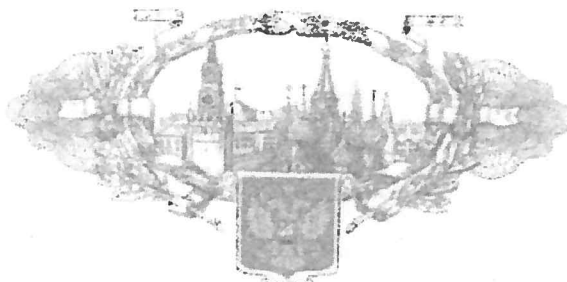


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PATENT
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**SMART HYDRAULIC PUMPING DEVICE FOR
RECOVERY OF OIL AND OBTAINING OF
INFORMATION FROM THE BOTTOM OF THE
RESERVOIR**

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*Head of the Federal Service for Intellectual
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[seal]

[signature]

L.L. Kiriy

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(54) SMART HYDRAULIC PUMPING DEVICE FOR RECOVERY OF OIL AND OBTAINING OF
INFORMATION FROM THE BOTTOM OF THE RESERVOIR

(57) Claims

1. A smart hydraulic pumping device for recovery of oil, obtaining and recording of

information from the bottom of the reservoir, characterized in that it includes a jet pump assembly, a bottom shut-off valve and gauge carrier that houses the electronic gauges, forming an integrated single block unit, which is activated by a drive fluid injected into the well from the surface to generate artificial lifting of oil, the closing of the bottom of the well, the restoration of the reservoir pressure and the recovery of the device to the surface.

2. The smart hydraulic pumping device, according to claim 1, characterized in that the jet pump is coupled to the bottom shut-off valve by means of a smart connector, which is connected to the lower part of the discharge body of the jet pump and is connected on the lower end to the bottom shut-off valve to allow the reservoir fluids to pass through its internal part from the bottom shut-off valve to the jet pump; it also opens and closes the by-pass so that the pressures are levelled when it is necessary to recover the smart device to the surface.

3. The smart hydraulic pumping device according to claim 1, characterized in that the bottom shut-off valve is coupled to the gauge carrier by means of a lower plug that allows the passage of fluids of the reservoir to the bottom shut-off valve and in its upper threaded part it is connected with the bottom shut-off valve and on its lower part it is connected to the gauge carrier; on the upper internal part it has a seat for the lower ball, and the metallic O ring.

4. The smart hydraulic pumping device according to claim 1, characterized in that the jet pump has a fishing neck; adaptor extension, upper packing mandrel that houses the nozzle on the inside and in the outer part it has the seal kit, the nozzle causes the transformation of the potential energy of pressure to kinetic energy of the speed of the injected fluid, known under the name Venturi effect; nozzle retainer, throat where the injection drive fluid and the well production fluid mix, the throat on the inside is formed by two angles of 2° and 15° , which reduce the loss of pressure due to friction; the outer tube that serves as a threaded coupling between the upper packing mandrel and the discharge body creating an empty space between the inner part of the outer tube and the outer walls of the throat and the diffuser through which the reservoir fluid circulates to later enter into the throat and continue its passage to the diffuser, which is the continuation of the cone of the throat, where the energy is increased to its maximum point to generate the lifting of the mixture till the surface, and the lower end of the diffuser is coupled to the discharge body that has longitudinal internal peripheral ducts through which the fluid enters the reservoir towards the jet pump and through a central internal duct transversally discharges the return of the drive and reservoir fluids mixed in the throat towards the empty space, between the casing e and the tubing.

5: The smart hydraulic pumping device according to claim 1, characterized in that the jet pump also includes an adaptor extension to assemble the fishing neck with the upper packing mandrel and fixes the jet pump in its housing through the pressure exerted by the anchoring bronze screws on the outer surface of this extension; this adaptor extension adapted to shear the bronze anchoring screws when the pump is displaced upwards in the operation for recovery of the same, and the connector is disengaged from the by-pass of the bottom shut-off valve.

6: The smart hydraulic pumping device, according to claim 1, characterized because the jet pump also includes a housing formed by an outer tube that is connected at the lower end to the body of the

bottom shut-off valve and its upper part it is connected to the upper packing mandrel that houses threaded holes where the screws are screwed on.

7: The smart hydraulic pumping device according to claim 1, characterized in that the bottom shut-off valve of the well includes a valve housing, the plunger assembly, the spring and the upper and lower balls made of tungsten carbide.

8: The smart hydraulic pumping device according to claim 7 in which the plunger assembly of the bottom shut-off valve includes two rectified surfaces where the upper and lower balls are housed for air-tight sealing of the bottom shut-off valve.

9. The smart hydraulic pumping device according to claim 1, characterized in that the bottom shut-off valve of the well also has a by-pass placed length-wise in the peripheral part of the valve housing.

10. The smart hydraulic pumping device according to claim 1, characterized in that the gauge carrier houses electronic pressure and temperature gauges and contains entry ducts of the fluid of the reservoir to the gauges, the springs and the Teflon MG 2 housing which completely insulate and protect the electronic gauges avoiding metal-metal contact, in the upper part it is screwed to the lower plug and the retainer nut fixes gauges to the gauge carrier. The gauge carrier is also a Chevron packing kit retainer when it is screwed on to the lower plug.

11. A method for recovery of oil and obtaining of recording of information from the bottom of the reservoir characterized because it contains a smart hydraulic pumping device which contains a jet pump, a bottom shut-off valve and gauge carrier that houses electronic gauges, coupled to each other to form an integrated single block unit, which uses the hydraulic energy of a drive fluid that is injected to the well from the surface to:

- positioning a smart device in the well;
- generating the artificial lift of oil for production and calculating the flow on the surface and recording the flowing pressure and temperature in the gauges;
- generating the closing of well and recording the pressure and temperature of the reservoir in the gauges and the restoration of the pressure of the same; and,
- generating the levelling of pressures and recovering the smart device towards the surface.

12. A method for recovery of oil and obtaining and recording of information from the bottom of the reservoir according to claim 11, characterized in that the positioning of the smart device in the completion of the well is initiated when plug is disconnected from the head, introducing the pump on the inside of the head, which is connected to the tubing, and initiating the displacing through this tubing till the pump is housed in the sliding sleeve at the bottom of the well, this displacement being done by means of a drive fluid through the injection line (water or oil) injected from the surface with a reciprocal hydraulic pump at a low pressure (100 -200 psi) till it reaches the depth of the sliding sleeve and is seated.

13. A method for recovery of oil and obtaining and recording of information from the bottom of the reservoir according to claim 11, characterized in that the artificial lifting is done after the hydraulic

pumping smart device is seated in the sliding sleeve and the drive fluid is injected at an increasing pressure (more than 1000 to 3500 psi) from the surface to the jet pump through the fishing neck till it arrives at the nozzle where a transformation of the potential energy of pressure of the fluid injected to the kinetic energy of speed takes place due to the Venturi effect, creates a vacuum, when the bottom shut-off valve automatically opens due to the upward push generated by the spring on the plunger, which in turn separates the ball from its seat, allowing the passage of the fluids from the reservoir from the lower plug towards the inside of the shut off valve, going through the inside of the plunger, lifting the ball and crossing the smart connector, moving towards the holes of the discharge body and in this manner arriving at the empty space between the inner surface of the outer tube and the outer surface of the diffuser, ending its trajectory at the suction point of the pump, which is the nozzle retainer where it is dragged and forced to enter the throat to mix with the injection fluid and this mixture of fluids to continue through the diffuser and continue its trajectory till the discharge body, moving towards the empty space between the casing tube and the production tube and finally lifting towards the surface and coming out through the production line.

14. A method for recovery of oil and obtaining and recording of information from the bottom of the reservoir according to claim 13, also characterized in that when the bottom shut-off valve is opened and the lifting of fluids till the surface takes place, the testing of the well to determine the maximum flow of the well, on the surface and the gauges housed in the gauge carrier continues to record the flowing pressure and the temperature.

15. A method for recovery of oil and obtaining and recording of information from the bottom of the reservoir according to claim 11, characterized in that the temporary closing of the well is started after completing the programmed flow period, suspending the injection of the fluid from the surface to the jet pump and closing the valves of the well head, at this moment due to the hydraulic push of the hydrostatic pressure that is acting on the shut-off valve, the upper ball along with the plunger descends, overcoming the resistance of the spring till it is seated in the lower ball, thus closing the bottom shut-off valve and automatically suspending the passage of fluid from the reservoir to the jet pump, at the moment in which the restoration of the pressure of the reservoir is initiated, reducing the "full effect" to a minimum.

16. A method for recovery of oil and obtaining and recording of information from the reservoir bottom according to claim 15, characterized also in that at the time in which the bottom shut-off valve closes and the closing of the well is generated, the gauges record the pressure of the reservoir and the temperature, that is to say the existing pressure in this interval from the reservoir to the bottom shut-off valve, simultaneously the restoration of the reservoir pressure is initiated, which increases with the passage of time till attaining its maximum point.

17. A method according to claim 15, characterized in that the recovery of the smart device to the surface is done by levelling the existing pressures above and below the bottom shut-off valve by opening a by-pass injecting a drive fluid in reverse, at a low pressure (100 to 500 psi) through the empty space that is found between the tubing and the casing, so that the jet pump is displaced upwards for a length of 381 mm, shearing the screws and the smart connector and comes out of the valve housing, at this

instant the by-pass is open, causing the pressure to be levelled and the smart device to be released from the sleeve and recovered to the surface.