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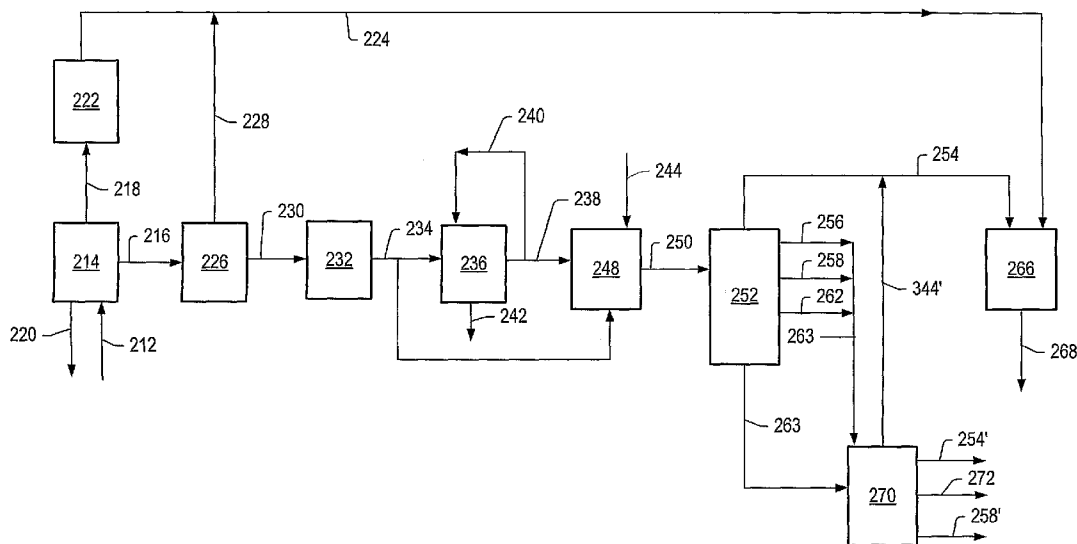
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(57) Abstract: The invention provides methods for producing one or more crude products that includes producing formation fluid (212) from a subsurface in situ heat treatment process; separating (214) the formation fluid to produce a liquid stream (216) and a gas stream (218); providing the at least a portion of the liquid stream to a nanofiltration system to produce a retentate and a permeate, providing the permeate to one or more processing units positioned downstream of the nanofiltration system; and processing the filtered liquid stream in one or more of the downstream processing units to form one or more crude products.

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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.
Y	WO 2005/042672 A (SHELL INT RESEARCH [NL]; MILLINGTON CHRISTOPHER RUSSELL [NIJMEIJER) 12 May 2005 (2005-05-12) the whole document -----	1-20
Y	US 2003/116315 A1 (WELLINGTON SCOTT LEE [US] ET AL) 26 June 2003 (2003-06-26) abstract -----	1-20
A	US 2004/033370 A1 (CHAU CHRISTOPHE [FR] ET AL) 19 February 2004 (2004-02-19) column 5, lines 6-9 ----- -/--	1
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* Special categories of cited documents :		
A document defining the general state of the art which is not considered to be of particular relevance	*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	
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O document referring to an oral disclosure, use, exhibition or other means	*8* document member of the same patent family	
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Date of the actual completion of the international search <div style="text-align: center; font-weight: bold;">6 March 2007</div>	Date of mailing of the international search report <div style="text-align: center; font-weight: bold;">31/03/2008</div>	
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 <div style="text-align: center; font-weight: bold;">van Berlo, André</div>	

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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	FRASER J. ET AL: "EVALUATION OF NF/UF [NANOFILTRATION /ULTRAFILTRATION] MEMBRANE TREATMENT IN DE-OILING PRODUCED WATER IN-SITU AT A HEAVY-OIL PRODUCTION FACILITY IN WESTERN CANADA" PRODUCED WATER INT SEM., 25 September 1995 (1995-09-25), XP008075811 TRONDHEIM, Norway the whole document	1-20
A	MACKINNON ET AL: "Nanofiltration: A new technology for application to water management challenges in oil sands operations" CONRAD OILSANDS WATER USAGE WORKSHOP, 24 February 2004 (2004-02-24), XP002422564 Fort McMurray the whole document	1
A	GB 2 346 636 A (BAKER HUGHES INC [US]) 16 August 2000 (2000-08-16) the whole document	1
A	US 5 158 681 A (FREEMAN SCOTT D N [US] ET AL) 27 October 1992 (1992-10-27) figure 1	1
A	EP 0 350 279 A (TEXACO DEVELOPMENT CORP [US]) 10 January 1990 (1990-01-10) the whole document	1
A	WO 2004/106697 A (WEIR WESTGARTH LTD [GB]; YOUNG CRAWFORD [GB]; THERON ARNO [GB]; BAILLI) 9 December 2004 (2004-12-09)	1
P,A	EP 1 602 637 A (INST FRANCAIS DU PETROL [FR]) 7 December 2005 (2005-12-07)	1
P,A	US 2006/096920 A1 (AYALA RAUL E [US] ET AL) 11 May 2006 (2006-05-11)	1
A	US 2005/056590 A1 (BAGGOTT SEAN [US] ET AL) 17 March 2005 (2005-03-17) the whole document	1
A	WO 03/000389 A (PETRO SEP INTERNAT LTD [CA]; BAIG FAKHIR U [CA]; KAZI ABDUL M [CA]; AL) 3 January 2003 (2003-01-03)	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2006/040981

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2005042672 A	12-05-2005	AU 2004285085 A1	12-05-2005
		BR PI0416152 A	09-01-2007
		CA 2544452 A1	12-05-2005
		CN 1886486 A	27-12-2006
		US 2005119517 A1	02-06-2005

US 2003116315 A1	26-06-2003	NONE	

US 2004033370 A1	19-02-2004	NONE	

GB 2346636 A	16-08-2000	NO 20000720 A	16-08-2000
		US 6196314 B1	06-03-2001

US 5158681 A	27-10-1992	NONE	

EP 0350279 A	10-01-1990	CA 1321358 C	17-08-1993
		DE 68913836 D1	21-04-1994
		DE 68913836 T2	30-06-1994
		DK 331489 A	06-01-1990
		NO 892771 A	08-01-1990
		US 4872991 A	10-10-1989

WO 2004106697 A	09-12-2004	BR PI0410823 A	27-06-2006
		CA 2533560 A1	09-12-2004
		EP 1633954 A1	15-03-2006
		US 2005023222 A1	03-02-2005

EP 1602637 A	07-12-2005	CN 1724617 A	25-01-2006
		FR 2871167 A1	09-12-2005
		JP 2005344118 A	15-12-2005
		US 2005283037 A1	22-12-2005

US 2006096920 A1	11-05-2006	NONE	

US 2005056590 A1	17-03-2005	NONE	

WO 03000389 A	03-01-2003	CA 2351272 A1	22-12-2002
		US 2004211726 A1	28-10-2004
