METHOD OF DRIVING A WELL PUMP

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ABSTRACT

Production liquid from a well is pumped to the surface by a hydraulically driven reciprocating piston pump. The pump is driven in a drive stroke by a flow of hydraulic fluid supplied through a single tubing line applied to a drive side of a drive piston and in a return stroke by the weight of the production liquid heavier than the hydraulic fluid applied to the return side of the drive piston. The production liquid is pumped through the well casing. A control valve causes application of pressure in the hydraulic fluid for the drive stroke and release for the return stroke. The pump body includes a first duct communicating between the tubing and the bottom drive side of the drive piston and a second duct communicating between the well casing and the top drive return of the drive piston.
METHOD OF DRIVING A WELL PUMP

[0001] This invention relates to a method of driving a well pump.

BACKGROUND OF THE INVENTION

[0002] Down-hole hydraulic pumps with the valving, piston and pump (and its variations) were originally developed under the trade names “Kobe” and “Oilmaster”. Both have been available to the industry for more than five decades. The product enjoys worldwide acceptance under the current direction of Weatherford Oil Tool. These pumps find special application lifting large volumes of light oil in deep wells.

[0003] More recently Canadian application 2,258,237 by Cunningham suggested bringing the valving to the surface, and proposed using a downhole double acting hydraulic piston, three (3) strings of tube and a conventional oil well pump for placement in a horizontally drilled heavy oil well. The double acting feature of the hydraulic piston would be particularly useful as a pump pull-down in the highly viscous heavy oil applications for which the system was conceived.

[0004] Canadian application 2,260,518 proposes using a down-hole rotary hydraulic drive, coupled to a progressing cavity pump rather than the reciprocating version suggested by the Cunningham application. Both address the task of pumping heavy oil in deviated wells.

[0005] U.S. Pat. No. 7,380,608 (Geier) issued Jun. 3, 2008 discloses a hydraulic pump which uses hydraulic pressure from the surface to drive the reciprocating pump where a down hole counterbalance chamber generates a back pressure from the hydraulic pressure which is used to drive the pump back when the hydraulic pressure is released.

[0006] The disadvantages of an insert pumping system are widely acknowledged in the oil and gas industry. Up front capital costs to install a pump jack, rod string and insert pump are significant and require the use of a workover rig. Day rates and availability of workover rigs in periods of high activity warrant special consideration but generally are viewed as a necessary evil and are accepted as a cost of doing business. Once installed, this pumping system requires regular maintenance, mobilization of a workover rig is again necessary in addition to the costs of replacing tubing, rods and the BJIP during the workover. In Northern areas the costs of a simple pump change can exceed $100,000.00. Due to the above factors a review of existing systems was conducted in an effort to identify a cost effective alternative to a rod pumping system.

SUMMARY OF THE INVENTION

[0007] It is one object of the invention to provide a method of pumping liquid from a production location of a down hole well to a surface location.

[0008] According to one aspect of the invention there is provided a method of pumping liquid from a production location of a down hole well to a surface location,

[0009] where the well includes a well casing extending from the surface location to the production location.

[0010] the method comprising:

[0011] providing a hydraulic force at the surface location for generating a flow of hydraulic fluid under pressure;

[0012] providing a tubing extending from the pump through the well casing to the production location, the tubing being connected so as to carry the hydraulic fluid under pressure through the tubing to the production location;

[0013] operating a control valve to cause application of pressure in the hydraulic fluid to be applied into the fluid in the tubing and to cause the pressure to be released;

[0014] locating the tubing in the well casing so that the well casing surrounds the tubing so as to define a duct around the tubing for transport of production liquid through the well casing;

[0015] providing at the production location a reciprocating piston pump having a pump cylinder with a pump piston movable therein, an inlet for production liquid and an outlet for the production liquid communicating with the pump cylinder such that in inlet stroke of the pump piston causes a volume of the production liquid to be drawn from the inlet into the cylinder and an outlet stroke of the pump piston causes the volume to be expelled from the outlet;

[0016] locating the reciprocating piston pump in the well casing at the production location;

[0017] providing a packing between the reciprocating piston pump and the well casing such that the inlet is located below the packing and the outlet is located above the packing such that the stroke of the pump piston carries the volume of liquid from the production location below the packing to the well casing above the packing;

[0018] the reciprocating piston pump having a drive piston mounted in a drive cylinder and arranged such that a drive stroke of the drive piston in the drive cylinder acts to cause the pump stroke of the pump piston in the pump cylinder;

[0019] connecting the tubing to the reciprocating piston pump and providing a first duct in the reciprocating piston pump so as to transfer hydraulic fluid under pressure from the tubing to the drive cylinder at a position thereon on a first side of the drive piston such that pressure in the hydraulic fluid is communicated to the drive piston to drive the drive piston along the drive cylinder in the drive stroke;

[0020] providing a second duct in the reciprocating piston pump connecting the drive cylinder on a second side of the drive piston to the well casing above the packing so as to allow communication of production liquid into and out of the drive cylinder on the second side of the drive piston;

[0021] arranging the pressure in the hydraulic fluid to drive the drive piston through the drive stroke to overcome the pressure of the production liquid against the second side of the drive piston and to overcome the pressure of the production liquid against the pump piston to carry the volume of liquid from the production location below the packing to the well casing above the packing;

[0022] and causing the drive piston to move through a return stroke by operating the control valve to effect releasing the pressure in the hydraulic fluid so that pressure in the production liquid in the well casing applied to the piston on the second side the pressure applies a force to the drive piston.

[0023] The tubing can be coiled tubing or a conventional jointed tubing system.

[0024] Preferably the density of the hydraulic fluid is arranged to be less than that of the production liquid so that the column of production liquid in the well casing has a weight which is greater than that of the hydraulic fluid in the tubing.

[0025] Preferably pressure from the production liquid below the packing is applied to the pump piston from the inlet...
and added to the pressure from the production liquid on the drive piston so as to cause the drive piston to move through the return stroke.

[0026] Preferably the first and second ducts are formed in a cylindrical body of the reciprocating piston pump.

[0027] Preferably the drive cylinder is located in the reciprocating piston pump below the pump cylinder. However, other configurations are possible.

[0028] Preferably the first duct extends to the bottom of the drive cylinder.

[0029] Preferably the inlet and outlet include one way valves arranged in the required orientation to allow inlet and outlet as required.

[0030] Preferably the first duct is in open communication with the tube such that the hydraulic fluid is free to transfer back and forth between the tube and the first side of the drive cylinder and wherein the second duct is in open communication with the well casing such that the production liquid is free to transfer back and forth between the well casing and the second side of the drive cylinder.

[0031] According to a second aspect of the invention there is provided a method of pumping liquid from a production location of a downhole well to a surface location, the method comprising:

[0032] providing a hydraulic pump at the surface location for generating a flow of hydraulic fluid under pressure;

[0033] providing a drive conduit extending from the pump to the production location, the tubing being connected so as to carry the hydraulic fluid under pressure through the tubing to the production location;

[0034] providing a return conduit from the production location to the surface for transport of production liquid;

[0035] operating a control valve to cause the application of pressure to the hydraulic fluid to be applied into the fluid in the drive conduit and to cause the pressure to be released;

[0036] providing at the production location a reciprocating piston pump having a pump cylinder with a pump piston movable therein, an inlet for production liquid and an outlet for the production liquid communicating with the pump cylinder such that in inlet stroke of the pump piston causes a volume of the production liquid to be drawn from the inlet into the cylinder and an outlet stroke of the pump piston causes the volume to be expelled from the outlet;

[0037] locating the reciprocating piston pump at the production location;

[0038] arranging the reciprocating piston pump such that the stroke of the pump piston carries the volume of liquid from the production location into the return conduit;

[0039] the reciprocating piston pump having a drive piston mounted in a drive cylinder and arranged such that a drive stroke of the drive piston in the drive cylinder acts to cause the pump stroke of the pump piston in the pump cylinder;

[0040] connecting the drive conduit to the reciprocating piston pump and providing a first duct in the reciprocating piston pump so as to transfer hydraulic fluid under pressure from the drive conduit to the drive cylinder at a position thereon to a first side of the drive piston such that pressure in the hydraulic fluid is communicated to the drive piston to drive the drive piston along the drive cylinder in the drive stroke;

[0041] providing a second duct in the reciprocating piston pump connecting the drive cylinder on a second side of the drive piston to the return conduit so as to allow communication of production liquid into and out of the drive cylinder on the second side of the drive piston;

[0042] arranging the pressure in the hydraulic fluid to drive the drive piston through the drive stroke to overcome the pressure of the production liquid against the second side of the drive piston and to overcome the pressure of the production liquid against the pump piston to carry the volume of liquid from the production location below the packing to the return conduit;

[0043] causing the drive piston to move through a return stroke by operating the control valve to effect releasing the pressure in the hydraulic fluid so that pressure in the production liquid in the return conduit applied to the piston on the second side the pressure in applies a force to the drive piston.

[0044] While the arrangement described particularly hereinafter is intended to be used with a single tubing inside the well casing with the production passing through the well casing around the tubing, the same concept can be used to de-water gas wells using this pump. In this case, the pump is located inside of jointed production tubing with the production tubing having an inlet below the perforations.

[0045] In this case the fluid is supplied down a small diameter jointed or coiled tubing string as described above inside the production tubing, produced water passes up the annulus between the string and the production tubing, gas then produced to surface between the production tubing and casing. Thus there is formed a three conduit system defined by the inner tubing carrying the hydraulic fluid, a surrounding tubing carrying the pumped water and the well casing surrounding the outer tubing and carrying the produced gas. This pump would typically be installed offshore but could also be used on shore.

[0046] According to a third aspect of the invention there is provided a reciprocating piston pump for pumping liquid from a production location of a downhole well to a surface location,

[0047] where the well includes a well casing and a tubing inside the well casing both extending from the surface location to the production location;

[0048] the reciprocating piston pump comprising:

[0049] a pump body having defined therein a pump cylinder and a drive cylinder;

[0050] a pump piston movable in the pump cylinder;

[0051] a drive piston movable in the drive cylinder and arranged to drive the pump piston such that a drive stroke of the drive piston in the drive cylinder acts to cause the pump stroke of the pump piston in the pump cylinder;

[0052] an inlet for production liquid at and outlet for the production liquid communicating with the pump cylinder such that in inlet stroke of the pump piston causes a volume of the production liquid to be drawn from the inlet into the cylinder and an outlet stroke of the pump piston causes the volume to be expelled from the outlet;

[0053] the reciprocating piston pump being arranged to be mounted in the well casing at the production location with a packing between the reciprocating piston pump and the well casing such that the inlet is located below the packing and the outlet is located above the packing such that the stroke of the pump piston carries the volume of liquid from the production location below the packing to the well casing above the packing;

[0054] a coupling for connecting the tubing to the reciprocating piston pump;
a first duct in the pump body so as to transfer hydraulic fluid under pressure from the tubing to the drive cylinder at a position thereon on a first side of the drive piston such that pressure in the hydraulic fluid is communicated to the drive piston to drive the drive piston along the drive cylinder in the drive stroke;

and a second duct in the pump body connecting the drive cylinder on a second side of the drive piston to the well casing above the packing so as to allow communication of production liquid into and out of the drive cylinder on the second side of the drive piston.

The arrangement herein is based on the concept that by setting a packer and supplying the hydraulic pressure through a single tubing in the well casing, two hydrostatic columns exist in the well bore. One of the columns can be used to produce the well and operate the intake stroke of the pump while the other column can be used in conjunction with a hydraulic pump at surface to operate the displacement stroke of the pump. The system may offer one or more of the following advantages:

1. The pump jack and rod string have been eliminated.
2. Tubing wear, rod string wear and stripping jobs have been eliminated.
3. A workover rig, trucking and associated personnel have been eliminated.
4. The footprint now consists of a small prime mover (i.e., electric motor), hydraulic pump and reservoir.
5. Live well operations can be safely carried out by the CT unit with superior well control at all times.
6. Reduced rig up and trip times with a CT unit.
7. Due to the utilization of differential areas and force multiplication within the pump a low horsepower hydraulic surface pump will move the nearly hydrostatically balanced columns efficiently.
8. No exotic materials exist in the system and only requires off the shelf components readily available from the existing supply chain.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the invention will now be described in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic illustration of the apparatus and method for pumping production liquid from a downhole well to the surface.

FIG. 2 is a schematic illustration of the downhole reciprocating pump used in FIG. 1.

In the drawings like characters of reference indicate corresponding parts in the different figures.

DETAILED DESCRIPTION

The system illustrated comprises a down hole reciprocating piston pump 10 which is mounted in a well bore 11 at a production location 12 where production liquid 13 enters into the pump 10 for pumping to the surface through a well casing 14. At the surface 15 above the ground 16 is provided a liquid recovery system 17 of a conventional nature for receiving the pumped liquid for transportation or storage as required using conventional systems.

The pump is mounted within the well casing 14 by a packing system 18 which locates the pump within the well casing and also divides well casing into a production zone below the packing and into a transportation zone above the packing. Thus, as is conventional in such pumps, the liquid is transpired by the pump from the location below the packing into the well casing so that the production liquid is carried up the well casing by the addition of further liquid into the well casing by the pumping action.

In the surface equipment as shown in FIG. 1, there is provided a hydraulic pump 20 which generates pressure in a hydraulic fluid supplied through a tubing 21. The tubing extends through the well casing to the pump 10 where the tubing is connected to the pump for supply of the hydraulic fluid under pressure to the pump.

The hydraulic pump 20 receives hydraulic fluid from a tank 22 which is supplied to the pump 20 through a filter 23. The pump 20 is driven by a motor 24 which can be of any suitable construction. The pump 20 supplies the hydraulic fluid under pressure to a relief valve 25 which releases the pressure back to the tank in the event that an over pressure condition is encountered. A pressure control switch or actuator 26 detects the pressure of the hydraulic fluid and operates a shuttle valve 27 to release that pressure when required.

The tubing 21 can be a jointed tubing arrangement or can be formed by coil tubing as is well known in the industry. The tubing carries the hydraulic fluid to the pump 10 and allows flow of the fluid in both directions depending upon the pressure applied. The pressure control switch 26 is operated to activate and release the pressure in the tubing 21.

The tubing 21 constitutes the only supply to the downhole pump and a return conduit for transfer of production liquid is defined by the well casing 14 in the annular area surrounding the tubing.

At the end of the tubing 21 immediately prior to the pump 10 is provided a release tool 28 which allows the pump to be released from the tubing as required. Arrangements of this type are well known. Immediately above the release tool 28 is provided a circulating valve 29 again of a conventional construction which allows the release from the tubing into the well casing of required chemicals again in a manner which is well known to persons skilled in the art.

The pump 10 as best shown in FIG. 2 is therefore driven by the application of pressure in the hydraulic fluid and by the release of that pressure. The pump 10 comprises a pump body 30 formed as a cylindrical body which is typically formed in a number of pieces or sections connected end to end using conventional constructions. The individual sections are then machined to provide the required duets, bores and cylinders as described hereinafter. The arrangement and construction of these connected units is well known to a person skilled in the art so that description of the details is not necessary. The packing arrangement 18 is mounted on the cylindrical body and is again of a conventional construction well known for surrounding and mounting a cylindrical pump of this type so that the pump is held in position within the well bore.

The pump body 30 includes a pump cylinder 31 and a drive cylinder 32. Within the pump cylinder is provided a pump piston 33 which can move along the cylinder in a pump stroke and a return stroke. In FIG. 2 the piston is shown at the lower end of the cylinder 31 in an initial position for commencement of a pumping stroke. The cylinder 31 has an inlet duct 35 with a check valve 36 allowing production liquid to enter form the formation 12 into the interior of the cylinder 31. The inlet duct 35 is located below the packing 18 at a position as close as possible to the top of the cylinder 31. The cylinder
31 also has an outlet 37 with a check valve 38 allowing the production liquid form the cylinder 31 to escape in the pumping stroke into the interior of the well casing 14. Thus the pumping strokes of the pump piston 33 act to transfer the volume of liquid from the cylinder so that the liquid is carried from the production formation 12 into the well casing for a pumping action. The return stroke of the piston 33 draws the liquid from the formation 12 into the cylinder. The pumping stroke drives the liquid out through the outlet 37.

[0079] The pump piston 33 is connected by a piston rod 40 to a drive piston 41 within the drive cylinder 32. The drive cylinder 32 is on the outer or lower end of the pump body beyond the pump cylinder. The drive cylinder and the pump cylinder are separated by suitable components of the body so that there is no transfer of liquid therebetween. A seal 42 is provided on the piston rod 40 at the junction between the cylinders so that the piston rod can slide through the seal.

[0080] The cylinder 32 connects at its first end with a duct 43 which extends longitudinally of the body 30 in a longitudinal portion 44 through to the upper end of the body where the duct 44 communicates with the tubing 21. Thus the hydraulic fluid is free to communicate from the tubing 21 through the duct 44 and into the cylinder 32. The upper end of the cylinder 32 connects with a duct 45 which connects with a longitudinal duct 46 in the body extending longitudinally of the body to a position above the packing 18 where the duct 45 extends outwardly of the body to define an open communication 47 with the production liquid within the well casing 14. Typically the ducts 44 and 46 are angularly offset around the cylindrical body so that they can be drilled along the body at the common diameter within the thickness of the body outside the cylinders. In the schematic illustration, these are shown for convenience of illustration at the same angular position but spaced radially.

[0081] Both the first and second ducts communicating the hydraulic fluid and the production liquid are free from valves so they provide a free communication of the liquids between the outside of the pump and the interior of the cylinder 32 on opposite sides of the piston 41.

[0082] In operation, the control switch 26 is operated so as to activate the supply of hydraulic fluid through the tubing 21 and the duct 44 to the cylinder 32 at the first end of the piston 41. This hydraulic fluid is arranged to be of a pressure which is sufficient to overcome the back pressure from the weight of the production liquid which is applied onto the piston 33 by the column of liquid within the well casing. This pressure is applied by the column of liquid passing through the outlet 37 so that in order to provide a pumping stroke of the piston 33 the piston 41 must overcome this pressure and carry the volume of liquid from the cylinder 31 through the outlet 37 into the well casing.

[0083] At the end of the pumping stroke, the control switch 26 is arranged to detect the increase in pressure in the hydraulic fluid which is generated by the piston 41 reaching the end of its stroke. Upon this detection of an increase in pressure, the switch 26 acts to release the pressure in the tubing 21 by releasing the valve 27 causing the fluid in the tubing 21 to communicate back to the tank 22. As the pressure is released from the lower end of the cylinder 32, the back pressure generated by the column of production liquid within the well casing applies a force onto the top of the piston 33 causing the piston to commence a return stroke. As soon as the piston 33 passes the inlet 35, fluid commences to enter the cylinder from the formation 12 and the pressure in the formation 12 is also applied to the piston 33. These two pressures overcome the pressure against the bottom of the piston 41 generated by the weight of the column of hydraulic fluid in the tubing 21.

[0084] The production liquid has a density which is greater than the density of the hydraulic fluid. For this reason typically hydraulic fluid such as diesel fuel can be selected which is relatively low in density so that there is a significant difference in the weight of the column of production liquid relative to the weight of column of the hydraulic fluid. This extra weight of the column of production fluid applies the pressure to the upper surface of the piston ring 41 through the duct 46 and 47.

[0085] Thus as the drive piston goes through its drive stroke and its return stroke, the drive stroke hydraulic fluid is supplied through the tubing 21 and the production liquid escapes from the cylinder to the duct 46. The fluids are free to flow in both directions. As soon as the hydraulic pressure is released, the column of production liquid generates a pressure which is applied through the duct 46 to the top of the piston 41 to move the piston through its return stroke. As soon as the piston 33 passes the inlet 35 this backpressure from the production liquid is increased by the addition of pressure from the formation 12 thus causing the pistons to move through the return stroke.

[0086] Since various modifications can be made in my invention as herein above described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without department from such spirit and scope, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

1. A method of pumping liquid from a production location of a down hole well to a surface location, where the well includes a well casing extending from the surface location to the production location the method comprising:
   providing a hydraulic pump at the surface location for generating a flow of hydraulic fluid under pressure;
   providing a tubing extending from the pump through the well casing to the production location, the tubing being connected so as to carry the hydraulic fluid under pressure through the tubing to the production location;
   operating a control valve to cause application of pressure in the hydraulic fluid to be applied into the fluid in the tubing and to cause the pressure to be released;
   locating the tubing in the well casing so that the well casing surrounds the tubing so as to define a duct around the tubing for transport of production liquid through the well casing;
   providing at the production location a reciprocating piston pump having a pump cylinder with a pump piston movable therein, an inlet for production liquid and an outlet for the production liquid communicating with the pump cylinder such that in inlet stroke of the pump piston causes a volume of the production liquid to be drawn from the inlet into the cylinder and an outlet stroke of the pump piston causes the volume to be expelled from the outlet;
   locating the reciprocating piston pump in the well casing at the production location;
   providing a packing between the reciprocating piston pump and the well casing such that the inlet is located below the packing and the outlet is located above the
packing such that the stroke of the pump piston carries the volume of liquid from the production location below the packing to the well casing above the packing;

the reciprocating piston pump having a drive piston mounted in a drive cylinder and arranged such that a drive stroke of the drive piston in the drive cylinder acts to cause the pump stroke of the pump piston in the pump cylinder;

connecting the tubing to the reciprocating piston pump and providing a first duct in the reciprocating piston pump so as to transfer hydraulic fluid under pressure from the tubing to the drive cylinder at a position thereon on a first side of the drive piston such that pressure in the hydraulic fluid is communicated to the drive piston to drive the drive piston along the drive cylinder in the drive stroke;

providing a second duct in the reciprocating piston pump connecting the drive cylinder on a second side of the drive piston to the well casing above the packing so as to allow communication of production liquid into and out of the drive cylinder on the second side of the drive piston;

arranging the pressure in the hydraulic fluid to drive the drive piston through the drive stroke to overcome the pressure of the production liquid against the second side of the drive piston and to overcome the pressure of the production liquid against the pump piston to carry the volume of liquid from the production location below the packing to the well casing above the packing;

and causing the drive piston to move through a return stroke by operating the control valve to effect releasing the pressure in the hydraulic fluid so that pressure in the production liquid in the well casing applied to the piston on the second side the pressure in applies a force to the drive piston.

2. The method according to claim 1 wherein the density of the hydraulic fluid is arranged to be less than that of the production liquid so that the column of production liquid in the well casing has a weight which is greater than that of the hydraulic fluid in the tubing.

3. The method according to claim 1 wherein pressure from the production liquid below the packing is applied to the pump piston from the inlet and added to the pressure from the production liquid on the drive piston so as to cause the drive piston to move through the return stroke.

4. The method according to claim 1 wherein the first and second ducts are formed in a cylindrical body of the reciprocating piston pump.

5. The method according to claim 1 wherein the drive cylinder is located in the reciprocating piston pump below the pump cylinder.

6. The method according to claim 1 wherein the first duct extends to the bottom of the drive cylinder.

7. The method according to claim 1 wherein the inlet and outlet include one way valves.

8. The method according to claim 1 wherein the first duct is in open communication with the tubing such that the hydraulic fluid is free to transfer back and forth between the tubing and the first side of the drive cylinder and wherein the second duct is in open communication with the well casing such that the production liquid is free to transfer back and forth between the well casing and the second side of the drive cylinder.

9. A method of pumping liquid from a production location of a down hole well to a surface location, the method comprising:

providing a hydraulic pump at the surface location for generating a flow of hydraulic fluid under pressure;

providing a drive conduit extending from the pump to the production location, the tubing being connected so as to carry the hydraulic fluid under pressure through the tubing to the production location;

providing a return conduit from the production location to the surface for transport of production liquid;

operating a control valve to cause application of pressure in the hydraulic fluid to be applied into the fluid in the drive conduit and to cause the pressure to be released;

providing at the production location a reciprocating piston pump having a pump cylinder with a pump piston movable therein, an inlet for production liquid and an outlet for the production liquid communicating with the pump cylinder such that in inlet stroke of the pump piston causes a volume of the production liquid to be drawn from the inlet into the cylinder and an outlet stroke of the pump piston causes the volume to be expelled from the outlet;

locating the reciprocating piston pump at the production location;

arranging the reciprocating piston pump such that the stroke of the pump piston carries the volume of liquid from the production location into the return conduit;

the reciprocating piston pump having a drive piston mounted in a drive cylinder and arranged such that a drive stroke of the drive piston in the drive cylinder acts to cause the pump stroke of the pump piston in the pump cylinder;

connecting the drive conduit to the reciprocating piston pump and providing a first duct in the reciprocating piston pump so as to transfer hydraulic fluid under pressure from the drive conduit to the drive cylinder at a position thereon on a first side of the drive piston such that pressure in the hydraulic fluid is communicated to the drive piston to drive the drive piston along the drive cylinder in the drive stroke;

providing a second duct in the reciprocating piston pump connecting the drive cylinder on a second side of the drive piston to the return conduit so as to allow communication of production liquid into and out of the drive cylinder on the second side of the drive piston;

arranging the pressure in the hydraulic fluid to drive the drive piston through the drive stroke to overcome the pressure of the production liquid against the second side of the drive piston and to overcome the pressure of the production liquid against the pump piston to carry the volume of liquid from the production location below the packing to the return conduit;

and causing the drive piston to move through a return stroke by operating the control valve to effect releasing the pressure in the hydraulic fluid so that pressure in the production liquid in the return conduit applied to the piston on the second side the pressure in applies a force to the drive piston.

10. The method according to claim 9 wherein the density of the hydraulic fluid is arranged to be less than that of the production liquid so that the column of production liquid in the well casing has a weight which is greater than that of the hydraulic fluid in the tubing.
11. The method according to claim 9 wherein pressure from the production liquid below the packing is applied to the pump piston from the inlet and added to the pressure from the production liquid on the drive piston so as to cause the drive piston to move through the return stroke.

12. The method according to claim 9 wherein the first and second ducts are formed in a cylindrical body of the reciprocating piston pump.

13. The method according to claim 9 wherein the drive cylinder is located in the reciprocating piston pump below the pump cylinder.

14. The method according to claim 9 wherein the first duct extends to the bottom of the drive cylinder.

15. The method according to claim 9 wherein the inlet and outlet include one-way valves.

16. The method according to claim 9 wherein the first duct is in open communication with the drive conduit such that the hydraulic fluid is free to transfer back and forth between the drive conduit and the first side of the drive cylinder and wherein the second duct is in open communication with the return conduit such that the production liquid is free to transfer back and forth between the return conduit and the second side of the drive cylinder.

17. A reciprocating piston pump for pumping liquid from a production location of a downhole well to a surface location, where the well includes a well casing and a tubing inside the well casing both extending from the surface location to the production location; the reciprocating piston pump comprising:
   a pump body having defined therein a pump cylinder and a drive cylinder;
   a pump piston movable in the pump cylinder;
   a drive piston movable in the drive cylinder and arranged to drive the pump piston such that a drive stroke of the drive piston in the drive cylinder acts to cause the pump stroke of the pump piston in the pump cylinder;
   an inlet for production liquid at and an outlet for the production liquid communicating with the pump cylinder such that in inlet stroke of the pump piston causes a volume of the production liquid to be drawn from the inlet into the cylinder and an outlet stroke of the pump piston causes the volume to be expelled from the outlet; the reciprocating piston pump being arranged to be mounted in the well casing at the production location with a packing between the reciprocating piston pump and the well casing such that the inlet is located below the packing and the outlet is located above the packing such that the stroke of the pump piston carries the volume of liquid from the production location below the packing to the well casing above the packing; a coupling for connecting the tubing to the reciprocating piston pump;
   a first duct in the pump body so as to transfer hydraulic fluid under pressure from the tubing to the drive cylinder at a position thereon on a first side of the drive piston such that pressure in the hydraulic fluid is communicated to the drive piston to drive the drive piston along the drive cylinder in the drive stroke;
   and a second duct in the pump body connecting the drive cylinder on a second side of the drive piston to the well casing above the packing so as to allow communication of production liquid into and out of the drive cylinder on the second side of the drive piston.

18. The reciprocating piston pump according to claim 17 wherein the density of the hydraulic fluid is arranged to be less than that of the production liquid so that the column of production liquid in the well casing has a weight which is greater than that of the hydraulic fluid in the tubing.

19. The reciprocating piston pump according to claim 17 wherein the drive cylinder is located in the reciprocating piston pump below the pump cylinder.

20. The reciprocating piston pump according to claim 17 wherein the first duct extends to the bottom of the drive cylinder.

21. The reciprocating piston pump according to claim 17 wherein the inlet and outlet include one-way valves.

22. The reciprocating piston pump according to claim 17 wherein the first duct is in open communication with the tubing such that the hydraulic fluid is free to transfer back and forth between the tubing and the first side of the drive cylinder and wherein the second duct is in open communication with the well casing such that the production liquid is free to transfer back and forth between the well casing and the second side of the drive cylinder.

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