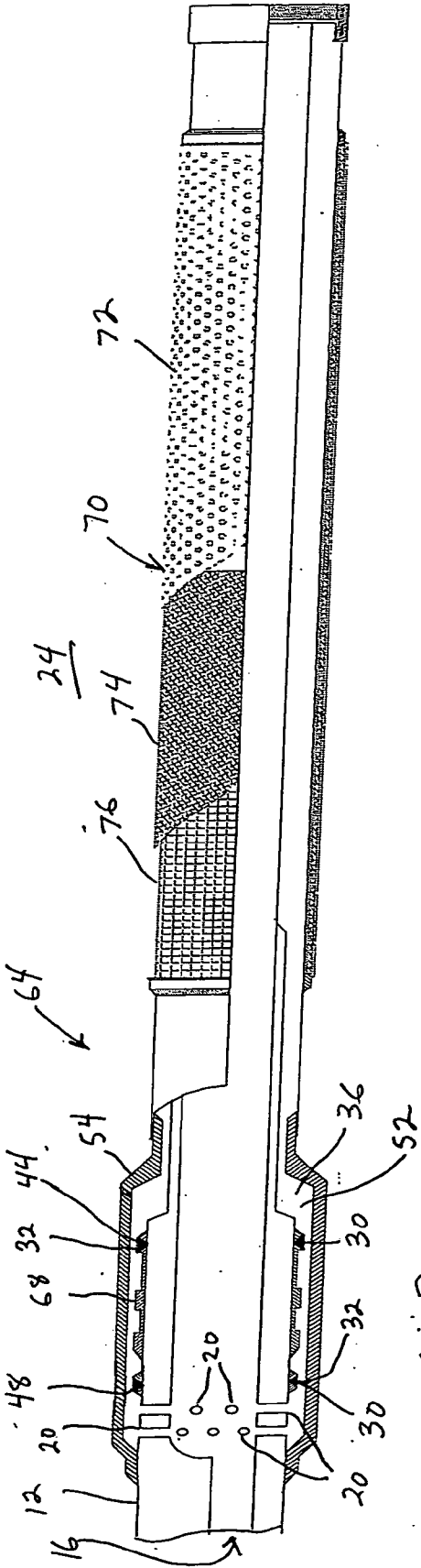


Fig. 2

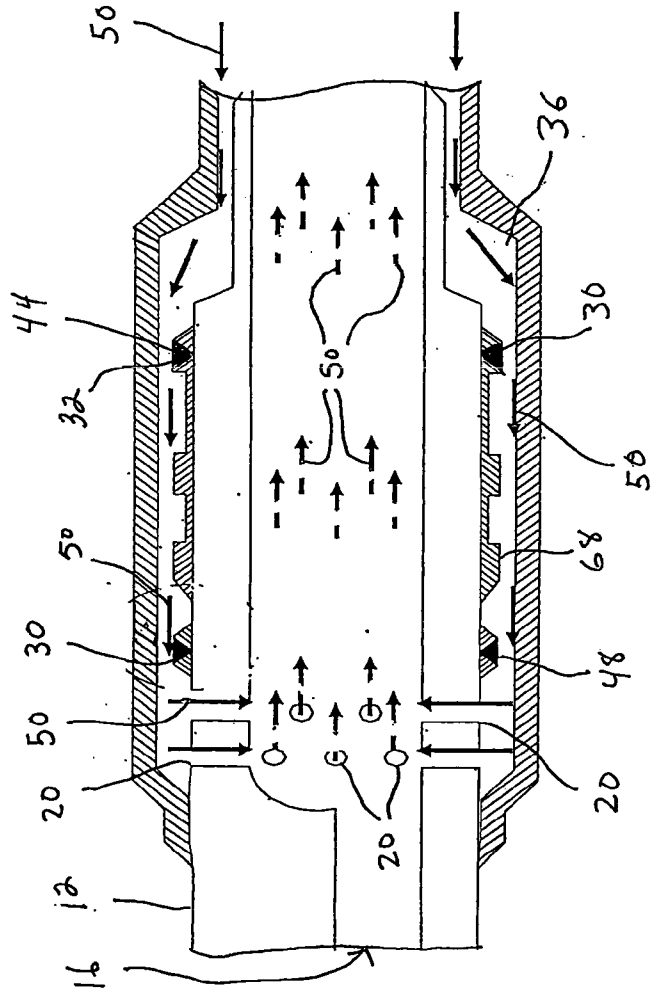


Fig. 3

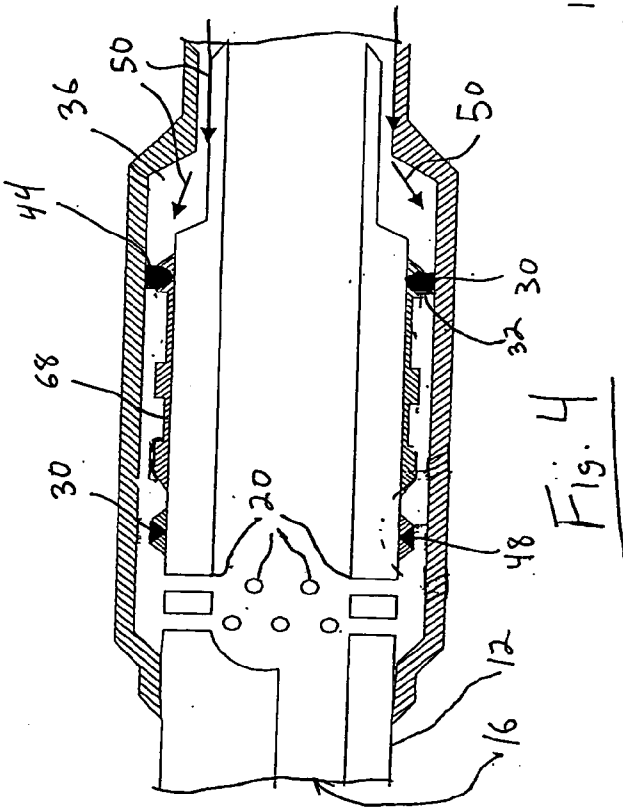


Fig. 4

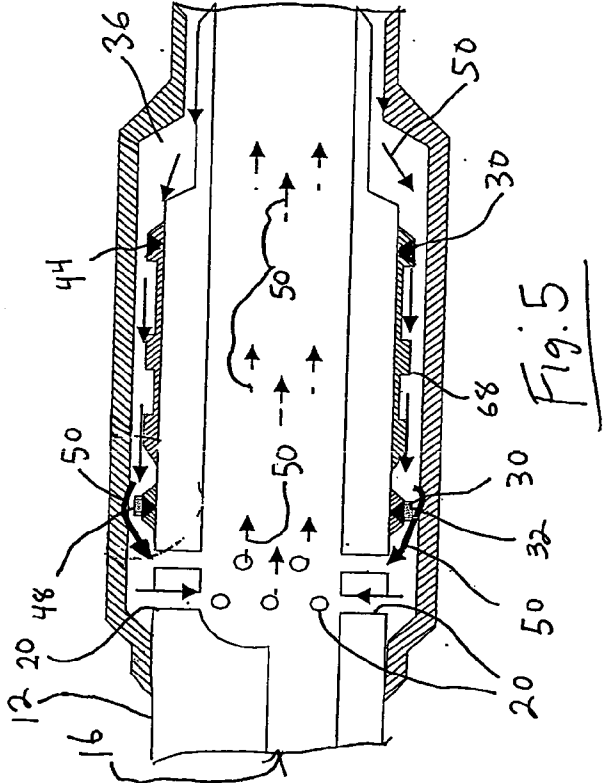


Fig. 5

FLOW RESTRICTION APPARATUS AND METHODS

[0001] This application claims priority to U.S. Provisional Application Ser. No. 60/873,245 filed Dec. 6, 2006 and entitled "Flow Restriction Apparatus and Methods", the entire disclosure of which is hereby incorporated by reference herein in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates generally to fluid collection or flow systems. In some embodiments, the present invention relates to restricting fluid flow with the use of at least one swellable member.

BACKGROUND OF THE INVENTION

[0003] In various operations involving fluid collection or flow, it is often desirable to restrict or stop the flow of fluids at certain locations. In subsurface hydrocarbon recovery operations, for example, it is sometimes preferable to stop the inflow of fluids from the formation into a production tubing string at locations when water is present in the recovered formation fluids. For another example, certain hydrocarbon production operations often warrant the restriction of formation fluid inflow at particular locations, such as to promote an even pressure drawdown across a long production zone.

[0004] Many existing and proposed techniques for restricting or blocking the inflow of fluids are believed to require the manufacturing and assembly of various components, use of positive mechanical action, costly interruption of operations or other requirements.

[0005] It should be understood that the above-described examples, features and/or disadvantages are provided for illustrative purposes only and are not intended to limit the scope or subject matter of the claims of this patent application, any patents granted hereon or any patent or patent application claiming priority hereto. Thus, none of the appended claims or claims of any related application or patent should be limited by the above discussion or construed to address, include or exclude the cited examples, features and/or disadvantages, except and only to the extent as may be expressly stated in a particular claim.

[0006] Accordingly, there exists a need for apparatus and methods useful with fluid collection or flow systems having one or more of the following attributes, capabilities or features: includes at least one swellable member that restricts the flow of fluid into a tubular member upon an external influence to the swellable member; includes at least one swellable member that restricts the flow of fluid into a tubular member upon contact with hydrocarbons; includes at least one swellable member that stops the flow of fluid into a tubular member upon an external influence to the swellable member; includes at least one swellable member that stops the flow of fluid into a tubular member upon contact with water; automatically at least partially restricts the flow of fluid into an underground tubular member upon the introduction of one or more particular activating agents; provides one or more of the aforementioned features as part of an inflow control device or multi-screen assembly; does not require mechanical action to at least partially restrict the flow of fluid into a base pipe; does not require interruption of operations to at least partially restrict the flow of fluids into a base pipe; is simple to

assemble and use; operates reliably; may be easily applied to existing equipment by retrofitting; involves low manufacturing costs because of its simple construction; or any combination thereof.

BRIEF SUMMARY OF THE INVENTION

[0007] In some embodiments, the present invention involves apparatus useful for shutting off the recovery of fluid from an earthen formation through a tubular member. The tubular member includes at least one interior space and at least one port that allows fluid flow into the at least one interior space from the earthen formation. A fluid flow passageway fluidly connects the earthen formation and the interior space of the tubular member. At least one swellable member is expandable into the fluid flow passageway. The swellable member is disposed between the port of the tubular member and the earthen formation. Upon swelling of the swellable member, the swellable member shuts off the flow of fluid into the at least one interior space of the tubular member from the earthen formation.

[0008] In various embodiments, the present invention involves an inflow control device for use in a production pipe for producing oil or gas from an oil and/or gas reservoir. A base pipe includes a bore and at least one port into the bore. An outer pipe extends around the port and forms an annulus around the base pipe. The annulus is in fluid communication with the port of the base pipe and the reservoir. Fluid from the reservoir must flow through the annulus to enter the bore of the base pipe. At least one swellable member is expandable into the annulus. The swellable member is disposed between the port of the base pipe and the reservoir. Upon swelling of the swellable member, the swellable member at least partially restricts the flow of fluid into the bore of the base pipe from the reservoir.

[0009] There are embodiments of the present invention that involve an apparatus for restricting the flow of fluid into or out of an interior space of a base pipe useful in a hydrocarbon production or completion system. The base pipe includes at least one port that allows fluid flow into or out of the interior space. A housing is disposed around the port of the base pipe. At least one passageway is disposed within the housing and fluidly connects the interior space of the base pipe and the exterior of the base pipe. Fluid flow between the interior space and exterior of the base pipe must pass through the at least one passageway. At least one swellable member is expandable into the passageway between the port(s) and the exterior of the base pipe. The swellable member includes at least one swelling elastomer. Upon activation of the swelling elastomer by at least one activating agent provided into the passageway, the swellable member at least partially restricts the flow of fluid through the passageway.

[0010] Some embodiments of the present invention involve a method of restricting the flow of fluid from an earthen formation into an interior space of a tubular member. The tubular member includes at least one port into the interior space to allow fluid flow into the interior space. The method includes forming a fluid flow passageway around the tubular member and fluidly connecting the fluid flow passageway with the earthen formation and the interior space of the tubular member. Fluid entering the interior space of the tubular member from the earthen formation must flow through the fluid flow passageway. At least one swellable member is positioned in the fluid flow passageway between the at least one port and the earthen formation. Fluid is allowed to flow

into the fluid flow passageway from the earthen formation. The swellable member expands into the fluid flow passageway upon contact with at least one activating agent, at least partially restricting the flow of fluid through the passageway and into the interior space of the tubular member from the earthen formation.

[0011] Accordingly, the present invention includes features and advantages which are believed to enable it to advance fluid flow/collection technology. Characteristics and advantages of the present invention described above and additional features and benefits will be readily apparent to those skilled in the art upon consideration of the following detailed description of various embodiments and referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The following figures are part of the present specification, included to demonstrate certain aspects of various embodiments of the invention and referenced in the detailed description herein.

[0013] FIG. 1 is a partial cross-sectional view of an example tubular member including a swellable member in accordance with an embodiment of the present invention;

[0014] FIG. 2 a partial cross-sectional view of another example tubular member including two swellable members in accordance with another embodiment of the present invention;

[0015] FIG. 3 is an enlarged partial cross-sectional view of the example tubular member of FIG. 2 showing an exemplary normal fluid flow pattern;

[0016] FIG. 4 is an enlarged partial cross-sectional view of the example tubular member of FIG. 2 showing a first swellable member in an activated state;

[0017] FIG. 5 is an enlarged partial cross-sectional view of the example tubular member of FIG. 2 showing a second swellable member in an activated state; and

[0018] FIG. 6 a partial cut-away view of another example tubular member including a swellable member in accordance with yet another embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0019] Characteristics and advantages of the present invention and additional features and benefits will be readily apparent to those skilled in the art upon consideration of the following detailed description of exemplary embodiments of the claimed invention and referring to the accompanying figures. It should be understood that the description herein and appended drawings, being of example embodiments, are not intended to limit the claims of this patent application, any patent granted hereon or any patent or patent application claiming priority hereto. On the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the claims. Many changes may be made to the particular embodiments and details disclosed herein without departing from such spirit and scope.

[0020] In showing and describing preferred embodiments, like or identical reference numerals are used to identify common or similar elements. The figures are not necessarily to scale and certain features and certain views of the figures may be shown exaggerated in scale or in schematic in the interest of clarity and conciseness.

[0021] As used herein and throughout various portions (and headings) of this patent application, the terms “invention”, “present invention” and variations thereof are not intended to mean the invention of every possible embodiment of the invention or any particular claim or claims. Thus, the subject matter of each such reference should not be considered as necessary for, or part of, every embodiment of the invention or any particular claim(s) merely because of such reference. Also, it should be noted that reference herein and in the appended claims to components and aspects in a singular tense does not necessarily limit the present invention to only one such component or aspect, but should be interpreted generally to mean one or more, as may be suitable and desirable in each particular instance.

[0022] Referring initially to the example of FIG. 1, a tubular member, or base pipe, 12 is shown having an interior space, or bore, 16. The illustrated tubular member 12 includes at least one port 20 through which fluids flow into the bore 16 from the exterior of the bore 16, such as from an earthen formation 24. In accordance with an embodiment of the present invention, at least one swellable member 30 is shown associated with the tubular member 12. The swellable member 30 is expandable into a passageway 36 that fluidly connects the interior space 16 of the base pipe 12 to the earthen formation 24 or other source. In this embodiment, fluid entering the base pipe 12 from the earthen formation 24 must flow past the swellable member 30 into the ports 20. If the swellable member 30 swells or expands into the passageway 36, it effectively reduces the cross-section of the passageway 36, at least partially restricting the inflow of fluid into the tubular member 12.

[0023] The swellable member 30 may have any suitable form, construction and configuration, as long as it is capable of swelling or expanding due to one or more external influences upon it. As used herein and in the appended claims, the term “swellable member” means at least one item capable of increasing in volume size in reaction to one or more external influences upon it. For example, the swellable member 30 may be designed to increase in volume upon its exposure to a particular temperature or pressure, as is and/or becomes known. For other examples, as in the present embodiment, the swellable member 30 may be at least partially constructed of at least one swelling elastomer 32 capable of increasing in volume size in reaction to (when activated by) one or more activating agents. The activating agent(s) may be any desired agent, such as, for example, water, hydrocarbons, drilling fluid or other fluids or chemicals.

[0024] Further information on the composition, behavior and use of various swelling elastomers is available in publicly accessible documents. Some examples of documents and sources of documents that may provide information on swelling elastomers include the web pages at www.swellfix.com and www.tamintl.com and other documents relating to the use of swellable elastomers in downhole packers by Swellfix, Tam International, Halliburton and other companies, U.S. Pat. No. 4,590,227 to Nakamura et al., entitled “Water-Swellable Elastomer Composition” and issued on May 20, 1996, U.S. Pat. No. 6,169,058 to Le et al., entitled “Compositions and Methods for Hydraulic Fracturing” and issued on Jan. 2, 2001, U.S. Pat. No. 6,358,580 to Mang et al., entitled “Sealing Material Which Swells When Treated with Water” and issued on Mar. 19, 2002, U.S. Pat. No. 6,834,725 to Whanger et al., entitled “Reinforced Swelling Elastomer Seal Element on Expandable Tubular” and issued Dec. 28, 2004

(including, without limitation, Column 6, line 34—Column 7, line 47), U.S. Pat. No. 6,907,937 to Whanger et al., entitled “Expandable Sealing Apparatus” and issued on Jun. 21, 2005 (including, without limitation, Column 5, line 47—Column 7, line 30 and figures referenced therein), U.S. Pat. No. 6,976,542 to Henriksen et al., entitled “Mud Flow Back Valve” and issued on Dec. 20, 2005 (including, without limitation, Column 3, lines 11-39), U.S. Pat. No. 7,026,272 to Reddy et al., entitled “Methods and Compositions for Sealing Oil Containing Subterranean Zones” and issued on Apr. 11, 2006 (including, without limitation, Column 4, lines 39-55), all of which are hereby incorporated by reference herein in their entireties. However, the present invention is not limited to the aforementioned types of swellable members and swelling elastomers.

[0025] Still referring to the embodiment of FIG. 1, the exemplary swellable member 30 is constructed, configured and positioned to provide the desired fluid restriction action in the passageway 36. The specific composition, size and location of the swellable member 30 may depend upon one or more factors, such as the size of the passageway 36 and/or ports 20, the nature of the system within which the base pipe 12 is included, and/or the nature and characteristics of the operating environment. In this example, the swellable member 30 includes an elongated strip of swelling elastomer 32 that, in an inactivated state, is double-layer wrapped around the outer circumferential surface of the base pipe 12 proximate to the ports 20. The illustrated swelling elastomer 32 is reactive to hydrocarbons to cause it to expand into and thus reduce the cross-section of the passageway 36. The rubber composition and thickness of the exemplary swelling elastomer 32 may be selected based upon its particular application. In other examples, the swelling elastomer 32 may have a single or more than two wraps, or may be arranged in a different manner. Thus, the swellable member 30 may be positioned with respect to the ports 20, configured and constructed in any desired manner and location.

[0026] Still referring to FIG. 1, the illustrated swellable member 30 is engaged with the base pipe 12 sufficient to secure its position relative to, and allow its desired expansion into, the passageway 36. For example, the swellable member 30 may be vulcanized, or otherwise attached directly, to the base pipe 12. For another example, side members 40, such as annular metal seats 42, may be included to assist in securing the swellable member 30 to the base pipe 12, maintain the swellable member 30 at a pre-defined location in an inactivated state, help direct the expansion of the swelling elastomer 32 when activated or other purpose. When included, the side members 40 may, for example, be formed into or associated with the swellable member 30. If desired, the swellable member 30 may include other components, such as one or more curing agents or structural members (not shown) to assist in maintaining the strength, shape or rigidity of the swellable member 30 in an activated state. However, the present invention is not limited to the above details. For example, the swellable member 30 may be secured to a component other than the base pipe 12 at any desired location relative to the passageway 36 and ports 20. For other examples, multiple swellable members 30 may be included in a single base pipe 12, and a single swellable member 30 may react to multiple activating agents or external influences and/or include multiple swelling elastomer sections.

[0027] The swellable member 30 may be designed to partially or fully block the flow of fluid through the passageway 36, as desired. For example, in the embodiment of FIG. 2, first

and second swellable members 44, 48 are included. In an inactivated state, the swellable members 44, 48 allow the inflow 50 of fluid through the passageway 36 and into the base pipe 12 as shown in FIG. 3. In this example, the first swellable member 44 is designed to block, or substantially stop, the flow of fluid into the base pipe 12. For example, the swellable member 44 may include a swelling elastomer 32 reactive to water. Upon activation by contact with water entering the passageway 36, the swellable member 44 is capable of expanding in volume to generally fill the cross-section of the passageway 36, as shown in FIG. 4. While a perfect seal may or may not be formed, depending upon the design and desired action of the swellable member 44, the inflow 50 of fluid is essentially blocked from entering the base pipe 12. One potential application for this arrangement is in a hydrocarbon production pipe string where it is desired to generally halt the recovery of formation fluids into the base pipe 12 when water appears in the incoming formation fluid.

[0028] When the swellable member 30 expands to fully block the passageway 36 and it is desirable to later re-open the passageway 36 or otherwise allow fluid into the interior space 16 of the tubular member 12, any suitable technique may be used. For example, a sliding sleeve (not shown) located between the earthen formation 24 and the swellable member 30 may be opened to allow access to the interior space 16 of the base pipe 12. For another example, an external influence, such as a chemical solvent, may be provided into the passageway 36, such as from the bore 16 of the base pipe 12, to dissolve or reduce the size of the swellable member 30. For yet another example, a tool may be inserted into the passageway 36 or bore 16 to move, extract or form openings in the swellable member 30.

[0029] Still referring to the embodiment of FIG. 2, the second swellable member 48, upon expansion, is designed to only partially block the passageway 36 and reduce the flow of formation fluid into the base pipe 12. For example, the swellable member 48 may include a swelling elastomer 32 reactive to hydrocarbons. Upon activation by contact with oil and/or gas entering the passageway 36, the swellable member 48 is capable of expanding in volume to partially fill the cross-section of the passageway 36, as shown in FIG. 5. The fluid inflow 50 is thus restricted at the swellable member 48. One potential application for this arrangement is in a hydrocarbon production line where it is desired to reduce or choke back the inflow of fluids at the location of the base pipe 12, such as to promote a more even recovery of formation fluid across a long span of pipe.

[0030] Referring back to the embodiment of FIG. 1, the passageway 36 may have any desired construction, configuration and flow path and may be formed in any desired manner. Further, multiple passageways 36 may be included. In the illustrated example, the passageway 36 is an annulus 52 formed between the base pipe 12 and an annular outer housing 54 that extends over the ports 20. In other examples, the passageway 36 may have a tortuous flow path (e.g. FIG. 2), include multiple sections (not shown) or other features. The housing 54 may be part of a second tubular member, another system component or have any other desired form.

[0031] Still referring to FIG. 1, fluid may enter the passageway 36 in any suitable manner. In the example shown, the housing 54 is associated with a screen assembly 58 positioned over a solid part of the base pipe 12. In this instance, the housing 54 is axially sealingly engaged with the screen assembly 58, such as by welding, so that the passageway 36 is

in fluid communication with the space (not shown) formed between the screen assembly 58 and base pipe 12. The illustrated screen assembly 58 includes a wire wrap screen 60 through which formation fluids pass into the passageway 36. However, any other suitable component arrangement (with or without a housing 54 or screen assembly 58) may be used to form and allow the flow of fluids into the passageway 36. For example, the swellable member(s) 30 may be used in an arrangement not including a screen or filter, such as where an outer surrounding pipe (not shown) has openings for drawing the fluid from an external source, or itself provides the fluids.

[0032] Referring again to FIG. 1, the swellable member 30 may be used in any system or operation involving fluid collection or flow. In some embodiments, the fluid flow may be reversed from the examples described above, where the fluid is moving out of the bore 16 of the tubular member 12 and restricted by the swellable member 30 as it passes through the passageway 36 to the exterior of the tubular member 12. In the arena of hydrocarbon exploration and production, the swellable member 30 may be used in any drainage or production piping, completion component or other location where it is desired to restrict or stop the flow of fluid upon the occurrence of at least one external influence upon the swellable member 30. For example, the swellable member 30 may be used in connection with a flapper valve (not shown).

[0033] For another example, the swellable member 30 may be used in devices commonly known as inflow control devices, fluid flow control devices, flow restriction devices and the like. These devices are collectively referred to herein and in the appended claims as "inflow control devices". Inflow control devices (ICD) are sometimes used to control formation fluid flow into a hydrocarbon production pipe string. For example, in long production zones (e.g. 1,000 meters or more of open hole section), it is often difficult to recover hydrocarbons across the entire span, as most of the hydrocarbons flow in at the heel of the well. In highly permeable geological formations, the pressure in the pipe may increase exponentially in the upstream direction as a result of the flow friction in the pipe. ICDs may be used at certain locations in the pipe string to restrict, or effectively choke, the inflow into the drainage pipe according to the pressure profile in the reservoir. In such instances, the ICDs may allow a more even pressure drawdown across the entire formation to evenly distributing the inflow of fluids from the reservoir to the production pipe, improving hydrocarbon production.

[0034] Further information about ICDs and their construction and operation may be found in publicly available documents, such as U.S. Pat. No. 5,435,393 to Brekke et al., entitled "Procedure and Production Pipe for Production of Oil or Gas From an Oil or Gas Reservoir" and issued on Jul. 25, 1995, U.S. Pat. No. 5,896,928 to Conn, entitled "Flow Restriction Device for Use in Production Wells" and issued on Apr. 27, 1999, U.S. Pat. No. 6,112,815 to Boe et al., entitled "Inflow Regulation Device for a Production Pipe for Production of Oil or Gas From an Oil and/or Gas Reservoir" and issued on Sep. 5, 2006, the Aramco ICD Specifications for Equalizer Type Completion dated Oct. 4, 2006 and entitled "Technical Parameters for ICD (Equalizer) Production System", and the article entitled "New, Simple Completion Methods for Horizontal Wells Improve Production Performance in High-Permeability Thin Oil Zones" by Kristian Brekke and S. C. Lien published in the September 1994 issue of SPE Drilling and Completion, all of which are hereby incorporated by reference herein in their entireties.

[0035] Referring to the example of FIG. 1, in accordance with certain embodiments of the present invention, the swellable member(s) 30 could serve the inflow control device function of limiting the flow of formation fluids into the pipe string (not shown) at the location of the base pipe 12. Thus, the embodiment of FIG. 1 is an example ICD.

[0036] In some known ICD arrangements, formation fluid enters the inflow control device through a tortuous path, such as through a labyrinth structure or spiral or helical channels, to create a pressure drop before the fluid enters the pipe interior. Sand/debris filters are also often included. In the example of FIG. 2, a profile member 68 extends into the passageway 36 to form a tortuous path for the fluid entering the bore 16 of the tubular member 12 from the earthen formation 24. The illustrated tubular member 12 is associated with a premium-type screen assembly 70 having an outer shroud 72, inner shroud 76 and intermediate filter media 74. In accordance with an embodiment of the present invention, one or more swellable member 30 may be included to assist in restricting the flow of hydrocarbons into the bore 16. In this particular arrangement, the illustrated second swellable member 48 (reactive to hydrocarbons), as previously described, may enhance the flow control effect of the ICD 64.

[0037] Inflow control devices may also or instead include adjustable throttling or valve devices, such as a remotely controllable sleeve assembly, to assist in adjusting the flow characteristics of the ICD. In accordance with certain embodiments of the present invention, one or more swellable member 30, as previously described, may be used in an ICD that includes a valve arrangement (not shown).

[0038] If desired, the swellable member(s) 30 may be used in an ICD to provide the added capability of entirely shutting off a section of pipe. In the inflow control device 64 of FIG. 2, for example, the first swellable member 44, as described above, is capable of substantially or entirely stopping the flow of formation fluid into the interior space 16 of the base pipe 12. One potential application for this arrangement is in horizontal wells when it is desirable to automatically shut off the section of pipe associated with the ICD 64 when water appears in the incoming formation fluid.

[0039] For another example, the swellable member(s) 30 may be used in a multiple screen arrangement, such as shown in FIG. 6. In this example, the swellable member 30 is expandable into a passageway 36 that fluidly connects an outer screen 80 and an inner screen 84. The passageway 36 is formed by an outer base pipe 88 that extends around an inner base pipe 92. On one side, the outer base pipe 88 includes, or is associated with, the outer screen 80, while the inner base pipe 92 includes, or is associated with, the inner screen 84 on the other side. The outer screen 80 filters incoming fluids from the earthen formation 24, while the inner screen 84 provides secondary filtration before the fluid enters the bore 16 of the inner base pipe 92. Should the outer screen 80 fail, the inner screen 84 may then serve as the primary filter in place of the outer screen 80. In this example, the outer screen 80 is shown as a wire wrap screen 60 and the inner screen is a premium-type screen assembly 70. However, the screens may have any desired construction and configuration. The normal flow of fluid through the illustrated dual screen device 94 is shown by arrows 96. In accordance with an embodiment of present invention, the illustrated swellable member 30 is expandable in the passageway 36 between the screens 80, 84 to restrict or stop the flow of fluid into the bore 16 of the inner base pipe 92, as desired. For example, the swellable member 30 may

include a swelling elastomer **32** that swells in reaction to water to stop the flow of fluid through the passageway **36**, effectively shutting the inflow of fluid into the inner base pipe **92**. For other examples, the swellable member **30** may be designed to only partially block flow through the passageway **36** in reaction to water, hydrocarbons or any other desired activating agent, or be reactive to multiple activating agents. **[0040]** Preferred embodiments of the present invention thus offer advantages over the prior art and are well adapted to carry out one or more of the objects of the invention. However, the present invention does not require each of the components and acts described above and is in no way limited to the above-described embodiments, methods of operation, variables, values or value ranges. Any one or more of the above components, features and processes may be employed in any suitable configuration without inclusion of other such components, features and processes. Moreover, the present invention includes additional features, capabilities, functions, methods, uses and applications that have not been specifically addressed herein but are, or will become, apparent from the description herein, the appended drawings and claims.

[0041] The methods that may be described above or claimed herein and any other methods which may fall within the scope of the appended claims can be performed in any desired suitable order and are not necessarily limited to any sequence described herein or as may be listed in the appended claims. Further, the methods of the present invention do not necessarily require use of the particular embodiments shown and described herein, but are equally applicable with any other suitable structure, form and configuration of components.

[0042] While exemplary embodiments of the invention have been shown and described, many variations, modifications and/or changes of the system, apparatus and methods of the present invention, such as in the components, details of construction and operation, arrangement of parts and/or methods of use, are possible, contemplated by the patent applicant(s), within the scope of the appended claims, and may be made and used by one of ordinary skill in the art without departing from the spirit or teachings of the invention and scope of appended claims. Thus, all matter herein set forth or shown in the accompanying drawings should be interpreted as illustrative, and the scope of the invention and the appended claims should not be limited to the embodiments described and shown herein.

1. Apparatus for shutting off the recovery of fluid from an earthen formation through a tubular member, the tubular member including at least one interior space and at least one port that allows fluid flow into the at least one interior space from the earthen formation, the apparatus comprising:

a fluid flow passageway fluidly connecting the earthen formation and the at least one interior space of the tubular member; and

at least one swellable member expandable into said fluid flow passageway, said at least one swellable member being disposed between the at least one port of the tubular member and the earthen formation.

whereby upon swelling of said at least one swellable member, said at least one swellable member shuts off the flow of fluid into the at least one interior space of the tubular member from the earthen formation.

2. The apparatus of claim **1** wherein the tubular member is part of a long span of production pipe disposed in a well, wherein said at least one swellable member is capable of

stopping the recovery of fluid from the earthen formation into the production pipe at the location of the tubular member.

3. The apparatus of claim **1** wherein said fluid flow passageway has a tortuous flow path.

4. The apparatus of claim **1** wherein said at least one swellable member is at least partially constructed of at least one swelling elastomer.

5. The apparatus of claim **4** wherein at least one said swelling elastomer is capable of increasing in volume size in reaction to at least one activating agent.

6. The apparatus of claim **5** wherein said at least one activating agent includes water.

7. The apparatus of claim **5** further including at least one side member associated with said at least one swellable member, said at least one side member capable of assisting in maintaining the location said at least one swellable member in an inactivate and an activated state.

8. The apparatus of claim **5** wherein said at least one swellable member includes at least one curing agent.

9. The apparatus of claim **1** further including a housing disposed around the at least one port of the tubular member, wherein said fluid flow passageway is an annulus formed between said housing and said tubular member.

10. The apparatus of claim **9** wherein said at least one swellable member swells based upon at least one among the influence of temperature and pressure.

11. The apparatus of claim **9** wherein at least one said swellable member is engaged with said housing sufficient to allow its desired expansion into said fluid flow passageway.

12. The apparatus of claim **1** wherein the tubular member is used in connection with a flapper valve.

13. The apparatus of claim **1** wherein the tubular member is an inflow control device.

14. The apparatus of claim **13** further including a screen assembly associated with the tubular member, said screen assembly fluidly connecting said fluid flow passageway and the earthen formation.

15. The apparatus of claim **1** further including at least first and second screens fluidly connecting the at least one interior space of the tubular member and the earthen formation, wherein said first screen is disposed between said fluid flow passageway and the earthen formation and said second screen is disposed between said at least one swellable member and the at least one port of the tubular member, whereby said at least one swellable member is capable of stopping the flow of fluid between said first and second screens.

16. An inflow control device for use in a production pipe for producing oil or gas from an oil and/or gas reservoir, the inflow control device comprising:

a base pipe having a bore and at least one port into said bore;

an outer pipe extending around said at least one port and forming an annulus around said base pipe said annulus being in fluid communication with said at least one port of said base pipe and the reservoir, wherein fluid from the reservoir must flow through said annulus to enter said bore of said base pipe; and

at least one swellable member expandable into said annulus, said at least one swellable member being disposed between said at least one port of said base pipe and the reservoir, whereby upon swelling of said at least one swellable member, said at least one swellable member at least partially restricts the flow of fluid into said bore of said base pipe from the reservoir.

17. The inflow control device of claim 16 further including at least one screen associated with said outer pipe and disposed between the reservoir and said at least one swellable member.

18. The inflow control device of claim 17 wherein said annulus includes a tortuous flow path.

19. The inflow control device of claim 18 further including a sliding valve member associated with said tortuous flow path.

20. The inflow control device of claim 17 further including at least first and second screens, wherein said at least one swellable member is disposed between said first and second screens.

21. The inflow control device of claim 16 wherein said at least one swellable member is capable of stopping the flow of fluid into said bore of said base pipe from the reservoir.

22. The inflow control device of claim 16 wherein a first said swellable member is activated by water and is capable of entirely blocking the flow of fluid into said at least one port of said base pipe.

23. The inflow control device of claim 22 wherein a second said swellable member is activated by hydrocarbons and is capable of restricting the flow of fluid into said at least one port.

24. The inflow control device of claim 16 wherein said at least one swellable member expands into said annulus upon activation by at least one activating agent.

25. The inflow control device of claim 24 wherein a first said swellable member is reactive to at least two activating agents whereby said first swellable member swells to restrict the flow of fluid into said base pipe upon contact with a first said activating agent and stops the flow of fluid into said base pipe upon contact with a second said activating agent.

26. The inflow control device of claim 25 wherein the inflow control device is useful in connection with a hydrocarbon completion or production piping system that includes a long span of production pipe disposed in a well, wherein said at least one swellable member is capable of choking back the inflow of fluids from the reservoir into said base pipe to assist in promoting even distribution of formation fluid recovery across the long span of production pipe.

27. An apparatus for restricting the flow of fluid into or out of an interior space of a base pipe useful in a hydrocarbon production or completion system, the base pipe having at least one port that allows fluid flow into or out of the interior space, the apparatus comprising:

- a housing disposed around the at least one port of the base pipe;
- at least one passageway disposed within said housing, said at least one passageway fluidly connecting the interior space of the base pipe and the exterior of the base pipe,

wherein fluid flow between the interior space and exterior of the base pipe must pass through said at least one passageway: and

at least one swellable member expandable into said at least one passageway and disposed between the at least one port of the base pipe and the exterior of the base pipe said at least one swellable member including at least one swelling elastomer and, whereby upon activation of the swellable member by at least one activating agent provided into said at least one passageway, the swellable member at least partially restricts the flow of fluid through said at least one passageway.

28. A method of restricting the flow of fluid from an earthen formation into an interior space of a tubular member, the tubular member including at least one port into the interior space to allow fluid flow into the interior space, the method comprising;

forming a fluid flow passageway around the tubular member;

fluidly connecting the fluid flow passageway with the earthen formation and the interior space of the tubular member, wherein fluid entering the interior space of the tubular member from the earthen formation must flow through the fluid flow passageway;

positioning at least one swellable member in the fluid flow passageway between the at least one port and the earthen formation,

allowing fluid to flow into the fluid flow passageway from the earthen formation; and

the at least one swellable member expanding into the fluid flow passageway upon contact with at least one activating agent to at least partially restrict the flow of fluid through the passageway and into the at least one interior space of the tubular member from the earthen formation.

29. The method of claim 28 further including a first swellable member expanding into and blocking the flow of fluid through the fluid flow passageway upon contact with water and a second swellable member expanding into and restricting the flow of fluid through the fluid flow passageway upon contact with hydrocarbons.

30. The method of claim 28 wherein the at least one activating agent is water, further including the at least one swellable member expanding into the fluid flow passageway upon contact with a desired quantity of water to stop the flow of fluid through the passageway and into the at least one interior space of the tubular member from the earthen formation.

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