

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
20 April 2006 (20.04.2006)

PCT

(10) International Publication Number  
WO 2006/041376 A1

(51) International Patent Classification<sup>7</sup>: B25D 9/14

(21) International Application Number:  
PCT/SE2005/001425

(22) International Filing Date:  
28 September 2005 (28.09.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
0402482-4 14 October 2004 (14.10.2004) SE

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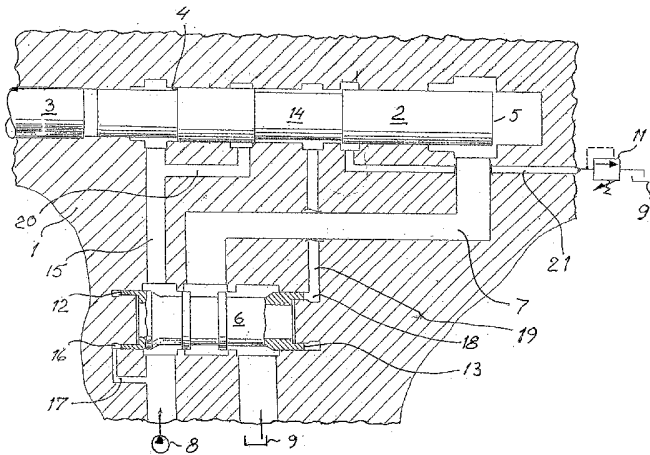
(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,  
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,  
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,  
KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY,  
MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO,  
NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK,  
SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,  
VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,  
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,  
FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,  
RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,  
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:  
— with international search report

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: PERCUSSION DEVICE



(57) Abstract: Percussion device including a machine housing (1), a forwards and backwards movable percussion piston (2) in the machine housing, and a reciprocatingly movable valve body (6) in the machine housing, said percussion piston (2) being arranged to subject a tool (3) to impacts, and said percussion piston including a first (4) and a second (5) driving surface intended to be subjected to pressure in order to drive the percussion piston (2) forwards and backwards, said valve body (6) including a first end surface (12) and a second end surface (13), wherein the pressurizing of the first end surface (12) tends to drive the valve body in a first direction and pressurizing of the second end surface (13) tends to drive the valve body in a second direction, whereby the valve body (6) is arranged, over a channel (7) arranged in the machine housing, to connect at least the second (5) of the driving surfaces alternately to a pressure source (8) or to low pressure (9), wherein the second end surface (13), by the percussion piston (2), is alternately connectable to the pressure source (8) or, over a valve device (11) for creating a counter-pressure, to the low pressure (9).

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**PERCUSSION DEVICE**

The present invention relates to a percussion device of the type that is included in rock drilling machines.

In a previously known percussion device of this kind, see US 5372196, it has been proved to be difficult to obtain sufficiently fast valve change-over in order to work at the high frequencies that are desired in modern high performance drilling. An essential explanation thereto is that an important portion of the liquid which is located in front of the valve body at the return of the valve body continues because of inertia. Because of this a refill must take place in order to build up the pressure before the valve body starts to move in the opposite direction.

The present invention as defined in the following claims, aims at creating a percussion device with fast valve change over which is suitable for high performance drilling.

An embodiment of the invention is described below with reference to the annexed drawing which schematically shows a section through a percussion device according to the invention.

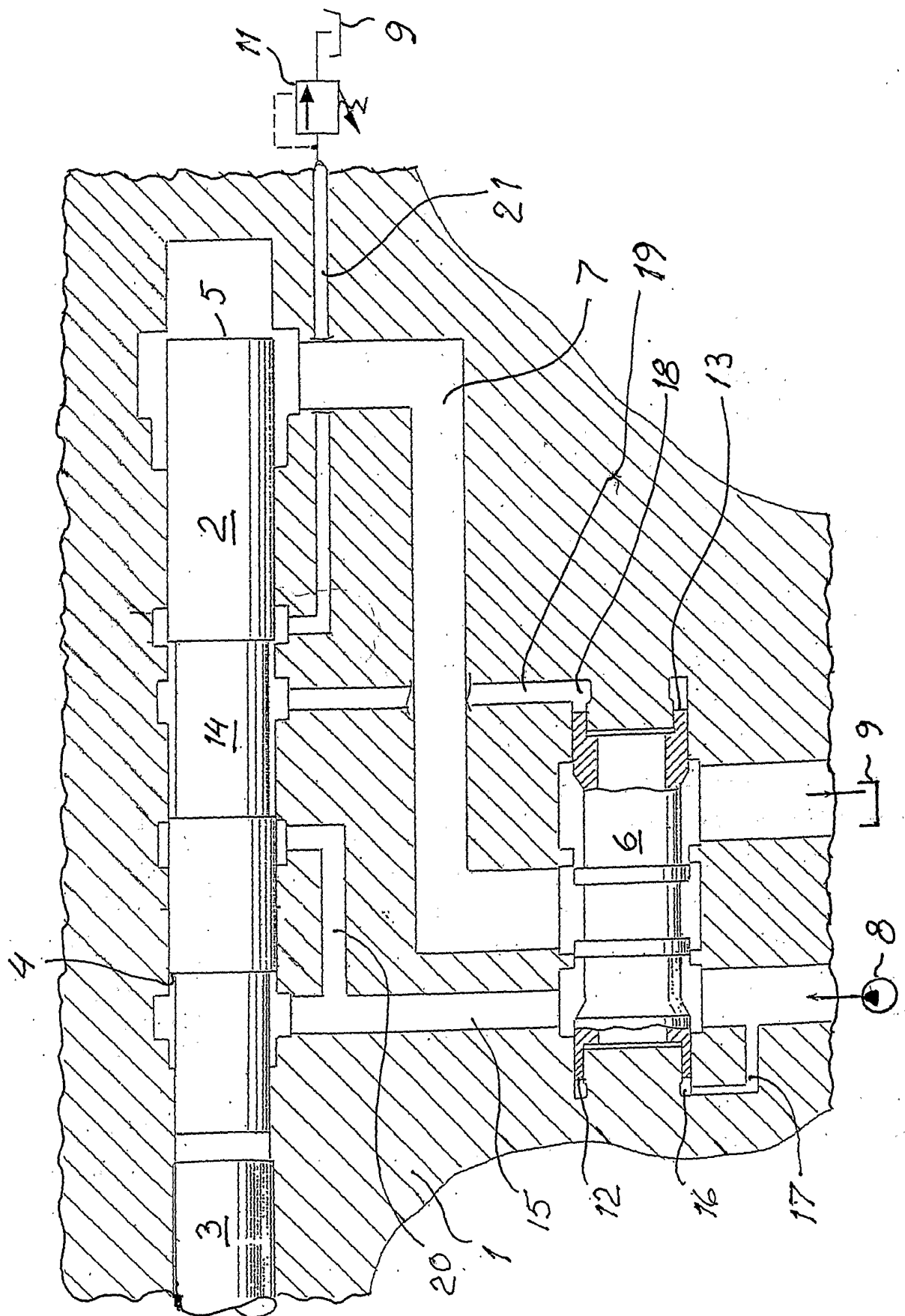
The percussion device shown on the drawing includes a machine housing 1, wherein a percussion piston 2 is reciprocatingly movable in order to subject a tool 3 to impacts. The tool is as usual provided with a here not shown drill bit. The percussion piston is provided with a first driving surface 4 which in the shown example is continuously pressurized by a pressure source 8 over a channel 15. The percussion piston is further provided with a second driving surface 5 which in the shown example is comprised of the rear surface of the percussion piston. The driving surface 5 is alternately

connected to the pressure source 8 or to the low pressure of the tank 9 over channel 7 and a valve body 6 which is movable forwards and backwards in the machine housing. As an alternative the valve body could connect both driving surfaces alternately to the pressure source or low pressure. In the shown example, the pressurizing of the first driving surface 4 drives the percussion piston to the right in the figure. Since the area of the second driving surface 5 is essentially larger than the area of the first driving surface 4, pressurizing of the driving surface 5 results in that the percussion piston is driven to the left in the figure, against the effect of the pressure on the driving surface 4. The valve body 6 is constructed as a tubular slide with a first end surface 12 which is subjected for the pressure in a first chamber 16. The chamber 16 is over the channel 17 connected to the pressure source 8. The valve body 6 is further provided with a second end surface 13 which is subjected to the pressure in a second chamber 18. The chamber 18 is over the channel 19 connected to the cylinder bore of the percussion piston 2. The pressure in the channel 19 is controlled by the percussion piston 2 which is provided with a portion 14 having a reduced diameter. When the percussion piston 2 is positioned somewhat to the left of the position in the figure, the channel 19 is in connection with the pressure source 8 over the channels 15 and 20. The valve body 6 is then pressed to the left in the figure. When the percussion piston 2 reaches the position shown in the figure, the connection of the channel 19 with the pressure source 8 has been broken and a connection with the channel 21 started to open. In the channel 21 there is positioned a constant pressure valve 11. Its function is to give a constant fall off pressure independent of the flow through the valve. It is thus a valve device for creating a counter-pressure. Hereby the amount of liquid leaving the channel 19 when the

valve body 6 changes direction in its right position in the figure is essentially reduced, whereby the change-over goes essentially faster.

**Claims**

1. Percussion device including a machine housing (1), a forwards and backwards movable percussion piston (2) in the machine housing, and a reciprocatingly movable valve body (6) in the machine housing, said percussion piston (2) being adapted to subject a tool (3) to impacts, and said percussion piston including a first (4) and a second (5) driving surface intended to be subjected to pressure in order to drive the percussion piston forwards and backwards, said valve body (6) including a first end surface (12) and a second end surface (13), wherein the pressurizing of the first end surface (12) tends to drive the valve body in a first direction and pressurizing of the second end surface (13) tends to drive the valve body in a second direction, whereby the valve body (6) is arranged, over a channel (7) arranged in the machine housing, to connect at least the second (5) of the driving surfaces alternately to a pressure source (8) or to low pressure (9), **characterized** in that the second end surface (13), by the percussion piston (2), is alternately connectable to the pressure source (8) or, over a valve device (11) for creating a counter pressure, to the low pressure (9).
2. Percussion device according to claim 1, **characterized** in that the first driving surface (4) is continuously connected to the pressure source (8).
3. Percussion device according to claim 1 or 2, **characterized** in that the first end surface (12) is continuously connected to the pressure source (8).



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 2005/001425

## A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5979291 A (E. JUVONEN), 9 November 1999 (09.11.1999), figures 1-3, abstract --	1-3
A	US 4899836 A (A. VENOT), 13 February 1990 (13.02.1990), abstract --	1-3
A	US 3965799 A (E. JUVONEN ET AL), 29 June 1976 (29.06.1976), abstract --	1-3
A	US 3774502 A (F.-K. ARNDT), 27 November 1973 (27.11.1973), abstract --	1-3

 Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search

1 December 2005

Date of mailing of the international search report

20-12-2005

Name and mailing address of the ISA/

Swedish Patent Office

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INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 2005/001425

Continuation of second sheet

B25D 9/14 (2006.01)



INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 2005/001425

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004073931 A1 (KOSKIMÄKI, A.), 2 Sept 2004 (02.09.2004), claim 8, abstract  -----	1-3

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/SE 2005/001425

US	5979291	A	09/11/1999	FI	104961 B	00/00/0000
				FI	962911 A	20/01/1998
<hr/>						
US	4899836	A	13/02/1990	AT	55080 T	15/08/1990
				AU	592357 B	11/01/1990
				AU	6018286 A	22/01/1987
				CA	1288317 A,C	03/09/1991
				DE	214064 T	02/07/1987
				DE	3673100 D	00/00/0000
				EP	0214064 A,B	11/03/1987
				SE	0214064 T3	
				ES	556161 A	01/07/1987
				ES	8706506 A	16/09/1987
				FI	86762 B,C	30/06/1992
				FI	862952 A	17/01/1987
				FR	2584968 A,B	23/01/1987
				FR	2595972 A,B	25/09/1987
				JP	1968925 C	18/09/1995
				JP	6098578 B	07/12/1994
				JP	62019386 A	28/01/1987
				NO	167266 B,C	15/07/1991
				NO	862855 A	19/01/1987
				ZA	8604892 A	25/02/1987
<hr/>						
US	3965799	A	29/06/1976	DE	2443800 A	20/03/1975
				FI	50390 B,C	01/12/1975
				FI	286673 A	15/03/1975
				SE	417584 B,C	30/03/1981
				SE	7411336 A	17/03/1975
<hr/>						
US	3774502	A	27/11/1973	NONE		
<hr/>						
WO	2004073931	A1	02/09/2004	AU	2004213190 A	02/09/2004
				AU	2004213191 A	02/09/2004
				AU	2004213192 A	02/09/2004
				FI	5983 U	20/10/2003
				FI	114290 B	00/00/0000
				FI	20030263 D,V	02/07/2003
				WO	2004073930 A	02/09/2004
				WO	2004073932 A	02/09/2004