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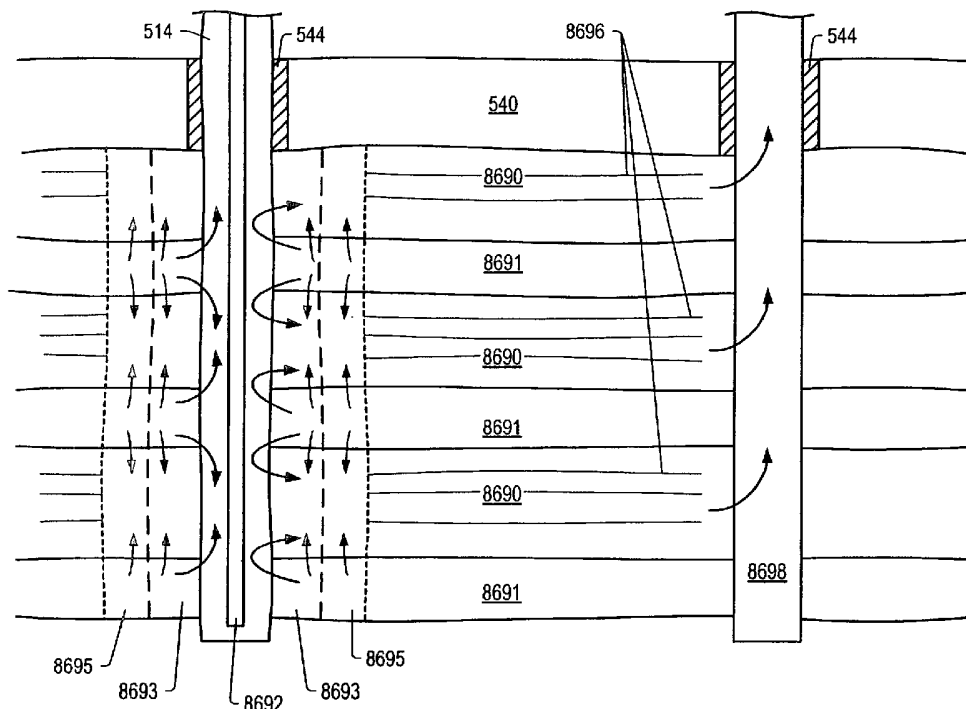
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[Continued on next page]

(54) Title: IN SITU RECOVERY FROM A OIL SHALE FORMATION



(57) Abstract: An oil shale formation may be treated using an in situ thermal process. Heat may be provided to a formation from a heat source (8692) in the formation. Hydrocarbons within the formation may be pyrolyzed. Hydrocarbons, hydrogen and/or other formation fluids may be produced from the formation. In some embodiments, the formation may include a relatively impermeable portion (8691) and/or a relatively permeable portion (8690).



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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/13311

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : C01B 3/24; C10G 47/22, 49/00; E21B 43/24, 43/243, 43/295, 43/30, 43/34, 47/00, 47/06  
US CL : 166/57, 59, 245, 250.01, 257, 267, 272.1, 272.2, 302, 308; 585/1, 2

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)

U.S. : 166/57, 59, 245, 250.01, 257, 267, 272.1, 272.2, 302, 308; 585/1, 2

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 practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,149,670 A (GRANT) 22 September 1964 (22.09.1964), Figure 2; col. 3, line 53 - col. 4, line 38; col. 5, line 12 - col. 6, line 21.	1-11, 14-20
X	US 3,352,355 A (PUTMAN) 14 November 1967 (14.11.1967), Figure 3; col. 2, lines 20-47; col. 5, lines 12-51.	1,2,4-9,11,14-20
X	US 3,273,640 A (HUNTINGTON) 20 September 1966 (20.09.1966), col. 3, lines 30-58; col. 4, line 4 - col. 5, line 31; col. 6, lines 26-40.	1,2,4-9,11,14-20
A	US 3,599,714 A (MESSMAN ET AL) 17 August 1971 (17.08.1971), see entire document.	1-21
A	US 3,132,692 A (MARX ET AL) 12 May 1964 (12.05.1964), see entire document.	1-21
A	US 3,116,792 A (PURRE) 07 January 1964 (07.01.1964), see entire document.	1-21

☐ Further documents are listed in the continuation of Box C.

☐ See patent family 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 application or patent 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

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/13311

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

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

1. ☐ Claim Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim 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. ☐ Claim 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:  
Please See Continuation 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.: 1-21

Remark on Protest

☐  
☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

**BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING**

Group I, claim(s) 1-21, drawn to a method of treating an oil shale formation by heating a first formation section to pyrolyze hydrocarbons, producing a mixture through a second formation section which has a higher permeability than the first formation section.

Group II, claim(s) 22-37, drawn to a method of producing a soluble compound from an oil shale formation by heating a hydrocarbon-containing layer to obtain a first fluid which is directed to the oil shale formation to produce a soluble compound.

Group III, claim(s) 38-51, drawn to a method of treating an oil shale formation by heating the formation while inhibiting dissociation of carbonate minerals, injection and recovering first and second fluids while conducting an in situ conversion process.

Group IV, claim(s) 52-61, drawn to a method of treating an oil shale formation by heating and pyrolyzing the formation while injecting and producing a first and second fluid from the formation, then producing a mixture.

Group V, claim(s) 62-66, drawn to a method of solution mining alumina from an oil shale formation by heating and pyrolyzing hydrocarbons in the formation, injecting a brine solution into the formation, and recovering alumina.

Group VI, claim(s) 67-75, drawn to a method of treating an oil shale formation by allowing the temperature of the formation to decrease, injecting a first fluid and producing a second fluid.

The inventions listed as Groups I-VI do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features: For example, only Group I includes the special technical feature of heating a first formation section to pyrolyze hydrocarbons, producing a mixture through a second formation section which has a higher permeability than the first formation section; only the Group III invention includes the special technical feature of heating an oil shale formation while inhibiting dissociation of carbonate minerals; only the Group V invention includes the special technical feature of recovering alumina from an oil shale formation.