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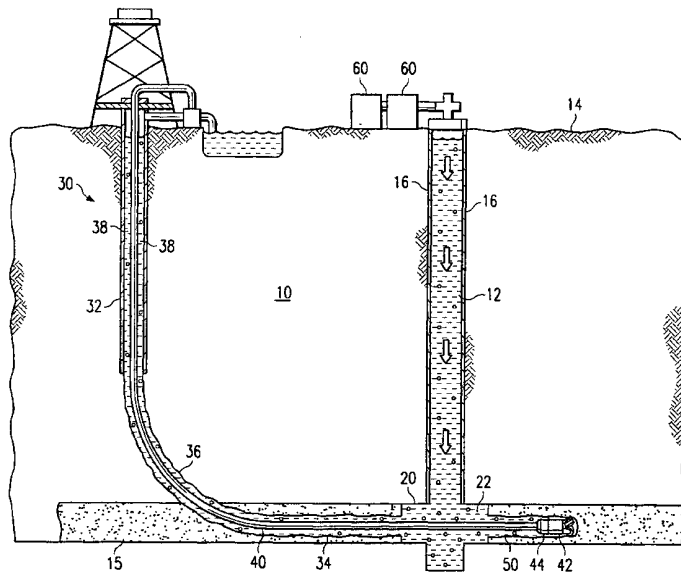
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(54) Title: METHOD AND SYSTEM FOR ACCESSING SUBTERRANEAN DEPOSITS FROM THE SURFACE



(57) Abstract: Improved method and system for accessing subterranean deposits from the surface that substantially eliminates or reduces the disadvantages and problems associated with previous systems and methods. In particular, the present invention provides an articulated well with a drainage pattern that intersects a horizontal cavity well. The drainage patterns provide access to a large subterranean area from the surface while the vertical cavity well allows entrained water, hydrocarbons, and other deposits to be efficiently removed and/or produced.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 E21B43/30 E21B7/04 E21B43/00 E21F7/00 E21C41/16
 E21B43/12

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 E21F E21C

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, TULSA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 819 834 A (GAZ DE FRANCE) 21 January 1998 (1998-01-21) column 3, line 48 -column 4, line 23; figure 1	1,2,5,7, 17,18,21 3,4,6, 19,20, 23,24
Y	---	
Y	US 5 450 902 A (MATTHEWS CAMERON M) 19 September 1995 (1995-09-19) abstract; figure 1	4,20
Y	---	
Y	US 4 037 658 A (ANDERSON DONALD J) 26 July 1977 (1977-07-26) figure 2	6,23,24
Y	---	
Y	US 4 220 203 A (STEEMAN JOHANNES W M) 2 September 1980 (1980-09-02) claim 1; figure 1	3,19

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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
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- *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
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- *&* document member of the same patent family

Date of the actual completion of the international search 3 November 2000	Date of mailing of the international search report 10. 11. 2000
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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 Fonseca Fernandez, H
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INTERNATIONAL SEARCH REPORT

International Application No

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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 5 016 710 A (RENARD GERARD ET AL) 21 May 1991 (1991-05-21) figure 6 ----	8-11, 25-28
A	US 5 246 273 A (ROSAR EDWARD C) 21 September 1993 (1993-09-21) figures ----	1,17
A	US 4 390 067 A (WILLMAN BERTRAM T) 28 June 1983 (1983-06-28) ----	
A	US 4 442 896 A (REALE LUCIO V ET AL) 17 April 1984 (1984-04-17) ----	
A	US 4 532 986 A (MIMS DONALD S ET AL) 6 August 1985 (1985-08-06) ----	
A	WO 94 21889 A (NORTH JOHN) 29 September 1994 (1994-09-29) ----	
A	US 3 347 595 A (J.B. DAHMS) 17 October 1967 (1967-10-17) ----	
A	US 4 702 314 A (HUANG WANN-SHENG ET AL) 27 October 1987 (1987-10-27) figures ----	1,29, 33-39, 41-43, 45,46
A	US 5 720 356 A (GARDES ROBERT) 24 February 1998 (1998-02-24) figures 8A,8B ----	29,37,42
A	US 5 074 360 A (GUINN JERRY H) 24 December 1991 (1991-12-24) figures 1,4,5 ----	1,29,37, 41,42,58
A	US 5 501 273 A (PURI RAJEN) 26 March 1996 (1996-03-26) figures ----	1,29,37, 42
A	EP 0 875 661 A (SHELL INT RESEARCH) 4 November 1998 (1998-11-04) figure 1 ----	1,29,37, 42
A	US 3 961 824 A (VAN EEK WOUTER HUGO ET AL) 8 June 1976 (1976-06-08) ----	
P,A	EP 0 952 300 A (COOPER CAMERON CORP) 27 October 1999 (1999-10-27) ----	
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INTERNATIONAL SEARCH REPORT

Inte 'ional Application No

PC1/US 99/27494

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 4 089 374 A (TERRY RUEL C) 16 May 1978 (1978-05-16) the whole document ---	48-50, 52,58, 66-68, 71,73,77
A	US 5 669 444 A (RIESE WALTER C ET AL) 23 September 1997 (1997-09-23) abstract; figures ---	1,48,66, 71,73, 77,78
A	US 5 501 279 A (GARG ARVIND K ET AL) 26 March 1996 (1996-03-26) the whole document ---	48,66, 71,73,77
A	US 4 544 037 A (TERRY RUEL C) 1 October 1985 (1985-10-01) the whole document ---	48,58, 66,71, 73,77
A	US 5 462 116 A (CARROLL WALTER D) 31 October 1995 (1995-10-31) the whole document ---	51,58-65
A	DE 197 25 996 A (TALLEY ROBERT R) 2 January 1998 (1998-01-02) abstract; figures 1,2 ---	58,66, 71,73, 77,78
P,A	US 5 879 057 A (SCHWOEBEL JEFFREY J ET AL) 9 March 1999 (1999-03-09) figures ---	73,77
A	US 5 411 104 A (STANLEY MATTHEW L) 2 May 1995 (1995-05-02) abstract ---	1,73,77
A	US 4 299 295 A (GOSSARD AMZI) 10 November 1981 (1981-11-10) ---	
A	US 3 934 649 A (PASINI III JOSEPH ET AL) 27 January 1976 (1976-01-27) -----	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 99/27494

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: 1-28

A method and a system for accessing a subterranean zone from the surface comprising a substantially vertical well bore, an articulated well bore intersecting the vertical bore at a junction close to the subterranean zone and substantially horizontal drainage extending from the junction into the subterranean zone.

2. Claims: 29-36

A substantially horizontal subterranean drainage pattern comprising an horizontal diagonal well bore extending from the surface defining a first end of an area in the subterranean zone; a first set of substantially horizontal lateral well bores extending in space relation to each other on a first side of the diagonal well bore ; and a second set of substantially horizontal lateral well bores extending on a second, opposite side of a diagonal.

3. Claims: 37-41

A structure for accessing a region of a subterranean zone comprising a first substantially vertical well bore; a second substantially vertical well bore; an articulated well bore including first and second portion; a first substantially horizontal diagonal well bore; a second substantially horizontal diagonal well bore; where each diagonal well bores comprising a plurality of substantially horizontal lateral well bores.

4. Claims: 42-47

A method for forming a subterranean drainage pattern comprising drilling through an articulated well bore an horizontal diagonal well bore; inclining the substantially horizontal diagonal well bore at a plurality of lateral points; after that backing the articulated drill string and drilling a first and second lateral well bores.

5. Claims: 48-57,66-70,71-72

A method for preparing a subterranean zone for mining comprising drilling a vertical and articulated well bores intersecting then at the subterranean zone; drilling an horizontal drainage pattern from the junction; drainage water from the subterranean zone; pumping the water to the surface; and producing gas from the subterranean zone.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

6. Claims: 58-65

A cavity well pump comprising a well bore portion having an inlet and a cavity positioning device operable to position the inlet at a predefined location within the subterranean cavity.

7. Claims: 73-76

A method for providing drainage well bores in a subterranean coal seams comprising providing, logging and enlarging a first substantially straight well bore; drilling an offset well bore spaced horizontally from said first one; using an articulated drill string to drill a main drainage well bore; supplying drilling fluid to remove cuttings; and admixing compressed air to reduced the hydrostatic pressure to decrease the over balanced drilling conditions.

8. Claims: 77-79

A process for mining a subterranean coal seam comprising pre-mining said coal seam to remove excess water and dangerous gases; providing an enlarged diameter cavity and a drainage in said well bore; draining and conducting said excess water and flowing said gases through a straight well bore; and continuing said steps of draining and flowing until a desired amount have been removed from the seam

INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0819834	A	21-01-1998	FR 2751374 A CA 2210866 A US 5957539 A	23-01-1998 19-01-1998 28-09-1999
US 5450902	A	19-09-1995	CA 2123075 A,C US 5655605 A	15-11-1994 12-08-1997
US 4037658	A	26-07-1977	CA 1057190 A DE 2649488 A FR 2329839 A	26-06-1979 05-05-1977 27-05-1977
US 4220203	A	02-09-1980	NL 7713455 A DE 2861379 D EP 0002306 A	08-06-1979 28-01-1982 13-06-1979
US 5016710	A	21-05-1991	FR 2600713 A FR 2601998 A FR 2600714 A BR 8703209 A CA 1324754 A CN 1030117 A,B DE 3778593 A EP 0251881 A IN 169933 A NO 872640 A CA 1317214 A CA 1332564 A	31-12-1987 29-01-1988 31-12-1987 15-03-1988 30-11-1993 04-01-1989 04-06-1992 07-01-1988 11-01-1992 28-12-1987 04-05-1993 18-10-1994
US 5246273	A	21-09-1993	CA 2083473 A,C	21-05-1994
US 4390067	A	28-06-1983	CA 1167373 A	15-05-1984
US 4442896	A	17-04-1984	NONE	
US 4532986	A	06-08-1985	NONE	
WO 9421889	A	29-09-1994	AU 6214794 A CA 2158637 A	11-10-1994 29-09-1994
US 3347595	A	17-10-1967	NONE	
US 4702314	A	27-10-1987	NONE	
US 5720356	A	24-02-1998	WO 9919595 A US 6065550 A AU 4982797 A	22-04-1999 23-05-2000 03-05-1999
US 5074360	A	24-12-1991	NONE	
US 5501273	A	26-03-1996	AU 685014 B AU 3946495 A CA 2176125 A CN 1136338 A PL 314802 A WO 9610683 A ZA 9508146 A	08-01-1998 26-04-1996 11-04-1996 20-11-1996 30-09-1996 11-04-1996 25-04-1996
EP 0875661	A	04-11-1998	AU 7760798 A	24-11-1998

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/27494

Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
EP 0875661	A		CN 1252851 T WO 9849424 A EP 0980463 A NO 995247 A	10-05-2000 05-11-1998 23-02-2000 17-11-1999
US 3961824	A	08-06-1976	NONE	
EP 0952300	A	27-10-1999	AU 2140199 A BR 9901345 A NO 991479 A	07-10-1999 02-05-2000 28-09-1999
US 4089374	A	16-05-1978	NONE	
US 5669444	A	23-09-1997	AU 1241297 A AU 720919 B AU 8613198 A CA 2196369 A CN 1165236 A DE 19703448 A EA 970009 A GB 2309719 A,B PL 318207 A US 5865248 A US 5967233 A US 5964290 A US 5944104 A ZA 9700789 A	07-08-1997 15-06-2000 12-11-1998 01-08-1997 19-11-1997 07-08-1997 30-09-1997 06-08-1997 04-08-1997 02-02-1999 19-10-1999 12-10-1999 31-08-1999 30-07-1998
US 5501279	A	26-03-1996	NONE	
US 4544037	A	01-10-1985	NONE	
US 5462116	A	31-10-1995	AU 3730595 A WO 9613650 A	23-05-1996 09-05-1996
DE 19725996	A	02-01-1998	US 5771976 A	30-06-1998
US 5879057	A	09-03-1999	NONE	
US 5411104	A	02-05-1995	AU 677484 B AU 1149495 A GB 2286614 A	24-04-1997 24-08-1995 23-08-1995
US 4299295	A	10-11-1981	NONE	
US 3934649	A	27-01-1976	NONE	