US 20080179063A1

(19) United States
(12) Patent Application Publication
Smith
(10) Pub. No.: US 2008/0179063 A1
(43) Pub. Date: Jul. 31, 2008

(54) CHEMICALLY ENHANCED GAS-LIFT FOR OIL AND GAS WELLS

(76) Inventor: David R. Smith, Kilgore, TX (US)

Correspondence Address:
FULBRIGHT & JAWORSKI, LLP
1301 MCKINNEY, SUITE 5100
HOUSTON, TX 77010-3095

(21) Appl. No.: 12/020,090

(22) Filed: Jan. 25, 2008

Related U.S. Application Data

(60) Provisional application No. 60/886,588, filed on Jan. 25, 2007.

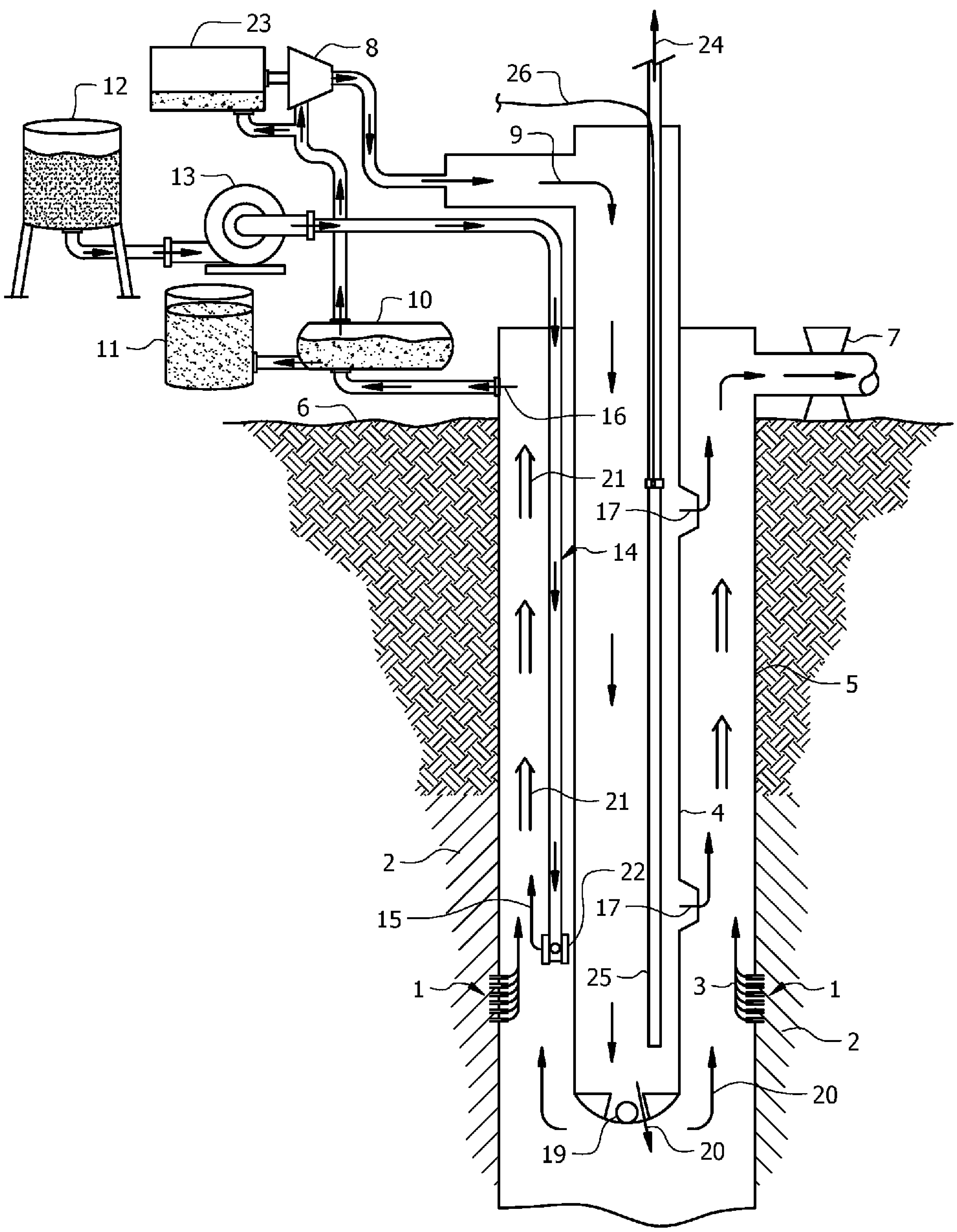
Publication Classification

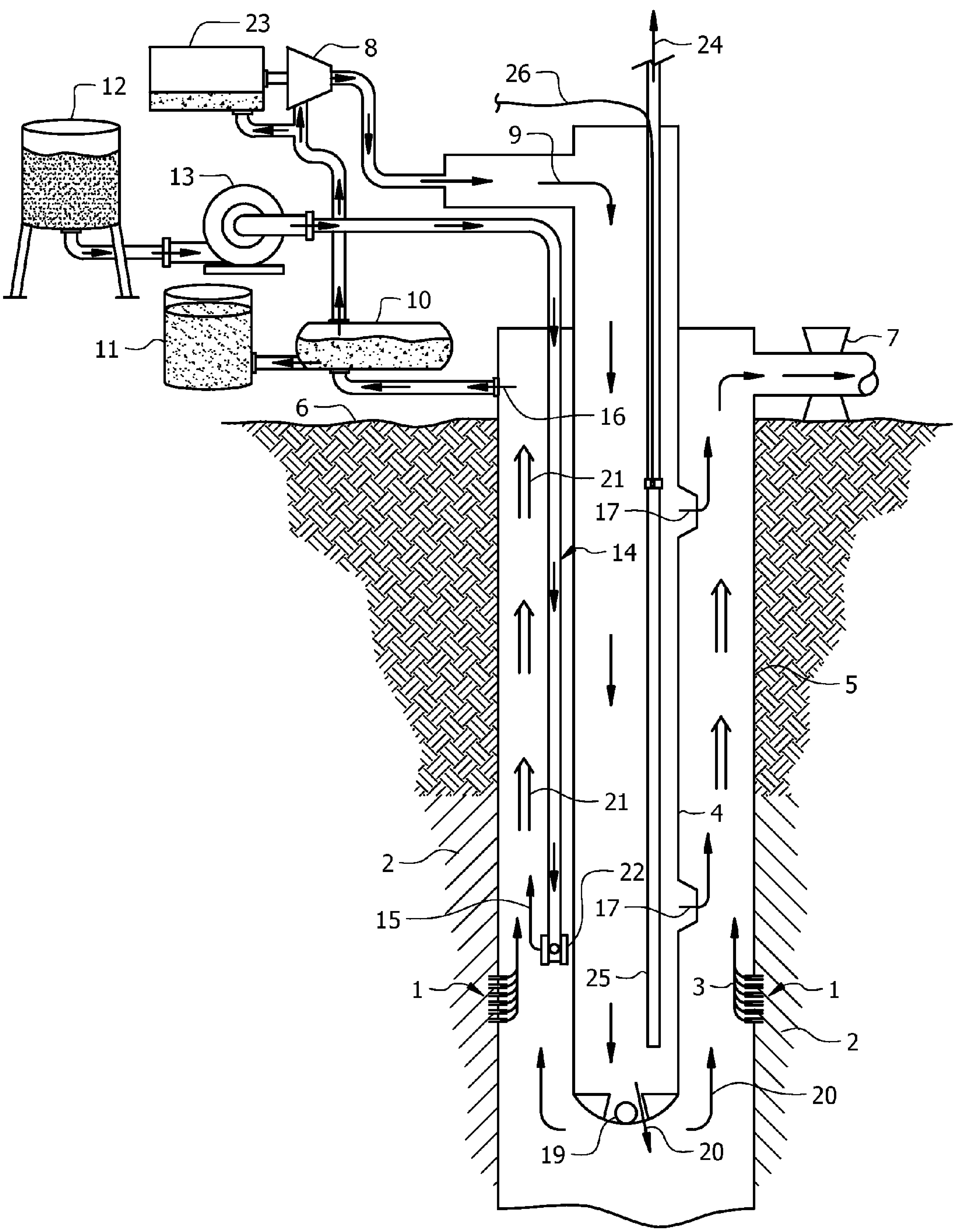
(51) Int. Cl.
E21B 7/12 (2006.01)

(52) U.S. Cl. 166/335; 166/252.1; 166/105

(57) ABSTRACT

A new well system and a corresponding method for the production of fluids from the well is presented. The well system and production process taught herein presents the means to use larger cross sectional flow areas for well fluid production by injecting energized gas and chemicals into the well.





THE FIGURE

CHEMICALLY ENHANCED GAS-LIFT FOR OIL AND GAS WELLS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to, and the benefit of, U.S. Provisional Application No. 60/886,588, filed on Jan. 25, 2007, which is herein incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention is directed to a chemical gas-lift method to enhance the fluid production from oil and gas wells.

BACKGROUND OF THE INVENTION

[0003] When a gas being produced from a subterranean reservoir in a well declines to a velocity insufficient for the reservoir energy to lift all of the well's liquids to surface, often referred to those familiar with the art of gas well production as the Minimum Critical Velocity ("MCV"), the well starts to accumulate liquids in the well bore. The accumulation of these liquids exerts a pressure against the subterranean reservoir thereby reducing the flow rate of fluids from the reservoirs into the well. In many cases this accumulation of fluids can cause the well to reduce the total amount of fluids to be produced from a well, and the rate of fluids a well can produce to surface. Indeed in many cases a well may cease flowing due to the liquid accumulation in the well bore and result in significant reserves of hydrocarbons going un-recovered. Therefore, it is necessary to remove these liquids from the well to enhance the gas produced from the subterranean reservoirs.

[0004] The current art of oil and gas well production has developed several methods to achieve this liquid removal. One method is to increase the velocity in the flowing stream of fluid being produced by deploying smaller production tubing strings into the well and flowing the fluids up these smaller tubing strings. This forces the reservoir fluids to flow up smaller diameter conduits at resulting higher velocities. Smaller production tubing strings are commonly known as velocity strings to those familiar with the art. This method has the advantage of being simple, but the disadvantage is that it increases the well system's friction loss, which results in increased pressure against the reservoir, thereby reducing the well's ability to produce fluids. Indeed, if one continues to run smaller and smaller velocity strings into a well over its life, the end result is a very small production tube with exceedingly high friction losses and exceedingly low production flow rates of fluids from the well. Moreover, as a well matures and the reservoir pressure declines, it is often found that large amounts of liquids accumulate in the well bore due to several phenomena including, but not limited to, the reservoir temperature dropping below the bubble point of oil, water condensing in the well bore at the lower production pressures associated with reservoir depletion, and underlying reservoir liquid coning in the reservoir up into the gas perforations in the well bore.

[0005] Another method used to remove liquids accumulating in gas wells, is to change the MCV of the well and increase the removal of well fluids by the injection of chemicals down hole into the well. This method of chemical injection has long been practiced by those familiar with the art of gas well deliquification in the form of dropping soap sticks, or the injection of friction reducing and foaming surfactant chemicals down the well. The chemicals injected cause the well fluids to be produced at a lower MCV. This method has the advantage of reducing friction in the well system. However, over time the well velocity continues to decline due to reservoir depletion and or the increase of liquid production in the well. Liquid increases can be caused by a multitude of issues including water coning, reservoir pressure depletion, or condensation of liquids from hot reservoir fluids. Therefore, even with the addition of MCV modifying chemicals, the well eventually cannot flow adequately as even the lower MCV threshold is insufficient to adequately bring liquids to the surface.

[0006] A still further method practiced by the oil and gas industry to remove well fluids from a gas well is to run a down hole pump into the well and pump the liquids out of the well while producing the gas up a separate conduit. This method is exceedingly difficult in gas wells because (1) pumps often gas lock with gas; (2) pumps actuated with sucker rods have a tendency to wear holes in the production tubing particularly in deep and deviated wells; (3) electrical pumps have difficulties related to solids produced in the well fluids and have cost disadvantages as they require electrical cable to be run with the pumps; and submersible pumps are susceptible to overheating in gas wells as the gas being produced often does not transmit internal motor heat away from the electrical submersible motor sufficiently to keep the pump cool enough to run in the well for extend months of service before it over heats and fails.

[0007] There is another method to assist in lifting fluids from wells, known as casing gas-lift to those familiar with the art of gas and oil production. This method of casing gas-lift injects high pressure gas into a well's casing, wherein a packer is set on the well's production tubing. The production tubing normally has a plurality of side pocket mandrels with gas-lift injection valves disposed along the length of the production tubing, which are set to allow the high pressure casing gas to inject gas into the well's production tubing to lighten the hydrostatic pressure in the well's production tubing. The advantage to this method is that it handles well solids very well, it does not have gas locking issues like pumps, it has minimal down hole moving parts, and it increases the velocity in the well system allowing the MCV to be maintained for a longer period of time. The disadvantage of this method is that casing gas-lift requires that well's reservoir fluid as well as the gas-lift gas be produced up the production tubing. As a well matures the volume of fluid that has to be moved up the production tubing can become exceedingly large which results in undesirably high friction losses at low flowing pressures to allow good production in the well. Additionally, this method does not allow the gas-lift gas to be injected below the shallowest perforations in the well. Hence in wells with many feet of perforated casing and production horizons the gas-lift gas does not get to the depth of the deeper sets of perforations, leaving these deeper perforations subject to more hydrostatic pressure exerted by a fluid accumulating in the well bore.

[0008] A further method of gas-lifting is known in the art of gas well production as tubing gas-lift. This method injects the high pressure gas-lift gas down the well's production tubing and through a plurality side pocket mandrels with gas-lift valves that allows the gas-lift gas to be injected into the well casing. The gas-lift gas than mixes with the produced reservoir fluids and the gas-lift gas and well fluids are produced up the casing where a much larger cross-sectional flow area is often available for the total production of fluids, both gas-lift gas and reservoir fluids, from the well. One advantage of this tubing gas-lift method is that it allows one to place the gas-lift gas past shallow perforations in the casing and get the gas-lift gas down to or below the deepest set of perforations. The disadvantage of this method is that the large amount of gas-lift gas required to achieve the MCV in these larger tubing by casing annulus areas, that is a velocity sufficient to lift the liquids out of the well, can be an exceedingly high velocity, as the MCV of a well system is a function of the flow area being used to lift the fluids to surface. Hence it is often cost prohibitive to produce tubing gas-lifted wells up the casing using previously known tubing gas-lift methods. This associated cost for current industry methods of tubing gas-lift is exceedingly high because the needed gas-lift gas injection rates become larger to achieve the MCV in the annulus flow area. The current gas-lift methods add cost due to the cost of compressors, power consumption of such compressors, and maintenance of compressors. However, the greater cross-sectional flow area presented in flowing the well fluids and the gas-lift gas up the casing is useful in reducing the well's systems friction component and allows a well to produce to a much lower abandonment pressure and at higher flow rates of gas and fluids to surface

[0009] What is needed is a tubing gas-lift method that reduces the well systems MCV and simultaneously reduces a well systems friction. A further need is to design a method and apparatus that allows the gas-lift gas injection to achieve the MCV to be minimized. A further need is a method and apparatus that allows surface read outs of down hole monitoring devices of these gas-lift gas injection methods in such a way so as to not incur significant cost or require interruption of the production of fluids from the well.

BRIEF SUMMARY OF THE INVENTION

[0010] The present invention is directed to a new well system and a corresponding method for the production of fluids from the well.

[0011] In one aspect of the present invention, there is a method for the production of fluids from subterranean reservoirs comprising the steps of: (a) constructing a well having a gas-lift injection conduit inserted inside a larger well conduit wherein said gas-lift injection conduit has at least one fluid passage to the larger well conduit, said gas-lift injection conduit and said larger well conduit extending from the surface of the well to a point below the surface of the well, said larger well conduit comprising a surface valve; (b) energizing a fluid at the surface with an energizing device; (c) injecting at least a portion of the energized fluid into a well through said at least one gas-lift injection conduit; (d) injecting a chemcial composition into the well, a foaming agent, and any combination thereof; and, (e) producing fluid to the surface from below the surface through said larger well conduit. In some embodiments, the chemical composition comprises a friction reducer, a foaming agent, a corrosion inhibitor, a scale inhibitor, or any combination thereof. In some embodiments, the energizing device is selected from the group consisting of a compressor, a pump, and any combination thereof. In some embodiments, the chemical composition comprises a foaming agent. In some embodiments, the fluid has a specific gravity less than water. In some embodiments, the step of constructing a well comprises deploying a side pocket mandrel on said gas-lift injection conduit. In some embodiments, the step of constructing comprises the step of deploying a gas-lift valve in said side pocket mandrel. In some embodiments, the method further comprised the step of monitoring said gas-lift valve deployed on the gas-lift conduit. In some embodiments, the step of monitoring comprises monitoring with a down hole optical fiber system and a surface optical time domain reflectometry ("OTDR") instrument. In some embodiments, the step of injecting into the well a chemical composition comprises injecting said chemical composition into said gas-lift injection conduit. In some embodiments, the step of constructing a well having a gas-lift injection conduit further comprises constructing said well with a separate chemical injection conduit inside the larger well conduit and said step of injecting a chemical composition comprises injecting a chemical composition through said separate chemical injection conduit. In some embodiments, the method further comprises the step of deploying a side pocket mandrel on said separate chemical injection conduit. In some embodiments, the method further comprised the step of deploying a chemical injection conduit valve on said side pocket mandrel on said separate chemical injection conduit. In preferred embodiments, the step of constructing a well having a gas-lift injection conduit and a separate chemical injection conduit inside the larger well conduit comprises constructing the well to have said separate chemical injection conduit outside said gas-lift injection conduit, said gas-lift injection conduit inside said larger well conduit. In some embodiments, the step of constructing a well having a gas-lift injection conduit and a separate chemical injection conduit inside the larger well conduit comprises constructing the well to have said separate chemical injection conduit inside said gas-lift injection conduit, said gas-lift injection conduit inside said larger well conduit. In some embodiments, the step of constructing a well comprises deploying a side pocket mandrel on said gas-lift injection conduit and deploying a chemical injection conduit valve on said side pocket mandrel on said gas-lift injection conduit, and wherein said separate chemical injection conduit is coupled to said side pocket mandrel and to said chemical injection conduit valve. In some embodiments, the step of energizing a fluid at the surface with an energizing device comprises energizing at least a portion of the fluid produced from the larger well conduit In some embodiments, the step of producing fluid comprises opening said surface valve on said larger well conduit to allow fluid to be produced to the surface. In some embodiments, the method further comprises the step of blending said chemical composition with said energized fluid prior to said step of injecting at least a portion of said energized fluid. In some embodiments, the step of injecting at least a portion of the energized fluid is performed using a different gas-lift injection conduit than said step of injecting into the well a composition selected from the group consisting of a friction reducer, a foaming agent, and any combination thereof. In some embodiments, one or both of said different gas-lift conduits has a distal end located above the a top perforation in a reservoir in said well. In some embodiments, one or both of said different gas-lift conduits has a distal end located between a top perforation and a bottom perforation in a reservoir in said well. In some embodiments, one or both of said different gas-lift conduits has a distal end located below a bottom perforation in a reservoir in said well. In some embodiments, the step of energizing a fluid comprises compressing said fluid.

[0012] In one aspect of the present invention, there is a well for the production of fluids from a subterranean reservoir comprising: (a) a gas-lift injection conduit extending from the surface of the well to a point below said surface; (b) a chemical injection conduit extending from the surface of the well to a point below said surface; (c) a larger well conduit extending from the surface of the well to a point below said surface, said larger well conduit comprising surface valve; wherein said gas-lift injection conduit and said chemical injection conduit is in fluid communication with said larger well conduit through a fluid passage point; and, (d) an energizing device fluidly coupled to said gas-lift injection conduit. In some embodiments, the chemical injection conduit and said gas-lift injection conduit are the same conduit. In some embodiments, the chemical injection conduit and said gas-lift injection conduit are separate conduits. In some embodiments, the well further comprises a pump coupled to a reservoir containing a chemical composition and to said chemical injection conduit. In some embodiments, one or both of said gas-lift injection conduit and said chemical injection conduit comprise an injection valve. In some embodiments, the injection valve of one or both of said gas-lift injection conduit and said chemical injection conduit is located at the distal end of said conduit. In some embodiments, one or both of said gas-lift injection conduit and said chemical injection conduit has a distal end located above the shallowest perforation in a reservoir in the well. In some embodiments, one or both of said gas-lift injection conduit and said chemical injection conduit has a distal end located between the shallowest perforation and the deepest perforation in a reservoir in the well. In some embodiments, one or both of said gas-lift injection conduit and said chemical injection conduit has a distal end located below a bottom perforation in a reservoir in the well. In some embodiments, one or both of said gas-lift injection conduit and said chemical injection conduit is located inside said larger well conduit. In some embodiments, one or both of said gas-lift injection conduit and said chemical injection conduit is located within another gas-lift injection conduit. In some embodiments, one or both of said gas-lift injection conduit and said chemical injection conduit comprises a plurality of side pocket mandrels along its length. In some embodiments, the well further comprises a valve in said side pocket mandrel. In some embodiments, the well further comprises means for monitoring said valve. In some embodiments, the means for monitoring comprises an optical time domain reflectometry instrument.

[0013] In another aspect of the present invention, there is a method of lifting fluids offshore on a facility from a riser pipe comprising the steps of transporting the production of a plurality of wells to the riser pipe, and injecting energized gas-lift gas into a gas-lift conduit located inside the riser pipe said gas-lift conduit in fluid communication with said riser pipe and injecting a chemical composition into the riser pipe, blending said chemicals in the energized gas, reducing the riser pipes minimum critical velocity required to lift fluids from the riser pipe.

[0014] The foregoing has outlined rather broadly the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention. It should be appreciated by those skilled in the art that the conception and specific embodiment disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention as set forth in the appended claims. The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages will be better understood from the following description when considered in connection with the accompanying figures. It is to be expressly understood, however, that each of the figures is provided for the purpose of illustration and description only and is not intended as a definition of the limits of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. **1** is a schematic of one embodiment of the well of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0016] As used herein, "a" or "an" means one or more. Unless otherwise indicated, the singular contains the plural and the plural contains the singular.

[0017] In the preferred embodiment of this invention, there is a well construction method and production process to lift fluids from gas wells. Numerical references refer to those shown in FIG. **1**. The well construction method comprises deploying with a rig or coiled tubing unit, a gas-lift injection conduit **4** into a well casing **5**, with a separate chemical injection conduit **14**, deployed parallel to the gas-lift injection conduit **4** using commonly known completion practices by the oil and gas industry. In FIG. **1**, the separate chemical injection conduit **14** is shown outside of the inner diameter of gas-lift injection conduit **4**. It should be understood that this is only one embodiment and that a separate chemical injection conduit **14** may be located within the inner diameter of gas-lift injection conduit **4**. Additionally, one or more separate chemical injection conduits may be both within and outside of the inner diameter of gas-lift injection conduit **4**. Ground level is shown as **6**. In some embodiments, the gas-lift injection conduit **4** has several side pocket mandrels, **17**, which may contain gas-lift or chemical injection valve disposed inside them wherein the side pocket mandrels are screwed onto gas-lift injection tubing joints at different depths selected based on the fluid loading characteristics of the well, the bottom hole flowing pressure of the reservoir, and other well and reservoir parameters understood and known by those familiar with the art of gas-lifting. In one embodiment, the gas-lift injection conduit **4** is deployed with the rig or coiled tubing unit such that the distal end is located below the deepest perforation of the well perforations **1** in the reservoir **2**, and at least one parallel and separate chemical injection conduit **14** is deployed with at least one distal end at or above the first shallowest reservoir perforations; the chemical injection conduit **14** having a chemical injection valve **22**. Reservoir **2** produces fluids **3**. It should be understood that the chemical injection conduit **14** and the gas-lift injection conduit **4** can be a continuous reel of tubing (tubing string) or jointed pipe which preferably may have one or more down-hole check valves located at their distal ends (and/or at other points in their respective lengths) to prevent back flow into the conduits. It is also clear that the spirit of this invention also includes the placement of the distal end of the chemical injection conduit **14** and its chemical injection valve **22** at other locations, including at the same level as, or at a level below the reservoir perforations **1**, as does the spirit and intent also include placing the distal end of the gas-lift injection conduit **4** at other locations, including at the same level as, or at a level above the reservoir perforated interval **1**.

[0018] In a preferred embodiment of the invention, there is a plurality of side pocket mandrel assemblies **17** are deployed in the gas-lift injection tubing above the top perforation, and a bottom orifice valve **19** is deployed below the lowest perforated interval on the bottom of the gas-lift injection conduit **4** allowing energized fluid **20** to pass from the gas-lift injection conduit **4** to larger conduit **5**. One or more of the plurality of side pocket mandrel assemblies **17** may have gas-lift valves disposed inside them for the flow of gas from gas-lift injection conduit **4**. Similarly, in some embodiments, the chemical injection conduit **14** may have injection assemblies and valves along its length for the passage of material from the interior of the chemical injection conduit **14** to its exterior. While the mandrel and valves are optional in both the gas-lift injection conduit **4** and the chemical injection conduit **14**, each of the gas-lift injection conduit **4** and the chemical injection conduit **14** must have at least one fluid passage point to fluidly couple the respective conduit to another area of the well. Preferably, this fluid passage point is located at or near the distal end of the conduits. This fluid passage point may be a valve or it simply may be an opening or orifice to allow material to pass. It may also be any other component capable of performing the task of material transfer; such components being known to those of ordinary skill in the art. The separate and parallel chemical injection conduit **14** may be strapped, banded, or clamped to the outer diameter of the gas-lift injection conduit **4** as the gas-lift injection conduit **4** and the chemical injection conduit **14** to allow the combined conduits to be more easily lowered simultaneously into a well with a rig or coiled tubing rig. It is clear to those having ordinary skill in the art that some wells may not need side pocket mandrels or bottom orifice valves for the gas-lift gas, and one can simply inject gas down the tubing and out the bottom of the distal end of the gas-lift injection conduit **4**, and that such is within in the spirit of this production method.

[0019] In one embodiment, the fluid lifting process is started using surface pump **13** to pump a chemical composition comprising a foaming anionic surfactant from a tank **12** down a separate and parallel chemical injection conduit **14** with the distal end of this chemical injection conduit **14** located at the top of the well perforations **1** while the well is shut-in. The surfactant is specifically designed to reduce the fluid friction pressure of the well system, and to foam the well fluids, while being compatible with the reservoir rock. Any surfactant composition known to those of ordinary skill in the art is useful here. Once the chemical has been injected, a compressor **8** is used to compress natural gas from a source, in this case the well's separator **10** connected to the well's fluid **16** being produced up the casing **5**. The well fluid **16** is separated into its gas and liquid components in separator **10**, with the liquid component directed to liquid storage tank **11** and the gas directed to compressor **8** or prime mover **23**. The energized fluid **9** is injected into the gas-lift conduit **4**. It is understood by those of ordinary skill in the art that in some wells, particularly those without gas-lift valves, the foaming surfactant can be injected at the surface into the energized fluid **9** and transported down-hole with the gas-lift gas stream. Preferably, the fluid to be energized has a specific gravity less than water.

[0020] In a preferred embodiment, a compressor **8** is placed at the well site such that the compressor's low pressure (i.e., suction) side takes gas either directly from the well's production stream or gas that is firstly passed through a separator **10** and then to the compressor's low pressure side to be energized. In some preferred embodiments, a portion of the gas from the separator is used to power the compressor's prime mover (i.e., power source) **23**, which is typically an internal combustion engine. This embodiment by using the compressor further allows the surface flowing pressure that the well's fluids must be produced against to be lowered by the compressor suction, allowing the well to continue to produce fluids from the reservoir to a lower abandonment pressure. In this way, the compressor's low pressure side is used to aid production by lowering the surface pressure and the pressurized side of the compressor uses the energized fluids to be injected in the well and increase the velocity in the well system.

[0021] A still further embodiment teaches that one or more separate chemical injection conduits **14** can be deployed within gas-lift injection conduit **4** instead of deployment outside and parallel to gas-lift injection conduit **4**, as in the preferred embodiment (alternatively, in embodiments having more than one gas-lift injection conduit **4**, one or more may be deployed within gas-lift injection conduit **4** and one or more may be separate chemical injection conduits, i.e., deployed outside of gas-lift injection conduit **4**). In some embodiments, the down-hole chemical injection fluid passage point at or near the distal end of the chemical injection conduit **14** is affixed to a side pocket mandrel **17** in the gas-lift injection conduit **4**, or at the bottom of the gas-lift injection conduit **4** in a bottom orifice. In some embodiments, kick over devices are used to retrieve gas-lift valves, dummy plug valves, or chemical injection valves from inside the gas-lift injection tubing using methods well known to those in the art of wireline and slick line tools. Deployment of one or more chemical injection conduits **14** within gas-lift injection conduit **4**, allows for the chemical injection conduit **14** to be pulled from the gas-lift injection conduit **4** without disturbing the gas-lift injection conduit **4**, pulling a damaged or plugged chemical injection valve, and replacing said valves without a rig intervention using wireline interventions methods.

[0022] In many embodiments, the production process comprises the injection of chemicals down into the well through the chemical injection conduit **14** while the gas-lift gas is injected down the gas-lift injection tubing **4** and both the energized gas-lift gas and the chemicals are injected into the larger well conduit **5** through which the mixed flow of fluids **21** from the well are produced to the surface. In some embodiments, depending upon the fluids being introduced into the well, the produced fluids comprise mixtures of fluids comprising the injected energized fluid, the injected chemical composition, and any fluids native to said subterranean reservoirs through said larger well conduit. The well's production conduit valve **7** is opened at the surface and the well is allowed to produce fluids up the production conduit, in this case the well casing **5**, while the gas-lift gas and the surfactant are being pumped down into the well via the gas-lift injection conduit **4** and the chemical injection conduit **14**. This method of tubing gas-lift introducing energized gas-lift gas deep into the perforated interval along with chemical injection for the for the purpose of lowering the well system's MCV in the casing allows the well to be produced up larger diameter conduits where friction is less with the minimal injection of energized fluids, thereby reducing the cost of compression of the energized fluid required to achieve the chemically enhanced MCV. Once the well starts to deliver the liquids up the casing, delivery of the gas-lift gas may slowly be reduced while the surfactant is continually pumped until a minimum gas-lift rate is achieved to deliver the liquids up the casing. If the well starts to produce at lower rates, delivery of the gas-lift gas may be increased to aid production. If the gas-lift compressor fails, or for any reason the well must be shut-in and fluids build up in the well, the upper gas-lift valves will allow the well fluids accumulated in the well to be lifted out again with minimal gas-lift gas due to the fact that the chemical composition being injected simultaneously down hole will again reduce the well system's MCV.

[0023] It is clear to those familiar with the art of gas well production that an almost unlimited combination of gas-lift gas injection rates and pressures, and chemical injection rates, pressures, chemical compositions and concentrations can be used, with each well system requiring adjustments to the lifting process throughout the life of the well. It is also clear that gas-lift valves and chemical injection valves and conduits can be substituted from inside the production tubing using well known apparatus and methods known to the industry such as slick line, braided wireline, jars, accelerators, coiled tubing, "kick over tools", and various other down hole tools well known to the oil and gas industry. It is also clear to those familiar to the art of well production that several chemical compositions can be injected into the well lifting process, via additional chemical injection lines, the blending of several chemical compositions at surface into a blend of well known oil and gas treatment chemicals or injecting said blends of chemicals at surface and injection them in with the gas-lift gas at surface. Various chemicals can be used with or for other well conditions in addition to surfactants chemicals used for reducing MCV. These other chemicals are well known to those in the oil and gas production industry and include corrosion inhibitors, scale inhibitors, freeze point depressant additives, paraffin and asphalteen inhibitors, diamanoid inhibitors, etc.

[0024] In preferred embodiments, the gas-lift injection valves are monitored for one or more variables. Monitoring may be by any analytical means, such as, but not limited to, optical and spectroscopic methods. One non-limiting example is optical time domain reflectometry ("OTDR"). An example of a commercial suppler of OTDR instruments is SENSORNET Ltd. This allows for a temperature measurement (thermometry) at multiple points along the gas-lift conduit simultaneously yielding a temperature versus depth profile of the gas-lift injection conduit. This temperature profile can be related to gas flow through the Joule-Thompson cooling effect occurring at gas-lift valves, orifices and tubing leaks as well as perforations in the well. Preferred application of optical and spectroscopic monitoring methods include the use of a fiber optic distributive sensor system **24** which is deployed from the surface to a down-hole location using an optical fiber monitoring tube **25** where the gas-lift injection valve is to be monitored. In some such embodiments using OTDR, distributive temperature monitoring is performed using a surface deployed OTDR instrument launching light down an optical fiber **26***nd* monitoring the back-scattered signal on an optical fiber as the well is being produced. Alternatively, flow can be measured directly with a thermal conductivity device located at the valve or fluid passage point. The analytical signal from the device can be transmitted to the surface through wire or wirelessly. Such methods are known to those of ordinary skill in the art.

[0025] Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims. Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the process, machine, manufacture, composition of matter, means, methods and steps described in the specification. As one of ordinary skill in the art will readily appreciate from the disclosure of the present invention, processes, machines, manufacture, compositions of matter, means, methods, or steps, presently existing or later to be developed that perform substantially the same function or achieve substantially the same result as the corresponding embodiments described herein may be utilized according to the present invention. Accordingly, the appended claims are intended to include within their scope such processes, machines, manufacture, compositions of matter, means, methods, or steps.

What is claimed is:

1. A method for the production of fluids from subterranean reservoirs comprising the steps of:

(a) constructing a well having a gas-lift injection conduit inserted inside a larger well conduit wherein said gas-lift injection conduit has at least one fluid passage to the larger well conduit, said gas-lift injection conduit and said larger well conduit extending from the surface of the well to a point below the surface of the well, said larger well conduit comprising a surface valve;

(b) energizing a fluid at the surface with an energizing device;

(c) injecting at least a portion of the energized fluid into a well through said at least one gas-lift injection conduit;

(d) injecting a chemical composition into the well; and,

(e) producing fluid to the surface from below the surface through said larger well conduit.

2. The method of claim **1**, wherein said energizing device is selected from the group consisting of a compressor, a pump, and any combination thereof.

3. The method of claim **1**, wherein said chemical composition comprises a corrosion inhibitor.

4. The method of claim **1**, wherein said chemical composition comprises a scale inhibitor.

5. The method of claim **1**, wherein said chemical composition comprises a hydrate inhibitor.

6. The method of claim **1**, wherein said chemical composition comprises a foaming agent.

7. The method of claim **1**, wherein said fluid has a specific gravity less than water.

8. The method of claim **1**, wherein said step of constructing a well comprises deploying a side pocket mandrel on said gas-lift injection conduit.

9. The method of claim **8**, wherein said step of constructing comprises the step of deploying a gas-lift valve in said side pocket mandrel.

10. The method of claim **9**, further comprising the step of monitoring said gas-lift valve deployed on the gas-lift conduit.

11. The method of claim **10**, wherein said step of monitoring comprises monitoring with a down hole optical fiber system and a surface OTDR instrument.

12. The method of claim **1**, wherein said step of injecting into the well a chemical composition comprises injecting said chemical composition into said gas-lift injection conduit.

13. The method of claim **1**, wherein said step of constructing a well having a gas-lift injection conduit further comprises constructing said well with a separate chemical injection conduit inside the larger well conduit and said step of injecting a chemical composition comprises injecting a chemical composition through said separate chemical injection conduit.

14. The method of claim **13**, further comprising the step of deploying a side pocket mandrel on said separate chemical injection conduit.

15. The method of claim **14**, further comprising the step of deploying a chemical injection conduit valve on said side pocket mandrel on said separate chemical injection conduit.

16. The method of claim **13**, wherein said step of constructing a well having a gas-lift injection conduit and a separate chemical injection conduit inside the larger well conduit comprises constructing the well to have said separate chemical injection conduit outside said gas-lift injection conduit, said gas-lift injection conduit inside said larger well conduit.

17. The method of claim **13**, wherein said step of constructing a well having a gas-lift injection conduit and a separate chemical injection conduit inside the larger well conduit comprises constructing the well to have said separate chemical injection conduit inside said gas-lift injection conduit, said gas-lift injection conduit inside said larger well conduit.

18. The method of claim **17**, wherein said step of constructing a well comprises deploying a side pocket mandrel on said gas-lift injection conduit and deploying a chemical injection conduit valve on said side pocket mandrel on said gas-lift injection conduit, and wherein said separate chemical injection conduit is coupled to said side pocket mandrel and to said chemical injection conduit valve.

19. The method of claim **1**, wherein said step of energizing a fluid at the surface with an energizing device comprises energizing at least a portion of the fluid produced from the larger well conduit.

20. The method of claim **1**, wherein said step of producing fluid comprises opening said surface valve on said larger well conduit to allow fluid to be produced to the surface.

21. The method of claim **1**, further comprising the step of blending said chemical composition with said energized fluid prior to said step of injecting at least a portion of said energized fluid.

22. The method of claim **1**, wherein said step of injecting at least a portion of the energized fluid is performed using a different gas-lift injection conduit than said step of injecting into the well a composition selected from the group consisting of a friction reducer, a foaming agent, and any combination thereof.

23. The method of claim **22**, wherein one or both of said different gas-lift conduits has a distal end located above the a top perforation in a reservoir in said well.

24. The method of claim **22**, wherein one or both of said different gas-lift conduits has a distal end located between a top perforation and a bottom perforation in a reservoir in said well.

25. The method of claim **22**, wherein one or both of said different gas-lift conduits has a distal end located below a bottom perforation in a reservoir in said well.

26. The method of claim **1**, wherein said step of energizing a fluid comprises compressing said fluid.

27. A well for the production of fluids from a subterranean reservoir comprising:

(a) a gas-lift injection conduit extending from the surface of the well to a point below said surface;

(b) a chemical injection conduit extending from the surface of the well to a point below said surface;

(c) a larger well conduit extending from the surface of the well to a point below said surface, said larger well conduit comprising surface valve;

wherein said gas-lift injection conduit and said chemical injection conduit is in fluid communication with said larger well conduit through a fluid passage point; and,

(d) an energizing device fluidly coupled to said gas-lift injection conduit.

28. The well of claim **27**, wherein said chemical injection conduit and said gas-lift injection conduit are the same conduit.

29. The well of claim **27**, wherein said chemical injection conduit and said gas-lift injection conduit are separate conduits.

30. The well of claim **27**, further comprising a pump coupled to a reservoir containing a chemical composition and to said chemical injection conduit.

31. The well of claim **27**, wherein one or both of said gas-lift injection conduit and said chemical injection conduit comprise an injection valve.

32. The well of claim **31**, wherein said injection valve of one or both of said gas-lift injection conduit and said chemical injection conduit is located at the distal end of said conduit.

33. The well of claim **32**, wherein one or both of said gas-lift injection conduit and said chemical injection conduit has a distal end located above the shallowest perforation in a reservoir in the well.

34. The well of claim **32**, wherein said one or both of said gas-lift injection conduit and said chemical injection conduit has a distal end located between the shallowest perforation and the deepest perforation in a reservoir in the well.

35. The well of claim **32**, wherein said one or both of said gas-lift injection conduit and said chemical injection conduit has a distal end located below a bottom perforation in a reservoir in the well.

36. The well of claim **27**, wherein one or both of said gas-lift injection conduit and said chemical injection conduit is located inside said larger well conduit.

37. The well of clam **27**, wherein one or both of said gas-lift injection conduit and said chemical injection conduit is located within another gas-lift injection conduit.

38. The well of clam **27**, wherein one or both of said gas-lift injection conduit and said chemical injection conduit comprises a plurality of side pocket mandrels along its length.

39. The well of claim **38**, further comprising a valve in said side pocket mandrel.

40. The well of claim **39**, further comprising means for monitoring said valve.

41. The method of claim **40** wherein said means for monitoring comprises an optical time domain reflectometry instrument.

42. A method of lifting fluids offshore on a facility from a riser pipe comprising the steps of transporting the production of a plurality of wells to the riser pipe, and injecting energized gas-lift gas into a gas-lift conduit located inside the riser pipe said gas-lift conduit in fluid communication with said riser pipe and injecting a chemical composition into the riser pipe, blending said chemicals in the energized gas, reducing the riser pipes minimum critical velocity required to lift fluids from the riser pipe.

* * * * *