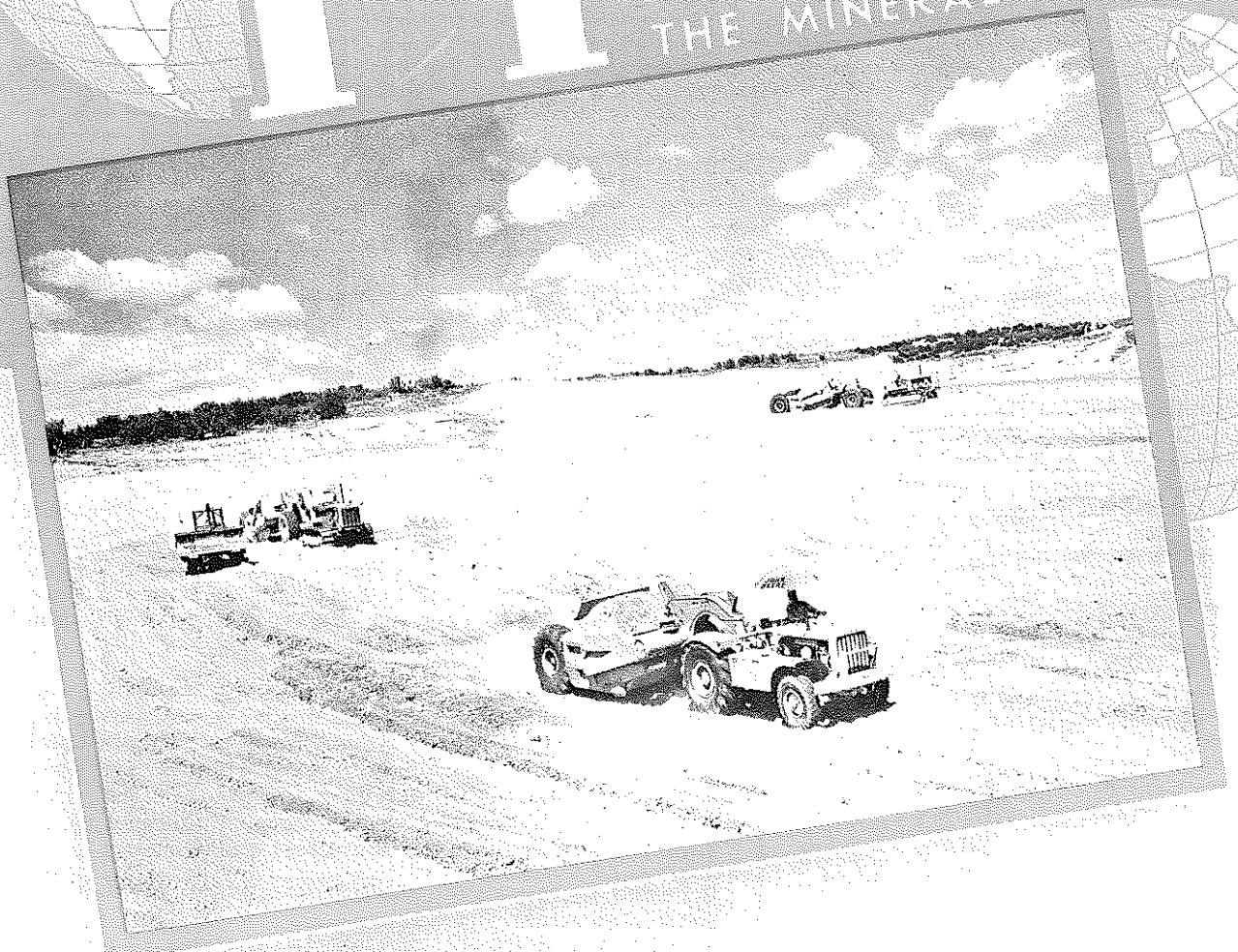
THE MINES MAGAZINE

AROUND THE WORLD WIT
THE MINERAL INDUSTRI



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SYNTHETIC LIQUID FUELS
ATOMIC ENERGY NEWS

JANUARY • 1950

VOLUME XL NO. 1

PERSONAL NOTES

S. Wm. Schoellhorn, '42, has entered the Graduate School, California Institute of Technology, and is addressed in their care, Pasadena, Calif.

Robert C. Schwab, '49, has accepted position of Assistant Computer, with General Geophysical Company. He is addressed in their care, Crew 13, 2513 Gulf Building, Houston, Texas.

John J. Seerley, '48, is also with Pend Oreille Mining & Metals Company as Mine Shift Boss, with address Box 54, Metaline Falls, Wash.

Robert E. Simpson, '42, resigned his position with the Slate River Mining Company at Crested Butte, Colorado, to become associated with Simpson-Turner Motor Company, Alamosa, Colorado.

F. E. Smiley, Jr., '40, Instructor in Civil Engineering at *Mines,* has moved his residence to 707 15th Street, Golden.

William K. Wood, '31, recently returned to the States from three years in Germany and is now in Supply Division, Office of Chief of Engineers, Washington 25, D. C.

Wallace W. Agey, '39, Metallurgist for the U. S. Bureau of Mines, has been transferred from Salt Lake City to Mexico City, where his address is in care of the American Embassy, Bureau of Mines, 64 Paseo de la Reforma, Mexico, D. F., Mexico.

Lt. Col. E. M. J. Alenius, '23, is now stationed in Washington, D. C., his residence address being 35 Williamsburg Road, Alexandria, Va.

John C. Anderson, Jr., '45, Mining Engineer for Kaiser Aluminum & Chemical Corporation, has a foreign assignment, his present address being in care of the company, Mandeville, Jamaica, B. W. I.

W. Z. Bancroft, '36, has been transferred from San Francisco to Los Angeles by LeRoi-Rix Machinery Co., for whom he serves as Sales Engineer. He is now being addressed in care of the company, 6403 East Slauson Ave., Los Angeles 22, Calif.

Leland J. Beckham, '30, has moved his residence from Richmond to Chester, Virginia, Route 2, Box 165-A. He is serving as Laboratory Director for The Solvay Process Division, Allied Chemical & Dye Corporation.

Robert J. Black, '49, has entered George Washington University for graduate work. His mailing address is 1512-21st Street, N. W., Washington 6, D. C.

John L. Bolles, '49, is Assisting Research Engineer for Anaconda Copper Mining Company, and resides at 306 West Fifth Street, Anaconda, Montana.

John E. Bowenkamp, '32, General Superintendent for Timmins Mining Enterprises, S. A., has a change of address to Apartado 86, Popayan, Colombia, S. A.

Dwayne M. Coleman, '49, Engineer Trainee, Magnolia Petroleum Company, is, at present, being addressed Route 1, Box 57, Opealousas, Louisiana.

Robin J. Corbett, '48, who is employed by the Sharples Oil Company, is addressed in their care, Box 544, Worland, Wyoming.

F. S. Crane, '43, has moved his residence to 416½ North Adams Street, Glendale 6, Calif., where he receives mail. He is Division Engineer for the Oil Well Supply Company.

Charles R. Criss, '39, has been transferred from Evansville, Indiana, to the Oklahoma City offices of the Sohio Petro-

(Continued on page 6)

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Professional . . . CARDS

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5031 Laurelcrest Lane
Seattle 5 Washington

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Aptitude Testing—Sales Training
Executives Selection & Training Institute
956 Maccabee Bldg. Detroit 2, Mich.

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The Mine & Smelter Supply Co.
1775 Broadway New York City

George R. Brown, '22
Brown & Root, Inc.
Engineering Construction
Houston Austin Corpus Christi

Walter E. Burlingame, '01
Assayer—Engineer—Chemist
2040 Broadway Phone: TA. 3615
Denver

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President
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417 S. Hill St. Los Angeles, Calif

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145 W. Lincoln Ave. Delaware, Ohio

Allan E. Craig, '14
Marcy Mill Division
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Denver Colorado

Ralph D. Curtis, '26
Production Manager
C. H. Murphy & Co.
1st Nat'l Bank Bldg. El Dorado, Ark.

E. E. Dawson, '38
Manager, Persian Gulf Operations
Brown Drilling Company
Long Beach California

Earlougher Engineering
Petroleum Consultants — Core Analysis
319 E. Fourth St. Tulsa 3, Okla.
R. C. Earlougher, '36, Registered Engineer

Albert C. Harding, '37
General Manager
Black Hills Bentonite, Inc.
Moorcroft Wyoming

Letters . . .

TOOK A DAY OFF TO CATCH UP ON MINES MAGAZINE

From DEWEY D. BOWLING, '49, *c/o Shell Oil Company, McCamey, Texas.*

I just received copies of three issues of *Mines Magazine* and really had a field day reading them!

Several trade publications interested me and I would appreciate it very much if you would send them to me, as listed. Also could you get the books for me which I have designated?

I am employed as junior exploitation engineer with Shell Oil Company, Inc., and find the work extremely interesting.

ESTABLISHES OFFICE IN SINGAPORE

From BURT AMSDEN, '25, *Consulting Mining Engineer, P. O. Box 361, French Bank Bldg., Singapore, Malaya.*

Herewith check covering my dues for the current year plus amount for publication of photograph in the 1949 directory. Please note my new address above and change your records accordingly.

I hope this letter will not be too long in reaching you. The mails are sometimes erratic in this part of the world.

HAS NEW POSITION

From JOHN E. MOTICA, '48, *54 West 13th Street, Sheridan, Wyoming.*

This is to advise you of my change of address from Vivian, Louisiana, to that given above.

I have resigned my position with the Stanolind Oil and Gas Company to accept one as mining engineer with the Sheridan-Wyoming Coal Company.

REGRETS HAVING MISSED THE 75TH ANNIVERSARY CELEBRATION

From R. W. KOONTZ, '44, *Box 512, Bowie, Texas.*

Please address future *"Mines"* publications to my new address. I am located here with Continental Oil Company as their field engineer.

Was sorry to have missed the 75th Anniversary for I know it would have been fun to resume old acquaintances and make new ones.

My regards to the boys for reconstructing the "M" in such short time—a job well done. I didn't, however, see any pictures of bald and painted monkeys.

RATHER SLOW IN GIVING CHANGE OF ADDRESS!

From L. P. MOSHEIM, '48, *Exploration Dept., Socony-Vacuum Oil Co. of Colombia, Aptdo. Aereo 4034, Bogota, Colombia.*

Enclosed you will find check covering my dues and also a modest contribution to the employment fund.

I regret to have been slow in notifying you of my change of address; since no good explanation is forthcoming, I won't try to dream up any excuse.

I have been in Colombia as a junior field geologist for nearly a year now, the better part of the time in the Guianas and the rest in Bogota. Naturally, I would like to receive *Mines Magazine,* if possible, at the address given above.

ATTENDED MEETING OF OKLAHOMA CITY CHAPTER

From CHARLES R. CRISS, '39, *518 So. Willow Road, Evansville 14, Ind.*

I am now in Evansville—still with Sohio Petroleum Company.

Was in Oklahoma City last week and attended the semi-monthly luncheon meeting of the Oklahoma City chapter of the Alumni Association. Saw some old friends and it really felt good to sit down again with a group of *Miners.* Since graduating I have been more or less off the beaten track and this was the first occasion on which I was in the right place and the right time.

ENTERS PRIVATE PRACTICE AS MINING ENGINEER

From MANUEL F. QUIROGA, '24, *Calle Puebla 29, Hermosillo, Sonora, Mexico.*

Please change my address from Nacozari, Mexico, to that given above, in order that I may continue to receive *Mines Magazine* without fail.

Following the closure of the Pilares Mine, operated by The Moctezuma Copper Company at Pilares and Nacozari, Sonora, early in June, I decided to settle in Hermosillo, where I am engaged in private practice and mining.

SOLE REPRESENTATIVE OF MINES IN HIS DISTRICT

From JOSEPH R. SOPER, JR., '44, *2606 Ave. G, Rosenberg, Texas.*

Just a note to tell you "Hello" and how much I enjoy *Mines Magazine.* Wish I could be up there for the big celebration.

So far I haven't seen a single *Miner* here. I enjoy my work very much and am glad I came here.

On July 29 we were blessed with another "prospective *Miner,*" Joseph R. Soper, III.

We've changed our home address to that given above but you can continue sending the magazine to the mine (Duval Texas Sulphur Company, Orchard, Texas).

A GEOPHYSICIST REPORTS HIS SON'S ARRIVAL

From ALBERT W. MUSGRAVE, '47, *1020-13th Street, Golden, Colorado*

I am enclosing a birth announcement of our baby boy who by this time is of a ripe old age of 4 mos. And needless to say his parents are very proud of him.

Name of Prospect: Real Wayne
Location: Odessa
Date: 6/7/49
Time: 12:30 P.M.
Country: Ector *State:* Texas
Density of Formation Mapped: 7 lbs. 6 oz.
Computed by: Maxine
Checked by: Albert

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TECHNICAL MEN WANTED

Those interested in any of the positions listed may make application through "Mines" Capability Exchange, 734 Cooper Building, Denver 2, Colorado.

(119) ENGINEERS FOR GEOPHYSICAL WORK. Men with training and experience in Geology, Physics, Mathematics, or Electronics, willing to enter foreign service will be specially trained for responsible positions in petroleum exploration.

(841) INSURANCE SALESMEN. An old established life insurance company offers excellent opportunities for inexperienced and experienced salesmen. The type of men wanted should be capable of earning several thousand dollars per year.

(860) SCHOOL TEACHERS. Positions are open with one of the Government bureaus in Central America for elementary and high school teachers. Also for Safety engineer. Salaries depending upon Civil Service ratings.

(1024) ENGINEERS. The Army engineers working on projects in the middle West have positions open for hydraulic engineers, civil engineers, structural engineers, and mechanical engineers. Ratings vary from P-1 to P-3. Salary from $2974.80 to $4479.60 per year.

(1030) SMELTER AND MILL SUPERINTENDENTS. An engineering company now building a concentrating mill and smelter in Turkey have positions open for a smelter superintendent who has had experience in smelting flotation concentrates in a reverberatory furnace and also in the conversion of copper matt by convertor into refined copper, and a flotation mill superintendent capable of operating a 1500 ton mill on chalcopyrite ore. Salary of both positions open, depending on experience and ability of applicants.

(1085) RESEARCH ENGINEER. An industrial company located in the East has position open for senior research engineer. The applicant must have full knowledge of crushing, classification, methods of chemical treatment and heat treatment of artificial abrasives. Salary open.

(1094) PETROLEUM ENGINEER. An oil company operating in mid-continent field and in western oil fields has a position open for experienced petroleum engineer with production experience in the state of California. Must have thorough knowledge on California laws and regulations applying to the petroleum industry. Applicant must have had several years experience. Salary open, depending upon experience and ability of applicant.

(1100) MINE FOREMAN. A position is open for mine foreman in Africa who has had experience in top-slicing methods and the use of square sets. Must be capable of handling bad ground in wide veins. Production will probably run several hundred tons per day. Applicant must have had wide experience and be able to produce with native labor. Salary open.

(1101) PETROLEUM GEOLOGIST. One of the major oil companies has position open for an experienced petroleum geologist, age between 30 and 35 years. Must have had at least two years experience in stratigraphic and research work. Must have ability to produce intelligent reports and carry on new work without constant supervision. Good opportunity for right man. Salary will depend upon experience and ability of applicant.

(1118) SENIOR PETROLEUM ENGINEER. One of the major oil companies with foreign operations has position open for senior petroleum engineer who has had at least 10 years experience in production engineering and reservoir engineering. Man should be between 35 and 45 years of age and one who can supervise and direct research in production and reservoir work. Salary open, depending upon experience and ability of applicant.

(1119) PETROLEUM RESEARCH ENGINEER. One of the major oil companies has position open for petroleum engineer in their Research Department who has had graduate work in fields of physics and physical chemistry as well as experience in connection with petroleum reservoir work. Research work will be in relation to petroleum reservoir fluid mechanics. Salary open.

(1120) RESEARCH GEOLOGIST. A position is open with one of the major oil companies operating in mid-continent field for a petroleum geologist who has had graduate work and is proficient in the knowledge of mineralogy and petrology. He should have had sufficient field experience to be well acquainted with reservoir rocks to enable him to carry on research and study of the composition and arrangement of the granular structure which may effect capillary flow phenomena. Salary open.

(1121) CHEMICAL ENGINEER OR METALLURGIST. A position is open with a zinc smelter or metallurgist with two or three years operating experience in chemical or metallurgical industries. Applicant will be trained for responsible position. Salary open.

(1122) JUNIOR MINING AND METALLURGICAL ENGINEER. One of the major companies operating in the Great Lakes region has a position open for junior mining and metallurgical engineer in connection with material handling and beneficiation problems. Applicant will be given training in their various plants before being assigned to regular duty. Work is extremely dirty and performed under adverse weather conditions. Excellent opportunity for the right man. Salary open.

(1123) PETROLEUM ENGINEER. A mid-continent oil company has position open for a petroleum engineer who has had experience in secondary recovery and water flooding operation. Applicant should have at least three years experience in the field, with a good understanding of all the requirements. Salary will be commensorate with experience and ability of applicant.

(1124) GEOPHYSICIST. One of the major oil companies has a position open in Venezuela for a geophysicist who is familiar with seismic and gravity interpretations and capable of independent review work. Probable salary from $600 to $700 per month, plus living allowance of from $200 to $275 per month.

(1126) DRAFTSMAN AND DESIGNER. A company operating in one of the central states has position open for young engineering draftsman capable of doing design and detail work for mine and mill along with general engineering. Should be able to handle design and layout of underground structures. Salary open.

(1127) DIESEL ENGINEER. A mining company with operations in Nicaragua has position open for diesel engineer who understands maintenance and operation of heavy four cycle diesel engines. Must be willing to go single status for indefinite period. Starting salary $300 to $400 per month plus living and traveling expenses.

(1127A) JUNIOR MINING ENGINEER. A Nicaragua mining company has position open for junior mining engineer. Must be in good health and willing to go single status for indefinite period. Liberal salary plus expenses.

(1127B) ELECTRICIAN. A mining company in Central America has position open for mine electrician who is thoroughly experienced and capable of handling maintenance on all electrical equipment. Starting salary depending upon experience and ability of applicant. Must be willing to report single status indefinitely.

(1128) SEISMOGRAPH PARTY CHIEF. A position is open with one of the geophysical companies for a party chief to be located in the North country. Must have thorough experience and be aggressive enough to direct an experimental crew with portable equipment. Salary open.

(1130) WAREHOUSEMAN. A mining company operating in Bolivia has position open for a warehouseman capable of maintaining all warehouse supplies both mine, mill and electrical. Must have a fluent knowledge of Spanish. Three year contract. It will be necessary to report single status for six months. Liberal starting salary plus yearly bonus. Vacation four weeks annually.

PERSONAL NOTES

(Continued from page 3)

leum Company, 12th Floor, Skirvin Tower. He is serving as Engineer for the company.

Walter L. Crow, '41, resigned his position with duPont Company to take over the ownership of Bradley Hatchery at Longmont, Colorado, where he is now addressed.

Allen S. Crowley, '39, Sales-Service Engineer for Hercules Powder Company, has a new residence address, 714 No. Pearl Street, Joplin, Missouri.

Eugene E. Dawson, '38, who has been in Saudi Arabia for some time as Manager of Persian Gulf Operations for Brown Drilling Company, has been transferred to their home office as Manager, Foreign Operations. His new address is in care of the company, 1456 East Hill Street, Long Beach, Calif.

Frank E. Delahunty, '25, accompanied by Mrs. Delahunty, is spending a vacation in the States. He was in Denver the early part of December and was plan-

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PERSONAL NOTES

(Continued from page 6)

ning to spend the Christmas Holidays with relatives in California.

Reeve M. Duhme, '40, Geologist with the U. S. Engineers Corps, is now being addressed in their care, Kernville, California, where they are doing work on the Isabella Dam.

C. Mac Dye, '40, is employed at the H & S Mine at Armstead, Montana.

Arthur E. Falvey, '34, has been named Process Development Engineer by Edgar Brothers Company and transferred from Gardner, Georgia, to their office at McIntyre, Georgia.

Glen E. Fassler, '29, has resigned his position as Chief Engineer for the New York & Honduras Rosario Mining Company in Honduras and is being addressed 1510 West 8th Street, Freeport, Texas.

Frank A. Foley, '49, has a change of address to 1726 East 2nd Street, Apt. 12, Long Beach 2, Calif. He is serving as Surveyor for E. B. Hall Drilling Company.

Bill Harris, '47, of Nurgdorf, Idaho, was in Denver last month and called at the Alumni office.

Wilford L. Hartz, '39, is Metallurgist for Wilfley Leasing Company at Kokomo, Colorado.

John F. Hatch, '49, Assistant Mine Superintendent for International Minerals & Chemical Corporation, has been transferred to Mulberry, Florida, where he is being addressed General Delivery.

Gerald Hoffman, '49, is Junior Engineer for Phelps Dodge Corporation, his present address being General Delivery, Morenci, Arizona.

Robert J. Hundhausen, '38, has a change of residence address in Albany, Oregon, to 940 West 6th Street. He is Mining Engineer for the U. S. Bureau of Mines.

A. T. Ireson, '48, Exploitation Engineer for Shell Oil Company, is, at present, in Elk City, Oklahoma, where he is addressed in care of the company.

Lyle R. Jenkins, '49, Metallurgist Trainee, Research Department, Carnegie-Illinois Steel Corporation, receives mail at his home, 615 West 7th Street, Davenport, Iowa.

Don M. Johnson, '29, Assistant Chief Metallurgist, Otis Works, Jones & Laughlin Steel Corporation, resides at 20613 Beaconsfield Blvd., Rocky River, Ohio.

Robert K. Johnston, '40, is Petroleum Chemist for Nox-Rust Chemical Corporation, receiving mail at 4700 So. Central Avenue, Chicago 38, Illinois.

F. B. Jones, '23, is Chemist, Food & Drug Administration, Federal Security Agency. His home address is 284 Park Avenue, Freeport, L. I., N. Y.

William H. King, '27, resides at 553 Salem Avenue, Woodbury, N. J. He is Chemical Engineer for Socony-Vacuum Oil Co., Inc.

Dana W. Leeke, '10, has returned to the States from Korea where he was doing consulting work for A.M.I.K., and, at present, is being addressed in care of Ada E. Leeke, Fern Glen, LaJolla, Calif.

R. H. Maddux, Ex-'07, has retired as Business Manager of Imperial Irrigation District, and is now residing at 1535 West 39th Street, Los Angeles 47, Calif.

J. R. Medaris, '49, has a change of address to 411 So. Eckroat, Oklahoma City, Okla. He is Junior Engineer for Phillips Petroleum Company.

Thomas C. Moseley, '47, resigned his position with The Texas Company to become associated with the U. S. Bureau of Reclamation as Hydraluic Engineer.

He receives mail at his home, 2210 So. Irving, Denver.

Lawrence B. Myers, '48, is employed by Phillips Petroleum Company with present address Box 81, Eureka, Kansas.

Maurice Naftaly, '38, Vice-President of David Naftaly & Sons, Inc., returned recently to the New York Office of the company after having been in Manila for several months. He receives mail at his residence, 99-46-64th Avenue, Forest Hills, Long Island, N. Y.

M. Jordan Nathason, '36, is Vice President and General Manager of Western Sealant, Inc. His residence address is 193 So. Holliston, Pasadena, Calif.

James M. Phillips, '41, resigned his position with the Chain Belt Company to become Industrial Engineer for Southern Gas Company. His new address is in care of the company, Watts Building, Birmingham, Alabama.

Donald O. Russell, '09, Governing Director, Perrin Cooper & Co., Ltd., of Tientsin, China, and Director of J. A. Russell & Co., Rustive Motors, Ltd., and W. R. Loxley & Co., Ltd., of China and England, arrived in Denver just before last Thanksgiving Day to spend the holiday with his son, Michael, who is a freshman at *Mines.*

Paul W. Smith, '35, is now with the U. S. Bureau of Reclamation, Design and Construction Branch, Administrative Engineering Division, as Specification Reviewer. His home is 1100 So. Vine Street, Denver.

Marvin B. Seldin, '48, Metallurgist, American Smelting & Refining Company, has been transferred to Santa Barbara, Chih., Mexico, where he is addressed in care of the company.

Glenn R. Stephens, '27, who is employed by Lockheed Aircraft Corporation, has a change of residence address to 11758 Sheldon Street, Sun Valley, Calif.

John T. Stubbs, '26, has moved his residence in Colorado Springs to 1832 No. Franklin Street. He is serving as Engineer for Colorado State Highway Department.

Thomas P. Turchan, '35, Production Superintendent for Stauffer Chemical Company, has been transferred from Henderson, Nevada, to Niagara Falls, N. Y., where he is addressed in care of the company, Box 616.

John H. Wilson, '31, is Manager of Field Operations for Bradshaw, Goodrich & Cia., Ltd., which operates in lumber, rubber, cocoa, and natural gums. His mailing address is Caixa Postal 923, Bahia, Brazil, S. A.

Gordon R. Wynne, '40, Engineer for Ingersoll-Rand Company, receives mail at 173 Harding Street, Ironwood, Michigan.

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TECHNICAL SOCIETIES and ASSOCIATION MEETINGS

MINING CONVENTION—DENVER FEBRUARY 2, 3, 4, 1950

The Mining Convention will be held in Denver on February 2, 3 and 4, 1950, at the Shirley-Savoy Hotel. The Gold and Silver Banquet will be on Friday evening, February 3, and the Sowbelly Dinner and Mining Ladies' Dinner on Saturday night, February 4.

John Hamm, President of the Association, will open the meeting at 10:00 a.m., Friday morning, at which time the activities of the Association and developments in the mining industry will be explained. Workmen's Compensation costs, Industrial Relations, Safety and the Tax Program of the mining industry will round out a highly important morning session.

The luncheon, presided over by George Rupp, Manager of the Mining Department of the Colorado Fuel & Iron Corporation, will be addressed by W. H. H. Cranmer, President of the New Park Mining Company, Keetley, Utah, and George E. Diggery, Superintendent of Industrial Relations of the C. F. & I. Plant at Pueblo.

A round-table forum, presided over by J. Price Briscoe, on the proposals of the Office of Land Management and the Hoover Commission will take place during the afternoon session. Prominent attorneys, miners and government officials will participate in these round-table discussions. The conception of Uranium discoveries will also be explained. Following this a Cocktail Party for men will be held at the University Club through the courtesy of Supply and Equipment firms of Denver. A. H. Patten will be in charge.

The popular Oil Shale section will be held at 7:30 Thursday evening in the Empire Room of the Shirley-Savoy. Included among the speakers are E. D. Gardner of the U. S. Bureau of Mines, Washington, D. C., and E. M. Sipprelle of the Experiment Station at Rifle. This discussion will include an explanation of mining costs developed after considerable experimentation at the government plant at Rifle, Colorado.

The Uranium section will take place Friday morning, presided over by Blair Burwell, Chairman of the Convention. Mr. Burwell will discuss Uranium Discoveries and Publicity. The Atomic Energy Commission staff will be represented by Dr. Fetzer of Grand Junction and Jesse Johnson of Washington. Howard Balsley, well-known small operator from eastern Utah, will present the Small Producers' Viewpoint and George Gallagher an explanation of the plant at Monticello. "Peacetime Uses of Atomic Energy" will be the subject presented by the General Electric Company, to be followed by D. W. Viles, Vice President and General Manager of the Vanadium Corporation of America, and John W. Hill of the United States Vanadium Corporation.

A luncheon will be held to be addressed by Senator Eugene D. Millikin, Junior Senator of Colorado, who will discuss the Implications of the Administration's Program with reference to Domestic Mining. Gold and the Gold Miners' Program is the subject assigned to Joseph Stagg Lawrence, Vice President of the Empire Trust Company of New York City, who made such a hit last year in his presentation at the Gold and Silver Banquet. Mr. Lawrence is accepted as the leading authority on the subject in the United States.

Charles Chase, Executive Vice President of Shenandoah-Dives Mining Company, will introduce Felix Wormser, Vice President of the St. Joe Lead Company, who will present one of the major addresses of the meeting on the subject of The Adverse Effect of Currency Devaluation on Mining in the United States. A round-table discussion will follow, presided over by Ed Snyder, President of the American Zinc Institute and of the Combined Metals Reduction Company.

The Problems of Base Metal Mining will be presented by J. H. Buchanan of the Nellie B Mining Company of Picher, Oklahoma; John A. Richards of St. Anthony Mining and Development Company of Tiger, Arizona; Joe Taylor of the Peru Mining Company of Silver City, New Mexico; C. A. Dye of the Apache Mining Company of Hailey, Idaho; Henry L. Day of the Day Mines, Wallace, Idaho; W. C. Page of the U. S. Smelting and Refining Company of Salt Lake City; H. P. Ehrlinger of the Bonita Mining and Development Company of Silverton; and others.

Milling Problems and the Treatment of Manganese Ores will be briefed by W. C. Clift of Denver and James Bradley of San Francisco, California, well-known expert on Tungsten and Antimony will give a complete report on these two metals.

The Toastmaster at the Gold and Silver Banquet will again be Frank A. Wardlaw, Jr. of the International Smelting Company of Salt Lake City. Paul Harrison of the American Smelting and Refining Company is Chairman of this banquet, with George Teal acting as Vice Chairman. Speakers will include Oscar A. Chapman, Secretary of the Interior, and Hubert Howard, Chairman of the Munitions Board.

Emphasis will be placed on the importance of Nonmetallics at the Saturday morning session and New Developments in Geology. Dr. A. H. Koschmann of the U. S. Geological Survey and Ed Eccle, Chief of the Engineering and Geological Section, will be speakers on the main subject, followed by a most interesting paper prepared by Dr. V. P. Sokoloff, who has just returned from Australia. He will explain Geochemical Exploration in Australia in 1949. The importance of this paper will be emphasized by Maury M. Travis, Consulting Geologist of Denver.

The Saturday luncheon session will be devoted to New Developments in Research. Participants in this discussion will include V. L. Mattson of the Colorado School of Mines Experimental Station, and John D. Sullivan of the Battelle Institute.

During the afternoon New Developments in Mining are on the agenda. The session will be presided over by J. Fred Johnson, Manager of Operations of the American Smelting & Refining Company of Salt Lake City. Jack Abrams of the Climax Molybdenum Company, and numerous other operators will participate in these discussions. There will also be a session on Silver and the Treatment of Low-Grade Gold Ores.

The "World-Famous" Sowbelly Dinner will close the Convention on Saturday night. John W. Valentine will act as Toastmaster and Melvin Brugger is Chairman. The speaker will be the Honorable Joseph C. O'Mahoney of Wyoming, together with Eugene D. Millikin of Denver. Other prominent speakers will include other Senators, Governors of mining states, leading Defense and Security officials, and at least one member of the Cabinet.

Ladies' parties are being arranged by a Ladies' Committee and on the evening of the Sowbelly Dinner the mining ladies will hold their traditional dinner at the Cosmopolitan Hotel.

Those desiring to secure tickets for these banquets in advance should contact the office of the Colorado Mining Association, 204 State Office Building, Denver, or mail checks for $3.50 for the Sowbelly Dinner and $5.00 for the Gold and Silver Banquet. The Committee is arranging plenty of entertainment and many new and novel features will be included in this year's program.

In the event that mining legislation is enacted by the Congress, an explanation will be given at the meeting by the Secretary of the Interior and the Director of the United States Bureau of Mines.

PROGRAM ANNOUNCED FOR 1950 ACI CONVENTION

The tentative program for the 46th Annual Convention of the American Concrete Institute, to be held at the Edgewater Beach Hotel, Chicago, Ill., February 20 to 22, has been announced by the Institute's Technical Activities Committee. There will be seven sessions in five periods, with two of the periods being held concurrently.

As now set up, the program includes sessions on inspection, ACI Building Code studies, reinforced concrete design problems, structural design of concrete pavements, admixtures for concrete, a panel discussion of questions on concrete problems and the annual open session on concrete and cement research.

Presiding officer at the convention will be ACI President Herbert J. Gilkey, Iowa State College, Ames, Iowa.

AMERICAN MINING CONGRESS ELECTS OFFICERS

Howard I. Young, St. Louis, president of the American Zinc, Lead and Smelting Co., was reelected president of the American Mining Congress at the organization's annual business meeting held in New York, N. Y. on the evening of December 7.

Reelected as vice presidents were: Andrew Fletcher, president, St. Joseph Lead Co., New York, N. Y.; and Donald A. Callahan, president, Callahan Consolidated Mines, Inc., Wallace, Idaho. W. J. Jenkins, St. Louis, president of the Consolidated Coal Co. of St. Louis was elected to a vice presidency to succeed James D. Francis, chairman of the Board, Island Creek Coal Company, Huntington, W. Va. Julian D. Conover, Washington, D. C. was reelected secretary.

The following were elected to the Board of Directors of the American Mining Congress: V. P. Geffine, Vice Pres., Cleveland Cliffs Iron Co., Cleveland, Ohio; W. H. Hoover, president, Anaconda Cop-

(Continued on page 43)

The Mines Magazine

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Stripping overburden for the stripmining of Bentonite near Sanders, Arizona, with caterpillar Diesel DW10 Tractor and No. 10 Scraper. Courtesy Caterpillar Tractor Company.

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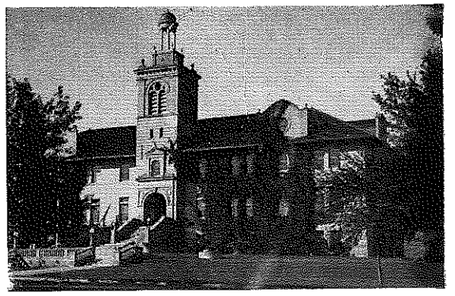

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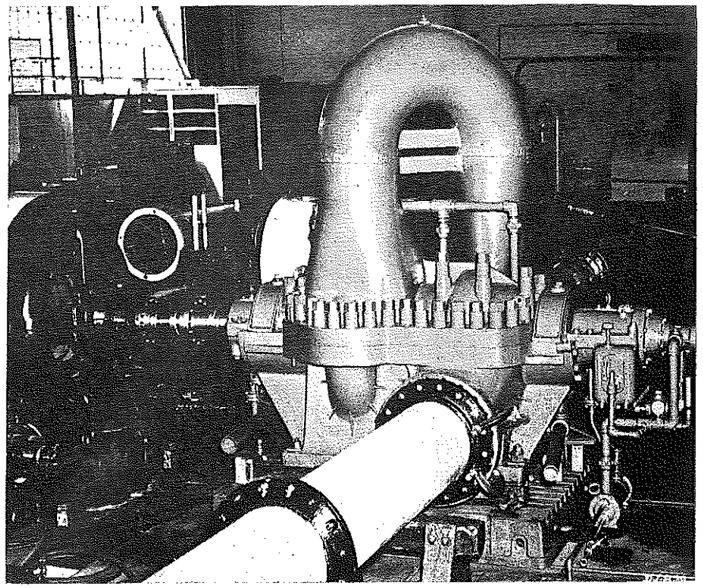
TRANS-ARABIAN PIPELINE

Opens New Chapter in International Oil History

(Continued from December, 1949)



▼ Byron-Jackson oil line pump, world's largest—to be installed at first station of Trans-Arabian pipeline.

Engineering Features of Trans-Arabian Pipe Line*

In early discussions of a proposed pipe line across Arabia, it was tacitly assumed that the pipe would be of 24-inch diameter such as had been employed on the Big Inch lines from Texas to the Atlantic seaboard and was the largest in use for oil transmission up to that time. When the subject came up for reexamination in 1945, however, it became clear that the 24-inch pipe was somewhat too small for greatest economy, and that for a nominal average rate of 300,000 barrels per day a thin-wall pipe of approximately 30-inch diameter would be preferable, and this size finally was adopted.

Specifications of Pipe

The pipe has been, and still is being, manufactured at Maywood, California, from plate rolled at Geneva, Utah. Half the pipe is 30 inches in diameter and half 31 inches in diameter, and most of it has a nominal wall thickness of ¼ inch. The steel is of medium carbon, medium high-manganese material and is semi-killed. Specification limits are as follows:

	Per cent
C	0.30 max.
Mn	.85 to 1.25
P	.045 max.
S	.0 max.

In general most of the pipe actually runs about .25 to .26 carbon and about 1.0 manganese.

When the plate arrives at Maywood, it is planed to exact size, rolled and welded inside and out by the "Union-melt" process. As fabricated, the pipe is about ½ inch undersize in diameter. After fabrication it is put into a heavy steel die and expanded under hydraulic pressure into its full size. This expansion stretches the steel beyond the yield point, and the cold work makes a significant increase in the tensile strength, especially in the circumferential direction. The specifications call for the pipe after expansion to have a minimum circumferential yield strength of 52,000 psi and an ultimate of 65,000. Both of these figures are consistently exceeded, and most of the material shows a yield strength over 60,000 psi. The expansion apparently causes a gain in yield strength of between 12,000 and 20,000 psi in the circumferential direction and perhaps half as much in the axial direction. The cold work also increases the ultimate strength of the metal in the circumferential direction by as much as 3,000 to 7,000 psi; this effect may not be generally known.

After being expanded, the pipe is tested hydrostatically to 90 percent of the minimum specified yield strength of 52,000 pounds. Very few failures result on this final test. The reason for making half the pipe 30-inch and half 31-inch was to permit it to be telescoped to save shipping space. It is impossible to load a cargo ship to more than a third its deadweight carrying capacity with large, thin-wall pipe. There was some consideration of telescoping three deep, but the complications seemed too great. In the beginning there were many who questioned whether a nominal difference of only an inch would be sufficient to permit easy nesting and de-nesting. It has proved to be sufficient, but another half-inch clearance would have facilitated de-nesting and have avoided some scoring of the pipe.

With pipe fabricated as outlined, the design basis for the pipe line was taken as 65 percent of the nominal yield point based on nominal thickness, stresses being computed by the conventional outside-diameter or Barlow formula. Such a procedure gives an allowable working pressure of approximately 570 psi for 30-inch pipe having a nominal ¼-inch wall thickness. When the pipe line was laid out on the basis of a minimum flow of 315,000 barrels per operating day (300,000 barrels per average day) and ¼-inch wall thickness, it was found that at least eight pumping stations would be required, but by increasing the wall thickness of the pipe at the high-pressure part of the line to a maximum of 7/16 inches, the working pressure could be increased to 885 psi, and by this move it was possible to reduce the number of stations to six. When it is realized that each pumping station is not just a small building with some pumps deriving power from a utility line, as they were on the Big Inch project, but instead means a new community out in the desert which has to be supplied with everything from the outside, this advantage can be seen in its true proportions.

*Condensed from a paper by S. P. Johnson, engineer, Standard Oil Company of California, presented before Petroleum Division, American Society of Mechanical Engineers, San Francisco, June, 1949.

Pipe Line Route and Terrain

The northern plains of Arabia slope gently upward from east to west at a fairly uniform rate, reaching a summit in Trans-Jordan only a little more than a hundred miles from the Mediterranean coast. The maximum elevation on the pipe line is nearly 2,900 feet at Milepost 785, but the controlling elevation for the line originally laid out was only 2,200 feet and was at about MP 1025.

At approximately MP 1032 the right-of-way plunges precipitously into a valley some 13 miles north of Lake Hula, descending to an elevation of 740 feet at MP 1042. This valley is the northern extension of the Jordan River drainage. Lake Hula drains into the Sea of Galilee about 12 miles to its south. The pipe line crosses the north end of the valley proper, although the river, still called the Jordan or Nahr el Hasbani, extends some miles to the north in a narrow and broken canyon.

From here the route crosses a spur of hills, reaching an elevation of 1,600 feet five miles from the valley floor, and again descends to the Nahr el Litani at MP 1052, elevation 700 feet. (Nahr means small river.) This river drains the Beqaa Valley in Lebanon but turns sharply westward and empties into the Mediterranean 8½ miles south of Sidon instead of entering the Jordan. The pipe line again climbs to an elevation of 1,700 feet across the southernmost spur of the Lebanese mountains, descending over 1,000 feet to the terminal in the last four miles. There is obviously an excess of pressure to be used up in this section, and it was deemed necessary for safety to have the pipe line capable of withstanding the maximum hill pressure (some 2,500 feet) under static conditions.

Although the pipe line, as indicated, was designed for six pumping stations, it began to appear after construction had actually started that a larger capacity than 300,000 barrels daily might be wanted. The heavy and light pipe was reallocated, therefore, so as to permit the addition of intermediate pumping stations which would make the total number of pumping stations ultimately twelve. This results in some unbalance when the line is operated with six stations and also results in cutting the pressure of several of the first six stations below the original design limit. As it stands now, the line will have a total capacity of 315,000 barrels per actual operating day with six stations and slightly over 500,000 barrels if the intermediate stations are added.

The picture many people have of Arabia is a wilderness of sand, with perhaps a little water hole or well here and there supporting a few date palms. This, however, applies only to a small part of the area traversed by the pipe line. Just to the north of Abqaiq where the major oil production of Arabian American Oil Co. is now located, and covering a part of the field, there are sand dunes close to 100 feet high which move southward at rates approximating 50 feet a year over a base of chert. These dunes are indeed a serious obstacle to construction, but they are almost entirely confined to the first 40 miles of the line between Abqaiq and Qatif. As a matter of fact, the moving dunes probably cover less than a third of even this section. The line here was the first to be completed and has been in successful operation for some time, handling oil to Qatif Junction, whence it is delivered to the coast for loading ships pending the completion of the entire line.

The appearance and behavior of the sand dunes themselves is most interesting. The principal wind blows from one direction, a few degrees east of north, and this is obviously the cause of the dune formation. They have a gradual slope on the windward side and plunge into a very steep slope at the angle of repose of the sand on the leeward side, and the steep slope in plan has the form of a new moon. The sand carried by the wind goes up the windward slope not more than a few feet above the surface and drops at the top of the leeward slope when its velocity is checked by the tremendous eddy that exists on the lee side. The sand then drops on the steep slope, and since the latter is already at the angle of repose, it slides down. In this sense the dunes do not blow forward; they slide forward. They are apparently in a delicate state of equilibrium and are quite sensitive to change in conditions. Their progress can be altered, and they can even be forced to destroy themselves by a relatively small amount of work intelligently applied.

The point to be made here, however, is that the overwhelming proportion of the right-of-way is either not sandy at all or is covered with a stable sand or sandy soil which supports a growth of small bushes and does not tend to shift. This latter type of terrain, largely confined to the first 150 miles of the line, has been found excellent for pipe line construction and road building.

Farther to the west the terrain for many miles consists of flat rock and gravel plains, virtually treeless except for a few spots, but supporting an intermittent and sparse growth of grass on which the Bedouins graze their flocks of sheep, goats and camels during favorable parts of the year.

Certain portions of the plains country are extremely rough, the surface being covered with fractured stone piled up in irregular heaps, making it almost impossible for road or other

▼ Saudi Arab and American employees tie in the thirty inch pipe line at the Quatif end anchor.

construction, even though it looks fairly smooth from an airplane at an elevation of 1,000 feet. Fortunately, however, it has been possible to avoid nearly all the worst of this country by adjusting the route slightly.

When the line approaches Trans-Jordan at about MP 860, it enters the well-known Trans-Jordan lava beds. Road construction here is moderately difficult. The lava beds themselves are quite different from what one might believe from looking at the maps or from a casual examination. Much of the lava has weathered into a yellow sand, but there are large boulders covering almost the entire surface. Below the surface there is a mixture of sand and boulders. A fair road can be made by sweeping away the surface boulders, provided enough binding material can be brought in to stabilize the sand and keep it from blowing away. The subsurface boulders, however, make ditching operations very difficult.

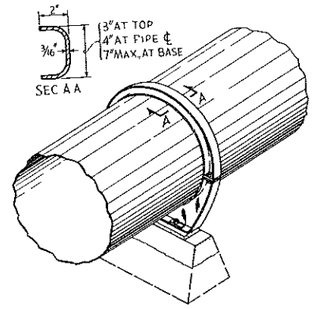
Beyond the lava beds the right-of-way enters country which becomes more and more built-up. Occasional settlements and villages with permanent structures come into evidence. Flowing streams develop and patches of soil, carefully terraced and intensively cultivated, are interspersed with rocky hills. Beyond the lava beds the right-of-way skirts the Jebel Druse, a volcanic butte which is a landmark for miles around, and finally drops into the valley above Lake Hula.

There is one other interesting type of country that a pipe line must cross in eastern Arabia, and that is the salt bogs known as "sabkhas." They are permanently wet and often have an almost absolutely flat surface, giving one the impression that they are natural pools of salty water that have blown full of sand, finally forming a stable surface just damp enough and smooth enough to prevent more dry sand from adhering. Sometimes the surface of sabkha is covered with loose sand of varying depth. They are always wet under the surface, and the crust may be anything from damp to very dry, depending on the location and season of the year. Sabkhas are all confined to the general vicinity of the Gulf Coast, but the pipe line crosses several of them, some of which are fairly large. They are treacherous for automobile and truck transportation, but a good road can be constructed by proper grading and by bringing in some outside material.

From the standpoint of pipe line construction, the terrain described can be classified as follows:

(1) Moving dunes
(2) Sabkhas
(3) Stable sand with small bushes, known locally as dikaka
(4) Gravel plains
(5) Rocky plains or plains with rock at varying distances below the relatively flat surface.
(6) Lava beds
(7) More or less cultivated land near the Mediterranean, much of it being rocky hills.

While only the extreme westerly part of the terrain is mountainous in the sense usually understood, some of it has prompted design features that have not ordinarily been used in the construction of oil pipe lines. Where the line crosses moving dunes it has, in general, been buried. Of course the



▼ Pressed steel ring girder support for thirty inch pipe line.

dunes were avoided as far as possible, and a good deal of work was done in moving sand to put the pipe in as stable a situation as possible, but it will have to be watched and perhaps readjusted as the sand moves. Across sabkhas the line is supported on steel piles. The piles have I-beam caps, and the pipe is held in pressed-steel ring girders. Across stable dikaka the line is and will be buried. It will also be buried across the gravel plains where reasonable excavation by ditching machine is possible. Across rock plains three different methods of construction are being used, depending on the depth of the rock below the surface. Where the rock is deep enough to permit the line to be buried, this construction is being used in most cases. Where the rock is on the order of two feet below the surface, the pipe is laid on a well-padded support after excavating down as far as the rock, and soil is mounded over the line to hold it in place. This second type of construction will not suffice to anchor the line, and at horizontal changes in direction or vertical overbends, anchorages have to be provided. Where the rock is close to the surface or on the surface, the line will be supported a few inches above the ground at intervals of 20 meters (about 66 feet) in pressed-steel ring girders supported on small concrete pads (Fig. 1).

The above-ground construction is of principal technical interest, since the other types of pipe line construction are well understood. As far as the supports are concerned, after study of the secondary stresses at supports, it became evident that it would be necessary to reinforce the pipe at these points in some manner, and pressed-steel ring girders were selected as the most economical method of reinforcement, being light and, in large quantities, fairly inexpensive. Static bending movements are maximum at the supports but are only moderate at a 66-foot spacing.

Effect of Temperature

A second problem was that of temperature. Careful study of the effects of temperature changes indicated that the pipe line would be under no more net stress if no attempt was made to permit expansion and contraction, but if, instead, it was simply held rigidly in place, of course being suitably anchored at changes in direction. In this study it was assumed that the pipe might reach a temperature 30° higher than the atmosphere or, in other words, a maximum of 140°F. The first part of the line will be operated at 160°F maximum, the hot oil coming from a crude oil stabilizer. The temperature of installation was assumed to average 80 or 90°, less during winter, and the minimum temperature reached by the flowing oil probably not less than 40°, although atmospheric temperatures in western Arabia often go below freezing. In other words, it was necessary to figure on a range of about 100° in temperature, perhaps two-thirds or more of which might be in one direction. Every degree change in the temperature of a completely restrained piece of steel results in an axial stress of approximately 190 psi, so 70° would result in an axial stress of about 14,000 psi which, it was believed, was not excessive in view of the fact that the circumferential tensile stresses were more than double this amount. Of course the column stability of the line on supports at 66 feet was verified.

In addition to the axial stress due to temperature, there is also that due to internal fluid pressure. The latter is tension and amounts to 30 percent of the circumferential stress instead of the 50 percent that it would be with a free-floating line closed at the ends. This tension tends to offset the compressive stresses due to rise in temperature in the more highly stressed portion of the line, and it appeared to the designers that it would be helpful. The two types of failure ordinarily encountered in a pipe line are rupture of the longitudinal weld, almost invariably as the result of inherent defects or, second, having the line pull apart as the result of tension of circumferential welds made in the field. The latter type of failure would, of course, not be expected when the line was in compression.

Effect of Wind Vibration

Still another problem considered was vibration caused by the wind. There is plenty of wind in Arabia, and during the so-called shamal (meaning north in Arabia, and that is where the wind usually comes from) period it may blow at 30 miles an hour for days at a time. The natural period of vibration of a 30-inch pipe line filled with oil and laid across 20-meter supports is about 2.6 cycles per second. The Karman effect supposedly disappears from 30-inch isolated cylinders at a wind velocity of about 20 miles per hour, at which time its exciting frequency is estimated to be between two and three cycles per second. It was realized that this result could not be applied to a pipe line close to the ground, and the decision was to lay the first part of the line, see what happened, and then do something about it if it proved to be necessary.

Up to now the line has shown some vibration, but the deflections have amounted to no more than about ½ inch by actual measurement, although offhand guesses have almost always been greater. There has been no evidence of resonance at any wind velocity so far encountered, but there has been some evidence that the line goes into free vibrations of fairly small amplitude at its natural frequency at certain times, perhaps after receiving a shock excitation from gusty or variable wind.

Protection of Buried Pipe

The portion of the pipe line that is buried, about four-fifths of the total length, will be wrapped, and cathodic protection will be applied where it seems warranted. The wrapping so far applied consists of a primer, a heavy coat of asphalt, a wrap of glass fabric, a second coat of asphalt, and finally an exterior wrap of asbestos fabric. In addition the bottom of the ditch is covered with a fabric padding to minimize the hazard of having the coating damaged before the backfill is complete. The results so far obtained with this type of coating have been very promising. Most of it has been installed in the dikaka country where the sand is stable and has a high electrical resistance, but where damp, salty, low resistance soil can be reached by excavating 10 to 20 feet. Under these favorable circumstances, a single magnesium anode dropped into the salty material has in several instances depressed the electrical potential of the pipe more than a volt for 10 or 15 miles.

It is fully realized, of course, that this extremely favorable situation will not exist in the more easterly parts of the line, and it is in fact expected that suitable low resistance spots for anodes may be difficult to obtain and that most of the protection may have to be supplied by magnesium ribbon and by anodes in deep wells at the station sites where plenty of power is available. Nevertheless, the high initial resistance of the wrapped coating so far applied furnishes a strong basis for the belief that, with a little care, corrosion of the buried section of this pipe line can be virtually prevented.

Pumping Stations and Power

The pumping stations of the Trans-Arabian Pipe Line are of interest mainly because of their large size rather than because of any particular unusual features or departures from ordinary practice. At the time of their design a careful study was made to determine whether they should be driven by steam or by internal combustion engines, since these two sources of power were the only ones commercially available at that time. At first the use of steam appeared preposterous in a country where there is very little water and where all of that is bad. Ordinary well water in eastern Arabia usually has about 3,500 parts per million of total solids, and of this 750 parts or more is hardness. In fact the steam power plant at Ras Tanura refinery operates with water that is perhaps as bad as anything now used by a steam plant anywhere. Although well water can be obtained at varying depths nearly everywhere along the right-of-way, and although there are hand-dug wells here and there of great antiquity and sometimes remarkable depth, yet the water required for a cooling tower for a steam station would have been prohibitive. This led to the consideration of dry air-blown condensers utilizing finned tubes or other types of extended surface. It was estimated that steam could be condensed at five pounds gage pressure under the most adverse circumstances in such a dry condenser. Of course during the night and in the winter conditions would be more favorable, and it would be possible to operate a condenser under vacuum if such operation was desired. The size of condenser required turned out to be perfectly practicable. It was estimated that by operating boilers at a pressure of 900 psi and 750F, exhausting at five pounds gage, a water rate in the vicinity of 11 pounds per horsepower-hour should be obtainable. The steam plant would have the advantage of fewer operating units and much less inherent complication, but even with the water rate quoted, the overall fuel consumption would probably be 18,500 Btu per hydraulic horsepower-hour as compared to 9,500 Btu for a diesel plant. It was finally decided to go ahead with the more orthodox internal combustion engines at all of the stations except at Station No. 1 in the Abqaiq field where there is a virtually unlimited amount of surplus sour gas for fuel. Station No. 1 contains two 6,000 hp steam turbines directly coupled to two-stage centrifugal pumps, each capable of delivering about 340,000 barrels daily against a maximum of 840 pounds pressure. The exhaust from these turbines under normal circumstances will be used for heating in a stabilizer which removes hydrogen sulfide from the crude oil, but it can be alternately routed to dry air-blown condensers of the type previously mentioned in case operation of the stabilizer does not parallel pumping requirements. As a matter of possible interest it may be mentioned that the Arabian American Oil Company is just completing a 30,000 kw steam power station in the same location. This power station will exhaust to dry air-blown condensers at five pounds gage, but steam will also be extracted at 50 pounds for additional heating in the crude oil stabilizer.

High-speed pumps of the type used at Station No. 1 require adequate pressure on the suction. This is provided by two vertical pumps in the tank field, each capable of delivering pull pipe line capacity at about 75 psi. All the usual accessories for a modern pumping station will be used. Among these are automatic flow and pressure controls, a recording flow meter for the main stream and remote reading tank gages. Precision gaging of oil for royalty purposes in this area is accomplished by balancing the oil column against a mercury manometer which, when properly done, has been found more accurate than the conventional method of tape gaging.

The pumps at Station No. 1 are of conventional design, although they are

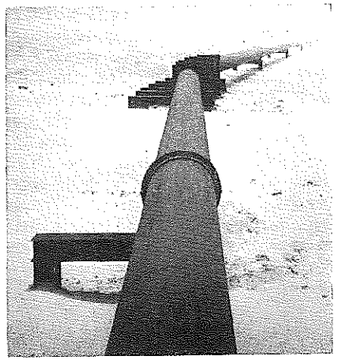
perhaps the largest units of their type ever built. On account of the large shaft and high peripheral velocities and comparatively high pressure, packing difficulties were feared, and it was finally decided to eliminate all packing and simply to install labyrinth bushings successively bled to lower pressures and finally to a sump whence the leakage is returned to the line.

As indicated, Stations 2 to 6 inclusive will be of the conventional type, operating with single-stage centrifugal pumps in series. The pumps are driven by 1700-hp diesel engines through speed-up gears. The pumps operate at a nominal 2200 rpm and the engines at 343 rpm. The engines are of the four-cycle type, supercharged by the Elliott Buchi system. They have eight cylinders, 16-inch bore by 20-inch stroke, and are capable of operating at a BMEP of 120 pounds per square inch. There will be five pumps in series, four normally operating to meet the requirements of the line and one spare. The individual pumps are by-passed with lines containing check valves and have motor-operated suction and discharge valves. Any unit can, therefore, be started and stopped without disturbing other units.

Besides the main driving units for the pumps, there will be three electric generators, one a spare, for driving auxiliaries, including the fans of the extended-surface dry air-blown radiators that will cool the jacket water and the lubricating oil. They will supply power for all incidental uses, including air cooling of the living quarters and refrigeration. Other important auxiliaries include pumps for the water wells and an auxiliary booster pump for putting pressure on the main pump suction when it is necessary to draw oil from the station tank. These generators will be driven by six-cylinder engines having the same cylinder dimensions and other general characteristics as the engines used for pumping.

The stations are piped in such a manner that they can be operated either straight-through with "closed suction" or by floating a 96,000-barrel tank on the line coming into the station. In the latter case the electrically-driven booster pumps just mentioned are provided to raise the pressure on the suction of the main pumps enough to prevent cavitation.

It is not certain at this time to what extent the stations will be operated with "closed suction." This method of operation is almost obligatory for a products line to minimize contamination and in an ordinary crude line has advantages in permitting the dispatchers to correlate receipts and deliveries without difficult and usually inaccurate corrections for tankage along the line. However, it has disadvantages too. Unless precautions are taken to limit the results of surge pressure to one section, pressures generated by the various stations can, under certain circumstances, be cumulative and result in over-pressuring the line. Where the line is laid above ground, there is another reason for operating with open tankage at each station that does not appear where the



▼ Making a thirteen degree turn, the Trans-Arabian pipe line heads into the desert and disappears into a sand storm.

pipe line is buried. Since few long commercial pipe lines have been laid above ground, this phenomenon is perhaps not generally appreciated. In a line with multiple stations, each section of which is exposed to sunlight, every station receives more volume of oil during the day than is pumped, and, conversely, pumps more during the night than it receives. The difference is substantial, and if it were allowed to accumulate over 1,000 miles, it would result in a substantial loss of capacity, since the capacity of the line during the day would be limited by the last section and during the night by the first section. The magnitude of this effect is uncertain, since the exact distribution and quantity of unburied line is not yet established.

In order to avoid over-pressuring the pipe line in case of accident or faulty operation, especially when operating with closed suction, it is now contemplated that relief valves of special design will be installed on both the incoming and outgoing main lines. In addition, over-pressure trips will be installed to shut down one or more of the engines in case of over-pressure on the discharge of the station.

Conventional scraper traps are being installed. The Arabian oil is known to be somewhat waxy. The pipe lines so far operated between the field and the Persian Gulf terminals have not experienced wax deposits, probably because the oil has never had the chance to cool off in the short distances involved, but wax has accumulated in the tanks. In the higher elevations in western Arabia and Trans-Jordan the oil temperature may fall as low as 55° in the winter time. It is understood that the temperature of oil received at the Haifa terminal of the Iraq Petroleum Company falls as low as 57°F in the winter, although the annual average is a little over 70°. Scrapers, and hence scraper traps, are also of value to remove air during the filling of the line, to separate the water used for testing from the oil following, as well as to assist in removing a certain amount of rubbish which always seems to get into pipe lines during construction.

Pump and engine houses at the stations are 230 feet long and 70 feet wide, the pump room being separated from the engine room by a gas-tight firewall. As previously indicated, there will be three 800-kw generators together with a sizable air conditioning plant, a refrigeration plant and a laundry. At the present time the plans are for the construction of six dwelling houses in addition to the superintendent's house and a four-room bunkhouse for single employees. There will be a children's playground, a tennis court, a baseball diamond and a swimming pool besides a community center and an infirmary.

In addition to the housing for Americans there will be quarters for about 24 Arab families and 200 Arab bachelors. The number of these Arab quarters may serve to emphasize the statement made earlier that the cost of constructing and operating a pipe line station in the middle of the desert is something wholly beyond and apart from any mere pumping cost in terms of kilowatt hours such as one might talk about in the United States.

Communications

Communications along the pipe line received very careful consideration from the start, and both wire lines and various forms of radio were considered. The wire line had three drawbacks. The first was expense, and the second was exposure to various forms of damage, including either unintentional or intentional sabotage from curious or malicious bands of nomads, but the consideration that loomed most important of all was that it would not be available during construction when communication was just as urgently needed as for operation.

(Continued on page 26)

OIL AND HUMAN WELFARE*

By

MAX W. BALL, '06 †

MAX W. BALL

The Milestones of Human Progress

The great events of human progress—those that have changed the way men live—are hard to find in the history books. Historians emphasize political changes; changes in the mastery of men over other men. Such changes are not basic; they are limited in time and scope. They affect a nation, a culture, a civilization; they last for a decade or a century or perhaps a millenium. They do not affect all men for all time to come.

The basic changes come from man's mastery over nature. They change the way men live forever after. They are not wrought by conquerors or rulers or even by statesmen.

Babylon rose and fell; she became a forgotten hill on a barren plain; but men still cooked their food and warmed themselves with fire. Alexander conquered the world, and after him his world fell apart; but men still fed themselves by raising crops. "Caesar had his Brutus and Charles I his Cromwell"; but men still moved themselves and their goods on wheels. Napoleon won at Jena and lost at Waterloo; but men went on shifting their work to machines. Hitler is dead, Mussolini is dead, and Stalin grows old; but oil and gas still light and heat and carry men.

We owe the way we live to the discoverers and inventors: our unknown ancestors who learned to use fire; the prehistoric men who first grew crops; the nameless geniuses who developed the wheel; the men who harnessed steam and tamed electricity; the men who drilled the first modern oil well. To such men we should raise our monuments. To such events—events that change man's way of life—this great School of Mines is dedicated.

The Obscure Event on Oil Creek

Such an event took place only ninety years ago—fifteen years before this School was founded—on a little stream called Oil Creek, in northern Pennsylvania. A man named Drake drilled a well. On an August day in 1859 he struck oil. That event started life as we know it. Let's place that event in time if we can.

Austria and France were fighting over Italian freedom; the North and South were about to fight over secession. The great names of the day were Cavour and Garibaldi, Napoleon III, Victoria. Bismarck was coming to the fore. Lincoln was an ex-Congressman from Illinois.

Drake and his backers were unknown men; their adventure was scarcely noticed. Only a few hundred people knew about it; none of them dreamed what it would do for mankind. An obscure event in an obscure place, brought about by obscure people. Yet that obscure event has made more difference in how more people live than all the conquests of history.

That obscure discovery has multiplied man's productivity, his hours of ease, his freedom and range of movement. It has given him a third dimension. It has brought the earth to his door and given him the sky.

Because of that discovery, one American in every four owns an automobile, an average of one in every family. Because of that discovery, millions of Americans no longer cut wood or shovel coal; when cold weather comes they turn a valve. Because of that discovery, a father in Stockholm flies to see his son in Detroit in a day; a mother flies home from Calcutta to New York in less than two.

Blessings to the Common Man

These are not blessings that the rich man has and the common man covets; the common man has them himself. Most oil and gas heaters are owned by work-day people. More common folks than plutocrats ride in American planes. More than half the automobiles are bought by people with less-than-average incomes. Parking space for employees' cars is a daily American problem.

One wage-earner in every four drives his own car—male or female, young or old, farm or store or factory—one worker in every four. He drives it to work, to the movies, to take the family for a ride, or for a trip to Yellowstone Park. He drives it an average of ten thousand miles a year, as far as from Paris to Bombay and back. For a day's wages he can buy enough gasoline to drive as far as from Vienna to Rome. These things have come from Col. Drake's discovery; the discovery that few men thought important when it happened.

The Need for Oil

That discovery came none too soon. The Industrial Revolution had started in England some sixty years before; between our War for Independence and the War of 1812. It started with the use of steam and the substitution of coal for wood. It soon reached America, then spread to Continental Europe.

The Industrial Revolution is still going on. Two things mark its growth: machines take the place of muscles; factories replace home handicraft. Two things result: man works less and he has more.

Factories need light. Machines need lubrication. Electric lights were unknown until the 1880's; candles were inadequate. Lubricants were scarce. The Industrial Revolution had to have oil for light and lubrication.

From Castor Oil to Coal Oil

Men used castor oil at first, and other vegetable oils. Soon they needed more oil than they could raise at reasonable cost. Next they used sperm oil. Those were the great days of the whaling fleets, New England harpoons had a range of 20,000 miles. They did their work too well; by the middle 1840's whales were scarce; the price of Sperm oil soared.

Before the crisis was acute, men learned to make oil from oil shale and then from coal; first the French, then the British, then the Americans. What they made was mostly kerosene. They called it coal oil, and the name still sticks. They made it from the boghead and cannel coals of Britain; from the oil shales of Scotland, Pennsylvania,

† Class of 1906. Oil and gas consultant, Washington, D. C.

* Address delivered at 75th Anniversary of the establishment of the Colorado School of Mines, Golden, Colo., September 30, 1949. Published in School of Mines Quarterly, Vol. 45, No. 1A. Published by permission.

West Virginia, and Kentucky. By the middle 50's, Great Britain had 130 plants, the United States 64. Even the proud old whaling port of New Bedford, Massachusetts, had a plant running, if you please, on Scotch coal.

The Search for More Oil

Still there was not enough. The cost of coal oil was high. Coal oil is not a lubricant. Man needed a bigger and cheaper source of oil. Without it the Industrial Revolution could not continue to grow. Looking back, we can see that the Revolution was in grave danger. It might have had to level off for lack of oil.

Then it happened. In a profit economy it was bound to happen. The need was there. Some enterprising men studied how to meet it and thereby make some money. They had vision; the hope of profit gave them courage. They risked much, and they succeeded.

Signposts to Finding Oil

They had some signposts to guide them. Men skimmed oil from springs here and there on both sides of the Alleghenies. The best known springs had given a name to Oil Creek, near Titusville, Pennsylvania. The Seneca Indians had gathered oil there and traded it to other tribes for medicine. White men continued to get it. They too sold it for medicine; they called it Seneca oil or rock oil.

For years men had been drilling wells to get brine; they evaporated the brine and got salt. In some wells the brine was polluted with oil. The oil was a nuisance; it spoiled the salt. Men were beginning to reason thus.

Oil rose from the ground through springs; it seeped into salt wells. Perhaps a well near an oil spring would tap the underground supply.

The First Oil Companies

A young doctor named Francis Brewer took a bottle of oil to his former professor of medicine, Dr. Dixi Crosby of Dartmouth. It came from a spring on Oil Creek. A young New York lawyer named George Bissell saw the bottle on Dr. Crosby's desk and was intrigued by it. He interested his partner Johnathon Eveleth. They made several trips to Titusville; eventually they bought the Hibbard farm, where the spring was. Then they organized the world's first oil company, the Pennsylvania Rock Oil Company of New York.

The next chapter sounds familiar: they couldn't finance their company. Whoever heard of digging for oil? What did Bissell and Eveleth know about it? Who were Bissell and Eveleth anyhow?

They scraped together enough money to pay for a report. It was made by Dr. Benjamin Silliman, Jr., professor of chemistry of Yale. His fee was $526.08, which might interest even a present-day professor. The report might have come from a present-day professor; its conclusion was sound, and couched in many words. It said:

> "In conclusion, gentlemen, it appears to me that there is much ground for encouragement in the belief that your company have in their possession a raw material from which, by simple and not expensive process, they may manufacture very valuable products."

With this report the young New Yorkers interested some New Haven business men: James Townsend and his associates. They abandoned the New York company. Together they organized the Pennsylvania Rock Oil Company of Connecticut. Then they fell out, the New Yorkers and the men from New Haven. For three years they did nothing. At last, in 1858, the Townsend group formed the Seneca Oil Company, leased the Hibbard farm from the Connecticut company, and got busy.

How Colonel Drake Struck Oil

They hired as general agent a man named Edwin L. Drake, "Colonel" by courtesy and custom. Drake was tall and bearded. He had been a steamboat clerk, a hotel clerk, a dry goods clerk, an express agent, and a railroad conductor on the New Haven. He had never dug or drilled a well, but he had two great assets: determination, and faith in the enterprise. He put in $200, probably which was a lot of money in those days and which represented his entire savings.

He went to Titusville and started to dig a well. Water drove his workmen out. He decided he would have to drill instead of dig. He went to Tarentum, Pennsylvania, talked with some salt well men, watched them drill. Then he designed and built a derrick and bought an engine and boiler. He had hired a salt well driller, but the driller failed to show up. By that time summer was over.

Next summer he hired a driller known as Uncle Billy Smith. Uncle Billy worked for $2.50 a day, and threw in the services of his fifteen-year-old son. Uncle Billy had been a blacksmith; he made the drilling tools.

The Colonel was a solemn man; he didn't like to be laughed at. He told the folks around Titusville that he was drilling an artesian well. They laughed anyway; they called the well "Drake's Folly." The Colonel was a determined man. He and Uncle Billy and Uncle Billy's boy went on drilling.

By a certain Saturday evening—it was August 27, 1859 — they had drilled to 69½ feet. They pulled the tools and quit for over Sunday. Sunday morning Uncle Billy's boy looked down the hole. He saw liquid standing near the surface. It was oil.

Vision and courage and the hope of profit had won. The future of the Industrial Revolution was secure. Man had taken another long stride in his mastery of nature. He and his sons and his sons' sons could look forward to better and better ways of living.

The World Has Changed

Ask any social economist; he can tell you how much the Industrial Revolution has changed the way men live. The last 150 years have seen more change than the previous 5,000. In the way they lived and worked, Paul Revere's artisans were closer to Ur of the Chaldees than to Detroit of today. Thomas Jefferson's farming was more like that of the First Dynasty than that of the last decade. As one writer has put it, "A new gigantic material framework for human affairs has come into existence."

What part in this amazing change has oil made possible? Let's look at the United States. The 100-year figures from 1850 to an estimated 1950 tell the story.[1]

Oil and Employment

One great index of the Industrial Revolution is increased employment. How much employment depends on oil?

Take first the industries that result directly from oil[2]; industries that did not exist when Col. Drake drilled his well: the oil and gas industry itself; the automobile and the industries that go with it; the airplane and its related industries; buses, trucks, and tractors; oil and gas stoves and heaters; the diesel industry; the building and upkeep of modern highways. They employ nearly ten million people: one American wage-earner in every six.

That's not all. Nearly all ships run on oil. More and more trains run on oil. More and more farm work is done by oil. Thousands of factories and power plants burn oil or gas. We have already counted nearly ten million people whose jobs come directly from oil; many more millions depend on jobs for which oil supplies the energy.

Still we have not told the story. The one inescapable use of oil is for lubrication. Without it, no wheel can turn for long. Without oil, every machine in the United States would

[1] Few 90-year figures from 1859 to 1949 are available.

[2] In this talk the term "oil" usually includes the associated hydrocarbons: natural gas, natural gasoline, and the liquefiable petroleum gases ("bottled gas").

(Continued on page 21)

CONSTRUCTION OF BELT CONVEYOR SYSTEM AND COAL TIPPLE IN ROUTT COUNTY

By

MASAMI HAYASHI, '48

Introduction

The Edna Coal Company has recently installed a long 42-in. belt conveyor system and a new coal tipple near Haybro, Colorado to improve the serious haulage situation that exists at their strip mine in Routt County.*

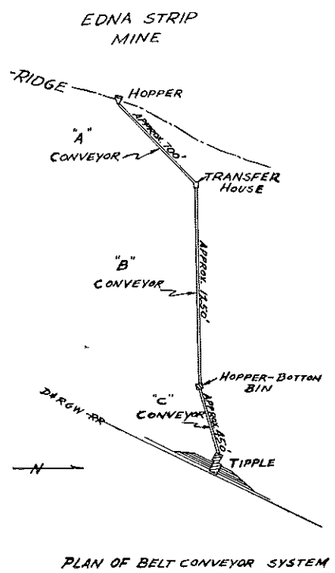
This haulage from the strip pits to the coal tipple has been a difficult task throughout the winter months. Trucks were required to travel over 4.3 miles of steep grades, maneuver around hair pin curves during all weather and temperature conditions, and frequently slow down on icy roads for safety reasons. A motor patrol was required to constantly keep the roads well-maintained. Maintenance and repair of trucks were expensive and the amount of production of coal was almost always determined by the conditions of the road.

With the installation of a conveyor belt system this haulage situation will be greatly improved. Trucks will travel over considerably shorter routes —as little as a few hundred yds. to the nearest pit. Elimination of hair pin curves will provide safer and better driving. Cost of maintenance and repair on trucks will be reduced. Better production of coal will be expected with a controlled and a more continuous flow of coal into the tipple.

It is the purpose of this paper to discuss the installation of this belt conveyor system and coal tipple on a mountainous terrain and not to consider the operation and the economies of this project. Before proceeding with the discussion of the construction, a general layout of this project will be first presented.

General Layout

The general layout of the conveyor belt system is as follows: A 150 ton capacity "pie-shaped" hopper is located on top of the hill near the strip pits to receive the run-of-mine coal from dump trucks. Three belt conveyor units, each consisting of a series of 48-ft. gallery sections, span the side of the hill down to the coal tipple. For convenience the top 700 ft. belt conveyor unit will be labeled, "A" conveyor; the second, 1250 ft. belt conveyor unit, "B" conveyor; and the lower, 450 ft. belt conveyor unit, "C" conveyor. An apron feeder takes the coal from the "pie-shaped" hopper and delivers it to the belt on "A" conveyor. A chute installed at the lower end of "A" conveyor transfers the coal to the belt on "B" conveyor. A 300 ton capacity hopper bottom bin equipped with Holme's spiral chute is located below conveyor "B." An apron feeder takes the coal from the bin and delivers it to the belt on "C" conveyor. From the belt of conveyor "C" the coal enters directly into a modern, five-track, 250 ton/hr. capacity preparation plant where it is sized, washed, and loaded.



PLAN OF BELT CONVEYOR SYSTEM

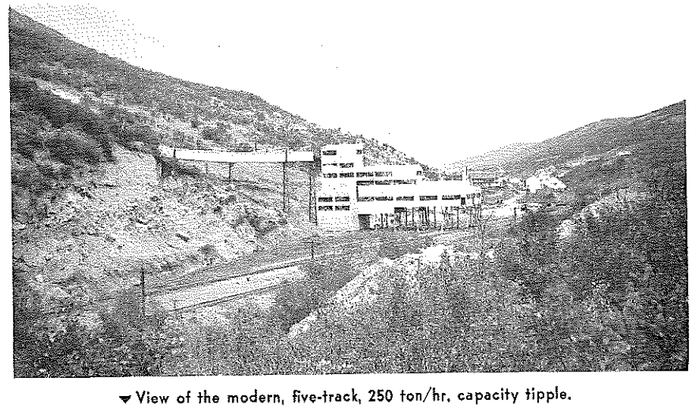
The total drop from the tail pulley on "A" conveyor to the head pulley on "C" conveyor is 669 ft. A gradual descent of 0° to 16° 30′ is made on the belt in the upper two 48-ft. gallery sections of each conveyor unit to allow any rolling coal to come to rest. Thereafter the decline is on a 16° 30′ slope. A gradual leveling of the belt on conveyor "C" is made as it nears the coal tipple. A gravity take-up provided at the lower end of each conveyor unit takes care of the tension on the belt. Steel bents on concrete piers are used to support the 48-ft. gallery sections. Expansion joints are spaced alternately with fixed joints to care for the expansion. A single span of catwalk along the conveyor belt provides complete facilities for maintenance and inspection.

Installation of Belt Conveyor

In the preceding section an effort has been made to present the general layout of the belt conveyor system on the side of the mountain. Next, the methods of installation of this conveyor belt system will be discussed.

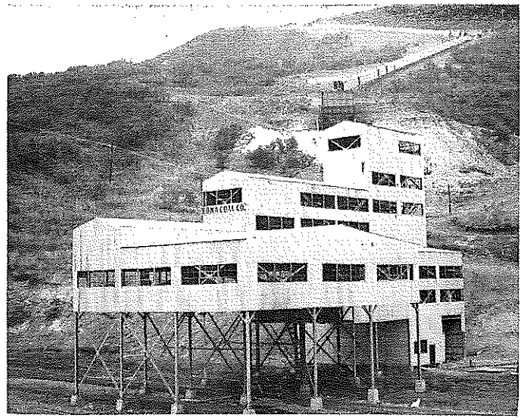
After completing the survey of the mountainside and the design of the conveyor belt system, construction started with the grading of conveyors "A" and "B." This grade was made to slope with the descent of the gallery sections and to serve as a road. An International TD-18 bulldozer and a Caterpillar motor patrol were used for grading.

Pouring of concrete was next after the pier holes and foundation sites were excavated. Concrete for piers was poured from a small hopper in-

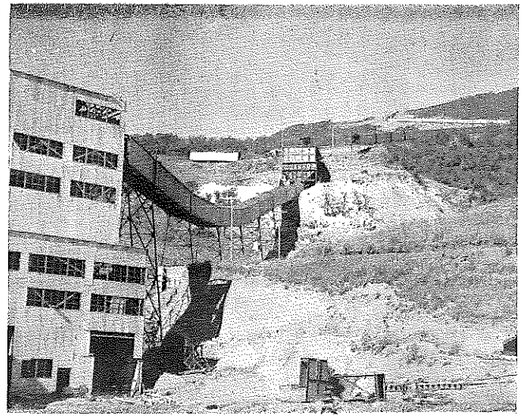


▼ View of the modern, five-track, 250 ton/hr. capacity tipple.

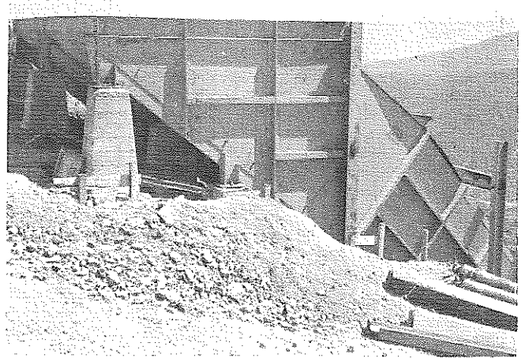
*Cooley, L. M., Hilltop stripping in Routt County: Mines Magazine, Vol. 38, No. 8, pp. 13-15 & 42, Aug., 1948.



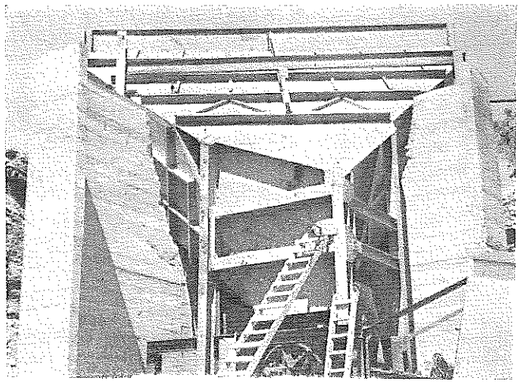
▼ View of the new tipple in the foreground and the two belt conveyor units spanning the hillside from the hopper on the hilltop to the hopper-bin at the bottom in the background.



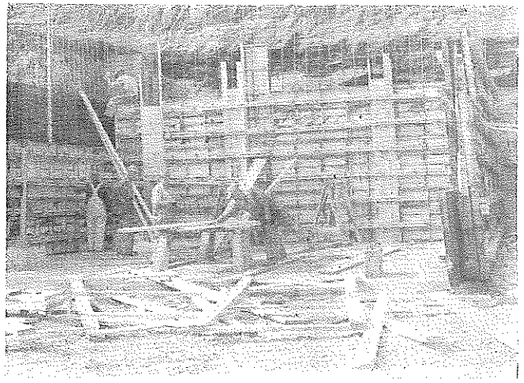
▼ Shows the 48-ft. gallery sections of conveyor "C" leaving the hopper-bin and gradually leveling as it approaches the tipple.



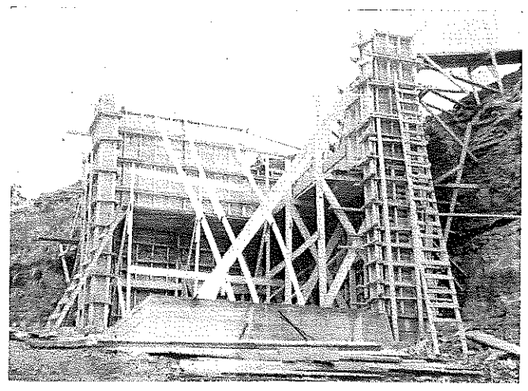
▼ View of the "pie-shaped" hopper which receives the run-of-the-mine coal from dump trucks.



▼ Another view of the hopper.



▼ Men working on the forms for the walls of the hopper-bin foundation below "B" conveyor.



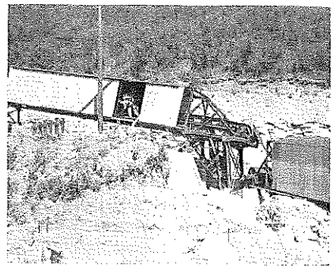
▼ Formwork of the foundation for the hopper above "A" conveyor.

stalled between the bumper and the radiator of an army surplus half-track. In this manner the aggregates were batched and dumped into a mixer at one place while the half-track was used to place the concrete in each pier. A few steel rods and scrap steel bars were inserted in each pier for reinforcement. Chuting system was used for concreting the foundations for the "pie-shaped" hopper above "A" conveyor, the transfer house above "B" conveyor, and the hopper-bin above "C" conveyor. A complete network of steel rods furnished the reinforcement for concrete floor and walls.

A real danger was presented while hauling material and moving equipment on the steep mountain side. An auxilliary road to the intersection of "A-B" and "B-C" conveyors was made for the convenience of vehicles unable to make the steep climb. As a matter of safety a half-track or a crawler assisted the loaded vehicles and equipments maneuver on the steep grade. A four-wheel-drive jeep was also used to haul smaller equipment and supplies on the steep slope.

After the conveyor gallery sections were hauled from Denver they were loaded on a trailer and pulled onto the mountainside with a D-8 cat. These sections were mounted on 4½-ft. steel bents with two truss hoist frames specially designed for use on the steep grades of "A" and "B" conveyors.

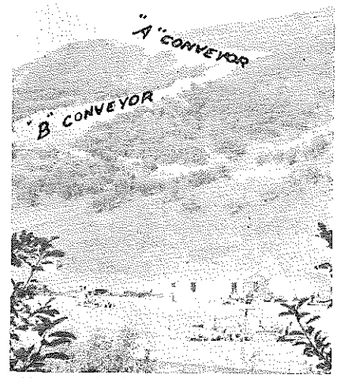
The installation of "C" conveyor was slightly different from that of "A" and "B" conveyors. Where solid footings weren't readily reached, 10-in. pilings 35 ft. long were driven down to solid. Four pilings were driven for each set of piers: Three pilings were lined across the two piers with one piling in each pier site and the third in between the piers; the fourth piling was set on the down grade side of the piers and in line with the third piling to furnish a toe hold on the thrust action of the belt conveyor. A reinforced concrete matte was set over the pilings. A crane and a winch half-track were employed to mount the gallery sections on the taller steel bents varying from 11½ ft. to 61 ft.



▼ View of the transfer house foundation between conveyors "A" and "B."

Tipple Construction

As the winter months approached more work was concentrated toward construction of the coal tipple. A Caterpillar D-8 bulldozer and carry-all combination were employed to grade the tipple site. Pilings were driven for pier supports where solid footings weren't readily reached and concrete for the piers was poured by the crane and bucket method.



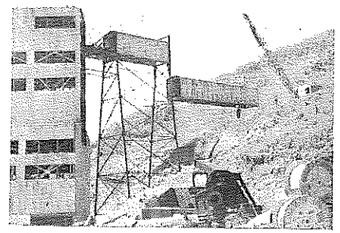
▼ View of the layout of the belt conveyor system early in the construction.

After the first snowfall hit Routt County all work on the mountainside was suspended for the winter. A small crew of eight was kept for the coal tipple erection.

The erection of the coal tipple was done in sections starting from the lower end of the tipple, the boom house, to the taller end of the tipple, the washery. The structural steel members of each section were first assembled on the ground before hoisting them into place. A crane and a winch half-track were used for the erection. The machinery for the tipple was also installed along with the erection of the structural steel.

Slow progress in the construction of the tipple was expected during the extreme winter months. Besides the normal difficulties presented during construction, it was necessary to deal with conditions of starting equipments and vehicles on cold mornings, clearing snow off working areas, working on the cold and icy structural steel with heavy and cumbersome clothing, digging structural steel and machinery from under ice and snow, and fighting the general cold. An area map showing the locations of each structural steel and machinery for the tipple prepared during the unloading of each piece aided considerably in finding them under the deep snow.

A small crew was kept throughout the winter and until after the spring thaw at which time the size of the construction crew was increased with locally picked laborers. The unfinished work on the mountainside and tipple area was then started and continued until its completion.



▼ Crane and winch-half-track (not shown) erecting a 48 ft. gallery section.

Conclusion

With the installation of a belt conveyor system and a new coal tipple a decided improvement will be seen over the old haulage system and tipple. However, it must be realized that the construction of this project on a mountainous terrain has been a costly one with the added expense required in working on a difficult and steep incline, the unsuspected conditions that developed, and the extreme winter that slowed construction.

OIL AND HUMAN WELFARE

(Continued from page 18)

grind to a stop. No factory can run without oil, no railroad, no ship, no mine, no car or bus or truck or tractor, no stationary engine, no generator.

The truth is, no one knows how many people depend on oil for their employment. We have to guess. Here is a guess that is probably too low: that 85 workers in every 100 would lose their present jobs if our oil supply should fail; that directly or indirectly, 85 jobs in every hundred depend on oil.

Hours of Work

Another great index of the Industrial Revolution is lessened hours of work. How much have working hours shortened since oil came in? In 1850, the average wage-earner worked 70 hours a week. Now he works 40. Man's hours of work have shrunk by 43 per cent since the advent of oil.

The Value of Work

What about the average value of an hour's work? In 1850 it was 27 cents[3]. Next year it will be about $1.20[3]. An hour's work is worth more than four times as much as before Col. Drake struck oil.

The value of an hour's work is a good measure of productivity, better than mere volume per hour; it takes account of quality as well as quantity. We complain about the high cost of living. What we are really paying is the price of high quality.

As a daily matter of course, we buy quality that even the richest man in 1859 could not have had. We buy quality in food that he never heard of. We buy comfort in our homes, convenience in our offices, precision in our equipment that no man could have bought in 1859. We buy an average thirty to forty miles an hour on the ground, where he could average no more than four or five. We buy two hundred miles an hour in the air, where he could not go at all.

We buy these things, and find them within our means. Why? Because, since oil became abundant, we create

(Continued on page 28)

[3] In terms of 1947 dollars.

THE CORPS OF ENGINEERS' SYNTHETIC LIQUID FUELS PROGRAM

By

LT. COL. IRVIN M. RICE, C.E., '39

The U. S. Potential for manufacturer of synthetic liquid fuels may prove to be considerably higher than has been the generally held opinion of leaders in the oil and coal industry. Specific information will soon be in the hands of federal officials charged with development of the Government's synthetic fuels program, as to possible areas where such plants could be located.

A nationwide survey, to procure basic data necessary for the initial planning of the location of synthetic liquid fuel plants, has been undertaken by the Corps of Engineers, U. S. Army, at the request of the Department of Interior. The survey is not intended to select specific sites for synthetic liquid fuel plants but is intended to determine general areas where the basic requirements (including such items as raw materials and water supply) for one or more plants can be met. Detailed site investigations would be required before any actual plant construction is undertaken.

The survey is being conducted by the Engineering Division, Military Construction, Office Chief of Engineers, this division being the military engineering agency of the Department of the Army. While the survey is primarily an inter-agency job for the Department of Interior, the National Military Establishment also has a direct interest in the development of synthetic fuel production since it has been estimated that an additional two million barrels of petroleum products daily over and above present production would be required to meet civilian and military needs in this country in the event of a national emergency of the magnitude of World War II.

The Bureau of Mines has selected the processes of manufacture to be considered and has prepared estimates of the plant requirements, including such items as coal, water, power, and labor. Basic processes under consideration are: The hydrogenation of coal; the gas synthesis process utilizing either coal or natural gas (the so-called Fischer-Tropsch process); and the retorting of oil shale. The Bureau of Mines is currently engaged in a program to develop processes which is to culminate in the construction and operation of demonstration plants. These include a shale-oil demonstration plant at Rifle, Colorado, and a coal hydrogenation plant and a gas synthesis plant, now under construction at Louisiana, Missouri.

When completed, the survey will provide an over-all picture of the Nation's potential for the production of synthetic liquid fuels. It will indicate the relative desirability of the various areas capable of supporting synthetic liquid fuels plants. It will indicate where the Nation's available raw material reserves for synthetic liquid fuels manufacture are located. It will serve as a guide to industry as to where detailed site location studies can most profitably be made prior to constructing synthetic liquid fuels plants.

Since the advent of a synthetic liquid fuels industry seems inevitable, unless present conditions of fuel production and consumption change radically, and since an adequate liquid fuel supply is of vital importance to the nation, this survey will be of value as a practical means of gathering and making available to interested agencies and groups the basic information for locating a synthetic liquid fuels industry. It is much more economical to prepare one comprehensive study which can be made available for the use of all those interested than for several separate surveys to be made for use of individual interests which will duplicate each other in scope and coverage.

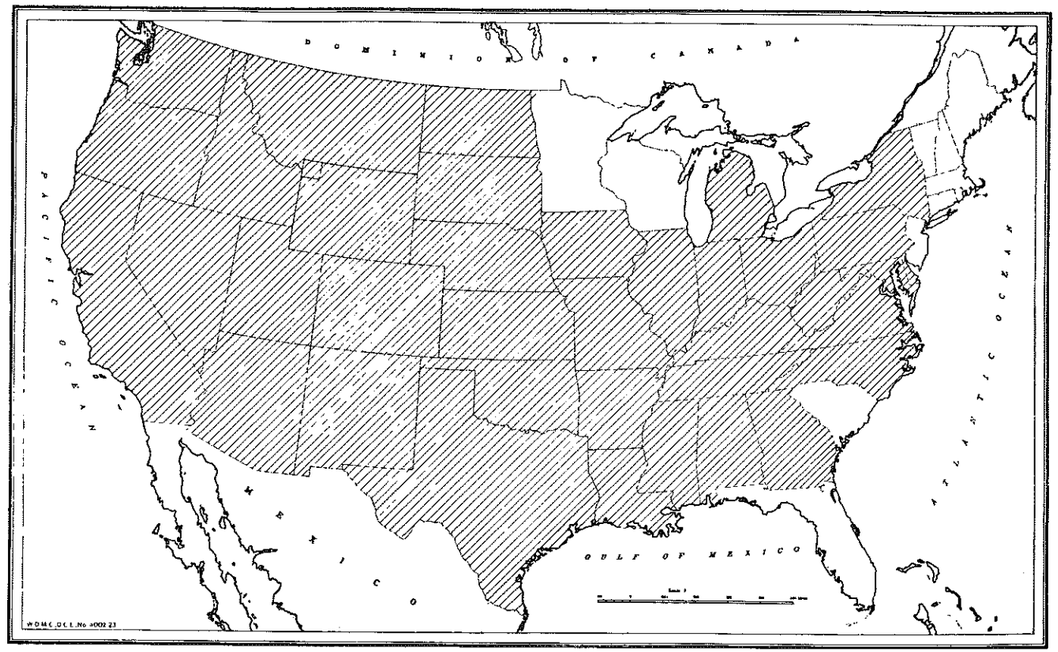
Need for Synthetic Liquid Fuels

The present critical situation with regard to supply of petroleum products is the result of the demand increasing more rapidly than the domestic supply can be developed. An idea of the magnitude of the jump in demand in recent years can be gained from the testimony of Mr. Max W. Ball, Director of the Oil and Gas Division of the Department of Interior before the House of Representatives Committee on Interstate Commerce, 12 December 1947, when he stated that in 1938, the per capita consumption of petroleum products in the United States was 360 gallons per year, while in 1947 it was estimated to be 600 gallons per year. He stated that this increase in consumption was due to many factors, including the following:

- 1,000,000 more automobiles were on the roads in 1947 than in 1941
- 1,600,000 more trucks were on the roads in 1947 than in 1941
- 38,000 more buses were on the roads in 1947 than in 1941
- 1,000,000 more tractors were in use on farms in 1947 than in 1941
- Aviation gasoline consumption has doubled between 1941 and 1946
- 800,000 oil furnaces were installed in homes in 1946
- 1,200,000 oil furnaces were produced in 1947
- 92% of all locomotives on order in December 1947 were to be Diesel driven
- Military demands, while only 5% of the total were three times as large in 1947 as they were in 1941.

According to Mr. Ball, the United States now approaches the maximum efficiency of domestic petroleum production, producing over 5½ million barrels per day, including both crude oil and secondary sources such as 'wet' gas. Prior to World War II, when actual production was less than 4 million barrels daily, the country had a cushion of 1 million barrels daily capacity which could be obtained on relatively short notice by stepping up production to the maximum in the oil fields. This cushion, plus liquid fuels made available from the market by rationing procedures, enabled the industry to provide the military establishment with sufficient petroleum products to carry on the war. After the cessation of hostilities, civilian demand so increased that it was necessary to maintain the maximum rate of production. It is for these reasons that the late Mr. Forrestal, Secretary of National Defense, stated that an additional 2 million barrels of daily productive capacity would be necessary in the event of a national emergency of the size and type of World War II.

Mr. Ball has expressed the opinion that the oil industry itself can overcome shortages of petroleum within 5 years (1) by utilizing foreign sources of oil, (2) by a continued aggressive oil exploration program in this country, and (3) by reworking old fields (using methods such as flooding, mining, chemical treatment and repressuring, among others). Large amounts of steel will be required for drilling and casing wells, building tankers, building pipe lines and tank cars and increasing refinery capacity. It is said that the oil industry itself plans to expend $4 billion in 1948 and 1949 on exploration and development.



▼ Figure 1: Cross-hatched area indicates States having deposits of raw materials of types suitable for synthetic liquid fuels manufacture.

Just how much new production of domestic oil and of foreign oil will result from this accelerated program of the oil companies is a subject on which differing opinions exist. The final solutions to the controversy over control of the oil bearing tidelands formations will affect new domestic production as will availability of steel. Undoubtedly, foreign sources can be tapped for large quantities of crude petroleum. From the standpoint of national defense, oil from foreign sources has a serious drawback since we may find it difficult to retain control of the production and transportation of the oil from its source to its eventual consumer.

Estimates have been made that the Continental United States contains roughly 30% of the world petroleum reserves whereas our consumption is about 60% of the world total. South America, with 15% of the world reserves, accounts for 10% of the world consumption. The Eastern Hemisphere has 55% of the reserves with a consumption of 30% of the total. In the future then, the United States may find itself in the position of a "have not nation" as far as petroleum production is concerned. Our fuel position can be protected by the establishment of a synthetic liquid fuel industry.

Synthetic Liquid Fuel Processes

Modern petroleum production from coal and oil shale, while in its infancy in the United States, has been practiced abroad for years. The Scottish shale beds, mined since 1851, produced over 260,000 barrels of oil in 1946. German production of synthetic fuels during World War II reached almost 600,000 tons per annum. A plant using the hydrogenation process has been in operation at Billingham, England since 1935 and produced 141,000 long tons of liquid fuels in 1938.

In this country at least two synthetic liquid fuel plants have been reported as definitely planned with natural gas as the source of raw material. The Stanolind Company had reported plans (presently suspended) for construction of a plant in Kansas, using gas from the Hugoton gas field. Carthage Hydrocol, Inc. proposes a plant at Brownsville, Texas, using gas from the Southeast Texas field. The Pittsburgh Consolidation Coal Company and the Standard Oil Development Company have jointly built an experimental coal gasification plant at Library, Pennsylvania.

However, there is general feeling in this country amongst those most familiar with synthetic fuel processes that considerably more work must be done to perfect flow sheets and process requirements in both the laboratory and pilot plant stages before any commercial size plants are built. The oil industry generally believes that the gas synthesis process offers the most promise from an economic viewpoint according to testimony before a Congressional Committee. The Bureau of Mines has reportedly stated that the hydrogenation process (also known as the Bergius Process) cannot be ignored because of the flexibility of the process in making products ranging from fuel oil to aviation gasoline (the gas synthesis process is more restricted in its products, being chiefly amenable to the production of ordinary gasoline or Diesel fuel).

The hydrogenation process, first reported by Bergius in Germany in 1913, depends on the fact that the essential chemical differences between bituminous coal and petroleum are that the ratio of carbon atoms to hydrogen atoms in coal is double that for petroleum (1.2 for bituminous coal and 0.6 for petroleum); that petroleum contains less oxygen, nitrogen and sulfur; and that petroleum constituents have a lower molecular weight. The hydrogenation process essentially consists then of cracking the larger coal molecules in the presence of hydrogen at elevated temperatures and pressures and suitable catalysts. This causes petroleum-like substances to be formed which have a higher hydrogen content than the original coal and removes the oxygen, nitrogen and sulfur in the forms of

water, ammonia and hydrogen sulfide, respectively.

In practice, pulverized coal is mixed with an equal amount of heavy oil (the latter a product of the process). The mixture is subjected to a hydrogen atmosphere in the presence of an iron or tin catalyst at 900° F. and pressures up to 10,000 pounds per square inch. The resulting oil is separated from the non-liquefiable components consisting chiefly of ash, but with some unconverted coal, and then distilled into light, middle and heavy oil fractions. The heavy oil is recycled to make up the paste. The middle fraction may be further hydrogenated into aviation gasoline while the light oil may be directly refined into gasoline.

The gas synthesis process, evolved from experimental work carried on in Germany by F. Fischer and H. Tropsch and others in the 1920's, essentially consists of the reaction of carbon monoxide and hydrogen in the presence of a catalyst to form hydrocarbons of various chain lengths and degrees of saturation. Using cobalt catalysts, a high grade Diesel fuel is produced together with a low octane gasoline, while the use of an iron catalyst promotes production of a higher grade motor gasoline and correspondingly poorer Diesel fuel.

The so-called synthesis gas, consisting of hydrogen and carbon monoxide in ratios of from 2 to 1 to less than 1 to 1 (depending on the catalyst used), can be produced from coal, coke or natural gas. It is purified and passed over the catalyst at pressures ranging from 1 to 15 atmospheres and temperatures of from 300° to 400° F. The products range from methane to waxes.

The process has been used in Germany on a commercial scale, using a cobalt catalyst and equipment of a low through-put capacity. American improvements envisaged include use of a fluidized catalyst bed and an iron catalyst, the latter for the purpose of producing a higher grade motor fuel. A considerable amount of by-products are produced, including alcohols, acids, ketones and waxes.

Oil shale contains an organic material called kerogen (but no free oil) which may be broken down and volatilized by the application of heat. The vapors, when condensed, are known as shale oil, a petroleum-like substance having a heating value of approximately 18,000 B.t.u. per pound and a high pour point, resulting in solidification at ordinary atmospheric temperatures. Expeimental work is being carried on to develop a suitable retort. Shale oil is being produced by the Bureau of Mines at Rifle, Colorado, in a batch-type retort and samples of the product are being made available to industry for the development of refining techniques.

Corps of Engineers Activities

Funds were included in the Supplementary Fiscal Year 1948 and in the Fiscal Year 1949 appropriations by the 80th Congress to carry out the synthetic fuels survey. A limited amount of money being available in FY 1948, it was decided to make sample surveys of representative areas to determine synthetic fuel possibilities with the expectation that the sample surveys would be incorporated into a later nationwide survey without any additional field work.

The representative areas selected were: Western Kentucky (because of its coal reserves mineable by both underground and strip methods); Northwestern Colorado (oil shale and coal reserves); Southeastern Texas (natural gas); and Southeastern Montana (vast deposits of subbituminous coals mineable at low cost by stripping methods).

A contract was entered into between the Corps of Engineers and the engineering firm of Ford, Bacon & Davis, Inc. of New York City, for the surveys in Kentucky, Colorado and Texas. The Montana survey is being accomplished by personnel of the Office Chief of Engineers with the aid of specialists on loan from the Bureau of Mines, Bureau of Reclamation and U. S. Geological Survey. These surveys will be completed and presented to the Department of Interior in February 1949, according to present plans.

A board of consultants to the Corps of Engineers was also formed including experts in the fields of coal mining, natural gas and coal processing, which consists of the following distinguished engineers:

Mr. Howard N. Eavenson, head of the firm of Eavenson and Auchmuty, mining engineers; past president of the American Institute of Mining and Metallurgical Engineers; past president and Director of Bituminous Coal Research Institute; member of the Technical Committee of Coal Research Laboratory, Carnegie Institute of Technology.

Mr. Everette DeGolyer, partner, DeGolyer and MacNaughton, consulting engineers; author of numerous publications on oil and gas industries; past president American Association of Petroleum Geologists; past president American Institute of Mining and Metallurgical Engineers.

Dr. H. H. Lowry, Director, Coal Research Laboratory, Carnegie Institute of Technology; consultant, national Inventors Council; author of numerous technical papers on gas absorption, coal and coal utilization; Editor "Chemistry of Coal Utilization."

Mr. C. R. Downs, Consulting Chemical Engineer and investigator; author of numerous papers in technical and scientific journals; winner of Howard N. Potts medal, Franklin Institute, and Grasselli medal of Soc. of Ch. Ind. (London).

This board has been active in guiding and directing the course of the survey. Invaluable assistance has been rendered the Corps of Engineers in reviewing the reports prepared on the sample areas and in planning the nationwide survey.

For the purpose of this survey, raw materials reserves have been defined as natural deposits of coal, oil shale and natural gas. Deposits resulting from the cleaning of anthracite will also be investigated since these deposits exist and would be available for conversion by the gas synthesis process. Specific plant sites will not be located but the survey will show how many plants can be supported in an area.

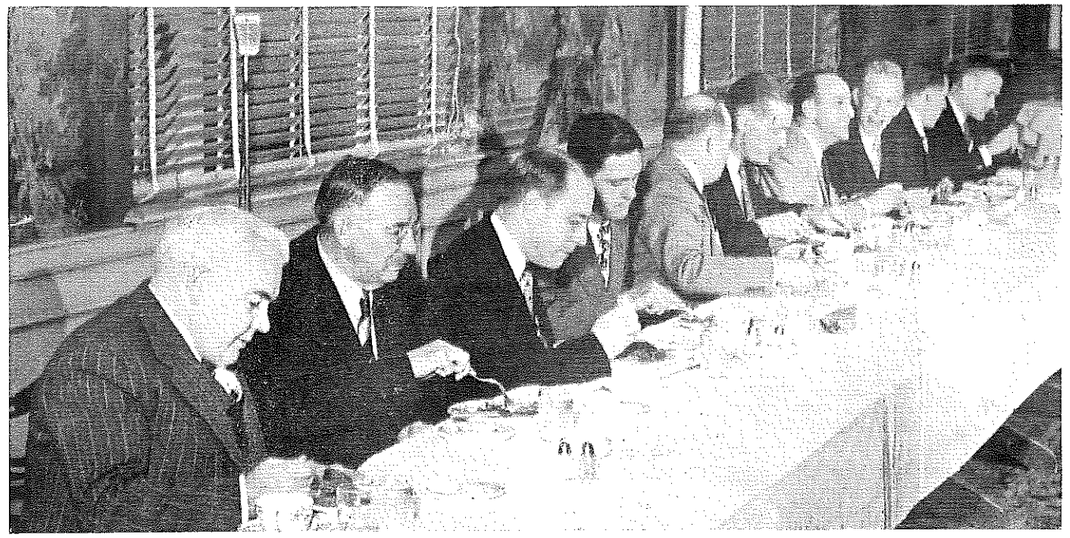
Existing available sources of information will be exploited. It is not planned to make field surveys or core drilling of raw materials deposits. It is believed that adequate information for the purposes of this survey can be secured from Governmental sources (both Federal and State) and from private sources such as mining, oil, railroad and drilling companies, engineering firms and from colleges and universities.

Raw Material Reserves

Reserves of raw materials suitable for synthetic liquid fuel manufacture (coal, oil shale, and natural gas), occur throughout most of the United States and Alaska. States in which deposits of one or more of the raw materials occur are indicated in Figure 1.

The first comprehensive estimate of coal reserves in the United States was made by M. R. Campbell of the U. S. Geological Survey in 1907. Mr. Campbell outlined on a map the areas underlain by coal formations and indicated the rank of the coal. Using as limits a maximum workable depth of 3000 feet for all coals except lignite (for which 1000 feet was used), and a minimum mineable thickness of 20 inches for all coals except lignite (36 inches), he estimated the easily accessible and still available coals of the U. S. to be 1,993,800,000,000 short tons, and the amount accessible with difficulty at 1,153,225,000,000 tons for a total of 3,147,025,000,000 tons. Mr. Campbell revised his estimates from time to time as more data became available, publishing his last figures in 1929. These

(Continued on page 41)



▾ At the head table—Left to right: R. J. McGlone, '27; Dave C. Johnston, Business Manager of Athletic Dept.; Frank Haraway, Denver Post sports writer; Fritz Brennecke, Head Coach; Toastmaster "Kep" Brierly, '34; Ed Kingman, '34, Alumni President; John Karamigios, Freshman Coach; Jack Weyler, '50; Keith Bowen, Asst. Freshman Coach; Joe Davies, Head Line Coach.

"MINES" FOOTBALL BANQUET

With that same enthusiasm and love of sports that is typical of *Mines Men* everywhere, a fine group of *Mines* Alumni and guests turned out on the night of December 2 to do honor to the great Mines football team. The occasion was the *Annual Colorado School of Mines Alumni Football Banquet* held in the Daniels and Fisher Club Room in Denver.

A welcoming committee consisting of Joe Ruth, Ed White, and Bruce La Follette greeted the banqueters as they arrived, and, with Joe doing his usual expert job, the old *Mines* spirit soon ran high.

For the "old timers" present it was a time for reminiscing and, with football the major topic of conversation, many a tale was told about the early blood and thunder days of the pigskin parade. Football players and ex-football players decades apart in age but with the same, ever-young interest in the gridiron, swapped stories of trick plays and last-minute touchdowns.

Soon, however, the call from the dining room sounded above the laughter and conversation, and, after a rousing rendition of "Rambling Wreck from Golden Tech" the assemblage sat down to enjoy a fine meal. The steaks proved no match for the diners' appetites and soon went where all good steaks go. Apple pie and coffee followed in short order, and after the desert, came Ed Kingman.

▾ Conversation and refreshments, two fine ingredients for a pleasant evening.

As president of the Association, Ed extended official welcome to the members and guests. Commenting on the 1949 football season, Ed said, "Of all the games I remember, the recent *Mines*-C.C. game was one of the greatest. That second-half rally by the *Mines* team gave me one of the proudest feelings I've ever known."

Describing him as a former *Mines* gridiron star and, therefore, especially fitted to preside at such a function, Ed introduced the inimitable "Kep" Brierly, who, as toastmaster, took charge of the proceedings.

"Kep" soon had the banqueters chuckling with his stories of the rough and ready football teams of earlier years. And then there was something about a blonde and a convertible . . . After the laughter had died away, a fine looking group of young athletes from several local high schools stood up to be introduced. Guests of the *Mines* Alumni Local Sections, they were: Frank Quintana, Holy Family; Bob Grabowski, St. Joseph; Louis Carisio, St. Francis; Jim McCullough, and Robert Dudan, Annunciation; Ralph Mason, West; Dick Valore, Littleton; Fred Kottenstetter and John O'Hara, Regis; Ron Johnson, Golden; Bob Lofgren, North;

Al McGlone, Keith Marks, and Al Whitaker, South; and Ed Peebles, Lakewood. Also present were coaches Harry Pemburton of Annunciation; Joe Loffreda of St. Francis; Harvey Riddle of North; Joe Fanning of Holy Family; and Ev Stewart of St. Joseph.

Guest speaker of the evening was Frank Harraway, well known Denver Post sports writer, who had some words of praise for the fighting spirit of the *Mines* team. Mr. Harraway punctuated his short talk with congratulations to *Mines* for a fine season.

Following Mr. Harraway's talk, the meeting was turned over to Head Coach Fritz Brennecke of *Mines,* who told some amusing tales about his days as a college gridiron "hero." Then Fritz introduced Track Coach Joe Davies who presented awards to track stars Paul Vaughn and "Iggy" Yakoushkin (in absentia).

Taking over once more, Coach Brennecke presented the "M" Club award to Jack Weyler for his fine performance in baseball last season. To Glen Pohler and Pat Mercier went the distinction of being chosen Honorary Captains of the football team. Coach Brennecke then presented Most Valuable Player Awards to Dick Bench and Harv Kingry.

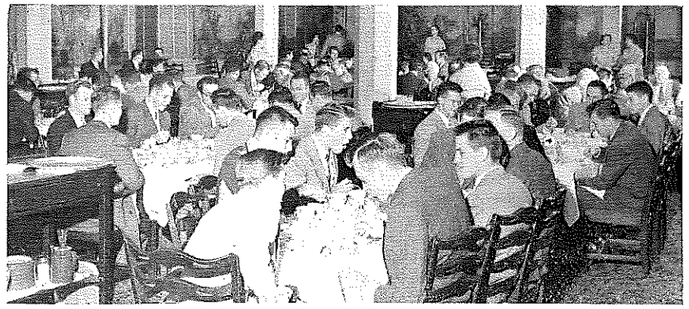
After the presentation of the awards was completed, Coach Brennecke spoke with obvious pride, of the team's record for the past year. "We feel," said he, "that we've had a good season. This team has been remarkable for several things: *They are the smallest team I've had at Mines.* They would probably be out-weighed by many high school teams in the Rocky Mountain area. *They have established a reputation for the cleanest playing in the Rocky Mountain region.* Perhaps we're too gentlemanly but we've never played unethical ball and we don't ever intend to. Winning isn't that important. *They have the ability to come from behind,* which is the measure of a good team. It's easy enough to score and keep scoring when you're ahead but it takes a good team to keep fighting when the going gets rough." There was general and enthusiastic agreement when Coach Brennecke said, in conclusion, "The Alumni can be proud of this team," and the applause was loud and long when he introduced the following team members who were present: Howard Kaylor, John Keating, George King, Harvey Kingry, Drexel Lee, Wally McGrego, Francis Mercier, Jay Naugle, Jack Petrocco, Keith Pottorff, Glen Poulter, Robert Pozzo, Max Settlemyre, Henry Snyder, Joe Taylor, Adam Thomas, William Traeder, John Miller, Hugh E. Bradley, Jack Earl, Ronald Bethurum, David Brown, Darrell Beckley, Richard Bench, James Ault, Wallace Arnold, Donald Adams, William Johnston, Robert Johnson, Claude Jenkins, Gerald Jeffries, Edgar Hunter, Joe Hill, Robert Harke, Paul Hamilton, and Roy Essary.

After the introduction of the team, color movies of the *Mines*-Colorado College game were shown with Coach Brennecke giving a fine running commentary on the plays. All present were on the edge of their seats as that terrific second half unfolded on the screen, and one and all were proud of the inspired playing of the *Mines* team.

At the conclusion of the film, toastmaster "Kep" Brierly suggested a standing vote of thanks to the members of *Mines* Local Sections all over the world whose splendid support contributed in large measure to the success of the Banquet. This suggestion was promptly carried out.

At this point it seems fitting that we pay tribute to the spirit of cooperation of these many *Mines* Local Sections. In this particular case, every Local Section, without exception was represented by a guest at the Banquet. Thus though many of them are thousands of miles away, they were present at the Banquet in spirit. Therefore, our appreciation goes to the Local Sections of: Arizona, Baguio, Bartlesville, Bay Cities, Birmingham, Central Ohio, Cleveland, Colorado, Great Lakes, Houston, Kansas, Manila, Montana, New York, North Central Texas, Oklahoma, Oklahoma City, Pacific Northwest, Pennsylvania-Ohio, Southern California, St. Louis, Utah, and Washington, D. C.

In bringing the Banquet to a close, Ed Kingman thanked those present for their attendance and for the cooperation which made the affair a success. The evening ended on a note of hope that every season can be as successful as the past one.



▼The Banquet progresses; guests from the high schools in the foreground.

TRANS-ARABIAN PIPELINE

(Continued from page 16)

Very high frequency radio of the line-of-sight variety was believed by some of the radio engineers consulted to be the only type that would guarantee performance under all weather conditions, but it required towers and a supply of power at intermediate locations where no power was available from a reliable source. If unattended, such intermediate relay stations would also be subject to derangement by the curious or malicious, or those bent on pilfering. Again it was impossible to obtain the necessary equipment in time to be used in the construction program, and possibly not in time for operation of the line.

It, therefore, seemed that some form of ordinary short-wave transmission was necessary for the construction program, and that experience might indicate that it could be expanded into a permanent system that would give reasonable satisfaction. This hope was partly based on the rather remarkable performance of the low-power transmitters which the Arabian American Oil Company geologists used in automobiles transmitting at a frequency of about four megacycles. The hope for satisfactory performance of the short-wave radio has apparently been more than borne out by the experience to date.

The temporary equipment consists principally of 1000-watt transmitters at Beirut and Ras el Misha'ab, 300-watt transmitters at the main intermediate construction camps, 50-watt transmitters at temporary tent camps, and 15-watt transmitters in certain of the motor equipment. The through communication from Ras el Misha'ab to Beirut, an airline distance of 850 miles, has been almost faultless. Various frequencies can be used between three and 18 megacycles, and two are

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PROGRESS NEWS
U. S. ATOMIC ENERGY COMMISSION

AEC Announces Developments in Nuclear Reactor Program. The U. S. Atomic Energy Commission recently announced the following actions in its reactor development program:

1. Selection of the Bechtel Corporation of San Francisco, California, by the AEC Idaho Operations Office to perform major construction work on the first experimental breeder reactor to be built at the Commission's new Nuclear Reactor Testing Station near Arco, Idaho.

Work on the reactor is beginning immediately, and is expected to be completed by the end of next year.

2. Decision to locate the AEC's proposed materials testing reactor at the Idaho reactor testing station.

Detailed design work on this reactor has been under way since last September, and construction is scheduled to begin by next spring.

3. Scheduling of December 1 as the date for transfer of custody of Naval Proving Ground property near Arco, Idaho, to the AEC from the Navy Department. Actual ownership of the property will be transferred at a later date.

Objectives of the Commission's reactor development program include development of nuclear reactors for the production of fissionable material, the generation of electric power and the propulsion of ships and aircraft. It is principally through the development of these atomic energy machines that the AEC expects in coming years to develop a means of utilizing for peaceful purposes the energy released by nuclear fission.

The materials testing reactor is of particular interest in the development of reactors for the propulsion of aircraft, since it points in the direction of compact, high radiation density reactors which must ultimately be developed if aircraft are ever to be propelled by atomic energy. On the basis of rough preliminary estimates, it is expected that the reactor will cost about $25,000,000.

Ship Propulsion Reactor: The Argonne National Laboratory and the Westinghouse Electric Corporation are engaged in the development of a land-based prototype of a reactor suitable for ship propulsion. Although this reactor, like the experimental breeder reactor and the materials testing reactor, will be built at the Nuclear Reactor Testing Station in Idaho, the engineering and development work is being carried out at Argonne and in the laboratory of the Westinghouse Atomic Power Division on the site of the old Bettis Airport near Pittsburgh.

Research and development work is well advanced, and detailed engineering design of the ship propulsion reactor is scheduled to begin in about a year.

AEC Announces Establishment of Reactor Development Training School. Advanced training in the field of reactor development will be given government and industrial scientists and engineers at a newly established Atomic Energy Commission Reactor Development Training School at the Oak Ridge National Laboratory.

The emphasis on the new school will be to supply as quickly as possible scientists and engineers with formal training in reactor development. The students will fall into three categories:

a. Engineers from industrial organizations who will remain on their companies' payrolls while attending the training school.

b. Employees of other atomic energy laboratories or other government agencies detailed to Oak Ridge for training.

c. Recent college graduates hired by Oak Ridge National Laboratory who will be trained as regular employees and will then be available for transfer to reactor groups throughout the atomic energy program.

Present plans call for about 60 students to be trained at one time, about 30 students in categories *a* and *b* and an additional 30 in category *c*. The school will operate continuously. All students will be required to have complete security investigation and clearance and the lectures and study material will be classified. Selection will be made by the Commission from qualified applicants on the basis of the need of the organization with whom its applicant is affiliated for personnel trained in reactor development, its potential contribution of the applicant to the AEC programs, and his academic record.

Dr. F. C. Von der Lage, former director of the training division of the Oak Ridge National Laboratory has been named director of the Reactor Development training School.

Uranium to be Sold under AEC License. The United States Atomic Energy Commission has authorized the production of 200 pounds of uranium metal for use under AEC license in non-Commission research projects in the United States.

The metal will be made available by Mallinckrodt Chemical Works through normal commercial channels and will cost approximately $50 per pound.

Status of AEC Contract Research in Physical Sciences. The contract research program for physical sciences in non-Commission laboratories is currently operating at a level of about $7,270,000 per year. Of this about $3,560,000 is allocated to some 50 research projects supported jointly with the Office of Naval Research. The remaining $3,700,000 is devoted to direct contracts with universities and industrial laboratories.

Progress in Radioisotopes Program. Radioisotopes are distributed from Oak Ridge at the rate of 400 shipments per month to laboratories all over the U. S. and in 22 foreign countries.

Using these radiochemicals as tracers, physicians and biologists are able to follow complicated biological processes in the living organism.

Radioisotope tracers also promise to have many industrial uses; radiocobalt is being used by one firm to test the wearing qualities of wax, a rubber company is using radio phosphorus to trace leaks in the cooling water line of an air conditioning system, and, last but not least, several companies are experimenting with radiosulfur in an attempt to find out how cows synthesize sulfur-containing amino-acids in milk proteins.

Status of Accelerator Program. Particle accelerators or atom smashers are among the most important tools in nuclear research. The 184-inch cyclotron at the AEC's Radiation Laboratory, Berkeley, is at present the greatest of these machines. However, two Commission-financed machines now being designed and under construction will dwarf this huge machine.

At Brookhaven National Laboratory scientists are building a proton synchrotron (the Cosmotron) which will impart energies of from 2 to 3 billion electron volts to sub-atomic particles.

A still greater machine—the Bevatron—is being built at the Berkeley Radiation Laboratory.

Completion of Brookhaven Reactor Delayed. Unforeseen technical difficulties in design engineering and construction have delayed completion of the nuclear reactor at the Brookhaven National Laboratory. The new research reactor originally scheduled for completion during the Fall of this year is now not expected to start operation for several months.

New Developments in Atomic Materials Production. A new pile went into operation at Hanford for the production of plutonium.

A new plutonium metal fabrication plant began operations at Hanford in July, 1949.

Construction was started in August on a $67,000,000 expansion of the U-235 production plant at Oak Ridge.

Radioactive Cobalt Used in Cancer Treatment. Radioactive cobalt (cobalt-60), which has been under investigation for several years as a possible substitute for radium in the treatment of cancer, is now being used experimentally for the treatment of selected types of cancer of the womb in humans at the Ohio State University School of Medicine.

Potential Industrial Uses Among Subjects of Atomic Energy Reports Issued in November. The effect of low dosages of radiation upon the blood count of exposed atomic energy workers, a novel method for detecting leaks in industrial chemical processing systems, a low-cost production method for industrial fluorine, and re-determinations of two basic properties of carbon, are among the subjects reported in 57 declassified and unclassified reports issued by Atomic Energy Commission laboratories during November.

These reports fall into five broad classifications: Biology and Medicine, 9 reports, 178 pages; Chemistry, 18 reports, 500 pages; Engineering, 14 reports, 162 pages; Mineralogy, Metallurgy and Ceramics, 5 reports, 250 pages; and Physics, 11 reports, 229 pages.

Information on how to get any of these reports issued by the AEC in November may be obtained from the Document Sales Agency, Atomic Energy Commission, Box E, Oak Ridge, Tennessee.

OIL AND HUMAN WELFARE

(Continued from page 21)

four times the value with half the hours of work.

Muscles and Machines

We have an even better index of progress: the form of energy with which we do our work. In 1850, 94 per cent of our productive energy was supplied by muscles. 94%. Now 90 per cent is supplied by machines. Here is Revolution beyond all doubt! Man has grown to a new stature.

Machines are servants—slaves, if you will—to do the work that man wants done. In 1850, machine slaves did 6 per cent of man's work; today they do 90 per cent. Speaking in averages, today's worker is master of nine slaves—machines that do nine times as much work as he does. This is slave labor on the grand scale; the most beneficent form of slave labor the world has ever known.

Having slaves to do his will has created a new workman. When he had to do 94 per cent of the physical work, the workman was paid for his brawn, with little heed to his brains. He could be narrow between the eyes if he was broad between the shoulders. Today he is paid for his brains. The percentage of unskilled work goes down and down. Much that we call unskilled would have taxed the general skill in 1859.

We have changed drudges into masters of machines. And nine-tenths of the change has come about since rock oil replaced whale oil.

Not Oil Alone

Oil alone could not have worked these miracles of course. Many other things were needed: the internal combustion engine to turn oil into energy; electricity for light and power and to spark the gasoline motor; better metals for machines and for tools to make them. Most important of all, perhaps, the substitution of steel for iron. The Bessemer furnace came just before the Drake discovery, the open hearth just after it. They made steel abundant.

All of these things, including oil, have been part of the revolutionary advance. Each of them has been essential. Oil could not have done the job alone; that much is clear. Another thing is also clear: the job could not have been done without oil. Even steel could not have done it; the value of steel is in making machines, and machines can not run without oiling. Since 1859, during 90 per cent of its growth, the Industrial Revolution has been an oil revolution.

Oil Use and Industrial Output

A great oil company has an advertising slogan: "The better you live the more oil you use." No slogan could be truer. Read in reverse it is equally true: "The more oil you use the better you live." The proof is easy to find.

The more men produce the more real wealth they create. The more real wealth they have the better they can live. Part of their real wealth is used to increase productivity still more; the rest goes into better living.

This gives us a good first step toward sizing up a country's standard of living; we can study the value of industrial output per person.

Let's take five typical industrial countries: the United States, Sweden, Great Britain, France, and Italy. The 1948 value[4] of industrial output per person in the United States was $1730, in Sweden $950, in the United Kingdom $910, in France $580, in Italy $450.

Then note this: the use of oil per person in those countries followed the same order. In the United States it was 598 gallons, in Sweden 151 gallons, in the United Kingdom 130 gallons, in France 55 gallons, in Italy 25 gallons.

Consistently, without exception the more oil per person the people of a country used, the greater its value of their industrial output per person..

Oil Use and National Income

The next step toward judging the standard of living is to study national income per person. It has a broader base than value of industrial output; it includes agriculture and distribution as well as industry.

On this scale the five countries again come in the same order. The 1948 national income per person[5] in the United States was $683, in Sweden $413, in the United Kingdom $401, in France $228, in Italy $105. The more oil per person the people of a country used, the greater their national income per person.

Oil Use and the Standard of Living

That brings us to the final question: how much of the oil used goes into productive activity, how much into better living?

An answer can be had by dividing the oil used per person into national income per person. The result is the national income per person for each gallon of oil used. If high, it shows that most of the oil used goes into production. If low, it shows that after productive demands are met a large amount is used for living better.

Take the same five typical countries. The 1948 national income per person per gallon of oil used in Italy was $4.20, in France $4.10, in the United Kingdom $3.08, in Sweden $2.74, and in the United States only $1.14.

From these figures, the average citizen of the United States, as compared to the average citizen of Italy, used three or four times as much oil for living well: for pleasure driving and pleasure flying; for heating his home and cooking his food; for electricity for better lighting and refrigeration and washing machines; for all the multitude of things by which oil makes life easier and more pleasant. All this, plus twenty times as much for productive purposes.

The evidence is clear. Oil is the great promoter of industrial progress; oil is the great contributor to a high standard of living. Country by country "The more oil you use, the better you live."

Great Risks and Great Results

The year when George Bissell picked up the bottle of oil from Dr. Crosby's desk was 1851. Eight years went by before Uncle Billy's boy looked down the hole and shouted "Oil." Eight years of hope and disappointment, of enthusiasm and discouragement, of failure and final triumph.

Who sweated out those eight years? Who won that final triumph? What motive found us oil? What system has made it abundant?

No government drilled the Drake well. No public man would have dared take such a risk with public funds, as Bissell and Eveleth and Townsend and Drake risked theirs. No statesman would have risked his reputation for good judgment as they risked theirs. No ruler told them where or how to drill. No conqueror supplied the vision or courage.

The vision and the courage came from everyday men like you and me; men who took big risks in the hope of making a fortune. Because of their vision and their courage, the United States produced last year more than 2 billion barrels of oil and 6 trillion cubic feet of gas.

A New World

We live in a new world: a world in which men work 40 hours a week instead of 70; a world in which an hour's work is worth four times its value 90 years ago; a world in which brains has superseded brawn; a world in which the average workman is master of nine mechanical slaves; a world in which we own the sky, as well as land and sea; a world in which we live better than men have ever lived before.

We live in a new world, because a little group of men were spurred by hope of profit; because they risked their money and their standing; because they drilled a well on a little stream called Oil Creek.

[4] In terms of 1938 dollars.
[5] In terms of 1938 dollars.

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.

Link-Belt Thru-Clean Bar Screen Announced (673)

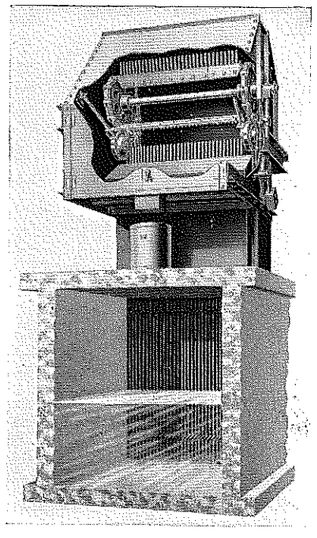
Link-Belt Company announces the development and manufacture of a new screen — the Link-Belt Thru-Clean Bar Screen—for efficiently removing trash and large solids from water and sewage at water, sewage, and industrial waste treatment plants.

The primary elements of the Thru-Clean Screen are a permanently supported rack of vertical steel screen bars and a power operated screen-bar-cleaning mechanism employing two endless parallel strands of "C" Class Combination chain between which are fastened two or more steel rakes at evenly spaced intervals.

The rake teeth engage the screen bars through the screen rack from the downstream side, and are moved upwards through the screen bars to the discharge point—where the screenings are discharged by a pivoted, counter-weighted mechanical wiper plate.

Screenings are discharged on the upstream side of screen rack to a belt conveyor for disposal elsewhere, or into a trough from which they can be raked by hand into either a shredder or a screenings-can located directly under the steel plate enclosure of the head of the machine.

The machine is operated by a Gearmotor and encased "RC" roller chain drive connecting with its head shaft. The operation may be automatic by means of



a time clock, or manually by push buttons.

Protection of machine in case of jamming is provided by conventional breaking pin, or by a Link-Belt Electrofluid drive which eliminates any occasion for using or changing breaking pins.

This new, Link-Belt Thru-Clean Bar Screen is covered by an illustrated Folder No. 2327, copies of which will be forwarded to any interested reader upon request.

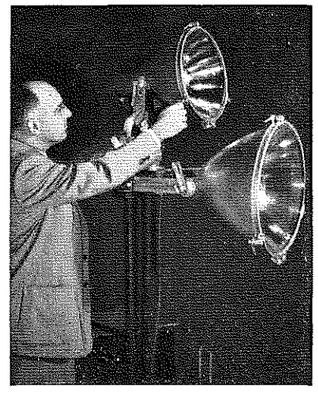
G. E. Announces Two New Heavy-Duty, General-Purpose Floodlights (674)

Two new heavy-duty, general-purpose floodlights have been announced by General Electric's Lighting and Rectifier Divisions.

The new lights, the Type L-84 rated at 500 watts and the Type L-85 rated 1000 watts, can be used for all general-purpose applications and are available for either general lighting service or floodlighting service lamps. A complete range of NEMA types 1 through 5 is provided.

Weather-tight and substantially constructed of heavy-gage aluminum, each of the new units weighs less than 17 lbs. Non-corrosive materials—aluminum and stainless steel—are used throughout.

The door, hinged for easy relamping,



uses three simple swing-type door latches. The heat-resistant door glass is cushioned in a silicone rubber gasket which wraps around the edge of the glass and also seals the joint between the door and the casing. A clamping handle for vertical adjustments is provided so that the floodlights can be serviced completely without the use of tools.

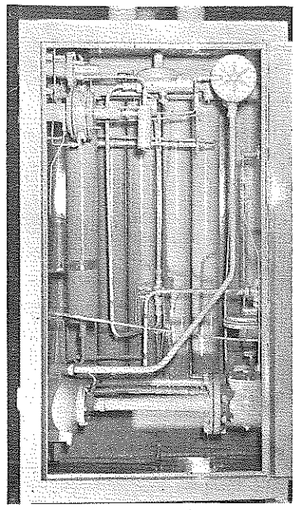
An auxiliary reflector of finished aluminum provides high beam efficiency. The floodlights can be provided with either narrow-beam polished or wide-beam etched reflectors.

Both the L-84 and the L-85 are available in three standard mountings, including a portable base.

Additional information on the new Type L-84 and Type L-85 heavy-duty floodlights is contained in Bulletin GEC-537 which may be obtained by writing to General Electric Co., Schenectady 5, N. Y.

New Gasair Machines by Eaton Metal (675)

Eaton Metal Products Company of Denver has just announced a new series



of Gasair machines which will be designated as the "HG" series.

Gasair machines are designed and sold by Gasair Associates, 68 Post Street, San Francisco, California and manufactured by Eaton Metal Products Company of Denver. The Gasair machines use butane or propane to manufacture gas of any predetermined BTU content and will deliver the gas at any desired pressure.

Improved Twin and Triple Roll Crushers (676)

Pioneer Engineering Works, Minneapolis, Minnesota offers a number of improvements in its new line of twin and triple roll crushers. Improvements consist of deeper mounting sills with less obstruction from cross members to provide more clearance for conveyors, a deeper top frame, separately cast star gears and driving gears and cast steel hubs for the roll shells.

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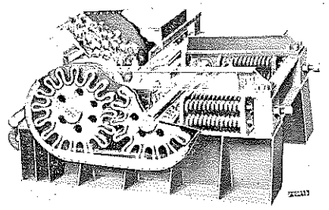
Twin roll crushers are now available in sizes 54x24, 40x22, 30x18 and 24x16. Two sizes of the triple roll are available: 40x22 and 30x18, the latter having just recently been added to the line.



Full facts and information are available in a new booklet just published by the company. Write to the Pioneer Engineering Works, Inc., Minneapolis 13, Minnesota, for free copy.

New Model 80 Trenchmobile (677)

Latest addition to the Parsons line of Trenchliners, the utility-size, rubber tire mounted Model 80 Trenchmobile, is described in detail in an 8-page catalog recently published by the Parsons Company of Newton, Iowa. Parsons is a subsidiary of the Koehring Company of Milwaukee.

One-man operated, the Trenchmobile is designed for fast and profitable handling of small digging assignments. It travels anywhere under its own power at rapid speeds. Tractor-type pneumatic tires avoid damage to sidewalks, lawns and curbs in work or travel.

Sturdily built and powered by a 31 h.p. 4 cylinder gasoline engine the Trenchmobile is equipped to dig in eight separate feeds from 1.7 to 14.6 feet per minute, 5 or 8 inches wide and up to 4 feet deep. Other features include automotive type steering and direct mechanical drive through enclosed friction clutches for raising and lowering the box type boom. Equipped with the optional dozer blade, the Trenchmobile also is used for backfilling.

Copies of the catalog may be obtained on request to the Parsons Company, Newton, Iowa.

World's Largest Single Unit Conveyor Belt Installed

Akron, Ohio—The world's longest single conveyor belt, for use in transporting coal at the Weirton Mine of the Weirton Steel Company, near Morgantown, W. Va., has just been installed by The Goodyear Tire & Rubber Co.'s Mechanical Goods division.

This Compass-150-Steel Cord belt will haul coal from the washery located near the mine through a tunnel in an adjacent hill to a tipple on the Monongahela river for loading into barges. Measuring 10,900 feet from center of the head to center of tail pulley, installation of the endless rubber, steel and cotton belt will establish a new record for length for any type belt.

Goodyear furnished more than 22,000 feet of belting for the haul through the tunnel and return. The construction of the new "super rubber railroad" which weighs approximately 122 tons, consumed 152,798 pounds of rubber, 50,941 pounds of cotton and 39,754 pounds of steel cable.

The belt is 30 inches wide and will be required to deliver, approximately 250 tons of coal per hour while conveying at a speed of 300 feet per minute, and will be driven by a 200 H.P. motor. A lump of coal dropped on the belt at the washery end will dump into a waiting barge on the Monongahela river 36 minutes later.

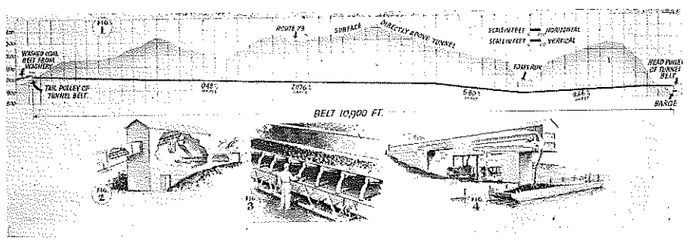
The conveyor has a vertical drop of approximately 135-feet in the 10,900 feet distance from washery to the tunnel mouth at the river.

It was decided to make the installation as one single belt to eliminate the hazards and added operating costs of transfer points.

Because of the unique layout of this belt it was essential that any stretch or shrink be reduced to the absolute minimum, as it was impossible to provide space for any takeup arrangement that would accommodate more than about 40 feet of belt.

One of the chief reasons for the selection of Goodyear Steel Cord Belt was its dimensional stability. The takeup required will not be more than about 25 feet despite the 22,000 length of the belt.

The conveyor is expected to be in operation late in 1949.



▼ Figure One: Profile of world's longest single unit conveyor belt. Figure Two: Transfer house and tail end. Figure Three: Thirty inch belt conveying coal through tunnel. Figure Four: General layout of river tipple and head end of belt.

PLANT NEWS

G. E. Engineers Report on Development of Gas Turbine Locomotive

General Electric engineers declared recently that the gas turbine-electric locomotive, the newest form of railroad motive power, will ultimately occupy a useful place in the nation's transportation system.

In a report to the annual meeting of the American Society of Mechanical Engineers, A. H. Morey and R. A. Williamson of Erie, Pa., detailed the development of the 4,500-horsepower American Locomotive Company-General Electric unit, America's first gas turbine-electric locomotive.

Promotions in Goodyear Sales Management

Important changes in the top level of sales management of Goodyear Tire & Rubber Company were announced on Nov. 28 by R. S. Wilson, vice president, at a meeting of the company's district sales managers in Akron, Ohio.

These changes were the advancement of Victor Holt, Jr., to the vice presidency of Goodyear's sales company, The Goodyear Tire & Rubber Company, Inc., in charge of the Replacement Tire Division, succeeding J. E. Mayl, Vice President, who moves up to the position of Sales Coordinator.

T. J. Jensen Appointed Sales Manager of Colorado Iron Works

The Board of Directors of Colorado Iron Works Company recently announced the appointment of T. J. Jensen as sales manager of the company. Mr. Jensen received a B.S. degree in Chemical Engineering from Colorado University in 1936. From that date until 1943 when he joined

Colorado Iron Works Co. as field engineer, Mr. Jensen was employed by mining companies in the U. S., Alaska and South America, including American Smelting & Refining Co., Kennecott Copper Co., London Mining & Milling Co. and Resurrection Mining Co.

Olin Industries Announce Entry Into Cellophane Industry

John M. Olin, president of Olin Industries, Inc., which was licensed by du Pont to make cellophane, announced recently that his company will launch its entrance into the cellophane industry with location of its initial facilities at the plant of the Ecusta Paper Corporation, Pisgah Forest, North Carolina.

CATALOGS AND TRADE PUBLICATIONS

(5277) OFFICE SUPPLIES "Kistler's Tele-Shopper," a six page folder by The W. H. Kistler Stationery Company, 1636 Champa St., Denver, Colorado. Contains descriptions and illustrations (with prices) of various items for use in the business office including office furniture and files, pens, pencils, copy holders, slide rules, staplers, and others.

(5278) FLUID DRIVES Catalog and engineering data book no. 2385 by Link-Belt Company, 307 N. Michigan Ave., Chicago, Illinois. 28 pages, largely a progress report on the type "ED" Electrofluid drive illustrating and describing the various applications of the drive and pointing out that it is now made in a greater number of sizes. Also included are descriptions and illustrations of other and newer types of drives. Coverage includes types, sizes, arrangements and dimensions of units available; features of construction; advantages to the user; selection tables; typical examples of fluid drive selections; and numerous photographs of actual installations.

(5279) PACKAGE SWITCHGEAR Bulletin GEA 5228 by General Electric Company, 1 River Road, Schenectady 5, N. Y. A six page bulletin containing descriptions and photographs covering two switchgear units, the AK-1 Air Circuit Breaker, and the M1-9 metal-clad Switchgear Unit. Advantages and ratings are included.

(5280) DORR PROCESSING EQUIPMENT, Bulletin 7001 by The Dorr Company, 570 Lexington Avenue, New York 22. An eight page booklet describing and illustrating 23 units used in agitation, classification, thickening, clarification, washing and related operations employed in these industries. Considerable information is given on each unit including capacities and descriptions of method of operation.

(5281) REDUCTION CRUSHER, Bulletin 07B6006E by Allis-Chalmers, Milwaukee 1, Wisconsin. An eight page bulletin describing and illustrating the type "K" reduction crusher. Complete information is provided on this new crusher, including capacities, dimensions, specifications and applications. Photographs of the unit in operation and of its various assemblies are included.

(5282) COMPRESSORS, Form 3071 A-X by Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y. Twenty pages illustrating and describing the XVII Compressor showing details of design and operation and picturing installations of the unit in operation. Ratings, dimensions, and capacity charts and diagrams are included. A list of other Ingersoll-Rand products is appended.

(5283) MINING MACHINE TRUCKS, Bulletin J-300 by Joy Manufacturing Company, Henry W. Oliver Bldg., Pittsburgh 22, Pa. Eight pages containing descriptions and photographs of six different types of mining machine trucks. Information on specifications and applications for these units is provided, including photographs showing the trucks at work in the mine.

(5284) BAROID NEWS BULLETIN, October, 1949, 18 page monthly magazine published by Baroid Sales Division of the National Lead Company, contains illustrated articles on a new emulsion mud, oil drilling in the South Mountain area in Ventura County, California, and a photographic coverage of the 1944 eruption of Vesuvious. Also included is a map showing NLC facilities in the U. S., and a list of appointments and new employees

(5285) OIL FIELD TOOLS AND SERVICES, "Tomorrow's Tools—Today," a 36 page magazine published quarterly by Lane-Wells Company, Los Angeles 11, California. This issue contains articles on radioactivity logging, an installment in the series on the shaped charge process of perforating, a profusely illustrated article on Norway, and a very entertaining backward look at the early days of bicycling. Also included is another section (2.3) in the very fine "Packer Handbook." This insert is so arranged that it can be taken out of the magazine without disturbing the rest of the material.

(5286) "RARIN-TO-GO", October, 1949, by The Frontier Refining Company, Cheyenne, Wyoming, a 12 page monthly publication devoted to news and items of interest to employees and customers of Frontier. This issue leads off with an article about Frontier's No. 1 Mallette-Government well at Fiddler Creek which was recently completed as a 4,000 bpd producer.

FOR YOUR CONVENIENCE

Send your publications to Mines Magazine 734 Cooper Building, Denver, 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.

(5287) THE BEACON, October, 1949, by the Ohio Oil Company, a monthly magazine containing 36 pages designed to be of particular interest to Ohio Oil employees. Beginning in this issue is a series of articles on the Hoover Report. In addition, there are sections devoted to sports, items of interest to the distaff side, plant news, promotions and retirements and personal notes.

(5288) BLOW-OFF VALVES, Bulletin B-432, by Yarnell-Waring Company, Philadelphia, Pa., 24 pages describing and illustrating type C seatless valves, hard seat valves, unit-tandem valves, single steel body blow-off valves for 400 to 2500 lbs. pressure, and tandem steel body blow-off valves for 400 to 2500 lbs. pressure. Details are given on construction, properties of the metals used in the manufacture of the valves, dimensions, typical installations, and parts prices. Urquhart Service Co., 306 Mercantile Bldg., Denver are sales representatives.

(5289) INDUSTRIAL CLEANING, "Oakite News Service," September-October, 1949, by Oakite Products, Inc., 22 Thames St., New York 6, N. Y. 22 pages containing information and illustrations describing various uses of industrial cleaning materials. This issue describes cleaning operations in railroads, meat packing plants, dairies, and vending machine maintenance.

(5290) RECIPROCATING DRY VACUUM PUMPS, Form 2196 by Ingersoll-Rand, 11 Broadway, New York, N. Y. A 12 page folder describing and illustrating vacuum pump cylinders with photographs and diagrammatic sketches. Steam and electrically driven types are considered and complete information is given on both

(5291) THRU-CLEAN BAR SCREEN, Folder No. 2327 by Link-Belt Company, Philadelphia 40, Pa. Describes and illustrates the L-B thru-clean bar screen designed for removal of trash and large solids from water and sewage. Diagrams and photographs illustrate the parts and operation phases of the unit and details of specifications and dimensions are given.

(5292) "STORAGE BATTERY POWER", October, 1949 by The Edison Storage Battery Division of Thomas A. Edison Inc., West Orange, New Jersey. A 16 page magazine describing the applications of storage battery power and containing illustrated articles on the handling of packaged materials in Gulf Oil's Philadelphia refinery through the use of pallet-fork trucks, storage battery power as applied to two new Southern Pacific streamliners, and the use by C.F.&I. Wickwire Spencer, of ram-truck units for material handling.

(5293) GATES VULCO ROPE DRIVES, "Gates Industrial News," November, 1949. Published monthly by the Gates Rubber Company, 999 South Broadway, Denver. Four page booklet describing and illustrating the use of Vulco Rope Drives in various industrial operations. This issue contains items on the use of these drives on lineshafts, mixers, pulverizers, gear hobbers, and pebble mills.

(5294) NEW LABORATORY APPARATUS, A 17 page bulletin by Precision Scientific Company, 3737 West Courtland Street, Chicago 47, Illinois. Contains an article describing and illustrating the precision sohio poly-reriform lubricant tester which is designed for the studying of the oxidation stability, varnish and sludge formation tendencies, and corrosion characteristics of lubricating oils. Also included is a reprint of an article from Analytical Chemistry describing a similar unit.

(5295) BALL AND ROLLER BEARINGS, Catalog 2550 by Link-Belt Company, 307 N. Michigan Ave., Chicago 1, Ill. A 112 page detailed catalog and engineering data book covering the company's complete line of ball and roller bearings. Information is provided on construction features, list prices, weights, load ratings, and dimensions for the standard models available. Many photographs and charts combine with the printed descriptive materials to make this a complete catalog.

(5296) NICKEL PRODUCTS "INCO Magazine," Fall Edition by The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y. A 32 page magazine containing information and illustrations describing nickel products and their uses. This issue contains a very interesting article about the Kure Beach Testing Project. Also included are several articles on the use of nickel or nickel alloys in hot food containers, motorboat mufflers, a Denver amusement park miniature train, and radioactive wire.

(5297) FLEXIBLE COUPLINGS, Bulletin 101 by Ajax Flexible Coupling Co. Inc., Westfield, New York. A four page booklet describing and illustrating the No. 403 Light Duty Flexible Coupling. Information given on construction features, service characteristics, operational advantages, and dimensions. Urquhart Service, 306 Mercantile Bldg., Denver are sales representatives.

(5298) "THE BUSINESS OF FARMING" Fall, 1949, by United States Gypsum, 300 W. Adams St., Chicago 6, Illinois. A 16 page magazine containing illustrated articles and items designed to be of interest to farm families This issue contains articles on farm dwellings and landscaping. The "News-Letter," a regular feature, is particularly interesting.

(5299) FLOTATION MACHINE, Bulletin No. F10-B43 by Denver Equipment Co., 1400 Seventeenth St., Denver 17, Colorado. Describes and illustrates the "Sub A" flotation machine, giving capacities and dimensions, and showing the machine in operation. Information is provided showing the advantages in economy of operation and better results.

(5300) ALUMINUM PRODUCTS "Alcoa Aluminum News-Letter," November, 1949, by Aluminum Company of America, Pittsburgh 19, Pa., contains short illustrated articles on the various uses of aluminum products. This issue pictures and describes the application of aluminum in the manufacture of ladders, chairs, musical instruments, awnings, boat hardware, and carpet sweepers.

(5301) "MINERAL INFORMATION SERVICE" November, 1949, an 8-page monthly news release by the State of California, Department of Natural Resources, Division of Mines, Ferry Building, San Francisco 11, California. Designed to inform the public on California discoveries, operations, markets, statistics, and new publications. This issue contains articles on lead and chromium and photographs of two of California's better know clay pit operations.

(5302) ELECTRIC MOTORS, Bulletin GEA-5401 by General Electric, Schenectady, New York, A 12 page booklet describing and illustrating the GE type KCS and type KCR electric motors. Photographs and text point out the new features that these motors have and the advantages to be gained thereby. Information given on dimensions, specifications, and characteristics of the motors.

(5303) "NEW MEXICO MINER AND PROSPECTOR," November, 1949, by the New Mexico Miners and Prospectors Association, Silver City, New Mexico, devoted to news and information pertaining to the New Mexico mining industry. This issue contains articles on wages in the mining industry in 1949, survey operations by the Department of the Interior for the purpose of establishing sites for the manufacture of synthetic fuels, and on the International Mining Days celebration at El Paso, Texas.

(5304) INDUSTRIAL HOSE, "Gates Industrial Hose Reporter" November 1949, by the Gates Rubber Company, 999 S. Broadway, Denver, Colorado, contains information and illustrations on the various types of Gates industrial hose giving dimensions and unusual applications. Included are location of dealers and stocks in Rocky Mountain States.

(5305) FLUOR WEATHER REPORT, November 1949, by the Fluor Corporation, LTD., 2500 South Atlantic Boulevard, Los Angeles, California. A folder published monthly giving the general weather outlook for the United States. The Weather run-down is given regionally and storm belt and air current, mean temperature, and precipitation maps are provided.

(5306) THE LOUIS ALLIS MESSENGER, September-October, 1949. A 32 page magazine published by the Louis Allis Co., Milwaukee 7, Wisconsin. Contains photographs, art prints, poems, and sayings, interspersed with advertising matter on Louis Allis electric motors.

(Continued on page 34)

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Alumni Endowment
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MEETINGS

Executive Committee Meetings
3rd Monday of each month, Alumni Office, 7:30 P. M.

Alumni Council Meetings
4th Thursday of each month, Argonaut Hotel, 6:30 P. M.

Publication Committee Meetings
2nd Monday of each month, Alumni Office, 5 P. M.

Magazine Staff Meetings, Alumni Office on call.

EXECUTIVE COMMITTEE MEETING

The regular meeting of the Executive Commitee, Colorado School of Mines Alumni Association, was held in the Alumni office, Wednesday evening, November 23, 1949. The meeting was called to order by President Kingman at 5:00 P. M. The minutes of meeting, October 17, 1949, were read and approved.

Roll Call

Members present: Edward F. Kingman, President; Malcolm E. Collier, Treasurer; Irvin T. Vaughan, Assistant Secretary; Harvey Mathews. Committee chairmen: Roger M. Schade, Harry J. McMichael, Herbert M. Heckt, James Colasanti for Ed White. Frank C. Bowman, Executive Manager.

Members absent: Robert F. Barney, Vice president; John W. Hyer, Jr., Secretary; Frank E. Briber, Carl I. Dismant. Committee chairmen: Robert J. McGlone, Frank Geib, Edwin F. White, Dart Wantland, C. E. McWhorter, A. George Setter, Hugh M. Connors.

Treasurer's Report and Budget & Finance Committee

Mr. Collier presented the report which showed a net profit of $3428.35, for the ten-month period and he stated that the showing was remarkably good and that he estimated that the operation for the year should show a profit although Mr. Bowman pointed out there were still some large expenditures ahead.

Moved by Mr. Collier the report be accepted; seconded by Mr. Mathews; passed.

Alumni Endowment

Mr. Schade presented the report which showed receipts for October of $140.38, with a balance as of October 31, 1949, of $1468.34.

He also reported the Placement Service balance $299.64 as of October 31, 1949.

Mr. Mathews moved acceptance of the reports; seconded by Mr. McMichael; passed.

Athletic Committee

Mr. Bowman presented the report which showed a balance of $5938.82 on October 31, 1949, and another note completely paid up in October.

Mr. Mathews moved the report be accepted; seconded by Mr. McMichael; passed.

Capability Exchange Committee

Mr. McMichael reported 5 calls for men in October, 4 recommendations, 2 placements, and 56 calls unfilled October 31, 1949. He also reported 844 letters mailed and 281 men on the active list.

Mr. Vaughan moved the report be accepted; seconded by Mr. Colasanti; passed.

Instruction Committee

No report.

Membership Committee

Mr. Bowman reported an increase of 42 for a total of 2181 which is the largest membership to date. It represents 67.6% of the possible membership and is also remarkable in the large number of "never members" who have joined this year.

Mr. McMichael moved acceptance of the report; seconded by Mr. Heckt; passed.

Nominations Committee

No report.

Public Relations Committee

Mr. Colasanti reported on the program for the Football Banquet and stated that response had been received from the local sections although not enough time has elapsed to have heard from all of them.

Mr. Schade moved acceptance of the report; seconded by Mr. McMichael; passed.

Publication Committee

Mr. Heckt reported the mailing of the November issue of the magazine and the progress made on the December Petroleum issue. He also reported the total earned credit for the ten-month budget period as $7348.41 which is $1394.54 more than that of the same period last year.

Mr. Mathews moved acceptance of the report; seconded by Mr. McMichael; passed.

Research & Investigation

No report.

General Report

It was stated that the Budget and Finance Committee would meet early in December and prepare the budget for submission to the December meeting of the Executive Committee.

Mr. Kingman read a letter from Sam Hochberger relative to establishing an Eastern Pennsylvania local section. Mr. Bowman said he would send the needed information immediately.

Report of Executive Manager

Mr. Bowman, in addition to the above, reported on the increase of earnings over 1946, 1947 and 1948, which has been progressively increasing. He stated that he believed a large part of it was due to the emphasis on the use of letters and follow-ups.

Adjournment

There being no further business, the meeting adjourned at 5:40 P.M.

EXECUTIVE COMMITTEE MEETING

The regular meeting of the Executive Committee, Colorado School of Mines Alumni Association, was called to order at 7:35 P. M. by President Kingman at the Alumni office, 734 Cooper Building, Denver, on Wednesday, December 21, 1949. The minutes of the meeting of November 23, 1949, were read and approved.

Roll Call

Members present: Edward F. Kingman, President; Malcolm E. Collier, Treasurer; Frank E. Briber, Carl I. Dismant. Committee chairmen: Earl Durbin, Edwin F. White, A. George Setter, Herbert W. Heckt. Frank C. Bowman, Executive Manager.

Members absent: Robert F. Barney, Vice President; John W. Hyer, Secretary; Harvey Mathews. Committee chairmen: Robert J. McGlone, Roger M. Schade, Harry J. McMichael, Frank Geib, James Colasanti, Dart Wantland, C. E. McWhorter, Hugh M. Connors.

Treasurer's Report and Budget and Finance Committee

Mr. Collier presented the combined reports which showed a balance of $2,439.43 in receipts over disbursements to December 1, 1949. The 1950 budget was presented by Mr. Bowman to the Executive Committee for approval. Proposed receipts are indicated at $520.00 more than in 1949 and proposed expenditures at $3,430.00 less than in 1949. Mr. Collier moved acceptance of the budget; seconded by Mr. White and carried.

Alumni Endowment

Mr. Bowman presented the committee report which showed a balance of $1542.34 in the Endowment Fund as of December 1, 1949 and $430.20 in the Placement Service. Mr. Briber moved the report be accepted; seconded by Mr. Dismant; carried.

Athletic Committee

Mr. Bowman presented the report in the absence of Mr. McGlone which showed a balance of $5938.82 as of December 1, 1949. Mr. Setter moved the report be accepted; seconded by Mr. Briber; carried.

Capability Exchange Committee

Mr. Durbin presented the committee report as only 5 calls for men; 13 referrals; and no placements; 293 letters mailed and 35 calls remained unfilled.

Mr. Durbin brought out the pertinent point of not having had any placements with oil companies as of December 1, 1949.

Mr. White moved report be accepted; seconded by Mr. Collier; carried.

Instruction Committee

No report.

Membership Committee

Mr. Setter presented the committee report showing total living graduates of 3226 and 2075 Alumni Association members as of December 1, 1949; added to this are 131 Associate members. Delinquent members of 86 is lower than it has been for a long time. President Kingman commended the Membership committee on their good work in getting new members. Moved by Mr. Dismant the report be accepted; seconded by Mr. White; carried.

Nominations Committee

No report.

Public Relations Committee

Mr. White presented the committee report on the Football Banquet. A poor turnout was indicated with total dinners served at 94. More personal contact is required to bring out the attendance.

A tentative date of January 12, 1950, was set for the Annual Business Meeting.

Mr. Durbin moved the report be accepted; seconded by Mr. Dismant; carried.

Publications Committee

Mr. Heckt presented the committee report which showed a total earned credit of $7150.31 as of December 1, 1949.

The Special Petroleum Number has gone to press. Arrangements are being made to get this issue out in September 1950.

The Year Book and Directory should be completed in January.

Moved by Mr. Dismant the report be accepted; seconded by Mr. Collier; carried.

Research & Investigation

No report.

General Report

Mr. Kingman presented the application of the Eastern Pennsylvania Section of the Alumni Association for a charter. The charter was signed by seven paid-up members. Mr. Collier moved that the charter application be accepted; seconded by Mr. Setter; carried.

Mr. Kingman presented the report of the Special committee concerning the operation of the Capability Exchange. Report indicated the feelings of the various sections of the Alumni Association but no recommendations were made by the Special committee. Therefore, Mr. White moved that the report of the recommendations by the local sections and Special Placement Valuation committee be referred to the Capability Exchange committee for action in accordance with the findings; seconded by Mr. Setter; carried. It was agreed that the Special committee is now relieved of their duties.

Adjournment

There being no further business it was moved by Mr. Dismant that the meeting be adjourned; seconded by Mr. White, carried. Meeting adjourned 9:10 P. M.

PERSONAL NOTES

(Continued from page 8)

T. J. Zagurski, '49, has a change of residence address in Casper, Wyoming, to 944 South Oak Street. He is Geologist for Shell Oil Company.

Visitors at the Alumni office during August included: *James E. Brown, Jr.,* '47 Field Engineer for Cardox Corporation, 205 Mount View Ave., Bluefield, West Va.; *George E. Crosby,* '40 District Engineer, Stanolind Oil & Gas Co., Lubbock, Texas; *George A. Davidson,* '31, Chemical Construction Corporation, Dumas, Texas; *Phillip R. Hammond,* '48, Contractors Division, Hercules Powder Co., Wilmington, Delaware; *Masami Hayashi,* '48, Fort Lupton, Colorado; *C. G. Hemberger,* '43, Sales Engineer, Mills, Winfield & Co. 6334 No. Artesian, Chicago 43, Ills.; *William F. Spain,* '47, Shift Boss, Howe Sound Company, Holden, Wash.; *Charles M. Tarr,* '38, District Engineer, Continental Oil Company, Griffin, Indiana; *Harry J. Wolf,* '03, Mining & Consulting Engineer, Associated Behre Dolbear & Co., Suite 963, 11 Broadway, New York 4, N. Y.

Cards from the following brought the Christmas Spirit to the Alumni office during the Holiday Season and were appreciated by the staff: R. L. Bolmer, '44; Edward J. Brook, '23; Louis DeGoes, '48; Ralph Ehret, '33; George Featherstone, '43; Charles Fogarty, '42; Roy Hall, '35; Jack Hyer, '42; Henry Inouye, '43; Manuel Javellana, '40; Dent L. Lay, '35; J. R. Medaris, '49; Bill Morris, '32; Howard Schmuck, '40; A. George Setter, '32; Robert E. Simon, '48; Sigmund L. Smith, '39; Floyd L. Stewart, '43; C. C. Tappero, '35; John H. Winchell, '17; Norman Whitmore, '26; Great Lakes Section, R. E. Watson, '43; President.

WEDDINGS

Riddle - Desilets

Mr. and Mrs. Paul J. Desilets have announced the marrige of their daughter, Pauline Marie, to John Alden Riddle on Saturday, August 13, 1949, the ceremony having been performed at the Blessed Sacrament church in Denver.

Mr. Riddle who received his degree from *Mines* this year is associated with the Oliver Iron Mining Company with post office address Box 762, Coleraine, Minn.

Bradley - Quaintance

Leo N. Bradley, also of the class of '49, and Miss Patricia Quaintance, daughter of Mr. and Mrs. A. D. Quaintance of Golden, were married at the home of the bride the afternoon of September 6.

The bride was graduated from the Uni-

(Continued on page 34)

CATALOGS AND TRADE PUBLICATIONS

(Continued from page 31)

(5307) LINK-BELT NEWS, November-December 1949, by Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill. An eight page newspaper devoted to news and information particularly interesting to employees and customers of the company. This issue includes articles on the new L.-B plant in Houston, and on L.-B. equipment in a big new sugar factory in Minnesota.

(5308) "ACI NEWS LETTER," October 1949. A 26 page journal published monthly by the American Concrete Institute, New Center Bldg., Detroit, 2, Mich. Contains technical information and other information of interest to Institute members and others concerned with concrete or concrete construction.

(5309) CONE CRUSHERS AND VIBRATING SCREENS. An engineering brochure by the Nordberg Manufacturing Co., Milwaukee 7, Wis. Contains many drawings with suggestions for arranging equipment to make up complete portable and semi-portable crushing and screening plants. Flow sheets and tables provided showing arrangements, horsepower requirements and conveyor, screen and crusher specifications for various hourly production capacities.

(5310) ROTARY DRYERS, KILNS, AND COOLERS. Bulletin 16-D by the Hardinge Company, Inc., 240 Arch Street, York, Pa. A 32 page catalog covering the complete line of "Ruggles-Coles" rotary dryers, kilns, and coolers. Includes overall dimensions of all models as well as typical "flow sheets" showing how the various rotary units are used in continuous flow operations in the mining, chemical, ceramic, stone products, coal, metallurgical, sewage treatment, and other processes.

(5311) "PAY DIRT" November, 1949, by the Arizona Small Mine Operators Association, 528 Title and Trust Bldg., Phoenix, Arizona. A 16 page magazine devoted to news and information designed to be of particular interest to the small mine operators of Arizona. This issue contains articles on the mining industry's stand on present mining laws, and on the outlook for federal aid to the mining industry.

(5312) VIBRATING SCREEN, Book no. 2154 by Link-Belt Company, Philadelphia 40, Pa. A 16 page booklet illustrating and describing the L.-B. concentric action vibrating screen, and covering operation and use, materials sized, flexibility and selection, outstanding design features, dimensions, and installations.

(5313) "ON TOUR," November, 1949. A monthly magazine by the Union Oil Company of California offering photographs, items, and articles of interest to Union Oil employees. Includes personal notes, personnel changes, new offices and installations and business and new products news.

(5314) THE U S. STEEL QUARTERLY, November, 1949, Eight page magazine by the United States Steel Corporation, 71, Broadway, New York 6, N. Y., largely concerned with a presentation of the corporation's position as to financial condition and production and as influenced by the strike situation. Also included is an article on new sintering facilities being installed by the corporation.

(5315) PLATE TYPE FIELD RHEOSTATS, Bulletin GEC-487 by the General Electric Company, Schenectady, New York. Describes and illustrates six types of plate type field rheostats with applications and dimensions. Rheostats described are designed for field control of d-c shunt—or compound-wound motors, self-excited generators, exciters, separately excited generators, and synchronous motors.

(5316) "ROPE DOPE," Vol. 3—No. 10 by Union Wire Rope Corporation, 21st and Manchester, Kansas City, Missouri. A four page folder giving information on "Tuffy" wire rope slings. Included are a list of the various types and a chart giving safe working loads. Also included are illustrations showing proper signals for overhead travelling cranes and locomotive operations.

(5317) "MIN AND CHEM," October, 1949, by the International Minerals and Chemical Corporation, 20 N. Wacker Drive, Chicago 6, Ill. A 24 page magazine devoted to news and information of interest to employees of the company. Lead article in this issue concerns Louis Ware, President of the company, who has recently completed 10 years of service with the organization.

(5318) "POPULAR HOME," Late Fall, 1949 by United States Gypsum, 300 W. Adams Street, Chicago 6, Ill. Contains 16 pages of illustrated articles and items concerning houses, house designs and construction, home furnishings and decoration and other information of interest to house owners and builders. This issue contains an interesting article on fire prevention measures in house construction.

(5319) DIESEL ENGINES, Bulletins 166, 167, 167-A, and 168 by the Nordberg Manufacturing Company, Milwaukee 7, Wis. These four bulletins give specifications, detailed information, and outline drawings of the Model 4FS-1 Diesel engines as adapted to power take-off with and without clutch, generating units and pumping units.

(5320) "PROGRESS NEWS," November 1949. A 20 page magazine by Gates Rubber Company, 999 S. Broadway, Denver, Colorado. Contains illustrated news and information on new products and processes, employee organizations and personal notes, employee recreation projects, and other items of interest to Gates employees.

(5321) GENERATOR INSTALLATIONS, Bulletin No. 2200-PRD-196 by the Electric Machinery Mfg. Company, Minneapolis 13, Minnesota. An eight page booklet describing and illustrating large a-c generators. Construction features and the advantages they give are pointed out and some recent installations of large, slow-speed engine-type generators are shown.

(5322) EARTH MOVING EQUIPMENT "LeTourneau Co-Operator," Sept.-Oct., 1949. A 16 page booklet by R. G. LeTourneau, Inc., Peoria, Illinois devoted to news and information about LeTourneau employees and customers. Included are illustrated items concerning unusual applications of power earth moving equipment designed to show the equipment's quality and versatility.

(5323) DIESEL LOCOMOTIVE, Bulletin GEA 3810A by the General Electric Company, Schenectady, New York. A 16 page bulletin describing and illustrating the GE 80 ton Diesel-electric locomotive for industrial switching. Gives dimensions, specifications, and construction features and points out the advantages to be gained from the use of this unit.

(5324) TARIFFS, Publication No. 125 by the American Tariff League, 10 W. 44th St., New York, 18, N. Y. An eight page booklet containing news and information on tariffs and trade. This particular issue is devoted entirely to an article on the "balance of trade" and presents certain theories and ideas on the subject.

(5325) PURIFICATION OF SOLUTIONS BY ION-EXCHANGE, Bulletin No. 4080 by the Dorr Company, 570 Lexington Ave., New York 22, N. Y. A 24 page booklet describing and illustrating Dorrco "DI" systems for the purification of solutions by the ion-exchange method. Includes theory, of operation, descriptions of units, run-down of advantages to be gained, costs, and applications. Many photographs of the units and operations provided.

(5326) SCIENTIFIC EQUIPMENT, "Burrell Announcer," a 16 page booklet by the Burrell Corporation, 1942 Fifth Ave., Pittsburgh 19, Pa. This issue is devoted largely to a fine article giving the historical background and modern trends in the analysis of gases. Also included is catalog information on several types of gas analyzers and other Burrell products.

(5327) POSTPULLER, Bulletin J-301 by the Joy Manufacturing Company, Henry W. Oliver Bldg., Pittsburgh 22, Pa. Four pages describing and illustrating the Joy Postpuller showing its use in mine timber recovery, and giving the dimensions, specifications, applications, and construction features of the various types.

(5328) NATURAL GAS, "Alec Crowell's weekly report on Natural Gas—North America." Week ending Sept. 24, 1949. Four page report covering activities, production, pipeline projects market trends, regulations, and individual concerns in the natural gas industry on the North American continent.

(5329) HEAVY DUTY FLOODLIGHTS, Bulletin GEC-537 by the General Electric Company, Schenectady, New York. A four page folder describing and illustrating types L-84 and L-85 heavy-duty floodlights. Detailed information is provided including photometric data, dimensions, and accessories and parts Also included is a list of GE apparatus service shops and sales offices.

(5330) A. C. GENERATORS. "E-M Synchronizer No. 27." By the Electric Machinery Mfg. Company, Minneapolis 13, Minn. 16 pages giving information on how to select A-C generators, paralleling A.C. generators, boosting capacity to meet electric power demand, and applying "Packaged" generators in industry.

(5331) SOLVING CORROSION PROBLEMS. Bulletin T-171 by the American Brake Shoe Company, Electro-Alloys Division, Elyria, Ohio. A six page folder containing charts showing the comparative corosion resistance of alloys and a list of standard corrosion resistant alloys.

(5332) FLOTATION MACHINE. An eight page booklet, by Booth Engineers, Salt Lake City, Utah, giving information and illustrations on the new Booth flotation machine, giving details on operation, advantages, construction features and dimensions.

WEDDINGS

(Continued from page 33)

versity of Colorado this summer where she was a member of the Phi Beta Phi sorority. Mr. Bradley, son of Mr. and Mrs. H. V. Bradley of Knoxville, Iowa, was a member of Sigma Alpha Epsilon fraternity. His parents, his sister and brother were in attendance at the marriage.

Following a honeymoon at the Broadmoor hotel at Colorado Springs, the couple left for Kimball West Virginia, where Mr. Bradley is Mining Engineer for the Carswell Mine.

Marvin-Pierson

Theodore Marvin, '22, and Miss Marjorie Mowbray Pierson, daughter of Mr. and Mrs. L. F. Pierson of Fredericksburg, Virginia, were married in New York City on September 12. The couple are now at home at Dunleigh, R. D. 1, Kenneth Square, Penna.

Mr. Marvin is Director of Advertising, Hercules Powder Company, Wilmington, Delaware.

Hoage-Gordon

Joseph H. Hoage and Miss Margaret Gordon of Denver were married in Denver October 23.

Mr. Hoage, of the class of '48, is Production Supervisor, Hanford Works, General Electric Company. He and Mrs. Hoage are residing at 1314 Stevens Drive, Richland, Washington.

Schaffer-Malenk

Richard F. Schaffer and Mrs. Dorothy R. Malenk were married in St. James Lutheran church, Golden, the evening of October 28.

The bride is the daughter of Mr. and Mrs. Fred J. Martensen of Fort Morgan, Colorado, formerly of Golden. She has made her home in Golden for the past fifteen years.

Mr. Schaffer, of the class of '40, is assistant metallurgist for Gardner-Denver Company. The couple are at home at 702 Second Street, Golden.

Brown - Wadsworth

Gordon T. Brown, '39, and Miss Elizabeth Baldwin Wadsworth were married November 20, 1949, at Nogales, Arizona.

Mr. Brown is chief engineer for Theodore A. Dodge Enterprises. The couple are residing at 403 No. Third Avenue, Tucson, Arizona.

BIRTHS

The following announcement was recently received: "At last! I arrived June 14, 1949 at 12:12 A. M. Weighed 7 lb., 13 oz. — all boy! Dorothy and Floyd named me Collin Lee Stewart." The father, F. L. Stewart, '43, wrote: "To use the unit F. W. Mann, '43, set down in the announcement included in the May issue of our magazine, I believe Collin is equipped with 2½ lung power. Luckily, though, he is pretty good about letting his mother and dad sleep most of the nights. Occasionally, he ups and practices so that he'll be in good shape to give forth with 'Give 'em Hell, Miners' when that time comes." The family reside in Maracaibo, Venezuela, where Mr. Stewart is Petroleum Engineer for Richmond Petroleum Company of California.

Mr. and Mrs. Perry A. Gill have announced the adoption of Dana Sue and Deborah Lou who were born July 28.

Mr. Gill, '36, is assistant division superintendent for Sunray Oil Corporation, with offices in the Midland Tower Building, Midland, Texas.

"The Wilson's Digest," 2nd edition, announces the arrival of Joseph Henry on August 8. Mr. and Mrs. Thomas E. Wilson, Sr., of the class of '48, are the proud parents. Mr. Wilson is petroleum engineer for Phillips Petroleum Company, receiving mail at their home, 1566 Emile Street, Beaumont, Texas.

(Continued on page 36)

Professor Clark B. Carpenter

head of the metallurgy department at *Mines* was elected national president of Sigma Gamma Epsilon, earth science fraternity, at their biennial convention held in Denver recently.

Professor Carpenter, who succeeded William A. Staab of Morgantown, Pennsylvania, as chief executive of Sig Gam, had served as secretary-treasurer of the organization for the last 25 years.

He was one of the charter members of Alpha chapter, the first chapter of Sigma Gamma Epsilon, when he attended the university of Kansas. Since its organization in 1915, the society has grown until it now includes 35 chapters throughout the colleges and universities of the United States and Canada.

The national meeting, held in Denver, was attended by representatives from all but two of the chapters of this honorary fraternity. Several groups had more than one man attending. In all 78 individuals registered for the conclave.

A Bronze Plaque

dedicated to the memory of John H. O'Connor, '26, has been placed by Blue Key in the hall of the Mining building. The plaque was presented to the school by Art Dickinson, president of Blue Key, during half time ceremonies of the Adams State-Mines football game on November 6. The game was designated "O'Connor Game."

Mr. O'Connor, founder of Blue Key at *Mines,* was killed last spring while defending fellow engineers in a miners' strike at the Bolivian Tin and Tungsten mine, Potosi, Bolivia.

The Mines Post

of the Society of American Military Engineers has elected David H. McMurrin as president for the coming year, Richard G. Martin as vice president, and Harvey C. Boyce as secretary-treasurer.

McMurrin, a member of Kappa Sigma social fraternity and chairman of last year's junior-senior prom committee, is a senior student in mining engineering.

Martin, also a senior military student, is an active of Beta Theta Pi social fraternity, and Theta Tau professional engineering fraternity. He earned a varsity letter in boxing last year.

Boyce, a junior cadet, is affiliated with Sigma Alpha Epsilon social fraternity and is a *Mines'* cheer leader.

All members of the advanced classes of R.O.T.C. at *Mines* are members of the S.A.M.E. At present the local post's membership totals over 130.

The Society of Military Engineers had its inception in the experiences of the engineering profession in World War I.

Tau Beta Pi

national honorary engineering fraternity, initiated the following men in a ceremony held last month: Seniors, Boris J. Bermes, Wayne F. Bohanan, Tyler Brinker, Emory F. Dedman, Joseph R. Driear, William N. Hostetter, Louis M. Hovart, Clarence L. Kassens, James R. Patch, F. Terry Quiett, and John G. Smith; Juniors, Paul A. Hodges, Roderick K. Rawlins, and Richard M. Zoerb.

Following the ceremony 39 old and new members of the fraternity including alumni and members of the faculty as well as students, attended a duck dinner at the Holland house.

Dr. Angelo Lapi was introduced as guest speaker by Tau Bate president, Martin French. Dr. Lapi who is medical examiner for Denver and one of the nation's leading pathologists, spoke on "The Age of Specialization."

Sigma Gamma Epsilon

national professional engineering fraternity, held a formal initiation recently for the following men: Lynn A. Brown, Walter M. Chapman, Franklin F. Clark, James R. Daniels, Fred C. Hohne, Wayne H. Jackson, Richard L. Klebe, Robert L. Menk, Robert R. Owen, Earl H. Ramsey, Roderick K. Rawlins, Horace F. St. John, Harvey A. Taylor, Robert E. Thompson, Howard C. Worzel, and Richard M. Zoerb.

Professor Carpenter, newly elected national president of the fraternity, gave an informal talk on the history of the fraternity.

R.O.T.C. Unit at Mines

reports a register of 401 men for this semester of whom 65 are seniors, 80 are juniors, 110 sophomores, and 146 freshmen. These men compose two combat battalions in which there are three companies.

The engineer unit is under the direction of advanced military students who are cadet officers. Each squad, consisting of 10 to 12 students, is under the direction of a sophomore who holds the grade of sergeant.

Due to an over-abundance of officers, command of a unit is rotated among the cadets until each has been in charge of a unit. The final assignment of an officer to a unit depends upon his efficiency and ability to command. This designation will be made at the Military Ball next spring.

The officers in charge of the training of the engineer unit are Colonel Wendell Fertig, Majors James Gray and Dave Roberts, and Captain Edmund Butch. Major Roberts, who conducts the drills, has been assigned to Bolivia; his departure will cut the officer staff of the military department to three members. These three officers are assisted by Sergeants Carpenter, Gunderson, and Palmquist. Sergeant Ohman is expected to be added to the staff.

In addition to teaching military sciences, the department also maintains a rifle team which it enters in competition. The ammunition for the team and for all matches is furnished by the Army. The department presents awards and trophies to cadets of merit, and to squads, platoons, and companies which have been outstanding in drill.

Miss Bernice Bowen

school dietician, was killed early in November while driving her car to Golden. The accident, which involved her sedan and a furrier's station

wagon, occurred on Cemetery Hill around 5:00 P.M. in a sleet storm.

Miss Bowen for many years served as dietician in numerous colleges, hospitals, and army camps. She was a member of the American Dietetic association.

Twelve Mines Seniors

have been accepted for recognition in the 1949-50 edition of "Who's Who Among Students in American Universities and Colleges." The annual publication is composed of brief biographies of outstanding seniors in over 600 American colleges and universities.

Miners whose biographies will appear in the forthcoming edition of "Who's Who Among Students in American Universities & Colleges" are:

Hubert E. Berninghausen, president of Sigma Gamma Epsilon and a member of Blue Key and Student council.

Tyler Brinker, business manager of the Prospector and a member of Blue Key, Tau Beta Pi, Sigma Gamma Epsilon, "M" club, and Kappa Sigma.

David L. Caldwell, president of the Barb organization and a member of Student council, Blue Key, Sigma Gamma Epsilon, and "M" club.

Arthur S. Dickinson, president of Blue Key and a member of Sigma Gamma Epsilon, "M" club, and Kappa Sigma.

Martin S. French, president of Tau Beta Pi, chairman of the Engineers' Day committee, and a member of Blue Key, Sigma Gamma Epsilon, and Alpha Tau Omega.

Dennis E. Gregg, president of the glee club, secretary of the Board of Publications, and a member of Blue Key, Tau Beta Pi, Sigma Gamma Epsilon, and Kappa Sigma.

Charles W. Irish, editor of The Oredigger and a member of Blue Key, Tau Beta Pi, Theta Tau, "M" club, and Beta Theta Pi.

Norman Korn, member of Blue Key, Theta Tau, "M" club, and Alpha Tau Omega.

Glenn J. Poulter, member of Tau Beta Pi, Student council, Blue Key, Theta Tau, "M" club, and Alpha Tau Omega.

F. Terrence Quiett, Student council treasurer and a member of Tau Beta Pi and Sigma Gamma Epsilon.

Paul J. Vaughan, Mines outstanding track star and a member of Blue Key, Sigma Gamma Epsilon, "M" club, and Alpha Tau Omega.

John R. Weyler, president of the Student council and the "M" club, and a member of Blue Key and Sigma Gamma Epsilon.

The Standard Oil Company of Texas

has established a graduate fellowship in geophysical engineering at *Mines*. This provides $1,250 a year to the holder plus an additional amount for expenses incident to the program of study.

The fellowship has as its objective the encouraging of young men in pursuing graduate study in the field of petroleum exploration by geophysics.

American Smelting and Refining Company

scholarships of $500 each have been awarded to four seniors for 1949-50.

Those receiving the scholarships are Leo Borasio of New York City, mining engineering senior; Louis L. Landers, Longmont, Colorado; Roger R. Nelson, Golden, and Lawrence R. Wolff, Chicago, all metallurgy seniors.

The Socony-Vacuum Oil Company

graduate fellowship in geophysics has been given to Norman Domenico of Denver. The fellowship, awarded for the present school year, is for $1,500 and has as its purpose research in the general field of elastic waves and solids.

Domenico received his engineering degree in geophysics at *Mines* in 1948 and the master of science degree at California Institute of Technology in 1949. He is now a candidate for the degree of doctor of science in geophysics at *Mines*.

Kennecott Copper Corporation

scholarship for 1949-50 has been awarded to John G. Smith of St. Albans, Vermont.

The scholarship, which is awarded annually, is for $750 and is made on the basis of scholastic record and promise in the mining engineering field.

Sigma Nus and Betas

were found to top the grade averages of *Mines'* social fraternities for the two semesters of the 1948-49 school year. Sigma Nu led the first semester and Beta Theta Pi, the second semester.

Ralph W. Wilson, scholarship councilor for the National Interfraternity council, in a recent letter to the school compared the overall grade average of the fraternities in the United States to those of *Mines* and referred to CSM fraternities as "a gem in the galaxy."

The first semester all-school average was 84.49, topped by an 85.89 all-school average second semester.

Twenty-seven Mines' Students

have received the Distinguished Military Students award in recognition of advanced ROTC achievement by the Department of the Army. These men rank in the upper third of the military class.

In announcing the awards Colonel Wendell W. Fertig, head of Mines Engineer ROTC unit, said that these men not only have distinguished themselves academically but also possess outstanding qualities of leadership. "A high moral character and a definite aptitude for the military service are other important factors contributing to the distinction," he added.

Denver area students are: Jerry F. Davis, Donald L. Johnson, Edward L. Karn, Jr., Robert B. Morrison, John H. Wyatt, Hugh E. Bradley, William L. Parker, Jr., and James D. Streit, Jr., all of Golden.

Others from Colorado are Tyler Brinker, Durango; Frederick C. Cazin, Englewood; John D. Closs, Estes Park; Keith G. Comstock, Pueblo; Louis L. Landers, Longmont; Howard K. Loenshal, Colorado Springs; and David H. McMurrin, Greeley.

Richard H. Beaver, North Platte, Nebraska; Joseph R. Driear, Sheridan, Wyoming; Jack F. Earl, Twin Peaks, California; Robert F. Garland, San Antonio, Texas; Niles E. Grosvenor, Carbondale, Pennsylvania; John E. Hudson, Lake Wales, Florida; Ralph H. Jones, Ogden, Utah; Edwin J. Mets, Englewood, New Jersey; George L. Miller, Cresson, Pennsylvania; Edward A. Morrison, New York City; Gustav Stolz, Jr., Victoria, Texas; and Joseph H. Sullivan, Mt. Vernon, New York are also among the 27 honored students.

Sixteen of the group have made application for commissions in the regular Army.

Of the 1418 applications for permanent commissions from distinguished military students in the ROTC program, the Army has chosen 726 men, whose names were released recently.

The Damage to Stratton Hall

caused by fire the latter part of November totals $2500. Classes were able to continue on schedule, however.

M. C. Smith, associate professor of metallurgy, said that the fire was caused by an electrical failure in the control box of an oil bath. It caused an estimated damage of $2500.

BIRTHS

(Continued from page 34)

Katherine Marie McCall has announced that she arrived on August 19, weighing 7 lbs., 2 oz. and that her parents are Mr. and Mrs. John E. McCall. Her father graduated from *Mines* in 1943 and is now district geologist for The California Company. He is addressed 1818 Canal Building, New Orleans 12, La.

Mr. and Mrs. Ellsworth B. Watson, are the parents of a daughter, Barbara Jean, born September 12. She has two big brothers to see that she receives proper attention.

(Continued on page 40)

FROM THE *Local Sections*

ARIZONA

Two meetings in year, second Saturday in April and October. H. Z. Stuart, '36, Bisbee, Vice-Pres.; C. A. Davis, '27, Phoenix, Vice-Pres.; W. W. Simon, '15, Superior, Vice-Pres.; B. G. Messer, '36, Secretary-Treasurer, Rt. 1, Box 40, Globe, Ariz.

BAGUIO

Frank E. Delahunty, '25, President; Luther W. Lennox, '05, Secretary-Treasurer, Benguet Consolidated Mining Co., Baguio, P. I. Meetings upon call of secretary.

BARTLESVILLE

Burt R. Kramer, '42, President; John W. Tynan, '41, Vice President; Richard M. Bradley, '36, Secretary, Cities Service Oil Co., Bartlesville. Luncheon meetings every Friday noon in the Burlingame Hotel Coffee Shop.

BAY CITIES

C. K. Viland, '29, President; E. C. Kinyon, '35. Vice President; D. J. Lyons, '30, Secretary; Wm. L. Burnham, '41, Treasurer. Visiting Miners contact Secretary, c/o Tide Water Associated Oil Co., Research Div., Associated, Calif.

BIRMINGHAM

Robert J. Blair, '39, President; Stanley M. Walker, Ex-'11, Vice President; Hubert E. Risser, '37, Secretary-Treasurer, Bradford Mine, Dixiana, Alabama. Meetings held upon call of secretary. Visiting "Miners" please contact secretary.

CENTRAL OHIO

Roland B. Fischer, '42, President; Frank M. Stephens, Jr., '42, Secretary-Treasurer, Battelle Memorial Institute, Columbus, Ohio.

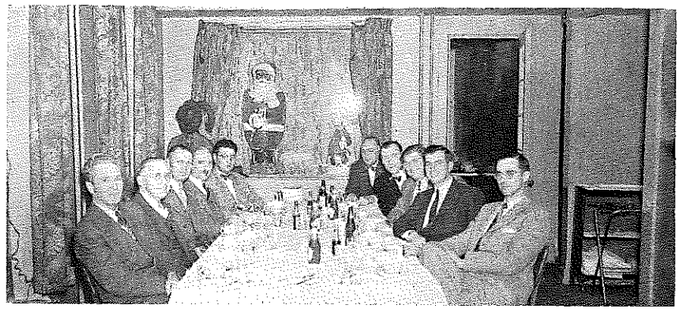
CLEVELAND

Joseph R. Gilbert, '42, Secretary, 14513 Northfield Ave., East Cleveland 12, Ohio. Meetings last Friday of each month at the Carter Hotel, Cleveland.

COLORADO

E. S. Hanley, '34, President; Herbert W. Heckt, '36, Vice President; David Roberts, '40, Treasurer; William J. Holtman, '43, Secretary, 930 Downing St., Denver, Colo. Meetings upon call of Secretary.

EASTERN PENNSYLVANIA



New Eastern Pennsylvania Section holds first meeting. Left to right: C. W. Spears, '31; T. G. Foulkes, '22; G. P. Mahood, '24; W. H. King, '27; A. C. Most, '38; E. B. Bunte, '20; F. E. Van Voris, '39; S. M. Hoohberger, '48; A. Jamison, '43; E. A. Sawitzke, '40.

A group of Mines Alumni met together in Allentown, Pennsylvania, the evening of November 30, 1949, the main subject under discussion being the organization of a chapter of the Alumni Association.

A form was completed making application for Charter for the Eastern Pennsylvania Section, the signees being: Samuel M. Hochberger, '48; F. E. Van Voris, '39; Ernest E. Bunte, '20; Arthur C. Most, Jr., '38; William H. King, '27; George Phillips Mahood, '24; Thomas G. Foulkes, '22; Clyde W. Spears, '31; Alex Jamieson, '43.

It was suggested to hold the next gathering in early March and at a place midway between Allentown and Philadelphia, in an effort to bring out some of the downstaters. F. E. Van Voris took some pictures of the group, one of which is shown herewith.

Anyone interested in joining the new section can get full information from Samuel M. Hochberger, 1232 So. Ninth Street, Allentown, Pennsylvania.

GREAT LAKES

Francis W. Mann, '43, President; R. D. Fernald, '37, Vice President; Stanley Ohlswager, Secretary. Meetings: Third Friday, January, April, October. Visiting Miners contact President, c/o Standard Oil Co. (Ind.) Pipeline Dept., 910 So. Michigan Ave., Chicago 1.

The October meeting of the Great Lakes Section of Mines Alumni Association was held the evening of October 21 at Forrest's Restaurant.

The members convened at 7:00 P. M. and dined with appropriate beverages supplemented by impromptu entertainment supplied by several old girls who were hooping it up in an adjoining dining room. As the ladies' path to the Powder Room led by our table, several fleeting acquaintances were made by the more interested parties of each group. As far as can be determined, there were no lasting relationships developed. The height of the evening's gaiety was reached in an exchange of serenades, the more conventional songs being supplied by the ladies. After the girls adjourned to some local saloon, the pace slackened enough to proceed with the following order of business:

I. *Old Business*—Mr. Watson reported on the status and awarding of alumni scholarships, and recommended that a committee be appointed to process applications for the succeeding year. Mr. Watson's report was accepted.

Mr. Mann reported that the Petty Cash Fund was depleted and recommended that contributions be made to cover mailing costs for the next year. Mr. Mann's report was accepted.

II. *New Business*—Mr. Watson requested nominations for officers for the succeeding year; balloting resulted in the election of the following:

President, F. W. Mann
Vice-President, R. D. Fernald
Secretary-Treasurer, S. Ohlswager

The newly-elected officers installed, Mr. Mann entertained a motion to approve appointment of an alumni scholarship committee. Such motion was passed and resulted in appointment of the following: R. D. Fernald, Chairman; H. A. Raab; R. E. Watson.

Mr. Mann advised the meeting that due to the members scheduled to give talks being out of town, entertainment for the meeting could not be obtained in time. Mr. Finney advised he is able to secure interesting movies on various technical subjects and would be pleased to present one in the future.

It was suggested and approved that the next meeting be held January 20, 1950.

There being no further business, the meeting adjourned.

Members present were:

Dick Downey, '44; Russ Fernald, '37; J. H. Finney, Jr., Ex-'38; Mort Frank, '06; R. A. Gustafson, '47; F. W. Mann, '43; Walter Meyer, '22; Stanley Ohlswager, Ex-; H. A. Raab, '37; D. L. Rankin, '23; Bill Roller, Ex-; R. E. Watson, '43.

HOUSTON

Albert L. Ladner, '27, President; McKay G.

Donkin, '29, Vice President; W. Bruce Barbour, '37, Secretary, c/o The Second National Bank of Houston, Oil & Gas Div., Houston. Monthly luncheon meetings held on the first Tuesday at Noon, Tenth Floor of the Houston Club. Visitors please contact the secretary at The Second National Bank of Houston.

The regular monthly luncheon meeting of the Houston Section of the C.S.M. Alumni Association was held at the Houston Club on Tuesday, December 6. The following "Miners" were present:

Irwin M. Glasser, '43; Edward A. Austin, '38; Glenn E. Bader, Ex-'27; R. K. Tracy, '28; Stanley A. Wickstrom, '38; Robert N. Hastings, '30; Raymond A. Kerr, '36; Jack B. Ferguson, '30; Donald I. Gahagan, '27; M. L. Gilbreath, '33; K. Pat Hurley, '22; George W. King, '42; Albert L. Ladner, '27; George H. Ripley, '36; Robert W. Harrison, '33; George B. Somers, '30; Lisle R. Van Burgh, '17; Charles E. Redmon, Jr., '39; Herbert E. Treichler, Jr., '40; E. A. Renfro, '30; L. E. Wichmann, '21; W. B. Barbour, '37; Vernon Redding, '40; J. H. Williams, '48.

We had one visitor, J. D. Duren, '48.

KANSAS

All activities suspended.

MANILA

John R. Wagner, Jr., '40, President; Ernesto C. Bengzon, '21, Vice-President; M. M. Aycardo, Jr., '41, Secretary-Treasurer, 3rd Floor Soriano Bldg., Manila, P. I. Luncheon meetings second Saturday all even months of the year.

MONTANA

A. B. Martin, '23, President; M. R. Hoyt, Ex-'08, Vice-President; C. B. Hull, '09, Secretary, 854 W. Silver, Butte, Montana. Meetings upon call of Secretary.

NEW YORK

Russell J. Parker, '19, Rupert B. Lowe, '22, Co-Chairmen; Fred D. Kay, '21, Secretary-Treasurer. Room 2202, 120 Broadway, New York 5, N. Y. Telephone: Worth 2-6720. Monthly meetings. Next two: January 19, 1950; February 13, 1950, Cocktail party in honor of visiting "Miners" to be held at Statler Hotel, preceding the Smoker, A.I.M.E. Convention.

NORTH CENTRAL TEXAS

E. J. Brook, '23, President; J. W. Peters, '38, Vice President; H. D. Thornton, '40, Secty.-Treas. (Ft. Worth) 506 Neil P. Anderson Bldg., Fort Worth, Texas, Telephone: 3-3058; Henry Rogatz, '26, Secty-Treas. (Dallas) 407 Southland Life Bldg., Dallas, Texas, Telephone: Riverside 4846. Four meetings during year, second Monday of month, February, May, September and November.

OKLAHOMA

Neil Whitmore, '29, President; George W. Reed, '35, Vice-President; Carl R. Holmgren, '38, Sec'y-Treas., 2612 East 13th St., Tulsa, Oklahoma. Luncheon meetings each and every Tuesday noon in the Hotel Tulsa Coffee Shop. Always glad to have fellow Miners when in Tulsa.

OKLAHOMA CITY

J. S. "Monty" Montgomery, '31, President; H. M. "Hugh" Rackets, '42, Vice President; M. O. "Shorty" Hegglund, '41, Secretary-Treasurer, c/o Stanolind Oil and Gas Co., First National Building, Oklahoma City, Okla. Meetings, first and third Thursdays of each month at the Oklahoma Club. Luncheon 12:00 Noon. All Mines Men are cordially invited to drop in.

PACIFIC NORTHWEST

A. R. Kesling, '40, President, 2915 Holgate, Seattle; Phone: PR-7392. W. I. Sedgely, '40, Secy-Treas., 6040-36th Ave., S. W. Seattle 6; Phone: AV-8641. Meetings upon call of Secretary.

A dinner meeting of the Pacific Northwest section was held on December 8, 1949 at the College Club, 605 Spring Street. President A. R. Kesling presided.

Those present were:

John S. Bradley, '48; Dewey Dutton, '21; W. M. Elzi, '42; C. L. Fox, '41; A. R. Kesling, '40; Elmer Mussleman, '48; W. I. Sedgley, '40; Amos Slater, '00; E. M. Smith, '05; H. G. Washburn, '04.

The attendance was fair considering some members were out of town on business and others were transferred from the district. The latter being the case for A. W. Warren, '40, who is now located in San Francisco and L. D. Knill, '33, who was transferred to Salt Lake City. The Section will miss these members since it is limited in its membership.

It was the first appearance of Elmer Mussleman, '48, who is taking graduate work in Geology at the University of Washington. However, he informed us that he had accepted a job with the Shell Oil Co. and will be leaving for Texas in the near future.

An unsuccessful attempt was made by the present officers to change the administration of the Section. Therefore, A. R. Kesling, President, and W. I. Sedgley, Sec.-Treas., will hold forth for the coming year.

With no other business on hand a general "bull session" was held, and was later followed by some movies of the Alcan highway project.

PENNSYLVANIA-OHIO SECTION

William H. Sparr, '39, President; George G. Yeager, '40, Secretary, 3229 Circle Drive, Pittsburgh 27, Pa. Meetings upon call of officers.

On the evening of August 26, 1949, the Pennsylvania-Ohio group gathered at the Point Grove, North Park of Pittsburgh, for the annual picnic. The following Miners and their wives attended:

John Hatch, '36; Wayne Ritter, '36; Bob Jones, Ex-'37; Harry Gaddis, '38; Bill Sparr, '39; Larry Corn, '40; Hank Newhall, '40; George Yeager, '40; Bob Michaelis, '47; and Jack Hicks, '48.

Harry Gaddis and Bill Sparr presided over the open-air cuisine offering a steaming pot of corn-on-the-cob while Wayne Ritter grilled hot-dogs for the 'Piece de Resistance.' Fresh tomatoes and cucumbers appeared from Miners' gardens and their ladies furnished salads, cakes, pies and various side-dishes to fill out a rib-stretching spread.

Horse-shoe contests and story-swapping diverted the group throughout the evening. Hank Newhall was designated as the Section's representative to the 75th Anniversary at Golden. Mr. and Mrs. Jack Hicks were bade farewell in their move from Pennsylvania to California where Jack will take up studies toward attaining an advanced degree at Stanford University.

A dinner meeting of the Section which took place on December 3, 1949 was called to order by President Bill Sparr. The meeting was held at the University Club in Pittsburgh. The following Miners and their wives attended:

Max Sheriger, '23; Homer Goddard, '25; John Hatch, '36; Wayne Ritter, '36; Bob Jones, Ex-'37; Bill Sparr, '39; Don Dowlin, '40; and George Yeager, '40.

Following the dinner, President Bill Sparr opened a discussion of the several items of business on the agenda. He introduced Max Sheriger and Don Dowlin as new members to our section. Max gave a short talk on his recent travels and advised us that he was now locating in Pittsburgh with the Joy Manufacturing Company. Don Dowlin has transferred recently from Ward, West Virginia, to Nemacolin, Pa., where he is associated with the Buckeye Coal Company.

The meeting was adjourned and the Miners and their ladies reassembled in one of the Club's ballroom for congenial conversations, dancing and Club amusements.

SOUTHERN CALIFORNIA

Frank A. Brown, '21, President; John Biegel, '39, Vice President; Franklin S. Crane, '43, Secretary, Oil Well Supply Company, Los Angeles; Roger F. White, '18, Treasurer. Four meetings during the year, second Monday of month, January, April, July, October, at Los Angeles Athletic Club, 431 West Seventh St., Los Angeles, 6:30 P.M.

ST. LOUIS

James E. O'Keefe, '37, President; Floyd M. Belleau, '23, Secretary-Treasurer, 955 Tuxedo Blvd., Webster Groves, Mo.

UTAH

H. J. Vander Veer, '30, President; Wallace W. Agey, '39, Secretary-Treasurer, 852 So. 19th East St., Salt Lake City 5, Utah.

WASHINGTON, D. C.

S. Power Warren, '13, President; Marcus G. Geiger, '37, Vice-President; Dale Kerstetter, '39, Secretary. Address, Bonifant Road, RFD No. 1, Silver Springs, Md. Phone: SH 7100, Exten. 209.

Scheduled evening meetings called for the third Thursday of every other month at the Continental Hotel, Washington, D. C. Special meetings arranged when warranted. Next scheduled meetings: December 15, 1949; February 16, 1950.

IN MEMORIAM

Lester L. Pullen

who received his metallurgical degree from *Mines* in 1910, died in Los Angeles, October 22, 1949.

LESTER L. PULLEN, '10

His first experience was gained in Mexico where he spent a year with two mining companies, after which he went to the Philippines as shift boss for the Syndicate Mining Company, at Aroroy, Masbate. He was later promoted to superintendent of the mill.

Upon returning to the States he accepted a position in the Research department of the Aluminum Company of America at Massena, New York, where he was promoted to production superintendent and where he remained until poor health caused his retirement in 1937. Since then he and his family had resided in Westwood Village, a suburb of Los Angeles.

Mr. Pullen was a member of the Lions Club of Massena, N. Y., the Philippine Society of Southern California, an organization of former residents of the islands, and of *Mines* Alumni Association.

His immediate survivors are his widow, Rae, and two sons, Charles R. and Edward A., both of West Los Angeles.

Burt Cole

of the class of '92, passed away at his home in Santa Monica, California, September 26, 1949, of a heart attack. He was 79 years of age.

A native of Chester, Illinois, he received his elementary schooling in a private school in Boston, Mass., and at Western Military Academy in Alton, Illinois, before entering Washington University in St. Louis, where he spent one year before coming to *Mines*.

After graduation he was associated with the U. S. Geological Survey in Willows, California, which position he resigned to become chief engineer for the Tecumseh Coal and Iron Works in Tecumseh, Alabama. He also served later as chief engineer for the Consolidated Coal Company of St. Louis, and of the Mount Olive and Staunton Coal Company of Staunton, Illinois.

In 1916 he accepted the same position with the Palmdale Irrigation district in Southern California which he held until his retirement in 1923.

Mr. Cole was married in 1908 to Miss Catherine Kendrick of Webster Groves, Missouri. She and a son, Charles B. Cole, are the immediate survivors.

He was a life member of the American Society of Civil Engineers.

Stuart S. Bruce

died in Berkeley, California, November 10, 1949, where he had made his home for the past eleven years. During this time he was an active member of the Berkeley Society of Friends and was largely concerned with philanthropic work of a civic character.

A native of Dublin, Ireland, Mr. Bruce came to the United States by way of Canada in 1893. He later entered *Mines* from where he was graduated with the class of '99.

His first position was with the American Smelting & Refining Company, where he started on designing and construction work connected with silver, lead, zinc and copper smelting plants at Leadville, Pueblo, Denver, and other Colorado points, and at Garfield, Salt Lake City, and other Utah points. He was for several years assistant engineer of the Colorado and Utah departments, and left this to accept a professorship in metallurgy at the Michigan College of Mines, where he remained for 5 years. After this he also taught at the University of Idaho School of Mines before becoming associated with St. Joseph Lead Company at Bonne Terre, Missouri, where he was engaged in designing and construction work for several years.

Mr. Bruce accompanied his brother, James L. Bruce, '01, to Golden the last of September to attend the 75th Anniversary celebration at *Mines*.

Besides his brother, he is survived by two sisters, Misses Ethel Mary Bruce and E. Maude Bruce, of Victoria, British Columbia.

Frank J. Nagel

consulting engineer of Denver, died December 13, 1949, after a brief illness. He was a native of Denver and received his elementary education here before entering *Mines* in 1899, where

FRANK J. NAGEL, '03

he received his Engineer of Mines degree four years later.

Upon his graduation he spent a year in Colorado before accepting position of assistant mill superintendent with the New York and Honduras Rosario Mining Company and was soon after promoted to mill superintendent. After three years in Honduras he returned to Colorado and was employed by the Vindicator Experimental Plant in Cripple Creek for a short time before going to Mexico where for the following twelve years he was associated with Cia. Minera de Penoles in the states of Durango, Chihuahua, and San Luis Potosi. He started with them as shift boss and promoted to district foreman, scout and ore buyer, mine superintendent, and for the last three years was assistant general manager at Monterrey.

Resigning the above work in 1921, he returned to Denver, where he had since resided and, as consulting engineer, accepted assignments in Arizona and other states of the southwest.

Mr. Nagel was an active member of the Alumni Association, having served in various offices and on committees.

He is survived by his wife, Lulu B. Nagel, two daughters, Mary N. Boland of Hotchkiss, Colo., and Ruth C. Nagel of Denver; three sons, William B. of Denver, John K. of Littleton, Colo., and Fred A. (Mines '40) of Geneva, N. Y.; two sisters, Emily Scott and Bertha N. Schaffer, and two brothers, Henry P. (Mines '04) and Fritz, all of Denver. He is also survived by eight grandchildren.

BIRTHS

(Continued from page 36)

Mr. Watson, '31, is traffic engineer for the Mountain States Tel. and Tel. Company, the family home being 1784 Leyden Street, Denver 7.

Paul Gardiner Atkinson, weighing 7 pounds, 1½ ounces, arrived at the home of his parents, Mr. and Mrs. Gerald V. Atkinson, on July 20, via Sibley Memorial Hospital, Washington, D. C.

The proud father, '48, is natural gas engineer for the Federal Power Commission, the family home being 5001 So. 10th Street, Arlington, Virginia.

Mr. and Mrs. Byron Applegate are now settled in their new home, 1436-A East 38th Street, Tulsa, Oklahoma, and have written of the arrival of their second child, Kim Lauree, on June 18. Mr. Applegate who graduated this year is with Bethlehem Supply Company.

From Mexico comes the news of the arrival of Charles Joseph Seldin on July 23, son of Mr. and Mrs. Marvin B. Seldin. Mr. Seldin, '48, is metallurgist, A. S. & R. Company, and receives mail at Tecolotes Club, Santa Barbara, Chih., Mexico.

Mr. and Mrs. Eugene E. Dawson announce the arrival of Cynthia Anne on September 11, her weight being 7 pounds, 12 ounces. Mr. Dawson, '38, has been serving in Arabia the past few years as manager, Persian Gulf Operations, Brown Drilling Company. At present he and the family are residing at 243-A Grand Avenue, Long Beach 3, California.

Mr. and Mrs. Gordon M. Miner are the parents of a son, James Gordon, born September 19. Mr. Miner, of the class of '48, is shift boss, Pend Oreille Mines & Metals Company, his mail address being Box 2, Metaline, Washington.

Carl Alton Cockle arrived at the home of his parents, Mr. and Mrs. Robert S. Cockle, October 1, tipping the scales at 4 pounds, 14 ounces. His father, '33, is shift foreman for the Idarado Mining Company, Box 225, Ouray, Colorado.

Mr. and Mrs. Arthur W. Lankenau are the parents of a second daughter, Helen Maria, born May 9, 1949. Her big sister, Margaret Ann, is 16 months old.

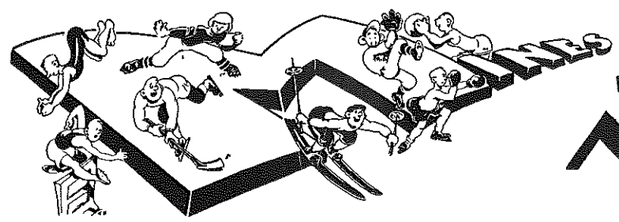
The family are now in Denver, 1541 So. Pennsylvania, until Mr. Lankenau, '48, is located in employment. He has just completed a year's graduate work at Columbia University.

Susan Elizabeth, daughter of Mr. and Mrs. Lester B. Spencer, arrived June 21. Her father, of the class of '44, is associated with Sohio Petroleum Company in Edmond, Oklahoma.

CONTRIBUTORS TO PLACEMENT FUND FOR PART OF 1949

These contributors to "Mines" Placement Service assure its success and continuous expansion. It makes it possible for "Mines" Men to improve their employment by automatically presenting their qualifications to the employer best suited to make use of their services. Your contribution now may insure your future advancement or that of some other "Mines" Man who has the ability but not the contacts with the better job. Every "Mines" Man takes a pride in watching this list grow.

R. F. Dewey, '43
W. R. Kilgore, Ex-'08
Clinton C. Knox, Ex-'29
D. L. Rainey, '42
Owen Kingman, '42
Donald W. Roe, '44
Ezell Flournoy, '32
Oscar Davila, '47
C. J. Lomax, Jr., '43
Chris A. Hesse
H. J. Schmuck, Jr., '40
Philip W. Peter
B. J. Shelton, '44
James F. Frost, '25
Claude E. Fertig, Ex-'27
Jack Q. Jones, '40
Jno. C. Andersen, Jr., '45
Robert F. Barney, '35
G. A. Golson, '42
R. L. Froemke, '43
Gene Meyer, '37
C. C. Towle, Jr., '34
R. L. Samuelson, '48
R. L. Garrett, '45
R. H. Hanson, '32
W. T. Millar, '22
Ben F. Angus, '29
Alex A. Briber, '48
John D. Moody, '40
John S. Southworth, '38
Ray F. Keller, '41
D. R. MacLaren
R. K. Lisco, Ex-'47
Parker Liddell, '03
J. R. Soper, Jr., '44
L. V. Osborn, '42
H. A. Bruna, '41
M. M. Aycardo, '41
J. T. Boyd, '08
F. L. Stewart, '43
E. D. Bieber, '47
J. W. Chester, '44
E. S. Larson, '23
E. F. Petersen, Jr., '37
J. A. Clark, '21
J. E. Motica, '48
A. F. Corbetta, '48
R. S. Brummett, '26
M. A. Lagergren, '33
J. E. Moody, '39
R. C. Earlougher, '36
Max R. Mott, '44
P. G. Sharp, '33
B. F. Rummerfield, '40
J. W. Tynan, '41
M. H. Robineau, '23
K. E. Lindsay, '40
J. H. Winters, '47
P. E. Janvrin, '34
R. F. Moe, '46
A. C. Levinson, '47
R. E. Morrison, '41
R. A. Gustafson, '47
A. L. Carver, '43
H. A. Wolf, '32
P. B. Davis, '39
F. E. DeGiacomo, '32
S. J. Marcus, '45
H. Y. Yee, '38
R. W. Price, '35
V. R. Martin, '41
R. F. Crawford, '23
B. C. Mariacher, '41
K. T. Lindquist, '46
E. C. Royer, '40
T. H. Cole, '43
A. G. Wood, '41
A. S. Wyner, '25
J. C. Mitchell, '39
J. H. Dismant, '39
F. L. Beamer, '43
E. C. Robacker, '42
L. M. Yarberry, '48
C. W. Tucker, '47
V. L. Redding, '40
M. B. Seldin, '48
B. V. Savoy, '47
K. W. Carlson, '42
M. S. Patton, Jr., '40
K. P. Campbell, '10
A. E. Falvey, '34
C. J. Cerf, '41
L. E. Sausa, '38
J. M. Carpenter, '35
L. H. Shefelbine, '43
C. F. Cigliana, '41
J. M. Suttie, '42
L. M. Dorr, '43
C. S. Dasgupta
P. V. H. Svendsen, '43
C. M. Hales, '48
J. E. Serrano, '20
Don F. Carlson, '43
M. M. Fernandez, '39
F. M. Bell, '21
Russell B. Paul, '02
O. P. Dolph, '25
John J. Folger
J. B. Livingston
V. D. Barth, Ex-'41
M. T. Honke, Jr., '47
Geo. E. Jaynes, Jr., '40
R. G. Godfrey, '38
Frank W. Todd, '41
St. Louis Section
Geo. E. Wagoner, '28
J. E. deMorazes, Sr., '21
A. F. Suarez, '41
C. W. Parisi, '41
E. L. Honett, '47
Geo. A. Kiersch, '42
A. J. Heiser, '43
Hans Warmbrunn, '43
R. D. Segur, '41
W. E. Redmond, Jr., '40
J. B. Willis, '40
C. Revertera
Ben R. Hudson, '45
R. D. McPhee, '42
E. H. Shannon, '36
J. V. Finnegan, '42
Robert W. Keil, '43
R. V. Sausa, '39
Wm. M. Gebo, '23
R. J. Hundhausen, '38
R. L. Hennebach, '41
Richard B. Nelson, '47
Edw. W. Anderson, '43
Rone B. Tempest, Jr., '42
John R. Wagner, '40
Z. S. Wyszynski
Harry G. Grigsby, Ex-'45
Paul M. Tyman, '44
Walter B. Levy, '48
Earl H. Miller
Oscar A. Lampe, '98
Don H. Peaker, '32
W. E. Laspe, '44
Rolf H. Hanson, '32
Alan E. Hall, '39
Charles B. Foster, '27
Lawrence E. Smith, '31
K. C. Heald, '47
Richard J. Frost
W. H. Breeding, '39
E. G. Holmberg, '32
Parke A. Hodges
C. A. Schwarck, '42
Walter E. Duncan
Martin T. Honke, Jr., '47
A. G. Hampson, Ex-'51
Joseph C. Knight
D. C. Deringer, Jr., '24
Leonard Katz
G. Keith Taylor, '23
Wm. F. Gaspar, '43
W. C. Page, '15
W. Clark Grove, '36
Robert G. Wheeler, '49
John W. Gableman, '43
Miles T. Rader, Jr., '48
J. J. Sanna, '41
Donald L. Whittaker
Glenn J. Allen, '29
Joseph W. Joyce
James L. Bruce, '01
Charles M. Tarr, '38
Donald E. Halter
L. W. Lennox, '05
W. H. Zwick, '32
Hedley S. Fowler
R. H. Adams, '43
Pitt W. Hyde, '22
Geo. W. Bashen, '48
Geo. H. Fentress, '49
J. L. Robinson, '31
Jno. W. Gabelman, '43
W. A. Shreading, '43
Robert G. Wheeler, '49
C. H. Carpenter, '09
P. M. Ralph, '48
Andrew Milek
M. L. Bailey, '47
G. D. Beeth, '24
Kenneth E. Bodine, '48
James A. Roy, '39
John W. Whitehurst, '10
James W. Clemens, '48
John L. Labriola, '49
John W. Gabelman, '43
Donald L. Graf, '45
David P. O'Keefe, '48
E. R. Johnson, '32
L. P. Mosheim, '48
V. G. Gabriel, '31; '33
H. F. Holliday, '42
J. R. Soper, '44
Geo. F. Jenkin, '38
C. R. Garland, Jr., Ex-'39
T. W. Callahan, '14
R. E. Marks
C. E. Kuehn, Jr., '41
Marion S. Bell, '49
C. R. Johnson, Jr., '49
D. O. Russell, '09
A. H. Graham, '15
Wm. R. Peery, '42
F. C. Aldrich, '48
Frank E. Delahunty, '25
Rolf H. Hanson, '32
U. H. Berthier, '16



Sports MARCH

By HERB WATERMAN

1949 Varsity Football Lettermen

Thirty five men received varsity football letters for the 1949 football season. Dick Bench was selected to an end position by the Omaha University squad members on their 1949 all-opponent team. The players placed Bench at end because of the many passes he caught against them.

Lettermen
Don Adams
Wallace Arnold
Darrell Beckley
Ronald Bethurum
David Brown
Jack Earl
Roy Essary
Robert Garland
Edgar Gaulke
Paul Hamilton
Joe Hill
Claude Jenkins
Robert Johnson
William Johnston
Howard Kaylor
John Keating
George King
Harvey Kingry
Drexel Lee
Francis Mercier
Jay Naugle
Jack Petrocco
Keith Pottorff
Glen Poulter
Robert Pozzo
Douglas Reese
Max Settlemyre
Henry Snyder
Adam Thomas
William Traeder
Bob Vinnedge
John Volosin
Ed Ziolkowski
John Miller, Mgr.

Miners Take First Two Games of Basketball Season

The Miners opened their 1948-50 basketball schedule with a couple of lopsided wins over a weak Fitzsimons hospital team. Thursday night, Nov. 31, the Miners defeated the Medics 60-23 at Golden, and on Saturday night they downed the hospital lads 48-24 at Fitzsimons.

The games gave little indication of the strength of this year's team. The Blasters did handle the ball nicely for so early in the season. The team is running harder this year and there is a more equal distribution of the scoring.

High scorer for the first game was "Long Tom" Johnson of Butte with 13 points; he was closely followed by Lou Landers who had 11 points. John Lockridge, promising sophomore center from Marshall, Mo., dislocated his knee Thursday night and was unable to see action Saturday night. He should be sufficiently recovered by the middle of this week.

The second game's scoring was evenly divided between Landers, Bill Ruehle, and Johnson. The Miners were stymied more by the smallness of the Fitzsimons gym than by the Medics attack.

The following weekend the team traveled to Alamosa to meet the Adams State Indians in a pair of games Friday and Saturday night. The strength of the Indians was unknown; they were soundly waxed by Western State in two games the previous weekend, however, the State squad is greatly improved over last season. Coach Karamigios took a twelve man squad plus himself, Joe Davies, and the team manager, John Hudson.

Miners Split with Adams State

A fighting Colorado Mines basketball team bounced back from a 60-45 first-night trouncing Friday, December 10, to win an exciting 63-59 decision from the Indians Saturday night.

Friday night Adams State grabbed a quick lead on the Orediggers which the boys from Golden could never overcome. The closest the Miners could come to the Indians was early in the third quarter when they pulled within three points of the Staters.

Neither team was able to work the ball in very well and the difference proved to be foul shots. The Indians made but one more field goal than did the visitors, 20-19, but Adams State dumped in 20 free throws to 8 for the Miners.

Tom Johnson led the Mines scoring with 18, Lou Landers and Doug Waterman each had 9 points.

The second game was a seesaw affair all the way. The Miners pulled the game out of the fire when, trailing by one point with two minutes remaining, Doug Waterman sunk two free throws and Jack Earl made a lay up to salt the game away. Johnson led scorers with 23 points, he was followed by Earl who had 17 and Waterman with 13.

The Miners played without the services of Clyde Kerns, John Lockridge and Herb Waterman.

Buffs Whip Grapplers 28-8

Showing plenty of spirit, but lacking experience, the Colorado Mines wrestling team fell before a powerful Colorado university squad, 28-8, at Steinhauer field house, Saturday, December 11th.

The Miners took the lead first when Bob Whitcomb (M) won a decision from McGuire in the 121-pound class. The Buffs came right back to put the meet on ice by taking the next four matches. The other Mines win came in the 165-pound class where Vern Coombs (M) pinned Clark in 5:33.

The grapplers next match is against Denver University.

LIQUID FUELS PROGRAM

(Continued from page 24)

were brought up to date in 1936 by T. A. Hendricks, whose total figures for coal reserves (based on maximum mining depths of 3,000 feet and minimum mineable thicknesses of 14 inches for bituminous and anthracite, 24 inches for subbituminous and 36 inches for lignite), gave an available reserve for the U. S. of 3,180,765,230,000 tons. The latest estimates of coal reserves made public by the Department of Interior were disclosed in hearings before a sub-committee of the Committee on Public Lands, 80th Congress, May 1947, and showed 3,103,167,000,000 tons of coal remaining as of January 1944. Except in a few instances the original quantities for the 1944 estimates were taken from the estimates made by Mr. Campbell in 1928 and used later by Mr. Hendricks.

(Continued on page 43)

Book Reviews

These books may be obtained through the Book Department of The Mines Magazine.

Atomic Energy and the Life Sciences

Prepared by The United States Atomic Energy Commission. United States Government Printing Office, 1949. 203 pages, 15 photographs, 9 microphotographs, 4 radioautographs. For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price $.45.

If one is willing to overlook the occasional areas of ambiguity and vagueness in this report, lapses which are extremely understandable in view of the highly secret nature of some of the material being considered, it will be admitted that the Atomic Energy Commission has gotten out an extremely fine pamphlet on a subject which should be high in the interest of all Americans and, indeed, of all human beings.

In the foreword, the report is described as one which "sums up briefly the major developments in the national atomic energy program and further gives a comprehensive review of one of its major phases—the biological and medicinal activities."

The material in the report is considered under six major headings:

I. Major Developments in Atomic Energy Programs
II. Biology and Medicine
III. Particle Accelerators
IV. Research in Metals
V. Accounting for Materials
VI. Finance—The New Control System.

Under the first heading the Commission describes the recent developments in the military application of atomic energy in which it points up the importance of the weapons program being developed at the Los Alamos Scientific Laboratory at Los Alamos, New Mexico. Under this same heading the report outlines the more important phases of the program for production of fissionable materials and goes into a discussion of secret and non-secret research emphasizing the scope and growth of the research programs. Other aspects of the first general heading which the report considers are security measures and labor-management relations.

The second topical division is Biology and Medicine and it is cheering to note and perhaps significant that the major portion of the report is devoted to this subject. In this section are found discussions of the affects of radiation on the human organism, protection against radiation, the use of radioisotopes in the diagnosis and treatment of disease, and the techniques and directions of tracer research. Of particular interest, in this discussion of the benefits of atomic energy, is the material devoted to the commission's work in cancer research. The report briefly outlines in this section an extensive program of research toward the use of radioactive material in the treatment of cancer.

In the section headed Particle Accelerators, the report discusses the purposes and operation of the main tool of atomic science. Beginning with an explanation of the nature of the particles used as bullets in the bombardment of nuclei, the report goes on to speak of the construction and operation of the machines which fire these "bullets." The cyclotron, the bevatron, the synchrotron and several other types of particle accelerators are compared and described.

With the continual advance in atomic knowledge has come a need for further knowledge of metals to be used in connection with atomic research. The fourth section in the report treats of the search for this further knowledge.

Plutonium and uranium 235, the end products of the atomic energy industry are extremely vital to the defense and security of the United States and, for those who wonder how these precious materials are safeguarded, the fifth section in the report considers the various means by which the commission prevents the waste, loss or theft of uranium 235 and plutonium. Mention is made of the complex systems of accountability and of the difficulties of accurate inventory.

Last but not least important is the information concerning the financing of the Atomic Energy Commissions vast enterprise. Descriptions of the new industrial accounting methods which the Commission has adopted will be found very interesting.

A lengthy section of appendices which is added to the report provides information on the membership of the staffs and committees which make up the Commission's top level personnel. There is a list of the Commissions Major Research Centers with locations and brief descriptions. Other appendices cover the existing research contracts, domestic, uranium regulations, A.E.C. fellowships, and the published or projected works dealing with the Medical and Biological aspects of the Commissions work.

For a straightforward, complete and intelligent study of a subject which has been too long surrounded by an aura of false rumor, political pussy-footing and misinformation, we recommend this report which comes, as it were, straight from the horse's mouth.

General Electric Review

Volume 52 Number 11, November 1949, monthly magazine published by the General Electric Company, 1 River Road, Schenectady, N. Y. Price 1 year $4.00.

The lead article describes a series of tests which permit the identification of different kinds of bearing greases without the necessity of having large samples. Very interesting, too, is the article on new types of automatic equipment designed to aid in the accurate plotting of steady-state fields. Other articles are included on transformer disconnecting switches, a new multichannel recorder, heavy duty bearings, dynamic breaking on mill type motors, and there is another installment in the excellent series on protective atmospheres in industry.

The material contained in the regular departments of the Review always furnishes much interesting information, and this issue is no exception. All-in-all, this November issue of the G. E. Review is one of the finest ever, and it is well known that the Review is a consistently fine technical magazine.

Engineer's Dictionary: Spanish-English and English-Spanish

2nd Edition by Louis A. Robb. John Wiley & Sons, Inc., New York, 1949. 664 pages, $12.50.

The first edition of this very useful work is already well known to the engineering profession. Compiled by an engineer for engineers, it fulfilled a definite need and was widely acclaimed.

This, the second edition, is an enlargement of the original work, the number of entries being increased from 44,000 to 75,000. While the first edition dealt almost exclusively with civil engineering, this expanded edition gives considerable coverage in other engineering fields such as radio, television, mining, shipbuilding, logging, sugar milling, and oil-field operations. It brings all branches of civil engineering up to date, special attention being given to photogrammetry, soil mechanics, and airport construction.

In considering Spanish terms, Mr. Robb includes not only single words but phrases in common usage which cannot be translated on a word-by-word basis. In cases where the Spanish equivalent for an English term varies with locality, all the variants are given and identified as to the areas in which they are used.

The book is handsomely bound in a durable flexible binding and will adapt itself equally well in the library or on the job. It is a complete and thoroughly dependable work and will prove to be a practical aid in any phase of inter-American engineering activity.

Summary of Operations California Oil Fields

Thirty-fourth Annual Report of the State Oil and Gas Supervisor Issued by Department of Natural Resources, Division of Oil and Gas, Ferry Bldg., San Francisco 11, Cal., 1948, 144 pages.

This issue of the California Oil and Gas Supervisor's report carries an extensive section devoted to the Wilmington oil fields which brings the information on that development (begun in an earlier issue) up to date. Included in this section are five large contour maps of the area and a longitudinal section of the Wilmington Anticline showing classification of producing pools.

Other features of this report include a general resume of oil field operations in the State, a discussion of operations considering the fields individually, a list of wildcat wells abandoned during 1948, and a directory of California oil operators. Numerous tables and statistical reports provide information on production, oil and gas reserves and general activity in the fields.

A comprehensive coverage of oil in California, this report is invaluable to anyone interested in operations in that area.

Oil in Venezuela

By Joseph E. Pogue, vice president Chase National Bank of the City of New York, published June 1949 by the Petroleum Department of the Chase National Bank, New York.

Here is another laurel to add to the author's well deserved reputation as an authority in the field of international petroleum development. As its title would indicate, this short study is mainly concerned with Venezuela's petroleum industry, but it contains enough additional information to make it a very fine consideration of Venezuela as a political and economic unit.

Oil is the life blood of Venezuelan prosperity; beginning with this axiomatic fact, the author explains the inter-relation of the industry and Venezuelan economy. He describes the extent of production and reserve and the value of this production and reserve to the Venezuelan people and government, and to the rest of the world. He explains the factors which effect capital formation and concludes with some discerning comments on the industry, its outlook, problems, and improvements needed.

This study should be "must" reading for anyone concerned with oil in Venezuela.

Internal Structure of Granitic Pegmatites*

Economic Geology Monograph 2 by E. N. Cameron, R. H. Jahns, A. H. McNair, and L. R. Page. The Economic Geology Publishing Co., Urbana, Illinois, 1949. 115 pages, 79 figures, and 5 tables. $4.00.

Recent studies of strategic pegmatite mineral deposits were begun by the U.S. Geological Survey in 1939 and work was done in several districts between 1939 and mid- 1942. As wartime demands for tantalum, mica, and beryl became more urgent, the scope of the investigations and of pegmatite mining activity was greatly increased.

This monograph is a study of the general features, internal structure, mineralogy, and origin of granitic pegmatites, drawn from 68 man-years of work by more than 40 cooperating geologists. The investigations, upon which this study is based, took place during the years 1939 to 1945 during which time the already mentioned, war-engendered activity in pegmatite mining created admirable conditions for geological investigations.

Thus this report is singularly valuable in that it represents the combined, cooperative efforts of many different geologists in studies undertaken at a time when conditions were very favorable to the carrying-out of extensive, detailed investigations.

The report covers the pegmatite districts of New England, the Southeastern States, South Dakota, Idaho, Montana, Wyoming, Colorado, and New Mexico.

*Published by permission of the director, U. S. Geological Survey.

TECHNICAL SOCIETIES and ASSOCIATION MEETINGS

(Continued from page 9)

per Mining Co., New York, N. Y.; Neil W. Rice, chairman of the board, U. S. Smelting Refining & Mining Co., Boston, Mass.; J. T. Ryan, Jr., exec. vice pres., Mine Safety Appliances Co., Pittsburgh, Pa.; Merrill E. Shoup, president, Golden Cycle Corp., Colorado Springs, Colo.; L. R. Kelce, president, Sinclair Coal Co., Kansas City, Mo.; Howard I. Young, president, American Zinc, Lead & Smelting Co., St. Louis; Raymond E. Salvati, president, Island Creek Coal Co,. Huntington, W. Va.

PLANS UNDER WAY FOR AMERICAN MINING CONGRESS WESTERN CONVENTION

D. D. Moffat, Chairman of the Western Division of the American Mining Congress has announced that Roy A. Hardy, consulting engineer in charge, Getchell Mine, Inc., Reno, Nevada has accepted the chairmanship of the Program Committee for the 1950 Metal Mining Convention and Exposition of the American Mining Congress to be held in Salt Lake City, August 28-31, 1950.

Hardy, an outstanding leader in the mining industry, will direct the activities of a nationwide committee in developing a program for the Salt Lake City meeting. State chairmen and members of the committee will be appointed early in 1950.

Arrangements for the Exposition of mining equipment, to be held concurrently with the convention, are already well under way, and a large number of leading manufacturers have applied for exhibit space. This Exposition will afford metal and nonmetallic mining men a valuable opportunity to inspect the latest developments in mining machinery, equipment and supplies and enable them to discuss their operating problems with the manufacturers.

Officials of the American Mining Congress point out that applications for housing accommodations for the meeting should be sent to Mrs. Winifred P. Ralls, Convention Bureau, Chamber of Commerce, Salt Lake City, Utah.

It was also announced that the 1951 Convention of the Western Division of the American Mining Congress will be held October 21-24, 1951 in Los Angeles, with convention headquarters at the Biltmore Hotel.

LIQUID FUELS PROGRAM

(Continued from page 41)

Estimates of coal reserves have also been made by individual states through their own geological surveys. These estimates have differed in some instances from those of the U. S. Geological Survey. Other agencies, such as the United States Coal Commission in 1923 and the National Coal Association in 1945, have also made estimates which differ from the U. S. Geological Survey. These discrepancies have pointed out the need for a revision of the estimates of coal reserves of the Nation. The American Institute of Mining and Metallurgical Engineers has formed a committee to make recommendations as to the action to be taken by this organization to further such a re-survey. It is reported that the National Bituminous Coal Advisory Council is considering "A Plan for a Rapid Reappraisal of Bituminous Coal Resources East of the Mississippi on the basis of Information Now Available." The Bureau of Mines is now engaged in making a survey to indicate coking coal reserves.

However, the criteria on which any estimates of reserves must be based are not agreed on by all interested parties. These include minimum mineable thickness, minimum depth of overburden for workable coals, and the definitions of the various categories in which reserves are to be divided as for example, "measured," "indicated" and "inferred." The division of coal into ranks according to A.S.T.M. definitions is generally accepted and will present no difficulty.

The Corps of Engineers, while not undertaking the task of estimating the total coal reserves of the United States, is interested in this question to a degree since estimates of reserves are the foundation on which the synthetic liquid fuels survey must be built. Although no attempt will be made in the survey to estimate total reserves, an estimate of reserves available for synthetic fuels must be developed. Information is wanted on present day reserves mineable by modern methods. Therefore, a set of rules to govern just what are to be considered mineable reserves must be prepared and accepted.

Although no complete Federal Governmental estimates of gas reserves by fields are in existence, reliable estimates are in the hands of various companies. This information can be obtained and the rules for estimating gas reserves are pretty well agreed on.

As for the oil shales, these occur in two widespread formations, namely, the Green River oil shales of Colorado, Utah and Wyoming and the Chattanooga shales of the Central States. The former, in general, offer the better possibilities for synthetic liquid fuels plants, being of higher quality than the latter. If a cut off grade can be established below which oil shales can be eliminated from consideration, the problem of estimating suitable oil shale reserves will be greatly simplified.

In evaluating the raw materials reserves of a locality, all available information as to the quality, quantity, location with respect to ground surface, thickness of seam (for coal and oil shale), gas pressure (for natural gas) is assembled for comparison. From the viewpoint of availability of economically mineable raw material reserves present in sufficient quantity and of such quality as to be suitable for synthetic fuels, the areas warranting further investigation as to production costs and other factors are determined. It has been decided to eliminate raw material reserves earmarked for commercial and industrial requirements from consideration for synthetic fuels such as for example, coals which have coking properties or natural gas dedicated to pipe lines, existing or proposed.

Water Supply

For the areas selected for further study on the basis of available raw materials reserves, the availability of sufficient water supply (either ground or surface) for the operation of various types of synthetic fuels plants is next investigated. The water requirements for synthetic fuels plants are large.

The possibility of supplying water requirements for synthetic fuels plants may be as important a limiting factor in determining the number of plants which can be located in an area as the reserves of raw materials. Areas which are found to have insufficient water supply for even one plant are dropped from further consideration even though the raw materials may be present.

Other Factors

For areas found to meet requirements for raw materials and water supply, further and detailed investigations are made to include: (1) cost of production of raw materials; (2) amount of construction required for and cost of developing a suitable water supply system; (3) existing transportation facilities and cost of developing additional facilities if necessary; (4) availability of labor and need for housing and community facilities; (5) potential markets for synthetic fuels produced; (6) availability of electric power for synthetic fuels plants and (7) waste disposal.

Areas are classified as to general relative order of desirability. Sufficient detail is included to indicate the reasons for selecting or rejecting an area from further consideration.

Indication of Sample Survey Results

In the few areas already examined, the magnitude of the raw materials reserves and the availability of water indicate a very large capacity of the country as a whole for synthetic liquid fuels manufacture. Existence of a wide choice of locations for plants is indicated. Apparently there is a large amount of coal mineable by stripping methods and there also appears to be a possibility of obtaining large tonnages from existing mines by increasing the number of working days per year to provide steady year-round employment.

Nationwide Survey

The nationwide survey to determine general areas suitable for location of synthetic liquid fuels plants, for which funds were appropriated by the 80th Congress, will get under way early in 1949. It will include the continental United States and part of Alaska. The previous surveys covering parts of Kentucky, Colorado, Texas and Montana will be incorporated into the nationwide report, but it is not contemplated that any additional field investigations work will be done on these areas. The survey of Alaska will be limited to that portion lying between the 142 and 152 meridians and south of the Arctic Circle because this area offers the best possibilities for economical utilization of the products of an Alaskan synthetic liquid fuels plant. It is expected that the nationwide survey will be completed in from one to two years.

Bibliography

"Synthetic Petroleum from the Synthine Process" — Weil and Lane, Remsen Press, 1948.

"Comparison of Major Processes for Synthetic Liquid Fuels" by W. C. Schroeder.

"Mineral Resources of the United States, 1907."

"Map Showing Coal Fields of the U. S." by M. R. Campbell.

"Minerals Yearbook"—U. S. Bureau of Mines, 1946.

LETTERS

(Continued from page 4)

Office Recomputations by: Dr. V. J. Elliott

Note: Like all small prospects the parties involved expect this one to grow as time goes on.

My work for the past 2 years has been in the Permian basin of west Texas and southwestern New Mexico on a seismic crew for Magnolia. I found great interest in fitting this data to the complicated geology there. During my stay in Odessa, Texas, I was promoted to seismologist.

Magnolia Petroleum Company has recently adopted a fellowship program. I am the first in our department to be selected to study for my Master's in Geophysics this year. It also accounts for the delay in this letter as I have been waiting to tell you of my schooling at the same time that I told of our boy.

I am very happy in the outcome of my job and of my chance to return to school I hope to drop by the office and see you during my stay at *Mines*.

COMMENDATIONS FROM PACIFIC NORTHWEST SECTION

From W. I. Sedgley, '40, Secretary, *6040-36th, S. W., Seattle 6, Washington.*

Enclosed are the minutes of the last meeting of the Pacific Northwest section which was held on December 8, 1949.

With reference to these minutes it can be noted that the officers of the section will be the same for the coming year and will, therefore, require no change in the Yearbook and Directory.

Our membership seems to recede with each meeting, due to transfers from this part of the country. However, we still have the "old die hards" that are here to stay and our infrequent meetings prove to be very interesting in renewing old acquaintances.

We would like to extend our congratulations to the Alumni Association for its part in the program of the Seventy-fifth Anniversary, and to Axel Anderson who was one of the recipients of the Distinguished Achievement medals. Anderson was out of town during our last meeting so we were unable to extend our congratulations to him at that time.

We were also impressed with the past successful football season and hope that the good work will continue.

TRANS-ARABIAN PIPELINE

(Continued from page 26)

normally set up, but the change-over is manual. Communication with the 50 and 300-watt line transmitters is also excellent, and at times even the 15-watt automobile transmitters have been able to communicate three-quarters of the way across Arabia. The latter situation is unusual and not to be depended on, but the automobile transmitters have ordinarily been able to get in communication with the nearest construction camps without difficulty.

It is contemplated that the permanent installation will consist of two more or less separate systems, one a through system from Sidon to Dhahran, and the other a dispatching system for the pipe line, taking in all the intermediate stations as well as the terminals. The through system will utilize transmitters of 1000-watt output feeding to rhombic antennas designed to obtain single-hop transmission. Three rhombic-antennas will be used for reception in conjunction with a diversity receiving arrangement which automatically selects the strongest signal and virtually eliminates fading. The dispatching system will utilize three frequencies simultaneously to provide dependable communication to any or all stations at distances varying from 125 to 1,000 miles. The frequencies will be in the vicinity of five, 10 and 16 megacycles.

Storage Tanks

At the Mediterranean terminus of the Trans-Arabian Pipe Line, which will be a few miles south of Sidon at a point where the Zahrani River empties into the Mediterranean, it is planned to install 16 tanks of 180,000-barrel capacity each at elevations 285 to 378 feet above the water. The tanks will be about 5,200 to 7,200 feet from the shore. Four submarine loading lines will extend some 2,700 feet from the beach to a point where the water is 50 to 55 feet deep, and in addition there will be separate ballast lines. The initial installation will probably be the simplest necessary for loading tankers by gravity with crude oil at a high rate, although the possibility of a refinery at this point at some later date has always been borne in mind. Incidental facilities required for a submarine loading terminal are a separator for handling oil ballast, a communication system from ship to shore and from shore to tankage for controlling flow of oil, and a small pier for the launches that are necessary for handling ships' mooring lines, transferring personnel and moving minor supplies.

The permanent radio transmitting station will be located at Sidon rather than at Beirut where the present station is, but the headquarters of the company will remain in Beirut, which is only about 30 miles to the north and is the metropolitan and commercial center of Lebanon.

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1018 Washington Ave.

Golden Savings & Loan Assoc. ....
Golden, Colorado, 808-13th St.

Golden Theatre ....
Golden, Colorado

G. G. Grigsby ★..... .....
Desloge, Missouri

Grisham Printing Company ★..... .....
Denver, Colo., 925 Eighteenth Street

Hassco, Inc. ....
Denver, Colorado, 1745 Wazee St.

Heiland Research Corporation ★..... .....
Denver, Colo., 130 East 5th Ave.

Hendrie & Bolthoff Co. ★..... .....
Denver, Colorado, 1059-17th St.

Hercules Powder Company ★..... .....
Denver, Colo., 650-17th St.
Wilmington, Delaware, 737 King Street

Heron Engineering Co. 40
Denver, Colo., 2000 So. Acoma

Hilger & Watts Ltd. ....
Watts Division, 48, Addington Sq.,
London, S.E.5. England

Holland House, The ....
Golden, Colorado

Humphreys Investment Co. ....
Denver, Colo., 1st Nat'l Bank Bldg.

Husky Oil & Refining Co. ....
Calgary, Alberta, 531 Eighth Ave. West

Independent Exploration Co. ....
Houston, Texas, Esperson Bldg.

Independent Pneumatic Tool Co. ....
Denver, Colorado, 1017-19th St.

Ingersoll-Rand ★..... .....
Birmingham, Ala., 1700 Third Ave.
Butte, Mont., 845 S. Montana St.
Chicago, Ill., 400 W. Madison St.
Denver, Colo., 1637 Blake St.
El Paso, Texas, 1015 Texas St.
Kansas City, Mo., 1006 Grand Ave.
Los Angeles, Calif., 1460 E. 4th St.
Manila, P. I., Earnshaws Docks &
Honolulu Iron Works
New York, N. Y., 11 Broadway
Pittsburgh, Pa.,
706 Chamber of Commerce Bldg.
Salt Lake City, Utah,
144 S. W. Temple St.
San Francisco, Calif., 350 Brannan St.
Seattle, Wash., 526 First Ave. So.
Tulsa, Okla., 319 E. 5th St.

Intermountain Exploration & Engineering Co. ....
Casper, Wyoming, 214 Cottman Bldg.

Ives, Richard ....
Denver, Colo., 661 W. Colfax Ave.

Jeffrey Manufacturing Company ★.... .....
Columbus, Ohio, 940-99 No. Fourth St.
Denver, Colo., E. & C. Building

Joy Manufacturing Co. ★..... .....
Henry W. Oliver Bldg., Pittsburgh, Pa.

Kellogg's Hardware, Inc. ....
Golden, Colo., 1217 Washington Ave.

Kennametal Inc. ....
Latrobe, Pa.

Kendrick-Bellamy Company ★..... .....
Denver 2, Colo., 1641 California St.

Kennecott Copper Corp. ....
New York, New York, 120 Broadway

Kistler Stationery Company ★..... 45
Denver, Colo.

Lesehen & Sons Rope Co., A. ....
St. Louis, Mo., 5909 Kennerly Ave.

Link-Belt Company ★..... .....
Chicago, Ill., 300 W. Pershing Rd.
Atlanta, Ga., 1116 Murphy Ave., S.W.
Indianapolis, Ind., 220 S. Belmont Ave.
San Francisco, Calif., 400 Paul Ave.
Philadelphia, Pa.,
2045 W. Huntington Park Ave.
Denver, Colo., 521 Boston Bldg.
Toronto, Can., Eastern Ave. & Leslie St.

Lufkin Rule Co. ....
Saginaw, Michigan

Mace Company, The ★..... .....
Denver, Colo., 2763 Blake St.

Manning, Fred M., Inc. ....
Denver, Colo., Continental Oil Bldg.

Martin Decker Corporation ....
Long Beach, Calif.

McElroy Ranch Company 3
Ft. Worth, Texas, 506 Neil P.
Anderson Bldg.

McFarlane-Eggers Mchy. Co. ....
Denver, Colo., 2763 Blake St.

McKeehen Clothing Co. ....
Golden, Colo., 1222 Washington Ave.

Merrick Scale Mfg. Co. ★..... .....
Passaic, New Jersey

Metropolitan Barber Shop ....
Golden, Colorado

Midwest Steel & Iron Works Co. ....
Denver, Colo., 25 Larimer St.

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El Paso, Texas
New York, N. Y., 1775 Broadway
Salt Lake City, Utah
Montreal, Canada,
Canadian Vickers, Ltd.
Santiago, Chile, W. R. Judson
Lima, Peru, W. R. Judson
Manila, P. I., Edward J. Nell Co.

Mines Magazine ★..... 45
Denver, Colo., 734 Cooper Building

Morse Bros. Machinery Company ★.... 7
Denver, Colo., 2900 Broadway,
P. O. Box 1708

Mosebach Elect. & Supply ....
Pittsburgh, Penna.,
1115 Arlington Ave.

Mountain States T. & T. Co. ....
Denver, Colo., 931 14th St.

National Fuse & Powder Company ★ 3
Denver, Colo.

Nat'l Malleable & Steel Casting Co. .....
Cleveland, Ohio, 10600 Quincy Ave.

National Titanium Co. ....

Nuclear Development Lab. ....
Kansas City, Mo., Box 7601

Oliver United Filters ....
N. Y., N. Y., 60 E. 42nd St.

Osgood Company ....
Marion, Ohio

Paramount Cleaners ....
Golden, Colo., 809 12th St.

Parker & Company, Charles O. ★.... 3
Denver, Colo., 2114 Curtis Street

Price Company, H. C. ★..... .....
Bartlesville, Okla.
Los Angeles, Calif.
San Francisco, Calif.

Professional Cards 4, 8

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Denver, Colo., Gas & Electric Bldg.

Pure Oil Company ....
Chicago, Ills., 35 E. Wacker Drive

Roebling's Sons Company, John A. ★ .....
Trenton, New Jersey
Denver, Colo., 1639 Seventeenth St.

Seismic Explorations, Inc. ....

Seismograph Service Corporation ....
Tulsa, Oklahoma

Silver State Printers ....
Golden, Colorado, 1313 Jackson St.

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Butler, Pennsylvania

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Golden, Colo., 1205 Washington Ave.

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Denver, Colo., 1000 E. 18th Ave.

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Golden, Colo.,
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Union Supply Co. ....
Denver, Colo., 1920 Market St.

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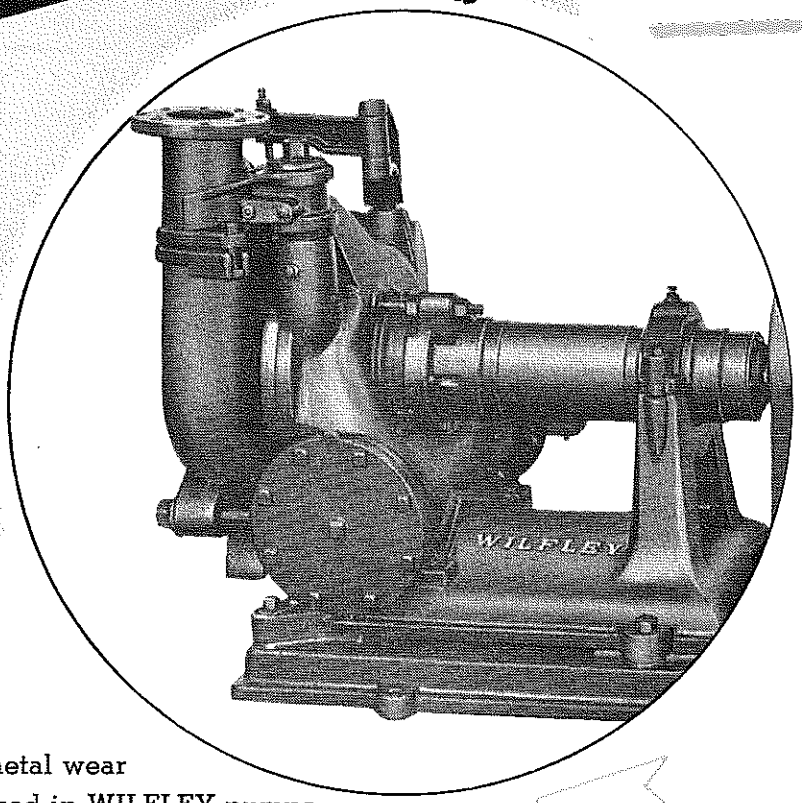

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