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(54) Title: VALVE ARRANGEMENT AND METHOD OF OPERATING THE SAME

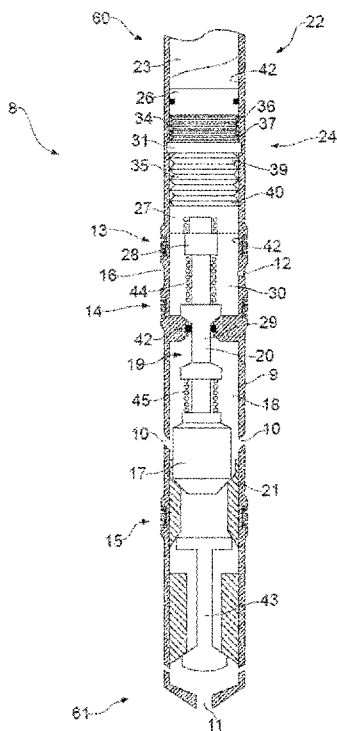


FIG. 2

(57) Abstract: A valve arrangement (8) for controlling the flow of an injection fluid from a well annulus (4) into a well conduit (5) of a hydrocarbon well (1), comprising a valve body (9) being insertable into a side pocket mandrel (6) of the hydrocarbon well (1), the valve body comprising: at least one inlet port (10) for receiving the injection fluid from the well annulus; at least one outlet port (11) for delivering the injection fluid to the well conduit; an injection fluid valve (19) being arranged in fluid communication with the least one inlet port and the at least one outlet port and being operable between an open position and a closed position for controlling the flow of the injection fluid through the valve arrangement; an actuating device (22) for actuating the injection fluid valve towards the closed position; and a bellows arrangement (24) comprising a first pressure member (26), a second pressure member (27) and at least one bellows element (34, 35) enclosing at least one bellows chamber comprising a bellows fluid, wherein the pressure members are hydraulically connected via the bellows fluid; wherein the injection fluid valve is connected to the second pressure member, and the actuating device is arranged adjacent to the first pressure member for biasing the injection fluid valve towards the closed position via the first pressure member, the bellows fluid and the second pressure member. According to the invention the valve arrangement comprises at least one control line port (12) being arranged in the valve body for fluid communication with a control line (7) of the well; and a control fluid chamber (30) being arranged inside the valve body adjacent to the second pressure member and in fluid communication with the at least one control line port, wherein the control fluid chamber comprises a hydraulic control fluid for biasing the injection fluid valve towards the open position via the second pressure member.





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According to International Patent Classification (IPC) or to both national classification and IPC

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E21B
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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009/113875 A2 (PETROLEUM TECHNOLOGY COMPANY A [NO]; KLEPPA ERLING [NO]; STOKKA OEYVIN) 17 September 2009 (2009-09-17) abstract; figures 1-3 -----	1-12
A	US 5 535 767 A (SCHNATZMEYER MARK A [US] ET AL) 16 July 1996 (1996-07-16) abstract; figures 3,4 -----	1-12
A	US 5 022 427 A (CHURCHMAN RONALD K [US] ET AL) 11 June 1991 (1991-06-11) claim 1; figure 2 -----	1-12
A	US 2004/182437 A1 (MESSICK TYSON R [US]) 23 September 2004 (2004-09-23) paragraph [0005] - paragraph [0006]; figures 3-6 ----- -/--	1-12

Further documents are listed in the continuation of Box C.

See patent family annex.

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003/111231 A1 (FAUSTINELLI JEAN LOUIS [VE]) 19 June 2003 (2003-06-19) claim 1; figures 1-3 -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2014/052080

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009113875	A2	17-09-2009	CA 2718215 A1 17-09-2009
			EP 2265794 A2 29-12-2010
			NO 328257 B1 18-01-2010
			US 2011067879 A1 24-03-2011
			WO 2009113875 A2 17-09-2009
US 5535767	A	16-07-1996	AU 706618 B2 17-06-1999
			AU 4808796 A 03-10-1996
			DE 69629973 D1 23-10-2003
			DE 69629973 T2 19-05-2004
			EP 0732479 A2 18-09-1996
			NO 961030 A 16-09-1996
			US 5535767 A 16-07-1996
US 5022427	A	11-06-1991	BR 9003919 A 12-11-1991
			GB 2241523 A 04-09-1991
			NO 903523 A 03-09-1991
			US 5022427 A 11-06-1991
US 2004182437	A1	23-09-2004	BR PI0401943 A 14-12-2004
			CA 2461485 A1 21-09-2004
			CA 2700296 A1 21-09-2004
			CA 2700640 A1 21-09-2004
			CA 2700642 A1 21-09-2004
			CA 2700661 A1 21-09-2004
			GB 2400412 A 13-10-2004
			NO 20041144 A 22-09-2004
			US 2004182437 A1 23-09-2004
US 2003111231	A1	19-06-2003	NONE