

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
31 January 2002 (31.01.2002)

PCT

(10) International Publication Number
WO 02/08789 A3

(51) International Patent Classification⁷: **G01V 3/32**,
G01R 33/44

(US). SCHEVEN, Ulrich [DE/US]; 5A Reservoir Street, Bethel, CT 06801 (US). VENKATARAMANAN, Lalitha [IN/US]; 1204 Hope Street, Stamford, CT 06907 (US).

(21) International Application Number: PCT/US01/23013

(74) Agent: **BATZER, William**; Intellectual Property Law Department, Schlumberger-Doll Research, Old Quarry Road, Ridgefield, CT 06877-4108 (US).

(22) International Filing Date: 20 July 2001 (20.07.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/220,053 21 July 2000 (21.07.2000) US

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(71) Applicants (*for all designated States except US*): **SERVICES PETROLIERS SCHLUMBERGER** [FR/FR]; 42, rue Saint-Dominique, F-75007 Paris (FR). **SCHLUMBERGER CANADA LIMITED** [CA/CA]; 525 - 3rd Avenue S.W., Calgary, Alberta T2P 0G4 (CA). **PRAD RESEARCH AND DEVELOPMENT N.V.** [NL/NL]; De Ruyterkade 62, Willemstad, Curacao (AN). **SCHLUMBERGER TECHNOLOGY B.V.** [NL/NL]; Parkstraat 83-89, NL-2514 JG The Hague (NL). **SCHLUMBERGER OVERSEAS S.A.** [PA/PA]; 8 Calle Aquilino de la Guardia, Panama City (PA). **SCHLUMBERGER SURENCO S.A.** [PA/PA]; 8 Calle Aquilino de la Guardia, Panama City (PA). **SCHLUMBERGER HOLDINGS LIMITED** [—/—]; P.O. Box 71, Craigmuir Chambers, Road Twon, Tortola (VG).

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

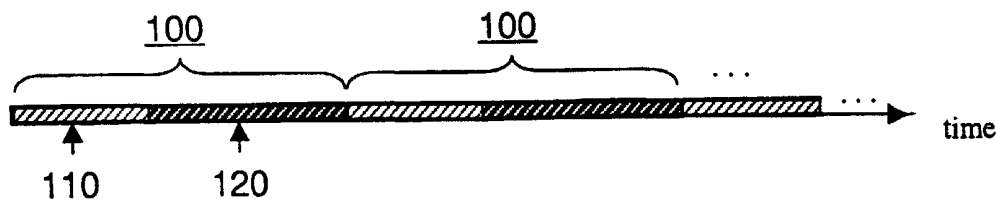
Published:
— with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **HURLIMANN, Martin, D.** [CH/US]; 29 Maple Shade Road, Ridgefield, CT 06877 (US). **TERNEAUD, Olivier, J.** [FR/FR]; 136 rue de Grand Cour, Saint Avertin (FR). **FREED, Denise** [US/US]; 14 Deer Ridge Road, Mount Kisco, NY 10549

(88) Date of publication of the international search report:
18 April 2002

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

(54) Title: NUCLEAR MAGNETIC RESONANCE METHODS FOR EXTRACTING INFORMATION ABOUT A FLUID IN A ROCK



(57) Abstract: Nuclear magnetic resonance methods for extracting information about a fluid in a rock are described. A system of nuclear spins in the fluid are prepared in a driven equilibrium, and a series of magnetic resonance signals generated from the fluid. The series of magnetic resonance signals is detected and analyzed to extract information about the fluid in the rock.



WO 02/08789 A3

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/23013

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 G01V3/32 G01R33/44

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 7 G01V G01R

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

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

WPI Data, PAJ, EPO-Internal, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	WO 01 42817 A (SCHLUMBERGER CA LTD ;SCHLUMBERGER SERVICES PETROL (FR); PRAD RES A) 14 June 2001 (2001-06-14) page 11, line 3 - line 15 page 22, line 10 -page 23, line 15; figures 3,8	1,2,5,6, 10,11,33
A	--- US 5 486 762 A (FREEDMAN ROBERT ET AL) 23 January 1996 (1996-01-23) column 5, line 38 -column 9, line 58; claim 13	1-34
A	--- GB 2 342 170 A (SCHLUMBERGER HOLDINGS) 5 April 2000 (2000-04-05) page 1 -page 6; figure 21 --- -/--	1-34

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

12 February 2002

Date of mailing of the international search report

19/02/2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Authorized officer

Skalla, J

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/23013

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HÜRLIMANN M D ET AL: "RESTRICTED DIFFUSION IN SEDIMENTARY ROCKS. DETERMINATION OF SURFACE-AREA-TO-VOLUME RATIO AND SURFACE RELAXIVITY" JOURNAL OF MAGNETIC RESONANCE. SERIES A, ACADEMIC PRESS, ORLANDO, FL, US, vol. 11, no. 2, 1 December 1994 (1994-12-01), pages 169-178, XP000485696 ISSN: 1064-1858 * see the chapter "PULSE SEQUENCE AND DATA ANALYSIS" and Fig. 2 *	1,6,9, 10,13
A	US 5 381 092 A (FREEDMAN ROBERT) 10 January 1995 (1995-01-10) column 20, line 42 - line 59	1,8,9
A	US 5 936 405 A (PRAMMER MANFRED G ET AL) 10 August 1999 (1999-08-10) column 5, line 13 - line 17 column 11, line 20 - line 28; claims 1-7	1,17,33, 34

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/23013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
WO 0142817	A	14-06-2001	AU 2053101 A WO 0142817 A1	18-06-2001 14-06-2001
US 5486762	A	23-01-1996	US 5381092 A US 5291137 A	10-01-1995 01-03-1994
GB 2342170	A	05-04-2000	US 6255818 B1 AU 718862 B2 AU 4352699 A IT MI991821 A1 NL 1012828 C2 NO 993950 A AU 5717799 A CN 1260497 A GB 2346448 A ,B IT MI992312 A1 NL 1013496 C2 NL 1013496 A1 NO 995395 A	03-07-2001 20-04-2000 23-03-2000 19-02-2001 13-03-2000 21-02-2000 11-05-2000 19-07-2000 09-08-2000 04-05-2001 06-07-2000 09-05-2000 08-05-2000
US 5381092	A	10-01-1995	US 5291137 A US 5486762 A	01-03-1994 23-01-1996
US 5936405	A	10-08-1999	AU 716950 B2 AU 7117296 A EP 0852737 A1 NO 981328 A WO 9714063 A1	09-03-2000 30-04-1997 15-07-1998 20-05-1998 17-04-1997