

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
4 October 2001 (04.10.2001)

PCT

(10) International Publication Number  
WO 01/73261 A3

(51) International Patent Classification<sup>7</sup>: E21B 43/12,  
43/01, 37/00, 36/00, 19/22, 17/01, 23/08, 43/36

(GB). ABRAHAM, William, Eric [GB/GB]; Little Barn,  
Linkside North, Beacon Hill, Hindhead, Surrey GU26 6NZ  
(GB).

(21) International Application Number: PCT/EP01/03405

(74) Agents: FÜCHSLE, Klaus et al.; Hoffmann. Eitle, Ara-  
bellastrasse 4, 81925 München (DE).

(22) International Filing Date: 26 March 2001 (26.03.2001)

(25) Filing Language: English

(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.

(26) Publication Language: English

(30) Priority Data:  
0007406.2 27 March 2000 (27.03.2000) GB  
0024931.8 11 October 2000 (11.10.2000) GB

(71) Applicant (for all designated States except US): ROCK-  
WATER LIMITED [GB/GB]; Hill Park Court, Spring-  
field Drive, Leatherhead, Surrey KT22 7NL (GB).

(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, GW, ML, MR, NE, SN, TD, TG).

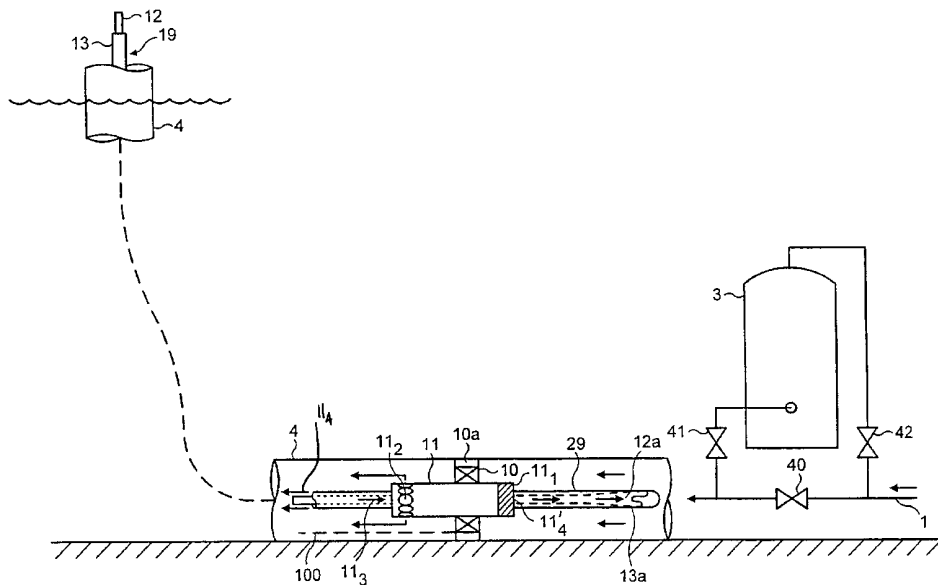
(72) Inventors; and

(75) Inventors/Applicants (for US only): HERD, Brendan,  
Paul [GB/GB]; 27a Spencer Road, Strawberry Hill, Mid-  
dlesex TW2 5TZ (GB). SEYMOUR, Ben [GB/GB]; 95  
Cottimore Lane, Walton on Thames, Surrey KT12 2BU

Published:  
— with international search report

[Continued on next page]

(54) Title: RISER WITH RETRIEVABLE INTERNAL SERVICES



(57) Abstract: Systems are described for raising production fluid from a source (1) on the seabed comprising a riser (4) having a first, lower, end for connection or connected to the source; a top end support for supporting the riser at or in the vicinity of the sea surface; and an operating device (11) mounted inside the riser (4) for displacement within the riser so that the pump is accessible to an operator for replacement or repair. The operating device (11) may be displaced on a pipe (12) which extends within the riser (4) and to a lower end of which the device (11) is attached. The device (11) may be *inter alia* an electric pump, a hydraulic pump, a gas injector, a heater or a cleaning device.



WO 01/73261 A3



**(88) Date of publication of the international search report:**  
28 February 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.*

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/03405

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7 E21B43/12 E21B43/01 E21B37/00 E21B36/00 E21B19/22  
 E21B17/01 E21B23/08 E21B43/36

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 E21B

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)

EPO-Internal, PAJ, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No.          |
|------------|--|--------------------------------|
| X          | GB 2 280 460 A (ALTRA CONSULTANTS LIMITED<br>;YTHAN ENGINEERING LIMITED (GB))<br>1 February 1995 (1995-02-01)<br>page 7, line 6 - line 34; figure 7          | 1-3, 12,<br>33-39              |
| Y          | ---  | 18-20,<br>40-42,<br>48, 49     |
| X          | WO 98 28519 A (SUDOL TADEUS)<br>2 July 1998 (1998-07-02)<br><br>page 3, line 27 - line 29; figure 1<br>page 6, line 8 - line 20<br>page 8, line 22 - line 27 | 1-3,<br>5-10, 12,<br>13, 35-39 |
| Y          | ---  | 11, 22-24                      |
|            | -/--   |                                |

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

7 November 2001

Date of mailing of the international search report

16. 11. 2001

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

Dantine, P

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/03405

| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT |  |  |
|--|--|--|
| Category *   | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No.                      |
| X  | GB 2 340 155 A (CAMCO INC)<br>16 February 2000 (2000-02-16)<br><br>page 1, line 22 - line 23; figure 1<br>page 5, line 6 - line 12<br>---  | 1-4,<br>15-17,<br>35-39                    |
| X  | US 4 125 162 A (GROVES SR DAVID L ET AL)<br>14 November 1978 (1978-11-14)<br><br>column 2, line 3 - line 37; figure 1<br>column 4, line 57 - column 5, line 6<br>column 9, line 5 - line 12<br>--- | 1-3,5,<br>10,13,<br>25,<br>33-36,<br>53,54 |
| Y  | ---  | 26,27,<br>55,56                            |
| X  | US 5 671 811 A (HEAD PHILIP)<br>30 September 1997 (1997-09-30)<br>column 1, line 25 - line 42; figure 7<br>---   | 1-3,13,<br>33,34                           |
| Y  | US 5 287 923 A (CORNETTE H MITCHELL ET AL)<br>22 February 1994 (1994-02-22)<br>column 7, line 9 - line 14; figure 1<br>---   | 11   |
| Y  | US 4 625 798 A (BAYH III RUSSELL I)<br>2 December 1986 (1986-12-02)<br>column 1, line 32 - line 33; figure 1<br>column 3, line 45 - line 55<br>---   | 22-24                                      |
| Y  | CA 1 185 519 A (HENNESSEY ALBERT)<br>16 April 1985 (1985-04-16)<br>page 3, line 16 - line 28; figure 3<br>---  | 24   |
| P,X  | WO 00 43632 A (HEADWORTH COLIN STUART)<br>27 July 2000 (2000-07-27)<br>page 11, line 15 - line 17; claim 36;<br>figure 13<br>---   | 1-3,5,<br>13,33,34                         |
| A  | US 5 967 699 A (KNAPP KENNETH M)<br>19 October 1999 (1999-10-19)<br>column 5, line 65 - column 6, line 62;<br>figure 2<br>---  | 1,35                                       |
| X  | GB 2 177 372 A (EXXON PRODUCTION RESEARCH CO)<br>21 January 1987 (1987-01-21)<br>page 1, line 53 - line 92; figure 2<br>page 2, line 42 - line 54<br>page 6, line 31 - line 37<br>---              | 45   |
| Y  | ---  | 18-20,<br>40,42,<br>46-50                  |
|  | ---<br>-/--  |  |

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/03405

| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT |  |                              |
|--|--|------------------------------|
| Category *   | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No.        |
| Y  | US 5 611 397 A (WOOD STEVEN M)<br>18 March 1997 (1997-03-18)<br>column 2, line 3 - line 35; figure 5<br>---  | 20,41,<br>46,47,50           |
| A  | EP 0 909 873 A (PETROLEO BRASILEIRO SA)<br>21 April 1999 (1999-04-21)<br>page 4, line 38 - line 40<br>page 5, line 14 - line 17<br>---   | 18,40,45                     |
| A  | US 5 490 562 A (ARNOLD KENNETH E)<br>13 February 1996 (1996-02-13)<br>column 1, line 28 -column 3, line 29<br>---  | 18,40,45                     |
| A  | WO 97 47855 A (PETROLEO BRASILEIRO SA<br>;LIMA PAULO CESAR RIBEIRO (GB))<br>18 December 1997 (1997-12-18)<br>page 8, line 4 - line 13; figure 2<br>---                               | 18,40,45                     |
| Y  | US 6 032 737 A (BRADY JERRY L ET AL)<br>7 March 2000 (2000-03-07)<br>column 5, line 6 - line 12; figure 2<br>column 5, line 21 - line 35<br>column 8, line 16 - line 22<br>---       | 21,44,<br>51,52              |
| Y  | EP 0 811 749 A (CAMCO INT)<br>10 December 1997 (1997-12-10)<br>column 3, line 56 -column 4, line 52;<br>figure 2<br>---  | 21,44,<br>51,52              |
| A  | GB 2 133 446 A (TREASURE OFFSHORE<br>PRODUCTION S) 25 July 1984 (1984-07-25)<br>claims 1,2; figure 1<br>---  | 21,44,<br>51,52              |
| A  | US 5 474 601 A (CHOI MICHAEL S)<br>12 December 1995 (1995-12-12)<br>cited in the application<br>column 3, line 8 - line 31; figure 1<br>---  | 21,44,<br>51,52              |
| Y  | US 4 378 051 A (CHOLET HENRI ET AL)<br>29 March 1983 (1983-03-29)<br><br>claims 1,2; figure 1<br>---   | 26,27,<br>29,30,<br>55,56,58 |
| A  | US 3 346 045 A (R.P. KNAPP)<br>10 October 1967 (1967-10-10)<br>claim 1; figure 1<br>---  | 1,25,53,<br>54               |
| X  | WO 98 06927 A (ASTEC DEV LTD ;SIMPSON NEIL<br>ANDREW ABERCROMBI (GB))<br>19 February 1998 (1998-02-19)<br>page 1, line 8 - line 12; figures 3,7<br>page 16, line 12 - line 25<br>--- | 1-3,5,<br>28,57              |
| Y  | ---  | 29,30,<br>32,58              |
|  | -/--   |                              |

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/EP 01/03405

**C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category | Citation of document, with indication, where appropriate, of the relevant passages                            | Relevant to claim No. |
|----------|---|-----------------------|
| X        | US 5 033 545 A (SUDOL TAD A)<br>23 July 1991 (1991-07-23)<br>column 5, line 60 -column 6, line 3;<br>figure 6 | 1-3,5-9,<br>13,35-39  |
| Y        | ---   | 32                    |
| X        | EP 0 921 268 A (SOFITECH NV ;SCHLUMBERGER<br>CIE DOWELL (FR)) 9 June 1999 (1999-06-09)<br>claim 1; figure 1   | 1-3,5,57              |
| A        | -----   | 28                    |

# INTERNATIONAL SEARCH REPORT

international application No.  
PCT/EP 01/03405

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-17,22-24,33-39

System and method to install retrievably an operating device inside a riser to raise production fluid to avoid to have time-consuming repair or replacement

2. Claims: 18-20,40-43,45-50

System and method to inhibit formation of solid hydrates in a production fluid during interrupted or shutdown conditions by expelling production fluid and pressure reduction

3. Claims: 21,44,51,52

Apparatus and method for separating production fluid prior to lift the liquid-rich underflow with a pump

4. Claims: 25-27,53-56

A traction device on a pipe to move inside an extended near-horizontal conduit

5. Claims: 28-32,57-59

System to clean the inside of a riser using a pipe, a motor and a rotary cleaning device



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 01/03405

| Patent document cited in search report | A | Publication date | Patent family member(s)  | Publication date   |
|--|---|------------------|--|--|
| GB 2280460                             | A | 01-02-1995       | NO 942753 A  | 24-01-1995   |
| WO 9828519                             | A | 02-07-1998       | CA 2193923 A1<br>AU 5473998 A<br>WO 9828519 A1<br>US 6250389 B1  | 24-06-1998<br>17-07-1998<br>02-07-1998<br>26-06-2001   |
| GB 2340155                             | A | 16-02-2000       | US 6298917 B1<br>BR 9904228 A<br>CN 1244633 A  | 09-10-2001<br>17-04-2001<br>16-02-2000   |
| US 4125162                             | A | 14-11-1978       | NONE   |  |
| US 5671811                             | A | 30-09-1997       | AU 4091096 A<br>AU 4091196 A<br>GB 2297104 A ,B<br>GB 2297105 A ,B<br>NO 960184 A<br>NO 960185 A<br>US 5749676 A | 25-07-1996<br>25-07-1996<br>24-07-1996<br>24-07-1996<br>19-07-1996<br>19-07-1996<br>12-05-1998 |
| US 5287923                             | A | 22-02-1994       | NONE   |  |
| US 4625798                             | A | 02-12-1986       | US 4529035 A<br>CA 1225022 A1<br>GB 2170531 A ,B<br>GB 2170533 A ,B  | 16-07-1985<br>04-08-1987<br>06-08-1986<br>06-08-1986   |
| CA 1185519                             | A | 16-04-1985       | CA 1185519 A1  | 16-04-1985   |
| WO 0043632                             | A | 27-07-2000       | AU 2509800 A<br>NO 20013363 A<br>WO 0043632 A2   | 07-08-2000<br>14-09-2001<br>27-07-2000   |
| US 5967699                             | A | 19-10-1999       | US 5895619 A<br>CA 2225570 A1<br>GB 2358450 A ,B<br>GB 2321291 A ,B  | 20-04-1999<br>21-07-1998<br>25-07-2001<br>22-07-1998   |
| GB 2177372                             | A | 21-01-1987       | US 4589434 A<br>AU 575483 B2<br>AU 5754386 A<br>BR 8602490 A<br>CA 1236753 A1<br>NO 861402 A ,B,                 | 20-05-1986<br>28-07-1988<br>18-12-1986<br>27-01-1987<br>17-05-1988<br>11-12-1986               |
| US 5611397                             | A | 18-03-1997       | US 5417281 A<br>US 5759019 A<br>US 6019583 A<br>US 6183226 B1  | 23-05-1995<br>02-06-1998<br>01-02-2000<br>06-02-2001   |
| EP 0909873                             | A | 21-04-1999       | BR 9705076 A<br>CA 2243835 A1<br>EP 0909873 A2<br>NO 980036 A<br>US 6035933 A                                    | 09-05-2000<br>17-04-1999<br>21-04-1999<br>19-04-1999<br>14-03-2000                             |
| US 5490562                             | A | 13-02-1996       | WO 9624750 A1  | 15-08-1996   |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

i. national Application No

PCT/EP 01/03405

| Patent document cited in search report |   | Publication date | Patent family member(s) | Publication date |
|--|---|------------------|-------------------------|------------------|
| WO 9747855                             | A | 18-12-1997       | BR 9602746 A            | 08-09-1998       |
|  |   |                  | AU 2646797 A            | 07-01-1998       |
|  |   |                  | WO 9747855 A1           | 18-12-1997       |
|  |   |                  | GB 2329658 A ,B         | 31-03-1999       |
|  |   |                  | US 6267182 B1           | 31-07-2001       |
| -----                                  |   |                  |                         |                  |
| US 6032737                             | A | 07-03-2000       | NONE                    |                  |
| -----                                  |   |                  |                         |                  |
| EP 0811749                             | A | 10-12-1997       | US 5730871 A            | 24-03-1998       |
|  |   |                  | CA 2206749 A1           | 03-12-1997       |
|  |   |                  | EP 0811749 A1           | 10-12-1997       |
|  |   |                  | NO 972418 A             | 04-12-1997       |
|  |   |                  | US 6033567 A            | 07-03-2000       |
|  |   |                  | US 6070661 A            | 06-06-2000       |
|  |   |                  | US 6017456 A            | 25-01-2000       |
| -----                                  |   |                  |                         |                  |
| GB 2133446                             | A | 25-07-1984       | NONE                    |                  |
| -----                                  |   |                  |                         |                  |
| US 5474601                             | A | 12-12-1995       | NONE                    |                  |
| -----                                  |   |                  |                         |                  |
| US 4378051                             | A | 29-03-1983       | FR 2473652 A1           | 17-07-1981       |
|  |   |                  | BR 8008370 A            | 07-07-1981       |
|  |   |                  | CA 1155390 A1           | 18-10-1983       |
|  |   |                  | DE 3047261 A1           | 17-09-1981       |
|  |   |                  | FR 2500419 A2           | 27-08-1982       |
|  |   |                  | GB 2065260 A ,B         | 24-06-1981       |
|  |   |                  | IT 1148749 B            | 03-12-1986       |
|  |   |                  | JP 56097095 A           | 05-08-1981       |
|  |   |                  | MX 7087 E               | 28-05-1987       |
|  |   |                  | NL 8006878 A            | 16-07-1981       |
|  |   |                  | NO 803833 A ,B,         | 22-06-1981       |
| -----                                  |   |                  |                         |                  |
| US 3346045                             | A | 10-10-1967       | GB 1132503 A            | 06-11-1968       |
|  |   |                  | NL 6605078 A            | 21-11-1966       |
| -----                                  |   |                  |                         |                  |
| WO 9806927                             | A | 19-02-1998       | AU 3948897 A            | 06-03-1998       |
|  |   |                  | GB 2350386 A ,B         | 29-11-2000       |
|  |   |                  | WO 9806927 A1           | 19-02-1998       |
|  |   |                  | GB 2334280 A ,B         | 18-08-1999       |
|  |   |                  | NO 990712 A             | 12-04-1999       |
| -----                                  |   |                  |                         |                  |
| US 5033545                             | A | 23-07-1991       | CA 1325969 A1           | 11-01-1994       |
| -----                                  |   |                  |                         |                  |
| EP 0921268                             | A | 09-06-1999       | US 6173771 B1           | 16-01-2001       |
|  |   |                  | EP 0921268 A2           | 09-06-1999       |
| -----                                  |   |                  |                         |                  |