Statistical analysis indicated that only 822 of the same articles were covered by BIOSIS, CAS, and Ei, and it was determined that this did not constitute a large enough overlap to warrant additional effort. In the two-way article overlap, the overlap between BIOSIS and CAS is approximately 43,000 and between CAS and Ei approximately 17,500 journal articles. The methodology used to determine the overlap at the journal article level and detailed tabular data have been published in Part 1;[3] Part 2 will be published soon.[4]

Cost figures for abstracting and indexing an individual article vary so widely that no true figure can be quoted at this time, but it is obvious that we are considering an overlap of some 50,000 journal articles which is substantial enough to warrant further bilateral investigation.

The three services are continuing the study to obtain the information they need for future cooperation to make their publications and services more useful to the information community.

Each of the three services has agreed to arrange to finance its contribution to the study. If it becomes necessary, the duration of the study will be extended so as not to place an undue financial burden on any of the participants.

LITERATURE CITED

(1) "Science, Government, and Information," report of the President's Science Advisory Committee, 52 pp., Jan. 10, 1963.
(2) National Academy of Sciences, "Scientific and Technical Communication," report of the Committee on Scientific and Technical Communication, Washington, D. C., National Academy of Sciences, 1969.
(3) Wood, J. L., Flanagan, Carolyn, and Kennedy, H. E., "Overlap in the Lists of Journals Monitored by BIOSIS, CAS, and Ei," *J. Amer. Soc. Inform. Sci.* **23**, 36-8 (1972).
(4) Wood, J. L., Flanagan, Carolyn, and Kennedy, H. E., "Overlap among the Journal Articles Selected for Coverage by BIOSIS, CAS, and Ei," *J. Amer. Soc. Inform. Sci.*, to be published.

A Cooperative Information Storage and Retrieval System for the Petroleum Industry*

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The *Petroleum Abstracts* bulletin was first published in January 1961, as a cooperative information storage and retrieval service for the exploration, development, and production segment of the petroleum industry. Information retrieval from retrospective files was first accomplished by an inverted subject card file. In 1965, this system was replaced by controlled-vocabulary, subject indexing. Currently under development is the PASS direct-access computer system (Petroleum Abstracts Search System) which allows real-time intercommunication with the disk-pack stored data base, through a telephone-linked portable teletype console. This system is designed to operate on a Xerox Sigma 6 computer.

The *Petroleum Abstracts* bulletin and associated Information Storage and Retrieval Services were initiated in January 1961 by a group of petroleum producing companies. Prior to this time, many of these companies had been monitoring the technical literature and abstracting articles and patents pertinent to their specific interests. Such operations were conducted by internal information services departments, usually in close association with the companies' technical libraries. Recognizing that this practice represented considerable duplication of effort, a group of these companies delegated The University of Tulsa to administer a cooperative abstracting service for the benefit of the exploration and production segment of the petroleum industry. The cost of conducting this service was divided among the various participating companies, each individual contribution being proportional to the company's capitalization. The operation of the abstracting service was guided by a Subscriber Advisory Board, consisting of representatives from each of the participants. The purpose of this group was to provide user feedback and to help establish policies and operational guidelines.

As a result of this cooperative venture, each company was able to obtain much greater coverage at much lower cost than had proved possible with their previous individual abstracting efforts. A similar abstracting and retrieval service, administered by the American Petroleum Institute, provides parallel coverage for the refining and petrochemical segments of the petroleum industry.

The cooperative information services provided by The University of Tulsa have greatly expanded and diversified since 1961.[1] The *Petroleum Abstracts* bulletin itself has expanded from 10,488 abstracts in 1961 to 16,924 abstracts in 1971. Much of this increase may be attributed to expanding technological developments and diversified new fields of interest—such as offshore exploitation methods, environmental pollution, etc. More sophisticated retrieval techniques also have been developed to provide faster, more comprehensive searching of the rapidly growing data base.

*Presented before the Division of Chemical Literature, 164th Meeting, ACS, New York, N. Y., Aug. 27, 1972.

INFORMATION SERVICES

The *Petroleum Abstracts* bulletin contains summaries of significant technical articles, patents, theses, reports, etc., in the field of petroleum exploration and exploitation. The original documents, received and later stored in the University's Sidney Born Technical Library, are reviewed daily and selections of significant technical items made for abstracting. Items of a purely news or promotional nature are usually omitted. The documents are then summarized by competent abstractors and, after suitable editing, are assembled in bulletin form under the following broad categories: geology, geochemistry, geophysics, drilling, logging, well completion, production, engineering, and transportation.

Petroleum Abstracts bulletin is issued weekly, and contains from 150 to 300 abstracts per issue. In format, it is printed four abstracts to a page (each abstract 4 × 5½ inches in size) and additional copies are printed on card stock for those who wish to maintain a card file. A typical abstract page is shown in Figure 1. Each abstract title is designed to contain all essential retrieval data, including title, author, affiliation, bibliographic reference, and language (if other than English). The abstract (approximately 150 words in length) follows, together with a small diagram, in the case of patents. All abstracts are numbered sequentially in the upper right-hand corner, providing unique identification for each document during later retrieval procedures.

During the last two years, a supplementary bulletin has been published monthly, entitled *Selected Petroleum Abstracts.* This bulletin is a condensed edition of the *Petroleum Abstracts* bulletin, containing only abstracts of English-language articles and reports. Patents, foreign-language articles, and abstracts taken from secondary sources (appearing in *Petroleum Abstracts*) are omitted from this "streamlined" edition, which has proved extremely popular for current awareness browsing among field and office personnel.

RETRIEVAL SERVICES

The retrieval aspects of the *Petroleum Abstracts* service originally consisted of assigning appropriate code numbers (up to a maximum of seven) from a classification system, especially devised to cover the subject area of the abstract comprehensively. At the end of each year, a computer-generated subject index was prepared from these classifications, together with author and patent number indexes.

It was thought, however, that the retrieval capabilities of this system were too limited and a committee of industrial representatives cooperatively developed a specialized *Exploration and Production Thesaurus,* hierarchically structured, and carefully screened to avoid synonyms and ambiguities.[2] This controlled vocabulary of descriptors or keywords was then used to index all abstracts, starting in January 1965. From 10 to 90 descriptors were assigned, delineating the subject matter of the document, individually, or in combination for coordinate searching. Additional specific, but seldom-used, terms (such as chemicals, company names, and geographic place names) were also

GAS PROCESSING 138,179

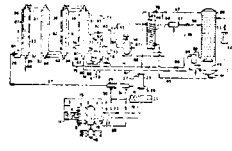
THE CONTROL OF THE DEW POINT OF A HYDROCARBONS FROM GASES WITH CONDENSATE-- O. Ungureanu, Tr. Mantulescu and Fr. Amann; PETROL GAZE v. 21, No. 8, pp 465-467, Aug. 1970 (In Romanian)

In a gas condensate field in Romania, separation of the gaseous and liquid phases is accomplished at a central separator station. It was impossible, however, to assure single-phase conditions in the gathering lines because, as calculations show, the heptanes-plus content causes a liquid phase to separate even at a very modest decrease in temperature, since at the wellhead, an equilibrium between the 2 phases exists. The absence of hydrogen sulfide in the produced fluid has made it possible to design and build an adsorption type dew-point reducing installation which removes essentially only part of the C_{7+} component, sufficient to reduce the dew-point, so that no liquid phase is formed in the gathering lines. The installation also serves to dehydrate the gas. The installation has functioned reliably for 5 mo., and can be used also as the first stage in a process for depropanizing and debutanizing the gas at low temperature.

GAS SEPARATOR 138,180

INSTALLATION FOR SEPARATING GASEOUS MIXTURES-- Fr. 2,025,204, c. 9/4/70, f. 12/3/69 (pr. U.S. 12/4/68, Appl. 781,201); J. J. Schauls, asr.; (Trane Co); Abstr., BULL. OFFIC. PROPRIETE IND. (FR.) v. 11, No. 41, Pt. 2 (No. 32), p 19874, 10/9/70 (In French)

This gas-separation installation uses reversible heat exchangers, with a reheating stream to facilitate temperature control and cleaning of the heat exchangers. At least 2 filters are provided in the exit gas stream from the heat exchangers, so that cleaning by a portion of the reheating stream takes place automatically without creating disturbing differential pressures in the gas during the separation stage. (Abstract only - original not available)



MASS TRANSFER 138,181

QUASI-STEADY STATE ASSUMPTION FOR MASS TRANSFER TO SPHERICAL BINARY BUBBLES OR DROPS-- V. D. Dang, E. Ruckenstein and W. N. Gill (Clarkson Coll Technol); CHEM. ENG. (LONDON) No. 241, pp CE248-CE251, CE259, Sept. 1970

Exact solutions of the convective diffusion equation for mass transfer from binary dispersed spherical bubbles or drops have been obtained for continuous phase-controlled systems with high Schmidt number. The analytical results are valid for most values of the parameters of practical interest for gas-liquid absorption systems. However, for liquid-liquid systems, the assumption of continuous phase control is restricted to the transfer of components that are relatively insoluble in the continuous phase. The quasi-steady state approach is used almost exclusively for design purposes and, therefore, the validity of this assumption is examined. It is found to be accurate at high Reynolds numbers, but is restricted to the transfer of relatively insoluble components for low Reynolds number systems. (12 refs.)

OFFSHORE PRODUCING 138,182

HUMBLE OIL'S BIG PLANS FOR DEEPWATER GIANT IN CHANNEL-- OIL GAS J. v. 68, No. 49, pp 30-32, 12/7/70

Humble Oil & Refining Co. has developed some surprising new techniques to produce oil safely in 200- to 2,000-ft waters of Santa Barbara Channel. Beyond the fact that the platforms will stand in water nearly twice as deep as the industry has penetrated so far, the most significant feature of the program is the submerged production system (SPS). SPS calls for groups of 5 to 40 wells which will be drilled from floating vessels, completed on the ocean bottom (or possibly on submerged platforms in the deeper waters), and maintained through flow-line pumpdown tools capable of performing all workover functions. These include perforating, cementing, acidizing, and paraffin removal. In addition, a robot-type manipulator, equipped with television cameras, will be lowered to the well-completion structures and moved around a track to perform such duties as replacing valves and testing them--all by remote control from the surface. Humble has been working on deepwater platform design for 6 yr and could build a platform in 1,000 ft of water. This may be done eventually--but the first one will be in 700 ft of water and stand 775 ft from the ocean floor to the top deck. It will cost $15 to $25 million, weigh 20,000 tons, and accommodate 3 drilling rigs.

 3632

Figure 1. Typical page from *Petroleum Abstracts Bulletin*

used as needed. Such descriptors are not entered into the Thesaurus but are cumulatively merged and periodically issued as a "Supplemental Word List" which is used in conjunction with the Thesaurus in framing search questions.

After the abstracts have been indexed, the descriptors are keypunched and computer processed to form a data base from which the various search tools (indexes, magnetic tapes, etc.) can be generated.[3]

MANUAL INDEXES

The most popular manual retrieving tool is the *Alphabetic Subject Index*, originally issued monthly, now published on a bimonthly basis. As the name indicates, this reference contains a tabulation of document titles, cross-indexed in multiple listings under the principal assigned descriptors. A sample page is shown in Figure 2. Some of the abstract titles (those listed under what the indexer

NEUTRON LOGGING*SOME FEATURES OF DUAL-SPACED NEUTRON POROSITY LOGGING 161,413
NEUTRON SOURCE*HIGH VOLTAGE CONNECTOR FOR A NEUTRON GENERATOR COMPRISING A PLASTIC INSULATOR 161,416
NUCLEAR LOGGING*RADIOACTIVITY LOGGING APPARATUS HAVING SHIELDED WALL CONTACTING SOURCE AND DETECTOR 159,656
VELOCITY LOGGING*CORRELATION OF ELASTIC MODULI DYNAMICALLY MEASURED BY IN-SITU AND LABORATORY TECHNIQUES 161,430

WELL PERFORMANCE
ARTIFICIAL LIFT*PREDICTING PLUNGER LIFT PERFORMANCE 160,834
GAS WELL TESTING*USE OF THE METHOD OF SUPERPOSITION FOR TESTING NATURAL GAS SOUNDS 159,682
OIL SATURATION*DETERMINATION OF RESIDUAL OIL SATURATION AFTER WATERFLOODING 159,705
WELL SAMPLING*TOOL TO DETERMINE QUANTITY OF OIL 160,333
WELL STIMULATION*STIMULATING PRODUCING WELLS WITH CHROMIC ACID 159,674
WELL TESTING*BACK-PRESSURE TESTING OF GAS WELLS 161,258

WELL PLUGGING
SELECTIVE PLUGGING*SELECTIVE PLUGGING METHOD 161,454

WELL PRESSURE
BEAM PUMPING*DESIGNED BEAM PUMPING 160,838
BLOWOUT PREVENTER*WELL BLOWOUT PREVENTER CONTROL PRESSURE MODULATOR 160,790

WELL PUMP
GEAR*CARE AND FEEDING OF GEARS 160,635
GYPSUM SCALING*SOLUBILITY OF CALCIUM SULFATE DIHYDRATE AND ASSOCIATION EQUILIBRIA IN SEVERAL AQUEOUS MIXED ELECTROLYTE SALT SYSTEMS AT 25 DEGREES C 160,362
WELL PUMPING UNIT*PUMPING JACK 160,381

WELL PUMPING
PUMPING WELL ANALYSIS 161,257
*ANALYTICAL METHOD *DATA RECORDING
*DYNAMOMETER CARD *TESTING
.DATA ANALYSIS .DATA PRESENTATION
.DIGITAL COMPUTER .INTERPRETATION
.MATHEMATICAL MODEL
DEEP PRODUCING*APPLICATION OF THE COMPUTER TO THE ANALYSIS OF PUMPING FAILURES AT GREAT DEPTH 161,460
ROD PUMP*SELECTION OF SUBSURFACE PUMP 161,249
WELL PUMPING UNIT*PUMPING JACK 160,381

WELL PUMPING UNIT
FREE AND PARAMETRIC OSCILLATIONS IN A PUMPING INSTALLATION WITH COUNTERWEIGHT 161,475
*COUNTERBALANCING *DEEP WELL
*ROD PUMP *VECTOR ANALYSIS
.CALCULATING .OSCILLATORY CHARACTERISTIC
.STABILITY .SUCKER ROD
.VIBRATION
PUMPING JACK 160,381
*ARTIFICIAL LIFT *KINETIC ENERGY
*WELL PUMP *WELL PUMPING
.CONTROL VALVE .ENERGY SOURCE
.KINETICS .POWER
.PUMP
BEAM PUMPING*DESIGNED BEAM PUMPING 160,838
BEAM PUMPING*METHODS FOR IMPROVED UTILIZATION OF BEAM PUMPING UNITS 160,839
HYDRAULIC WELL PUMP*DOWNHOLE PUMP ASSEMBLY HAVING ENGINES SPACED APART BY A PRODUCTION PUMP 160,364
HYDRAULIC WELL PUMP*FLUID OPERATED PUMP ASSEMBLY WITH TANDEM ENGINES 160,365

WELL SAMPLING
TOOL TO DETERMINE QUANTITY OF OIL 160,333
*FLUID SAMPLER *WATER OIL RATIO
*WELL FLUID *WELL PERFORMANCE
.CONTROL VALVE .DATA RECORDING
.ELECTRIC MOTOR .REMOTE CONTROL
.VALVE ACTUATOR
FLUID SAMPLER*FORMATION-SAMPLING APPARATUS 160,323
WATERFLOOD SUSCEPTIBILITY*CONTROL OF WATER SOLUBILIZATION IN MICELLAR SOLUTIONS 159,730

WELL SERVICING
JUNK REMOVAL*COMBINATION WELL CLEAN-OUT TOOL AND JAR 160,341

WELL SHOOTING
EXPLOSIVE WELL STIMULATION 161,228
*CASE HISTORY *FRACTURE EXTENSION
*LIQUID EXPLOSIVE *WELL STIMULATION
.EXPLOSION .FRACTURE (ROCK)
.PAYOUT .PRODUCING CAPACITY
.WELL COMPLETION
METHOD OF PRODUCING PARTICLES OF ROCK IN A SUBTERRANEAN SITUS 160,351
*FRACTURE EXTENSION *LIQUID EXPLOSIVE
*MOBILITY RATIO *SELECTIVE INJECTION
.CONTROL .MOBILITY
.SELECTIVITY .SLURRY
.VISCOSITY
FORMATION PLUGGING*METHOD OF TREATING PERMEABLE FORMATIONS 161,617
NUCLEAR BLAST*NUCLEAR EXPLOSIVES AND HYDROCARBONS 161,444

WELL SPACING
GAS WELL CAPACITY*EFFECTS OF DRAINAGE SHAPE AND WELL LOCATION ON STABILIZED GAS DELIVERABILITY CALCULATIONS 160,647
SOUR GAS*ON THE PRODUCTION OF HYDROGEN SULFIDE-SULFUR MIXTURE FROM DEEP FORMATIONS 160,641

WELL STIMULATION
A NEW METHOD OF INCREASING THE DEPTH OF ACID TREATMENTS IN WATER INJECTION WELL FORMATIONS 159,919
*ACIDIZING *INJECTION WELL
*PENETRATION DEPTH *WATER INJECTION
.FIELD DATA .LIQUID VISCOSITY
.THICKENER .VISCOUS WATER
.WATER THICKENING
CHEMICAL STIMULATION. THEORETICAL AND EXPERIMENTAL STUDY OF CHEMICAL EQUILIBRIA DESCRIBING HYDROFLUORIC ETCHING ON A CLAYEY SANDSTONE 161,457
*ACIDIZING *ARGILLACEOUS SANDSTONE
*COMPLEX FORMATION *SILICA MINERAL
.CLAY .COMPUTER PROGRAMING
.HYDROFLUORIC ACID .SILICA
.SOLUBILITY
CHROMIC ACID INJECTION FOR WELL STIMULATION 159,673
*HYDROCARBON COMPOUND *RELATIVE PERMEABILITY
*SAND GRAIN *WETTING AGENT
.CHROMIC ACID .INJECTION WELL
.INJECTIVITY .WATERFLOODING
INCREASING THE INJECTIVITY INDEX AND PRODUCTIVITY INDEX OF WELLS 159,672
*COLLOIDAL DISPERSION *INJECTIVITY
*PRODUCTIVITY INDEX *SOLUBLE OIL
.BUFFER (CHEMICAL) .CHEMICAL INJECTION
.DISPLACEMENT .MICELLE
.MOBILITY RATIO
STIMULATING PRODUCING WELLS WITH CHROMIC ACID 159,674
*PRODUCING CAPACITY *PRODUCTIVITY
*PRODUCTIVITY INDEX *WELL PERFORMANCE
.ACIDIZING .CHROMIC ACID
.HYDROCARBON COMPOUND .OIL WETTABILITY
.POROSITY (ROCK)
FERRIC ION CORROSION*SYNERGISTIC INHIBITION OF FERRIC ION CORROSION DURING CHEMICAL CLEANING OF METAL SURFACES 160,338
FRACTURE EXTENSION*FRACTURING AND SCAVENGING FORMATIONS WITH FLUIDS CONTAINING LIQUEFIABLE GASES AND ACIDIZING AGENTS 159,663
FRACTURING*GAS FRAC--A NEW STIMULATION TECHNIQUE USING LIQUID GASES 160,623
NUCLEAR BLAST*RIO BLANCO GAS STIMULATION PROJECT, RIO BLANCO COUNTY, COLORADO 159,912
NUCLEAR BLAST*WAGON WHEEL GAS STIMULATION PROJECT. SUBLETTE COUNTY, WYOMING 159,913
WELL SHOOTING*EXPLOSIVE WELL STIMULATION 161,228

WELL SURVEY EQUIPMENT
INCLINOMETER*A NEW BORE-HOLE INCLINOMETER 159,904

WELL TEMPERATURE
EQUILIBRIUM BORE HOLE TEMPERATURES FROM OBSERVATION OF THERMAL TRANSIENTS DURING DRILLING 159,651
*GEOTHERMAL GRADIENT *HEAT TRANSFER
*NUMERICAL ANALYSIS *SUBSURFACE TEMPERATURE
.DEEP DRILLING .EQUILIBRIUM
.FIELD TESTING .MEASURING
.TEMPERATURE LOGGING

WELL TESTING
BACK-PRESSURE TESTING OF GAS WELLS 161,258
*BACK PRESSURE *GAS WELL
*GAS WELL CAPACITY *WELL PERFORMANCE
.DATA RECORDING .DELIVERABILITY
.GAS PRODUCING .RECOVERY FACTOR
.RESERVOIR CHARACTERISTIC
BOTTOM HOLE CHOKE*SUBSURFACE SAFETY VALVE 160,353
HYDRAULIC WELL PUMP*A UNITIZED, ONE-WELL HYDRAULIC PUMPING SYSTEM 160,845
OIL PRODUCING*MONITORING YOUR EQUIPMENT AND PRODUCTION 161,244
OIL SATURATION*DETERMINATION OF RESIDUAL OIL SATURATION AFTER WATERFLOODING 159,705
OIL SATURATION*DETERMINATION OF THE RESIDUAL OIL SATURATION IN TWO AUX VASES SANDSTONE RESERVOIRS 159,708
OIL SATURATION*SINGLE-WELL TRACER METHOD TO MEASURE RESIDUAL OIL SATURATION 159,706

WELL TOOL
PUMPDOWN TOOL*JAR STROKE ACCELERATOR FOR PUMPDOWN WELL TOOL 159,666
SHOCK ABSORBER*EXPENDABLE SHOCK ABSORBER 160,347

WELL WORKOVER
FORMATION EVALUATION*37 WAYS TO IMPROVE YOUR WELL COMPLETIONS 159,909
OFFSHORE PRODUCING*WORKOVER OPERATIONS SPARK OFFSHORE PRODUCTION ACTIVITY 160,369
WATER POLLUTION*AGGLOMERATED POROUS MASS AND METHOD OF PREPARING SAME 160,436

WEST AFRICA
SPORE-POLLEN CHARACTERISTICS OF THE UPPER CRETACEOUS DEPOSITS OF MALI-NIGERIAN SYNECLISE (S. SAHARA) 160,540
*CRETACEOUS *MALI
*NIGER *PALYNOLOGY
*SAHARA AREA .DISTRIBUTION
.GEOLOGIC RANGE .OUTCROP
.STRATIGRAPHIC CORRELATION .SUBSURFACE
GONDWANALAND*NON-MARINE CRETACEOUS OSTRACODS AND THEIR IMPORTANCE FOR THE HYPOTHESIS OF 'GONDWANALAND' 159,786

WEST VIRGINIA
WEST VIRGINIA'S NEWBURG SILURIAN SAND CONTINUES TO BE THE STATE'S BIG TARGET 160,760
*OIL AND GAS ENTRAPMENT *SILURIAN
*STRATIGRAPHY *WILLIAMSPORT SANDSTONE
.GAS FIELD .GAS RECOVERY
.GAS RESERVOIR .POROSITY (ROCK)
.SANDSTONE RESERVOIR
APPALACHIAN AREA*PALEOENVIRONMENTAL STUDY OF THE HELDERBERG GROUP OF WEST VIRGINIA AND VIRGINIA 160,443

WESTERN AUSTRALIA
AUSTRALIA*THE RANKIN TREND NORTHWEST SHELF, WESTERN AUSTRALIA 160,459
AUSTRALIA*THE TECTONIC ELEMENTS OF THE PERTH BASIN 160,461

WESTERN EUROPE
TRACE ELEMENT DISTRIBUTION IN REEF AND SUBREEF ROCKS OF JURASSIC AGE IN BRITAIN AND SWITZERLAND 159,602
*ENGLAND *JURASSIC
*REEF *SWITZERLAND
*TRACE ANALYSIS .CHEMICAL CORRELATION
.DIAGENESIS .REGRESSION ANALYSIS
.SPECTRAL ANALYSIS .TRACE ELEMENT RATIO
WIDENING GEOLOGICAL PERSPECTIVES ON THE NORTHWEST EUROPE SHELF 161,164
*CONTINENTAL SHELF *EXPLORATORY DRILLING
*NORTH SEA AREA *OIL AND GAS ENTRAPMENT
.BASIN .PERMEABILITY (ROCK)
.POROSITY (ROCK) .ROTLIEGENDE SERIES
.ZECHSTEIN SERIES
PALEOMAGNETISM*A PATTERN OF RUPTURE OF THE EASTERN

Figure 2. Typical page from *Alphabetic Subject Index*

BIBLIOGRAPHIC INFORMATION

159,648 *AN ASSESSMENT OF EXISTING SUBMARINE SOIL STRENGTH TESTING TECHNIQUES*
INT UNESCO ET AL ENG PROPERTIES OF SEA FLOOR SOILS GEOPHYS IDENTIFICATION SYMP PROC PP 49-74, 1971
(SOIL (EARTH))

159,649 *EFFECT ON THE CORROSION BEHAVIOR OF MATERIALS OF SIMULTANEOUS FRICTIONAL WEAR*
WERKSTOFFE KORROSION V 23, NO 2, PP 87-94, FEB 1972 (IN GERMAN)
(STRESS CORROSION)

159,650 *STRUCTURAL SAFETY--A LITERATURE REVIEW*
J STRUCT DIV AMER SOC CIVIL ENG PROC V 98, NO ST4, PP 845-884, APRIL 1972
(STRUCTURAL ENGINEERING)

159,651 *EQUILIBRIUM BORE HOLE TEMPERATURES FROM OBSERVATION OF THERMAL TRANSIENTS DURING DRILLING*
EARTH PLANETARY SCI LETT V 14, NO 1, PP 47-49, FEB 1972
(WELL TEMPERATURE)

159,652 *WEIGHT CONTROL SYSTEM*
U S 3,648,783, C 3/14/72, F 4/17/70; AUTOMATIC DRLG MACH INC
(WEIGHT CONTROL)

159,653 *SOME ASPECTS OF THE APPLICATION OF NUMERICAL METHODS IN WELL LOGGING PRACTICE*
ACTA GEOPHYS POL V 19, NO 4, PP 423-433, 1971 (IN POLISH)
(DIGITAL RECORDING)

159,654 *QUADRUPOLE LOGGING IN THE HOMOGENEOUS ANISOTROPIC ROCK MEDIUM*
ACTA GEOPHYS POL V 19, NO 4, PP 405-422, 1971 (IN POLISH)
(ELECTRIC LOGGING)

159,655 *CALCULATION OF THEORETICAL CURVES OBTAINED BY USING DOUBLE COIL INDUCTION LOGGING PROBES IN NONUNIFORM STRATA*
IZV VYSSH UCHEB ZAVEDENII GEOL RAZVEDKA NO 11, PP 105-110, NOV 1971 (IN RUSSIAN)
(INDUCTION LOGGING)

159,656 *RADIOACTIVITY LOGGING APPARATUS HAVING SHIELDED WALL CONTACTING SOURCE AND DETECTOR*
U S 3,648,515, C 3/14/72, F 10/29/69; DRESSER INDUSTRIES INC
(NUCLEAR LOGGING)

159,657 *APPLICATION OF PULSED NEUTRON CAPTURE LOGS TO THE DETERMINATION OF RESIDUAL OIL*
SPE OF AIME MID-CONTINENT SECT IMPROVED OIL RECOVERY SYMP PREPRINT NO SPE-3796, PP 247-262, 1972
(OIL SATURATION)

159,658 *DETERMINATION OF RESIDUAL OIL USING THE NUCLEAR MAGNETISM LOG*
SPE OF AIME MID-CONTINENT SECT IMPROVED OIL RECOVERY SYMP PREPRINT NO SPE-3797, PP 263-280, 1972
(OIL SATURATION)

159,659 *SOLUTION OF THE PROBLEM OF THE DISTRIBUTION OF SELF POTENTIAL IN AN INHOMOGENEOUS MEDIUM WHILE ACCOUNTING FOR THE INVADED ZONE*
IZV VYSSH UCHEB ZAVEDENII GEOL RAZVEDKA NO 11, PP 118-123, NOV 1971 (IN RUSSIAN)
(SELF POTENTIAL LOGGING)

159,660 *SHRINKAGE COMPENSATING CEMENT*
U S 3,649,317, C 3/14/72, F 11/12/70; FULLER CO
(CEMENT ADDITIVE)

159,661 *WELL BORE CIRCULATING TOOL INCLUDING POSITIONING METHOD BY CASING ANNULUS FLUID STRETCHING TUBING STRING*
U S 3,648,777, C 3/14/72, F 4/4/69
(CIRCULATING EQUIPMENT)

159,662 *FRICTION FACTORS IN SOLID MATERIAL LADEN SYSTEMS*
J HYDRAUL DIV AMER SOC CIVIL ENG PROC V 98, NO HY4, PP 681-699, APRIL 1972
(COEFFICIENT OF FRICTION)

159,663 *FRACTURING AND SCAVENGING FORMATIONS WITH FLUIDS CONTAINING LIQUEFIABLE GASES AND ACIDIZING AGENTS*
U S 3,640,344, C 2/8/72, F 12/2/68
(FRACTURE EXTENSION)

159,664 *ELECTRO-HYDRAULICALLY CONTROLLED PERFORATOR*
U S 3,648,785, C 3/14/72, F 5/13/70; DRESSER INDUSTRIES INC
(PERFORATED COMPLETION)

159,665 *EXTRA HIGH EARLY-STRENGTH PORTLAND CEMENT*
U S 3,649,316, C 3/14/72, F 7/15/69, PR JAPAN 7/20/68; ONODA CEMENT CO LTD
(PORTLAND CEMENT)

159,666 *JAR STROKE ACCELERATOR FOR PUMPDOWN WELL TOOL*
U S 3,642,069, C 2/15/72, F 9/28/70; OTIS ENGINEERING CORP
(PUMPDOWN TOOL)

159,667 *STATIC UNIAXIAL DEFORMATION OF 15 ROCKS TO 30 KB*
INT J ROCK MECH MINING SCI V 9, NO 2, PP 271-288, MARCH 1972
(ROCK DEFORMATION)

159,668 *THE CONTROLLED FAILURE OF ROCK DISCS AND RINGS LOADED IN DIAMETRAL COMPRESSION*
INT J ROCK MECH MINING SCI V 9, NO 2, PP 241-248, MARCH 1972
(ROCK FAILURE)

159,669 *USE OF POLYMERS TO CONTROL WATER PRODUCTION IN OIL WELLS*
SPE OF AIME MID-CONTINENT SECT IMPROVED OIL RECOVERY SYMP PREPRINT NO SPE-3783, PP 125-134, 1972
(WATER OIL RATIO)

159,670 *WELL CLEANER*
U S 3,648,769, C 3/14/72, F 9/4/70
(WELL CLEANOUT)

AUTHOR INDEX

PATENT INDEX

UNITED STATES

Figure 3. Excerpts from appendices in *Alphabetic Subject Index*

considered the primary, or most important, descriptor) are followed by a listing of secondary descriptors. This serves as an additional indication to the searcher of the document's contents. Secondary listings of this particular abstract (appearing elsewhere in the index under the secondary descriptors) do not carry this descriptor listing but instead, the title is preceded by the primary descriptor under which this listing may be found. Further information on items of interest can be obtained by referring to the abstract or to the original document itself.

Bibliographic information, names of authors and inventors, and patent numbers by country are also tabulated in separate sections of the *Alphabetic Subject Index*, as shown in Figure 3. The December issue of this index is a cumulative issue, containing all of the information appearing in the previous bimonthly issues. This annual issue serves as an index for the entire year, making it unnecessary to check through all of the individual bimonthly issues when performing a search.

The *Alphabetic Subject Index* is generated entirely by computer, the output of which is in page form, ready for offset printing. This past year, in place of the usual computer printout, the *Alphabetic Subject Index* pages have been photocomposed directly from CRT images, the availability of bold-face and italic characters greatly improving the readability of the printed index.

Another manual search tool is the *Dual Dictionary Coordinate Index*. This is an inverted index in which each descriptor is followed by a tabulation of the abstract numbers to which the descriptor is pertinent, as shown in Fig-

OIL SOLUBILITY	•146,890	•	•	•145,053	•	•	•146,826	•145,937	•145,928	•145,929
(8)	•	•	•	•146,953	•	•	•	•146,217	•	•
OIL STATES RUBBER CO	•	•	•	•	•144,134	•	•	•	•	•
OIL TREATING (FIELD)	•141,690	•140,061	•141,682	•141,683	•141,094	•138,785	•139,566	•139,047	•139,048	•138,569
(39)	•143,170	•140,731	•144,192	•145,613	•146,874	•140,445	•140,436	•140,047	•	•141,689
	•144,990	•141,441	•144,972	•146,193	•	•144,645	•141,096	•142,047	•	•145,629
	•145,630	•143,471	•	•146,953	•	•145,255	•142,386	•145,617	•	•146,189
	•145,910	•	•	•	•	•145,615	•145,616	•	•	•
	•	•	•	•	•	•146,195	•146,876	•	•	•
OIL WASTE	•139,650	•139,331	•138,892	•138,643	•138,644	•139,625	•138,646	•138,647	•138,888	•139,649
(163)	•139,660	•139,611	•139,342	•139,613	•139,624	•140,445	•139,336	•139,287	•139,648	•140,179
	•140,110	•139,651	•139,652	•139,623	•139,644	•140,785	•139,626	•140,137	•140,138	•140,199
	•141,480	•139,661	•140,192	•140,023	•141,164	•142,925	•140,526	•140,147	•140,528	•140,529
	•142,120	•140,501	•141,162	•140,523	•141,794	•144,365	•141,465	•141,787	•141,148	•141,479
	•142,790	•141,161	•141,172	•141,163	•141,804	•144,375	•142,446	•141,797	•141,418	•142,919
	•142,910	•141,171	•142,922	•141,793	•142,474	•145,295	•142,476	•142,137	•142,768	•142,929
	•142,920	•142,881	•143,102	•141,803	•142,914	•145,315	•143,266	•142,787	•142,908	•143,249
	•142,930	•142,921	•143,272	•142,483	•142,924	•145,585	•143,546	•142,917	•142,918	•144,039
	•143,560	•142,931	•144,352	•142,893	•144,764	•145,735	•144,366	•143,267	•144,368	•144,049
	•144,340	•143,561	•144,372	•142,913	•144,374	•145,995	•144,376	•144,367	•144,378	•144,369
	•144,370	•143,571	•144,382	•144,353	•145,314	•146,255	•146,256	•144,377	•144,388	•144,379
	•144,380	•144,271	•145,312	•144,363	•145,734	•146,265	•146,266	•144,387	•144,618	•144,729
	•145,070	•144,291	•	•144,373	•146,254	•146,555	•146,976	•144,267	•144,728	•145,069
	•146,270	•144,351	•	•144,723	•146,264	•	•	•146,967	•145,068	•145,309
	•	•144,371	•	•145,313	•146,554	•	•	•146,977	•145,308	•145,729
	•	•144,381	•	•145,733	•146,974	•	•	•	•144,268	•145,739
	•	•146,551	•	•146,263	•	•	•	•	•146,978	•145,999
	•	•	•	•	•	•	•	•	•	•146,269
	•	•	•	•	•	•	•	•	•	•146,529
OIL WATER CONTACT	•	•	•139,662	•	•145,664	•142,945	•138,756	•143,517	•142,938	•139,099
(19)	•	•	•141,522	•	•	•143,195	•146,096	•	•143,438	•145,599
	•	•	•143,102	•	•	•146,215	•	•	•143,468	•146,089
	•	•	•143,202	•	•	•	•	•	•146,738	•146,739
OIL WATER SEPARATION	•140,110	•139,331	•139,342	•138,643	•138,644	•138,785	•139,566	•138,647	•138,798	•139,579
(103)	•141,690	•141,161	•140,192	•139,623	•139,624	•140,445	•140,436	•139,057	•139,048	•140,079
	•141,720	•141,171	•141,162	•140,023	•141,164	•140,755	•140,526	•139,207	•140,068	•140,529
	•142,790	•141,721	•141,682	•141,163	•141,794	•145,255	•142,086	•141,677	•140,138	•142,919
	•143,170	•143,471	•141,702	•141,683	•141,794	•145,315	•142,386	•142,047	•141,418	•142,929
	•143,560	•143,561	•142,122	•141,793	•145,734	•145,615	•143,266	•142,137	•142,918	•143,249
	•143,570	•143,571	•142,412	•142,853	•146,254	•145,735	•143,546	•143,267	•144,368	•144,379
	•144,240	•144,191	•144,192	•142,893	•146,264	•146,195	•145,616	•143,517	•144,728	•145,309
	•144,370	•144,381	•144,352	•145,033	•146,874	•146,555	•145,636	•145,617	•145,668	•145,629
	•144,390	•	•144,642	•145,313	•	•	•146,256	•146,967	•	•145,729
	•144,990	•	•	•145,733	•	•	•	•	•	•146,189
	•145,070	•	•	•	•	•	•	•	•	•
	•145,630	•	•	•	•	•	•	•	•	•
	•145,910	•	•	•	•	•	•	•	•	•
	•146,200	•	•	•	•	•	•	•	•	•
OIL WATER SEPARATOR	•139,100	•140,731	•140,192	•139,623	•138,644	•140,445	•139,566	•140,487	•140,138	•145,309
(49)	•140,110	•141,161	•144,352	•141,793	•141,164	•145,255	•142,386	•141,677	•141,418	•145,629
	•141,690	•143,471	•144,972	•142,853	•142,774	•145,625	•	•142,137	•142,818	•146,189
	•143,170	•144,651	•	•145,033	•145,734	•146,195	•	•143,517	•142,918	•
	•143,560	•145,741	•	•145,613	•146,264	•	•	•145,617	•145,668	•
	•144,990	•	•	•145,733	•146,874	•	•	•	•	•
	•145,070	•	•	•	•	•	•	•	•	•
	•145,630	•	•	•	•	•	•	•	•	•
	•145,910	•	•	•	•	•	•	•	•	•
	•146,200	•	•	•	•	•	•	•	•	•
OIL WELL	•140,170	•141,351	•139,572	•138,773	•141,684	•140,435	•143,876	•142,367	•140,288	•138,799
(39)	•141,660	•141,971	•146,322	•139,053	•142,044	•143,185	•144,216	•	•140,728	•139,049
	•145,930	•146,471	•145,442	•140,043	•143,914	•145,625	•144,316	•	•145,458	•143,009
	•146,190	•	•	•142,073	•144,214	•145,635	•145,246	•	•	•143,149
	•146,880	•	•	•143,303	•145,634	•	•	•	•	•
	•	•	•	•	•145,914	•	•	•	•	•
	•	•	•	•	•146,214	•	•	•	•	•
OIL WETTABILITY	•	•	•146,912	•140,043	•140,044	•146,855	•	•	•	•144,039
OISHI FM	•138,920	•	•	•	•	•	•	•	•	•
OKHOTSK BASIN	•	•	•	•	•	•	•	•	•145,098	•
OKHOTSK SEA	•141,950	•144,501	•	•	•	•	•	•145,097	•145,098	•
OKINAWA ISLAND	•145,130	•	•	•143,363	•143,364	•141,535	•143,326	•143,327	•143,328	•143,439
(11)	•	•	•	•143,413	•	•143,325	•	•	•143,478	•

Figure 4. Typical page from *Dual Dictionary Coordinate Index*

```
ENTER FIRST DESCRIPTOR
:    COMPUTER
FND- 385
ENTER CONN• + DESCRIP•
:OR  DATA PROCESSING
FND= 786 GRP= 958  1
ENTER CONN• + DESCRIP•
:•
ENTER FIRST DESCRIPTOR
:    GEOLOGY
FND-3230
ENTER CONN• + DESCRIP•
:NOT STRATIGRAPHY
FND=1923 GRP=1319  2
ENTER CONN• + DESCRIP•
:END
  99 DOCUMENTS FOUND
COMMAND:PR
ENTER NO• TO PRINT:0020
122245  122343  122452  124370  124439
124662  124720  125219  125359  125580
125601  125696  125880  125982  125986
126010  126389  126417  126488  126521

COMMAND:PT
ENTER NO• TO PRINT:0005
ENTER MODE:2
  122452
OSTRACODES AS QUATERNARY PALEOECOLOGICAL INDICATORS
CAN J EARTH SCI V 6 NO 6 PP 1471-1476 DEC 1969

  124370
PRELIMINARY EVALUATION OF A CORE SCINTILLATION
  COUNTER FOR BULK DENSITY MEASUREMENTS IN
  MARINE SEDIMENT CORES
J SEDIMENT PETROLOGY V 39 NO 4 PP 1509-1519 DEC
  1969

  124439
CARBOHYDRATES IN BOTTOM SEDIMENTS OF THE KURIL-
  KAMCHATKA TRENCH
OCEANOLOGY ACAD SCI USSR ENGL ED V 9 NO 2 PP
  203-207 1969
```

Figure 5. Typical computer search printout

ure 4. This includes listings under appropriate broader terms, autoposted by the computer. The *Dual Dictionary* is issued twice a year, in microfilm form, the December issue being cumulative for the year. This index can be searched by standard coordination techniques, using two or more appropriate descriptors and cross-checking to find abstract numbers common to each of the descriptors. In this manner, greater specificity of searching can be achieved.

COMPUTER SEARCHING

In addition to the manual searching indexes, a *Master Record* magnetic tape is prepared periodically for computer searching. This tape contains titles, authors, bibliographic data, and pertinent descriptors for each abstract, including company affiliations, category (general subject classification), aspect (article, patent, reports, etc.), and language. This tape is issued in several different formats to match the operating requirements of the users' specific computers.

Under current development is the PASS (Petroleum Abstracts Search System) which is an interactive search routine that greatly facilitates computer searching. As the search progresses, the questioner is kept informed of the number of pertinent references in the file, singly and in combination, and can modify his search question immediately if he is not obtaining the information he desires.

In conducting a search, the user first translates his search question into suitable descriptors, chosen from the *Exploration and Production Thesaurus,* and the Supplemental List. These are combined in logical relationship, to form a search question. Three types of association are possible:

AND—multiple descriptors, all of which must be present to satisy search requirements

OR —alternate descriptors or groups of descriptors, any one of which is acceptable

NOT—the presence of such descriptors eliminates the abstract from consideration

Once the question has been framed, it is entered into the computer via a keyboard console, one descriptor at a time. The first term is searched and the numerical result is reported. The second term is then entered and reported. The total number of abstracts pertinent to the combination is also reported. The figure increases or decreases with each new descriptor, depending upon the relationship of the descriptors, as indicated above. The searcher can obtain printouts of individual groups of abstract numbers at any time without interrupting the search. When all descriptors are entered, the search is terminated and the final tabulation of responsive references printed out. Normally, this consists of a list of abstract numbers, but other information available on the *Master Record* tape (titles, bibliographic information) may also be called for.

A typical search, to retrieve all articles published in 1970 concerning the use of computers in geology (excluding stratigraphy), is shown in Figure 5. The question is first converted into descriptors, as follows:

(COMPUTER or DATA PROCESSING) plus (GEOLOGY not STRATIGRAPHY)

At each step of the search, the number of citations in the file is given, singly and in combination. At the end, 99 references are cited as fulfilling the search conditions. In the example shown, 20 of these are printed out as abstract number citations, and 3 as complete title and bibliographic citations.

This search system has been developed using a Xerox Sigma-6 computer, with FORTRAN IV language.[4] Another convenience has been the portable remote terminal, which can be tied into the main computer by simple telephone connection. At the present time, this system is still restricted in operation, owing to limitations in computer storage capacity (48K). As a result, each year's data file must be searched separately. The entire data file (1965 to present) will require approximately one complete disk-pack for storage, and as soon as it becomes available, the PASS facility will be made available to participating companies.

CONCLUSIONS

The *Petroleum Abstracts* system has provided prompt, thorough coverage of technological developments in the fields of petroleum exploration, development and production, to members of the petroleum industry.[5] Replacing multiple individual, overlapping company systems has made possible more comprehensive coverage of the technical literature, at a greatly reduced cost to each of the participants. The petroleum industry has greatly benefitted by its access to required technical information, made available by this cooperative information storage and retrieval system.

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Public/Private Cooperation in Planning and Developing Reference Data Programs*

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The National Standard Reference Data System relies heavily on the advice of experts in special subject-areas of science and technology to plan and develop programs for compilation and evaluation of quantitative data. Advisory panels provide a means of bringing together generators and evaluators of data to define needs, recommend specific projects, determine priorities, and coordinate new activities with those already in process. Such advisory panels are the natural basis for the development of cooperative programs, not only for data compilation and evaluation, but also for improvement in the quality of original experimental work, standardization of techniques, and agreement on formats for the presentation of, e.g., spectroscopic data. While such panels are sponsored by the Federal Government, the panel membership includes people from universities, private industry, professional societies, and consultant organizations. The cooperative nature of the undertakings fosters attention to user needs and public benefits.

In a symposium concerned with cooperative efforts, it is highly appropriate to give some consideration to those kinds of cooperation which cross the interface between the public and the private sectors. In so many of the relationships between Government agencies and private individuals or groups, there exists a one-way-only action. For example, Government may take things (via taxes, the draft, etc), or provide them (roads, flood relief); it may buy (through contracts or cash purchase); or sell (books from the Government Printing Office). In more sophisticated relationships, Government agencies call upon individuals or groups to give advice which the agency may then unilaterally follow or modify. But this also is a one-way-at-a-time activity—the advice is requested, then it is given, and then follow-up action may be taken.

What I intend to describe is a truly two-way relationship in which public and private parties work together actively toward a commonly defined set of goals. This type of relationship can, and does, lead to situations in which everyone benefits.

BACKGROUND

To provide a background for this discussion of cooperative activities, it may be worthwhile to spend a few minutes describing the National Standard Reference Data System (NSRDS), its mission, its scope, and its organizational approaches. This description will be brief, since details have been presented at an earlier symposium sponsored by this Division[1-3] and written descriptions are readily available in many publications.[4,5] The primary mission of the NSRDS is the provision of reliable, critically evaluated, numerical data in the physical sciences, in a convenient and accessible form for the use of the scientific and technical community. The technical scope of the program is restricted to well-defined physical and chemical properties of substances and systems which are well characterized. The organizational approach utilized in seeking the goals of the NSRDS is a decentralized activity comprising many projects, with coordination furnished by a program office (the Office of Standard Reference Data, OSRD) in the National Bureau of Standards.

The scope of the NSRDS, encompassing all of the physical sciences, is too broad to permit any small group of people to be knowledgeable and expert in either operating all of the projects or in managing the program as a whole. Moreover, the program is both government-wide in that it includes many agencies of the Federal government, and national in the sense that it seeks to improve the capabilities of *all* segments of the country's science and technology to perform their defined tasks effectively. Not only is the technical scope too broad to permit expert operation by any small group, but also the diverse uses and needs for standard reference data are too varied and wide ranging for full appreciation by the central program office alone.

Accordingly, it is essential that the OSRD obtain a great deal of advice of many different kinds.

* Presented before the Division of Chemical Literature, 164th Meeting, ACS, New York, N. Y., Aug. 27, 1972.