INTRODUCTION

Background

Patents, as incentives for innovation are well established in the U.S. free enterprise system. Often overlooked, however, is a second great benefit of the patent system: the enormous, continually expanding patent file. This file includes more than 4 million distinct U.S. patents. These patents are classified and cross-referenced among the approximately 100,000 categories of technology that make up the U.S. Patent Classification System. Along with similarly categorized foreign patents and other technical publications they make up a collection totaling more than 23 million documents -- a collection which grows by over half a million documents annually.

Patent law requirements for a full disclosure of invention (which is then published as part of a patent grant) have resulted in an unique assemblage of technological information. Not only does the patent file embody the most comprehensive collection of technical information of its kind in the world, the information is inherently presented in a manner such that nearly every significant development in almost all technical fields flows in a natural time-series sequence -- virtually welcoming monitoring and analysis.

In its own unique way, this file represents a national resource. The Patent and Trademark Office (PTO) recognizes it heavy responsibilities not only to preserve, maintain, and improve the file, but, as well, to maximize its use for the greatest public benefit. It was as part of its effort to discharge this latter responsibility that the Patent and Trademark Office established, in 1971, its technology assessment and forecast program.

In its most general terms, the mission of the program is to stimulate and enhance the use and usability of the patent file, and to assemble, analyze and make available meaningful data about the file. In carrying out this mission, the Office of Technology Assessment and Forecast (OTAF), which administers the program, has assembled and built a master data base covering all U.S. patents. This data base has been used to support: (1) the preparation of a series or nine OTAF general distribution publications (see Appendix B); and (2) OTAF's special report services (see Appendix C).

Patent Profile

In an effort to continually provide data in a form which is useful and convenient to the interested reader, OTAF is now presenting a new publication series -- PATENT PROFILES. Each of these publications will deal with a specific technological area and will survey the patent activity of that area for a given period of time.

PATENT PROFILES provide many different kinds of information about a particular area of the patent file and assembles this information in a format which enables the user to extract the information needed or to collect necessary data to lead to the desired information.

Thus, interested users, both technically and non-technically oriented, from the public and private sectors, will be able to gain insight into what is being done in a technology, who is doing it, where it is being done and in what direction the technology is headed.

The objective of these publications is to use the U.S. patent file as a prime reference source in significantly adding to the universe of knowledge from which future inventors and innovators draw, and upon which corporate and public policy planners rely.

Synthetic Fuels

Escalating prices and widespread concern for the availability of foreign oil have brought this nation's interest in alternative energy sources to an all time high. The President's recent proposal for the development of domestic resources in sufficient amounts to replace 2.5 million barrels per day of imported petroleum by 1990 has naturally resulted in the focusing of a great deal of attention upon the previously untapped potential of synthetic fuels ("synfuels"). Such alternatives are especially attractive because the U.S. is rich in carbonaceous deposits from which synfuels are prepared, having about 29% of the world's total proved and currently recoverable coal, shale and tar sands.*

Technically speaking, synfuels is a term which has no precise definition. It refers for the most part, to fuels obtained from other than the usual sources, e.g., oil or methane produced from coal as opposed to well production of these fuels. This report examines levels and trends in patenting in those synfuel technologies dealing with the production of liquid hydrocarbons, gaseous hydrocarbons and synthesis gas (carbon monoxide and hydrogen) from any solid carbonaceous material except inorganic carbonates. Coal and oil shale are usually the carbonaceous materials employed, but other materials, such as bituminous sands, wood, and organic wastes, can also be used.

There are many different processes for preparing synfuels from carbonaceous materials. Broadly, these are characterized as In-Situ and In-Vitro processes, the major divisions used in this report. Passing treated coal through a pressurized fixed-bed gasifier (Lurgi process) is an example of the latter; in-ground retorting of shale, an example of the former. Each broad area is subdivided into a number of smaller component areas. Patenting for the period 1969-1978 is profiled in each component area.

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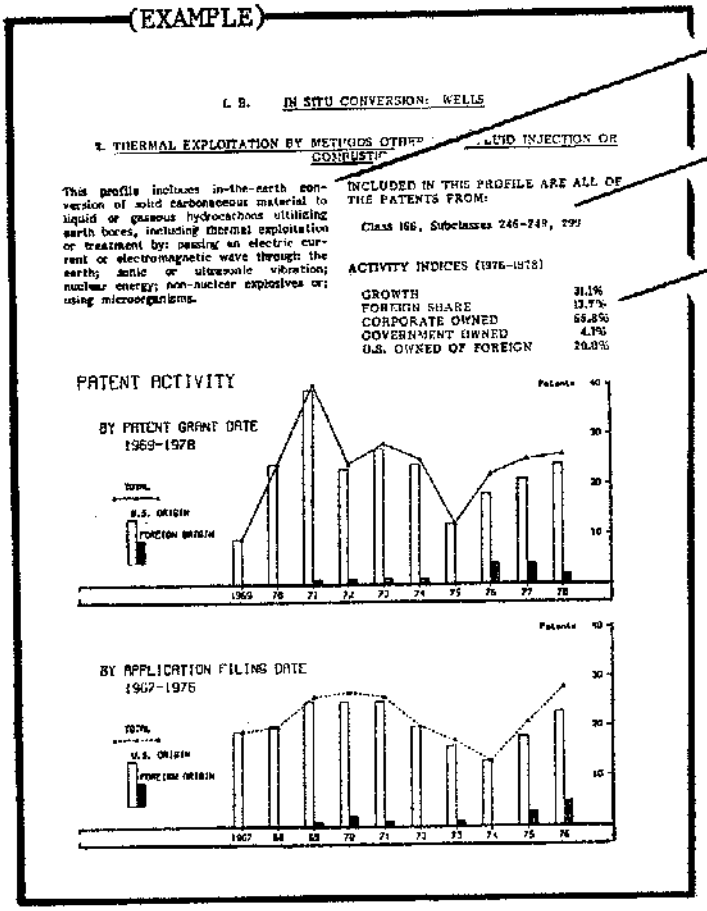
*Chemical and Engineering News, August 27, 1979, page 24.

EXPLANATION OF DATA AND FORMAT

This report presents profiles of patenting* in ten major areas of synthetic fuel technology. Each of the profiles is divided into three parts:

PART 1

Part 1, the first page of each profile, identifies the area which is examined, lists the pertinent U.S. Patent Classification(s) involved, and graphically illustrates patent activity (across a designated 10-year span) in two ways: (1) by the patent grant date; (2) by the granted patents' application filing date. The latter method presents what is often considered a more useful measurement tool since application filing dates are closer in time to the actual development of the technology disclosed in the patent and are independent of PTO production variance.** Levels of involvement by foreign residents, corporations, and government agencies in recent U.S. patent activity, as well as a measure of relative growth in the particular technological area are presented in the "Activity Indices" (defined below).



% GROWTH: The number of patents granted in the period 1976-78 divided by the total number of patents granted in the period 1969-78, multiplied by 100. (Average for all technologies = 28.4%)

% FOREIGN SHARE: The number of patents granted to residents of foreign countries in the years 1976-78, divided by total number of patents granted in these years, multiplied by 100. (Average for all technologies = 37.0%)

% CORPORATE OWNED: The number of 1976-78 patents assigned at time of grant to U.S. or foreign non-government entities -- mainly corporations -- divided by the total number of patents granted in this three year period, multiplied by 100. (Average for all technologies = 76.4%)

% GOVERNMENT OWNED: The number of 1976-78 patents assigned at time of grant to the U.S. Government or a foreign government, divided by total number of patents granted in this three year period, multiplied by 100. (Average for all technologies = 2.6%)

% U.S. OWNED OF FOREIGN: The number of 1976-78 patents with a foreign resident inventor assigned at the time of grant to a U.S. organization, divided by the number of patents with a foreign resident inventor in these years, multiplied by 100. (Average for all technologies = 8.5%)

The information on this page can be interpreted as indicative of trends in the direction and rate of growth of the subject technology.

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* U.S. Patents only

**See further explanation in Appendix A.

PART 2A

Part 2A of each profile shows in tabular form the data relied upon in constructing the graphical illustrations in Part 1. The first table shows the yearly distribution of patents by the date of the patent grant, while the second table redistributes this data based on the application filing date of the patents. The usefulness of this latter data distribution is mentioned in the explanation of Part 1, and further detailed in Appendix A.

(EXAMPLE)

SYNTHETIC FUELS I B 3- IN SITU - WELLS - RECOVERY OF SOLIDS WITH LIQUID OR GASEOUS HYD

PATENT ACTIVITY (PATENTS GRANTED 1/69-12/78) BY DATE OF PATE

NUMBER OF PATENTED APPLIC

	PRE 65	1965	1966	1967	1968	1969	1970	1971	1972	1973
TOTAL	5	9	16	13	14	17	19	10	11	18
U.S. ORIGIN	4	8	14	10	13	12	15	10	10	17
FOREIGN ORIGIN	1	1	2	3	1	5	4		1	1
CANADA	1	1	2	2	1	3	1			1
NETHERLANDS						1	1			
GERMANY							1		1	
UNITED KINGDOM				1			1			
TURKEY						1				
BELGIUM										
U.S. ORIGIN	4	8	14	10	13	12	15	10	10	17
U.S. CORP. OWNED	4	6	13	6	9	10	13	10	10	13
U.S. GOVT. OWNED					2					1
U.S. INDIV. OWNED				3		2	1			4
FOREIGN OWNED		2	1	1	2		1			
FOREIGN ORIGIN	1	1	2	3	1	5	4		1	1
U.S. OWNED	1		1			2	3			
FOREIGN OWNED		1	1	3	1	3	1		1	1
FOREIGN CORP		1	1	2	1	3	1			1
FOREIGN GOVT										

PART 2B

Part 2B of each profile provides a list of assignees* ranked by the number of patents, in the technology, to which they held title at the time of the patent grant. In some instances, the listing is limited by designation of a "cut-off" (e.g., "2 or more patents"). The time period covered is 1969-1978. This list identifies those assignees, mostly corporations, which received the most patents in the technology encompassed by the profile during the subject time period, and shows the comparative relationship of their activity to that of the other participants in the field.

(EXAMPLE)

I.B. IN SITU CONVERSION - WELLS
I. THERMAL EXPLOITATION BY FLUID INJECTION OR COMBUSTION

ASSIGNEES WITH 2 OR MORE PATENTS (1/69-12/78)

TEXACO INC.	56
SHELL OIL COMPANY	44
PHILLIPS PETROLEUM COMPANY	37
OCCIDENTAL OIL SHALE, INC.	22
MOBIL OIL CORPORATION	16
IN SITU TECHNOLOGY, INC	16
EXXON PRODUCTION RESEARCH COMPANY	13
CONTINENTAL OIL COMPANY	12
CITIES SERVICE COMPANY	12
OCCIDENTAL PETROLEUM CORPORATION	10
UNITED STATES OF AMERICA, DEPARTMENT OF ENERGY	9
PAN AMERICAN PETROLEUM CORPORATION	8
TEXACO EXPLORATION CANADA LTD.	8
MARATHON OIL COMPANY	8
DEUTSCHE TEXACO AKTIENGESELLSCHAFT	7
CHEVRON RESEARCH COMPANY	7
ATLANTIC RICHFIELD COMPANY	5
SUN OIL COMPANY OF PENNSYLVANIA	5

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*See definition in Appendix A.

PART 2C

Part 2C of each profile also covers assigned patenting during the period 1969-1978. Assignees are listed alphabetically followed by a numerical listing of patents to which they held title at the time of patent grant.

This section provides valuable information to potential entrepreneurs, competitors and those in need of technological know-how by identifying corporate actors in the field. Inclusion of patent titles further defines the subject technology arena.

(EXAMPLE)

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SYNTHETIC FUELS    I B 1-  IN SITU - WELLS - FLUID INJECTION OR COMBUSTI
                           ASSIGNED PATENTING(1/69 - 12/78) - - ALPHA LISTING

AIRCO INC.
  3422892  -  SUPPLY OF HIGH-PRESSURE COMBUSTION- SUPPORTING GAS TO WELLS

AMERICAN OIL SHALE CORPORATION
  3465818  -  UNDERCUTTING OF NUCLEARLY DETONATED FORMATIONS BY SUBSEQUEN
              E RECOVERY OF VARIOUS MINERALS

AMOCO PRODUCTION COMPANY
  3964947  -  RECOVERY OF HEAVY HYDROCARBONS FROM UNDERGROUND FORMATIONS

ATLANTIC RICHFIELD COMPANY
  3536377  -  METHOD OF RETORTING OIL SHALE IN-SITU
  3603398  -  METHOD FOR INCREASING SUBTERRANEAN FORMATION PERMEABILITY
  3616856  -  METHOD OF PLUGGING A WATER-PRODUCING FORMATION
  3627044  -  METHOD OF PRODUCING TAR SANDS WITH LATERALLY CRATERED NUCLE.
  3986557  -  PRODUCTION OF BITUMEN FROM TAR SANDS

AZS CORPORATION
  4063780  -  METHOD OF RECOVERING LIQUID AND GASEOUS PRODUCTS OF OIL SHA

BAISCH  J. CARROLL
  4007791  -  METHOD FOR RECOVERY OF CRUDE OIL FROM OIL WELLS

CARMEL ENERGY, INC.
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PART 2D

Part 2D of each profile presents an alphabetical listing of inventors of unassigned patents (1975 to 1978) together with their addresses, the patent numbers and titles. This information facilitates identification of the apparently unaffiliated or "independent inventor" participants in the technology. Standard, two character codes are used to designate U.S. states and foreign countries. While the meaning of state codes should be obvious, the foreign country codes may not. Consequently, those appearing in the Part 2D listing are given in Appendix A.

(EXAMPLE)

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SYNTHETIC FUELS    I B 1-  IN SITU - WELLS - FLUID INJECTION OR COMBUSTION                    PAGE 0   1
                           UNASSIGNED PATENTS (1/75-12/78) INVENTORS (ALPHA LISTING)
  INVENTOR NAME                                STREET                    CITY          ST   ZIP/CNTRY
  ALEXANDER          HARVEY        C.          610 W. 69TH ST.           ODESSA        TX     79762
      4011906 - DOWNHOLE VALVE FOR PARAFFIN CONTROL
  ANTONOVA           ROZA          IVANOVNA    CHONGARSKY BULVAR, 10, KORPUS  MOSCOW          SU
      3990514 - METHOD OF CONNECTION OF WELLS
      4083402 - METHOD OF UNDERGROUND GASIFICATION OF A COAL BED
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At the end of Part 2D is a list of those patents (1963-1978) with neither assignment nor inventor information in the data base. Essentially, this encompasses all patenting in the period 1963-1968, and non-assigned ("independent inventor") patenting from 1969 through 1974. Titles are included for most patents granted subsequent to Jan. 1969.

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                PATENTS (1/63-12/78) WITH NEITHER ASSIGNMENT NOR INVENTOR INFORMATION IN DATABASE

  3460867 - MINING AND RETORTING OF OIL SHALE
  3487335 - UNDERGROUND GASIFICATION OF COAL
  3506309 - METHOD AND SYSTEM FOR GASIFYING UNDERGROUND DEPOSITS OF COAL
  3529867 - PROCESS FOR THE COLLECTING OF THE PIT GAS FROM AN UNDERGROUND COAL MEASURE
  3159976   3205012   3236053   3254921   3316020   3362751
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PART 3

Part 3 of each profile updates the preceding material by listing patent numbers, assignee or inventor, and title for those patents which issued from January to August, 1979.

A CAVEAT

The user of this publication should be aware that patent activity profiles are generated by first identifying key Patent and Trademark Office classifications, i.e., those entirely or substantially pertinent to the technology of interest. All the patents in these classifications are included in the profile. This procedure results, in most cases, with the inclusion of the majority of patents relevant to the technology and few non-relevant patents. However, in a collection as large and as varied as the patent file one can never be sure of the absolute completeness or "purity" of any subset. Consequently, the totality of patents covered in a profile should not be considered to be inclusive of all relevant patents, nor exclusive of all non-relevant patents.

I. A. IN SITU CONVERSION: MINES

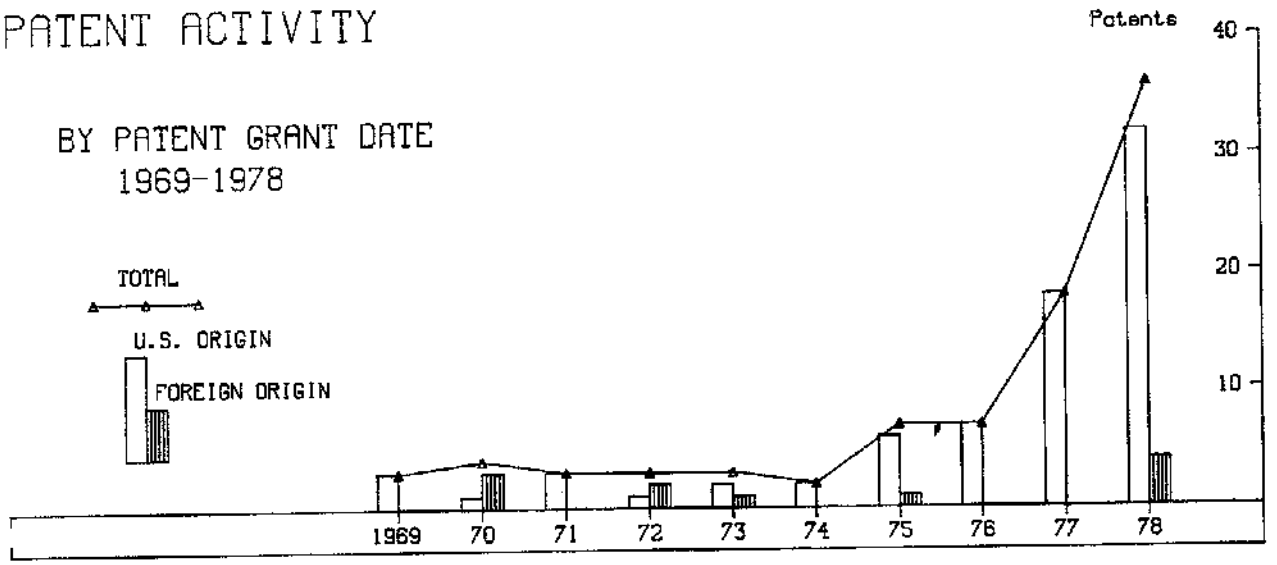
This profile includes in-the-earth conversion of solid carbonaceous material to liquid or gaseous hydrocarbons utilizing horizontal tunnels or chambers formed by mining processes.

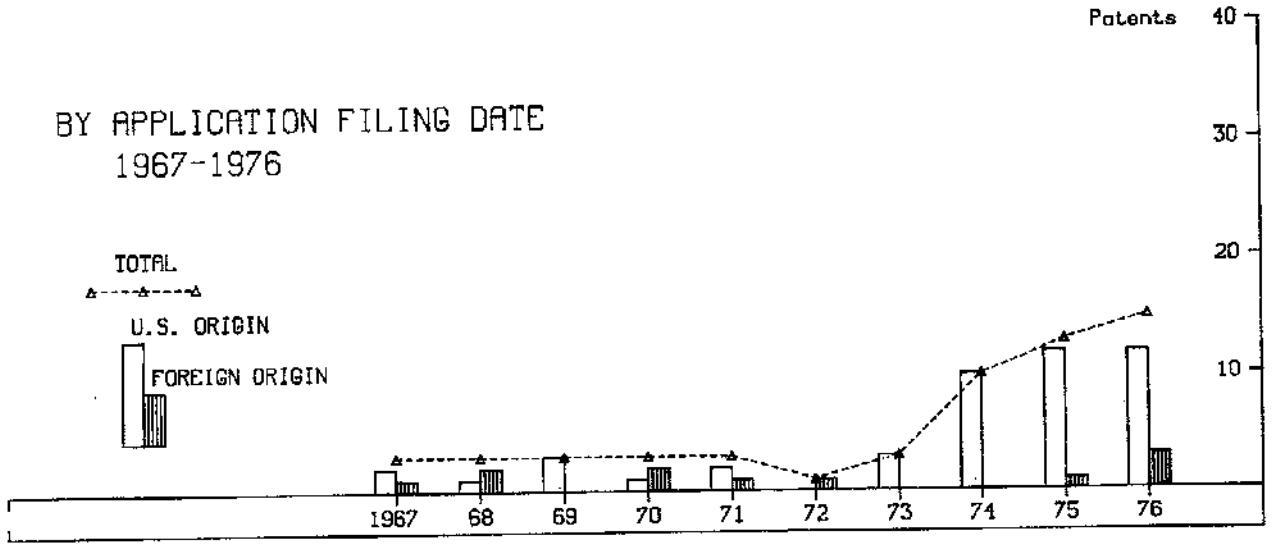
INCLUDED IN THIS PROFILE ARE ALL OF THE PATENTS FROM:

Class 299, Subclass 2

ACTIVITY INDICES (1976-1978)

GROWTH	70.9%
FOREIGN SHARE	6.6%
CORPORATE OWNED	85.2%
GOVERNMENT OWNED	4.9%
U.S. OWNED OF FOREIGN	0.0%





SYNTHETIC FUELS 1 A - IN SITU - MINES

PATENT ACTIVITY (1963-1978) BY DATE OF PATENT GRANT

	NUMBER OF PATENTS															
	63-64	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	TOTAL
TOTAL	1	1	2	1	1	3	4	3	3	3	2	7	7	18	36	92
U.S. ORIGIN	1	1	2	1	1	3	1	3	1	2	2	6	7	18	32	81
FOREIGN ORIGIN							3		2	1		1			4	11
GERMANY							1		1	1		1				4
CANADA															3	3
U.S.S.R.															1	1
BELGIUM							1									1
UNITED KINGDOM							1									1
JAPAN									1							1
U.S. ORIGIN	1	1	2	1	1	3	1	3	1	2	2	6	7	18	32	81
U.S. CORP. OWNED	1		1	1		2	1	3	1	2	2	5	6	16	30	71
U.S. GOVT. OWNED		1	1		1	1							1	1	1	3
U.S. INDIV. OWNED												1		1	1	7
FOREIGN OWNED																
FOREIGN ORIGIN							3		2	1		1			4	11
U.S. OWNED																
FOREIGN OWNED							3		2	1		1			4	11
FOREIGN CORP.									1	1						2
FOREIGN GOVT.							3		1			1			4	9
FOREIGN INDIV.																

SYNTHETIC FUELS 1 A - IN SITU - MINES

PATENT ACTIVITY (PATENTS GRANTED 1/67-12/78) BY DATE OF PATENT APPLICATION

	NUMBER OF PATENTED APPLICATIONS															
	PRE 65	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	TOTAL
TOTAL	1	1	1	3	3	3	3	3	1	3	10	13	15	28		88
U.S. ORIGIN	1	1	1	2	1	3	1	2		3	10	12	12	28		77
FOREIGN ORIGIN				1	2		2	1	1			1	3			11
GERMANY					1		1	1	1							4
CANADA													3			3
U.S.S.R.												1				1
BELGIUM					1											1
UNITED KINGDOM				1												1
JAPAN							1									1
U.S. ORIGIN	1	1	1	2	1	3	1	2		3	10	12	12	28		77
U.S. CORP. OWNED	1			2	1	3	1	2		3	8	12	9	27		69
U.S. GOVT. OWNED											1		2			3
U.S. INDIV. OWNED		1	1								1		1	1		5
FOREIGN OWNED																
FOREIGN ORIGIN				1	2		2	1	1			1	3			11
U.S. OWNED																
FOREIGN OWNED				1	2		2	1	1			1	3			11
FOREIGN CORP.							1	1								2
FOREIGN GOVT.																
FOREIGN INDIV.				1	2		1		1			1	3			9

I.A. IN SITU CONVERSION - MINES

ASSIGNEES WITH 1 OR MORE PATENTS (1/69-12/78)

OCCIDENTAL OIL SHALE, INC.	26
OCCIDENTAL PETROLEUM CORPORATION	11
STANDARD OIL COMPANY (INDIANA)	4
CONTINENTAL OIL COMPANY	4
ATLANTIC RICHFIELD COMPANY	4
UNITED STATES OF AMERICA, DEPARTMENT OF ENERGY	3
IN SITU TECHNOLOGY, INC.	3
WINTERSHALL AKTIENGESELLSHAFT	2
CITIES SERVICE COMPANY	2
MOBIL OIL CORPORATION	2
AZS CORPORATION	1
COPPER RANGE COMPANY	1
EXXON RESEARCH + ENGINEERING CO.	1
CONSOLIDATION COAL COMPANY	1
GEWERKSCHAFT EISENHUTTE WESTFALIA	1
GULF OIL COMPANY	1
GEOKINETICS, INC.	1
BECHTEL INTERNATIONAL CORP.	1
RAPIDEX, INC.	1
SHELL OIL COMPANY	1
ST. JOE MINERALS CORPORATION	1
NIPPON KOGEI KOGYO COMPANY, LIMITED	1
TECHNOLOGY APPLICATIONS SERVICES CORPORATION	1
GULF RESEARCH + DEVELOPMENT COMPANY	1

SYNTHETIC FUELS 1 A - IN SITU - MINES

ASSIGNED PATENTING(1/69 - 12/78) - - ALPHA LISTING

ATLANTIC RICHFIELD COMPANY
- 3586377 - METHOD OF RETORTING OIL SHALE IN-SITU
- 3917344 - IN SITU RETORTING SYSTEM
- 3917346 - METHOD OF BLASTING A SUBTERRANEAN DEPOSIT
- 3917348 - METHOD OF DEVELOPING PERMEABLE UNDERGROUND ZONES

AZS CORPORATION
- 4063780 - METHOD OF RECOVERING LIQUID AND GASEOUS PRODUCTS OF OIL SHALE

BECHTEL INTERNATIONAL CORP.
- 3934935 - HYDRAULIC MINING OF OIL BEARING FORMATION

CITIES SERVICE COMPANY
- 3628929 - METHOD FOR RECOVERY OF COAL ENERGY
- 3770398 - IN SITU COAL GASIFICATION PROCESS

CONSOLIDATION COAL COMPANY
- 3905430 - APPARATUS FOR RAISE DRILLING

CONTINENTAL OIL COMPANY
- 3437378 - RECOVERY OF OIL FROM SHALE
- 3765722 - METHOD FOR RECOVERING PETROLEUM PRODUCTS OR THE LIKE FROM SUBTERRANEAN MINERAL DEPOSITS
- 3814480 - METHOD OF CONTROLLING GAS ACCUMULATION IN UNDERGROUND MINES
- 4109719 - METHOD FOR CREATING A PERMEABLE FRAGMENTED ZONE WITHIN A SUBTERRANEAN CARBONACEOUS DEPOSIT FOR IN SITU COAL GASIFICATION

COPPER RANGE COMPANY
- 3853353 - METHOD OF EXTRACTING A METAL FROM A MATERIAL CONTAINING THE METAL IN ELEMENTAL FORM

EXXON RESEARCH + ENGINEERING CO.
- 3537753 - OIL SHALE MINING METHOD

GEOKINETICS, INC.
- 3980339 - PROCESS FOR RECOVERY OF CARBONACEOUS MATERIALS FROM SUBTERRANEAN DEPOSITS

GEWERKSCHAFT EISENHUTTE WESTFALIA
- 4099783 - METHOD FOR THERMOSHAFT OIL PRODUCTION

GULF OIL CORPORATION
- 4119349 - METHOD AND APPARATUS FOR RECOVERY OF FLUIDS PRODUCED IN IN-SITU RETORTING OF OIL SHALE

GULF RESEARCH + DEVELOPMENT COMPANY
- 4015664 - SHALE OIL RECOVERY PROCESS

IN SITU TECHNOLOGY, INC.
- 4092052 - CONVERTING UNDERGROUND COAL FIRES INTO COMMERCIAL PRODUCTS
- 4093310 - SEALING AN UNDERGROUND COAL DEPOSIT FOR IN SITU PRODUCTION
- 4102397 - SEALING AN UNDERGROUND COAL DEPOSIT FOR IN SITU PRODUCTION

MOBIL OIL CORPORATION
- 3950029 - IN SITU RETORTING OF OIL SHALE
- 4018280 - PROCESS FOR IN SITU RETORTING OF OIL SHALE

NIPPON KOGEI KOGYO COMPANY, LIMITED
3695001 - METHOD AND SYSTEM FOR REMOVING PARTICLES OF FLOATING DUSTS PRODUCED UPON AN EXCAVATION OF A TUNNEL

OCCIDENTAL OIL SHALE, INC.
4029360 - METHOD OF RECOVERING OIL AND WATER FROM IN SITU OIL SHALE RETORT FLUE GAS
4043595 - IN SITU RECOVERY OF SHALE OIL
4043596 - FORMING SHALE OIL RECOVERY RETORT BY BLASTING INTO SLOT-SHAPED COLUMNER VOID
4043597 - MULTIPLE LEVEL PREPARATION OF OIL SHALE RETORT
4043598 - MULTIPLE ZONE PREPARATION OF OIL SHALE RETORT
4045085 - FRACTURING OF PILLARS FOR ENHANCING RECOVERY OF OIL FROM IN SITU OIL SHALE RETORT
4047760 - IN SITU RECOVERY OF SHALE OIL
4072350 - MULTI-STAGE METHOD OF OPERATING AN IN SITU OIL SHALE RETORT
4076312 - METHOD AND APPARATUS FOR RETORTING OIL SHALE AT SUBATMOSPHERIC PRESSURE
4082145 - DETERMINING THE LOCUS OF A PROCESSING ZONE IN AN IN SITU OIL SHALE RETORT BY SOUND MONITORING
4082146 - LOW TEMPERATURE OXIDATION OF HYDROGEN SULFIDE IN THE PRESENCE OF OIL SHALE
4086962 - DECREASING HYDROGEN SULFIDE CONCENTRATION OF A GAS
4086963 - METHOD OF OXIDIZING HYDROGEN SULFIDE
4089375 - IN SITU RETORTING WITH WATER VAPORIZED IN SITU
4093026 - REMOVAL OF SULFUR DIOXIDE FROM PROCESS GAS USING TREATED OIL SHALE AND WATER
4105072 - PROCESS FOR RECOVERING CARBONACEOUS VALUES FROM POST IN SITU OIL SHALE RETORTING
4106814 - METHOD OF FORMING IN SITU OIL SHALE RETORTS
4109718 - METHOD OF BREAKING SHALE OIL-WATER EMULSION
4109964 - METHOD FOR PRECONDITIONING OIL SHALE PRELIMINARY TO EXPLOSIVE EXPANSION AND IN SITU RETORTING THEREOF
4118070 - SUBTERRANEAN IN SITU OIL SHALE RETORT AND METHOD FOR MAKING AND OPERATING SAME
4118071 - IN SITU OIL SHALE RETORT WITH A HORIZONTAL SILL PILLAR
4119345 - IN SITU OIL SHALE RETORTING PROCESS USING INTRODUCTION OF GAS AT AN INTERMEDIATE LOCATION
4120354 - DETERMINING THE LOCUS OF A PROCESSING ZONE IN AN IN SITU OIL SHALE RETORT BY PRESSURE MONITORING
4121663 - REMOVING HYDROGEN SULFIDE FROM A GAS
4125157 - REMOVING SULFUR DIOXIDE FROM GAS STREAMS WITH RETORTED OIL SHALE
4126180 - METHOD OF ENHANCING YIELD FROM AN IN SITU OIL SHALE RETORT

OCCIDENTAL PETROLEUM CORPORATION
3661423 - IN SITU PROCESS FOR RECOVERY OF CARBONACEOUS MATERIALS FROM SUBTERRANEAN DEPOSITS
3915498 - OIL SHALE RETORT FLUE GAS COOLING AND CLEANING
3941421 - APPARATUS FOR OBTAINING UNIFORM GAS FLOW THROUGH AN IN SITU OIL SHALE RETORT
3951456 - PROCESS FOR EFFECTING EVEN RETORT WORKING FLUID FLOW THROUGHOUT AN IN SITU RETORT CONTAINING CARBONACEOUS DEPOSITS
4005752 - METHOD OF IGNITING IN SITU OIL SHALE RETORT WITH FUEL RICH FLUE GAS
4007963 - OIL COLLECTION AND RECOVERY SYSTEM FOR IN SITU OIL SHALE RETORT
4014575 - SYSTEM FOR FUEL AND PRODUCTS OF OIL SHALE RETORT
4022511 - RECOVERY OF LIQUID AND GASEOUS PRODUCTS FROM AN IN SITU OIL SHALE RETORT
4025115 - METHOD OF ENHANCING RECOVERY OF OIL FROM PILLARS ADJACENT IN SITU OIL SHAFT RETORT
4027917 - METHOD FOR IGNITING THE TOP SURFACE OF OIL SHALE IN AN IN SITU RETORT
4087130 - PROCESS FOR THE GASIFICATION OF COAL IN SITU

RAPIDEX, INC.
3957305 - IN SITU VALUES EXTRACTION

SHELL OIL COMPANY
3434757 - SHALE OIL-PRODUCING PROCESS

ASSIGNED PATENTING(1/69 - 12/78) - - ALPHA LISTING

STANDARD OIL COMPANY (INDIANA)
- 4105251 - DISPERSION OF CATALYSTS WITH EXPLOSIVES FOR IN SITU MINING OF CARBONACEOUS MINERALS
- 4117886 - OIL SHALE RETORTING AND OFF-GAS PURIFICATION
- 4120355 - METHOD FOR PROVIDING FLUID COMMUNICATION FOR IN SITU SHALE RETORT
- 4131416 - SLURRY BACKFILLING OF IN SITU OIL SHALE RETORT

ST JOE MINERALS CORPORATION
- 3563606 - METHOD FOR IN-SITU UTILIZATION OF FUELS BY COMBUSTION

TECHNOLOGY APPLICATION SERVICES CORPORATION
- 4067390 - APPARATUS AND METHOD FOR THE RECOVERY OF FUEL PRODUCTS FROM SUBTERRANEAN DEPOSITS OF CARBONACEOUS MATTER USING A PLASMA ARC

UNITED STATES OF AMERICA, DEPARTMENT OF ENERGY
- 3933447 - UNDERGROUND GASIFICATION OF COAL
- 4017119 - METHOD FOR RUBBLIZING AN OIL SHALE DEPOSIT FOR IN SITU RETORTING
- 4069867 - CYCLIC FLOW UNDERGROUND COAL GASIFICATION PROCESS

WINTERSHALL AKTIENGESELLSCHAFT
- 3695711 - METHOD OF RECOVERING UNDERGROUND DEPOSITS OF SOLUBLE MINERALS, AND APPARATUS FOR CARRYING OUT THE METHOD
- 3744847 - APPARATUS FOR RECOVERING UNDERGROUND DEPOSITS OF SOLUBLE MINERALS

UNASSIGNED PATENTS (1/75-12/78) INVENTORS (ALPHA LISTING)

INVENTOR NAME			STREET	CITY	ST	ZIP/CNTRY
BACIU	PETRU	C.	48-20 48TH ST.	WOODSIDE, QUEENS	NY	11377
3883177 - DIAMOND DRILL AND ROCK FRAGMENT EXCAVATION DEVICE						
FISHER	CHARLES	B.	53 MORRISON AVE.	MONTREAL, QUEBEC		CA
4116273 - INDUCTION HEATING OF COAL IN SITU						
FISHER	SIDNEY	T.	2850 HILL PARK RD.	MONTREAL, QUEBEC		CA
4116273 - INDUCTION HEATING OF COAL IN SITU						
GARRETT	DONALD	E.	505 W. 9TH ST.	CLAREMONT	CA	91711
4057293 - PROCESS FOR IN SITU CONVERSION OF COAL OR THE LIKE INTO OIL AND GAS						
JOHNS	ROBERT	W.	349 ASHLEY CRESCENT SE.	CALGARY, ALBERTA		CA
4076311 - HYDRAULIC MINING FROM TUNNEL BY RECIPROCATED PIPES						
KILBURN	JAMES	S.	3060 B-1/2 RD.	GRAND JUNCTION	CO	81501
4121662 - WATER PURIFICATION WITH FRAGMENTED OIL SHALE						
RABBITTS	LEONARD	C.	BIG CHIEF RD. R.R. #3	ORILLIA, ONTARIO		CA
4101172 - IN-SITU METHODS OF EXTRACTING BITUMEN VALUES FROM OIL-SAND DEPOSITS						
VON HIPPEL	HANS	JOACHIM	LATE OF P.O. OBERSTENWEILER	OBERSTENWEILER		DT
3865186 - METHOD OF AND SYSTEM FOR GASIFYING UNDERGROUND DEPOSITS OF COAL						
VON HIPPEL	MILA			OBERSTENWEILER		DT
3865188 - METHOD OF AND SYSTEM FOR GASIFYING UNDERGROUND DEPOSITS OF COAL						

PATENTS (1/63-12/78) WITH NEITHER ASSIGNMENT NOR INVENTOR INFORMATION IN DATABASE

3460867 - MINING AND RETORTING OF OIL SHALE
3497335 - UNDERGROUND GASIFICATION OF COAL
3506309 - METHOD AND SYSTEM FOR GASIFYING UNDERGROUND DEPOSITS OF COAL
3529867 - PROCESS FOR THE COLLECTING OF THE PIT GAS FROM AN UNDERGROUND COAL MEASURE
3159976 3205012 3236053 3254921 3316020 3362751

I.A. IN SITU CONVERSION: MINES

PATENTING UPDATE (1/79-8/79)

Patent No.	Assignee & Title
4,133,380	Occidental Oil Shale, Inc.: Establishing A Combustion Zone Below A Sill Pillar In An In Situ Oil Shale Retort
4,133,580	Occidental Oil Shale, Inc.: Isolation Of In Situ Oil Shale Retorts
4,140,181	Occidental Oil Shale, Inc.: Two-Stage Removal Of Sulfur Dioxide From Process Gas Using Treated Oil Shale
4,140,343	Occidental Oil Shale, Inc.: Gas Withdrawal From An In Situ Oil Shale Retort
4,143,917	Continental Oil Company: In-Situ Retorting Of Oil Shale With In-Situ Formed Arches
4,146,272	Occidental Oil Shale, Inc.: Explosive Placement For Explosive Expansion Toward Spaced Apart Voids
4,147,388	Occidental Oil Shale, Inc.: Method For In Situ Recovery Of Liquid And Gaseous Products From Oil Shale Deposits
4,147,389	Occidental Oil Shale, Inc.: Method For Establishing A Combustion Zone In An In Situ Oil Shale Retort
4,148,358	Occidental Research Corporation: Oxidizing Hydrocarbons, Hydrogen, And Carbon Monoxide
4,148,529	Occidental Oil Shale, Inc.: Doping A Retort To Determine The Locus Of A Processing Zone
4,149,592	Occidental Oil Shale, Inc.: Containers For Indicators
4,149,595	Occidental Oil Shale, Inc.: In Situ Oil Shale Retort With Variations In Surface Area Corresponding To Kerogen Content Of Formation Within Retort Site
4,149,752	Occidental Oil Shale, Inc.: Operation Of An In Situ Oil Shale Retort
4,150,722	Occidental Oil Shale, Inc.: Determining The Locus Of A Retorting Zone In An Oil Shale Retort By Rate Of Shale Oil Production
4,151,877	Occidental Oil Shale, Inc.: Determining The Locus Of A Processing Zone In A Retort Through Channels

4,153,110 Occidental Oil Shale, Inc.: Ignition Of Fragmented Oil Shale Below A Sill Pillar In An In Situ Oil Shale Retort

4,153,297 Occidental Oil Shale, Inc.: Ground Water Control For An In Situ Oil Shale Retort

4,153,298 Occidental Oil Shale, Inc.: Removal Of Pillars From A Void For Explosive Expansion Toward The Void

4,153,299 Golder Associates, Inc.: Combustion Air Supply To In-Situ Retorts

4,153,300 Golder Associates, Inc.: Recovery Of Fluid Fuels By In-Situ Retorting Of Carbonaceous Deposits

4,156,461 Occidental Oil Shale, Inc.: Decreasing Hydrocarbon, Hydrogen And Carbon Monoxide Concentration Of A Gas

4,158,467 Gulf Oil Corporation: Process For Recovering Shale Oil

4,160,481 The HOP Corporation: Method For Recovering Subsurface Earth Substances

4,162,706 Occidental Oil Shale, Inc.: Determining The Locus Of A Processing Zone In An Oil Shale Retort By Monitoring Pressure Drop Across The Retort

4,162,808 Gulf Oil Corporation: In-Situ Retorting of Carbonaceous Deposits

4,163,475 Occidental Oil Shale, Inc.: Determining The Locus Of A Processsing Zone In An In Situ Oil Shale Retort

4,165,903 John H. Cobbs, 5021 S. Fulton St., Tulsa, OK 74135: Mine Enhanced Hydrocarbon Recovery Technique