

## Search history

Search 1: FT=(hole\* and control\* and device\* and flow\* and polymer\* and shear\* and tubular\* and inlet\* and outlet\* and coiled\* and tortuous\*) (Results 54)

Search 2: (FN=(44432240 OR 23890648 OR 30872858 OR 68162933)) (Results 4)

Search 3: 1. injection\* and viscosity\* (Results 1935)

Search 4: (3) AND IPC=(E21 OR C10 OR F16) (Results 271)

Search 5: (4) AND IPC=(E21 OR C10) (Results 235)

Search 6: (FN=(34891007 OR 60176164 OR 57713178 OR 9760349 OR 43365377 OR 55003583 OR 49084713)) (Results 7)

## 1) Family number: 34891007 (US2007168056A)

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Title: WELL CONTROL SYSTEMS AND ASSOCIATED METHODS

**Abstract:** Well control systems and associated methods. A well control method includes the steps of drilling a wellbore and predicting a change in flow between the wellbore and a reservoir prior to the change occurring, the predicting step being performed, and the change in flow occurring while drilling. Another well control method includes the steps of: sensing at least one first drilling operation variable while drilling a wellbore, thereby generating first sensed variables; sensing at least one second drilling operation variable while drilling the wellbore, thereby generating second sensed variables; and training a predictive device, using the first and second sensed variables, to predict the second drilling operation variable at a selected time.

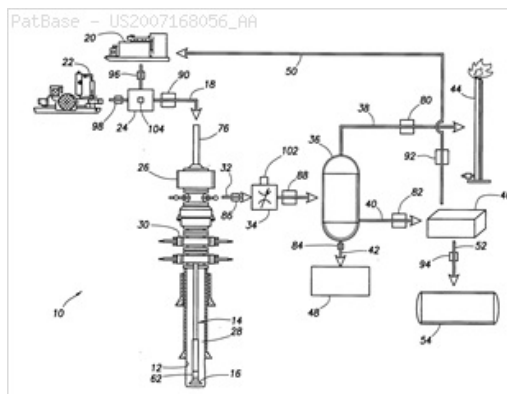
## Classifications:

**International (IPC 8-9):** E21B44/00 G05B13/02 G05B13/04 G06E1/00 G06E3/00 G06G7/00 (Advanced/Invention); E21B44/00 G05B13/02 (Core/Invention)

**CPC:** G05B13/048 E21B2041/0028 E21B44/00 G05B13/02 E21B44/005 G05B13/041 G05B13/026 G05B2219/2616

**European:** E21B44/00 G05B13/02 G05B13/02A4 G05B13/04D P21B41/00F S05B219/2616

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## Family:

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|--------------------|------------------|--------------------|------------------|
| BRPI0707157 A2     | 20110426         | BR2007PI07157      | 20070101         |
| CA2637584 AA       | 20080717         | CA20072637584      | 20070101         |
| CA2637584 C        | 20131126         | CA20072637584      | 20070101         |
| CN101395545 A      | 20090325         | CN200780007908     | 20070101         |
| CN101395545 B      | 20110316         | CN200780007908     | 20070101         |
| GB200813422 A0     | 20080827         | GB20080013422      | 20070101         |
| GB201108125 A0     | 20110629         | GB20110008125      | 20070101         |
| GB201108126 A0     | 20110629         | GB20110008126      | 20070101         |
| GB201108127 A0     | 20110629         | GB20110008127      | 20070101         |
| GB2447820 A1       | 20080924         | GB20080013422      | 20070101         |
| GB2447820 B2       | 20110720         | GB20080013422      | 20070101         |
| GB2479662 A1       | 20111019         | GB20110008125      | 20070101         |
| GB2479662 B2       | 20111207         | GB20110008125      | 20070101         |
| GB2479663 A1       | 20111019         | GB20110008127      | 20070101         |
| GB2479663 B2       | 20111130         | GB20110008127      | 20070101         |
| GB2480385 A1       | 20111116         | GB20110008126      | 20070101         |
| GB2480385 B2       | 20111228         | GB20110008126      | 20070101         |
| NO20083392 A       | 20081017         | NO20080003392      | 20080801         |
| NO20083392 L       | 20081017         | NO20080003392      | 20080801         |
| NO338495 B1        | 20160822         | NO20080003392      | 20080801         |
| US2007168056 AA    | 20070719         | US20060333768      | 20060117         |
| US7610251 BB       | 20091027         | US20060333768      | 20060117         |
| WO08016717 A2      | 20080207         | WO2007US60001      | 20070101         |
| WO08016717 A3      | 20081002         | WO2007US60001      | 20070101         |

## Priority:

**Probable Assignee:** HALLIBURTON CO**Assignee(s):** (std): CHEN DINGDING ; GODFREY CRAIG ; HALLIBURTON CO ; HALLIBURTON ENERGY SERV INC ; HALLIBURTON ENERGY SERVICES INC ; SCHULTZ ROGER L ; SHAYEGI SARA**Inventor(s):** (std): GODFREY CRAIG ; SCHULTZ ROGER L ; SHAYEGI SARA ; CHEN DINGDING ; SCHULTZ ROGER LYNN ; SARA SHAYEGI ; DINGDING CHEN ; CRAIG GODFREY ; GODFREY CRAIG W**Inventor(s):** ROGER L SCHULTZ**Agent(s):** OGILVY RENAULT LLP SENCRL SRL; NORTON ROSE FULBRIGHT CANADA LLP SENCRL SRL; SMITH IP SERVICES PC; MARLIN R; SMITH MARLIN R**Designated states:** AE AG AL AM AT AU AZ BA BB BE BF BG BJ BR BW BY BZ CA CF CG CH CI CM CN CO CR CU CY CZ DE DK DM DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GT GW HN HR HU ID IE IL IN IS IT JP KE KG KM KN KP KR KZ LA LC LK LR LS LT LU LV LY MA MC MD ME MG MK ML MN MR MW MX MY MZ NA NE NG NI NL NO NZ OM PG PH PL PT RO RS RU SC SD SE SG SI SK SL SM SN SV SY SZ TD TG TJ TM TN TR TT TZ UA UG US UZ VC VN ZA ZM ZW**2) Family number: 60176164 (WO15123736A1)**

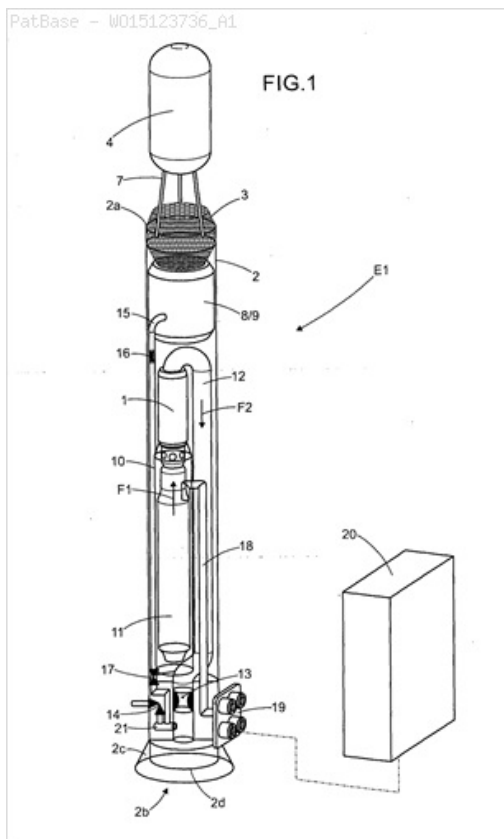
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**Title:** SUBSEA SYSTEM FOR INJECTION OF SEAWATER BY MEANS OF A SUBMERGED CENTRIFUGAL PUMP

**Abstract:** Subsea system for injection of seawater by means of a submerged centrifugal pump, more especially relating to a subsea system for injection of water into aquifers of petroleum or gas reservoirs requiring a secondary recovery method using water injection. The system is formed by a capture tube (2) that includes and keeps longitudinally aligned the pumping unit formed by a submerged centrifugal pump (1), a motor (11), a screen (3) or filters (6) and (8) or (9) and a flow measuring device (14). The stream of water is filtered through the screen (3) or filter (6) and then through the filter (8) or (9), and then flows towards the suction side of the submerged centrifugal pump (1). The suction side of the submerged centrifugal pump (1) is isolated from the discharge by means of a discharge pipe (12) or by means of a jacket (10). The capture tube (2) is able to float by means of a flotation device (4) and tethers (7) or is connected to/mounted directly onto the subsea tree (22); an ROV panel (19) is provided for connection of power cables and hoses for injection of chemicals, where necessary, and also comprises interfaces for valve operation. The speed of the motor (11), and consequently the flow and discharge pressure thereof are controlled by means of a speed-varying device (20) arranged externally to the capture tube (2). The present invention is mainly intended for use in injector wells where the injection of untreated seawater does not cause undesirable damage to the formation. The application thereof is directly linked to a reduction in water-injection plants installed on floating units.

**Classifications:****International (IPC 8-9):** E21B43/12 E21B43/20

F04D13/08 (Advanced/Invention)

**CPC:** E21B43/20 F04D13/066 F04D13/10 F04D29/708**Family:**

| Publication number | Publication date | Application number | Application date |
|--------------------|------------------|--------------------|------------------|
| WO15123736 A1      | 20150827         | WO2014BR00052      | 20140219         |

**Priority:**

WO2014BR00052 20140219

**Probable Assignee:** PETROLEO BRASILEIRO S A PETROBRAS**Assignee(s):** (std): PETROLEO BRASILEIRO S A PETROBRAS**Assignee(s):** PETROLEO BRASILEIRO PETROBRAS SA**Inventor(s):** (std): CAPELARI ORLOWSK RENE THIAGO ; MAIA DE SOUZA CARLOS EDUARDO**Agent(s):** FERNANDO DE CASTRO SA**Designated states:** AE AG AL AM AO AT AU AZ BA BB BE BF BG BH BJ BN BR BW BY BZ CA CF CG CH CI CL CM CN CO CR CU CY CZ DE DK DM DO DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GT GW HN HR HU ID IE IL IN IR IS IT JP KE KG KM KN KP KR KZ LA LC LK LR LS LT LU LV LY MA MC MD ME MG MK ML MN MR MT MW MX MY MZ NA NE NG NI NL NO NZ OM PA PE PG PH PL PT QA RO RS RU RW SA SC SD SE SG

**3) Family number: 57713178** (WO16030658A3)

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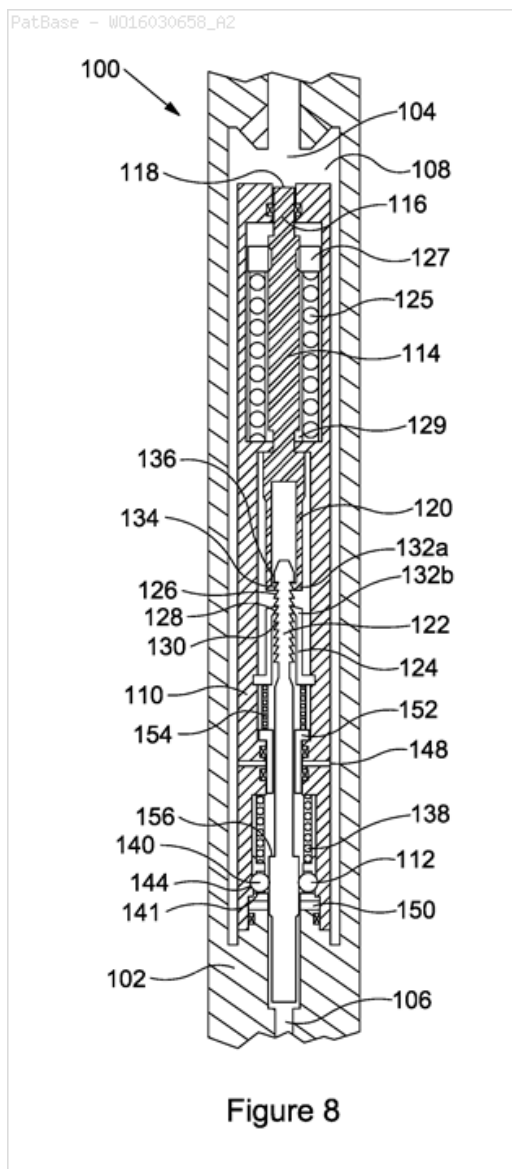
**Title:** FLOW SYSTEM

**Abstract:** A device and system and associated methods or operating and producing the device, the device (100) being configured to control flow in a line, conduit or capillary (40, 40'). The device includes at least one inlet (104), at least one outlet (106) and at least one flow path (148) extending between the at least one inlet and the at least one outlet. The at least one inlet and/or outlet is connectable to the line, conduit or capillary. The device includes at least a first part (114) and a second part (122). The first part includes at least one engagement or attachment member (120). The second part has at least one cooperating arrangement (126). The first part is movable in a first direction into a configuration where at least one of the engagement or attachment members engages, attaches or is attachable to or engagable with at least one of the cooperating arrangements of the second part. The first part is movable in a second direction whilst at least one of the engagement or attachment members of the first part is engaged or attached to at least one of the cooperating engagements of the second part so as to move the second part and thereby vary opening of and/or open and/or close the flow path. Optionally, at least one or each of the engagement or attachment members and/or at least one or each of the cooperating arrangements forms part of a ratchet mechanism.

**Classifications:**

**International (IPC 8-9):** E21B34/00 E21B34/10 E21B34/14  
E21B37/06 (Advanced/Invention)

**CPC:** E21B34/10 E21B34/14 E21B37/06 E21B2034/007

**Family:**

| Publication number | Publication date | Application number | Application date |
|--------------------|------------------|--------------------|------------------|
| GB201415275 A0     | 20141015         | GB20140015275      | 20140828         |
| WO16030658 A2      | 20160303         | WO2015GB51781      | 20150618         |
| WO16030658 A3      | 20160623         | WO2015GB51781      | 20150618         |

**Priority:**

GB20140015275 20140828

**Probable Assignee:** TCO IN WELL TECHNOLOGIES UK LTD

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**Inventor(s):** (std): WOODFORD KEITH DONALD

**Agent(s):** SCHMIDT CLAUS

**Designated states:** AE AG AL AM AO AT AU AZ BA BB BE BF BG BH BJ BN BR BW BY BZ CA CF CG CH CI CL CM CN CO CR CU CY CZ DE DK DM DO DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GT GW HN HR HU ID IE IL IN IR IS IT JP KE KG KM KN KP KR KZ LA LC LK LR LS LT LU LV LY MA MC MD ME MG MK ML MN MR MT MW MX MY MZ NA NE NG NI NL NO NZ OM PA PE PG PH PL PT QA RO RS RU RW SA SC SD SE SG SI SK SL SM SN ST SV SY SZ TD TG TH TJ TM TN TR TT TZ UA UG US UZ VC VN ZA ZM ZW

**Title:** STAND FOR INVESTIGATION OF PROCESS OF PUMPING BINDING SOLUTIONS INTO FISSURED ROCKS

**Abstract:** Source: SU1652581A **Machine translation:** E About ate ate th 00 Figure { tion borehole and formation with cracks and apparatus for pumping a hydraulic pump CP 11, cylinder 14 and piston 15. The last section is the internal volume of the cylinder 14 on the piston cavity 16 and the working cavity 17 filled Wed The cavity 17 is connected with the model 1. Hidroimpul'sy generated jet pulsator comprising a body 18c of the nozzle chamber (IC) 24 and the drain line 25. In the housing 18 arranged rotatable supply nozzle 20 connected to the hydraulic pump 11 and the nozzle receiver 22, coupled with the cavity 16 of cylinder 14. The pulsator is provided with a pressure regulator as a regulated drosselZobretenie relates to mining and can be used to study the process of injection solutions fastener cracks in rocks to select rational design parameters of the injection device, the injection process modes fastener solutions and parameters characterizing component composition, formulation and performance properties of the solutions. object of the invention - enhancing the technological capabilities of the stand by examining the process of pulsed injection fastener solution to crack rocks. 1 schematically depicts a stand for the study of the injection process fastener solutions in fractured rocks, general view in Figure 2 - a diagram explaining the operation of the pulsator in the borehole; fig.Z on - a schematic diagram of the control system pressure a pulsator nozzle chamber. Stand model comprises injection well connected thereto fractured reservoir model and the setting of the injection solution into the fastener, the simulated fracture. Model injection well is formed as a tube 1 with distributed therealong for exit holes fastener -, developing solvent, and with cracks formation model includes two cracking system models, each of which is attached to the tube 1 and comprises plates 3 and 4 of transparent material (e.g. plexiglass) defined therebetween thickness adjustable spacers forming a height adjustable gap 5, a crack. Plates 3 and 4 are fixed 139 and 40 instrument registering pressure in the UK 24. 39 has a throttle actuator control system software, installed in the UK containing 24 pressure sensors and fluid counter installed in the drain line 25, the software device (PU) and the correction block. Yield PU is connected to a counter, and its output connected to an input of the correction. The second input of the correction unit is connected to the sensor and an output - to the actuator. The processing of the drive control signal generated by the UE varies the hydraulic section of the throttle 39 and the pressure varies in the IC 24 to a value equal to the value computed PU. 3 ill. between rigid plates b and 7. which are made longitudinal slots 8 and 9 serving as viewing windows for visual and instrumental observation of the movement fastener solution to the gap (artificial crack) 5 during its injection. On the plate 6 along the viewing window 8 is set to the reference scale 10 the distance by which progresses solution in the gap 5 of the tube 1, modeling injection well in an array. Installation for pumping fastener solution reservoir model comprises a hydraulic pump 11 cracks the hydraulic tank 12 and discharge line 13, the hydraulic cylinder 14 operating piston 15 separating the internal volume of its cavity 16 by the piston and the working chamber 17 filled with solution and the fastener is connected to pipe 1 as well as the hydraulic pulse generator is configured as an inkjet pulsator comprising a housing 18 within which the rotor is mounted feeding 19c nozzles 20 provided with the drive 21, and receiver nozzle 22 connected to the piston cavity 16 of the hydraulic cylinder 14. In the housing 18 above the rotor 19 a cavity 23, high pressure, coupled to a nozzle 20 and a discharge line 13, and between rotor 19 and the receiving nozzle 22 - nozzle chamber 24, low pressure, provided with a drain line 25 connected to the hydraulic tank 12. In the discharge line 13 are mounted flow meter 26 and 27 gauge for registering the flow rate and fluid pressure at the inlet of the pulsator, wherein the discharge line 13 communicates with a hydraulic reservoir. 12 via an adjustable throttle 28, a tank 12 is provided with a thermoregulator 29, providing the possibility of varying the temperature of the working fluid circulating through the pulsator stand. In the nozzle chamber 24 of the pulsator 30 is installed a thermometer for monitoring the magnitude of said temperature. Stand equipped with a sensor system for detecting the pulse pressure pulse pressure parameters at different points of the working cylinder of 14 - Model 1 injection well - Model 2 cracks. 8 shows a sensor system 31, the sensor input r, a piston mounted in the cavity 16 of the hydraulic cylinder 14, the sensors 32 mounted at regular intervals along the pipe 1, the sensors 33 installed on two models of fissures uniformly along the length of the gap 5. Pressure sensors are connected to the recording equipment (eg, a multi-channel recorder, oscilloscope, etc.). In pulsed discharge fastener solutions to real crack rocks through the well shown in Figure 1 pulsator with a hydraulic cylinder 14, the operating chamber 17 is threaded fastener solution is lowered to 34 column drill pipe into the well 35 and positioned over an interval of fractured species subject to consolidation grouting fastener solution. The drill string 34 provides a supply of working fluid from the mud pump 36 and the pulsator to rotate its rotor with feed nozzles with drilling machines using the spinner and the lower end of the hydraulic operation / shndra packer 14 is provided, the sealing region of the fastening injection solution. The nozzle chamber is connected to the pulsator 36 to the annulus of the well drain windows 37 through which a pulsator otrabotavsha fluid discharged into the well. Drain over the windows 37 in the well 35 pulsator there washing liquid column height 38 h. In the absence of absorption of drilling fluid through the wellbore wall height h is equal to the depth of N. dipped pulsator 36 into the well (ie, well before the sun ust filled with fluid), and the presence of fluid loss height h of the liquid column 38 may have a different meaning depending on the degree of absorption of wash liquid, and with increasing absorption intensity value h is decreased, while in case of catastrophic acquisitions and shallow wells may decrease to a zero value. In the process of injection solutions fastener fractured rocks in absorbing the washing liquid, the height h of the liquid column 38 in the hole 35 is increased by eliminating the washing liquid absorption by filling cracks with fixing solution, and also due to the drain through the drain hole 37 the fluid box worked in the pulser. Thus, the value of the height h of the liquid column 38 in the well 35 may have a different meaning is determined and the immersion depth H of the pulsator 36 in the hole 35. the degree of absorption of wash liquid in the borehole and the time of the pulsator, defining an increment of the height h due to discharge flushing fluid through the window into the hole 37 of the pulsator. The greater the height h liquid column 38, the more the hydrostatic pressure transmitted from the wellbore to the pulsator nozzle chamber 36 through its drain window 37. Furthermore, h increases with increasing value of the hydraulic resistance and the annular space between the annular walls of the hole 35 and the drill string 34 in the interval h. As a result, an increase in h causes an increase in pressure in the wellbore zone accommodating pulsator 36 legally  $PC = h \cdot \rho \cdot g + P_0$  where PC - the pressure in the borehole in the zone of the pulsator; have - the weight of the liquid filling the well: DR - hydraulic resistance of the annulus of the well at the site height h, filled with liquid. size hydraulic resistance R L is calculated by known formulas and in each of the current time is determined: 1) geometrical parameters which relate to the diameter D of the borehole 35, the outer diameter d of the drill pipe in the drill string 34, the height h of the fluid column in the borehole 38 as well as the eccentricity between the axis C and the axis 34 of the column 35 wells roughness  $k_1$  wellbore and the outer surface roughness  $k_2$  drill pipe string 34, 2) the physical and mechanical characteristics of the pulsator is used for working fluid (water or mud), which relate to the temperature T degrees, proportion  $\gamma$ , n, and the dynamic viscosity  $\mu_0$  shear stress; 3) for flow rate Q discharged from the nozzle hole in a pulsator chamber 35 of the liquid defining a flow rate of the last device in the ring annulus; 4) rotational speed of the drill string 34, expressed in terms of its number of revolutions n per unit of time and the flow regime of the fluid in the annulus (laminar or turbulent) dependent on the magnitude of the number schim Reynolds  $Re$  stream. Accordingly, in view of (1) the pressure in the borehole in the zone of the pulsator can be represented in the following functional relationship:  $P_c = f(D, d, h, C, k_1, k_2, T, \gamma, n, \mu_0, Q, Re)$  (2) pressure  $P_c$  is transmitted to the pulsator nozzle chamber through its drain window 37 and has an influence on the formation conditions of turbulent flow characteristics submerged jet propagating in said chamber and, respectively, on the characteristics (amplitude, shape, slope and duration) the output pulses of the pulsator pressure generated in the piston cavity 16 of the hydraulic cylinder 14. In turn, the change in output characteristics of the pressure pulses of the pulsator 36 has an effect on the efficiency of a pulsed pumping of the solution of the fastener 17 from the working cylinder cavity 14 in the rock fractures. Said effect may vyrazits change in shape and energy parameters of pressure pulses acting on the solution in the range of fractured rocks and accordingly a change in resolving power (performance limit), a pulsed pumping the solution into the fastener fracture rocks which include the maximum value of the distance from the source of hydraulic pressure pulses (pulsator) to a range of fractured rocks in the wellbore, wherein the passage is provided by a source of pressure pulses generated to the specified interval and discharge them under the influence of the fastener solution fracture rocks at a predetermined distance from the borehole wall, the magnitude of the maximum power (along the extension of the borehole) interval fractured rocks, which can be sufficiently efficiently (with a solution of advancing by a predetermined distance from the walls of the borehole 35) is fixed with fixing solution, the minimum value of the crack opening at which injection is possible solution therein at a predetermined depth of the borehole walls, the value of the maximum distance of advance of the fastener from the solution in the wellbore fracture rocks and the maximum value of the formation fluid back pressure in the fractures, at which possible cracks in the injection solution to a predetermined depth of the borehole wall. To enable the study of the effect of on the bench alternating

pressure  $P_c$  transmitted from wells in the nozzle chamber 24 pulsator, the performance pulsator and analyzed by pulsed injection process fastener solutions in fracture rock chamber 24 is provided with a pressure regulator, designed as an adjustable throttle 39. Installed in the drain line 25, and reception-borom40 pressure in said chamber (e.g., manometer or an electromechanical transducer with a connected remote pointer device showing the pressure or recorder). Adjustable throttle 39 may be formed, for example, as the throttle washer 41 placed in the housing 42 and the conical adjusting needle 43, extending into the bore of the pulley 41. With this structure, the regulated throttle pressure  $P_c$  in the nozzle chamber 24 is defined by a pulsator under otherwise equal conditions, the magnitude of the flow resistance adjustable choke, which depends on the annular area and the geometric parameters (the taper angle of the needle 43, the edges of the apertures in the corners of the washer 41, those parts of the surface roughness) choke passageway. In turn, the flow area of the throttle aperture is determined by the magnitude  $S$  of the axial stroke of the needle 43 relative to the conical washer 41. The larger the stroke  $S$ , measured from the position where the hole in the washer 41 is completely closed by the needle 43 (corresponding to the maximum flow resistance of the throttle), the greater flow area of the throttle openings, and so smaller the flow resistance and, accordingly, the  $P_c$  is less than the pressure in the nozzle chamber 24 of the pulsator. Regulated throttle may be formed in the form of throttle holes overlapped rotary valve, and a spool device, etc. magnitude stroke  $S$  cone needle 43 can be adjusted manually adjustable control pressure  $P_c$  in the nozzle chamber 24 to 40 gauge. At the same time to allow the simulation to the real stand  $P_c$  pressure changes in the nozzle chamber 24 pulsator with his work in a well regulated throttle actuator 39 is provided with the system software 44 automatic control sufficient to maintain the pressure in the nozzle chamber 24 pulsator at a level appropriate to the real conditions of the pulsator in downhole. Said system comprises a sensor 45 for the pressure  $P_c$  in the nozzle chamber 24, the counter 46 volume flow passing through the adjustable orifice fluid (different from the flow meter that measures the flow rate is not in a unit time, and the volumetric amount of fluid flowing through the meter), the software 47 and device correction unit 48, while the input program device 47 is connected via inverter 49 to the counter 46 and its output connected to the input correction unit 48, whose second input is connected to the sensor 45 through the inverter 50, and an output - to the throttle actuator 44 through the inverter 51.

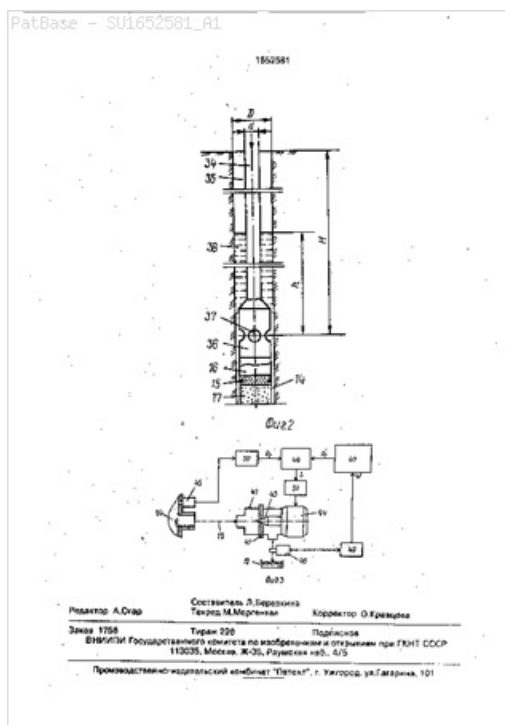
hydraulic cylinder 14 is mounted on a removable stop 52, locking piston 15 in its upper position. Stand operates as follows. In the first stage studies effect is examined, which gives a pressure change in the nozzle chamber  $P_c$  pulsator 24 to change the parameters hydraulic pressure pulse generated at the output of the pulsator in the cavity 16, in particular to modify the amplitude, shape, slope and duration of said pulses. At this stage, the load pulse is deaf mountain chamber cavity 16 formed at a fixed position of the piston 15, the stopper 52 opirayuschegos: To conduct research include motor 21, drive extending to rotate the rotor 19 to the nozzles 20 and the pump 11, forcing the working fluid in the cavity 23, the pressure pulser, wherein the fluid flows from the nozzles 20, which are formed on the outlet pressure, turbulent jet propagating in the nozzle chamber 24 and engaged with the rotary motion of the rotor 19. During each rotation of the nozzle 20 is periodically (at each revolution of the rotor 19) is aligned with the nozzle receiver 22, whereby the outlet nozzle 22 in piston cavities 16 formiruem pressure pulse whose frequency is determined by the number of supply nozzles 20 and the number of revolutions of the rotor 19, and amplitude - the magnitude of the pressure in the nozzles 20, the distance between the ends of the nozzles 20 and 22 and the value of the pressure  $P_c$  in the nozzle chamber 24. The working fluid is not popadayuscha nozzle 22, is discharged from the nozzle chamber 24 to the tank 12 through the drain line 25. With choke 39 regulates the pressure  $P_c$  in the nozzle chamber 24 from 0 to an upper limit corresponding to the maximum immersion depth of the pulsator in hole (2) in the actual conditions of the injection solution of the fastener. In the process of adjusting the pressure  $P_c$  in the register 20 to the nozzles 27 a manometer, the pressure in the nozzle chamber 24 by a manometer 40. 0 fluid temperature on the thermometer into the pulsator 30. the working fluid flow through the nozzle 20 via the flow meter 26 and the cavity formed in the piston 16 by means of a pulsating pressure datchi5 ka and 31 connected thereto the recording apparatus. Following this procedure is carried out a series of experiments in which regulates the pressure in the nozzles 20, the throttle 28. frequency 0 output pulse pressure in cavity 16 the change in the rotational speed of the rotor 19 and the number of supply nozzles 20, the temperature of the working fluid in the pulser temperature controller 29 through the working fluid flow adjustable pulsator 5 idros pump 11 mudflow-28, diameter of the nozzles 20, by replacing the feeding of the rotor of nozzles 19 or 20 (in case they are made in the form of singly parts fixed to the rotor 19). diameter 0 receiving nozzle 22 by replacing part of the nozzle and the distance between nozzles 20 and 22, axial movement of the nozzle 22 or the rotor 19. These studies establish the degree of influence of the variable 5 pressure in the nozzle chamber 24 of the pulsator by the amplitude, shape, slope and duration of pressure pulses generated in the piston cavity of the pulsator 16. In this set, nor under any znache0 x adjustable parameters characteristics of the output pulse pressure in the cavity 16 of the pulsator most significantly dependent on the magnitude of the pressure  $P_c$  in the nozzle chamber 24 and the value of any of the said 5 parameters of this dependence is less noticeable. The second stage of research studying the effect of that change has pressure  $P_c$  in the nozzle chamber 16 on the process 0 pulsed pumping fastener solution. At this stage, the workload of the pulsator pipe 1 and are connected thereto two fracture model assembled with a predetermined gap 5 simulating cracks 5 rocks. Working chamber 17 of the hydraulic cylinder 14 is charged with a solution of fastener with a predetermined component composition, formulation and viscosity, the pump 11, drive motor 21, the recording apparatus, to which are connected the pressure sensors 31-33, and if necessary, adjusting the system pressure in the nozzle chamber 24 shown in fig.2. After incorporation of the pump 11 and motor 21 forms the pulsator 16 in the piston cavity pressure pulses acting on the piston 15, which is in the upper position without motion until removed until stop 52 m. With 39 of the throttle set the initial pressure  $P_c$  in the nozzle chamber 24 pulsator corresponding actual pressure in the borehole 35 in the area of placing the pulsator 36, then remove the emphasis from 52 cylinder 14. Thus formed in the piston cavity 16 of said pressure pulse 15, a pulsating movement of the piston, during which the piston displaces the fastener solution gaps 5 fractures two models. In accordance with the pulsating nature of the movement of the piston 15 of the fastening pressure solution and its movement along a path cylinder 14 - Trumpet 1 - 5 clearances are also pulsating character. For the pulsatile motion of the solution to 5 clearances are watching through viewing windows 8, and documentation for the process observed for the purpose of providing the possibility of subsequent studies were conducted his movie or photograph. During pulsed pumping of the solution into the gaps 5 all the way to the piston 15 by the sensor 31, the pulse parameters are recorded pressure generated in the piston cavity 16 of pulsator 32 via sensors receive information about the degree of attenuation of the amplitude and duration of the change in shape and extending at pulse pressure in a solution, depending on the distance traversed by the data pulses along the pipe 1, and also depending on the extent of the (along the axis of the pipe 1) fractured reservoir model, the density and size of the simulated fracture-opening, while using a sensor 33 detects the distribution of pressure pulsing 5 along the gap in each pattern and simultaneously two times (time) passing a solution of said space portions, which are mounted on the sensors 33. Registration parameters pulsating pressure sensed by the sensor 31-33, produced with the help of them connected to the recording apparatus. Is recorded as the pressure in the nozzles 20 through the pressure gauge 27, pressure in the nozzle chamber 24 to the pressure gauge 40, flow rate and temperature on the thermometer 30 and the flowmeter 26. Simultaneously carry out surveillance of pulsating movement fastener solution to the gap 5 through viewing windows 8. When this distance is determined at which the solution is pushed across the gap 5 of the tube 1. With slow solution within said distance scale register 10, and at a rapid flow of the solution - with the help of sensors 33. Determined by the speed of movement of the pulse of the fastener along za0 Zorov solution based on the movie-shooting process observed through viewing windows 8. or according to recording signals from the sensor system 33 to the recording apparatus, said derivatives ing 5 record. Stand provides for both manual and automatic, if necessary, adjust the throttle 39. Manual adjustment of the throttle 39 is carried out 0 when the process is simulated but stand fastener pulsed pumping solution into the wells, in which there is no absorption of the washing liquid, whereby the borehole is completely filled 5 liquid (the height  $h$  of the liquid column in the well 38 is the immersion depth  $H$  of the pulsator 36, Figure 2) In this case ulceration kamerr  $P_c$  in the nozzle is kept constant during the injection, it is easy to 0 calculated by the formula (1) and is also easy to configure manually adjustable throttle 39. In case of simulating a pulsed injection at stand fastener solution wells fractured rocks PA5 is absorbed by the washing liquid, whereby the hole is only partially filled with fluid, manual adjustment of the throttle 39 becomes barely acceptable because of the fact that in this case the pressure  $P_c$  0 in the chamber 24 of the pulsator not permanently, and increases in accordance with the expression (1) due to the increase of the height  $h$  post 38 liquid in the well 35 as a result of draining it to work in the pulser 36 zhidko5 STI through its drain box 37. In this case, the adjustment of the throttle 39 and, accordingly, the pressure  $P_c$  is effected by an automatic control system (fig.2) containing 0 software device 47 into which is introduced the program, which takes into account the effect of the amount of  $F_c$  involved in the process of geometric, physical and mechanical parameters listed in dependence funktsional5 (2). The input device 47 via software converter 49 receives information from the counter 46 with the current amount of fluid (volume)  $W$  fluid drained in real conditions (Figure 2) into the hole 35 through the discharge window 37 pulsator 36 (Booth conditions in the tank 12), which leads to an increase in height  $h$  of the liquid column in the well 38 and accordingly, the pressure in the nozzle chamber of the pulsator 36. Counter 46 is included immediately after the removal of the stop 52 of the hydraulic cylinder 14 and said pulsator fluid drained from the beginning to the end of the piston 15, ie Evacuate until the end of the test pulse injection process fastening solution. In the program information of the device 47, The incoming signal in the form of  $W$ , processed (initially converted to growth of the height  $h$  of the liquid column 38 in the borehole 35, and then to increase the pressure  $P_c$

in the left chamber 24 of the pulsator nozzle) and after treatment is calculated pressure value  $P_V$ , which should be in the nozzle chamber 24 at the current time. Correction unit 48 receives from the sensor 45 via the signal converter 50 with the current  $P_C$  value of the pressure in the nozzle chamber 24, compares it with a signal  $P_s$  supplied from the program unit 47, and generates a control signal  $S$ , fed through inverter 51 to the actuator 44 that moves the throttle needle 43 relative throttle washer 41 by a distance  $S$ , corresponding to the input received signal. As a result of mining actuator 44 a control signal  $S$  varies flow resistance of the throttle, and simultaneously with the pressure  $P_c$  varies in the nozzle chamber 24 to a value equal to the value  $P_c$  calculated programming device 47. Following this procedure is carried out a series of experiments in which regulate 1) the main design parameters of the pulsator: diameter feed nozzle 20 through the rotor 19 or replacement of the nozzles themselves (if they are made in the form of singly parts actuated secured to the rotor 19), diameter nozzle receiver 22 by replacing part of the nozzle, distance between the nozzles 20 and 22, axial movement of the receiving nozzle 22 or the rotor 19; 2) The process parameters fastener pulsed injection solutions in fracture rocks: output frequency pressure pulses in the piston cavity 16 of the pulsator by changing the number of revolutions of the drive motor 21 and the feed amount of nozzle 20, amplitude output pulses of pressure in the piston cavity 16 the change in pressure drop at the nozzles 20 (the difference pressures in cavities 23 and the pulsator 24), an adjustable throttle 28 and 39. temperature of the circulating working fluid through the pulser 29 thermoregulator. flow of working fluid through the pulsator change performance variable displacement pump 11 and the throttle 28, providing a fine adjustment 0 specified flow: 3) parameters fastener solutions, the fill in the actuated cylinder 17: component composition, formulation, viscosity, and temperature. May 4) the parameters characterizing the geological conditions in a downhole injection zone of fastener solutions: initial pressure  $P_c$  in the area accommodating the pulsator 36 (Fig. 2) in the hole 35, 0 occurring before the pulsator and accordingly before draining of the pulsator 36 in the borehole, the guide variable height  $h$  of the liquid column in the well, and accordingly the pressure  $P_c$ . 5) varying gap in  $5 \times 2$  models simulating the magnitude of the crack opening rocks. spatial position (orientation) gaps 5. simulating cracks and 0 their mutual position by turning to  $\pi-1$  in a vertical plane and rotating the two patterns relative to the tube 1, depth of the injection well, the modeled pipe 1 by varying the length  $F$  upper interval of the tube 1, made between its inlet opening (mouth) connected to the hydraulic cylinder 14. and on top of the first two adjacent patterns of cracks and fissures in the density range of the discharge 0 well be treated with fixing solution, the amount of change patterns of cracks 2 and lengths of intervals intermediate pipe 1, enclosed between two models  $m_i$ , the length of the upper and promezhutoch5 intervals of the tube 1 is adjusted by changing the interchangeable nozzle comprised in the structure of the tube 1 and differing from each other in length, reservoir backpressure value 0 liquid simulated spring-loaded gates to be installed in outlets gaps in models  $5 \times 2$ . while setting the value of the counter-regulate the amount of force neobhodit5 direct for opening these gates. These parameters control within which can occur in real conditions during pulsed discharge fastener solution fissured rock interval in the well using pulsator shown in figure 1. As in the study process involves a large number of adjustable parameters increases the complexity of experimental studies, in order to simplify these studies use mathematical methods of experiments and statistical data processing, as well as the theory of similarity and dimensions allowing guide combine the single parameters characterizing the process in several complex parameters (criteria similarity), the number substantially smaller than the number of individual parameters. In this study, are a series of experiments, each of which vary one of the criteria of similarity at a constant value of the remaining criteria. These studies establish the degree of influence of the varying pressure values  $P_c$  in the nozzle chamber 24 of the pulsator by the amplitude, shape and duration of pressure pulses in the piston cavity 16, acting through the piston 15 on the fastener solution was injected into the fractured interval of rock and, respectively, for allowing power (performance) of the method of pulse injection fastener solution crack rocks which include the maximum value of the distance from the source of hydraulic pressure pulses (pulsator) to the fractured interval of the wellbore rock, which is provided with passage of generated source pressure pulses to the specified interval and discharge them under the influence of the fastener solution fracture rocks at a predetermined distance from the borehole walls, the value of the maximum power (along the extension of the borehole) interval fractured rocks, which can be of sufficient efficacy (providing advance solution at a predetermined distance from the wellbore) is fixed with fixing solution, the minimum value of the crack opening at which the possible injection solution therein at a predetermined depth of the borehole walls, the value of the maximum distance of advance of the fastener from the solution in the wellbore fracture mountain rocks and maximum value of the formation fluid back pressure in the fractures, at which possible cracks in the injection solution to a predetermined depth of the borehole walls. claims stand to investigate the process of injecting fastener solutions in fractured rocks containing model and injection well connected thereto fractured reservoir model, the apparatus for injecting the fastener rpstvora hydraulic pump with a cylinder and a piston separating its internal volume on the piston cavity and a cavity with a working solution fastener coupled with a model of the injection well, inkjet pulsator comprising a housing having a nozzle chamber and a drain line arranged in the housing at least one rotating feed nozzle connected to the hydraulic pump and the front nozzle a cavity piston coupled to the hydraulic cylinder, characterized in that in order to expansion of technological capabilities of the stand by examination process, a pulsed pumping the solution into the fastener fracture rocks pulsator jet pressure regulator is provided, made in the form of an adjustable throttle, and the pressure registering device in the nozzle chamber of the pulsator, wherein an adjustable throttle is driven from the system software the control comprising a pressure sensor mounted in the nozzle chamber of the pulsator and the counter fluid drain line mounted in the nozzle chamber pulsator device software and correction unit, wherein the input device connected to the program counter of the liquid, and an output - to one of the inputs of the correction unit, the second input of which is connected to a pressure transducer, and an output - to the actuator controlled throttle. Figure 2

#### Classifications:

**International (IPC 8-9):** E21C39/00 E21D11/00 (Advanced/Invention);  
E21C39/00 E21D11/00 (Core/Invention)

**International (IPC 1-7):** E21C39/00 E21D11/00



#### Family:

| Publication number | Publication date | Application number | Application date |
|--------------------|------------------|--------------------|------------------|
|--------------------|------------------|--------------------|------------------|

**Priority:**

SU19894701905 19890606

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**Title:** MANAGED PRESSURE DRILLING

**Abstract:** A method for drilling a wellbore comprises circulating a foam F through a tubular body and into the annulus between the tubular body and the wellbore 203, and maintaining a substantially homogenous foam flow regime F using one or more pressure control mechanisms. The control mechanism may be a choke 265, separator, gas injector, downhole lifting device, pump or other Equivalent Circulating Density (ECD) tool. The foam F may be a foamed cement. The homogenous foam flow regime may be maintained by altering foam quality, foam viscosity or foam shear strength.

**Classifications:****International (IPC 8-9):** E21B21/00 E21B21/08 E21B21/14

E21B33/06 E21B33/13 E21B33/14 E21B4/02 E21B44/00

E21B7/00 (Advanced/Invention);

E21B21/00 E21B33/03 E21B33/13 E21B44/00

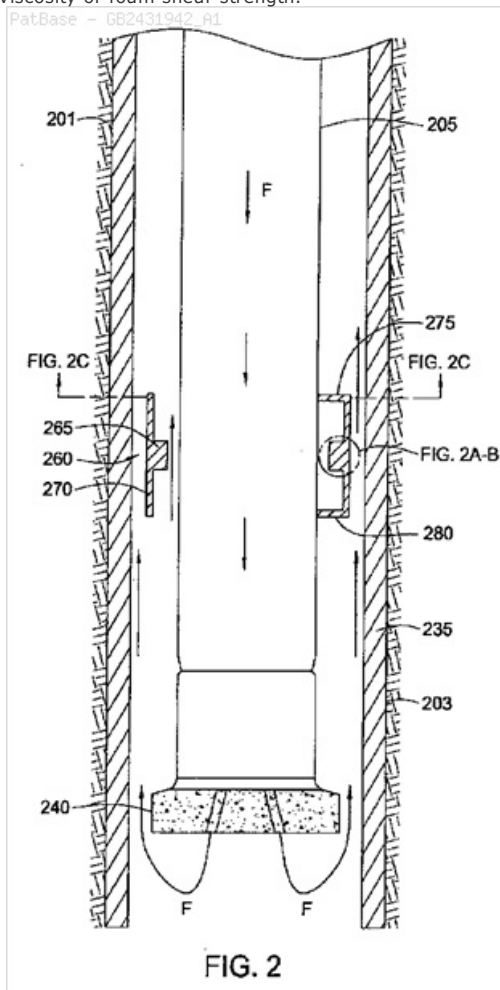
E21B7/00 (Core/Invention)

**CPC:** E21B33/13 E21B21/08 E21B4/02 E21B21/00 E21B21/14

E21B33/14 E21B2021/006

**European:** E21B21/00 E21B21/08 E21B21/14 E21B33/13 E21B33/14

E21B4/02 P21B21/00U

**Family:**

| Publication number | Publication date | Application number | Application date |
|--------------------|------------------|--------------------|------------------|
| CA2539266 AA       | 20070420         | CA20062539266      | 20060301         |
| CA2539266 C        | 20111011         | CA20062539266      | 20060301         |
| GB200603997 A0     | 20060405         | GB20060003997      | 20060301         |
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| GB2431942 B2       | 20090715         | GB20060003997      | 20060301         |
| NO20061019 A       | 20070423         | NO20060001019      | 20060301         |
| NO20061019 L       | 20070423         | NO20060001019      | 20060301         |
| NO337070 B1        | 20160111         | NO20060001019      | 20060301         |

**Priority:**

US20050254993 20051020 CA20062539266 20060301

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**6) Family number: 55003583** (US2015129465A)

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**Title:** SURFACE VERTICAL RETORT AND PROCESS TO OBTAIN OIL AND GAS FROM PYRO-BITUMINOUS OIL SHALE AND/ OR MATERIALS CONTAINING ORGANIC CARBON COMPOUNDS

**Abstract:** The invention relates to a surface vertical shaft retort (100), heated by an external source, which includes (i) a multifunctional central pipe (110), (ii) a top sealing device (120), (iii) a load distribution system (130), (iv) a retorting vessel (140) with an annular shaped bed (141) furnished with a set of load pipes (142), spaced among themselves, to form a collecting chamber to gather gas and mist (143), a hot gas injector (144), a cold recycle collector (145) and distributor (146), and a bed control and unloading mechanism (147), (v) a plenum chamber (150), (vi) a device for heat recovery of the spent shale (160) containing a piping network (162) for recirculation and spraying of the retorting water and accumulation hoppers (161) and (vii) a device for dry bottom sealing (170). In addition, this patent application comprises a process to obtain oil and gas from pyro-bituminous oil shale and/or materials which contain organic compounds using the referred surface vertical retort heated by an external source (100) through the following steps (a) load supply, (b) sealing of the load supply, (c) load distribution, (d) gathering and removal of gases and mist, (e) heating and drying of the load, (f) reinjection of gas stream from the cold recycle gas from stage (i), (g) load pyrolysis, (h) injection of the gas stream from the hot gas recycle, (i) removal of the cold gas recycle stream, (j) heat recovery of the spent shale, (k) discharge of the bed with annular shaped, (l) cold gas recycle injection (m) mixture of the cold recycle stream with water vapor stream, (n) collection in the accumulation hoppers of discharged spent shale, (o) spraying of the recycled retorting water, (p) vapor generation by the contact of the recycled retorting water with the retorted material deposited in the accumulation hoppers and (q) dry discharge of the spent shale, and bottom sealing.

**Classifications:**

**International (IPC 8-9):** C10B C10B1/04 C10B47/06 C10B49/04 C10B49/06 C10B53/06 C10G1/00 C10G1/02 C10G9/02

C10G9/04 (Advanced/Invention);

C10B (Subclass/Invention)

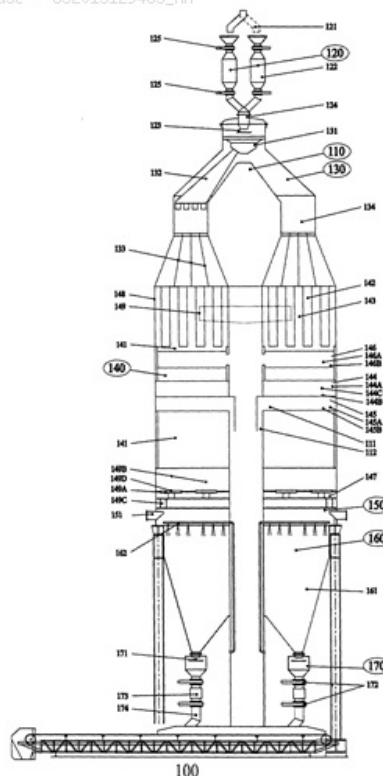
**International (IPC 1-7):** C10B1/04 C10B47/06

**CPC:** C10B53/06 C10B1/04 C10B49/04 C10B49/06 C10G1/02

C10G9/02 C10G9/04

**US:** 202/108 208/430

PatBase - US2015129465\_AA



**Family:**

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| BR102012009128 A2  | 20131126         | BR20121009128      | 20120418         |
| BR102012009128 B1  | 20190226         | BR20121009128      | 20120418         |
| CA2870361 AA       | 20141010         | CA20132870361      | 20130327         |
| CL2014002809 A1    | 20150116         | CL20140002809      | 20141017         |
| CN104245888 A      | 20141224         | CN201380020623     | 20130327         |
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| IL235070 A0        | 20141231         | IL20130235070      | 20130327         |
| MA37465 A1         | 20160429         | MA20140037465      | 20141029         |
| RU2014145951 A     | 20160610         | RU20140145951      | 20130327         |
| US2015129465 AA    | 20150514         | US20130395228      | 20130327         |
| WO13155578 A1      | 20131024         | WO2013BR00100      | 20130327         |

**Priority:**

BR201210009128 20120418 BR20121009128 20120418 WO2013BR00100 20130327

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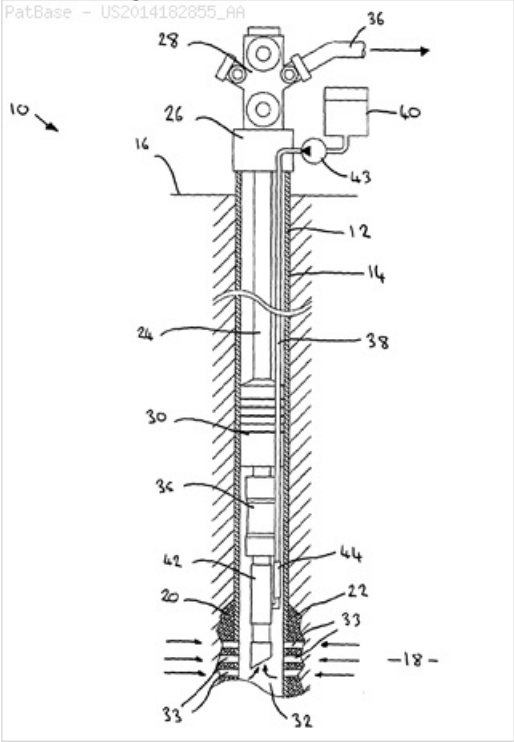
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7) Family number: 49084713 (US2014182855A) PatBase

**Title:** INJECTION DEVICE

**Abstract:** An injection device for use in injecting a fluid into a target location comprises a housing and a valve assembly located within the housing. The housing defines an inlet for communicating with an injection line, an outlet for communicating with a target location, and an injection fluid flow path extending between the inlet and outlet. The valve assembly located is configured to control the flow of injection fluid along the flow path and comprises first and second valve members both arranged to move within the housing, wherein in an open configuration to permit flow the first and second members are disengaged, and in a closed configuration to prevent flow the first and second members are engaged and the first valve member is biased against the second member by inlet fluid pressure to assist sealing therebetween.

**Classifications:**  
**International (IPC 8-9):** E21B34/08 E21B34/10 E21B37/06 E21B41/02 E21B43/25 F16K17/04 (Advanced/Invention)  
**CPC:** E21B34/08 E21B34/10 E21B37/06 E21B41/02 F16K17/044 E21B43/25  
**US:** 166/305.1 166/321



**Family:**

| Publication number | Publication date | Application number | Application date |
|--------------------|------------------|--------------------|------------------|
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| AU2012238486 BB    | 20170223         | AU20120238486      | 20120405         |
| BR112013025868 A2  | 20170404         | BR20131125868      | 20120405         |
| CA2832511 AA       | 20131007         | CA20122832511      | 20120405         |
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| EP2694778 A2       | 20140212         | EP20120716509      | 20120405         |
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| GB2489730 A1       | 20121010         | GB20110005873      | 20110407         |
| GB2489730 B2       | 20170809         | GB20110005873      | 20110407         |
| RU2013149407 A     | 20150520         | RU20130149407      | 20120405         |
| US2014182855 AA    | 20140703         | US20120110310      | 20120405         |
| US9540905 BB       | 20170110         | US20120110310      | 20120405         |
| WO12136966 A2      | 20121011         | WO2012GB00326      | 20120405         |
| WO12136966 A3      | 20130418         | WO2012GB00326      | 20120405         |

**Priority:**  
GB20110005873 20110407 WO2012GB00326 20120405

**Probable Assignee:** TCO AS

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**Assignee(s):** KEITH DONALD WOODFORD

**Inventor(s): (std):** KEITH DONALD WOODFORD ; WOODFORD KEITH DONALD ; TCO AS

**Agent(s):** MARKS AND CLERK AUSTRALIA; FB RICE; FB RICE PTY LTD; MARKS AND CLERK; DOCHERTY ANDREW JOHN; BELZER PC; JOHN G; DOCHERTY ANDREW

**Designated states:** AE AG AL AM AO AT AU AZ BA BB BE BF BG BH BJ BR BW BY BZ CA CF CG CH CI CL CM CN CO CR CU CY CZ DE DK DM DO DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GT GW HN HR HU ID IE IL IN IS IT JP KE KG KM KN KP KR KZ LA LC LI LK LR LS LT LU LV LY MA MC MD ME MG MK ML MN MR MT MW MX MY MZ NA NE NG NI NL NO NZ OM PE PG PH PL PT QA RO RS RU RW SC SD SE SG SI SK SL SM SN ST SV SY SZ TD TG TH TJ TM TN TR TT TZ UA UG US UZ VC VN ZA ZM ZW