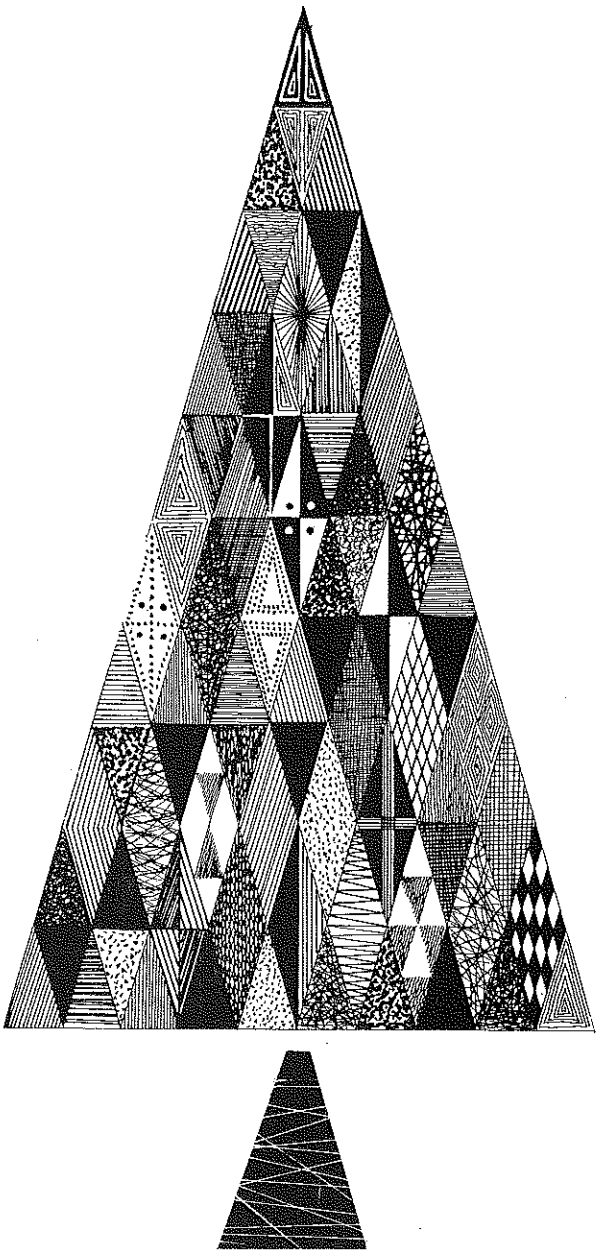
# THE MINES MAGAZINE

DECEMBER 1960



Season's Greetings

# CLASS NOTES

When advising us of a change of address, please confirm your position or title and company affiliation.

### 1882-1930

M. E. CHAPMAN, '27, and Annabelle are spending the winter in Tucson, Ariz. Before locating their apartment at 3815 E. Third St., they attended the American Mining Congress in Las Vegas.

HENRY L. CONGER, '30, is off the list of unknowns. His dues letter came in from 1426-H East 38th St., Tulsa, Okla. He was pictured in the 1930 Prospector as "typical Miner of the Class of '30."

GLEN E. FASSLER, '29, has managed to come back to the Golden area. This seems to be the perfect season to become an employee of the State Game and Fish Department, Denver 3, Colo.

CHARLES B. GAUTHIER, '16, has moved north from San Diego to 115 Gough St., San Francisco 2, Calif. Mr. Gauthier is one alumnus who came back from the dead. He was carried as deceased for three years before someone notified us in 1956, and we were able to contact him once again.

DON M. JOHNSON, '29, has moved to 1063 Viewpoint Dr., Dayton 59, Ohio. An Ohioan, he is one of the few Miners to live his whole life in his native state.

R. B. LOWE, '22, is now using his home address for alumni mailing, Navesink River Rd., Locust, N. J. He has been with Bakelite at least 30 years and is also one of the earliest (if not a charter member) of the New York City Section, the first local section chartered by the association.

PAUL McCUNE, '24, has been reported "found" by F. L. Michaels, '25. The last time this happened was in 1944. McCune's address is Hq. 7, Log. Ord., APO 612, San Francisco, Calif. Pitt Hyde, '22 saw him recently, too, on his return from Korea.

GEORGE W. MITCHELL, '23, is retired and living in Ajijic, Jalisco, Mexico, Apartado No. 72, after years of service in the mining industry which included tours in Canada, Nevada, and Mexico.

P. S. MOSES, '14, wishes his mail sent to Mutual Life Insurance Co. of New York, Realty Building, Savannah, Ga.

BEN H. PARKER, '24, senior vice president of Frontier Refining Co. was one of the principal speakers at the 30th annual international meeting of the Society of Exploration Geophysicists held recently in Galveston, Texas.

A. J. PETERSON, '23, has a new address: P. O. Box 2641, Detroit 31, Mich. He has recently retired after serving as a realty appraiser for the city of Detroit since 1926.

FRED L. TYLER, '23, has joined the rush to suburbia. His San Francisco address has been changed to 2221 Lake Rd., Apt. 9, Belmont, Calif. He spent a year in the Netherlands with Reed Roller Bit before going to San Francisco.

### 1931-1940

EMMETT B. ASMUS, '40, wrote an article "Design for Lower Cost Maintenance," for *PETRO/CHEM ENGINEER*, September 1960 issue. Central maintenance coordinator and engineer of Sinclair Refining Co. for six years at Harvey, Ill., he has also been in company service in Wyoming in many different capacities. He has been with Sinclair for 20 years.

TED BENSON, '33, who is service manager for Frigidaire and Household Appliance, General Motors Overseas Operations, was in Denver on two weeks' vacation. Mr. and Mrs. Benson make their home at 120 Haring St., Closter, N. J. While in Denver they visited with Mrs. Benson's father. Although Ted was on short time and unable to visit the office, he did telephone us. This was certainly appreciated.

EUGENE D. BISHOPP, x-'37, who has been serving as a consulting engineer in Ecuador is now president of Ladusticia, S. A. in Chihuahua City, Chihuahua, Mexico. His office is at Calle Aldama 510, Dep. 4

EUGENE L. CURRENT, '40, is going East instead of West. His recent promotion by Cities Service Petroleum, Inc. to chief geophysicist has caused his transfer from Midland, Texas, to No. 70 Pine St., New York 5, N. Y.

JEROME P. HAYES, '34, is off to India this time with Lummus. Since 1940 his travels have taken him to France and England. His address will be "Bakhtavar" —7th floor, Wodehouse Rd., Opposite Colaba, P. O., Bombay 5, India.

HENRY J. LONG, x-'40, was recently appointed manager of mining and milling for the Clute Corp's. mica operations at Cordova and Pojaque, N. M. Before gaining 20 years experience in mining and mineral processing, Long attended Mines for three years.

J. G. MARSHALL, '31, has moved to V. P. Nixon's home town. His new address is 727 E. Penn St., Whittier, Calif., not far from his former Fullerton, address.

HENRY SCHOELLHORN, III, '40, is another Miner in Whittier. He is with Standard Oil of California and lives at 1771 West Rd.

CHARLES D. SANDS, '37, is moving his office to Box 911, Ketchum, Idaho. He became a consulting geologist after first serving in World War II and then a number of years with Ohio Oil Co., Hobbs, N. M.

*(Continued on page 4)*





# NEWS OF THE MINERAL INDUSTRIES

### 1959 Mineral Production In Colorado Reported By Bureau of Mines

Value of all minerals produced in Colorado in 1959 was $313.4 million, a gain of 2 per cent over 1958 and only 7 per cent below the 1957 record of $338.5 million, according to a report just released by the U. S. Bureau of Mines.

Molybdenum and uranium topped the metals group in production in 1959, the report said, and cement, sand and gravel were the primary nonmetals. Metals accounted for 31 per cent of the value of all minerals produced—4 per cent more than in 1958—and as a group, they advanced in value from $81.8 million in 1958 to $97.2 million in 1959.

Advances in the Colorado minerals industry included expansion of the Cotter Corp. uranium mill at Canon City, start of work on a 300,000-cubic-yard shale processing plant at Rocky Flats (near Denver) by Great Western Aggregates, Inc., and the continued expansion of the American Gilsonite Co. operation near Fruita.

The report noted a continued decline during 1959 in Colorado oil production, but said the reason was lower output from the Rangely Field. Coal production last year was 11 per cent over 1958 largely because of increased power demands. Long range investigations of coal utilization are being carried on by the Bureau of Mines at its Denver coal research laboratory.

Output of gold in Colorado in 1959 was reported down 23 per cent or 18,000 troy ounces valued at $646,000 below 1958 production. Total value of Colorado's 1959 gold output was listed as $2,138,000.

The report disclosed that vanadium production jumped 23 per cent in 1959, and that several mills that do not now recover vanadium are planning to install recovery equipment.

### Stauffer Sinking Shaft On Trona Mining Project

Stauffer Chemical Co. began sinking the first shaft at its Green River, Wyoming trona mining project on Nov. 1. The access road to the property, which is about 21 miles from Green River, has been completed and major construction equipment has been moved in. The mine will have two shafts, one a haulage-way shaft and the other a man-shaft.

H. D. Hellmers, vice president production, West End Chemical Co., Division of Stauffer, is project manager. Winston Bros. Co. of Minneapolis, Minn. is the prime contractor for engineering and mine development.

Stauffer's Western Engineering Department, under the direction of A. C. Mohr, will design the soda ash refinery. J. W. Woomer and Associates will act as mining consultants. George Bowland is resident representative for Stauffer on the project.

The project involves sinking shafts, building a railroad bridge to span the Green River, a railroad spur, highway and a refinery.

The as-mined trona contains some shale and carbonaceous material. Stauffer has developed a process to refine the trona to yield top quality soda ash. Initial capacity of the soda ash refinery will be 150,000 to 200,000 tons annually. It is anticipated that the mine and refinery will be in full operation by late 1962.

### Barite Vein Reported Near Eureka, Mont.

Existence of a vein of barite near Eureka, Mont. was reported recently by the Montana State Bureau of Mines & Geology in a preliminary report on the summer's field work for the Northwestern Montana Mineral Resources Survey.

Uno M. Sahinen, state bureau's chief geologist, announced the details of the barite mineralization were being reported so anyone interested in the commercial development of the prospect could conduct further investigations.

The state geologist reported barite has extensive industrial uses in the paint, pigment and chemical industries and in sugar and petroleum refining processes. Large quantities also are used as an additive to the circulating fluid employed during oil and gas well drilling operations, he said.

Sahinen reported the barite vein is exposed on the west flank of Tobacco River Valley in the N. E. 15-minute Ural quadrangle in Lincoln County in S½ Sec. 6, T. 35 N., R. 26 W. The property can be reached by a gravel-dirt road into the area about 5 miles southeast of Eureka.

The exposure has been made by a recent bulldozer cut of about 150 by 30 feet, possibly during the construction of a logging road. Earlier prospecting in the area is indicated by two short adits a few hundred yards northwest of the cut. One adit may intersect the barite vein at shallow depth, but both are blocked by caving, it was reported.

Detailing the known geology the state geologist said the mineral zone was several feet wide and contained three bands of barite five, 12 and 16 inches wide. The barite is believed to occur in a lower Purcell volcanic flow within a near-vertical fault-zone trending No. 40° E.

## CLASS NOTES

*(Continued from page 2)*

RICHARD N. SPENCER, '34, who is the U. S. Bureau of Mines representative with the U. S. Embassy, Lima, Peru, has been hospitalized in the Bethesda Naval Hospital, Bethesda, Md. (He may be there for some time and I know that he would appreciate hearing from any of the Local Alumni in the Washington area.)

GEORGE D. TARBOX, '38, got his transfer with Union Carbide to Sault Ste Marie, Mich., just in time for winter. Having served in the Sheffield, Ala. unit as asst. supt., he was promoted to superintendent of the Michigan group.

ARTHUR N. WINSOR, '40, is a civil engineer, Federal Aviation Agency, P. O. Box 90007 Airport Station, Los Angeles 45, Calif. He has also followed his profession in Florida and Minnesota.

### 1941-1945

ALLEN J. CUMMINGS, '42, was recently appointed administrative engineer in the Colorado State Public Works Department. A war-time engineering graduate he has been with the public school system of Denver for a number of years.

GEORGE J. FEATHERSTONE, '43, is now district manager of American Cyanamid, Explosive and Mining Chemicals Department in Bluefield, W. Va., offices at 135 Bradmann Building. He has spent most of his years with the company in Pennsylvania.

GEORGE A. KIERSCH, '42, has joined the staff of Cornell University, Ithaca, N. Y. Dr. Kiersch is an internationally recognized geoscientist. His part in the Navajo Mineral Resources Survey won him high praise and his more recent lecture engagements in Alaska and Norway have further added to his recognition. He may be addressed at Department of Geology, McGraw Hall at Cornell.

NORMAN V. LOVETT, '42, after five years with Husky Oil in Wyoming, is moving to Dallas, Texas. He will be director of personnel for Gifford Hill & Company and will reside at 6517 Prestonshire.

HENRY H. NOGAMI, '42, is also moving to Dallas. After serving in the 442nd combat team composed entirely of Japanese-Americans, he joined Atlantic Refining Co. in 1948. In his 12 years with this company he has served in constantly changing posts, the last one being in Guatemala. The Atlantic post office box number is 2819.

E. E. RULEY, '43, is now a petroleum research engineer for the state of West Virginia. The laboratory is located on the West Virginia University campus in Morgantown, W. Va. A West Virginian by birth, Ed is returning to his home state after serving as a geophysical interpreter for Phillips Petroleum Co. in Bartlesville, Okla. He also earned an M.Sc. at Mines in 1952.

### 1946-1950

GEORGE E. ANDERSON, JR., '48, is a native of Denver and has managed to spend a good deal of his time since graduation in this area although his latest transfer is to Casper, Wyo. where he will live at 250 S. Minnesota.

BILLIE L. BESSINGER, '50, is the new mine project engineer for International Minerals and Chemical Corp. at Carlsbad, N. M. A year ago he was secretary of the Arizona section but has lived in Houston and Birmingham, Ala. since then.

KEN E. BODINE, '48, went to Kuwait, and everybody in the office had to find it on the map. Now he wants his mail sent to his company's office in New York: American Independent Oil Co., 50 Rockefeller Plaza, New York 20, N. Y.

PHILIP E. COMSTOCK, '47, has been with A.S.&R. Co. since his graduation, the last three years being spent in Hayden, Ariz. Now his address is Box 1111, El Paso, Texas.

MALCOLM R. CURTIS, '48, is with Schlumberger Well Surveying Corp. He was recently transferred from the Casper, Wyo. office to Kimball, Nebr.

EDWARD M. FEELY, '50, 1407 S. Grand Ave., Glenwood Springs, Colo. is a drilling and production superintendent with Wadkins Producing Co. The company offices are in Englewood.

CLEMENT R. HOFMANN, '49, has moved his home a little closer to the old Mines stomping ground. His new address is 4700 S. Cherokee, Englewood, Colo.

HOWARD R. JOHNSON, '50, is to be the new quarry supervisor for Phoenix Cement at Camp Verde, Ariz., after being in Redlands, Calif. for three years. His background should make a trip to the nearby Indian ruins at Montezuma Castle of particular interest.

ARTHUR W. LANKENAU, '48, is still on the Western Slope. He has recently moved from Uravan to Grand Junction, Colo., where he heads Union Carbide Nuclear's experimental and development laboratory. After graduating in Met. E. in '48, Lankenau did graduate work at Stanford and Columbia Universities. The Lankenaus have three children.

JOHN H. McKEEVER, JR., '47, is returning to Billings, Mont., after a nine year absence. He will be the senior geologist with Pan American Oil. His last post was a year spent in Bismarck, N. Dak.

HOMER N. OPLAND, '49, is with the Aerojet General Corp., Atlantic Division, and has a new home at 408 Delaware Rd. Besides having won recognition for his seismic analysis of the 1951 atomic tests, later work in Nevada, and acoustical measurement in oceanographic study, he was also co-editor of the 1959 "Mukluk Telegraph" which featured news of the Oplands: children, wife, bird, car, and cat.

PHILIP WEST PETER, '48, has left the consulting engineering business and joined Susquehanna-Western, Inc. as district representative and mine superintendent in Edgemont, S. Dak.

PAUL R. SHANKLIN, '48, has been transferred to the Duluth offices of Oliver Iron Mining Division after 12 years with the company. He joined Oliver when he graduated and has spent most of this time in Virginia, Minn. His new address is 769 Washington Rd., Duluth 3, Minn.

JAMES H. WILLIAMS, JR., '48, is on his way to far places. Working as an exploitation engineer for Shell Oil Co., his general address is c/o Exploration & Production Department, 50 West 50th St., N. Y., N. Y.

### 1951

ALAN K. CRAIG has returned to the states from Lima, Peru. He is acting as consulting geologist and is currently located at 257 Pearl Street, Denver, Colo.



JOHN D. NOLL is living in Sunnyvale, Calif., while his office is in Palo Alto. He is a product engineer with Varian Associates.

### 1952

JAMES S. AULT is a member of the General Engineering Staff of the North Burbank unit, in Shidler, Okla.

BART J. BURNS is one of a growing list of Miners in Massachusetts. He lives at 101 Etna St., Brighton, Mass.

JOHN C. DINGMAN has recently transferred to Austin from Houston, Texas. He is senior technical service representative for Jefferson Chemical Co., Inc., and lives at 2700 Greenlawn Pky.

JOHN M. HINGST a member of the 517th Engineers Detachment is currently attending the USA Language School, Presidio, Monterey, Calif.

GEORGE W. MAO has left Foote Mineral Co. to join the central research staff of Minnesota Mining and Manufacturing Co. as a research chemist. Mao received his M.Sc. at Mines in 1952 and his doctorate at MIT in 1956. His address is 3012 Lake St., North St. Paul 9, Minn.

ROBERT F. MEHL is on temporary assignment with U. S. Steel Corp., Beethovenstrasse 32, Zurich 2, Switzerland. His regular job is director of metals research laboratory at Carnegie Tech. in Pittsburgh, Pa.

ROBERT M. POZZO has moved to No. 11 Holden St., Attleboro, Mass. He received his MBA from Harvard Graduate School in June. See MINES Magazine, Sept. 1960, p. 38.

ADAM THOMAS 1114 S. Coast Building, Houston, Texas. This is the address of Exploration Engineering Co. of which Robert D. Turley, '52, is president. Thomas joined the organization recently; he was formerly staff geologist for Doeringfeld, Amuedo & Ivey.

THOMAS A. WARFIELD has moved from Placerville, Calif., to 708 Camellia Dr., Paradise, Calif. He is an engineer with Frazier-Davis Construction Co.

### 1953

GERRETT H. BRYANT, has been living in Riverton, Wyo. He's another Miner who has recently moved to Englewood, Colo. His home address is 560 E. Amherst Pl.

JOHN B. CHASE, JR. is a geologist with Sinclair Oil & Gas Co., 1554 W. Coffman, Casper, Wyo. He recently transferred to Wyoming from Albuquerque, N. M.

GEORGE W. MITCHELL, JR. has changed his address to 967 Roble Ave., Menlo Park, Calif. He's a graduate student at Stanford. G. W. Mitchell, Sr. is listed in the class of '23.

JOSEPH J. REBECK recently moved to Grand Junction to go into business for himself. His home address is 715 Ash Dr., Grand Junction, Colo.

### 1954

JOHN C. CAPSHAW is a petroleum engineer with John W. Mecom Co. in Houston. His home address is 2508½ Mandell, Houston 6, Texas.

DUNN KRAHL is with Underwood Typewriting Co. and is located at 1735 Jay St., Lakewood, Colo. His former address was in Wheaton, Ill.

MELVIN S. LEGGE, x-'54, is a Denver resident and member of the consulting engineering firm, E. A. Polumbus, Jr. and Associates. His article entitled, "How to Forecast Accurate Drilling Costs," appeared in *WORLD OIL*, October 1960.

### 1955

HORACIO B. AYCARDO, moved about as far as a man could from his last address. Last year he was in Manila, P. I., now he is at No. 11 Scratton Road, Stanford-Le-Hope, Essex, England.

ROBERT G. MARTIN, is a member of the General Engineering Staff of the North Burbank unit, in Shilder, Okla. Jim Ault works for the same group.

### 1956

JOHN E. O. DAVIS was with the Lucky Mc Uranium Corp. at Riverton, Wyo. Recently he moved to 2202 Cochiti, Farmington, N. M.

C. A. DENNISON, JR. is staying at 1701 Arapahoe, Golden, temporarily. He was formerly with the California Co. at Rangely.

LEWIS J. EFFENBERGER is continuing his graduate work at the University of Washington. His address is 4220 - 12th N.E., Apt. 11, Seattle 5, Wash.

MARTIN J. GRABER, JR. lives at 549 N. Water Ave., Apt. 9, Idaho Falls, Ida.

GEORGE E. REEVES received his discharge from the U. S. Army Corps of Engineers where he served as a fixed and rotary wing pilot and joined Heinrichs Geoexploration Co. as a mining engineer. He is living at 2225 N. Santa Rita Ave., Tucson, Ariz.

JOHN R. RITER, JR. moved to 3972 Union Bay Circle, Seattle 5, Wash.

JOHN A. SPRINGER works for Boeing Airplane Co. and lives in Bellevue, Wash. at 13400 N.E. 16th St.

JOSEPH L. TEETERS has become an instructor of mathematics at Stout State College, Menomonee, Wisc. He was formerly located in Greeley, Colo.

FRED VAN MATRE, JR. has moved from Ft. Collins, Colo., to 3230 S. Birch St., Denver, Colo.

GEORGE P. WALKER, III employed by Tennessee Gas Transmission Co. as district petroleum engineer has been transferred from Great Bend, Kan., to P. O. Box 1127, Oil Center Station, Lafayette, La.

DON L. WARNER and wife Betty have moved from Bradford Hall to 752 Juniper St. in Golden. Betty is working on her degree at D. U. while Don completes his master's study. They lived in Guatemala before returning to the campus.

### 1957

STANLEY S. GIMA is now living at 870 Monterey St., San Luis Obispo, Calif.

JOHN E. HOFFMAN is in Grand Junction. His street address is 2545 Gunnison Ave.

ROBERT R. STODDARD, JR. has entered the law school at UCLA, and his address is 817 N. Englewood Ave., Apt. 8, Inglewood 3, Calif. He was formerly a geologist with Standard Oil Co. of California.

WALTER W. TYLER should now be addressed: c/o Paul Bonapart Agent, Standard Beryllium Corp., Albina, Surinam.

### 1958

JAMES L. EIRLS with Gardner-Denver since his graduation, has returned from Johannesburg, South Africa, and is in the Denver office; mailing address P. O. Box 1020.

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# THE MINES MAGAZINE

Volume L December, 1960 Number 12


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**DEPARTMENTS—**



**FRONT COVER—**

The tree on the front cover is intended to symbolize the Christmas Season with its perennial message of Glad Tidings, Happiness, and Good Wishes to one and all.

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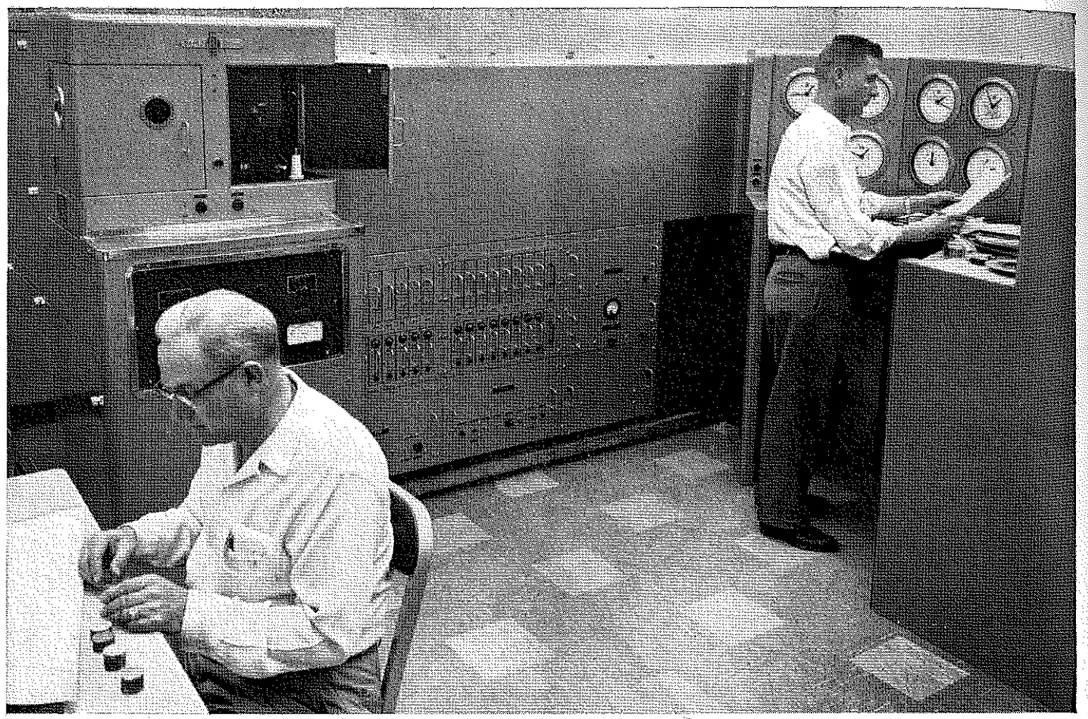

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# TECHNICAL SOCIETIES and ASSOCIATIONS

### Space and Nuclear Age Featured at Fall Meeting Of Metallurgical Society

The role of metals in the Army's future fighting equipment, as well as the space and nuclear age in general, was featured at the Fall Meeting of the Metallurgical Society of AIME in Philadelphia, Oct. 17-20.

The Army's research and development program occupied one of the all-day sessions held Oct. 17. A session comparing titanium with steel and aluminum in space pressure vehicles was held Oct. 18. Metals used in liquid oxygen and liquid hydrogen tanks for missiles and space vehicles, as well as nuclear fuel cladding materials and metallic moderators used in nuclear reactors, was discussed Oct. 19. Three sessions on refractory metals, particularly tungsten and columbium were held Oct. 19-20.

Other sessions covered ingot structure control, plastic deformation, powder metallurgy, recent advances in stainless steel, high-pressure effects, phase transformations, hot extrusion, and thermodynamics.



### Mines Faculty Contributes Papers to GSA Meetings Oct. 31-Nov. 2 in Denver

Annual meetings of the Geological Society of America and associated groups (Mineralogical Society of America, Paleontological Society, Society of Vertebrate Paleontology, Society of Economic Geologists, National Association of Geology Teachers, Geochemical Society) were held Oct. 31-Nov. 2 in Denver, Colo.

Technical papers were presented by the following Colorado School of Mines faculty members:

Dr. Leslie W. LeRoy, Geol.E., '33, professor and head of Geology Department, "Selenography of Some Prominent Lunacrates;"

Dr. Robert M. Hutchinson, associate professor, Geology Department, "Time-Space Relations Along Southwest Flank of Pikes Peak Batholith and Its Metamorphic Wall Rocks, Park and Teller Counties, Colo.;"

Dr. Leonid Bryner, assistant professor, Geology Department, "Breccia and Pebble Columns Associated with Hydrothermal Ore Deposits;"

Dr. Michael A. Klugman, assistant professor, Geology Department, "Laramie Anorthosite;"

Duane N. Bloom, graduate student, Geology Department, Dr. M. A. Klugman, assistant professor, Geology Department, and Dr. Ramon E. Bisque, assistant professor, Chemistry Department, "Calcium/Magnesium Ratio Wall-Rock Studies, Hilltop Mine, Park County, Colo.;"

Dr. Ramon E. Bisque, assistant professor, Chemistry Department, "Teaching Geochemistry;"

Dr. John S. Rinehart, professor of Mining Engineering and director, Mining Research Laboratory, "Wave Propagation in Rocks;"

Dr. Parke O. Yingst, project engineer CSM Research Foundation, Inc., "Coking Properties of Rocky Mountain Coals."

Drs. John D. Haun and Robert J. Weimer, associate professors, Geology Department, were in charge of preparation of a guidebook entitled, "Guide to the Geology of Colorado."

### Lake Superior Iron Ores Theme of Symposium

"Factors Affecting the Future of Lake Superior Iron Ores" will be the theme of the 22nd Annual Mining Symposium to be held Jan. 10-11 in Duluth, Minn. The symposium is being sponsored by the University of Minnesota's School of Mines and Metallurgy and Center for Continuation Study in cooperation with the annual meeting of Minnesota Chapter of AIM&ME.

### AIME Annual Meeting Feb. 26-Mar.2 in St. Louis Comprehensive Mining Program

In one of the most comprehensive programs it has scheduled in years, the Society of Mining Engineers, a constituent organization of the American Institute of Mining, Metallurgical, and Petroleum Engineers has listed technical sessions on 27 themes, to be sponsored by its four Divisions, at the AIME Annual Meeting in St. Louis, Feb. 26-March 2.

As presently drawn, the Coal Division plans the following:

Symposium on Froth Flotation; Coal Preparation Plant Design; Safety and Ventilation; Materials Handling; New Developments in Midwestern Coal Mining; Symposium on Underground Mining; Utilization, Carbonization, and Gasification.

The Industrial Minerals Division has scheduled sessions with the following themes:

Raw Materials for Chemical Industries in the Midwest; Transportation of the Bulky Minerals (jointly with the AIME Council of Economics); Industrial Waters; Conflicting Interests in Exploitation of Industrial Minerals; Foreign Trade Aspects of Fillers, Fibers, and Pigments; Mineral Aggregates.

The present program plans of the Minerals Beneficiation Division includes sessions on:

Crushing and Grinding; Concentration; Chemical Processes; Basic Symposium on Kinetics; Materials Handling and Mill Design; Solid Fluid Separation; Operation Control; Pyrolysis and Agglomeration.

For the Mining and Exploration Division the following themes are in prospect:

Geochemical; Geology (jointly with the Society of Economic Geologists); Geophysics for the Geologist and Engineers; Open Pit Mining; Research Symposium; Underground Mining.

The Mining and Exploration Division program also will include presentation of the Jackling Award to Vincent D. Perry, vice president and chief geologist of The Anaconda Co., and delivery by Mr. Perry of the Jackling Lecture.

Thomas E. Millsop, president and chief executive officer of National Steel Corp., will be presented with AIME's Benjamin F. Fairless Award for 1961 in recognition of Mr. Millsop's "accomplishments in behalf of the steel industry, for his support of continuing technical progress in the industry, and for his civic endeavors."

The following newly elected presidents of AIME and its constituent organizations for 1961 will be installed in office on Feb. 28:

Ronald R. McNaughton, manager of the Metallurgical Division of The Consolidated Mining & Smelting Co. of Canada, Ltd., as president of the 36,000-member American Institute of Mining, Metallurgical and Petroleum Engineers;

John S. Smart, Jr., general sales manager of American Smelting & Refining Co., as president of the Metallurgical Society of AIME;

James C. Gray, administrative vice president of Raw Materials, U. S. Steel Corp., as president of the Society of Mining Engineers of AIME;

Earl M. Kipp, special consultant for Standard Oil Co. of California, as president of the Society of Petroleum Engineers of AIME.





# Orco Process Used On K & S Project*

By J. P. POWELL

The Wellsville Oil Co. as flood operator of a joint venture in which Oil Recovery Corp. has 80 per cent of the working interest, began water injection on three leases in sees. 5 and 6, T. 27 N., R. 13 E., Washington County, Okla., in February 1958. The ORCO process, which combines standard waterflooding techniques with injection of carbon dioxide during the fillup and early oil-producing stage of the flooding process, is being used on the K & S project. *Figure 1* shows a map and the waterflood production history of the project. Since February 1958 nearly 50,000 barrels of oil was recovered from the project, when 190 acres, containing 29 water-input wells and 16 oil wells, was developed.

The formation flooded is the Bartlesville, which occurs at an average depth of 1,300 feet and has an average thickness of 33 feet. Analyses of cores, cut before development of the flood, indicated that the formation had the following average reservoir conditions: Porosity, 18 per cent; permeability to air, 50 millidarcys; oil saturation, 32 per cent; and water saturation, 41 per cent. *Figure 2* shows the results of the analysis of a representative core. A sample of the oil taken before water injection began had an API gravity of 33° and a viscosity of 6.3 cp. at 100° F.

## History Before Flooding

The leases were originally drilled in 1905, and production was produced by primary methods until the 1930's, when the wells were abandoned. A few wells were drilled in 1918 in an attempt to develop production from the shallower sands; however, the rate of oil production was not economical, and the wells were abandoned. In 1951 several wells were drilled and cored to evaluate the waterflood potential of the property. In 1954 the K & S Drilling Co. began developing a small pilot flood, known as the Bonnie Wilson project. Wells drilled for this project have been recompleted and used in the new flood.

## Completing and Operating Wells

Input wells were drilled to the top of the formation, and the sand was cored but not shot. Each input well was completed with a rag packer on 2½-inch tubing set at the top of the pay sand and cemented with 20 sacks of cement. The compressed carbon dioxide is injected through a string of ¾-inch pipe hung inside the 2½-inch tubing to a point 3 feet off the bottom of the sand.

In the ORCO flooding process the metered water is pumped down the annulus between the 2½-inch pipe and the ¾-inch pipe, while the $CO_2$ is injected through the ¾-inch pipe under pressure. Water and carbon dioxide mix at the sand face in the well bore. The volumes of $CO_2$ and water are controlled for each well in a common meter house and injected proportionately to obtain a predetermined saturation of $CO_2$ in the water at the sand face. Although average injection rates of 7 barrels of water per foot of sand at wellhead pressures of 0 to 700 p.s.i. are usual in this area; the operator is presently injecting 14 barrels of water per foot of sand at an average wellhead pressure of 220 p.s.i. Water input rates have been increasing steadily without increases of plant or wellhead pressures.

Delayed drilling of the producing wells permitted better fillup of the reservoir. The oil wells were completed with 7-inch casing set at the top of the sand and cemented with 25 sacks. They were cored to the bottom of the sand and shot with 2 quarts of nitroglycerin per foot of oil-saturated sand. They were equipped with 2½-inch tubing and rods for pumping with individual gas engines. Early in the development stage of the old wells served as test wells. These old wells were pumped by individual units and water, oil, and gas analyses were completed regularly.

Oil-metering equipment for each lease is installed at the tank battery. A dual arrangement of metering free-water knockout tanks permits each well to be tested at least once a week. Water and oil from the well are separated within tanks, and charts record when oil or water

* This article which describes one of four waterflooding projects in Washington and Nowata Counties, Okla., was taken from U. S. Bureau of Mines Information Circular No. 7896. It is being published because of its description of the ORCO Process, which combines waterflooding techniques with injection of carbon dioxide.


THE AUTHOR

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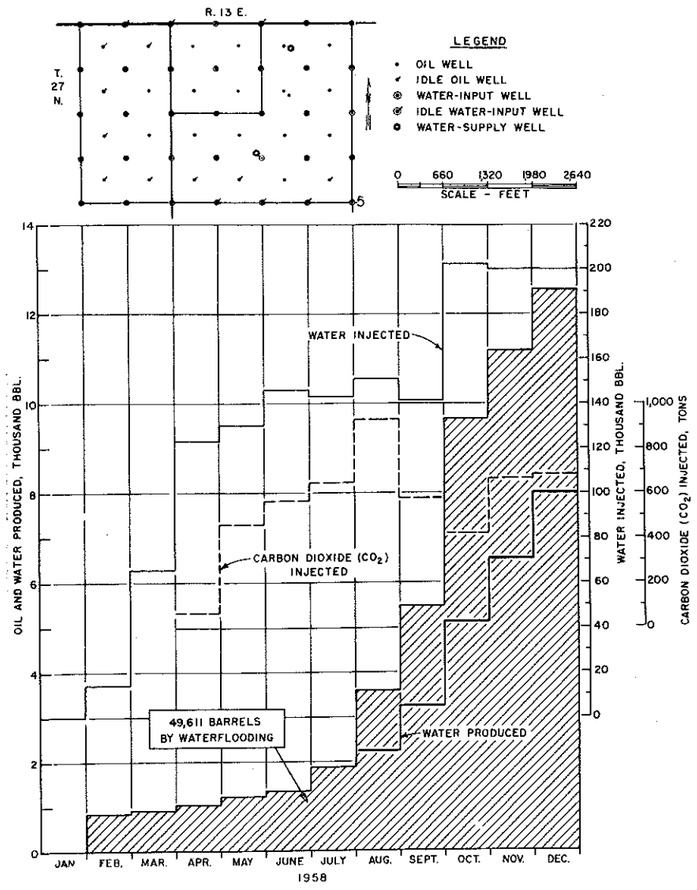



▼ Figure 1. Map and history of production by waterflooding and carbon dioxide injection of Wellsville Oil Co. & Oil Recovery Corp. ORCO Process K & S Project, Washington County, Okla., Jan. 1, 1959.

TABLE 1
MINERAL ANALYSES OF INJECTION WATERS, WELLSVILLE OIL CO. & OIL RECOVERY CORP. ORCO PROCESS K & S PROJECT, WASHINGTON COUNTY, OKLA.

| | Supply-well water | | Produced brine | | Treated water | |
|---|---|---|---|---|---|---|
| Ion or radical | P.p.m. | Reacting values, percent (Palmer) | P.p.m. | Reacting values, percent (Palmer) | P.p.m. | Reacting values, percent (Palmer) |
| Calcium (Ca) | 6,500 | 7.62 | 5,580 | 9.47 | 4,400 | 7.17 |
| Magnesium (Mg) | 1,660 | 3.20 | 1,560 | 4.36 | 1,140 | 3.06 |
| Sodium (Na) | 38,400 | 39.18 | 24,400 | 36.17 | 28,000 | 39.77 |
| Carbonate ($CO_3$) | 0 | 0 | 0 | 0 | 0 | 0 |
| Bicarbonate ($HCO_3$) | 323 | .12 | 550 | .31 | 202 | .11 |
| Sulfate ($SO_4$) | 0 | 0 | 0 | 0 | 0 | 0 |
| Chloride (Cl) | 75,300 | 49.88 | 51,800 | 49.69 | 54,200 | 49.89 |
| Total solids | 122,183 | 100.00 | 83,890 | 100.00 | 87,942 | 100.00 |
| Hydrogen sulfide ($H_2S$) | None | | None | | None | |
| Barium (Ba) | 65 P.p.m | | 389 P.p.m. | | 47 P.p.m. | |
| Specific Gravity, 60° F. | 1.085 | | 1.063 | | 1.070 | |

is produced. Experience with this equipment has shown an overall accuracy within 1 per cent of the actual stock-tank measurement of oil runs. Other equipment at the tank battery allows for heating or treating of the oil as needed.

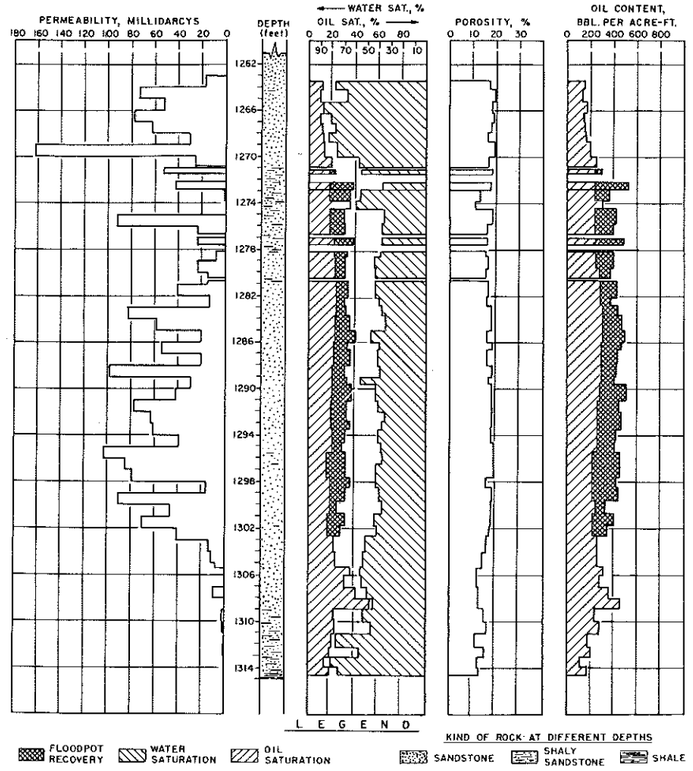
## Source and Treatment of Water

Water for flooding purposes is supplied by two wells completed in the Arbuckle formation at an average depth of 2,547 feet. Brine is produced from several aquifers in the Arbuckle lime, including the Roubidoux sand. These supply wells were completed with 8-inch casing set at about 1,665 feet and cemented to the surface. Electric submersible pumps, hung on 5½-inch pipe at a depth of 1,860 feet, pump the water from the supply wells over an aerating tower. The redwood tower is 9 feet wide, 9 feet long, and 14 feet high and is a tray-type aerator.

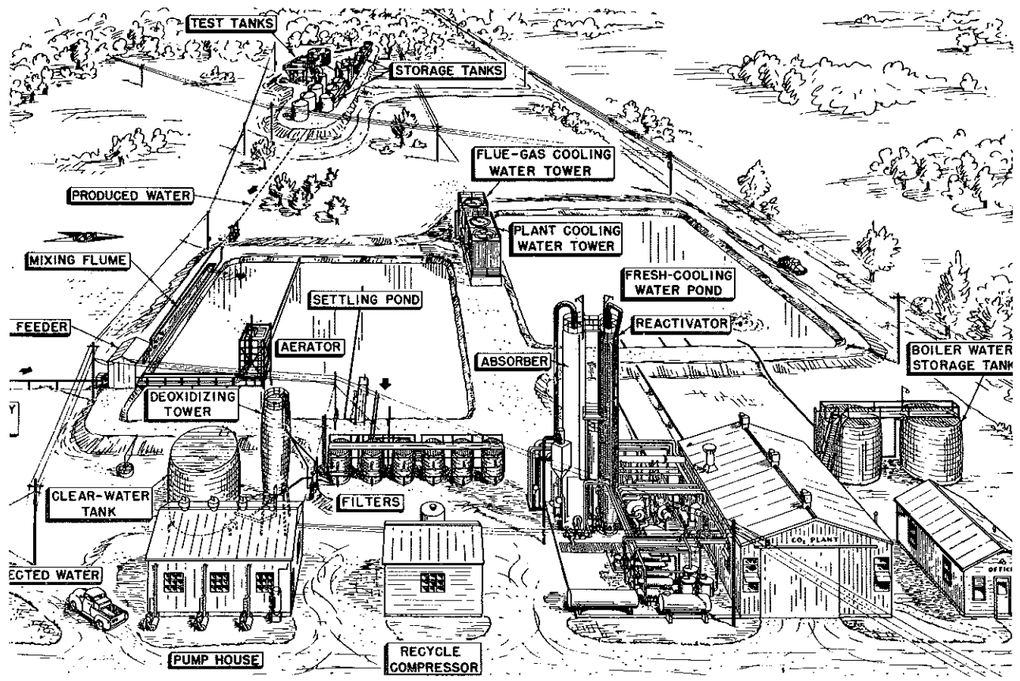
Raw water from the supply wells and produced brine from the lease tank batteries are mixed at the top and percolate through the aeration trays. Aerated water flows in a trough from the base of the tower to the treating house, where approximately 12 pounds of lime and potassium permanganate is added to each 1,000 barrels of water. The treated water then flows through a baffled mixing trough into the settling pond. This pond, divided by baffles, allows the products from the aeration and chemical reactions to settle out of the water.

A centrifugal pump forces the treated water from the settling pond through a battery of six open-type wooden filters packed with graded gravel and sand. The filters are backwashed approximately once a day or when necessary. From the filter the water is pumped into the top of a deoxidizing tower, where the dissolved oxygen in the water is partly replaced by nitrogen. The wooden deoxidizing tower is about 6 by 20 feet and has several built-in wooden trays. The water entering at the top flows down over the trays, while nitrogen from the $CO_2$ plant bubbles up through it. This procedure reduces the dissolved oxygen content of the treated water more than 50 per cent. No attempt is made to remove all the oxygen by using pressured nitrogen or vacuum deaeration. The water from the deoxidizing tower flows into a 1,000-barrel clear-water storage tank that supplies three triplex pumps. *Table 1* shows the mineral analyses of the injection waters. The pumps,






▼ Figure 2. Results of core analyses of Bartlesville sandstone, Wellsville Oil Co. & Oil Recovery Corp. ORCO Process K & S Project, Washington County, Okla.




equipped with porcelain plungers and powered by 70-hp. gas engines, force the water to the input wells at a plant pressure of 700 p.s.i.

## Manufacture of Carbon Dioxide

The supply of carbon dioxide used in the ORCO process is manufactured on the flooded property. Engineers of the Oil Recovery Corp. maintain and operate the plant in conjuction with the waterflood operations of the Wellsville Oil Co. *Figure 3* shows the water-treating and $CO_2$ plant. The plant is a modification of a commercial plant and was designed especially for use with this waterflood. It has a capacity of 30 tons of carbon dioxide per day and consumes about 600,000 cubic feet of natural gas.

In the process natural gas mixed with air is burned under a water-tube boiler and the carbon dioxide separated from the resultant flue gas. Steam formed in the boiler is used for power and heating in other phases of the extraction process. The flue gas at 450° F. contains

▼ Figure 3. Water-treating and $CO_2$ plant of Wellsville Oil Co. and Oil Recovery Corp. K & S Project, Washington County, Okla. The plant has a capacity of 30 tons of carbon dioxide per day and consumes about 600,000 cubic feet of natural gas.

about 11 per cent $CO_2$. The flue gas is drawn from the boiler through a concrete tower, countercurrent to cooling water, and through a mist extractor by a steam-turbine-driven blower. From the blower the gas passes into the bottom of a steel absorber tower filled with ceramic Raschig rings and again flows countercurrent to an incoming stream of lean cool monoethanolamine (MEA). The $CO_2$ gas is absorbed by the MEA, and the remaining waste gas flows out the top of the tower. A portion of the waste gas, rich in nitrogen, is used to deoxidize the brine.

The $CO_2$-laden MEA is pumped from the bottom of the absorber tower through heat exchangers where it is warmed and then enters the top of the reactivator tower, where it flows countercurrent to steam entering at the base of the tower. The $CO_2$ gas is stripp- from the MEA solution and flows out the top of the reactivator tower through a water-cooled condenser and then through a liquid separator before entering the steam-driven compressor. The hot, lean MEA solution is pumped from the bottom of the reactivator tower through the heat exchangers and transfers heat to the rich cool MEA solution mentioned above. From these the MEA solution passes through a water-cooled heat exchanger and back to the absorber tower to repeat the process.

A separate fresh-water system, including cooling towers, filter, and storage pond, is maintained to supply the boiler and heating system.

## Results of Flooding

This project is too new to evaluate properly, the first increase being noted in July 1958. During the last 6 months of 1958 oil production was increasing at the rate of about 2,000 barrels per month. Several oil wells have not yet been put on production, and water has not been turned into several input wells. About 50,000 barrels of oil has been recovered as a result of injecting more than 1.5 million barrels of water. This is a water-injected to oil-produced ratio of about 31 : 1. Based on experience with several waterfloods in the Midcontinent area developed without the use of carbon dioxide, the operator believes that carbon dioxide injection has helped immeasurably on this project and that it is 6 months in advance of a project using only water.

## Summary of Operations

*Wellsville Oil Co. & Oil Recovery Corp. ORCO process, K & S project, Washington County, Okla.*

Location—secs. 5 and 6, T. 27 N., R. 13E.
Sand flooded—Bartlesville.
Depth to top of sand—1,300 feet.
Average sand thickness—33 feet.
Productive area—240 acres.
Area flooded—190 acres.
Well pattern—5-spot (660 x 660 ft.)
Type of water—brine.
Type of system—open.
First water injection—February 1958.
First oil increase—July 1958.
Status—active.
Gravity of oil—33° API.
Viscosity of oil—6.3 cp. at 100° F.

OIL PRODUCTION, BY YEARS, BBL. (240 ACRES)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1905[1] | | 1915 | 13,440 | 1925 | 4,663 | 1951[3] | 2,696 |
| 1906 | 37,974 | 1916 | 11,064 | 1926 | 4,628 | 1952[3] | 6,982 |
| 1907 | 39,336 | 1917 | 10,560 | 1927 | 3,120 | 1953[3] | 9,134 |
| 1908 | 45,374 | 1918 | 9,912 | 1928 | 3,255 | 1954[3] | 15,556 |
| 1909 | 36,176 | 1919 | 7,986 | 1929 | 3,434 | 1955[3] | 13,627 |
| 1910 | 39,752 | 1920 | 5,526 | 1930 | 3,640 | 1956[3] | 12,990 |
| 1911 | 47,344 | 1921 | 5,591 | 1931 | 3,581 | 1957[3] | 11,732 |
| 1912 | 34,896 | 1922 | 5,856 | 1932 | 3,061 | 1958 | [4]50,703 |
| 1913 | 28,496 | 1923 | 5,286 | 1933 | 1,206 | | |
| 1914 | 17,104 | 1924 | 5,266 | 1934[2] | 252 | | |

[1] Production data not available for 1905. [2] Leases abandoned. [3] Production attributed to redrilling and early pilot waterflooding operations. [4] 49,611 barrels attributed to ORCO process; 1,092 barrels to pilot flood.

SUMMARY OF WATERFLOOD PERFORMANCE

| Date 1958 | Acres flooded | Active oil wells | Active input wells | Oil recovery bbl. per acre | Cumulative water injected-oil produced ratio |
|---|---|---|---|---|---|
| February | 30 | 11 | 8 | 27 | 18 |
| March | 70 | 11 | 13 | 25 | 46 |
| April | 80 | 11 | 15 | 34 | 74 |
| May | 110 | 11 | 20 | 36 | 84 |
| June | 110 | 11 | 22 | 48 | 90 |
| July | 120 | 15 | 22 | 60 | 87 |
| August | 120 | 15 | 22 | 90 | 72 |
| September | 120 | 15 | 22 | 135 | 50 |
| October | 125 | 15 | 23 | 207 | 43 |
| November | 130 | 15 | 24 | 285 | 36 |
| December | 190 | 16 | 29 | 261 | 31 |

| | Bbl. |
|---|---|
| Water injected to January 1, 1959 | 1,517,909 |
| Water injected per acre (190 acres) | 7,989 |
| Oil recovered to January 1, 1959 | 49,611 |
| Oil recovered per acre (190 acres) | 261 |
| Oil recovered by primary methods to 1935 (240 acres) | 437,779 |
| Oil recovered per acre (240 acres) | 1,824 |
| Oil recovered by pilot flood (240 acres) | 73,809 |
| Oil recovered per acre by pilot flood (240 acres) | 308 |
| Total oil recovered (240 acres) to February 1, 1958 | 511,588 |
| Oil recovered per acre (240 acres) to February 1, 1958 | 2,131 |
| Oil recovered by ORCO process (240 acres) to January 1, 1959 | 49,611 |
| Oil recovered per acre by ORCO process (240 acres) to January 1, 1959 | 207 |

MONTHLY RECORD OF WATER AND $CO_2$ INJECTED AND OIL AND WATER PRODUCED

| | 1958 | | | |
|---|---|---|---|---|
| Month | Water injected, bbl. | Oil produced, bbl. | $CO_2$ injected, tons | Water produced, bbl. |
| January | | | | |
| February | 14,577 | 820 | 0 | |
| March | 65,588 | 905 | 0 | |
| April | 122,694 | 1,023 | 65 | |
| May | 130,109 | 1,220 | 457 | |
| June | 145,995 | 1,336 | 566 | |
| July | 143,353 | 1,885 | 645 | |
| August | 151,707 | 3,583 | 929 | *2,227 |
| September | 141,371 | 5,471 | 575 | 3,231 |
| October | 201,973 | 9,642 | 418 | 5,122 |
| November | 200,337 | 11,192 | 667 | 6,521 |
| December | 200,205 | 12,534 | 683 | 8,005 |
| Total | 1,517,909 | 49,611 | 5,005 | 25,106 |

* Not measured before August.



# Tenth Annual Drilling and Blasting Symposium at Mines

Tenth Annual Drilling and Blasting Symposium, sponsored by the Colorado School of Mines, University of Minnesota, and Pennsylvania State University, was held Oct. 16-19 on the CSM campus and was attended by 234 technical and production men from the United States and several foreign countries. Symposium co-chairmen were Prof. Lute J. Parkinson, head of CSM Mining Department; Prof. E. P. Pfleider, chief, Division of Mineral Engineering, University of Minnesota; Dr. Howard L. Hartman, head, Department of Mining, Pennsylvania State University. The entire faculty of the CSM Mining Department worked equally hard to take care of operational details of the conference.

Titles, authors, and abstracts of papers at the symposium were as follows:

*Drag Bits and Machines* by Ross H. Goodrich, product manager for Coal Cutter & Rotary Drill Products, Joy Manufacturing Co., presented data and experience gained during eight years of research. Nomenclature of rotary bits was clarified by means of drawings, and the various types of bits were described and illustrated. Performance curves were given, and general conclusions were drawn regarding the influence of various design factors on bit performance. Several rotary drilling machines were described and illustrated together with their practical applications.

*Laboratory and Field Testing of Rotary Rock Bits* by J. D. Medlock, staff engineer, Special Applications Department, Hughes Tool Co., traced the development of rolling cone bits for mine and quarry industries. It was pointed out that present day bits for blast hole drilling are much improved over the bit designs of several years ago, and these improvements are the result of extensive laboratory and field testing of experimental features. Component parts of rock bits have been tested on specialized machines to obtain comparative information on experimental features. Mr. Medlock emphasized that field testing is the final proving ground for evaluating experimental features of rock bits.

*Efforts to Develop Improved Oil Well Drilling Methods* by L. W. Ledgerwood, Jr., section head, Jersey Production Research Co., reviewed research and development expended during the past three decades by the oil industry in seeking drilling tools or systems to reduce drilling costs. Some of the possibilities investigated are: impact at frequencies ranging from 6 to 300 cps; electrical, mechanical, and hydraulic means of actuating percussors; rotary bit speeds up to 2000 rpm; electric and hydraulic bottomhole means of rotating bits; shock waves; explosives; high-velocity pellets; flame; arc; grinding wheels; abrasive jets; erosion by high-velocity gases; chemical attack; electric current; magnetic waves; retractable rock bits; reelable drill pipe; continuous coring with reverse circulation; and automation of drilling rigs. In spite of this effort to replace rotary drilling with an improved system, rotary maintains its economic leadership. Ledgerwood believes that further significant long-range improvement may be a research rather than a development problem.

*Rotary Percussion Air Hammer Drilling* by W. E. Liljestrand of Mission Manufacturing Co. described the advantages of the new method of rotary percussion drilling with a down-the-hole type, air operated drill. The impact flow of the bit on the formation is like that of the cable tool while the high frequency of blows is like that of the wagon drill. Continuous hole cleaning and drilling is similar to that of rotary air drilling and the hold-down is similar to cable tools in that almost none is needed. A down-the-hole hammer tool will drill at any depth that the hole can be cleaned of cuttings. The combination of these advantages results in drilling rates from 10 to 40 feet per hour depending on hardness of rock. Liljestrand said the best use of this drill is where formations are hard to dig, as in quarrying, mining or drilling oil wells (whenever air or gas can be used).

*Higher Air Pressures for Bottom-Hole Percussion Drills* by E. P. Pfleider and W. D. Lacabanne, both of the University of Minnesota, presented a theoretical study on the effects of varying air pressures on the operating characteristics of percussive drills. The principal factors considered were air pressure, total percussive energy, striking energy per blow, blows per minute, and the dimensions and stroke of the hammer. Secondary factors—such as air quantities, velocities in annulus for cuttings removal, back or exhaust pressures and friction losses—were mentioned. The influence of piston velocity on impact stresses and drill rod fatigue were discussed insofar as they related to the problem. Blast hole drills, using low pressure air, were compared to high pressure bottom-hole units recently developed in the oil fields.

*The Galis Rotary Percussion Drill* by Harley G. Pyles, vice president of Galis Electric and Machine Co., described a hydraulically driven rotary percussion drill designed to answer the need for a machine to drill harder materials without the use of compressed air. In seeking a percussive mechanism other than a pneumatic hammer, various interrupter mechanisms were considered, such as wobble plates and spring loaded cams, but these were discarded from the standpoint of maintenance and wear. Further research and development produced a satisfactory mechanical oscillator which could be driven hydraulically and a successful production model of the drill has been available for about nine months.

*Drilling and Drill Steel Progress at the Idarado Mining Co.* by J. C. Keenan, chief engineer for Idarado Mining Co., explained how the company increased drill steel life six fold by establishing research and test procedures. Simple methods of recording mine wide drill steel usage enabled the production-use evaluation of fabrication developments. Additional benefits derived from the close study of drill steel life and drilling practice have been improvement of productivity and lessening of machine maintenance cost. Air pressure studies revealed improved drill steel life with controlled compressed air distribution.

*Recent Developments and Trends in Production Blast-Hole Drilling on the Mesabi Iron Range* by Donald K. Nelson, assistant superintendent for M. A. Hanna Co., reviewed the gradual transition from mining soft iron formations to the more recent hard taconites. This trend has had a decided influence on the ratio of drilling to over-all mining and haulage costs. While recent developments have concentrated on the application of vertical drill holes, some thought is being given to the use of inclined holes. The large diameter, vertical hole is still favored by the major operators but its production by turn drilling is rapidly giving way to rotary drilling.

*The Effect of Coupling on Explosive Performance* by Thomas C. Atchison, physicist with U.S. Bureau of Mines, described tests for measuring the effect of coupling on the strain produced by the detonation of an explosive charge in limestone. The strain was shown to be approximately proportional to the 1.5 power of the ratio of the charge diameter to the hole diameter.

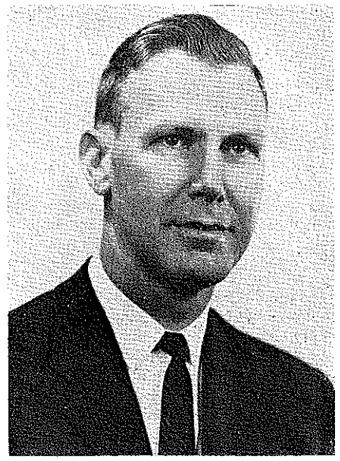
*Application of the Livingston Theory* by Alan Bauer, a Ph.D. candidate at the University of Utah, outlined the Livingston Crater Theory and described certain preliminary stages in the application of it to open pit iron mining. This theory provides a method of designing single and multiple shot blasts using H.E. and/or nuclear explosives.

*Some Effects of Particle Characteristics of Ammonium Nitrate on Blasting Agent Performance* by Dr. George B. Clark of the Missouri School of Mines, stated that more data are now available on the effects of particle size upon the performance of ammonium nitrate as a blasting agent. Depending upon particle density, particle shape and particle size distribution, explosives may be sensitive or insensitive to initiation. The same factors have a marked effect upon

*(Continued on page 29)*

# The Engineering Aspects of Pressure Maintenance and Secondary Recovery Operations *

By SHOFNER SMITH



SHOFNER SMITH

*(Editor's Note. Because of space limitations in the November 1960 issue of The MINES Magazine, it was necessary to divide this article into two parts—the first of which, published last month, discussed "Pressure Maintenance and Secondary Recovery," "Comparison of Conventional Recovery Processes," and "New Recovery Processes." This portion of the article considers the "Physical Aspects of Oil Production and Fluid Injection.")*

## Physical Aspects of Oil Production and Fluid Injection

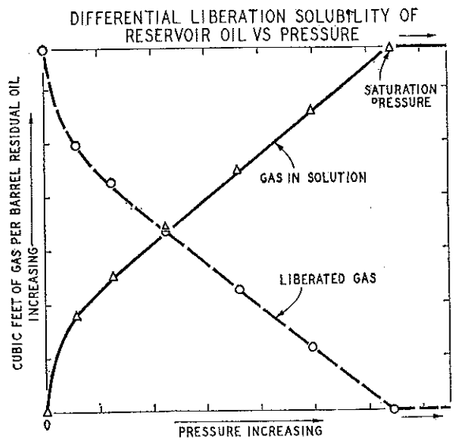
It was stated initially that the distinction between pressure maintenance and secondary recovery operation of oil reservoirs relates to the difference in reservoir pressure, and other related differences of degree rather than kind, existing at the time fluid injection operation is initiated. The pressure level at which fluid injection operations are conducted becomes important when consideration is given to pressure related physical changes in solubility, reservoir volume factor, and viscosity of reservoir oil; and other factors, which vary with change in reservoir pressure. It is the manner in which these properties of the reservoir oil vary, and our ability to control and take advantage of these variations, that offers the opportunity to improve the efficieney of oil recovery processes.

### Solubility

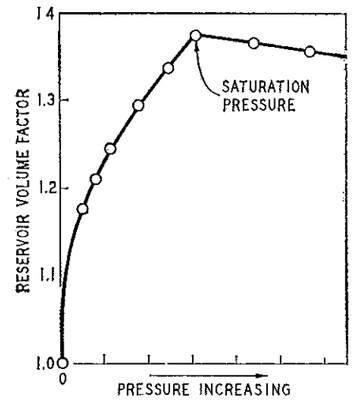
*Figure 17* is a graphic illustration of the manner in which volume of gas remaining in solution with reservoir oil, and gas liberated from solution with oil, change with decline of reservoir pressure. At all pressures above the bubble point, gas in solution with the oil remains constant. The volume of gas in solution with oil at the bubble point, and higher pressures, is commonly referred to as the solution gas-oil ratio; and is generally expressed in terms of cubic feet of gas per barrel of oil at atmospheric pressure and reservoir temperature. It will be noted from examination of *Figure 17* that a progressive decrease in pressure below the bubble point pressure results in liberation of increasing volumes of gas from solution with the oil, with corresponding decreases in the quantity of gas remaining in solution.

### Shrinkage and Reservoir Volume Factor

The reservoir volume of a barrel of oil varies because of changes in the volume of gas in solution with the oil. *Figure 18* is a graphic illustration of the manner in which the reservoir volume of a barrel of oil at atmospheric pressure and temperature, changes with decline in pressure. This relationship is referred to as the "reservoir volume factor." The reservoir volume factor is the number of barrels of reservoir space occupied by a single barrel of oil at atmospheric pressure and temperature, with its associated gas in solution at reservoir pressure and temperature. Shrinkage of reservoir oil is the change in volume from reservoir to atmospheric conditions of pressure and temperature, or the reservoir volume factor minus one. The reservoir volume of oil with gas in solution is a maximum at the bubble point or saturation pressure. At pressures above the bubble point pressure, the volume occupied by reservoir oil is less than at the saturation pressure, because of compression of the liquid reservoir oil. As pressure declines below the bubble point, the reservoir volume of a barrel of residual oil decreases, until it reaches the value of unity at atmospheric pressure.




▼ Figure 17. Gas Liberated from Solution and Gas Remaining in Solution Versus Pressure.




▼ Figure 18. Reservoir Volume Factor Versus Pressure.

*Figure 18* shows that for each 1.4 barrels of residual reservoir oil saturation, with pressure maintenance operations conducted near the bubble point pressure, ultimate oil recovery is reduced by only one barrel. In contrast, *Figure 18* also shows that each 1.4 barrels of residual reservoir oil saturation, with secondary recovery operations conducted near the abandonment pressure, reduces ultimate oil recovery by approximately 1.4 barrels. This contrast of difference in ultimate oil recovery for the same residual oil saturation is one of the important physical reasons for pressure maintenance operations yielding greater ultimate oil recovery than could be obtained by secondary recovery operation of the same reservoir.

### Viscosity

*Figure 19* is a graphic illustration of the manner in which viscosity of the reservoir oil with gas in solution varies with changes in reservoir pressure. Oil viscosity reaches its maximum value at atmosphere pressure. Minimum viscosity occurs at the bubble point pressure. Inasmuch as less work is required to overcome the effects of friction in moving oil through the formation at the lower values of viscosity, *Figure 19* again illustrates that pressure maintenance operations are preferable to secondary recovery operations in achieving maximum ultimate oil recovery.

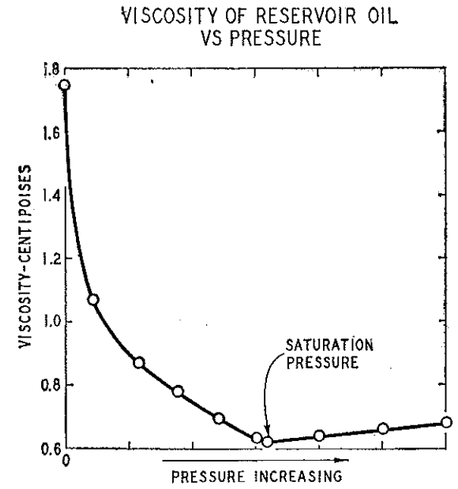
### Capillary Forces

Capillary forces, which are a combination of wettability and surface tension effects, play a very significant role in the recovery of oil by water injection operations. These forces cause water to move faster in the smaller, low permeability channels in the reservoir rock; and will bring about the displacement of oil from dead-end pore spaces, or channels, into the more permeable flow paths where the oil may be moved into producing wells by the water drive. The displacement of oil by water because of capillary forces is often referred to as "water imbibition." A reduction in oil saturation reduces the effectiveness of these capillary forces; consequently, they work most efficiently when the oil saturation is at or near its maximum value, and viscosity is at or near its minimum value. This condition exists at the bubble point pressure. Capillary forces can displace oil more efficiently with pressure maintenance operation than in secondary recovery type operations.

### Economic Aspects of Pressure Maintenance and Secondary Recovery Operations

Pressure maintenance or secondary recovery operation of a reservoir is not a low cost method of developing additional oil reserves. Investment in lease and surface facilities required for such operations will frequently equal or exceed the investment required to develop the field for primary production. Increased operating cost stemming from the increased complexity of such operations results in a lesser operating profit per unit volume of additional oil produced than is realized from oil produced by primary operations. Investments for pressure maintenance and secondary recovery facilities are not made in the interest of conservation alone. Such investments are made because of the conviction, on the part of working interest owners, that increased net operating income, from sale of increased oil, will return the investment required; and an additional sum of money which provides adequate earnings on the investment.

At the time investment is required for pressure maintenance operation, the oil producing rate from the reservoir is generally at or near the maximum permissible, consequently, the investment must be justified by the financial advantages resulting from preventing or minimizing future decline in the oil producing rate. Under these conditions, it may be several




▼ Figure 19. Viscosity of Reservoir Oil Versus Pressure.

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years before working interest owners realize significant additional income from their investment. Investment required for pressure maintenance can normally be carried by current income from the producing properties.

At the time investment is required for secondary recovery operations, producing rate from the reservoir has generally declined to near the abandonment level. Working interest owners must provide funds for capital expenditures from which no return can be expected for a period of approximately two years. Following the period required to obtain stimulation from secondary recovery operation, very substantial gains in net operating income may be realized from the project because of substantially increased producing rates.

### Payout and Return on Investment

Generally speaking, the time required for increased oil production to return investment in secondary recovery operations is less than for pressure maintenance operations. The average annual rate of return on the investment, as determined by the cash flow method, is usually slightly higher for secondary recovery operations than for pressure maintenance operations. In contrast, the ultimate net income to be realized from a reservoir is, with few exceptions, appreciably higher with pressure maintenance operation. The form of operation which a group of working interest owners may elect to adopt for a particular reservoir will depend on the financial position of the working interest owners and their preference for the short term profit or the greatest ultimate profit from the operation.

### Agreements Necessary—Desirable Provisions

Lease agreements must be modified by unit or cooperative injection agreements in order to conduct pressure maintenance or secondary recovery operations. In any successful fluid injection operation, pressure gradients are created within the reservoir which cause migration of oil over distances greater than the dimensions of surface lease lines. This migration of oil would result in a serious distortion to correlative rights of parties in interest to the various leases unless some effective means is devised for preventing migration of oil across lease boundaries, or rendering such migration acceptable without distortion of correlative rights. There are two methods commonly used for the protection of correlative rights with fluid injection operations. These are: first, unitization of the common source of supply of oil, and second, cooperative operation of the various leases or groups of leases within the reservoir.

### Unit and Unit Operating Agreements

Unit operation is the most satisfactory means of protecting correlative rights. Unitization of a common source of supply of hydrocarbons involves the pooling of all producing properties into one unit for purposes of operation. Correlative rights of the parties in interest in the various leases are protected by their agreeing to accept a predetermined share of the production from all of the leases within the unit, in lieu of actual production from leases contributed to the unit. Unit operation has the further advantage of allowing the reservoir to be operated in the manner best designed to achieve maximum ultimate oil recovery without the necessity of being concerned with migration of oil across arbitrarily established boundaries.

Unit agreements and their companion unit operating agreements deal with many complex considerations, most of which are common to all unit operations. In recognition of this fact, the American Petroleum Institute has established a subcommittee comprised of attorneys, engineers, and managers representing all segments of the oil producing industry, for the purpose of drafting model forms of unit and unit operating agreements. This committee's efforts resulted in a first edition model form of unit agreement and unit operating agreement being adopted in January, 1957. These model form agreements have received widespread acceptance throughout the industry, which attests to the conscientious and considerable effort put forth by the committee members, all of whom were eminently qualified and thoroughly familiar with problems relating to unitization and unit operation. These model forms offer valuable assistance in drafting unit and unit operating agreements. It may be necessary to modify some of the provisions and add other provisions to properly deal with problems peculiar to some reservoirs. Units involving Federal Lands, or lands under Federal supervision, will require extensive modification of the model form in order to properly recognize the responsibility and meet the requirements of the Secretary of the Interior, and the other governmental agencies concerned. The API committee which drafted these agreements has continued to study possible modifications and improvements. It is expected that a second edition of these agreements will be adopted within the year.

One of the most important areas for improvement of present forms of unit and unit operating agreements relates to the methods established for resolving differences of opinion between working interest owners. It is essential that sound and workable methods for resolving these differences be established if the pressure maintenance or secondary recovery operation is to proceed in an orderly and logical fashion. The voting procedure specified for the unit operators' committee in the unit operating agreement should generally be such that a majority of the working interest ownership can alter the magnitude or method of fluid injection in any manner which, in the majority opinion, will increase ultimate oil recovery and profit from the unit operation. Voting procedures which allow a minority of working interest ownership to block improvements in unit oil recovery programs tend to promote dissension among working interest owners, and on occasion result in less than maximum attainable oil recovery from a unit operation. Attention to this feature of unit and unit operating agreements will yield dividends in the form of increased ultimate oil recovery, and increased profit from unit operations.

### Cooperative Injection Agreements

Pressure maintenance or secondary recovery operations can, in some cases, be conducted without unitization in such fashion that each owner has a reasonable opportunity of recovering his fair share of the oil from the reservoir. Cooperative development of a reservoir requires that the locations at which fluids are injected be so selected as to either prevent or bring about compensating migration of fluids across lease lines. Cooperative development will inevitably result in the recovery of a lesser quantity of oil, and higher total development and operating costs than would unit operation.

The most important feature to be incorporated in cooperative injection agreements is a statement as to the objective and principles to be served by the fluid injection contemplated. The objective can be stated simply and briefly as the desire of the parties to inject fluids for the purposes of: (a) increasing ultimate oil recovery, and (b), preventing, minimizing, or balancing the migration of fluids across lease lines to the end that the reasonable protection of correlative rights of the parties will be accomplished. Cooperative injection agreements should also include designation of initial injection wells, with provision for additional wells as may be agreed to by the parties; provisions for the sharing of costs of converting and equipping wells for injection, and the costs of injection; a statement of the terms and conditions of the sale of fluid for injection from one party to another, or in the alternative, a provision that each party is responsible for obtaining and injecting fluids into its injection wells; designation of an effective date and initial term of the agreement, with provisions for extension of the initial term by mutual consent, together with provision for orderly termination of the cooperative injection operation should one or more of the parties elect to terminate the program. Such agreements should not require the injection of specific volumes of fluid because of the unpredictable variation of many physical factors which may well render injection of the specified volumes unreasonable and burdensome on one or more of the operators.

The cooperative injection agreement can be little more than a statement of the desired objectives of the parties, and an agreement to agree on the detailed procedure for accomplishing these objectives. Such agreements are subject to all the inherent disadvantages of any agreement to agree, and therein lies one of the principal disadvantages to this type of operation. In those instances where several groups of working interest owners are involved in a cooperative injection arrangement, an effort should be made to provide for some reasonable means of settling differences of opinion among the various groups to the end that fluid injection operations may be continued in orderly fashion in the face of honest differences of opiion that inevitably arise.

### Lease and Farmout Agreements

Lease and farmout agreements should not contain provisions that exert an influence on the well spacing pattern on which a field is developed. Operators should always have the opportunity to determine the proper well spacing pattern on the basis of physical factors as they are found to exist on obtaining factual data as to the nature of the reservoir rock and reservoir fluids. Lease or farmout agreement requirements which bring about the drilling of unnecessary wells cause economic waste. Such agreements may also cause physical waste of oil because of delay in initiating pressure maintenance operations occasioned by time required for drilling unnecessary wells.

Lease and farmout agreements should not contain provisions that restrict the manner in which production from a lease may be handled beyond the requirement to accurately account for lease production. Mechanical equipment for metering and measuring lease production is now available which permits continuous metering and running of lease production to pipelines. This method of handling lease production brings about substantial labor cost savings for lease operation, as compared to presently conventional tank battery oil storage and measurement techniques. Economy of lease operation benefits both royalty and working interest owners, and effects conservation of oil. Greater oil recovery is realized because lower operating cost permits operation of wells to lower producing rates prior to reaching the "economic limit" of operation.

### Compulsory Unitization

The preceding discussion has dealt with voluntary forms of agreements for pressure maintenance and secondary recovery operations. One of the greater remaining roadblocks to broader application of improved oil recovery techniques is the problem that arises when working interest and royalty owners are unable to agree on any form of unitized or cooperative operation of an oil producing reservoir. Such a condition usually ariscs because of failure of a portion of the working interest, and/or royalty interest ownership, to properly appreciate the physical principles involved in the oil producing mechanism. Occasionally such a condition arises from a deliberate and non-cooperative attitude stemming from purely selfish motives, and an attendant desire to capitalize, at the expense of the other working interest owners, on a nuisance position. The survival of an economically healthy oil producing industry demands improved understanding of the physical principles governing oil production, as well as an enhanced sense of moral responsibility on the part of working and royalty interest owners. The alternate solution, which will preserve an economically healthy oil producing industry, is compulsory unitization. As with any compulsory program, adequate and reasonable safeguards must be established to protect the rights of working interest and royalty interest owners. Protection must be afforded the majority against abuses by a minority; and conversely, the interests of the minority must be protected against abuses from a majority. Compulsory programs should require approval by qualified regulatory agencies acting both judicially and administratively; subsequent to showing by petitioners for establishment of such compulsory program, that each owner of an interest in the reservoir will be afforded a reasonable opportunity to recover or receive his fair share of the oil under such a program, and that operations contemplated will promote the conservation of oil and gas.

### Conclusion

Consideration of the physical factors relating to production of oil from underground reservoirs reveal that pressure maintenance operation will usually recover more oil than will secondary recovery operation. Ultimate net income to both royalty and working interest owners is usually greater for pressure maintenance operation than for secondary recovery operation. The world supply of oil is presently such that preservation of an economically healthy domestic oil producing industry requires recognition, aggressive promotion, and application by all segments of the industry, of producing methods that yield greater net income and promote conservation of oil and gas. The drafting of agreements relating to oil producing operations in such manner as to place minimum restriction on the freedom of operators to apply technologically superior oil producing practices is essential to preservation of an economically healthy oil producing industry.

# Fluid Injection Projects and Unit Operations In the State of Colorado*

By A. J. JERSIN, '49

THE AUTHOR

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As of January 1960, the oil industry discovered an estimated total of 3,217,000,000 barrels of oil in place in the state of Colorado. Of this volume of oil in place, 552,000,000 barrels have already been produced, with an estimated remaining primary reserve of 214,000,000 barrels, as of January 1960. As a result of fluid injection projects now in operation, an estimated volume of 543,000,000 additional barrels of oil will be recovered over and above primary reserves, for a total state oil reserve of 757,000,000 barrels. These figures represent a recovery of about 41 per cent, which will be larger with the commencement of new fluid injection systems now in the formulative stage; and it is very likely that improved methods of recovery such as insitu combustion and use of miscible fluids will yield an even greater per cent of recovery than can now be predicted with conventional methods.

Throughout this article, a directed effort was made to eliminate use of the phrases "secondary recovery project" and "pressure maintenance project." Heretofore, when using these two phrases, fluid injection projects were classified in accordance with the following definitions adopted by the Interstate Oil Compact Commission:

"In most oil reservoirs, natural energy for production can be supplemented to bring about increased oil recovery by injection of either gas or water into the reservoir. If such injection takes place while the reservoir pressures are still high and most of the wells still flowing, the operation is classified as *pressure maintenance.* If it is started after pressures have been substantially depleted and the field is in the general pumping or stripper stage, it is classified as *secondary recovery,* repressuring, or water-flooding."

The definitions of the phrases cited above are not accepted by the entire oil industry, and in some instances, the meanings of the phrases have created extremely controversial discussions because of far-reaching effects. It is my sincere hope that the matter will again be discussed by oil-industry representatives and organizations in an effort to arrive at acceptable definitions before costly lawsuits are brought about needlessly by having these terms become commonplace in forthcoming legal documents and statutes.

The first fluid injection project to function in Colorado was started in the Wilson Creek field, Rio Blanco County, on May 14, 1946, when gas was first injected into the Morrison formation. Our second fluid injection project began in November 1950, in the form of a pilot gas injection system for the Weber reservoir of the Rangely field, also in Rio Blanco County. The first fluid injection system to use water started Sept. 18, 1956, when water was initially injected into the "D" sand of the Willard field, Logan County.

* The bulk of this article is a condensation of material prepared by the author and the engineering staff of the Commission, for a book entitled, "Mineral Resources of Colorado—First Sequel", prepared under the supervision of S. M. Del Rio, engineer of mines and mining geologist, Golden, Colo., and published by the Mineral Resources Board of Colorado.



As of January 1960, 23 different fluid injection programs were in operation, and plans were well under way in six other fields for installation of some type of fluid injection equipment. Of these 23 active programs, over 80 per cent were started since January 1957, and are located in 21 different oil fields. Sixteen of the programs utilize water injection systems; four utilize gas injection systems, and three utilize both water and gas injection systems.

Generally, none of these injection projects have been in operation long enough to allow a concrete determination of the degree of effectiveness; however, performance data accumulated thus far are favorable. Following is a very brief outline of each fluid injection project operating in Colorado, and approved by the Oil and Gas Conservation Commission as of January 1960.

### Adena Field—"J" Sand

On May 26, 1953, the Falcon Seaboard Drilling Co. completed the No. 1 Snodgrass, NE NW, Section 20, Township 1 North, Range 57 West, Morgan County, as the discovery well. This field is the largest oil field discovered to date in the Denver-Julesburg Basin, and was completely defined by 170 oil wells on 40-acre spacing units, and 15 gas wells on 160-acre spacing units. The areal extent of the oil zone is about 8,450 acres, and the gas cap covers about 4,650 acres. The average net sand thickness is 30 feet, with an average porosity of 19.7 per cent and average permeability of 356 millidarcys. The field is basically a stratigraphic trap which dips to the west at a rate of only 48 feet per mile.

The Pure Oil Co., unit operator, is employing a line-type water injection program at the gas-oil contact zone.

Primary recovery of oil by competitive production methods, with a limitation of 125 barrels of oil per day and a penalty GOR of 1200 to 1, was estimated to be 40,365,000 barrels, or approximately 30 per cent of the original oil-in-place. With unitization and the gas-oil contact water injection program, the most recent estimate reveals that an additional 30,635,000 barrels of oil will be recovered, for a total recovery of 71,000,000 barrels, which is in excess of 50 per cent of the volume of oil-in-place.

The water injection program was started February 25, 1957. As of Jan. 1, 1960, 65,016,637 barrels of water were injected into the reservoir through 38 water injection wells, with a cumulative volume of production of 31,137,936 barrels of oil, and 30,917,500 MCF of gas.

### Badger Creek Field—"D" Sand

The "D" sand reservoir of the Badger Creek field is a stratigraphic trap with a pinch-out to the east and a water table on the west, north, and south, discovered by the Forest Oil Corp.'s No. 1 C. D. Causey well, SW NW, Section 23, Township 2 South, Range 57 West, Adams County. The pay sand covers an area of approximately 1430 acres, with an average effective pay thickness of 13 feet, an average porosity of 20.05 per cent, and an average water saturation of 22 per cent.

A water injection plan was commenced Sept. 8, 1958. The pattern of the plan is best described as a diagonal alternating line drive in which every other row of wells in a NE SW direction became injection wells. There are 17 injection wells in operation, and as of Jan. 1, 1960, 2,159,435 barrels of water were injected.

Primary reserves have been estimated at 4,000,000 barrels of oil, or 21.1 per cent of the original oil-in-place. It is estimated that an additional 4,292,148 barrels of oil will be recovered by water injection operations, for a recovery factor of 43.7 per cent. Cumulative production from 36 completed wells in the field is 2,671,407 barrels of oil, and 1,453,103 MCF of gas as of Jan. 1, 1960.

### Black Hollow Field

On July 30, 1953, The California Co. (now unit operator) completed the No. 1 Baiamonte well, NE NW, Section 6, Township 7 North, Range 66 West, Weld County, as the discovery well. This reservoir, which is a dome, was completely defined with 17 oil wells, and is operated by a unit which comprises 2016 acres.

On Aug. 16, 1958, initial injection of water commenced, and as of Jan. 1, 1960, 266,628 barrels of water had been injected through the one injection well located on the northeast edge of the field. Cumulative production from the field, as of Jan. 1, 1960, was 3,762,773 barrels of oil, and 90,003 MCF of gas.

### Canadian River Field

On April 7, 1956, the Cabeen Exploration Co. completed the discovery well in the Dakota-Lakota formation, NW NW, Section 11, Township 9 North, Range 78 West, Jackson County. Subsequently, 10 oil wells and two gas wells were completed in this reservoir.

Gas is being injected through one injection well in the gas zone. The initial injection of gas began July 9, 1958, and as of the beginning of this year, 331,232 MCF of gas was injected into the reservoir. The cumulative production figures as of Jan. 1, 1960, were 313,107 barrels of oil, and 1,374,259 MCF of gas.

### Dune Ridge Field

Thirteen oil wells completed in the "D" sand defined the limits of the field which was discovered on June 20, 1954, by Shell Oil Co.'s State No. 1 well, NW SE, Section 32, Township 7 North, Range 52 West, Logan County.

It was estimated that the primary recovery of oil would be 700,000 barrels, and that an additional 200,000 barrels would be produced as a result of gas injection. Gas injection commenced August 1955, and was discontinued Feb. 4, 1959, during which period a total of 1,167,813 MCF of gas was injected.

A water injection program was started in February 1958, and water is now being injected into the "D" sand through five injection wells located on the west edge of the field. As of Jan. 1, 1960, there had been 1,366,495 barrels of water injected. An additional 475,000 barrels of oil is estimated to be recovered as a result of this water injection, for a total recovery of 1,375,000 barrels, or 49 per cent of the original oil-in-place.

As of January 1, 1960, 1,094,783 barrels of oil, and 1,674,871 MCF of gas had been produced from this reservoir.

### Fort Morgan Field

The Fort Morgan Field was discovered in May 1954, with the completion of S. D. Johnson's Lind-Bacon No. 1 well in the SW SW, Section 19, Township 3 North, Range 57 West, Morgan County, in the "D" sand. Following this discovery, drilling continued at a slow rate until 10 wells capable of producing from this reservoir were completed in April 1955. The reservoir primarily contains gas, with a small but significant oil band on the down-dip side of the stratigraphic trap which covers approximately 2,200 acres.

Gas has been injected through one injection well since July 1958, and as of Jan. 1, 1960, 729,086 MCF of gas was injected into the reservoir. Cumulative production as of Jan. 1, 1960, was 107,582 barrels of oil and 3,336,558 MCF of gas.

### Graylin-Northwest Field—"D" Sand

The British-American Oil Producing Co. completed the "D" sand discovery well May 2, 1951, which was their Monroe No. 1, NE SW, Section 7, Township 8 North, Range 53 West, Logan County. Forty-one producing wells were completed in this reservoir, which is a combined stratigraphic trap and anti-cline covering an area of 3,808 productive acres. Producing mechanism in the reservoir is solution gas with a slight water drive. The average net pay thickness is 8.7 feet, with an average porosity of 21.2 per cent and an average permeability of 344 millidarcys.

The original oil-in-place was calculated to be 27,295,000 barrels, with primary reserves estimated at 7,435,422 barrels. A semi-peripheral water injection pattern was started Sept. 1, 1960, utilizing 19 injection wells. It is estimated that an additional 3,535,000 barrels of oil will be recovered as a result of water injection, for a total recoverable volume of 10,970,422 barrels of oil, which represents 40 per cent of the original oil-in-place.

Cumulative production as of Jan. 1, 1960, was 6,807,534 barrels of oil, and 9,345,881 MCF of gas.

### Jackpot Field

This field was brought in on Jan. 7, 1955, when J. L. Nelson completed the discovery well, NW SW, Section 1, Township 6 North, Range 59 West, Morgan County, in the "D" sand formation which is a stratigraphic trap, the limits of which were defined by 36 commercial wells. The Unit area consists of 2,320 acres, and is being operated by the Monsanto Chemical Co.

A water injection plan was commenced on Aug. 24, 1960, utilizing 15 injection wells at the present time. The estimated oil recovery by primary methods was estimated to be 1,064,000 barrels, or about 19 per cent of the original oil-in-place. An additional 1,142,000 barrels of oil is estimated as recoverable by water injection, for a total recovery of 2,206,000 barrels, or about 40 per cent of the original oil-in-place.

Cumulative production from the "D" sand, as of Jan. 1, 1960, was 995,702 barrels of oil, and 1,737,745 MCF of gas.

### Kejr Field (North Unit)

On April 18, 1955, the Sohio Oil Co. completed the

No. 1 Kejr "A" well, SE SE, Section 2, Township 2 South, Range 56 West, Washington County, in the "D" sand formation. Subsequently, there were 17 wells completed in this common source of oil, which is primarily a stratigraphic trap underlying approximately 840 acres.

A peripheral-type water injection plan utilizing 8 injection wells began on Jan. 15, 1959, and as of Jan. 1, 1960, 905,206 barrels of water had been injected. The ultimate recovery of oil by primary means was estimated to be 1,167,000 barrels, with an additional 1,500,000 barrels of oil estimated as recoverable due to water injection. Cumulative production figures as of Jan. 1, 1960, were 1,044,723 barrels of oil, and 403,239 MCF of gas.

### Kejr Field (South Unit)

On Dec. 3, 1955, the discovery well for the south portion of the Kejr field was completed by the Dawson-Cramer Company. The well is the No. 1 Kejr, NE NW, Section 14, Township 2 South, Range 56 West, Washington County, completed in the "D" sand formation. A total of 14 commercial oil wells defined this reservoir.

A water injection plan began Sept. 18, 1958, utilizing five injection wells at the present time, and as of Jan. 1, 1960, there have been 643,239 barrels of water injected. The Sinclair Oil & Gas Co. is the operator of the Unit, which consists of 960 acres. The estimated primary recovery of oil was 721,550 barrels, with an additional 1,184,610 barrels to be recovered as a result of water injection, for a total recovery factor of 41.7 per cent. As of Jan. 1, 1960, 721,829 barrels of oil, and 213,137 MCF of gas were produced from this reservoir.

### Leader Field

Ginther, Warren & Ginther completed the No. 1 G. H. Leasure well on May 23, 1954, in the "J" sand formation, SE SW, Section 17, Township 2 South, Range 59 West, Adams County, as the discovery well of this field. One gas well and six oil wells define the limits of this reservoir, which is a stratigraphic trap. The Unit area includes 1,040 acres of land. Both water and gas are being injected into this reservoir. Injection of gas commenced in April 1957, through the discovery well, and as of Jan. 1, 1960, there have been 715,677 MCF of gas injected. Initial injection of water started in another well on Sept. 11, 1959, and as of Jan. 1, 1960, 18,051 barrels of water were injected. Cumulative production as of Jan. 1, 1960, was 135,389 barrels of oil, and 872,641 MCF of gas.

### Lewis Creek Field

The discovery well for this field was completed in the "J" sand formation on July 30, 1953, by the British-American Oil Producing Co., in the SW SE of Section 12, Township 11 North, Range 53 West, Logan County. Subsequently, 23 commercial wells were completed in this reservoir, which is a combination permeability barrier and enclosed structure. The Unit area consists of 1,450 acres, and is operated by British-American. Reservoir estimates indicate that 4,500,000 barrels of oil are recoverable by primary methods, with an additional 2,500,000 barrels of oil recoverable by a water injection plan commenced May 13, 1959, utilizing five injection wells. As of Jan. 1, 1960, 1,346,455 barrels of water were injected into the reservoir, with a cumulative production of 3,019,158 barrels of oil, and 2,596,805 MCF of gas.

### Little Beaver Field—"D" Sand

The "D" sand of the Little Beaver field was discovered on May 12, 1952, by the Goodall Oil Co.'s Wheatlake No. 1 well, located in the SW SW of Section 5, Township 2 South, Range 56 West, Washington County. The reservoir was completely defined by 70 oil wells, and is a stratigraphic trap monoclinal structure with a porosity pinch-out on the east and southwest, and an aquifer on the down-dip portion. The average porosity is 20 per cent, with an average permeability of 300 millidarcys. An estimated volume of 9,401,000 barrels of oil would be recovered by primary methods, for a 24.1 per cent recovery of original oil-in-place. It is indicated that additional recovery by water injection will be 8,149,600 barrels of oil, for a total recovery of 17,550,600 barrels. The Unit area consists of 2,688 acres, and is being operated by the Continental Oil Co.

The injection of water into this reservoir began on Oct. 16, 1958, and as of Jan. 1, 1960, 10,958,827 barrels of water have been injected, utilizing 33 injection wells in a "five-spot" injection plan. Cumulative production figures as of Jan. 1, 1960, were 8,927,052 barrels of oil, and 7,407,732 MCF of gas.

### Little Beaver—East Field

This field was discovered Nov. 24, 1954, with the completion of Vaughey & Vaughey's No. 1 Downing well, located in the NE NE, Section 34, Township 1 South, Range 56 West, Washington County, in the "D" sand formation. A total of 23 oil wells defined this reservoir, which is primarily a stratigraphic trap. The Monsanto Chemical Co. is the operator of this unit, which comprises 1,280 acres. Primary recovery of oil was estimated at 2,314,000 barrels, with an estimated additional 2,386,000 barrels of oil to be recovered by a water injection program, for a total recovery factor of 50.1 per cent.

The injection plan is a line-type flood on the down-dip edge of the reservoir, utilizing five injection wells at the present time. The injection of water began on Sept. 19, 1958, and as of Jan. 1, 1960, 2,650,842 barrels of water had been injected, with cumulative production figures of 1,825,255 barrels of oil, and 1,870,947 MCF of gas.

### Luft Field

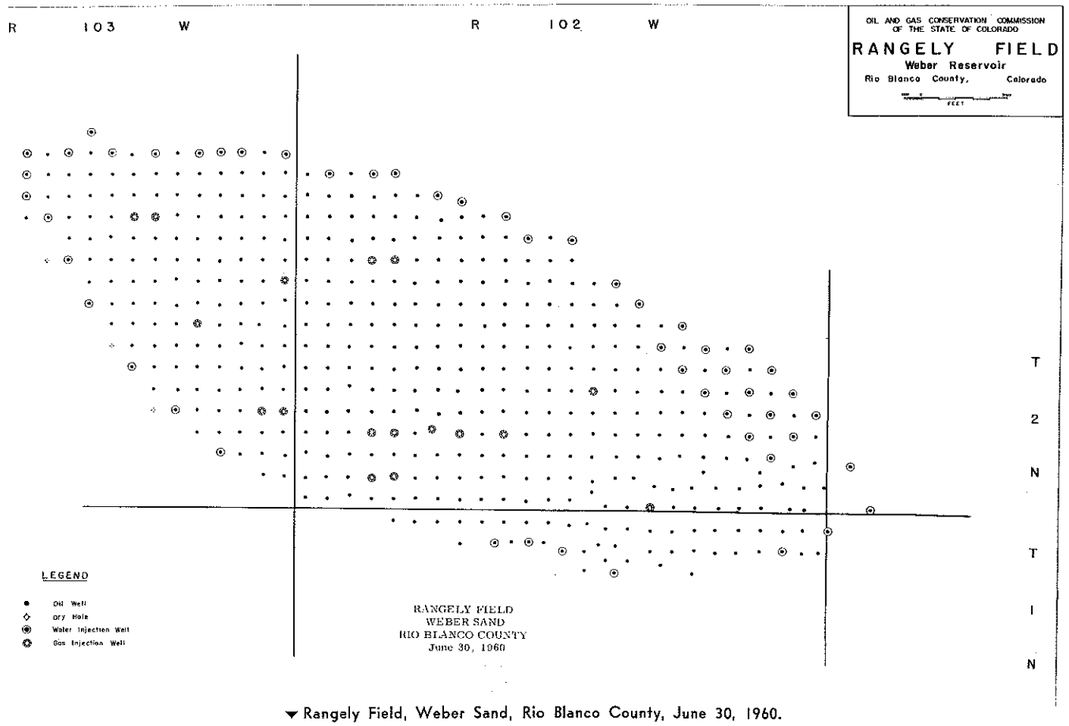
The Plains Exploration Co. discovered this field on April 20, 1952, by the completion of its No. 1 Conrad Luft, Jr. well, NE SW, Section 17, Township 8 North, Range 53 West, Logan County, in the "D" sand formation. This reservoir is a trap created by a permeability pinch-out on a structural nose, and was completely defined by 35 commercial wells. The reservoir underlies 1,080 acres of land, which is being operated by the Shell Oil Co. A peripheral water injection plan is now utilizing 13 water injection wells.

Total recovery of oil from this reservoir is estimated at 2,825,000 barrels of oil, 1,175,000 barrels of which is attributed to the water flood program. Injection of water into this reservoir began on Jan. 23, 1959, and as of Jan. 1, 1960, 1,367,654 barrels of water had been injected, and the cumulative production was 1,714,176 barrels of oil, and 2,615,440 MCF of gas.

### Phegley Field

On June 6, 1955, the discovery well was completed in the "D" sand formation by the Dawson-Cramer Oil Co. This well was the No. 1 Mintie Morgan well located in the SE SE of Section 30, Township 1 South,






▼ Rangely Field, Weber Sand, Rio Blanco County, June 30, 1960.

Range 55 West, Washington County. This reservoir is a combined stratigraphic and structural trap, defined by 14 commercial wells, covering an area of approximately 1,600 acres, which is now being operated by the Champlin Oil & Refining Co.

Primary recovery of oil was estimated to be 1,195,000 barrels, or 20.9 per cent of the original oil-in-place. The additional oil that will be recovered due to water flooding is estimated to be 1,109,430 barrels, with a total recovery being 40.4 per cent of the original oil-in-place, or 2,304,430 barrels. A "five-spot" injection plan is being employed, utilizing 11 injection wells. The initial injection of water was on Oct. 8, 1959, and as of Jan. 1, 1960, 216,367 barrels of water were injected, at which time the cumulative production was 766,012 barrels of oil, and 212,674 MCF of gas.

### Plum Bush Creek Field

On Dec. 7, 1954, the Kimbark Co. completed the discovery well in the "J" sand of this field. This well is the No. 1 Porter, located in the SW SW, Section 30, Township 2 South, Range 55 West, Washington County. This reservoir is a combined structural and stratigraphic trap completely defined by 40 commercial wells, and underlies 2,640 acres of land, with the Continental Oil Co. as Unit operator.

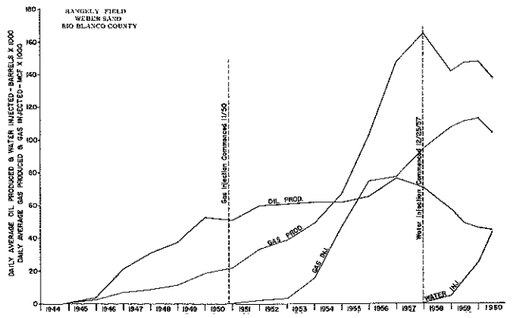
The estimated primary recovery of oil is 8,975,600 barrels, or 23 per cent of the original oil-in-place. An additional volume of 8,582,300 barrels of oil is estimated as recoverable as the result of a water injection plan. A "five-spot" injection program is in use in the field, and 21 wells are being used as injection wells. Initial injection of water began on June 15, 1959, and as of Jan. 1, 1960, there had been 2,237,350 barrels of water injected, with cumulative production figures of 2,983,681 barrels of oil, and 974,207 MCF of gas.

### Rangely Field—Weber

The Weber reservoir of the Rangely field was discovered in August 1933, by The California Co., with the completion of its Raven No. 1 well located in the NW SE of Section 30, Township 2 North, Range 102 West, Rio Blanco County. Because of market conditions, the development of the field did not commence until 1943, at which time oil demands created by World War No. II created development activity in boom proportions. The reservoir is a trap created by an asymmetrical anticline trending northwest southeast, with 1900 feet of surface closure. Dips range from 15° to 35° on the southwest flank, and from 4° to 6° on the northeast side. The top of the Weber formation lies at depths ranging from 5500 to 6500 feet, and is about 1200 feet thick, with the oil-pay interval distributed through the uppermost 550 to 600 feet. The average porosity is about 12 per cent, and the average permeability is from 10 to 15 millidarcys. The oil zone is overlain with a relatively small but significant gas cap in the crestal area.

Productive limits of the field cover an area of approximately 19,000 acres, and was defined by 480 commercial wells.

Injection into the Weber reservoir was commenced Nov. 26, 1950, when The California Co. started gas into a converted oil well as a pilot injection operation, which was a joint venture with the Texas Co., who started gas into a converted oil well on Dec. 4, 1950. A dispersed type of gas injection operation was in full swing by all operators by November 1952, when 18




▼ Rangely Field, Weber Sand. Daily average oil produced and water injected, barrels x 1000; daily average gas produced and gas injected, MCF x 1000.

wells were injecting gas as a result of an order issued by the Oil and Gas Conservation Commission. The field was unitized Oct. 1, 1957, and The California Co., designated as Unit operator, is now injecting both water and gas. The gas injection is slowly being changed, basically, to a crestal type system, now utilizing 16 gas injection wells. The water is being injected through 51 injection wells at the present time, utilizing both peripheral and five-spot systems. Water was initially injected in the reservoir in December 1957.

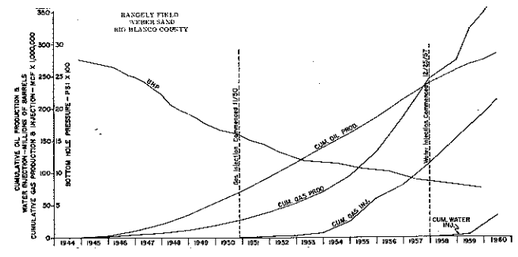
Primary oil reserves have been estimated at 350,000,000 barrels, with an estimated 438,000,000 barrels to be recovered as a result of fluid injection, for a total recovery of 788,000,000 barrels of oil.

As of January 1, 1960, the volume of gas injected was 193,173,430 MCF of gas, and volume of water injected was 8,760,514 barrels. Cumulative production figures as of Jan. 1, 1960, were 276,426,933 barrels of oil, and 349,965,784 MCF of gas.

### Roggen-Southwest Field

The discovery well for the Roggen-Southwest field was completed Nov. 5, 1953, in the "D" sand formation. This well was the Spears Free Clinic No. 1 Zimbleman, located in the SE NE, Section 22, Township 2 North, Range 63 West, Weld County. A total of nine commercial oil wells defined the productive limits of this field.

Only one water injection well is presently being utilized to flood this reservoir. It was estimated that the primary recovery of oil would be 570,000 barrels, and that by the injection of water, an additional 220,000 barrels would be recovered, for a total recovery




▼ Rangely Field, Weber Sand. Cumulative oil production and water injection—millions of barrels. Cumulative gas production and injection—MCF x 1,000,000.

of 790,000 barrels of oil. Injection of water began on Nov. 14, 1957, and as of Jan. 1, 1960, 624,846 barrels of water had been injected into the reservoir, at which time 549,042 barrels of oil, and 1,037,506 MCF of gas had been produced from the field.

### Willard Field

The Willard field, located in Section 19, Township 7 North, Range 54 West, Logan County, was discovered by the Sinclair Oil Co. on Oct. 23, 1951, by the completion in the "D" sand of its W. M. Phillips No. 1 well at approximately 5100 feet. The reservoir is a stratigraphic trap with no significant structure, which is typical of most "D" sand reservoirs in the Denver-Julesburg Basin. The average net pay of the field is approximately 13 feet. Four wells were completed in this field, on 20-acre locations. Recovery estimates for this small reservoir are 92,000 barrels of oil by primary methods, and 73,000 barrels of additional oil by the injection of water, for a total estimated recovery of 165,000 barrels of oil.

The initial injection of water began on Sept. 18, 1956, and as of Jan. 1, 1960, there had been 264,523 barrels of water injected, at which time cumulative production figures were 143,738 barrels of oil, and 153,269 MCF of gas.

### Wilson Creek Field

The Wilson Creek field was discovered by the completion of the Unit No. 1 well located in the SW NW, Section 35, Township 3 North, Range 94 West, Rio Blanco County, drilled jointly by the Texas and California companies. The well was drilled on a closed anticline in 1938, and encountered oil in the basal Morrison formation. Twenty-one commercial oil wells were completed in the Morrison formation, and 18 wells were completed in the Entrada formation. It is interesting to note that the surface elevations of the wells vary from about 7600 to 8600 feet, and for many years, it had the reputation of having the highest producing oil well in the world. The Morrison formation has an effective pay section ranging from 20 to 35 feet, with productive limits of the reservoir extended over approximately 3890 acres.

Gas was initially injected into the Morrison formation on May 14, 1946, and in January 1959, a water injection project was commenced. As of Jan. 1, 1960, 7,094,838 MCF of gas, and 642,523 barrels of water had been injected, with cumulative production from the Morrison reservoir being 25,828,405 barrels of oil, and 13,505,777 MCF of gas.

Discovery of oil in the Entrada formation occurred in March 1941. This reservoir covers an area of approximately 1298 acres, and has a very active natural water drive. To supplement this natural water drive, the operators commenced injecting gas into the Entrada formation in October 1956, and as of Jan. 1, 1960, a total of 1,160,304 MCF of gas had been injected. Cumulative production from the Entrada reservoir, as of Jan. 1, 1960, was 16,680,553 barrels of oil, and 4,242,579 MCF of gas.

### Xenia-West Field—"J" Sand

The discovery of oil in the "J" sand reservoir of the Xenia-West field was made on Dec. 23, 1954, when the Kingwood Oil Co. completed its No. 2 Snyder well, located in the SW SE, Section 2, Township 2 North, Range 54 West, Washington County. This reservoir is a combined stratigraphic and structural trap, completely defined by 15 oil wells. A water flood plan, presently utilizing three injection wells, was com-



menced on Nov. 6, 1959, and as of Jan. 1, 1960, 43,727 barrels of water had been injected.

Primary reserves have been estimated at 380,000 barrels of oil, and it was further estimated that an additional 950,000 barrels would be recoverable by water flood. The cumulative production as of Jan. 1, 1960, was 1,063,260 barrels of oil, and 813,871 MCF of gas.

Included as a part of this article is a tabulation of all producing Federal units in Colorado which are operating without any type of fluid injection, as of Jan. 1, 1960.

More detailed information concerning the subject of this article may be found in a book entitled, "Mineral Resources of Colorado—First Sequel," prepared under the supervision of S. M. del Rio, engineer of mines and mining geologist, Golden, Colo., and published by the Mineral Resources Board of Colorado.

### Acknowledgment

Members of the staff of the Oil and Gas Conservation Commission and Mr. S. M. Del Rio, for allowing this material to be condensed from a section prepared for the book, "Mineral Resources of Colorado — First Sequel," and Mr. Thomas C. Hiestand, consultant geologist, for his discussion on pressure maintenance.

## PRODUCING FEDERAL UNITS BEING OPERATED WITHOUT ANY TYPE OF FLUID INJECTION PROGRAM

| Field | County | Date Unitized | Reservoir | Acreage | Discovery Well | | Discovery Date | To: 1-1-60 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Name | Location | | Cumulative Oil (Bbls.) | Production Gas (MCF) |
| Douglas Creek | Rio Blanco | 2/1/38 | Dakota | 4,411 | Superior Oil Co. #1 Unit | NW SW 5-3S-101W | 7/1/43 | 0 | 6,880,420 |
| Powder Wash | Moffat | 7/1/39 | Ft. Union-Wasatch | 9,018 | Mt. Fuel Supply B. W. Musser #1 | SE NW NE 5-11N-97W | 4/9/31 | 2,886,023 | 50,001,023 |
| Piceance Creek | Rio Blanco | 1/1/40 | Green River | 62,477 | White Eagle Oil Co. #1 Fordham | SW SW 9-2S-96W | 8/28/30 | 0 | 17,293,577 |
| Maudlin Gulch | Moffat | 7/1/45 | Morrison-Sundance | 7,235 | Texas Co.—Frontier Ref. #1 Unit | NW NW 35-4N-95W | Nov. 1947 | 1,195,496 | 259,084 |
| Iles Dome | Moffat | 11/23/45 | Morrison-Sundance | 3,007 | Midwest Oil Corp. Parkinson #4 | SW SE 22-4N-92W | 4/1/27 | 16,001,263 | 1,801,793 |
| Asbury Creek | Mesa | 8/31/49 | Dakota | 720 | Amerada Pet. Co. Asbury Creek Unit #1 | C SE NE 14-9S-101W | 12/16/49 | 0 | 1,794,912 |
| Highline Canal | Mesa | 8/10/51 | Dakota | 10,267 | Amerada Pet. Co. Unit #1 | NW SE NE 2-9S-103W | 12/20/51 | 0 | 227,743 |
| Bar X Anticline* | Mesa | 9/30/52 | Dakota-Morrison | 1,971 | Frontier Ref. Co. Bar X Unit #1 | NW 31-8S-104W | 4/30/53 | 0 | 1,936,319 |
| McCallum | Jackson | 12/29/52 | Dakota-Lakota | 8,292 | Continental Oil Co. #1 Sherman | NW NW 12-9N-79W | Dec. 1926 | 3,458,969 | 285,127,073 |
| Twin Buttes | Garfield | 6/26/53 | Morrison | 3,762 | Greenbrier Oil Co. #1 Gov't. | C NW NW 24-5S-102W | 10/10/51 | 0 | 2,500,093 |
| Ace | Moffat | 6/25/54 | Ft. Union-Wasatch | 6,400 | Mt. Fuel Supply B. W. Musser #1 | SE NW NE 5-11N-97W | 4/9/31 | 96,096 | 3,651,020 |
| Thornburg | Moffat-Rio Blanco | 4/13/55 | Weber-Sundance | 3,760 | Marland Oil Co. Wymore #1 | SW NW 16-3N-91W | 3/27/25 | 753,598 | 8,497,476 |
| Douglas Creek—North | Rio Blanco | 1/18/56 | Weber | 32,356 | Phillips Pet. Co. #1—"A" Douglas | NW NE 19-1S-101W | 4/23/56 | 10,324 | 2,059,108 |

* Unit extends into Utah Prod. Colo. Portion only

# A Profile—

# Golden Cycle Corporation

By MAX W. BOWEN, '24

Golden Cycle Corp. was incorporated in November, 1895 as the Golden Cycle Mining Co., the name changed in April, 1915 to The Golden Cycle Mining and Reduction Co. and in July, 1929, the name again changed to The Golden Cycle Corp. The company began as a mining company, but later entered the milling business and when it was acquired by the Carlton interests, it was still further diversified. The original Golden Cycle Mining Co. was owned largely by the John T. Milliken Interests of St. Louis, Mo., who sold 95 per cent of the capital stock to A. E. Carlton in March, 1915. The Carlton interests then acquired the Midland Railroad just prior to World War I, but during the war all but the branch line, called the Midland Terminal Railroad, was abandoned. Thus within a period of very few years the Carltons had acquired active mines in the Cripple Creek-Victor District, the Golden Cycle Mill and the Pikes Peak Fuel Co. in Colorado Springs, as well as the main railroad serving the District.

The Carlton brothers, usually referred to as A. E. and L. G., were very farsighted and realized that to have a well integrated operation they should have first a continuing source of ore, the transportation facilities to get the ore to their mill in Colorado Springs, as well as ore haulage in the District—which they had developed under the name of The Colorado Trading and Transfer Co.—and a coal mine (Pikeview Mine) to furnish fuel for the roasting of District ores and used later to generate power to run the mill and coal mine. Also, since business was unusually good in the District, they acquired control of a bank which has been the only bank operating in the District for many years.

The Carltons also branched out into the beet sugar business having acquired control and operated The Holly Sugar Corp. and the Franklin County Sugar Co. and other subsidiary companies active in the sugar and petroleum businesses.

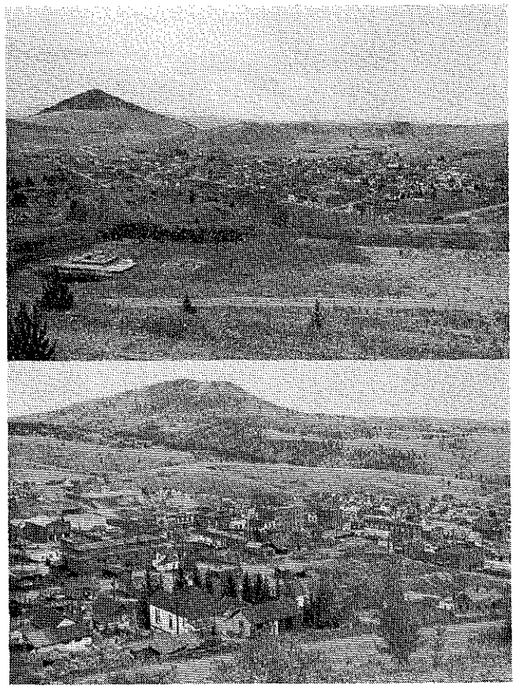
After the closing of the Portland Gold Mining Co.'s Independence Mill at Victor, Colo., in 1928, the Golden Cycle Mill continued to treat all of the ore mined in the Cripple Creek District with the exception of two brief periods when the Cameron Mill

MAX W. BOWEN, '24

### THE AUTHOR

*Since 1929 Max W. Bowen, a 1924 graduate of the Colorado School of Mines, has been in various managerial and supervisory capacities with Golden Cycle Corp. For the past 10 years he has served as vice president and general manager of the company.*

*Mr. Bowen was a member of the Board of Trustees of the Colorado School of Mines for 12 years and this spring received the School's Distinguished Achievement Award. In 1959 he was president of the Colorado Mining Association.*



▼Top picture is a view of Cripple Creek, Colo., taken Sept. 28, 1960. Lower picture shows Victor, Colo., as it looks today.



treated the ore from the Cameron Mine and when the Cripple Creek Mill was built on Globe Hill in the District to treat the ore from the Stratton Estate properties and also that ore from the Carbonate Queen Mine, which was owned by the John T. Milliken Estate. Neither of these mills operated for long, primarily for lack of suitable tonnage.

The original Golden Cycle Mill burned in 1907, and was rebuilt. The new mill had its first full year's operation in 1908, and through 1949 had treated 13,564,982 tons of ore from the Cripple Creek District and 794,280 tons from other districts in Colorado or a total of 14,359,262 tons having a gross value of $182,961,359. This value is based upon $20 per ounce price for gold up to and including 1934, and $35 per ounce value thereafter. It is seen from the total value of all ore shipped from the Cripple Creek District ($436,000,000), the Golden Cycle Mill treated over 40 per cent of this ore. The gold content of the Cripple Creek ore varied from 0.30 ounces per ton to 1.08 ounces per ton. Based on a price of $35 per ounce, the value varied from $10.50 to $37.80 per ton.

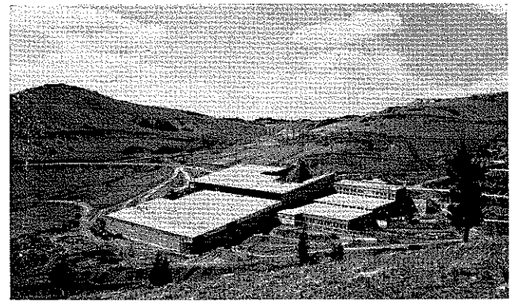
The Golden Cycle Mill installed Edwards-type roasters when it was being rebuilt after the fire, and since this type roaster had proven so successful in Australia where ore similar to District ore was being milled, these roasters gave the best results obtained to that time on Cripple Creek ores. This accounted largely for the success of the early operation of the Golden Cycle Mill and its long continuous operation.

The general process was as follows: Crushing to size of approximately one eighth inch, roasting, wet grinding in cyanide solution to minus 16 mesh, blanketing (amalgamation of blanket concentrates), sand-slime separation and leaching of sands in large diameter sand tanks, thickening and agitating in both mechanical and at times air-agitators, filtering and clarifying gold-bearing cyanide solutions and finally precipitating the gold (and small amount of silver) from the pregnant cyanide solutions first in zinc shavings boxes which were later replaced with zinc dust precipitation presses; the zinc precipitate was refined in Rockwell type furnaces and the resulting bullion was shipped to the United States Mint in Denver.

The Carltons decided in 1929 to add a flotation unit to the Golden Cycle Mill for treating base metal as well as gold-silver ores from other parts of Colorado. The writer joined the Cycle Mill staff at that time and designed such a plant which was installed and it continued to operate until the Cycle Mill was closed in early 1949. This flotation section treated gold, silver, lead, copper, zinc ores, making a shipping grade of lead-copper and zinc concentrates; the flotation tails were treated in the cyanide plant to recover any remaining gold-silver values.

The treatment of base metal ores was discontinued in the middle or late 1930s as the base metal market became so depressed that the flotation plant was used most of the time to treat the Cripple Creek dump and low grade mine ores. The roasting process was thereby eliminated on a large tonnage of head ore, as only about 3 per cent of the tonnage (the pyrite concentrate) had to be roasted.

However, at the beginning of the World War II, it was deemed advisable to again resume the milling of base metal ores produced in Colorado, since by so doing we were permitted to continue to operate the Cripple Creek District on a limited scale. This contributed greatly to the war effort as we were treating approximately 400 tons of base metal ore per day, producing



▼The Carlton Mill started treating ore in May 1951.

lead/copper concentrates and zinc concentrates which were shipped to the smelters. However, at the end of the war the base metal mining industry in Colorado suffered greatly, so we were not justified in continuing treating this type of ore in the flotation plant (which resulted in the Cycle Mill discontinuing the purchase of base metal ores). This section of the mill resumed the treatment of low grade and dump ore until the Cycle Mill was closed.

The Pikes Peak Fuel Division, a wholly owned subsidiary of The Golden Cycle Corp., produced and sold lignite coal at its Pikeview Mine, located just north of Colorado Springs, for many years. During the World War II period, the power plant at Pikeview, having a capacity in excess of 8000 kilowatts, served in a standby capacity to the city of Colorado Springs, thereby insuring the city of sufficient power capacity to serve the numerous armed services establishments in the region.

The Fuel Division also operated a sand, crushed rock and gravel business, supplying most of the concrete aggregate used in the region for the past several years. Prior to abandoning the railroad in 1949, crushed rock aggregate was produced in the Cripple Creek District and shipped to Colorado Springs by rail.

The Corporation operated the Midland Terminal Railroad as a wholly owned subsidiary from the time of World War I until 1949. The main tonnage in recent years was ore, crushed rock and ballast gravel, all of which amounted to as much as 1500-1600 tons per day, plus a freight haul back to Cripple Creek. However, at the close of World War II, the operations in the District had become so disrupted that the tonnage of ore being shipped did not justify the continued operation of the railroad—especially since the railway unions made exhorbitant demands. Consequently, the Corporation abandoned the operation, sold the rail and rolling stock and simultaneously decided to move the mill to the Cripple Creek District.

The Carlton Mill, which was completed and started treating ore in May 1951, was similar to the Cycle Mill, so far as treatment processes used. However, the knowledge gained through processing Cripple Creek ores for nearly 40 years helped to develop new techniques, so that one might say that the Carlton Mill was a newly improved Cycle Mill.

Briefly, the present flowsheet employed in the Carlton Mill is as follows: Ore is crushed and automatically sampled, ground to approximately all minus 80 mesh, subjected to flotation where about 90 per cent of gold values are recovered in 3 per cent of the tonnage as a sulpho-telluride concentrate. This con-

centrate is thickened and filtered and fed as a slurry (78 per cent solids) to a Dorrco-Fluosolids Reactor (roaster) wherein the sulfur and tellurium are eliminated as their respective oxides. This type roasting is called "autogenous roasting" in that the sulfur in the pyrite produces the fuel to complete the roast. The calcined concentrates are then subjected to the usual cyanide treatment and finally join the flotation tailings which have been thickened and agitated in the cyanide Dorr-type agitators. Gold which is recovered from cyaniding the roasted concentrates is precipitated by the conventional zinc dust precipitation presses, but the gold in the low grade cyanide agitator solutions is recovered on fine activated carbon which is fed to the agitator pulp, counter current to the flow of the pulp, a portion of the carbon being screened out of No. 2 agitator and is sent to the refinery or melt room for converting the gold into bullion. This improved process and new equipment in the Carlton Mill permits it to operate much more economically than could have been done in its predecessor, the Golden Cycle Mill.

The Carlton mill has a daily capacity of approximately 1000 tons of Cripple Creek ore, but on account of the depressed condition of the gold mining industry it is presently treating only 200 tons daily. It has treated 1,054,081 tons to date, bringing the combined tonnage treated by the Golden Cycle Mill in Colorado Springs and the Carlton Mill to 15,413,343 tons.

Thus it is seen that The Golden Cycle Corp. has had a very definite influence upon the life of the Cripple Creek-Victor District. There is no doubt in the mind of anyone who has real knowledge of the life, history and the development of the District, that the two Carlton brothers, Albert E., and Leslie G., did more to keep the District going since World War I, than all the rest of the operators who were active in the District since that time. Their influence has continued since their deaths. No gold mining camp has continued to operate at a high peak of production indefinitely. The relatively small (area wise) Cripple Creek District is no exception, and although it has enjoyed a fantastic production in the past, it is now producing on a much smaller scale.

Those who know the District are confident that it will produce many more ounces of gold before it comes to its end. Not only has it produced "millions in gold", but it has also had many illustrious persons and likewise many notorious characters, both types becoming known not only throughout the United States, but in many foreign countries. Many methods of mining and milling have been pioneered and proven in the District and have then become standard practice throughout the mining world. The Golden Cycle Corp. and its personnel have been responsible for many such achievements.*

* The writer desires to express his thanks and appreciation to Merrill E. Shoup, president of The Golden Cycle and Holly Sugar corporations, as well as numerous other Carlton controlled companies—for permission to prepare this paper. Information included in this paper was partially obtained from the following publications: *The Official Manual of The Cripple Creek District* (1900) by Fred Hills, EM; *Geology and Gold Deposits of the Cripple Creek District, Colorado,* (1906) by Lindgren & Ransome, USGS; Mining in Colorado, U.S. Prof. Paper 138, (1926), by C. W. Henderson; several Papers by Loughlin and A. H. Koschmann, USGS (1926-1949), and Annual Reports of The Golden Cycle Corporation. Some of pictures in the October 1960 issue of The Mines Magazine were supplied by Raymond G. Colwell, retired, U.S. Forestry Service.





# A Fifty Year Retrospect— THE MINES MAGAZINE

By DEAN JESSE R. MORGAN

DEAN JESSE R. MORGAN

Any worthwhile publication holds a unique position in the field of its endeavor. It is an encyclopedic source of information for people about people and events; it is a mouthpiece for men with a message; it inspires plans for peaceful propaganda or suggests questionable themes to arouse discussion; it is a policy builder for the future. But even with these positive paramount factors in the blueprint, effective service will be nil without forceful and constructive aggressiveness.

In reviewing the history of the Colorado School of Mines Alumni Magazine in its semi-centennial celebration, I believe the Magazine rates high in all requisites for approved accomplishment. In the Mines Library, there are 58 bound volumes of the Magazine containing every issue from its initial number in October 1910 through September 1958 with the remaining issues to September 1960 yet to be bound. It is a 50-year history of a World School of Mineral Industries—The Colorado School of Mines. These volumes are replete with records of events and engineering articles pertinent to the Institution they represent. They also serve as a human document devoted to the activities of students, present and past, whose accomplishments have made "Mines" a school of international repute.

The Alumni Magazine is the voice of the Alumni. The preamble of its constitution reads: "The object shall be: The cultivation of friendship, acquaintance, mutual aid, and the elevation of the reputation and standards of the Alma Mater." These principles, sparked by the Alumni, have been maintained through the past 50 years. Their magazines record a wide range of material which appeals to the average reader as well as to the engineering group. They connote a deep-seated influence in the field of mineral industry and in the art of living for almost two generations. They emphasize technical articles relating to the progress of mineral industries, advancement of modern engineering education, and the encouragement of college activities which build for active citizenry in post-college life.

The Colorado School of Mines always has been known as a friendly school. In the first issue of the Magazine there is a column captioned "Personals" which has been continued for 50 years. It now has the heading, "Class Notes" and is perhaps the most carefully read section in the Magazine. Perhaps, Mr.

## THE AUTHOR

*Jesse R. Morgan, beloved dean of faculty at the Colorado School of Mines from 1926 to 1946, was employed after his "retirement" by the Colorado School of Mines Research Foundation for three years and later served on the faculty at Regis College for another two years.*

*His association with Mines began in 1923 when he became field secretary and head of the department of English and economics, in which capacities he continued until 1926, when he became dean of the faculty and head of the department of languages. From 1926 to 1942 he was director of the summer session at the School of Mines.*

*Dean Morgan's work in the field of education began as assistant principal of the Saguache, Colo., high school from 1900 to 1904. He served first as principal of the Trinidad, Colo., high school (1905-09) and later (1909-18) as superintendent of schools in that city. From 1918 to 1923 he was made assistant in charge and supervisor of professional training for Colorado, Wyoming, New Mexico, and Utah for the rehabilitation division of the U. S. Veterans Bureau.*

*The author of numerous magazine articles and of several books, he is a member of innumerable educational and engineering societies.*

*Student editors of the 1960 Prospector dedicated the publication to him in these words:*

*"Since he joined the Colorado School of Mines faculty in 1923, Dean Emeritus Jesse R. Morgan has worked diligently and effectively as instructor. His influence and example are guide posts to scholastic achievement. We take great pleasure in dedicating this 1960 Prospector to a man who has dedicated his life to the ideals of higher education, Dean Emeritus Jesse R. Morgan."*

Miner, you have not heard from that four-year-Mines buddy of yours for years. You have wondered where he is and what he is doing. Please refer to "Class Notes." If he is to be found, he will be listed. You may recall that your roommate was in Tulsa last year. Today he may be in Leopoldville. Your magazine will tell you his change of address and what he is doing.

The MINES Magazine has specialized always in information relative to every phase of the mineral industry. The first issue carried a contributed article on "Ore Dressing and the Metallurgical Plant," and each number since has contained one or more papers written by Mines men or by other engineers of experience. This free information is doubly valuable, serving the donator and the public in one gesture. A supply of articles is kept moving through personal contacts and requests by the editor.

The following list of articles were published at different times in the Magazine from 1910 to 1960, and are listed as indicative of the type of subjects presented and of their practical application to current problems:

| Date | Title | Author |
|---|---|---|
| Sept. 1910 | New Ore Dressing and Metallurgical Plant of Colorado School of Mines | F. W. Traphagen C.S.M. Faculty |
| Jan. 1915 Dec. 1915 | The High Cost of Living Features of Coal Mining in Utah | Henry J. Wolf, '03 A. C. Watts, '02 Utah Fuel Co. |
| Jan. 1925 | What a Geologist Means When He Says "Evolution" | J. Harlan Johnson C.S.M. Faculty |
| | Health Hazards in the Mining Industry | R. R. Sayers Consultant |
| Jan. 1930 | Calculations of Gas Analysis | R. A. Baxter C.S.M. Faculty |
| | Science as a New Feature | Israel Klein Science Editor NEA, Cleveland, O. |
| | Trend of Flotation | A. J. Weinig, '08 Experimental Plant |
| | Oil and Gas Flow Through Reservoir Rocks | Byron Boatright C.S.M. Faculty |
| | Colorado and Its School of Mines | M. R. Budd, '24 |
| Jan. 1940 | Mitchell's Marble Mountain | B. Bartholomew Vermont Marble Co. |
| | Strategic Minerals | John W. Finch Bureau of Mines |
| | Interesting France | J. Harlan Johnson Merle K. Johnson |
| | Slushing and Scraping | Charles Cutler, '39 Howe Sound Co., Mich. |
| | Cogne, Italy—Europe's Highest Mine | R. D. Grillo Italian Consul |
| | Sedimentation Studies in Soil Conservation Service | Jack L. Hough Geologist, Soil Conservation Service |
| | Early Day Gold Mining in Brazil | Alan Caplan Mineralogist, N. Y. |
| Jan. 1960 | Geochemical Prospecting | Harold Bloom USGS Geochemical Program |
| | Carnival in the High Andes | Ben R. Hudson, '45 U. N. Bureau Technical Operations |
| | Fundamentals of Electrical Concentration of Minerals | James V. Lawver, '43 International Minerals and Chemical Corp., Fla. |
| | Mineral Development and Research | V. L. Mattson, '26 Manager Mineral Development and Research, Kerr-McGee |
| | Explosive Working of Metals | John Rinehart C.S.M. Faculty |

Since the first year of its existence, The MINES Magazine has served the Alumni and its supporting friends and has been the promoter and defender of legitimate projects for the advancement of its Alma Mater. Mistakes of commission and omission have been made, but all were human and forgiveable.

One of the most outstanding and far-reaching services of The MINES Magazine toward the growth of the school and the maintenance of good fellowship of its Alumni has been its activity in the organization of local and foreign sections of the Alumni. The first section on record was in New York, June 1926. Under the able guidance of Harry J. Wolf, '03, this group had been meeting informally for many months, but in June 1926, the following resolution was passed:

"Resolved, That the New York Section propose to the Editor of the Colorado School of Mines Magazine, that a special department of the Magazine be set aside for news relating to the various local sections of the Alumni Association with the view to encourage the organization of such local sections and to the stimulation of their activities."

This resolution was an incentive for action and in the fall of 1926, three local sections were organized: Colorado, William M. Traver, '16, Secretary; New York, Harry J. Wolf, '03, Secretary; California, Los Angeles, Southwest Section, F. A. Brown, Secretary. In the August issue of 1960 there are listed 29 Local Sections in 19 states and Washington, D. C., and seven Sections in six foreign countries.

Comparisons may be helpful if the purpose is constructive. Present readers are familiar with the 1960 MINES Magazine. As a matter of interest, the following items are taken from the first issue, 50 years ago:

The first editor and manager of the Magazine was Jay Lonergan of the class of 1905. He is the only living member of the original staff and is living in Wenatchee, Wash.

Athletics always has been a live and interesting activity at Mines, and the Magazine has been an enthusiastic booster. The October 1910 issue reported two games: Mines 0—Utah 6, and Mines 10—Colorado Aggies 6, with this comment on the Aggie game, "Outweighed, outroughed by the husky warriors from the School of Mines, the farmers from Agricultural College went down to defeat."

The Thanksgiving game was to be played with Boulder in Denver. A rally was held in the Integral Club.

The "Personal" column (now "Class Notes") carried news of graduates from 1894 to 1910.

Brief write-ups were included under the following headings: YMCA Notes; Abstracts of Current Articles and New Books; College Notes; one technical article and an editorial by Jay Lonergan were also included.

A note of comparative interest was a request from the Alumni for the addresses of 10 graduates from whom no word had been received for several years. The 1960 Directory is requesting the whereabouts of 345 "lost" graduates.

Another subject, still presently active, was a news item to the effect that the Capability Exchange "since August 15, 1910 had received requests for 15 men for engineering jobs in the United States and Mexico, six of which had been filled." (During 1959-60 over 100 requests were received and 40 to 50 men were placed.)

The following notice appeared in the October 1910 Magazine:

WAKE UP MINERS
SEE IF YOU CANNOT AROUSE
SOME OF YOUR MINES SPIRIT
AND HELP WIN THE CHAMPIONSHIP
THIS YEAR.

(Similar appeals have been appearing in the Magazine and the Oredigger for the past 50 years.)

The influence of a carefuly edited publication cannot be over-estimated when its objective is special topics of interest to a special professional group. The MINES Magazine is classified in such a category. Its method of circulation is most unusual and effective. Its message is broadcast primarily by the printed word. This is only the beginning. Where The MINES Magazine is, there also is a Mines-booster and where there is a Mines-booster, there also will be a MINES Magazine. The setup is perfect: a material magazine and a forceful human-distributor become partners in an aggressive combine in business for an engineering school of distinction.

The circulation of the first issue was limited, but after 50 years, 3925 copies are mailed each month to every State in the Union and to 126 foreign countries. Each person receiving one of these 3925 magazines is personally interested, and each person to whom he talks about its contents becomes interested to a greater or less degree. Our 50 States of the Union constitute the greatest area of interest, but the latest Mines Directory reports that 392 graduates of Mines are living in 45 different countries and are receiving their mail at 126 separate postoffices. Any industrial organization carrying on a business with a corps of 392 patrons in 45 different countries, rightly would expect marvelous returns.

The Colorado School of Mines—with The MINES Magazine as a keynoter backed by over 5,000 alumni and by many of the more than 10,000 X-Miners who have registered at Mines in the past—has an undisputed opportunity to rise above and even beyond our coveted Horizon Plan which outlines the planned advance of the Colorado School of Mines into an even more brilliant future.

## TENTH ANNUAL DRILLING AND BLASTING SYMPOSIUM AT MINES

*(Continued from page 13)*

detonation velocity through control of mass reaction rates by particle size distribution and hydrodynamic parameters by control of the loading density. Though interdependent, a well defined relationship between sensitivity and detonation parameters has not yet been established.

*Ammonium Nitrate Slurry Blasting Agents* by Dr. Melvin A. Cook of the University of Utah described the most recent developments of the slurry blasting agents including, in addition to recent field experience, new formulations of ever greater economic potential, fume studies, detonation pressure measurements by the new "aquarium" method, and sensitivity results by the new high velocity impact method. Comparative results reveal a significant superiority of the slurry type blasting agents over other commercial types. He said that the new era in blasting inaugurated by the introduction of "prills and oil" has been greatly strengthened and expanded by the introduction of the slurry blasting agents.

*Post-Shot Exploration of Fracture Pattern Surrounding a Contained Explosion in Salt* by Dr. Nicholas M. Short, geologist with Lawrence Radiation Laboratory, described a study recently completed as part of the Plowshare Program of industrial applications of nuclear explosives. The fracture patterns, plastic deformations and physical changes produced in the surrounding medium by a completely contained high explosive detonation were outlined. By the use of carefully controlled mining methods, it was possible to re-enter the region of the explosion where large numbers of cracks delineated by traces of carbon were noted. Dr. Short also drew some interesting conclusions about the effects of a completely contained explosion in salt.

*New Drilling and Blasting Techniques for Longer Rounds* by Karl-Fredrik Lautmann of Sandvik Steel Works Co., Ltd., discussed the reasons for the limited advance per round in precision drilling for all types of drill round cuts. Possible advances with different types of cuts were considered, including some theoretical aspects of the V-cut. Lautmann told of the superior results obtained with the cylinder cut and discussed the different methods used to drill the center hole. A new type of cylinder cut, the Coromant cut, using 2¼" center holes and designed for hand-held airleg rock drills has given advances of up to 13 feet per round. Production results, time studies and advantages of this method were described.

*Inclined Drilling in Quarry and Open Pit Operations* by Dr. B. J. Kochanowsky of Pennsylvania State University covered the theory and practice of inclined drilling as applied to surface mining. Dr. Kochanowsky described the results obtained with inclined drilling and explained its advantages in order to arouse interest among engineers and managers in a broader application of this method. He said that since 1953 an ever-increasing number of mining companies have become interested in the use of bore holes drilled at angles of 45° to 70° to the vertical and parallel to the bench face.

*Drill Pattern and Initiation-Timing Relationships for Multiple-Hole Blasting* by Richard L. Ash of Missouri School of Mines explained that blasting practices today require much more control than in the past due to changes in products and environment for use. In all multiple-hole blasts, initiation-timing and drill-hole placement patterns must conform to rock structural characteristics in definite basic relationships. Multiple-hole blasts perform best when each hole and each row can complete their respective tensile and shear stressing processes, to provide uniform displacement and fragmentation. He gave examples of many basic patterns for the time, direction, and linear proportioning of controlled balanced-blasting, and discussed the determination of spacing dimensions relative to that of the burden. He also explained the controversial subject of whether square or staggered multiple-hole arrangements are to be preferred.

# WITH THE MANUFACTURERS

## Equipment News

In these columns the latest in equipment of interest to our readers is reviewed. Many readers request additional information and prices. For their convenience each article is numbered. Fill in the number on the coupon at the bottom of the page and mail your request to Mines Magazine, checking information requested.

### Pipe Turning Mechanism (1006)

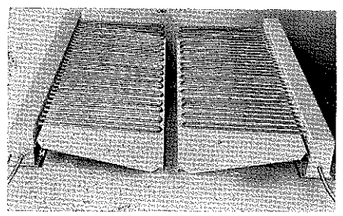
A new pipe turning mechanism, developed by Lake Shore, Inc., mining equipment firm, has extended the life of taconite tailings pipe and speeded turning operations. The new Lake Shore device attaches to a front end loader at the fork ends and, by means of a ratchet and pawl arrangement, holds the pipe in place while turning it. The device handles lengths up to 1200 ft. The ratchet fitting attaches to the pipe at the flange with the aid of an alloy pin through a single bolt hole.

### Shuttle Car (1007)

Capacity, power and structural strength are features of the new, big AC shuttle car offered by the Goodman Manufacturing Co. for use in mining coal, metals and non-metallic minerals. With a basic height of 44" or 49" and a width of 96" or 106" the car is easily capable of transporting 10 tons of coal or 13 tons of rock, a payload that can be increased with the addition of 6" or 12" sideboards. An 80 HP traction motor with two sets of windings provides for two-speed operation (2½ mph or 5 mph) without the use of clutches and torque converter, and also permits the use of simple electrical, mechanical and hydraulic systems.

### Electric Undercar Heaters (1008)

The long-time need of a device for quickly and economically removing ice, snow and frozen residual material from railway hopper cars before loading, has been met by the introduction of a specially designed electric radiant heater by Radcor, Inc. With this new Radcar unit installed, it is a simple matter to clear the car bottom of snow, ice and frozen residue in a matter of minutes, thereby completely emptying the car for a full payload.

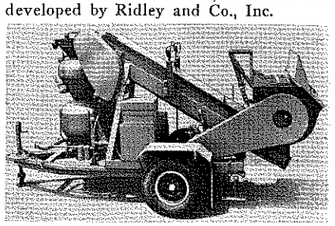


### New Explosives (1009)

Cyamon S blasting agent and Cyamon S Primer, two new explosives developed for use in seismograph exploration are now available from the Explosives & Mining Chemical Dept. of American Cyanamid Co. The new blasting agent is a nitro-carbo-nitrate that requires a primer for detonation. Packaged in hermetically sealed cylindrical containers, Cyamon S blasting agent has a moderate to high degree of resistance to water pressure and stands up well during storage. Cyamon S primer can be coupled to Cyanamid's new blasting agent through the threaded connections of its cylindrical metal package.

### Underground Guniting Rig (1010)

Mine and tunnel crews can now roll a compact new guniting plant right into underground work areas and shoot their own concrete into place at the rate of six to 12 tons an hour. The rig makes short work of reinforcing drifts, shafts, stopes and pillars. It brings an inexpensive concreting process underground where it stabilizes the ground, reduces water and air slacking, and thus eliminates the need for the majority of the normal roof bolting and timbering. Designated as Model C-3 UG, the unit was developed by Ridley and Co., Inc.



### Hole-Saver (1011)

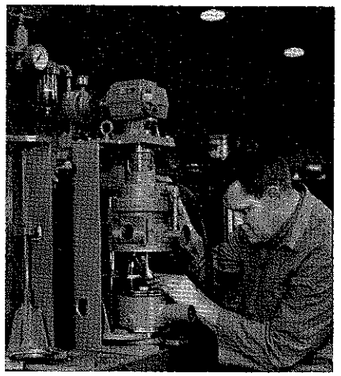
Rock drillers faced with the problem of reclaiming lost bits, couplings and broken steele, to save the hole, now have Brunner & Lay Hole-Saver tools available in all popular connections including the new HL-14, HL-16 and HL-17 threads, for pulling out related sizes of bits, etc., Brunner & Lay, Inc., 9300 W. King St., Franklin Park, Ill.

### Power Shift Transmission (1011A)

Quality production of a new power shift transmission for off-road vehicles has started at Clark Equipment Co. Designated the 200 series, the new transmission is designed for use with the Clark 270 series torque converter. It will be used with gasoline or diesel engines of about 200 lb. ft. of torque output. Major feature is a system of four hydraulic clutches.

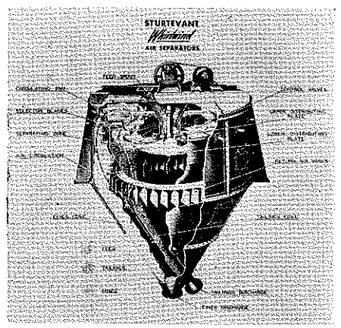
### Vertical Planetary Mixer (1012)

Besides simplifying experimental compounding, the mixing results of a true production machine can be produced on a miniature scale to formulate pilot and production operation data with a new, pint-size, vertical planetary mixer announced by the Chemical Machinery Division of Baker Perkins Inc. Believed to be the smallest of its type available for laboratory use, the tiny mixer is a general purpose unit capable of handling a wide range of products employed in chemical compounding.



### Air Separators (1013)

Schematic of Sturtevant Air Separator, manufactured by Sturtevant Mill Co., Dorchester, Boston, Mass. Canadian Johns-Manville Ltd. is using six such units in the selection of asbestos fiber at Asbestos, Quebec. A complete line of auxiliary crushing, grinding and blending machinery also is engineered at the Dorchester plants of Sturtevant.




MINES MAGAZINE, Golden, Colorado

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# CATALOGS and TRADE PUBLICATIONS

**FOR YOUR CONVENIENCE**

Send your publication to The MINES Magazine, Golden, Colo., for review in these columns. Readers will please mention MINES Magazine when requesting publications from the manufacturer. Readers may order publications from this office by giving index number. These publications are FREE.

(1061) CONSTRUCTION INDUSTRY. A 12-page bulletin by Le Roi Division, Westinghouse Air Brake Co., Sidney, Ohio, with new product information about mining, construction and quarrying markets. The bulletin includes information on the "Trac-Newmatic," a self-propelled blast-hole drill, as well as specifications for stationary compressors from 25 to 100 horsepower.

(1062) CAST-TOOTH SPROCKETS. A 12-page book, No. 2867, just released by Link-Belt Co., Prudential Plaza, Chicago 1, Ill., lists stock sizes of cast-tooth sprockets available for immediate delivery. Basic types of sprockets illustrated include arm center, plate center, segmental and split rim sprockets and traction wheels. These in turn are available in materials that include a chilled cast, wear-resistant tooth surface; gray iron; cast steel; stainless, aluminum and many other metals and alloys.

(1063) MINE LOAD CENTERS. Two-page bulletin, GEA-7306, by General Electric Co., Schenectady 5, N. Y., lists applications for GE's portable a-c power supply units rated 45 through 600 kva with a primary voltage of 24000, 4160, or 7200 volts and a secondary voltage of 480Y/277 volts. Illustrated publication discusses customer benefits as well as construction and operating features.

(1064) D-H ALLOY CRAFTSMAN. A four-page publication, by Driver-Harris Co., Harrison, N. J., Vol. 20, No. 1, is devoted to Nickel Alloy Applications.

(1065) SPECIFIC GRAVITY TRANSMITTER. A two-page bulletin by Weighing & Controls (Div. of CompuDyne Corp.), Industrial Park, Hatboro, Pa., describes the W & C weight transmitter-in-process measurement, features, how it works, accuracy, and prices. A standard W & C "Uniforce" Weight Transmitter is coupled with a specially designed steel tank, so that a constant volume of the slurry or liquid is weighed. The weight of a constant volume of material is defined as density, and is directly proportional to the specific gravity of that material. The tank size and calibration of the scale can be chosen so readout is directly in specific gravity units, or density.

(1066) AIR LINE OILERS. Bulletin LO-2, Fifth Edition, by Gardner-Denver Co., Quincy, Ill., gives operational and specification data on oilers with half pint to five gallon capacities. The bulletin describes the company's various size oiler models and lists the data on care and operation of pipe lines, hoses, and lubrication. Graphically illustrated, the brochure points out the advantages of line oilers.

(1067) INSIDE STORY. A booklet by Caterpillar Tractor Co., Peoria, Ill. No. DE040, points up some of the differences, both large and small, which mean longer life and greater production for engines when original manufacturers' replacement parts are used.

(1068) AIA FILE. An eight-page brochure, Form No. 144, by Filon Plastics Corp., Hawthorne, Calif., provides builders, contractors, architects and engineers with complete technical data and product information. It incorporates full testing details and conclusions about "Filoplate," a recently developed panel structurally guaranteed for the lifetime of any installation, and specifications for "Rololite," the first cross-corrugated panel in roll form.

(1069) LOADING VALVES. Bulletins F-49 and SRBc 61-60 by OPW-Jordan, Cincinnati 13, Ohio, gives details of all improvements, features, cut sections and engineering information about improvements made in the No. 417 and No. 418 loading valves from OPW-Jordan. As redesigned, the loading valves have kept pace with the trend toward higher flows and pressures in modern bulk loading practices.

(1070) LAB TESTING UNIT. Bulletin L1-B4 by WEMCO, San Francisco 7, Calif., describes the "Mineral Master," a multiple purpose lab machine for flotation, agitation and attrition batch testing.

(1071) INDUSTRIAL CHEMICALS. Bulletin K6, by Nalco Chemical Co., Chicago 38, Ill., presents a broad spectrum of cationic and nonionic surface active agents, ranging from fatty nitrogen derivatives to polyether alcohols. Physical characteristics of the chemicals and some of their uses are included.

(1072) FURNACE FUME. An eight-page bulletin, by Wheelabrator Corp., Mishawaka, Ind., discusses the three accepted hooding methods for controlling fume from electric arc melting furnaces. Operating principles and advantages of each system are described to serve as a guide in evaluating each hooding method for a particular furnace fume control application. Illustrations of typical installations and diagrams are included to show features and uses.

(1073) FITTINGS AND FLANGES. Folder FB-502A, by The Babcock & Wilcox Co., New York, N. Y., is an eight-page booklet describing seamless welding fittings and flanges in carbon, alloy and stainless steels. The booklet includes charts of standard sizes and schedules according to ASA B36.10 and ASA B36.19. It also contains a comprehensive breakdown of dimensional tolerances, illustrations of the most commonly produced fittings and flanges, and a chart of the sizes and types available.

(1074) RE-PORTER. A 12-page publication, by H. K. Porter Co., Inc., Pittsburgh, Pa., October 1960, contains short illustrated articles covering activities of the various companies associated with the H. K. Porter Co.

(1075) PURE OIL NEWS. November 1960, by The Pure Oil Co., Palatine, Ill., is a 32-page magazine published monthly for company employees. Contents in this issue includes Man of the Month, Thanksgiving Day, 705 Computer Is a Work Horse, API Meritorious Safety Award, They Are Informed, Unusual Museum Within Easy Drive of New General Office, Hitting the Line for Pure, etc.

(1076) SPECTROPHOTOMETERS. Bulletin 738, by Beckman Scientific & Process Instruments Div., Beckman Instruments, Inc., Fullerton, Calif., describes accessories that have been precision engineered to adapt DK spectrophotometers to the requirements of such analyses as flame photometry, fluorometry, reflectometry, spectroradiometry, colorimetry, solid phase studies, reaction rate studies, and turbidity observations.

(1077) LATHES AND RADIAL DRILLS. Bulletin No. 144, dealer: Mine & Smelter Supply Co., P.O. Box 9041, Denver 10, Colo., describes briefly the mammoth Super Tailstock now furnished on American De Luxe Model 32" Style "I" and 40" Style "J" Lathes.

(1078) RUBBER EXPANSION JOINTS. Catalog M685, dealer: A. J. Philpott Co., 1816 California, Denver, Colo., is an eight-page publication describing the uses, advantages, general construction features, installation and maintenance suggestions, recommendations for Raybestos-Manhattan rubber expansion joints, flexible rubber pipe and acid hose.

(1079) SIDE DUMP WAGONS. Bulletin D-73, by Differential Co., Findlay, Ohio, is a four-page publication presenting the many advantages of its hauling and dumping equipment patented under the name of "Wagon Train." Slogan for "Wagon Train" is "More tons per trip; a convenient way to unload—side delivery—keep going; leave road clear for next wagon train."

(1080) CYLCAP. Bulletin No. 882, by Denver Fire Clay Co., Denver, Colo., describes Cylcap, a specially compounded product with over 25 years of service in concrete testing. It sets to over 10,000 PSI within five minutes after pouring, forms a perfect union with test cylinder ends. The bulletin also gives laboratory procedure for use of Cylcap.

(1081) OAKITE NEW SERVICE. Vol. XLIV, Nos. 9-10, by Oakite Products, Inc., New York, N. Y., contains articles and information on New Lives for Big Cats, Precious Metal Plating for the Electronics Industry, Bottling Plant Studies in Sanitation, How Important Is Good Radiator Service, New Products and Developments.

(1082) HARDROCK DRILLING. Bulletin SP-3286, by Chicago Pneumatic Tool Co., New York 17, N. Y., is a 16-page publication of detailed description and illustrations of the newest drilling equipment on the market. The bulletin features equipment covering practically every phase of mining. Crawler-mounted rotary drill rigs, Tracdrils, In-Hole percussion drills, Air-Blast Bits, Diamond Drills, hard hitting Sinker Drills, easy handling demolition tools, portable compressors, sump pumps, etc.

(1083) Brochure S-1013, by American Optical Co., Southbridge, Mass., describes a new line of six basic models of safety glasses offered in smoke, pink crystal, mahogany, two-tone smoke on crystal, two-tone mahogany on crystal and two-tone black on crystal. Durasafe provides a complete range of bridge and eye sizes to fit everybody—with and without side shields.

(1084) SLINGS, RINGS, LINKS AND HOOKS. A 16-page illustrated brochure giving the specifications and working load limits for the company's line of alloy chain slings, rings, links and hooks has been issued by Jones & Laughlin Steel Corp., Muncy, Pa. The new brochure describes the advantages of alloy chain slings over wrought iron or carbon steel chains. It also presents the design advantages of Jallink, the company's permanent, tamper-proof alloy chain connector link. How to use and maintain chain slings and their attachments is concisely explained. Four points of good periodic inspection program and the danger signals to look for in a link-by-link inspection are listed. A page is devoted to selecting and ordering the correct chain slings.

(1085) FALLOUT SHELTER SURVEYS. A 60-page publication, NP-10-2 National Plan Appendix Series, by Executive Office of the President, Office of Civil and Defense Mobilization, providing architects and engineers with procedures and standards for (1) evaluating the fallout shelter potential of existing structures, and (2) modifying structures from the standpoint of radiation shielding and habitability to improve their worth as fallout shelters. These same procedures and standards may be used for preliminary design to incorporate shelter into new structures. Emphasis in this guide is on procedures for collecting, analyzing, and summarizing information on potential shelter areas.

MINES MAGAZINE, Golden, Colorado

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# PLANT NEWS

### Daman, Jr., Assumes New Duties At Denver Equipment Co.

Arthur C. Daman, Jr., has recently returned to Denver from Lima, Peru, where he organized and managed Denver Equipment Co., (Peru) S.A. for the past three years.

In his new assignment he will be attached to the International Sales Division headquartered in Denver.

ARTHUR C. DAMAN, JR.

His knowledge and grasp of the problems of the industry well qualify him for his new position. He will be responsible for all sales activities in Latin America, including Mexico, Central America, and South America.

### Sodium Chlorate Plants Increase Production

Two major construction projects at American Potash & Chemical Corp's sodium chlorate plants have just been completed, it was announced by Peter Colefax, president and chairman of the board.

Production capacity at the firm's Aberdeen, Miss., sodium chlorate plant was increased 50 per cent when an expansion project, begun last spring, went on stream.

A week earlier, work was completed on an extensive modernization program involving replacement of the sodium chlorate recovery system at the Henderson, Nev., plant.

### Lindsay Made Responsible For Coke and Pig Iron Sales, Crucible Steel Company

Martin N. Lindsay has been made responsible for the sales of coke and pig iron for the Crucible Steel Co. of America. Mr. Lindsay will be located in Crucible's new general and executive offices at Four Gateway Center, Pittsburgh, Pa. His new duties will supplement his activities in Crucible's Raw Materials Section.

### Nuclear Power Plant Shipped to Greenland

An atomic reactor, built by ALCO Products, Inc., at a cost of $3.2 million, is being shipped to Greenland, where it will be installed to provide heat and power for Camp Century, a remote base of the Army's Research and Development Center.

The power plant, known as the PM-2A, will be the first remote-area installation of its kind. It is being watched closely as a demonstration of the logistical advantages of the use of nuclear power at remote bases of the nation's defense network.

It has been pointed out that at some arctic installations 70 to 80 per cent of the supply effort involves the transportation of fuel for the generation of power. More than 850,000 gallons of conventional diesel fuel, contained in more than 15,500 drums of 55 gallons each, would be required to supply Camp Century with heat and power for a year, whereas the same heat and power will be available from a single loading of fully enriched uranium fuel which will be shipped to Greenland in 11 steel drums with an equivalent 55-gallon capacity.

The plant will deliver about 1560 net kilowatts of electricity, plus about 1 million Btu's of steam for heating.

Polar research studies by a team of 100 engineers and scientists are being conducted at Camp Century.

### Airdrill International, Inc. Appointments Announced

A Canada-based officer and a New York representative have been announced by Robert W. Sneed, x-'49, president of Airdrill International, Inc., of Denver, Colo.

A. G. G. de Chastelain, Calgary, Alta., Canada, has been named vice-president of Airdrill International, air/gas drilling consultants. de Chastelain will remain based in Calgary where he is vice-president and general manager of Wellsite Air Services Ltd.

Contact representative for New York City is Fred J. Jobst, vice president of Val R. Wittich, Inc., 30 Rockefeller Plaza. According to Sneed, Jobst will process inquiries and initiate consultation services with National and Private oil company officials in the New York area.

### Polyethylene Film Used As Seal in Coal Mines

One of the newest applications for polyethylene film, the versatile plastic which has found wide and ever-increasing utility in many fields, is its use as a seal over stoppings in coal mines.

In its Robena Mine No. 3 in Greensboro, Pa., United States Steel Corp. is experimentally trying 6-mil. clear Durethene polyethylene film, a product of the Plastics Division, Koppers Co., Inc., to limit air leakage on metal stoppings used to direct vital air currents to the working face.

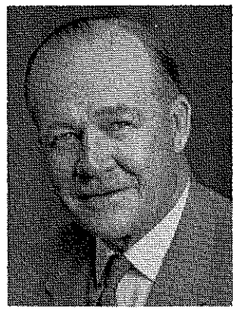
### Knudson Named Sales Agent For Vascoloy-Ramet Corp.

Harlan K. Knudson of Denver has been appointed sales agent for mining tools by Vascoloy-Ramet Corp., Waukegan, Ill. He will supervise sales and distribution of V-R bits throughout Colorado, Wyoming, and Utah.





# FROM THE EXECUTIVE MANAGER'S DESK



COL. WENDELL W. FERTIG

### Christmas Greetings

We would like to send every graduate a personal Christmas card, telling each one how much we have enjoyed the past year. The growing support has become a tangible asset that indicates that the 50th Anniversary of The MINES Magazine is the starting point for a larger and better magazine which will, in turn, reflect the growing strength of the Alumni Association. The past months have proven that there is great interest in The MINES Magazine and the Alumni Association. I want you to know that we would like to tell each of you these facts in a personal message, but the cost of first class mail and the attendant problems of preparation are just beyond our strained finances at this time. As a result you will have to be content with this message:

*A Merry Christmas and Best Wishes*
*For a Prosperous New Year*

From the Officers and Members of
the Executive Committee

### Reminder

If you have not sent in the Proxy which you received with your dues notice, please do so without further delay. Your signed approval will allow the proposed Amended Articles of Incorporation to be adopted at the annual meeting, which will be held at the Lakewood Country Club on Thursday evening, Jan. 26, 1961.

### Progress

The reports that will be given at the annual meeting will show the status of your organization and what has been accomplished during the past year. Membership has increased, as has circulation of the Magazine, yet this was not enough to completely defray the added expenses involved in revitalizing The MINES Magazine and increasing our services to the members. Although the final figures may be somewhat different, I believe the deficit for 1960 will be about $4,000. To break that down quickly, the loss consists of approximately $2,000 additional printing costs (600 pages in 12 issues in 1959 compared to 740 pages in 1960); $1,200 in advertising solicitation costs, $500 additional in postage, due to increased correspondence and a heavier magazine, while another $400 represents increased labor costs here in the office.

The question of paying for that kind of deficit is one which has no single easy answer; and yet the simplest method would be to encourage every graduate, who is not an active member of the Association, to join in 1961. If only one half of those who were not members in 1960 (about 1800) were to join, the deficit should be cleared up and enough money would be available to carry on the operations in 1961 on the same scale as in 1960.

In addition to the membership drive there are two other means of earning the money required to meet this deficit. These are:

1) Constant pressure from all alumni to encourage prospective advertisers to use The MINES Magazine. The MINES Magazine is now listed in Standard Rate and Data Service which is the Bible of the advertising agency. In addition, the Magazine is now carrying original articles in all fields of Mineral Engineering.

2) Those men who attended Mines but did not graduate are frequently firm supporters of the School and are interested in becoming Associate Members of the Alumni Association. Each of you may know one or more men who are eligible and would be interested in becoming Associate Members. There is no initiation fee, and dues are the same for regular and associate members. I am sure that if you will give this some consideration you will remember at least one friend who falls in this classification. Give him an application or ask us to send him one. This group of prospective associate members offers a simple means of strengthening our association.

### 1961 Membership

We have been pleased with the early response to our Dues letter. All of those who have sent us a check should have their 1961 Membership Cards by the time this issue of the Magazine reaches them. This Membership Card is our method of saying thank you for your support.

### Vacation

President Crabtree has agreed to keep his eye on things while I take some time off. Present plans are that I will leave here in November, visiting the Local Sections in St. Louis, Washington, Philadelphia and some of our members in North Carolina and in Florida. Of course, that all leads up to the opportunity to spend the Christmas holidays with my grandchildren in St. Petersburg, Fla.

I will be back here in time to have everything ready for the annual meeting. Why don't you plan on joining us that evening? We will limit the dry reports on the past, and expect the future to stand on the activities of 1961.

# ALUMNI NEWS

### Norden, '34, Transferred To New York Office

Following a series of heart attacks, William E. Norden, Met. E. '34, was transferred in May by Union Carbide International Co. from Geneva back to the head office in New York. Although Mr. Norden is not now active in the company, he is subject to recall if and when he enjoys an improvement in health.

W. E. NORDEN, '34

Mr. Norden writes that in the meantime, he is taking it easy—the recent 'round the world trip having been an attempt to rest up. His permanent address is still c/o Union Carbide International Co., 270 Park Ave., New York 17, N. Y., a modern skyscraper built over the New York Central Railroad tracks. Mr. Norden describes the skyscraper as having no cellar—all utilities, elevator, machinery, etc., being on the top two floors. An escalator leads from the street level to the first floor and elevators.

"Last week," Mr. Norden writes, "we had an exhibition on the first floor similar to the Atom Show we had in Geneva in 1955. The 'swimming pool' reactor is only simulated, not real, and there were lots of pictures of uranium mining and concentration in Colorado."

### Kiersch, '42, Professor Of Geology at Cornell

George A. Kiersch, Geol. E. '42, has joined the faculty of Cornell University, Ithaca, N. Y., to replace Prof. C. M. Nevin, retired. He will teach courses in structure, sedimentation, and engineering geology.

At the annual meeting of the Geological Society of America (held Oct. 31-Nov. 2 in Denver), Dr. Kiersch was elected chairman for 1961 of the Division on Engineering Geology, largest specialized group within GSA.

For the past five years Dr. Kiersch has been directing a special large-scale geological mapping and resources survey for the Southern Pacific Co., San Francisco, Calif., and prior to that was on the faculty of the University of Arizona. During his career Dr. Kiersch has participated in many projects throughout this country and abroad. He expects to continue his consulting practice in engineering geology and industrial materials.

GEORGE A. KIERSCH, '42

Dr. Kiersch writes that "we are living at 333 The Parkway, Ithaca, N. Y., and the family is enjoying the area very much." Mailing address is: Prof George A. Kiersch, Dept. of Geology, McGraw Hall, Cornell University, Ithaca, N. Y.

### Mines Men Married

Mines men who are recent recruits to the ranks of wedded bliss are:

Carl J. Forstrom, Jr., a M.E. senior at Mines, to Miss LaBelle M. Barton of Phoenix, Ariz.

John C. Stoddard, Jr., E.M. '52, now an engineer with Ingersoll-Rand Co., to Miss Nitsa Spanos of Rockville Center, L. I.

Allen R. Spelman, Geol. E. '57, now a research assistant and candidate for a doctorate degree at Penn State University, to Miss Karen M. Holgren of Freeport, L. I.

## ANNUAL BUSINESS MEETING, JAN. 26, 1961

THE DATE: January 26, 1961

THE PLACE: Lakewood Country Club

THE TIME: Dinner at 7:30 p.m. Social hour 6:15 p.m.

THE PROGRAM: Reports by President Ed Crabtree, Treasurer Bob Waterman and Committee Chairmen—Activities of 1960

Introduction of Newly Elected Officers

This is your annual meeting! We would like you to hear about our progress and express your support for the future.

Please make your reservations early—by mail—CSM Alumni Assn., Golden, Colo., or by telephone—CRestview 9-3381, Extension 251.

Dinner 7:30 p.m.—Lakewood Country Club

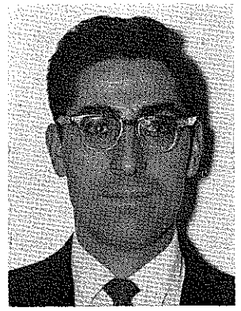
Thursday—January 26, 1961

WENDELL W. FERTIG
*Executive Manager*



### Falcone, '49, Promoted By Kaman Aircraft Corp.

A. S. Falcone, Met. E. '49, was promoted Sept. 1, to chief materials engineer at Kaman Aircraft Corp., Bloomfield, Conn. In this capacity he will direct the activities of the chemical, plastic, and metallurgical laboratories in the Materials Engineering Department. He has been employed by Kaman for the past seven years and prior to that time by Hamilton Standard, Division of United Aircraft Corp. for four years.



A. S. FALCONE, '49

Mr. Falcone recently obtained his P.E. license from Connecticut and his M.S. degree in metallurgical engineering from Rensselaer Polytechnic Institute Graduate Center at Hartford, Conn. He writes that the graduate study was made possible by a company sponsored program, adding that "three years of night classes and study was not an easy task after being out of school so long . . . One point brought out by this graduate work was the advance in metallurgical technology within the last decade and the almost unavoidable pitfall of not keeping abreast in one's field without a planned course of study."

Kaman Aircraft is primarily engaged in the manufacture of helicopters. The H43B Huskie took the world altitude record for its class by exceeding 30,000 feet early this year, and other models, the HOK and HUK, are seeing extensive duty around the world with the Navy and Marines. The newest product to the Kaman family is the HU2K Sparspite which is undergoing advance flight test and is scheduled for fleet duty during 1961. The company is also engaged in development of Short Take-Off and Landing Aircraft (STOL), Rotor Shuts, Missile Recovery and Nuclear Research (with the nuclear section being located in Colorado Springs).

## VISITORS TO THE ALUMNI OFFICE

ANTHONY F. CORBETTA, '48, who is assistant to the manager of sales, The Rocky Mountain Division of CF&I, stopped in at the office. His home address is 2310 W. 39th Ave., Denver 11, Colo. This visit may have been a mistake because Tony was then appointed a member of the Nominations Committee. This doesn't mean that every visitor who comes in gets a job, but we do appreciate the help.

ROBERT P. RAMER, '44, is a fraternal worker (missionary) for the Kolhapru Church Council in India. Robert is back in the States for several months leave and can be reached at 2661 Yates St., Denver 12, Colo. It was certainly a pleasure to talk with a man who has such intimate knowledge of the people and the conditions in India.

JACK P. BONARDI, '21, who is sales representative for both Wilfley and Mines Smelter in New York City, came in with his usual gusto. After saying that he was still living at 122 E. 42nd St., New York City, he remarked that as his company position he intended to put down that he was President of the Haywire Engineering Co. Later saw Jack and his son, who missed out going to Mines, at the Mines luncheon in Las Vegas.

MAX W. BOWEN, '24, executive vice president for Golden Cycle Corp., Colorado Springs, Colo., called at the office to discuss the material which I had asked him to prepare for the 50th Anniversary issue of The MINES Magazine.

CHARLES H. CARLTON, '34, mines manager for the Golden Cycle Corp., and who lives at 317 N. 4th St., Cripple Creek, Colo., came up with Max Bowen and brought some very recent pictures of Cripple Creek and Victor. The old-time pictures were run in the October issue, while the new look will be carried in the December issue.

GEORGE W. HEIM, '32, mining engineer for Food Machinery and Chemical Corp., was a visitor again. George has been doing considerable traveling for his company and it is certainly a pleasure to see him at relatively frequent intervals.

HARRY O. McLEOD, JR., a graduate of '53, is a graduate student, department of Petroleum Engineering, University of Oklahoma. Harry is living at 1211 Leslie Lane, Norman, Okla., while he is attending Graduate School.

WALTER J. HEAP, '48, is senior Apparatus engineer, C. F. Braun & Co. His home address is 5440 N. Mapletree Ave., Arcadia, Calif. Walter brought us the name of an address unknown that we believe we have located as a result of his information.

HARLEY F. HOLLIDAY, '42, petroleum Engineer with the Republic National Bank of Dallas, Texas, came in to discuss some of the problems of the North-Central Local Section. Harley is still living at 4505 Arcady Ave., in Dallas. As a result of his visit, we hope to see if the Local Section in question can't become more active.

MARTIN J. GARRITY, JR., '51, dropped in to discuss the article which he had written for the November issue of The MINES Magazine. Martin is petroleum engineer, City of Long Beach, Harbor Department, and his address is P. O. Box 570.

L. W. ENGEL, '60, who is a metallurgical engineer, in training with Bethlehem Steel, stopped in to ask us to send his mail to 1831 E. Center St., Denver, Colo., until he is settled in his new location.

WILLIAM E. BRUCE, '59, is a graduate trainee with Allis-Chalmers in Milwaukee. His home address is 3800 N. 76th St., Milwaukee, Wis.

WILLIAM A. REHRIG, '59, reported that his new address is Apartado 548, care of Tidewater Oil Co. of Spain, S. A., Las Palmas, Gran Canaria, Spain.

DONALD H. DOWLIN, a project engineer for Allen & Garcia Co., at 332 S. Michigan Ave., Chicago 4, stopped at the office on his way home from the American Mining Congress meeting in Las Vegas.

ALAN K. CRAIG, x-'51, is a consulting geologist, with offices in Denver. His home address is 257 Pearl St., Denver, Colo.

FRANK H. PERSSE, '48, sales and service representative for the Hercules Powder Co., lives at 3062 S. Steele St., in Denver. The red carpet was rolled out for Frank as he has indicated an interest in giving to the AADF of the CSM Foundation.

ROBERT E. JOHNSON, '52, who is an attorney for the Plains Exploration Co. in Denver, was out to Guggenheim for a meeting of the House corporation representatives of the various fraternities on the campus.

DeWITT C. DERINGER, '24, who is a consulting engineer for Patino Enterprises, but who now lives in Denver, was out for the same meeting with Bob Johnson.

ADAM THOMAS, '52, came to the office en route to his new position with Exploration Engineers, who have offices at 1114 S. Coast Building, Houston, Texas. This company employs a substantial number of Mines Men.

NORMAN SMALLWOOD, '60, was fortunate enough to be back on the campus on a pre-recruiting trip, for Proctor & Gamble. This enabled him to be here for Homecoming. Norm was editor of The Oredigger during the school year 1959-60.

CHARLES E. SEARS, Dr. of science, '53, was back on the campus for the first time since he received his degree. He is teaching at Virginia Military Institute and his home address is Box 522, Blacksburg, Va.

DAVID R. LOHR, '51, said that he had just come down for Homecoming. Dave is distillation superintendent in charge of all processing units in the refinery of the Mobile Oil Co., Casper, Wyo. Dave lives at 2251 S. Richard, Casper, Wyo.

RAYMOND "MIKE" LOEB, JR., '51, who is still with Aramco, Abqair #669, Dhahran, Saudi Arabia, was on long home-leave and was able to attend Homecoming. Mike and his wife were in the office several times during their long stay in the Denver area. They are both enthusiastic boosters of Saudi Arabia.

In the October MINES Magazine, under this heading, I remarked that ARVID ANDERSON, '54, had his wife Sally with him, but that she did not come to the office. Arvid just wrote to say that he is not married and I must have been referring to JIM FABER, '54, whose wife is apparently named Sally. In any case, I am sorry that I tried to marry Arvid off by this method, but certainly a member of the Class of '54 is a fair gain, if he is not already married. Sorry and my apologies to both concerned. WWF.

# FROM THE LOCAL SECTIONS

**Minutes of Section Meetings should be in the Alumni Office by the 15th of the Month preceding Publication.**

## ALABAMA

### Birmingham Section

Pres.: Joseph Hohl, '25
Sec.: Richard White, '42
249 Flint Dr., Fairfield

## ARIZONA

### Arizona Section

Pres.: Spencer R. Titley, '51
V. Pres.: Roger R. Nelson, '50
Sec.-Treas.: John H. Bassarear, '50
c/o Pima Mining Co., Box 7187, Tucson
Annual meetings. First Monday in December; 3rd Sunday in May (annual picnic).

### Four Corners Section

**See New Mexico for officers**

## CALIFORNIA

### Bay Cities Section

Pres.: John D. Noll, '51
V. Pres.: Ralph D. Eakin, '48
Treas.: Herbert D. Torpey, '51
Sec.: Charles G. Bynum, '26
2810 Loyola Ave., Richmond

### Southern California Section

Pres.: R. E. "Ray" McGraw, '53
Treas.: J. R. Leonard, '42
Sec.: H. David Squibb, '34
2215 E. Sycamore St., Anaheim

## COLORADO

### Denver Section

Pres.: Ronald F. Lestina, '50
V. Pres.: Hugh Wallis, '28
Sec.-Treas.: Patrick C. Brennan, '53
1893 S. Leyden, Denver 22
Office: AC 2-2060

Regular luncheon meetings are held the third Tuesday of each month at the Denver Press Club, 1330 Glenarm Pl.

### Four Corners Section

**See New Mexico for officers**

### Grand Junction Section

Pres.: Joe E. Hopkins, x-'37
V. Pres.: George E. Morehouse, '49
Sec.-Treas.: D. H. Fulton, '48
2637 Chestnut Dr., Rt. 5

### Grand Junction Section

Newly elected officers of the Grand Junction Section, to serve during the 1960-61 season, are as follows:

Joe E. Hopkins, x-'37, president
George E. Morehouse, '49, vice president
D. H. Fulton, '48, secretary-treasurer

Social activities for the coming year have been announced in a recent letter to alumni in the area. We also hope to have Coach Fritz Brennecke over in the spring for a meeting with potential Mines students.

### Grand Junction Section

The Nov. 4th issue of *The Wet Stope* calls attention to a program arranged by Section officers for the 1960-61 season which they hope will meet with approval and pleasure. As a starter, a picnic was held on the National Monument in September, successful in all respects except that we were unable to finish a keg of COORS—

"We are not now that strength which in old days

"Moved earth and heaven; that which we are, we are;"

Notwithstanding, to round out the program of frivolity, four parties, cocktails and dinners have been planned with other alumni functions of a more serious nature to be announced as they can be arranged.

Saturday, Nov. 19, 1960—Hosts for cocktails were John and Mary Emerson, 1924 N. 5th, from 6:30 to 8 p.m., with dinner and dancing following at Bookcliff Country Club.

Saturday, Jan. 28, 1961—Cocktails at the D. H. Fultons, 2637 Chestnut Dr., 6:30 to 8 p.m. Dinner and dancing to follow at the Cafe Caravan.

Saturday, Mar. 25, 1961—Gladys and El Lewis will be your hosts for cocktails at their new address, 2063 S. Broadway. Festivities will start at the usual hour. We have been trying to think of something different (within reason, of course) for dinner and entertainment afterwards. You will be canvassed for your ideas.

Saturday, May 20, 1961 — The Shipmans have again graciously offered to host another spring chicken Bar-B-Que at their home, 627 26½ Rd. Cocktails will be served on the premises starting at 6:30. Other entertainment planned for the evening will be the annual (democratic) election of officers.

Reminder cards will be sent out two weeks before each of the last three parties with additional information. Guests will be welcome. Notch your calendar for these dates—allons.

## DISTRICT OF COLUMBIA

### Washington, D. C., Section

Pres.: Alexander S. Wyner, '25
V. Pres.: Leroy M. Otis, '14
Sec.-Treas.: Horace T. Reno, '48
708 N. Wayne St., Arlington 1, Va.

### Washington, D. C. Section

The Washington, D. C. Section was pleased to have Douglas Ball, '43, from Golden, Colo., attend our meeting on Thursday, October 13, at the Shrine Club. Dick Fulton, '50, also from Ball Associates, and who is out of town much of the time, brought Doug.

In addition, the following Miners enjoyed the lunch and fellowship:

Hon. John Winchell, '17; Ernest Ristedt, '09, from Gainsville, Va.; Frank Johnson, '22; Harry Stevens, '23; John Croston, x-'20; Hollis Joy, '25; George Leslie, '35; Hal Cronin, '26; Leroy Otis, '14; Dave Caldwell, '50; Charles Baroch, '23, with guest, Bill Waggerman, retired U. S. Bureau of Mines specialist, and Al Wyner, '25.

The Section's next meeting will be held Tuesday, Nov. 15, at the Shrine Club, Washington, D. C., instead of Thursday, Nov. 10. We are looking forward to greeting Wendell Fertig at that time.

## ILLINOIS

### Great Lake Section (Chicago)

Ray Watson, c/o Standard Oil Co., 910 So. Michigan Ave., Chicago 80, Ill.

## KANSAS

### Kansas Section

Pres.: Francis Page, '39
Sec.: James Daniels, '51, AM 5-0614
205 Brown Bldg., Wichita
Meetings: Called by Sec. Contact Sec. for date of next meeting

## LOUISIANA

### New Orleans Section

Pres.: George Burgess, '49
V. Pres.: Emory V. Dedman, '50
Sec.-Treas.: Thomas G. Fails, '54
P.O. Box 193, New Orleans 12, La.
Special meetings on call of officers; no regularly scheduled meetings.

## MINNESOTA

### Iron Range Section

Pres.: Paul Shanklin, '49
V. Pres.: Leon Keller, '43
Sec.-Treas.: James Bingel, '53
50 Garden Dr., Mt. Iron, Minn.
Exec. Com.: Wm. Gasper, '43 and Robert Shipley, '52

## MISSOURI

### St. Louis Section

Pres.: Earl L. Sackett, '33
Sec.: H. A. Dumont, '29
227 Crane St., Edwardsville, Ill.

### St. Louis Section

A dinner meeting of the St. Louis Section was held Nov. 12 at the Cafe Rouge, Statler Hotel, in St. Louis.



Attending the meeting were Jean McCallum, '10; Floyd M. Balleau, '23; H. A. Dumont, '29; E. W. Markwardt, x-'32; Earl L. Sackett, '33; J. E. O'Keefe, '37 and Col. W. W. Fertig, '51.

Purpose of the meeting was to consider the St. Louis Section's activities during the 1961 AIME annual meeting to be held Feb. 26-Mar. 2, 1961 in St. Louis. Earl Sackett and other members present at the Nov. 12 meeting will take care of local arrangements for a MINES GET-TOGETHER during the AIME meeting in St. Louis. Details about the MINES gathering in St. Louis will be published in the January issue of the Magazine.

## MONTANA

### Montana Section

**Pres.: John Suttie, '42**
**V. Pres.: John Bolles, '49**
**Sec.-Treas.: Wm. Catrow, '41**
**821 W. Silver St., Butte**

## NEW MEXICO

### Four Corners Section

**Pres.: Dick Banks, '53**
**V. Pres.: Tony King, '57**
**Sec. Treas.: Tom Allen, '41**
**2104 E. 12th St., Farmington**

## NEW YORK

### New York Section

**Pres. & Treas.: Ben F. Zwick, '29**
**Sec.: H. D. Thornton, '40**
**Union Carbide Olefins Co.**
**30 E. 42nd St., New York City**

## OHIO

### Central Ohio Section

**Pres.: Roland Fischer, '42**
**Sec.-Treas.: Frank Stephens, Jr., '42**
**Battelle Mem. Inst., Columbus**

### Cleveland Section

Pres.: Charles W. Irish, '50
3811 Merrymound Rd.
No regularly scheduled meetings. Special meetings on call of the president.

### Pennsylvania-Ohio Section

**See Pennsylvania for officers**

## OKLAHOMA

### Bartlesville Section

Pres.: W. K. Shack, '51
V. Pres.: W. H. Courtier, '28
Sec.-Treas.: C. F. Hinrichs, '57
403 Parkview Drive
Bartlesville, Oklahoma
Luncheon meeting every Friday, Bartlesville Y.W.C.A.

### Oklahoma City Section

Pres.: Fred E. Rugg, '49
V. Pres.: Lincoln F. Elkins, '40
Sec.-Treas.: C. E. Ramsey, Jr., '58
511 NW 47th St.
Regular meeting first Monday of each month

### Tulsa Section

**Pres.: Chester H. Westfall, Jr., '52**
**V. Pres.: Brook Tarbel, '50**
**Sec.-Treas.: Charles J. Diver, '52**
**528 S. New Haven, Tulsa 12**

## PENNSYLVANIA

### Eastern Pennsylvania Section

**Pres.: Samuel Hochberger, '48**
**V. Pres., Sec-Treas.: Arthur Most, Jr., '38**
**91 7th St., Fullerton**

### Pennsylvania-Ohio Section

Pres.: L. M. Hovart, '50
Sec.-Treas.: George Schenck, '52
7130 Thomas Blvd., Pittsburgh
Meetings upon call of the secretary

## TEXAS

### Houston Section

Pres.: Richard B. Hohlt, '47
V. Pres.: Jasper N. Warren, '50
Sec.-Treas.: Robert D. Turley, '52
1114 South Coast Bldg.

### Houston Section

Emptying 7-oz. cans of COORS, which had been carefully escorted to Houston by Adam Thomas, '52, was first on the order of business at the Section's luncheon on Nov. 3. Among new arrivals to Houston were Jim Huff, '53, with Ohio Oil Co., and Adam Thomas, '52, to join Exploration Engineering. Visitors were John Holland, '53, Humble Oil, from Corpus Christi and Ben Zwick, '29, Chemical Bank, New York Trust Co.

A Texas-type election was held and the new officers are:

Dick Hohlt, '47, president
Jack Warren, '50, vice president
Bob Turley, '52, secretary-treasurer

Miners attending the Nov. 3rd meeting at the Lamar Hotel were:

Sydney Mewhirter, '17; James Ballard, '25; Albert Ladner, Harold Haight, E. C. Borrego, '27; Ralph Schilthuis, Jack Ferguson, George Somers, '30; Ivan Burrell, '31; James Perryman, '35; Raymond Kerr, '36; Bruce Barbour, '37; James Morris, Stanley Wickstrom, '38; John Biegel, Charles Thurber, '39; Lynn Ervin, Nick Shiftar, '40; Horace Goodell, '42; J. E. Perry, '43; Richard Hohlt, '47; Morad Malek Aslani, Dennis Gregg, '50; William Johnston, '51; Robert D. Turley, Clement Lehnertz, Jr., Adam Thomas, '52; Howard Kaylor, Jack Earl, Jim Huff, '53; Bob Abercrombie, John Capshaw, '54; Parks Bunn, Fred Gruberth, '55; William Bagby, Dick Kellenbenz, '58; E. P. Worden, '60.

Miners visiting Houston who would like to contact old buddies are invited to call CA 8-4305 day, or MO 7-2229 night for information.

### North Central Section

V. Pres.: Howard Itten, '41
Sec.-Treas.: Harley Holliday, '42
4505 Arcady Ave., Dallas 5
Sec.-Treas.: John Thornton, '50
609-B Scott St., Wichita Falls

### Permian Basin Section

Pres.: William D. Owens, '45
V. Pres.: Thomas M. McLaren, '52
Sec.-Treas.: James F. Rucker, '52
2102 Club Drive, Midland
Luncheon meeting the first Friday of each month at Midland Club.

### South Texas Section

Pres.: James Wilkerson, '31
V. Pres.: Edward Warren, '50
Sec.-Treas.: Richard Storm, '53
1007 Milam Bldg., San Antonio

## UTAH

### Four Corners Section

See New Mexico for officers

### Salt Lake City Section

Pres.: Robert B. Ingalls, '48
Vice Pres.: Edwin T. Wood, '48
Sec.-Treas.: Major W. Seery, '56
260 W. 1200 North, Bountiful, Utah
Regular luncheon meeting second Thursday of each month at the Ft. Douglas Club.

### Salt Lake City Section

The Salt Lake City Section held two social functions during the month of October.

During the Rocky Mountain Minerals Conference a number of local Miners and visiting out-of-towners got up early on Oct. 6 to have breakfast together in the Hotte Shoppe's Sirloin and Saddle Room. A Scotch breakfast was considered somewhat elegant for the group involved, so Bloody Marys instead were mixed and administered by the steady and talented hand of Ben Slothower. In due course everyone sat down to eat and it is believed that some even made the technical sessions later in the day.

Those at the breakfast were:

J. F. Frost, '25; C. D. Michaelson, Eugene Pressett, '32; Milton Lagergren, '33; Joe Rosenbaum, N. F. Wetzel, '34; Phil Pelton, '35; J. H. Cone, '37; W. W. Agey, '39; G. J. Hussey, H. K. Schmuck, E. J. Mayhew, '40; Clyde Johnson, '45; W. P. Gillingham, '47; E. J. Wood, '48; Paul Placek, Don Siljestrom, '49; Niles Grosvenor, Don Rausch, Ben Slothower, '50; Edgar Hunter, '53; Bob Pinkerton, Major Seery, '56; James Link, '59; Lawrence Long, '60.

On Oct. 15 some 25 alumni, wives and guests had cocktails and lunch at the Fort Douglas Country Club before the Mines-Westminster football game. Jim Sankovitz, Mines public information officer, acquainted us with the team's record for the year and Jim Robinson, assistant to the president, brought us up to date on recent changes on the campus. Lute Parkinson, '23, in his own inimical fashion formed a few epigrams for posterity and give a discussion of some of the problems facing the school that are of concern to all alumni.

After lunch everybody advanced to the stadium at Westminster College to watch the Orediggers spoil the local Homecoming celebration by defeating the Parsons in an exciting contest. Impartial observers conceded that the small but enthusiastic Mines cheering section was more than a match for the home crowd. After the game concluded in true Mines fash-

ion, was suggested that next year we schedule the University of Utah in order to have a local game every year.

Those attending the Oct. 15 gathering of the Salt Lake City Section were:

C. D. Michaelson, '32; Helen and Keith Bentley, Kathy and Art Humphry, Berg and Major Seery, '56; Evie and Bob Coleman, '49; Peg and Bob Seklemian, '48; Laura and George Allen, '37; Jacquie and Bob Peters, '51; Gwen and Milt Lagergren, '33; Atha and Bob Ingalls, '48; Lute Parkinson, '23; Jim Sankovitz and Jim Robinson.

President Bob Ingalls introduced C. D. Michaelson, '32, of Kennecott Copper, who was awarded the Distinguished Service Medal in 1957. Jim Robinson reported on the progress of the U.S. Scholarship program as it relates to our enrollment problem and offered the help of his office in working with the Section on its plans to approach public schools in Utah for student recruitment.

Salt Lake City Section is planning an educational campaign in the public school system utilizing "The Silver Diploma," the School's film, to help the enrollment problem. Alumni who will be involved in the educational program include Ned Wood, Bob Ingalls, C. D. Michaelson, and Ben Slothower.

## WASHINGTON

### Pacific Northwest Section

Pres.: Wm. C. Douglas, '11
Sec.-Treas.: C. Ted Robinson, '53
16204 S.E. 8th, Belleview

### Pacific Northwest Section

Following cocktails and an excellent dinner at Andy's Diner, Seattle, Wash., the meeting on Oct. 11 was called to order by W. C. Douglass, president. Ten members attending the meeting were:

Walter H. Jackson, '01; Eric M. Smith, '05; William C. Douglass, '11; Dewey A. Dutton, '21; Arthur R. Kesling, '40; Colin L. Fox, '41; C. W. Bowlby, '50; C. Ted Robinson, '53; Richard O. Barnes, '55; Lewis J. Effenberger, '56.

Minutes of the last meeting were read and approved. President Douglass discussed letters received by alumni from Mr. Frank C. Bowman, '01, concerning solicitation of advertisers for The MINES Magazine. No one had been successful at this point in getting any new advertisers but several said they were trying.

The new organization of CSM Alumni was discussed and it was felt by all that it was a good move. The business portion of the meeting was closed and a football movie of Mines vs. Western State was shown. The meeting adjourned at 10:30 p.m.



## WYOMING

### Central Wyoming Section

Vice Pres.: Martin Hegglund, '41
806 W. 13th St., Casper

## CANADA

### Calgary Section

Pres.: Joe S. Irwin, '54
V. Pres.: G. L. Gray, '50
Sec.-Treas.: Hugh Evans, '49
Hudson's Bay Oil & Gas
320 7th Ave. West
Luncheon meetings held 3rd Monday of each month in Calgary Petroleum Club; visiting alumni welcome.

## PERU

### Lima Section

Pres.: Richard Spencer, '34
V. Pres.: Martin Obradovic, '53
Sec.-Treas.: Norman Zehr, '52
Casilla 2261, Lima
Meetings first Friday of each month, 12:30 p.m., Hotel Crillon (April through December), or on call.

## PHILIPPINES

### Baguio Section

Pres.: Francisco Joaquin, '26
V. Pres.: Claude Fertig, x-'27
Sec.: P. Avelino Suarez
Balatoc Mining Co., Baguio, Philippines

### Manila Section

Pres.: Anselmo Claudio, Jr., '41
205 Wilson Bldg., Manila
V. Pres.: Rolando Espino, '41
Sec.-Treas.: Edgardo Villavicencio, x-'40

## TURKEY

### Ankara Section

Alumni visiting Turkey contact:
Ferhan Sanlav, '49, Turkiye Petrolleri A. O. Sakarya Caddesi 24, Ankara; Tel. No. 23144.

## VENEZUELA

### Caracas Section

Pres.: William A. Austin, Jr., '27
V. Pres.: G. V. Atkinson, '48
Sec.-Treas.: T. E. Johnson, '52
c/o Phillips Petr. Co.
Aptdo 1031
Asst. Sec.-Treas.: R. L. Menk, '51
c/o Creole Petr. Corp.
Aptdo 889

## CLASS NOTES

*(Continued from page 5)*

DOUGLAS P. HILDENBRANDT is senior civil engineering assistant for the Los Angeles County Flood Control District. His home address is 372 Monterey Road No. 10, South Pasadena, Calif.

JAMES E. JONES is a product engineer with Hewitt-Robins, Inc., and his address is 45 River Dr., Passaic, N. J.

BENSON L. JOSEPH has moved from San Jose to Campbell, Calif. His apartment is located at 475 Dover Way, No. 3.

ANDREW C. LAMBERSON is the new product supervisor of the Eastern Zone, CF&I. A Met. E. graduate, Lamberson is a Coloradoan by choice being a Kansan by birth. He joined CF&I at Pueblo when he graduated.

PATRICK C. RYAN is another Californian. Employed by Bechtel Corp. as a process engineer, he lives at 1110 Manzanita Dr., Pacifica, Calif.

DONALD H. SHAW, x-'58, is on his way to Tanganyika to serve as a staff assistant in the Ministry of Finance in the field of mineral resources. Shaw is being sponsored by the "Fellows in Africa," a joint project of the Ford Foundation, World Bank, British Colonial Government, and MIT. Before entering MIT, which awarded him a master's degree in June, he attended Mines for three years. His wife, Barbara, and two pre-school age sons will accompany Shaw on this two-year assignment.

PETER FREDERICK THORNE, x-'58, is to be married to Nancy Caroline Sistar, a native Pennsylvanian and a graduate of Penn State now teaching music. Thorne attended Mines for three years and is currently a junior student majoring in business management at Fairleigh Dickinson University.

OLIN D. WHITESCARVER has been transferred by Pure Oil Co. from Midland to Box 987, Andrews, Texas.

VINCENT E. WOOD has been transferred back to the states from Okinawa by the U. S. Marine Corps. Mail will now reach him c/o USMC, MABS 36, MAG 36, MCAF, Santa Ana, Calif.

### 1959

LESLEY O. BOND an engineer with Schlumberger Well Surveying Corp. is located in Falfurrias, Texas at 623½ W. Allen St.

DONALD E. DALTON has gone overseas with his group. His mail should be addressed: U.S.A.D.E.F.E., APO 31, San Francisco, Calif.

C. HOWARD HAMILTON is a research metallurgist with North American Aviation, Missile Division. His home address is 12800 Lakewood Blvd., Apt. 1, Downey, Calif.

GEORGE KRAUSS was in Worthington, Ohio. His new address is 21442 Lorain Road, Cleveland.

CRAIG S. MARTENSON is an ensign in the U. S. Navy. His home address is 7717 Lakeview Drive, Falls Church, Va.

DEWITT A. MOSS has left the Los Angeles County Road Department and joined the Atomic Energy Commission as a nuclear engineer at Oak Ridge, Tenn. His street address is 161 Wade Lane.

GEORGE N. MUNRO has served a year as a service engineer with Dowell,

*(Continued on page 40)*



# IN MEMORIAM

### Dr. Bert S. Butler

Dr. Bert S. Butler, who in 1929 received an honorary Doctor of Science degree from the Colorado School of Mines in recognition of his ceaseless contributions to the mineral industries, died Nov. 13 in Tucson, Ariz.

Long a prominent figure in geological circles, the well known teacher-scientist earned many distinctions during a career marked by outstanding successes in the field, classroom, and industry. Among these were the R.A.F. Penrose Medal, awarded to him in 1947 by the Society of Economic Geologists, and the University of Arizona's 75th Anniversary Medallion of Merit, which he received in 1959 for his services to the institution, the state, and the nation.

Born March 30, 1877, in Gainsville, N. Y., Dr. Butler completed his undergraduate degree at Cornell University in 1905. Two years later he received a Master's degree from the same institution. Dr. Butler joined the University of Arizona faculty in 1928 after 20 years of active field experience with the U. S. Geological Survey and the Calumet and Hecla Consolidated Copper Co. In addition to teaching, he made numerous studies of the mineral districts of Arizona for

DR. BERT S. BUTLER

USGS while supervising the work of graduate students.

Dr. Robert L. Nugent, University of Arizona executive vice president, said, "Dr. Butler was one of the leading economic geologists of the world . . . First as professor of geology, then as professor and head of the Department of Geology and Mineralogy from 1931-48, and in recent years as professor with part-time responsibilities, his record of service was marked by inspirational teaching, scholarship of far-reaching importance, and close personal association with his colleagues . . ."

Dr. Truman H. Kuhn, dean of the faculty at the Colorado School of Mines, once commented that "noteworthy in Dr. Butler's career as a teacher is the integrity with which he searched, evaluated, and concluded. A seeker of the truth, by example he instilled in his students those principles necessary for the ethical basis of a scientist . . ."

Dr. Butler was the author of numerous scientific publications in the field of geology, many of which are still considered by geologists as classics of their type. A revealing indication of the value of his work is the fact that his name has for many years been "starred" by the publication "American Men of Science," evidence that his work was considered among the most important in his field.

Survivors include his wife, Mrs. Loretta B. Butler of Tucson, Ariz., and his son, Waldo D. Butler of Chicago, Ill.

# ALUMNI BUSINESS

### Executive Committee Meeting On October 26th Reported

The Executive Committee met on Oct. 26th, 1960, at 7:30 p.m., in the Conference Room, Guggenheim Hall, Golden, Colo. Those present were Edwin H. Crabtree, president; Robert W. Evans, executive committee; S. M. Del Rio, executive committee; J. A. Mullinax, secretary. Members absent were John Petty, vice president; Robert Waterman, treasurer, and Harvey Mathews, executive committee. Committee chairmen present were Warren Prosser, Public Relations; Robert Bolmer, Publications Committee; Oran Pack, Research and Development Committee, and Ken Nickerson, Membership.

At this meeting it was regularly moved and seconded that the executive manager should be instructed to provide The MINES Magazine with a digest of the actions taken at the regular meeting, so that this might be published in the next issue of The MINES Magazine. In the past the minutes have not been published until they were regularly approved by the Executive Committee. This frequently resulted in a long delay so that the information contained in the minutes was no longer current.

In accordance with the above instructions, the executive manager reported that at the meeting held on Oct. 26th, 1960 the minutes of the previous meeting held on Sept. 15th, 1960, were read and approved. The financial statements for September were presented and approved.

Under the heading of Old Business, the executive manager reported that nearly 80 per cent of the members of the Class of 1960 have become members of the Alumni Association. In addition, six members of the Class of 1961 have already joined as Junior members.

In general comment, the executive manager reported that the dinner given during the Petroleum Engineers Convention was attended by 146 Miners and their wives. The Alumni Stag luncheon, held at Las Vegas during the American Mining Congress, was attended by 93 Alumni.

Homecoming plans are complete and the programs have been mailed to all concerned.

Under the heading of New Business, the list of nominees for all officers and members of the Executive Committee were read and upon motion by Evans and seconded by Del Rio, the report of the nominations Committee was approved.

Names on the Ballot are: *For President*—Albert M. Keenan, '35, and James A. Mullinax, '47; *For Vice-President*—Theodore F. Adams, '29, and Hugh A. Wallace, '28; *For Secretary*—Robert L. Bolmer, '44, and John J. Wanner, '48; *For Treasurer*—Anthony F. Corbetta, '48, and Ken Nickerson, '48; *For Member of Executive Committee*—Oran L. Pack, '26, and Francis E. Smiley, '40; *For Director, CSM Foundation, Inc.*—Edwin H. Crabtree, '27, and John J. Flynn, '48.

Activities to encourage increased membership continued at a high rate, as separate letters were mailed to all those who were active in 1959, but had not yet paid in 1960. To those active members, who have paid their dues for 1960, the Ballot, the Proxy requesting signature for approval of the proposed amendment to the Articles of Incorporation, dues card, and return envelopes were mailed to each. To those inactive members, a letter, dues card and return envelope were mailed, requesting that they join the Association as soon as possible.

A loan to Eugene Smart, a senior at Mines, was approved and the loan will be made.

Increased interest upon the part of Local Sections raised the question of the need for new Sections in areas where industrial changes have increased the number of Alumni present.

The executive manager reported that The MINES Magazine printed a four-page spread of the results of CSM Foundation activities in the October issue of The MINES Magazine. This was done without cost to the Foundation.

A general report upon the condition of the Magazine was made, stating that the October issue has begun to reflect the effect of the advertising solicitation being carried out by Mr. Bowman.

Committee reports: Mr. Prosser suggested a Silver Plaque be placed under the portrait of Dr. Chauvenet. He suggested that funds from the Alumni Recognition Fund be used for such purpose.

Candidates for Honorary Membership in the Alumni Association were discussed and petitions bearing the names of those nominated will be circulated for signature.

The Executive Committee adjourned at 9:25 p.m., having completed all the business before them.

# OREDIGGER SPORTS

## Mines 1960 Football Season Roundup

By DAVID CHASIS

At the beginning of the season, Mines football team was picked by most sportswriters to fight Western State for last place honors. This was all the stimulus the Blue and White needed; for if it's anything the Orediggers thrive on, it's playing a contest in which they are the underdogs.

Mines did not get off to a good start this season. They lost their first game 14-6 to New Mexico Highlands, although they out-rushed, outpassed, and got more first downs than Highlands. John Rossi played such inspired football that he received the "Outstanding Player" award for the game.

In their second game, the Orediggers bounced back and downed Omaha University by the score of 28-20. Kay White won the "Outstanding Player" award of this game by intercepting two passes and throwing a touchdown pass to end Leroy Wretlind.

The first home game of the season matched Mines with Colorado College. Bruce Henry and Frank Patete went over for touchdowns in the second quarter to give Mines a lead of 14-6. The fourth quarter saw the Tigers make a touchdown, and the Orediggers a safety to make the final score 16-12 in favor of Mines.

Led by the passing of Bruce Henry and kicking of Marv Kay, the Miners won their third straight game by beating the Westminster Parsons 20-13.

Colorado State College hosted the Orediggers for their homecoming game and proceeded to beat Mines 20-12. Mines beat the Bears in statistics, but they fumbled and had two passes intercepted which were all the breaks CSC needed.

Idaho State College came to play Mines at our Homecoming bringing with them a team that had averaged 61.5 points per game in conference play. Idaho State was favored to win by four touchdowns over Mines. Mines played one of the greatest games in the School's history and managed to beat the Bengals 7-0. Mike McCutchan starred offensively by intercepting a pass and set up the only score of the game. The Mines defense was the big surprise of the game, as they stopped Idaho State time and again even though they were outweighed 30 pounds per man. It was worth the price of admission just to see the look of disbelief on the faces of the Idaho State players after the game was over.

Mines won their sixth game of the the season by trouncing Western State College 13-3. Standouts in the game were backs Jerry Cronen and Mike McCutchan. The Miners' defense was tremendous and did not let the Mountaineers pass Mines' 35-yd. line in the second half.

Frank Patete went over for three Oredigger touchdowns to lead Mines to a 21-13 victory over Panhandle A & M. Mines started slowly and were behind 13-0 in the first quarter, but battled back in the second and third quarters to win their sixth game of the season.

Mines was tied with Idaho State and Adams State College for the Rocky Mountain Conference going into their final game with Adams State. The winner of this game would be RMC champs. Mines played their hearts out, but were soundly defeated 44-14. It was a close game until the third period with Adams State leading 17-14, then everything that the Indians did was right. They scored two touchdowns in the third, two in the fourth quarter, and a safety. This was the only game of the season that Mines was definitely outplayed.

Thus ended the successful football season of Mines. The Blue and White played exciting and colorful ball throughout the season and ended the season with a 6-3 record. The football team and Coach Fritz Brennecke should be complimented on a job well done.

## CLASS NOTES

*(Continued from page 38)*

Inc. He is now doing graduate work at Pennsylvania State University and lists his address as Entry No. 9, Graduate Circle, University Park, Penn.

WILLIAM A. REHRIG has been seeing the world with Tidewater. He did a tour of duty in Ankara, Turkey, then Burbank, Calif. Now his address is c/o Tidewater Oil Co. of Spain, S. A. Apartado 548, Las Palmas, Gran Canaria, Spain.

CHARLES H. REILING is a geologist with Superior Oil Co. He was recently transferred from La Crescenta, Calif., to Casper, Wyo. He lives at 2355 E. Seventh.

KENNETH C. RUSSELL works for Westinghouse Electric Co. in Pittsburgh. His address is 116 W. Swissvale, Pittsburgh 18, Pa.

RICHARD KENT SPEARS is living in Littleton. Employed as a metallurgist by Martin of Denver, his home address is 8437 S. Reed, Rural Route No. 1, Littleton, Colo.

GORDON L. STEELE was recently commissioned 2nd Lt. He may be addressed Co. B, 2nd Btn., 1st Trng, Regt. Engr., Ft. Leonard Wood, Mo.

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WILLIAM A. ANDERSON'S new address is 3433 Belle Terrace, Bakersfield, Calif.

JOSEPH L. ANJIER was in Colorado Springs. His new address is 610 North Imboden, Apt. 204, Alexandria, Va.

EDUARDO GABRIEL-ARANA went to La Paz, Bolivia, on graduation. Now he is located Y.P.F.B., Camiri, Bolivia, S. A.

JOHN A. BOWLER, III, left Vernal, Utah, and is now at 3630 39th Street N.W., Washington, D. C.

WARREN E. BROWN, E.M. is another graduate of the class of '60 who has been placed in a training job. He is a superintendent trainee with Fisher Contracting Co. He still lists 128 E. Monroe, Sterling, Kan. as his home.

EDWIN H. CRABTREE, III, is back in Golden from Salt Lake City. His Golden box number is 465.

JAMES C. DORIAN went to Los Angeles after graduation. Now he is at 1457 Ridge Ave., Evanston, Ill.

IRWIN WILLIAM ENGEL is now employed by Bethlehem Steel as a metallurgical engineer. His address is 5950 Carmelita, Apt. No. 11, Huntington Park, Calif.

WALTER I. KNUDSEN, JR. is living in North Hollywood, Calif. He is employed as civil engineering assistant in the Los Angeles County Flood Control District. Mail will reach him c/o Mr. D. McComb, 8137 Mary Ellen St., North Hollywood, Calif.

GEORGE A. LINDROTH is now a Lt. with the 561st Engr. Corps (PC), Presidio, San Francisco, Calif. He was with Crucible Steel Co. of America before his induction into the Army.

QUENTIN T. McGLOTHIN 1300 E, James St., Apt. 10, Baytown, Texas has a new assignment. He was recently transferred to Manufacturing Research and Development Division, Humble Oil & Refining Co. He is a Petroleum Refining option graduate.

KEITH P. RHEA is working with Bear Creek Mining Co. of Denver, Colo., as a geologist. He is to leave early next year to study geology at Victoria University of Wellington, New Zealand. See MINES Magazine, July 1960, p. 50.

2nd LT. JOHN J. SELTERS has completed the officer orientation course at The Chemical Corps School, Fort McClellan, Ala. Upon completion of his tour of duty with the Army, John is to begin employment with U. S. Smelting Refining & Mining Co. John won many honors while on campus and his wife, Judy, was also an active and well-known campus figure.

ROBERT WAISSAR, x-'60, left the CSM graduate school this summer and is now in Venezuela. He is employed as a mining engineering trainee by Orinoco Mining Co.

JAMES N. WINSTON has moved from St. Francis, Kan., to Shiprock, N. M. He is working for Kerr-McGee Oil Industries as a mining engineer. His P. O. Box is 383.

1961

REGINALD WORSLEY, is now living at 575 Grand St., Apt. 1204 E. New York, N. Y. His M.Sc. in mining will be awarded in 1961.



# CAMPUS HEADLINES

# The Colorado School of Mines Library

By VIRGINIA LEE WILCOX, Librarian

MISS VIRGINIA WILCOX

### THE AUTHOR

*Virginia Lee Wilcox, who in 1937 and 1953 received A.B. and M.A. degrees in Library Science from the University of Denver, has served as librarian at the Colorado School of Mines since 1956. For 10 years prior to 1956 she was successively assistant librarian and acting librarian at Mines.*

*Miss Wilcox has also served as librarian for Colorado Fuel & Iron Corp. and for the U. S. Armed Forces in La Junta, Colo., and in Rheims, France.*

*She is the author of* Colorado: A Selected Bibliography of Its Literature, 1858-1952, *and is a member of many organizations—including Special Libraries Assn., American Library Assn., Mountain-Plains Library Assn., Bibliographical Center for Research, American Society for Engineering Education, Colorado State Historical Society, and PEO.*

### Descriptive—Early Days

A history of the Colorado School of Mines Library must reflect the history of the Colorado School of Mines itself, since it is an integral, functional part of the institution. It has played a vital part in the educational program since the beginning and will continue to do so if it is to justify its existence. For any good library of an institution of higher learning must of necessity reflect the aims and purposes of that institution, support and supplement the academic disciplines, and be a vital and enduring channel through which the cumulative thought of man may be transmitted to the entire college community.

The founding fathers of the Colorado School of Mines realized the value and necessity of a good library. In the beginning, when the School of Mines was also called a "Department of Physics" of Episcopal Bishop George M. Randall's "University Schools at Golden, Colo.," there is the following mention of a library in the prospectus, "In the second story is the library and a lecture room."[1] There is no mention of any collection at this earliest date, 1873.

In 1874, the School of Mines was established by act of the Territorial Legislature when the Episcopal Church found support for the School increasingly difficult and relinquished control to the government. In 1876, when the Territory became the State of Colorado, the School became the State School of Mines. The location of the School at this time was the present site of the State Industrial School, at the southeastern edge of Golden.

In the *Biennial Report* of the School for 1880-81, is found the first statement concerning the Library after the School reopened in its present location, Oct. 13, 1880, "Large additions have been made to the Library," and later, "The Institution possesses a good library of standard scientific works."[2] The first statement of actual expenditures for books for the Library is noted in the *Biennial Report* of the School for 1882, "Additions to the Library have been made during the past two years to the amount of $455. The books have been carefully selected with reference to their scientific value and their special utility in such a technical institution."[3]

Not until the *Catalogue* for the year 1885-86 appeared, do we find the first statement concerning the size of the collection, "The Library comprises about 1,000 volumes of standard works, every department of science being fairly represented. Additions are being constantly made."[4]

With the growth of the School and the addition of a new building, first occupied in the fall term, 1890, the Library received new quarters, according to a *Special Circular* for that year, a large room on the first floor of the new building. It contained "over 2,000 volumes, chiefly standard reference works, and is being constantly enlarged."[5] In the *Catalogue* for 1890-91, the number of volumes is restated, and in addition, ". . . history, travels and literature are not neglected. Its cost per volume, as must be the case with scientific works, has been large. Additions are constantly be-

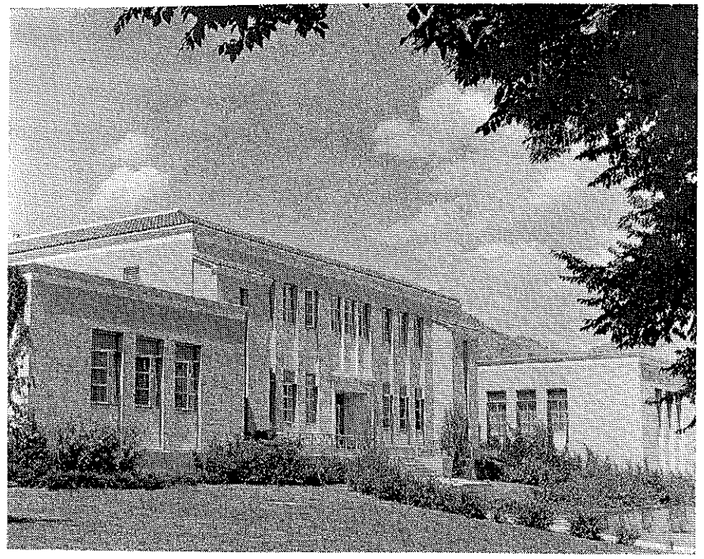
[1] University Schools at Golden, Colorado, 1873-74. (Golden, Colo.: 1873) p. 4.

[2] State School of Mines *Biennial Report*, 1880-81. (Denver, Colo.: Tribune Publishing Co., 1881) p. 42 and p. 49.

[3] State School of Mines *Biennial Report of the President*, December, 1882. (Denver, Colo.: Rocky Mountain News Publishing Co., 1883) p. 11.

[4] State School of Mines *Catalogue*, 1885-86. (Golden, Colo.: The School, 1886) p. 53.

[5] State School of Mines *Special Circular* for the Fall Term of 1890. (Golden, Colo.: The School, 1890) p. 14-15.



▼Arthur Lakes Library was completed in January, 1955, at a cost of $750,000.

ing made. Students have free access to the library, which can be used as a reading-room during a portion of each day, the students having also a separate reading-room on the same floor."[6]

The first mention of a librarian as a member of the School's faculty, although not full time, appears in the *Special Circular* just cited. Mr. John B. Garvin is listed as both "Librarian and Registrar."[7]

The earliest entry in the Accession Records of the Library, the descriptive list of books as they were added to the collection, is dated Dec. 1, 1892. There was no Call Number given, or classification of volumes according to the Dewey Decimal Classification, until probably several years later. However, in the *Catalogue* of the School for 1896-97, is found the first mention of the organization of the Library's collection. "The shelf and catalogue arrangements are upon the Dewey Decimal System. Pamphlets are separately placed in special drawers, also under classification."[8]

Although it is not quite clear just to what extent use was made of the Dewey system at this time, it is evident that there was a commendable attempt to keep abreast of developing library techniques and procedures. For it is only a few years earlier, in 1876, that Melvil Dewey first published his *Decimal Classification.* At that time it comprised only 12 pages, while today it appears in two volumes, sixteen editions later, and is used by approximately 95 per cent of the libraries of the country.

It was not until 1902 that the administration appointed a full time professional librarian to the School's faculty. Up until that time such duties were performed by one person who served as both librarian and registrar, with little, if any professional education. The *Catalogue* of 1901-02 lists under "Faculty," the first separation of the positions of librarian and registrar, and the appointment of Mabel C. Shrum, B.L.S. (University of Illinois), as the first professional librarian.[9]

From the *Annual Catalogue* of 1902-03 comes a pertinent statement of some historical significance. "The accumulation of a library suitable for a technical school has been the growth of years, but it was not until January 1902, that President Chauvenet and the Trustees wisely decided to reduce to a system the gathering and registering of the various materials, by employing a competent librarian, Miss Mabel C. Shrum. The books number 6,000 volumes, including the bound files of the standard periodicals, and excluding many hundred unbound pamphlets. While the substance of such a collection of books must always emphasize particularly the technical phase, yet a touch of the human is recognized by including some of the standard histories, travels, and the English classics, as well as some of the more popular journals of the day."[10]

The Library continued to grow and develop with the School. In 1906 Guggenheim Hall was dedicated, and the Library of about 5,000 volumes was moved to the south wing of the second floor of this building, which was to remain its home for almost 50 years! When the collection outgrew these accommodations, the first floor of the same wing in Guggenheim Hall was filled with temporary shelving in about 1936, and the collection overflowed into this area. Finally books were stored in the sub-basement and the tower of Guggenheim, until all storage had been exhausted. When the holdings came to a total of about 64,000 volumes, there was no more room left to grow!

### A New Library Building

Which brings us to the Arthur Lakes Library of the Colorado School of Mines, named in July, 1959, in honor of the School's first professor of geology, and pioneer Colorado geologist. In August 1954, ground was broken for the $750,000 library building. It was completed and opened for use in January 1955. The collection was moved from Guggenheim Hall next door in special book trucks, in the same order as they were found on the shelves so that they received a minimum of handling. Even when a chute was used to slide the books down from the upper floor levels to the trucks on the ground, no great amount of disorder resulted. This new physical plant opened up new avenues of service, with its new equipment, expanded facilities, and room for growth.

The modern building, all 39,782 square feet of its floor space, with its three floors and five stack levels, and its 170,000 volume capacity, was the answer to many of the problems which had plagued those responsible for Mines' Library service for years.

A rather detailed description of this new physical plant appeared in a previous issue of THE MINES MAGAZINE, so much of that description will be eliminated here.[11] But

[6] *Op. cit., Catalogue,* 1890-91. p. 66.

[7] *Op. cit., Special Circular,* 1890. p. 5.

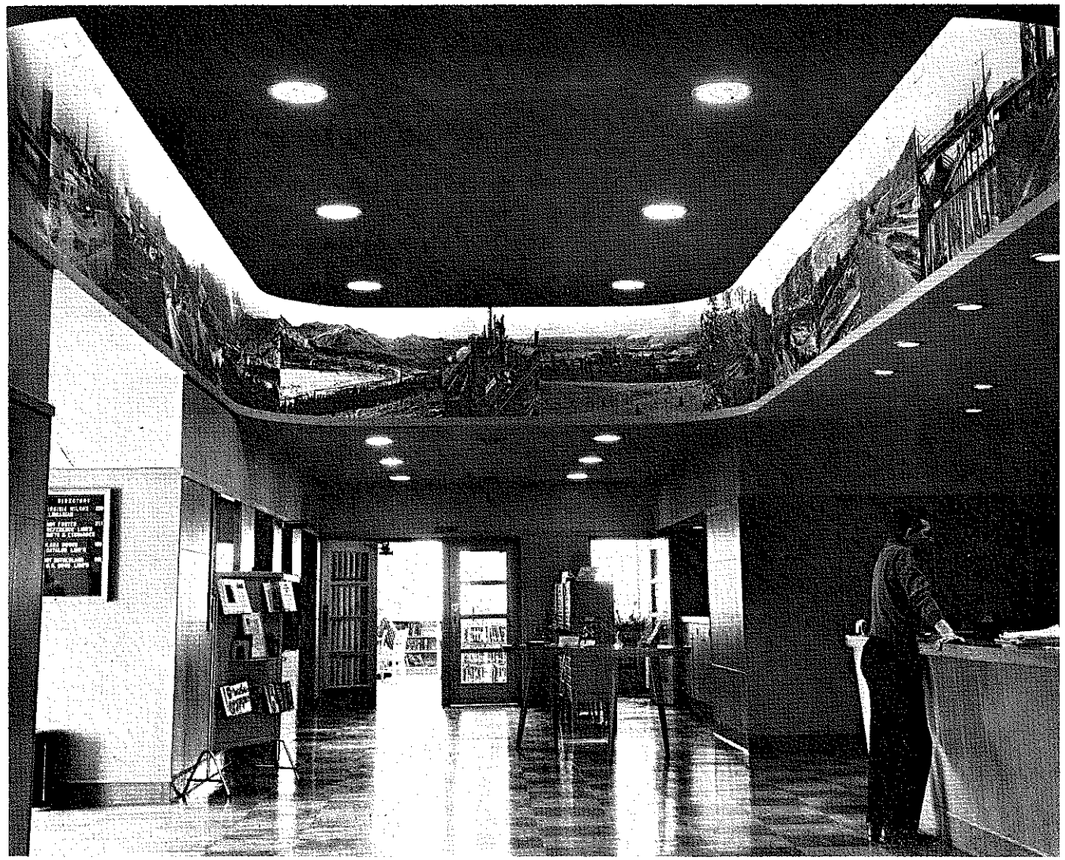
[8] *Op. cit, Catalogue,* 1896-97. p. 82.

[9] Colorado School of Mines *Catalogue,* 1901-02. (Golden, Colo.: The School, 1901) p. 7.

[10] Colorado School of Mines *Annual Catalogue,* 1902-03. (Golden, Colo.: The School, 1902) p. 28.

[11] Wilcox, Virginia Lee, "New Colorado School of Mines Library," *Mines Magazine,* v. 46, no. 10, Oct., 1956. p. 33-36.





▼The mural (in the library entrance lobby) depicts scenes of prominent Colorado mining operations.

of the new facilities and increased services made possible by the new building something certainly must be said.

First perhaps should be mentioned the fact that the various functions and collections were physically separated in the new building, requiring additional staff members and giving them adequate room and equipment, in most instances, to function efficiently.

### Staffing the Library

The staff of the Library grew slowly, but gradually, with the enrollment and collection, over the years.

There follows a list of the librarians at Mines, including those who served the needs of the Library at the beginning, although part time:

John B. Garvin, B.S., 1890-91, Librarian and Registrar.

Elbridge Graves Moody, 1892-1900, Librarian and Registrar.

Benjamin A. Ambler, 1900-1901, Librarian and Registrar.

Mabel Claire Shrum, B.L.S., 1902-1913, Librarian.

Pearl Garrison, M.Di., 1913-1920, Librarian.

Irma Downes Jacobs, Pd.B., 1920-1923, Librarian.

Mary E. Hoyt, B.L., 1923-1951, Librarian.

Raymond R. Dickison, A.B., B.L.S., M.S., 1951-1955, Librarian.

Virginia Lee Wilcox, A.B., M.A., 1955-1956, Acting Librarian.

Virginia Lee Wilcox, 1956 to date, Librarian.

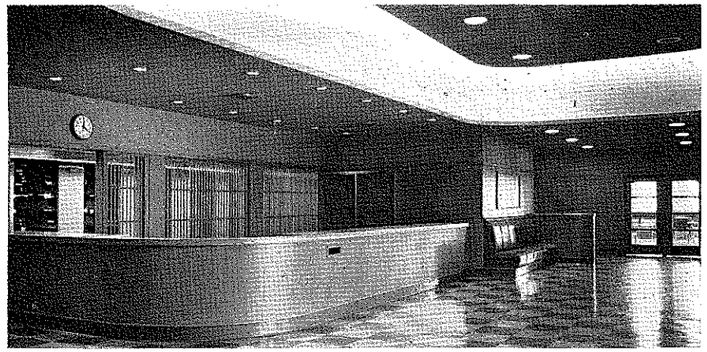
The quality of service a college library can render is in direct ratio to the quality of the staff which makes those services available and interprets them in terms of patrons' needs. It is not until 1932, we find from the School records, that there was an assistant librarian added to the staff. And it was not until 1946 that a third professional librarian was employed; and in 1955, another, making four professional librarians in the staff pattern at the present time.

It was in 1950 that the professional librarians on the staff achieved faculty status at the School. Before that time only the head librarian was a member of the faculty.

We know there were others down through the years who helped with the Library program, and perhaps a group of Faculty Women Volunteers, as there has been in the last five years, contributing generously of their time and abilities.

The non-professional library staff members are employed through State Civil Service. They have grown in numbers as the needs of the Library have increased until today there are six such full-time staff members.

Students have assisted in the Library at Mines from the early days, but graduate fellowships in the Library have been of recent origin, dating from the academic year 1955-56, when one fellowship was granted, with assignment to the Library. During the past year the Library had three graduate fellowships assigned, and for 1960/61



▼ Another view of the entrance lobby and circulation desk in the library, taken before completion of the mural.

there are four assigned for the academic year. The need for student assistance has grown until this year, 1960/61, there are budgeted 3,850 hours of student help. Graduate fellows and student assistants are invaluable in the duties they perform, although they cannot be expected to take the place of full time, specifically trained staff members.

There have been monthly staff meetings scheduled regularly since the spring of 1955, the first attempt to hold such meetings; and on occasion, special Staff meetings have been called by the Librarian when the need arose, in addition to those scheduled monthly. These meetings have proved helpful in solving library problems which freqently occur, in promoting interstaff cooperation, understanding of mutual problems, and better communication and rapport among all Staff members.

## Library Services

It would be meaningful to look at the performance of the staff members, graduate fellows, and student assistants, and some of the services which they make available in the new building.

With the Assembly Hall, projection equipment, and Hi-Fidelity equipment, an Audio-Visual program has been offered regularly since the new building was occupied. Lectures by local as well as national figures have been presented. Art and feature films have been scheduled regularly, both in color and cinemascope. A collection of art prints of the old masters and modern artists is available for loan. A collection of long-play recordings for loan, and concert programs of recorded music are also a service of the Audio-Visual Section of the new library. None of this was possible in the old building. The use of these and other facilities will appear later in tabular form.

The new library provided a Photocopy Room, and better equipment to improve the quality of the service. The use of this service has grown from a few hundred pages a year to 9198 for the fiscal year 1959/60. This has included pages for the personal use of both faculty and students, interlibrary loan materials, and duplication for library needs to replace worn or damaged pages and out-of-print materials.

Microprint readers, both for film and cards, and storage for the microform collection, is provided for in the new building. A new microfilm reader-printer makes possible an enlarged page copy from microfilm. The Library has around 500 volumes of periodicals in one form or another of microreproduction.

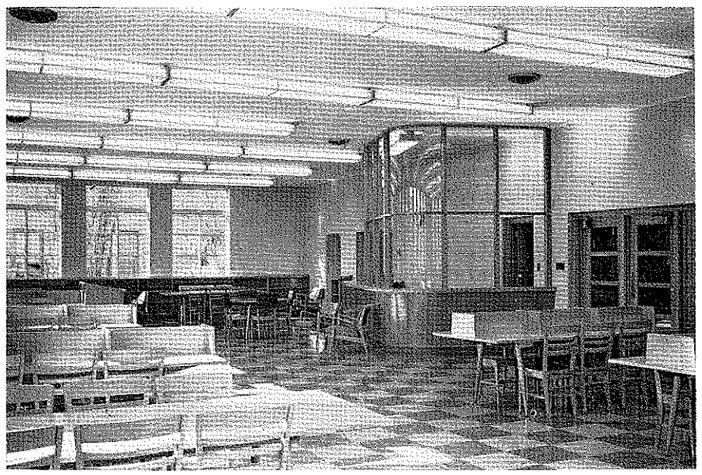
A Map Room makes possible the proper care of the Library's large map collection, in one location, where formerly, many were in the Geology Department.

The overall holdings of the Library are presented in the following tables. A large part of the collection is made up of long runs or sets of periodicals and serials, which is an important factor in the basic strength of the Mines Library for study and research. Books and periodicals are shelved together by subject. In the *Annual Catalogue* for 1902-03, we find a list of some 155 periodical and serial titles received in the library at that time, and many are currently received and constantly in use today.[12] A comparable list of such titles today would total some 1500 periodicals and serials; and the bound volumes of all of these titles, in the aggregate, represent approximately 60 per cent of the Library's present holdings.

[12] *Op. cit.*, p. 28-29.

### MAP HOLDINGS

| TYPE | Total as of 6/30/58 | Total as of 6/30/59 | Total as of 6/30/60 |
|---|---|---|---|
| Topographic | 40,389 | 44,911 | 47,094 |
| Geologic | 4,921 | 5,322 | 5,446 |
| Other | 377 | 454 | 454 |
| Total Maps | 45,687 | 50,687 | 52,994 |



▼ Reference section and general reading room in the library.

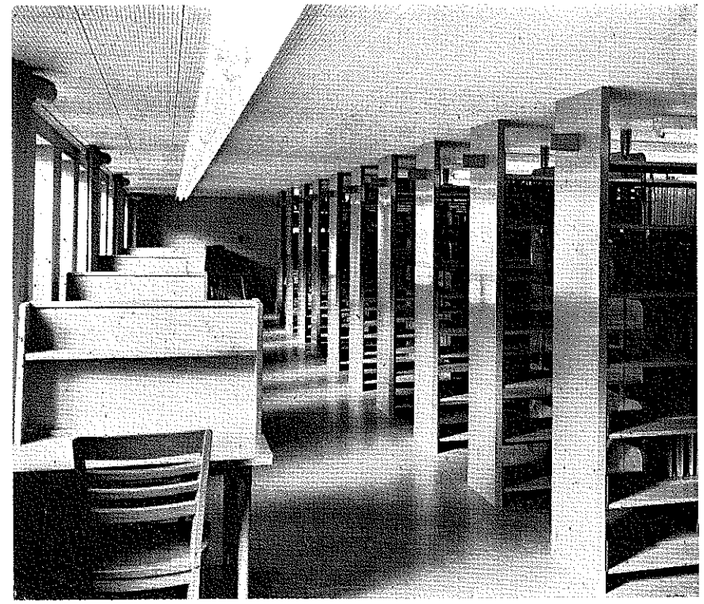


The tables following are an analysis of the size of the collection for the periods indicated. Figures represent volumes or volume equivalents:

Many of the volumes represented by the figures just given are received as gifts. The Library collection each year is strengthened by gifts from the School's many alumni and friends. An early *Catalogue* makes note of one of the first donors to the Library, "The authorities of the institution desire to acknowledge the generosity of Capt. Edw. L. Berthoud, formerly a trustee of the School, in presenting a number of the valuable works."[13] Within the covers of a number of volumes will be found the names of former owners: successful alumni, faculty members of yesterday and today, and many names prominent in the pioneer period of both School and state.

The Library has been enriched for many years by the receipt of material sent on the basis of exchange arrangements for the Colorado School of Mines *Quarterly*, THE MINES MAGAZINE, and only recently, the new publication of the Colorado School of Mines Research Foundation, the *Mineral Industries Bulletin*.

[13] *Op. cit., Catalogue*, 1896-97 p. 82.



▼ Stack area in the library.

Noted in an early *Catalogue* is an acknowledgment of significance: "To the Hon. H. M. Teller, for the regular receipt of reports and documents from the Department of the Interior of the United States Government."[14] This gift was the nucleus of one of the most valuable collections in the Library, the United States Government documents, especially the numerous series of the Geological Survey and the Bureau of Mines. In 1939, the Mines Library was designated a Depository, to receive selected documents of the government. The proportion of documents to the whole collection is indicated in the foregoing tables.

### HOLDINGS OF THE LIBRARY

#### TECHNICAL

| | As of June 30, 1958 | As of June 30, 1959 | Total of June 30, 1960 |
|---|---|---|---|
| 500's Pure Science | 23,319 | 24,140 | 25,109 |
| 600's Applied Science | 29,503 | 30,299 | 30,941 |
| *Documents | 10,951 | 11,640 | 12,269 |
| Theses | 1,463 | 1,532 | 1,532 |
| Total Technical | 65,236 | 67,611 | 69,851 |

#### NON-TECHNICAL

| | As of June 30, 1958 | As of June 30, 1959 | Total of June 30, 1960 |
|---|---|---|---|
| 000's-900's (Less 500's & 600's) | 14,327 | 15,008 | 16,105 |
| Fiction | 1,680 | 1,818 | 1,973 |
| *Documents | 7,229 | 7,823 | 8,465 |
| Total Non-Technical | 23,236 | 24,649 | 26,543 |

* Documents counted as volume equivalents. (All "Documents" references following apply only to U. S. Documents.)
Documents of other countries and all states are classified and included above.

#### SUMMARY

For Fiscal Years, ending June 30

| | 1958 | 1959 | 1960 |
|---|---|---|---|
| Technical | 65,236 | 67,611 | 69,851 |
| Non-Technical | 23,236 | 24,649 | 26,643 |
| Totals | 88,472 | 92,260 | 96,494 |

## Use of the Library

The test of a library's value is, in the last analysis, how useful it is to those for whom it exists. A perusal of the following tables will give a statistical picture of the use of the Library from circulation records alone. It is well to remember also, that there are many intangible uses and values which cannot be measured by the number of books circulated.

The Circulation Section is re-

[14] *Op. cit., Catalogue*, 1882-83 p. 57.

## CIRCULATION RECORD

### SUMMARY

Materials Borrowed from the Library
For the Fiscal Years, as Indicated:

The following table indicates the number and type of materials loaned for use outside the Library, including loans from the Main Circulation Desk, U. S. Documents, Audio-Visual Office, and some Departmental loans.

| | 1957/58 | 1958/59 | 1959/60 |
|---|---|---|---|
| Scientific & Technical (Includes Theses, Reserves, Documents) | 13,742 | 15,492 | 15,603 |
| Non-Technical (Includes Documents, Non-Fiction & Fiction) | 4,314 | 6,437 | 6,707 |
| Total—Books | 18,056 | 21,929 | 22,310 |
| A-V Materials (Includes Art Prints, records) | 685 | 597 | 606 |
| Grand Total | 18,741 | 22,526 | 22,916 |

### FACULTY-STUDENT CIRCULATION

The total Book Circulation for the fiscal year 1959/60 may be broken down by borrower as follows:

| | Faculty | Student | Others* |
|---|---|---|---|
| Scientific & Technical (Includes Theses, Reserves, Documents) | 1,446 | 11,613 | 2,544 |
| Non-Technical (Includes Documents, Non-Fiction & Fiction) | 1,085 | 3,927 | 1,695 |
| Total—Books | 2,531 | 15,540 | 4,239 |
| A-V Materials (Includes Art Prints, records) | 286 | 320 | 0 |
| Grand Total | 2,817 | 15,860 | 4,239 |

* Included here are Colorado School of Mines Research Foundation, alumni, wives of Faculty and Students, visiting engineers, scientists, research specialists, and neighboring Technical library loans.

### INTERLIBRARY LOANS

| Fiscal Year | Loaned | Borrowed |
|---|---|---|
| 1957/58 | 497 | 283 |
| 1958/59 | 467 | 354 |
| 1959/60 | 671 | 430 |

sponsible for loans to other libraries, and the borrowing from other libraries is a function of the Reference Section.

The Library uses several methods to encourage use and publicize its resources. There are several publications proceeding from various Sections, and the responsibility of designated Staff members, which point up news, new books, new subscriptions, services and the like. The Arthur Lakes Library *Newsletter*, v. 1, no. 1, May, 1955—, a quarterly, gives timely information as well as serving as a "facts on file" for historical reference. *New Books* is a monthly selection by the Catalogue Section of the books added to the Library's collection during the month. "Library Notes" is an *Oredigger* column written by the Documents Librarian. It gives annotations of timely selections of the new books received.

Exhibits and displays, a function of the Audio-Visual office, announce new books, point up literature on particular subjects, and stimulate reader interest.

A "Faculty Shelf" is at one end of the third stack level, at the left of the Circulation Desk. It brings together, in a secluded area, the newer books on such subjects as engineering education, improvement of college and university teaching, promotion of research, service and leadership in education, and academic freedom.

The Library is an original sponsoring member of the Bibliographical Center for Research in Denver. Through its Union Catalog of many of the significant libraries in the country, including the Library of Congress, and its many subject bibliographies, research and source material are made available to Mines' Library. Interlibrary loans as shown in the foregoing table, are a significant part of the services performed by the Library, whether direct, or through the Bibliographical Center. When needed for research by faculty or graduate student, the Library borrows across the country, if necessary, and makes even more loans on the same scope, as many an alumnus knows!







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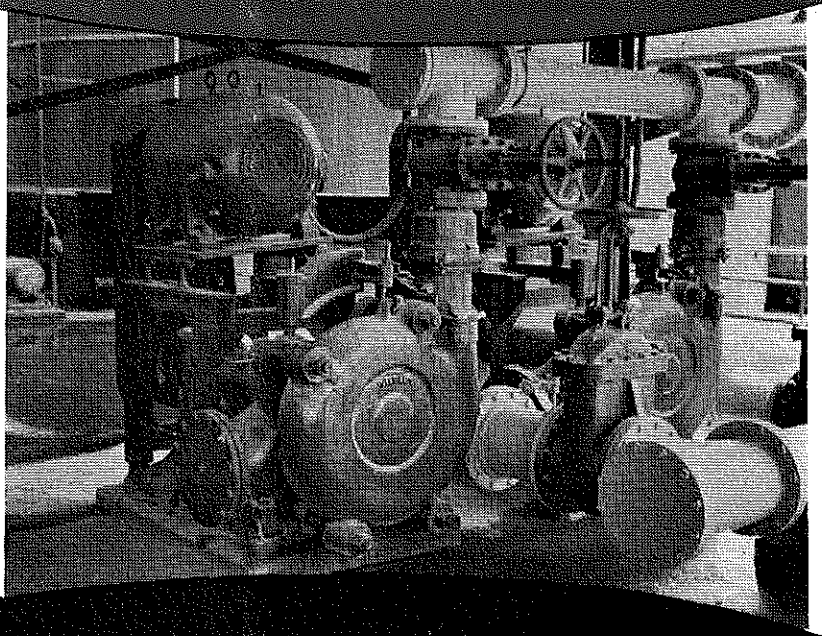

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