THE MINES MAGAZINE

AROUND THE WORLD WITH THE MINERAL INDUSTRIES

Featuring—

MINING TENNESSEE COPPER COMPANY

ENGINEERS' DAY MINES

FUNCTION PETROLEUM ENGINEERING DEPARTMENTS

DUCTILE CAST IRON

"MINES" GEOLOGICAL MUSEUM

MAY • 1950

VOLUME XL NO. 5

PERSONAL NOTES

E. James Acker, '49, has moved his residence in Beeville, Texas, to 150 Ann Burke. He is Engineer Trainee with Stanolind Oil & Gas Company.

William Allen, Jr., '47, Geophysical Engineer in Research department, Phelps Dodge Corporation, is addressed at his home, 1140-14th Street, Douglas, Arizona.

John W. Barnes, '34, Construction Engineer, Mining department, Stearns-Roger Manufacturing Co., has returned to the Denver office from an assignment at Odessa, Texas. His home address is 1738 Glencoe Street, Denver 7, where he receives mail.

Pertev I. Bediz, '41, completed his assignment as Geological Engineer with E.C.A. in Turkey and has accepted a position with the Century Geophysical Company in Calgary, Alta., Canada.

Eric A. Berg, '41, resigned his position with the International Minerals and Chemical Corporation at Lakeland, Florida and, at present, is being addressed 500 So. Race Street, Denver.

J. W. Bodycomb, '48, has moved his residence to 614 Cleveland Street, Pueblo, Colorado. He is Assistant Mining Engineer for the Colorado Fuel & Iron Corporation.

John S. Bradley, '48, is serving as Graduate Fellow at Columbia University, Department of Geology, and is receiving mail in care of the department, 202 Schermerhorn Hall, New York 27, N. Y.

Lt. Col. F. Erich Bruhn, '22, has been transferred from Fort Monroe, Virginia to San Francisco, Calif., with address c/o Hostess Howe, Fort Mason, SFPE.

George W. Burgess, '49, Junior Exploitation Engineer, Shell Oil Company, is now being addressed in care of the company, Centralia, Illinois.

H. F. Carpenter, '23, has resigned his position as Mill Superintendent for the Cia. Minera Santa Maria del Oro at Santa Maria del Oro, Dgo., Mexico, and is now being addressed Septima 300, Chihuahua, Chih., Mexico.

Bruce C. Clark, '48, received his discharge from the Army in December 1949 and in January of this year returned to work for the U. S. Smelting, Refining and Mining Company at their Midvale Works. He receives mail at his home, 653 Milton Avenue, Salt Lake City, Utah.

Willis K. Daggett, '35, is Manager of Welex Jet Services and receives mail through Box 234, Ardmore, Oklahoma.

Charles J. Dunn, III, '49, Engineer Trainee, Gulf Oil Corporation, receives mail at his home, 505 No. Bernice, Odessa, Texas.

T. L. Donovan, Ex-'26, is in the States on vacation from his duties as Chief Engineer for Sinclair Petroleum Company in Ethiopia. While here mail will reach him at his home, New Cumberland, West Virginia.

Morton E. Frank, '06, has a change of residence address in Chicago to 5468 Hyde Park Boulevard.

Raymond B. Franklin, '49, Geologist for The Texas Company has a new mailing address, 448 Washington, Shreveport, La.

R. L. Gibson, '30, was recently promoted to Exploitation Engineer for the Corpus Christi, Texas, division of Shell Oil Company. He joined the company in 1936, serving in various exploitation engineering positions along the Texas and Louisi-

(Continued on page 7)

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Professional . . . CARDS

A. E. Anderson, '04
Booking Cruises to South America
5031 Laurelcrest Lane
Seattle 5 Washington

Daniel L. Beck, '12
Aptitude Testing—Sales Training
Executives Selection & Training Institute
956 Maccabee Bldg. Detroit 2, Mich.

Byron B. Boatright, '22
Consulting Petroleum & Natural Gas Engineer
Capital National Bank Building
Austin, Texas

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

W. W. Cline, Ex-'29
President
San Joaquin Drilling Company, Inc.
417 S. Hill St. Los Angeles, Calif.

Will H. Coghill, '03
No Consultations
145 W. Lincoln Ave. Delaware, Ohio

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

Thomas S. Harrison, '08
Consulting Oil Geologist
1104 First National Bank Bldg.
Denver, Colorado

Letters . . .

LEAVING ACTIVE DUTY WITH THE ARMY

From MAJOR ARTHUR C. KINSLEY, '20, *301 Santa Clara Avenue, Alameda, California.*

You have had various addresses for me the past three years, in Korea, where I was with the Korean Bureau of Mining as Advisor, and in Sapporo, Japan, where I was a member of the Special Coal Production Coal Team, and here in Sendai, where I have been Assistant Regional Post Engineer, and now, approaching the age limit, I am being returned to the States to leave active duty with the Army. Therefore, kindly change my address to my home, as given above.

I plan on returning to the Department of the Interior at the Field Office in San Francisco, where I expect to stay for five to ten years more before I think of retiring.

HAS BABY DAUGHTER

From COURTNEY E. COOK, '49,*5542 Highway No. 9, Corpus Christi, Texas.*

As you see by the address we have been transferred. I am working under the District Engineer here and am enjoying the experience very much.

My wife and I were very pleased to have received a promotion and raise in January. With the addition of a baby girl, Carol Lee, to our family on October 30, 1949, we are very happy.

Both my wife and I always look forward to receiving monthly copies of *Mines Magazine* for the latest news about our friends and of the mineral industries.

ANNOUNCES RETIREMENT

From FRANK A. ("Gus") GOODALE, '10, *1007 El Paso Drive, Los Angeles, California.*

I had the pleasure of attending the celebration of the 75th Anniversary of the founding of the Colorado School of Mines, the last of September, '49, where I met a number of my classmates and friends, the reunion with whom I enjoyed very much.

These will probably be interested in knowing that, on January 31st, this year, I retired from the Los Angeles County Road Department, Bridge Division, after 22 years of service, the last 10 of which was "Civil Engineer in charge of Design in Wood." My work was concerned mainly with the design of wooden bridges and their maintenance.

My wife and I will leave Los Angeles around April 1st for an extended automobile trip of about six months through a number of southern and eastern states, returning here about October 1st. My permanent address will be that given above.

My kindest regards and best wishes to the Alumni Association.

APPRECIATION FROM BLUE KEY FRATERNITY

From ARTHUR S. DICKINSON, *President, Golden, Colorado.*

Thank you for sending Mr. Aycardo's contribution. He is typical of *Mines'* alumni all over the world who have contributed to the "M-Protection Fund." Of the total amount in the fund ($1,720.00), the alumni have contributed nearly $1,000.00, the remainder coming from the student body, the faculty, and the town's people of Golden.

Our Blue Key War Memorial Fund is functioning very well, and we send our thanks again to you for setting up the legal aspects of the fund.

SENDS CONGRATULATIONS

From PROF. CHARLES E. ROWE, '02, *1407 Ethridge Avenue, Austin, Texas.*

I just want to congratulate you fellows for publishing the best college magazine I know about, and also for running the most successful alumni association.

RETURNING TO THE STATES

From CHARLES E. BASSO, '25, *30 Hilp Building, 129 No. Virginia Street, Reno, Nevada.*

Am enclosing herewith check for 1950 dues which is a bit overdue for which I trust you will pardon.

I have resigned my position here with the CMUCP and leave next month (May) sailing from Antofagasta, Chile, on June 3, arriving in New York the 19th. Please change my address to that given above.

Will take a much needed rest and then will be available for another assignment. Will stop off in Denver to give you my personal saludos.

TECHNICAL MEN WANTED

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

(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.

(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.

(1142) TOPOGRAPHICAL ENGINEERS. One of the Federal Bureaus has positions open for Topographical Engineers covering work in the Rocky Mountain Region. These will be rated as GS-5 grade. Starting salary per year, $3100, plus expense allowance when away from headquarters.

(1143) DESIGNING ENGINEER. One of the Rock Drill Manufacturing Company's has a position open for a Rock Drill Designer who has had three to five years experience in the designing of rock drills. Salary open.

(1146) JUNIOR SALES ENGINEER. A company selling construction equipment in the Rocky Mountain territory has a position open for a Junior Engineer to train in connection with sales and service. Moderate salary to start on but good opportunity for advancement for the right man.

(1147) SALES ENGINEER. A company located in Ohio manufacturing and selling concrete masonry construction materials has a position open for Sales Service Engineer who has had engineering experience in concrete construction and estimating costs. Should have good personality and ability to sell concrete products. Salary will depend on experience and ability of applicant.

(1148) JUNIOR MINING ENGINEER. An eastern manufacturer of iron products has a position open for young mining engineer in connection with their iron mines. Applicant should have some mining experience and ability to supervise men. Salary will depend upon experience and ability of applicant.

(1153) PHYSICISTS AND RESEARCH ENGINEER. A research organization established in the middlewest has positions open for physicists, and electrical engineers with good background in physics, electronics and electrical research. Applicants should have Master's or Doctor's degrees. Salary open.

(1154) MINING OR METALLURGICAL ENGINEER. A well established company operating in foreign countries has a position open for an engineer who has ore-buying experience and a good knowledge of the Spanish language. Salary open.

(1155) MINING AND METALLURGICAL ENGINEER. A company operating non-metallic mines in the south has a position open for graduate engineer to work in open pit mining and carry on research work for the flotation of non-metallics. However, several months training will be required before taking on an executive position. Salary open.

(1171) MILL FOREMAN. A South American mining company has a position open for a graduate metallurgist as Mill Foreman. Applicant must have had experience in the operation of flotation and concentration equipment. Must have a good working knowledge of Spanish and be able to successfully handle South American employees. Must report single status for six months. Salary open with liberal vacation allowance and free living quarters. Bonus to the right man.

(1171a) MINE FOREMAN. A South American mining company has a position open for Mine Foreman. Must be a college graduate with mining experience and a good working knowledge of Spanish. Must report single status for six months. Salary open and includes air transportation to South America together with liberal vacation allowance and salary. Free living quarters.

(1172) RESEARCH CHEMICAL ENGINEERS. A South American mining company has a position open for Research Chemical or Metallurgical Engineers under 30 years of age. Must be familiar with analytical procedures in the determination of all elements, including rare metals. Salary open.

(1176) METALLURGIST. An aircraft manufacturer has position open for metallurgical graduate with education and experience covering metallurgical testing of ferrous and non-ferrous metals as well as physical processing, heat treatment, welding practices and ability to coordinate these practices with the application of metals for manufacturing. Salary open.

(1178) JUNIOR METALLURGIST. A mining company in South America has position open for Junior Metallurgist with some experience in ore-dressing and laboratory work. Knowledge of Spanish is desirable. Starting salary, $3000 per year plus living quarters. Transportation by air, free. Yearly bonus of 1 month. 3-year contract.

(1181) MINE MANAGER. A mining company with extensive operations in Central America has a position open for Mine Manager. Applicant should have extensive Latin-American experience and a successful record as General Supt., Asst. Mgr. or Mgr. Only top men will be considered. Good opportunity for a qualified man. Salary open.

(1182) SALES ENGINEER. A large steel company has position open for Sales & Service Engineer. Must be thoroughly acquainted with oilfield practice and have had 5 to 10 years experience. Applicant must have administrative ability and excellent personality. Fine opportunity for the man who can meet requirements. Salary depends upon experience and ability of applicant.

(1186) JUNIOR MINING ENGINEER. Well known mining company operating in Central America has position open for Junior Mining Engineer who is qualified to make underground and surface surveys and maps. Good opportunity to advance into production. Salary open.

(1187) JUNIOR SALES ENGINEER. Well known manufacturing company has position open as Junior Sales Engineer for a livewire young engineer. Good opportunity to advance. Territory eventually to be covered will be in the Rocky Mountain Region. Salary open.

(1188) DRAFTSMAN & DESIGNING ENGINEER. Well known consulting engineering organization located in the middle-west has a position open for designing engineer who has had extensive experience with the cement industry. Should have had from 5 to 10 years experience of which 3 to 4 years have been drafting and designing. Probable salary, $400 to $500 per month.

(1192) SURVEYOR & DRAFTSMAN. A prominent engineer located in Colorado has position open for young man with experience surveying and drafting. Salary open. Good opportunity for the right man.

(1193) DRAFTSMAN AND DESIGNING ENGINEER. A company operating in California has position open for experienced designer and draftsman. Must have knowledge and experience covering steel and concrete design and also working knowledge of typical underground layouts, including car dumps, chutes, loading pockets, haulage systems, etc. Probable starting salary, $450 to $500 per month.

(1194) MINING ENGINEER. A well known company operating a gold mine in Central America has position open for mine manager. Applicant must have had several years experience in operation of mines in Latin America. Salary depends upon qualifications and experience of applicant.

(1197) RESEARCH METALLURGIST. A well known research organization is setting up a new department covering research in connection with projects for pyro- and hydro-metallurgy. Applicant must be able to direct research and be well grounded in physical chemistry and especially thermodynamics. Should have few years experience in concentration of ores. Salary will depend upon the experience and ability of applicant.

(1198) JUNIOR METALLURGIST. A company operating large concentration mill in an eastern state has position open for a Junior Metallurgist. Processes involve gravity, magnetic and flotation methods. Probable salary to start, $250 to $275 per month.

(1199) PETROLEUM ENGINEER. A company operating in a southern state has position open for Petroleum Engineer 30 to 40 years of age with experience in natural gas transmission and distribution. Will be necessary to travel approximately 50% of the time. Salary open.

(1200) MINING ENGINEER. Federal position open for Mining Engineer and Technologist who has had experience in coal mine operations, steel plants and gas manufacturing plants. Foreign employment. Probable salary $7600 per month plus travel and living expenses.

(1203) MINING GEOLOGIST. Position open in Mexico for Mining Geologist. Must have at least five years experience. Length of present engagement, six months. May be extended longer. Starting salary, $450 per month, U. S. Cy., plus travel expenses.

(1204) CHEMIST. A company operating smelter and sulphuric acid plant has position open for Junior Chemist. Routine work consists of determination of content of ores and analysis of products. Starting salary, $250 per month with good opportunity for advancement.

(1208) MINING ENGINEER. Position open for Mining Engineer in connection with Greek mining. Applicant must have broad experience in operation, examination and report work in connection with non-ferrous metals. Probable salary, about $9000 per year plus living allowance.

(1209) MINING ENGINEER. Company operating in South America has position open for assistant to Mining Superintendent. Man must have had a few years mining experience, be able to stand high altitudes and report single status. Three year contract. Probable salary, $400 to $500 per month.

CONTRIBUTORS TO PLACEMENT FUND FOR 1950

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.

M. T. Honke, Jr., '48
George Baekeland, '22
Max Schott, Hon., '40
J. L. Fusselman, '42
H. V. Stewart, '49
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F. D. Kay, '21
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R. E. Buell, '41
Daniel H. Dellinger, '31
A. C. Harding, '37
R. L. Scott, '42
P. W. Crawford, '22
M. L. Gilbreath, '33
R. F. Dewey, '43
J. A. Kavenaugh, '38
J. G. Johnstone, '48
Wm. C. Lieffers, '48
F. E. Woodard, '42
Wm. H. Bashor, Jr., '49
T. H. Allan, '18
T. F. Adams, '29
C. V. Woodard, '44
Otto Herres, '11
E. J. Brook, '23
J. W. Gabelman, '43
J. B. Ferguson, '30
D. W. Butner, '15
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R. L. McLaren, '32
J. A. Davis, '39
C. D. Reese, '43
W. F. Distler, '39
G. W. Mitchell, '23
N. H. Donald, Jr., '39
Parker Liddell, '03
G. M. Miner, '48
J. B. Larsen, '36
J. A. Clark, '21
H. E. Lawrence, '48
F. W. C. Wenderoth, Ex-'36
V. R. Martin, '41
T. J. Lawson, '36
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C. C. Towle, Jr., '34
J. N. Gray, '37
D. W. Reese, '48
S. E. Anderson, '32
Herbert Schlundt, '43
F. E. Johnson, '22
W. E. Norden, '34
P. A. Jennings, '34
W. R. Parks, '38
Masami Hayashi, '48
G. R. Rogers, '48
G. O. Argall, Jr. '35
J. R. McMinn, '42
R. M. Frost, '48
R. D. Eakin, '48
K. B. Hutchinson, '39
W. S. Chin, '49
K. W. Nickerson, Jr., '48
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L. O. Green, '32
James Colasanti, '35
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Finley Major, '47
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W. H. Nikola, '41
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G. H. Fentress, '49
J. L. Bruce, '01
W. L. Falconer, '41
G. P. Mahood, '24
J. A. Bowler, '39
W. C. Kendall, Ex-'47
J. C. Smith, Ex-'35
E. L. Durbin, '36
W. D. Caton, '35
W. A. Conley, '19
H. H. Christy, '22
F. E. Lewis, '01
E. C. Royer, '40
E. A. Berg, '41
G. A. Smith, '34
H. L. Jacques, '08
S. C. Sandusky, '48
J. W. R. Crawford, III, '48
O. P. Dolph, '25
A. M. Keenan, '35
W. H. Breeding, '39
N. S. Whitmore, '29
R. G. Hill, '39
L. E. Wilson, '27
L. P. Corbin, Jr., '40
W. J. Rupnik, '29
F. C. Aldrich, '48
R. H. Sayre, Jr., '34
R. W. Evans, '36
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R. L. Bradley, '47
F. Clinton Edwards, '41
E. D. Hyman, '48
Nikolai Belaef, '27
G. S. Schonewald, '48
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P. M. Howell, '38
A. D. Swift, '23
H. D. Campbell, '42
R. R. Bryan, '08
R. W. Knapp, '40
S. H. Hochberger, '48
G. V. Atkinson, '48
Robert Bernstein, '42
C. G. Hayes, '41
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E. G. Snedaker, '14
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K. E. Bodine, '48
H. F. Holliday, '42
R. D. Locke, '44
B. E. Duke, '39
W. D. Lord, Jr., '44
Christian Kuehn, '41
Douglas Ball, '43
L. I. Railing, Jr., '47
H. F. Carpenter, '23
R. P. Olsen, '49
E. M. Watts, Ex-'26
L. O. Storm, '40
W. B. Barbour, '37
J. R. Hallock, '49
E. W. Steffenhagen, '41
W. W. Simon, '15
R. F. Corbetta, '48
J. H. Vose, Jr., '39
J. L. Bolles, '49
B. W. Knowles, '08
G. B. Harlan, '49
Gene Meyer, '37
G. A. Parks, '06
C. W. Campbell, '47
J. N. Wilson, '42
J. S. Phillips, '49
A. F. Beck, '25
F. J. Weishaupl, '49
Victor Bychok, '42
C. F. Fogarty, '42
M. M. Aycardo, Jr., '41

(Continued on page 39)

PERSONAL NOTES

(Continued from page 3)

ana Gulf Coast until two years ago when he was named Reservoir Engineer in the Corpus Christi division.

Horace N. Goodell, '42, District Geologist for Union Oil Company, who was recently transferred to Denver from Laramie, Wyoming, now has his family with him and they are residing at 980 Flower Street, Lakewood, Colorado.

William H. Goodhue, '49, has accepted position as Engineer with Peter Kiewit Son's Company on the Ross Dam at Rockport, Washington. His mailing address is Box 516, Mount Vernon, Washington.

Masami Hayashi, '48, is Topographical Engineer for the U. S. Geological Survey with mailing address Route 3, Box 227, Golden, Colorado.

R. E. Hochscheid, '48, has been transferred by The Dorr Company from Westport, Connecticut, to their Denver office, 1009-17th Street.

George W. Hoffman, Jr., '48, is now being addressed Box 911, Thermopolis, Wyoming, having been transferred by the Continental Oil Company from Ponca City, Okla.

Lyle R. Jenkins, '49, Metallurgist, Research department, Carnegie-Illinois Steel Corporation, resides at 927-13th Avenue, Moline, Illinois.

Arthur J. Jersin, '49, is Petroleum Engineer for Texas Pacific Coal & Oil Company with address in their care, Box 635, McCamey, Texas.

Charles R. Johnson, Jr., '49, resigned his position with the Richmond Exploration Company in Venezuela to accept one with the Standard Oil Company of California. His new address is in care of the company, David Keith Building, Salt Lake City, Utah.

Warren O. Johnson, '49, Field Engineer for the Republic Natural Gas Company, is now located in Dallas, Texas, with home address 1109 No. Crawford.

James A. Kavenaugh, '38, has moved his residence from Los Angeles to Arcadia, California, 4087 Lynd Street. He is serving as Technical Advisor for Revere Copper & Brass, Inc.

Harry E. Lawrence, '48, is Assistant Superintendent, Lead Smelting division, Goldsmith Bros. Smelting & Refining Company. He is addressed in their care, 1300 West 59th Street, Chicago, Illinois.

T. J. Lawson, '36, resigned his position with the Neptune Gold Mining Company in Nicaragua and has returned to the States. At present he is being address in care of Dr. H. W. Houf, E. 1302 Wilmette, Colorado Springs, Colorado.

William R. Lewis, '40, Assistant to Superintendent, Electro-Metallurgical Company, has moved his residence to 4815 Lafayette Circle, Niagara Falls, N. Y.

R. F. Miller, '43, resigned his position with The Texas Company to enter the Army, his new address being 1st Lt., Hq. 29th Engr. Base, Topographical division, APO 900, c/o Postmaster, San Francisco, Calif.

Norman S. Morrisey, '42, is now residing in Tulsa, Oklahoma, 1530 East 14th Street. He is associated with Stanolind Oil and Gas Company.

Fred A. Nagel, '40, resigned his position with U. S. Gypsum Company to accept one with Pre-Fabricated, Inc., of Denver. He is now being addressed 855 Humboldt Street, Denver.

(Continued on page 8)

PERSONAL NOTES

(Continued from page 7)

Richard B. Nelson, '47, Mine Face Boss for Potash Company of America, receives mail at his home, 910 No. Canal Street, Carlsbad, New Mexico.

G. L. Neumann, '21, Mining Engineer for U. S. Bureau of Mines is being addressed in their care, College Park, Maryland.

Daniel Oakland, '49, has been transferred from Harvey, Illinois, to Chicago by the Whiting Corporation for whom he serves as Sales Engineer Trainee. His new address is 6341 So. Western Avenue, Chicago 36, Ills.

William D. Owens, '45, Technical Trainee for Union Oil Company of California, is addressed 216 East Elm Street, Fullerton, Calif.

W. G. Park, '49, Field Engineer, Petroleum Service Company, is now located in San Antonio, Texas, where he is addressed 442 Delmar Street.

Warren L. Parks, Ex-'45, resigned his position with New York & Honduras Rosario Mining Company in Honduras, and, for the present, is being addressed Apple Valley, California.

Walter E. Redmond, Jr., '40, has moved his residence to 686 So. Gilpin Street, Denver 9. He is Manager, M.R.G. Technical division, Gates Rubber Company.

John L. Robison, '31, after a few months vacation in the States, has returned to Bolivia as General Manager for Cia. Huanchaca de Bolivia at Pulacayo.

John H. Ross, Jr., '34, Vice-President of Ross Manufacturing Company has a new home address where he receives mail, 1228 Arno Road, Kansas City Missouri.

Richard S. Russ, '37, resigned his position with Aluminum Ore Company at East St. Louis, Illinois, to take over the duties of Plant Engineer for the Reynolds Metals Company at Bauxite, Arkansas. His mailing address is Green Hills Farm, Route 2, Box 437, Benton, Arkansas.

Robert W. Sneed, Ex-'49, receives mail at his home, 2233 Fairfield Avenue, Oklahoma City, Okla. He is District Sales Manager, Eastman Oil Well Survey Company.

David Squibb, '34, called at the Alumni office the early part of April while on a several days visit in Denver. He is Sales Representative for Victaulic Company of America, his home address being 56 Lincoln Avenue, American Fork, Utah.

Thomas M. Straney, '28, has a change of address to c/o American Smelting & Refining Company, Angangueo, Mich., Mexico.

W. A. Van Hook, '35, Field Superintendent for Stanolind Oil & Gas Company, has moved from Thermopolis, Wyoming, to Midwest, with P. O. Box Number 818.

R. O. Walker, '24, has moved from Denver to Vernal, Utah, P. O. Box 301, where he is serving as Superintendent for Richland Oil Development Co. of Montana.

W. P. Morris, '30, formerly Mine Superintendent, Potash Division, International Minerals & Chemical Corporation, resigned that position to accept one as General Superintendent of Duval Sulphur & Potash Company. He is still in Carlsbad, New Mexico, with P. O. Box number 510. His home address there remains the same 1001 No. Halagueno Street.

W. T. Millar, '22, who has been serving as Mining Engineer with the U. S. Geological Survey and, recently, at Grand Junction, Colorado, has been transferred to the Bureau of Mines with headquarters at College Park, Maryland.

Norman M. Nichols, '40, Computer for the Honolulu Oil Corporation, receives mail at his home, 821 No. Hay Street, Montebello, California.

H. E. Nyberg, '06, has a change of address in Mexico City to Articulo 123, No. 41, Depto. Numero 204, Mexico, D. F., Mexico.

Henry Rogatz, '26, Consulting Geologist, has moved his offices in Dallas, Texas, to 1215-16 First National Bank Building.

Harold A. Rogers, '42, Civil Engineer for Bechtel Corporation, has a new residence address, 278 Wilshire Avenue, Daly City, Calif.

Arthur W. Ruff, Jr., '49, is taking graduate work at the University of Arizona under a teaching fellowship and receives mail in care of Department of Geology, University of Arizona, Tucson, Arizona.

A. T. Rylands, '34, Division Production Manager, Shell Oil Company, has moved his residence to 3230 Austin Street, Corpus Christi, Texas.

William W. Sabin, '49, has a new residence address in Salt Lake City, 975 East 1st South Street. He is Chemical Engineer for Utah Oil Refining Company.

Rodney L. Samuelson, '48, receives mail through Box 512, Cottage Grove, Oregon, where he is serving as Lumberman for the Coast Pacific Lumber Company.

H. A. Sawitzke, '37, General Manager and Treasurer of Empire Painting & Decorating Company, resides at 621 West Jefferson, Detroit 26, Michigan.

Lt. Col. T. J. Skeahan, '27, who has been overseas with 584th Engr. Const. Group for some time has been returned to the States and, at present, is being addressed Fort Logan, Colorado.

Joseph R. Soper, Jr., '44, is Assistant Mine Engineer for the Duval Sulphur & Potash Company at Orchard, Texas.

William F. Spain, '47, has recently accepted position as Mine Superintendent with the Yankee Mines, Inc., at Sunbeam, Idaho.

D. F. Sylvester, '38, is now Engineer for the Austin Bridge Company, residing at 1006 Drayton Street, Savannah, Georgia.

H. B. Starbird, '97, Consulting Engineer, has moved his residence to 856 Devon Avenue, Apt. 5, Los Angeles 24, Calif.

(Continued on page 34)

The Mines Magazine

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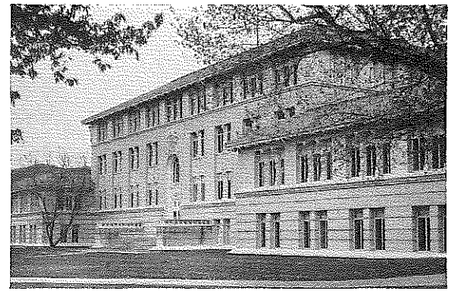

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Front Cover—

Giant B-36, world's largest bomber, takes off from runway at Fort Worth utilizing caterpillar-type track landing gear for first time.—Courtesy of the Goodyear Tire & Rubber Company.

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▼ Ducktown back in Roht's time. The Isabella Smelting Works in 1875.

ONE CENTURY OF MINING IN THE DUCKTOWN BASIN

By EZELL FLOURNOY, '32
Mining Engineer, Boyd Mine
Tennessee Copper Company
Copperhill, Tennessee

The famous Ducktown Basin Mining District lies in the southeastern corner of the State of Tennessee, and is surrounded by the beautiful foothills of the Great Smoky Mountains of North Carolina and Tennessee. Extensive timber cutting, which supplied the charcoal and fuel for the plants in the early decades of the industry, did away with the trees which once flourished in the Basin. The many years of exposure to gases, from roasting heaps and blast furnaces before sulphur gas-recovery plants were built, completed the job of denuding the Basin of nearly all its vegetation so that, now, it is a rather bleak looking place.

Copper Discovery

The Basin was quite a wilderness in the fall of the year 1843, when copper was discovered by a Mr. Lemmons who was prospecting for gold on Potato Creek, later the site of the famous Hiwassee and Burra Burra mines. It was a very disappointing discovery, for gold was the ultimate goal of the prospector at that time. It was not until 1847 that A. J. Weaver, a German mining engineer, appraised the old Lemmons workings. In due time, 31,210 pounds of oxide ore was shipped by Weaver, in two lots, to a Boston smelter. The lots assayed 14.5% and 32.5% copper, respectively. Such was the beginning of copper mining in the Ducktown Basin, and by 1854, some twenty odd mining companies had been formed. Some of these companies performed little or no mining, and it was not long before the larger and more prosperous companies had absorbed many of them.

Between the years 1858 and 1860 the mining operations of the Basin had narrowed to three major corporations, namely, The Union Consolidated Mining Company, The Polk County Mining Company, and The Burra Burra Copper Company. These companies operated, at one time or another, all of the present known ore bodies. It is with due respect that one must speak of the old-time prospector of the Ducktown Basin, for not an outcrop has been found that was not known to him some eighty or ninety years ago.

Consolidation

In the course of time the mining companies of the Ducktown Basin had their trials and tribulations, and in 1936 the final consolidation took place. At that time the Tennessee Copper Company purchased the only other remaining operating company. The Tennessee Copper Company now controls the whole of the twenty-five

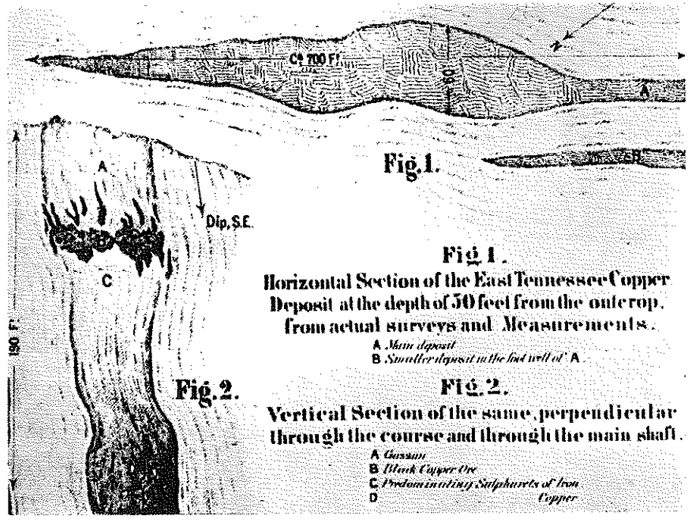


Fig. 1.
Horizontal Section of the East Tennessee Copper Deposit at the depth of 50 feet from the outcrop, from actual surveys and Measurements.
A *Main deposit*
B *Smaller deposit to the East west of* A

Fig. 2.
Vertical Section of the same, perpendicular through the course and through the main shaft.
A *Gossan*
B *Black Copper Ore*
C *Predominating Sulphurets of Iron*
D *Copper*

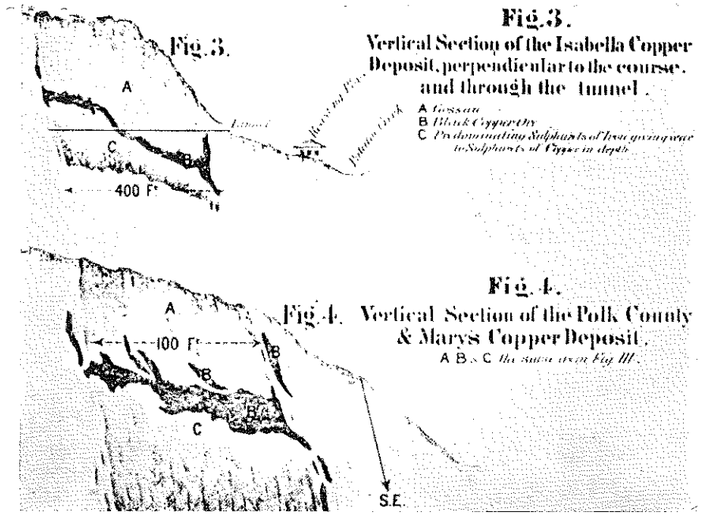


Fig. 3.
Vertical Section of the Isabella Copper Deposit, perpendicular to the course, and through the tunnel.
A *Gossan*
B *Black Copper Ore*
C *Predominating Sulphurets of Iron giving place to Sulphurets of Copper in depth*

Fig. 4.
Vertical Section of the Polk County & Marys Copper Deposit.
A B C *the same as in Fig III.*

▼ Diagramatic representation of original ore formations of the Ducktown district.

square miles of mining territory of the Ducktown Basin, in which it operates, at present, six mines, with a total production of well over one million tons of ore a year.

These ores are conditioned in two flotation plants, for subsequent use in two roasting and sintering units, and one reverberatory furnace and converter unit. The SO_2 gas produced in these operations is used to make sulphuric acid in three contact and one chamber acid plants. The sulphuric acid is shipped to fertilizer and commercial plants. The iron sinter is shipped to various steel producing plants. A considerable proportion of the blister copper is used to make copper sulphate and copper fungicides in the Company's plants, and the remainder is shipped to refineries. The zinc concentrate produced at the flotation plants is shipped direct to a zinc smelter.

In discussing the trends in mining of the Ducktown ores, one must go back to the geology of the Basin.

Geology of Basin

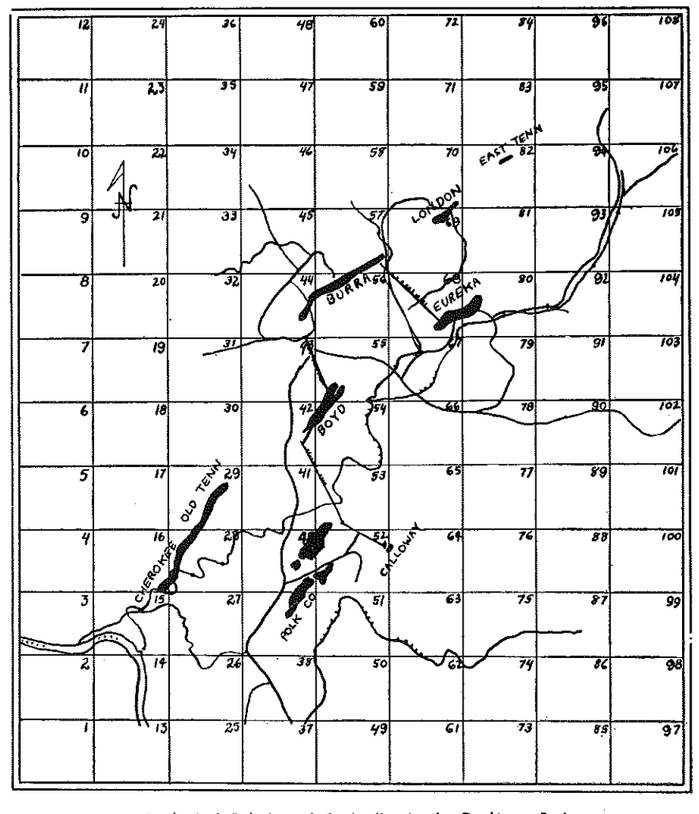
According to Professional Paper 139, Geology and Ore Deposits of the Ducktown Mining District, Tennessee, by W. H. Emmons and F. B. Laney, the rocks of the Ducktown Basin are almost wholly metamorphosed sediments, of Lower Cambrian Age. The metamorphic rocks all belong to the Great Smoky formation.

"The Great Smoky formation in the Ducktown district consists mainly of graywackes, which make up probably two-thirds of the formation; the remaining third is divided between arkose, graywacke conglomerate, conglomerate, mica schist, slate, staurolite schist, and garnet schist, in the order named. Limestone occurs probably near the middle of the formation, immediately beneath the staurolite schist, in thin and probably discontinuous and lenticular beds."

"This limestone is not known to be exposed at the surface at any place within the district, and indeed its occurrence was not suspected until the limestone or its equivalent marble was found in the mines. The limestone is in the same stratigraphic zone as the ore deposits, and when followed along its strike and dip it is found to grade into a rock composed of the gangue materials of the ore, with more or less of the ore itself. In nearly every mine in the district, the massive sulphide ore presents incontrovertible evidence of having replaced beds of limestone. . . . The ore deposits then represent original beds or lenses of limestone."

The ore deposition was the last of the major geologic events taking place in the later part of the Paleozoic era and following the period of intense regional metamorphism. The intense metamorphism produced three main anticlinal folds with corresponding synclines, closely compressed and for the most part overturned and steeply pitching, with a somewhat uniform dip of 60°—80° S. E.

(Continued on page 14)



▼ Geological Relation of Orebodies in the Ducktown Basin.

TABLE I

ANALYSIS OF THE ORES OF SEVERAL OF THE MINES AS REPORTED BY RICHARD O. CURREY IN 1854.

Mine	Type of Ore	Per Cent Copper
Culchote	Green Carbonate	21.5
Cherokee	Red Oxide	40.0
Polk County	Black Oxide	29.5
Isabella	Black Oxide	26.5
London	Red Oxide	44.0
East Tennessee	Black Oxide	20.5
Eureka	Black Oxide	24.0

TABLE II

SMELTING SCHEDULE OF THE ISABELLA SMELTING WORKS, IN 1876

From "Ducktown Back in Raht's Time"

First—Roasting the ore—500 ton piles.
Second—Smelting for first matte—50 ton piles.
Third—Roasting the first matte.
Fourth—Smelting for second matte and black copper.
Fifth—Smelting for blister copper.
Sixth—Refining.

TABLE III

COMPOSITION OF PYRITIC ORES

Mineral	Boyd Mine	Burra Mine	Calloway Mine	Eureka Mine	Isabella Mine	London Mine*	Mary Mine*	Polk County Mine*
Cu	0.65	1.45	2.03	0.80	0.72	1.96	2.51	1.96
Fe	41.4	28.9	33.5	40.6	41.8	26.31	31.12	31.47
S	33.0	21.3	23.0	27.5	29.0	16.78	20.18	20.12
SiO_2	9.0	28.6	38.32	9.6	9.2	38.05	24.05	28.83
Al_2O_3	1.00	5.60	2.49	1.09	1.51	3.06	3.27	3.40
CaO	4.4	3.3	9.61	4.0	3.5	6.83	7.67	6.30
MgO	2.46	2.03	10.07	4.06	3.08	2.15	3.01	2.76
Zn	0.61	1.10	2.65	0.40	0.40	0.88	3.14	1.88
P	0.014	0.047	—	0.018	0.019	—	—	—

*Analysis of ores between the years 1900-1918. These mines are not in production.

TABLE IV

FROM PROFESSIONAL PAPER 139
GEOLOGY AND ORE DEPOSITS
OF DUCKTOWN MINING DISTRICT, TENNESSEE

ANALYSES OF GOSSAN IRON ORES

	Burra Mine	London Mine	Isabella Mine	Mary Mine
Cu	0.48	0.70	0.40	0.75
Fe	41.11	40.01	54.67	49.23
S	—	—	0.74	0.65
SiO_2	8.98	14.64	6.68	8.72
Al_2O_3	3.41	3.10	0.45	2.63
CaO	—	—	0.46	0.30
O, CO_2, Etc.	—	—	23.43	21.10
P	0.045	0.063	0.038	0.08
H_2O	13.65	14.13	13.70	10.30

TABLE IV (Continued)

ESTIMATED CHEMICAL COMPOSITION OF RICH SECONDARY COPPER ORES (BLACK COPPER) AT DUCKTOWN

Cu	25.0%
Fe	20.8
S	20.0
SiO_2	13.5
Al_2O_3	2.2
CaO	0.8
CO_2	—
MgO	0.6
MnO	0.1
SO_4	7.6
Zn	0.1
H_2O	8.5
H_2O in SiO_2	0.8

ESTIMATED MINERAL COMPOSITION OF RICH SECONDARY COPPER ORES (BLACK COPPER) AT DUCKTOWN

Pyrrhotite	25.0%
Pyrite and Marcasite	5.0
Chalcopyrite	2.5
Chalcocite (Includes a little Covellite)	27.4
Kaolin	4.0
Chalcanthite	9.0
Melanterite	10.0
Goslarite	0.2
Sulphur	1.0
Gypsum	1.0
Quartz	8.8
Silicates	5.3
Water	0.8

Note: In Table I R. O. Currey reported the Black Copper Ores as Oxides.

Ores of Ducktown Basin

The ores of the Ducktown Basin vary considerably in grade and composition in the various mines. Notably, the Burra Burra, London, East Tennessee, Mary, and Calloway ores are comparatively high in copper, in somewhat narrow pyrrhotitic siliceous veins; while the ores of the Boyd, Eureka, Isabella and Cherokee mines are low in copper but are massive pyrrhotite and pyrite deposits. Sphalerite occurs in varied amounts in each of the two general types of deposits. The ores are practically phosphorus free, and contain but little gold (see Table III).

The eras of metamorphism and ore deposition were followed by a long epoch of erosion and many hundreds of feet of the original formation were eroded away, forming the present structure. It was during the latter part of the period of erosion that the gossan ores were formed, and beneath the gossan ores were the rich "black copper" ores (see Table IV) which graded into the primary ores at the water table level. The black copper ore zone averaged about four feet in thickness, while the gossan ores extended upwards of one hundred feet or more.

At the present time the ores of the Ducktown Basin are being mined for the sulphur, iron and copper content, in the order named in respect to their economic value, for the manufacture of sulphuric acid, iron sinter, copper sulphate and copper fungicides.

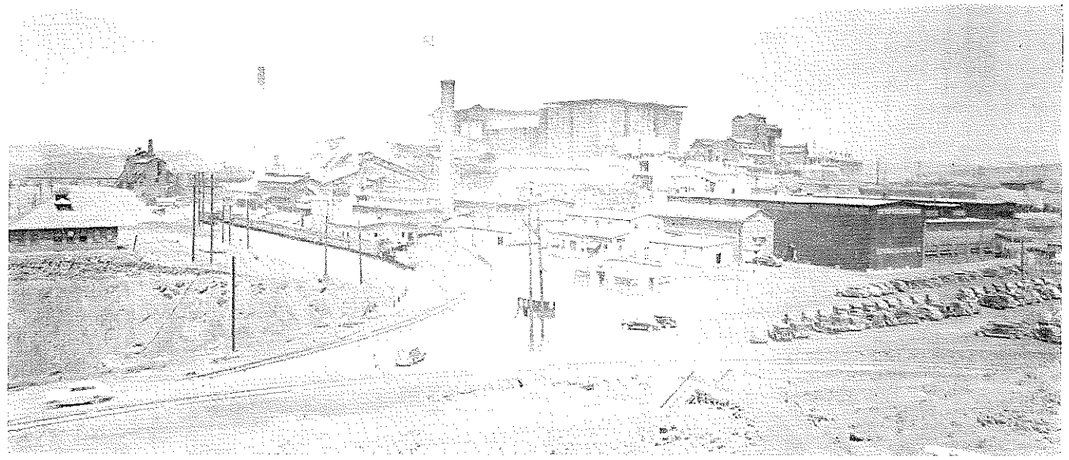
In the early mining of the gossan ores, open cut methods were used; and as the black copper ores were beneath the gossan ore, cribbed shafts were sunk and the black copper was mined in much the same manner as a "deep placer."

The black copper ores were soon depleted and graded in depth to the sulphides of iron and chalcopyrite. It was at this point that an important change took place in the copper grade, as the black copper ores assayed sometimes as high as 44% copper (see Table I). The sulphide ores assayed from less than one per cent to two or three per cent copper.

Smelting

This change in ore brought about the construction of smelting works, which consisted of roasting sheds, blast furnaces, and reverberatory furnaces. The blast furnaces were of the type shown in cut. It took nearly four months to produce metallic copper from the time the ore was first placed on the roast heaps. The smelting schedule was somewhat as shown in Table II. It was not until the year 1866, when a process was invented and patented for forcing air through the molten matte produced by the furnaces, vaporizing the sulphur and producing a blister copper, that a real improvement in the smelting of the copper ores took place. This improvement also stimulated and revived the Ducktown Basin as a whole.

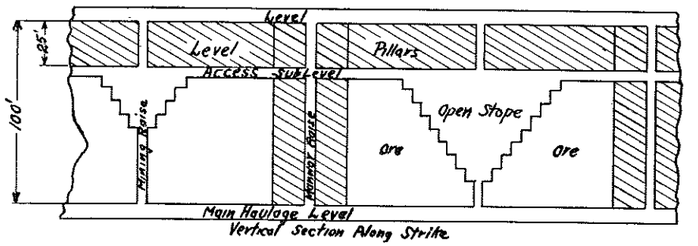
The drop in grade of the ores and the improvement of the smelting process brought forth the necessity for improvement in mining to produce larger tonnages of the low grade copper ores. This meant the sinking of deeper and better shafts, driving of levels and raises, and eventually the process of stoping the ore blocked out in development.



▼ Copper Hill Plant.

Mining Methods

In nearly all of the mines prior to 1912, a system of underhand stoping was employed. Essentially, the method was as follows (see Figure I): Shafts were sunk, usually in the footwall, and crosscuts driven from the shafts to the ore body at 100 foot intervals. At these intersections, drifts were driven along the footwall of the ore. Along the footwall drift and at intervals of 50 to 100 feet, raises were driven from one level to the other.



▼ Figure I—Underhand Stope Method Applied to Narrow & Wide Ore Bodies.

From these raises, leaving 25 to 30 foot level pillars, the ore was underhand stoped in all directions to the level below. The stoped ore, falling into the raise holes, spilled out on the level below and was hand mucked into one ton cars and trammed to the shaft.

As the ore and walls stood very well, supporting timber was not needed. In some cases, where low grade ore or waste was encountered, these portions were left as pillars.

This method, although fairly successful, was far from being a safe, efficient method of mining, and the

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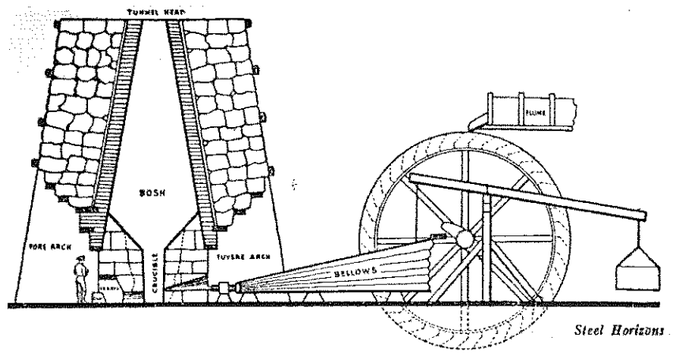


An old-fashioned water wheel. Bellows operated by waterpower were used to produce blast for the smelting furnaces at Ducktown until the wheels were replaced by steam engines.

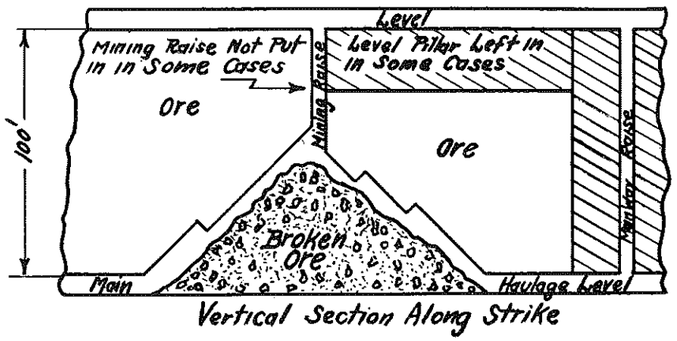
miner was unable to check the back of the stope for scale and balk ground.

The underhand stoping gave way in most of the mines to methods of overhand stoping, for two reasons: One, reduced mining costs and; second, greater safety for the miner.

The open, overhand stoping methods as practiced in the Ducktown Basin mines (see Figure 2) consisted of driving crosscuts to the orebody at intervals of 100 feet, from shafts sunk in or near the footwall, and drifting along the footwall of the orebody. Raises were then driven from one level to the other where needed, for stoping, service manways, and to afford ventilation. Pillars were left around the manway raises. In exceptionally wide veins, crosscuts were driven from the footwall drift at convenient intervals; and in this case the stopes were laid off along these crosscuts from the hanging wall to the footwall, leaving pillars between the stopes.

The stoping consisted of incline slice rounds around the mining raises, blasting the ore down to the floor of the drifts or crosscuts, and hand loading the ore into cars to be trammed to the shaft. Some muck was left in the stope to afford access to the back of the stope, and the same process was repeated until the stope was mined out. This method resembled very much the conventional rill back stope of the present day.

In the Isabella and Mary mines, openings of from 100 to 200 feet in width and over 100 feet in length and 100 to 200 feet in height were not uncommon. This method was possible due to the nature of the ore, which stood very well and needed no support except for the irregularly spaced manway and stope pillars.



▼ Figure 2—Overhand Incline Slice Stope Method Applied to Narrow & Wide Ore Bodies.

Change in Mining Methods Improves Milling Efficiency

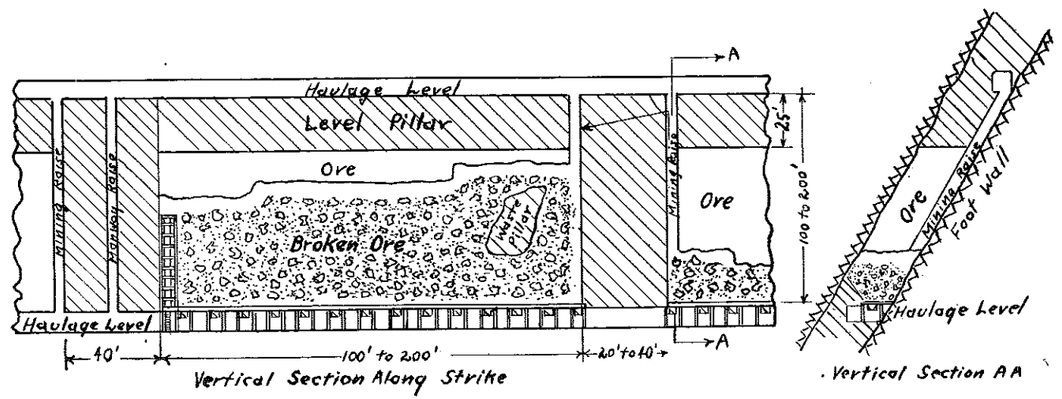
In mines with veins of narrower width, such as the Burra Burra mine, a combination of the open overhand and the conventional shrinkage stope methods were used. These stoping methods were used until the advent of selective flotation milling, in the early twenties. It was then found that the flotation of the sulphide ore was being affected by oxidized ore. The oxidation took place in the stopes, where the ore was broken and allowed to stay for months at a time, exposed to the action of water and air, as in the shrinkage and overhand stoping methods. This problem was solved by the introduction of the sublevel, underhand stoping method, a method by which the ore broken would be trammed and delivered to the flotation mill within a matter of a few days. The milling operation began, almost at once, to function with an excellent increase in recoveries.

In order for a milling process to operate at a high efficiency, it is imperative that the mining department strive to accommodate the mill by delivering to it an ore of uniform characteristics. This may be accomplished by the blending of ores at the mill storage bins, or by selective mining, or by pulling high and low grade stopes in such a ratio that a uniform mill head is obtained. Close supervision and stope sampling is imperative, and the latter method mentioned above is practiced in the Ducktown Basin today, with excellent success.

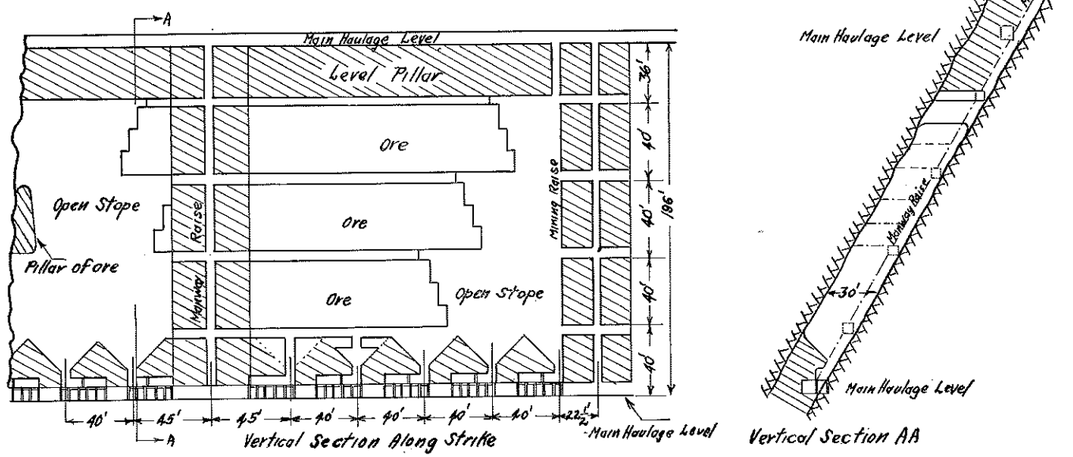
Introduction of Sublevel Underhand Stoping

The introduction of the sublevel underhand stoping method brought forth another development—the use of grizzlies for drawing and tramming the ores from the stopes.

The method of sublevel underhand stoping as practiced in narrow veins of the Ducktown Basin is as follows (See Figure 3): The main levels are spaced 200 feet apart, and the 8x8 drifts along the footwall of the vein are carried to the extent of the orebody. At intervals of 230 feet, 5x5 manway raises are put up from one level to the next. From these raises, at 40 foot intervals, 4x6 sublevels are



▼ Figure 2A—Shrinkage Stope Method Applied to Narrow Ore Body.



▼ Figure 3—Sublevel Underhand Stope Method Applied to Narrow Ore Body.

driven along the footwall. Along the main haulage level, between the manway raises, pull hole or mining raises, at 40 foot intervals, are put up the first sublevel. At one end of the block, one mining raise is extended to the haulage level above and connected to each sublevel. On the main haulage levels, the mining raises are fixed for grizzly loading, and in most cases the draw holes are reamed together on 45° slopes. A refinement in grizzly loading has introduced the use of 25 horsepower slusher drags for loading the ore into the cars.

In mining, the stopes are retreated towards the manways by reaming the mining raise at each sublevel by a series of slabbing rounds around the raises to form benches, and in sequence the benches are drilled and blasted away. The stopes, in this method, are mined from the first sublevel above the reamed draw holes, and so on to the level pillar of the main haulage level above. At no time is a miner, working on a lower sublevel, exposed to the stoping of a sublevel above.

The ore is trammed into six ton cars and hauled by five ton battery motors to a gathering station. From the gathering station, a seven ton battery motor hauls the cars to a rotary car dump at the shaft skip loading storage pocket.

It is seen that with each improvement in mining, an improvement in the safety conditions automatically took place; and it was primarily a safety measure that brought about the latest change in mining in the Ducktown Basin.

Diamond Drill Blasthole Method

The introduction of ring drilling, or diamond drill blasthole stoping, was the outcome of a safety measure to protect the miner in the sublevel underhand stopes, in which the mining bench had a tendency to slough off or fall away. This sloughing was confined primarily to the Boyd Mine orebody, a massive sulphide crossed by numerous joint floors or seams.

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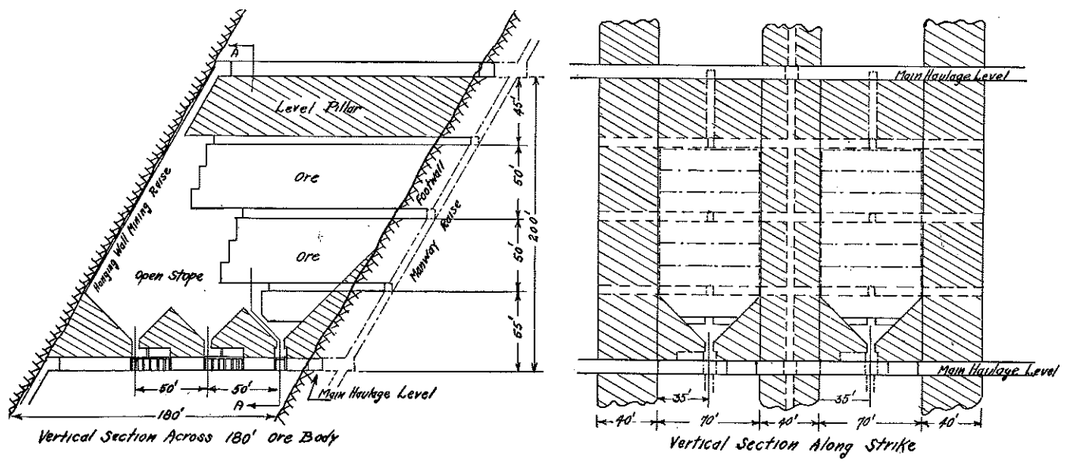
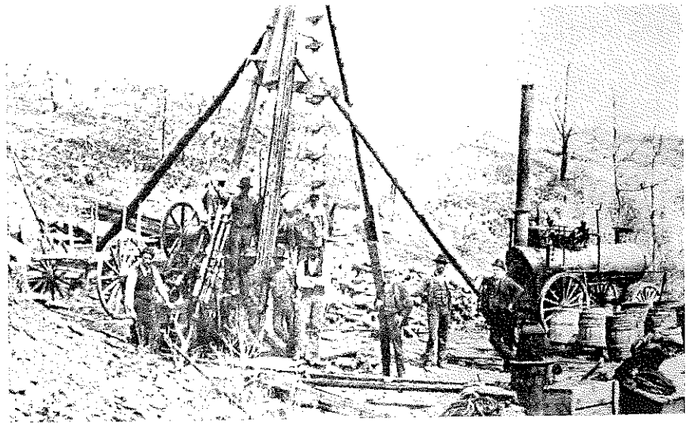


▼ Figure 4—Sublevel Underhand Stope Method Applied to Wide Ore Body.

Although diamond drill blasthole stoping was adopted as a safety measure, it is interesting to note that the method has proven to be very economical in mining some of the Ducktown Basin ores.

The blasthole stoping (Noranda type) is used extensively in the Boyd Mine. Although this method of stoping is comparatively new, there is a definite trend in mines all over the world towards the use of diamond drill blasthole stoping, with reservations and adaptions to their particular problem. So it might be of interest to discuss in detail the practice used in the Boyd Mine.

As previously stated, the Boyd orebody is a massive sulphide, varying in widths up to 300 feet, with steeply dipping foot and hanging walls. The orebody is lenticular, tapering at the extremities to thin, unminable veins. It also tapers and narrows down near the top of the orebody to very irregular shapes. The main Boyd orebody does not reach the surface, and was tapped by a crosscut from the 10th level of the Burra Burra mine; consequently, the Boyd ore has been developed from this level up. At the present time, ore has been blocked out for 1500 feet along strike and to 400 feet above the 10th level.

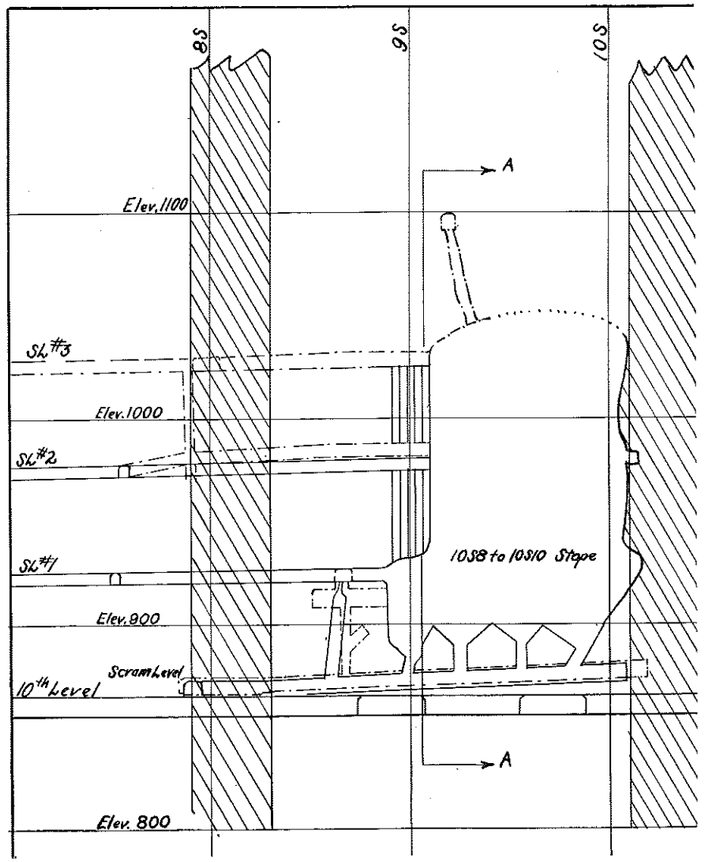


▼ Early Day Prospecting.

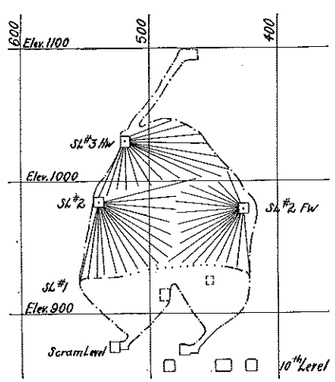
Originally, the stope pillar system for sublevel underhand stoping (see Figure 4) was laid out for 70 foot stopes and 40 foot pilars, but it has been found that stopes of 180 feet between pillars will stand.

The stope shown in Figure 5 was the first stope in which blast hole stoping or ring drilling was practiced on a large scale, and experiments with burdens between slices, burdens at points or bottoms of holes, and charging and blasting of the slice rounds, were carried out. It was found that a burden of 4 feet between slice rounds was the most economical, with a burden at the points of the holes of between 7 and 9 feet.

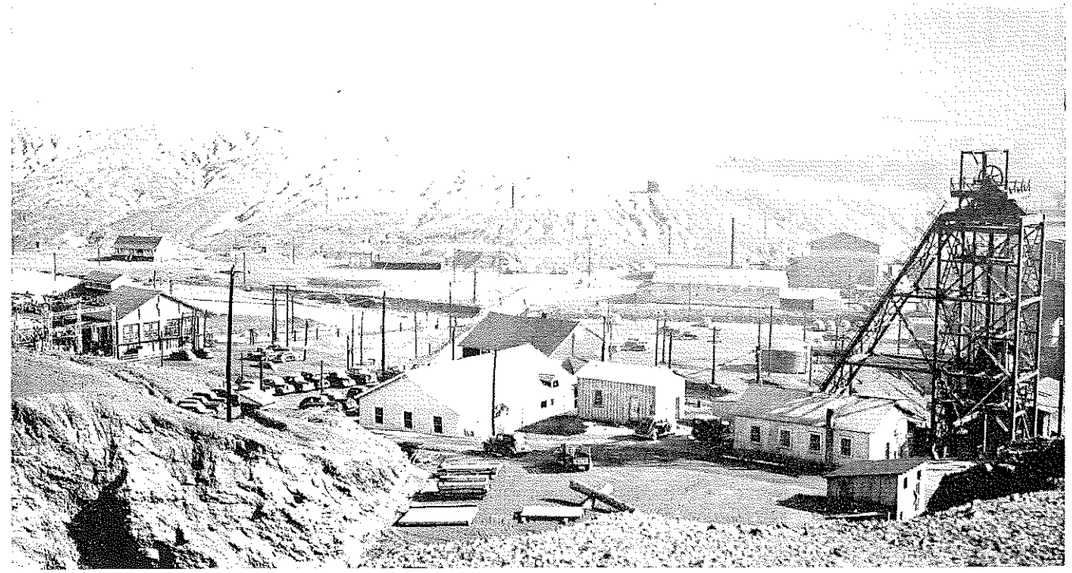
In the early development of the stope, the draw holes into the slusher drifts were reamed in the conventional manner, and the undercutting to the reamed pull holes was done by the conventional sublevel underhand stoping method. It was soon found that



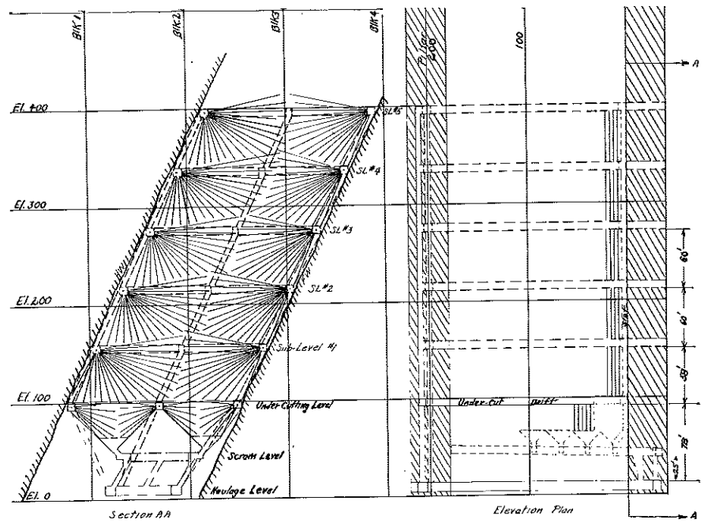
▼ Figure 5—Boyd Mine—Elevation thru Ring Drilling Stope.

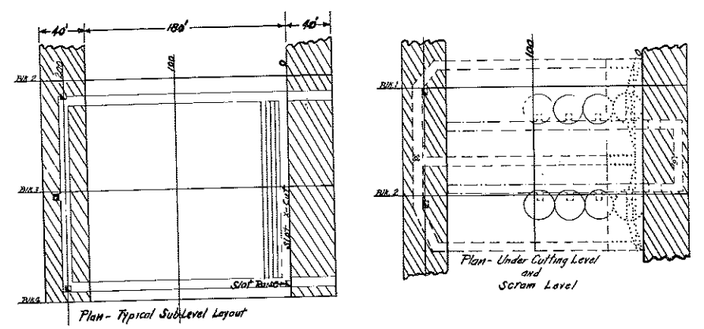


▼ Figure 5A—Boyd Mine—Section AA showing Ring Drilling.



▼ Isabella Shaft and Mine Buildings.





▼ Figure 6—Typical Stope Layout.

the undercut could not be carried more than five or ten feet ahead of the slice round, because of the falling out of large blocks of ore in the back of the undercut when a slice round was blasted. Since it was not possible to maintain such an interval by sublevel underhand stoping, a method of ring drilling the undercut in slice rounds, not unlike the stope slice round, was devised. It was then that the undercut could be controlled and the falling out of large blocks of ore from the back of the undercut was stopped.

The typical slice round shown in Figure 5 produces approximately 7100 tons of ore, at 2.5—2.65 tons per foot of hole drilled. Drilling is done with Sullivan HS 15 machines using EX, 2 foot change, drill rods and concave plug diamond bits. An average of 127 feet of hole is drilled per man shift.

For blasting, 1¼" x 12" stick, high velocity ammonium gelatin dynamite is used. The loading of the holes is done according to a loading chart corresponding to the slice round drill pattern; about 80% of the feet of hole drilled is loaded. The blasting is done electrically, using one victory cap in each drift attached to primacord arranged to each hole. In long holes, the primacord is placed in the hole to a depth that not more than 30 feet of dynamite is beyond the primacord. This is to insure the proper propagation of the dynamite.

(Continued on page 24)

SIXTEENTH ANNUAL ENGINEERS' DAY AT MINES

APRIL 21-22, 1950

COLORADO SCHOOL OF MINES, GOLDEN COLORADO

Engineers' Day at the *Colorado School of Mines* has been, since its inception in 1927, an important event in the school year. It has provided an opportunity for undergraduates to meet practicing engineers; for engineers to get an idea of what *Mines* has to offer and for potential *Mines* students from the high schools to get acquainted with *Mines* and its methods for training mineral engineers.

The Sixteenth Annual Engineers' Day held on April 21-22, 1950, was the result of months of preparation by a hardworking student committee, who arranged a program of addresses, technical sessions, contests, luncheons, and industrial exhibits measuring up to the same high standard of excellence which has characterized E-Day during the past sixteen years.

Friday, April 21

The E-Day program began officially at 8:30 A.M. in the Steinhauer Field House, when guests were registered and the Exhibit Section was opened to the public.

Exhibit Section

A very popular part of the E-Day celebration was the Exhibit Section which occupied most of the floor space in the Field House. Forty-six industrial, research, and government organizations displayed examples of their products and distributed literature descriptive of their manufacture and uses.

The small scale working models which were exhibited by some firms gave visitors a good idea of the performance that might be expected from full size equipment.

A most interesting process model was that of an open hearth steel manufacturing unit which was displayed by the Colorado Fuel and Iron Corporation. This tiny model was a perfect replica of an actual unit in operation at C. F. and I.'s steel plant in Pueblo, and, through the use of clever lighting and various moving parts, duplicated the original in everything but size insofar as the eye could see.

Another interesting exhibit by Morse Brothers Machinery Company displayed a working model of a Morse Truline Classifier, actuated by an electric motor. The tiny parts of this model moved in perfect imitation of the original and gave a very clear idea of the principal of mechanical ore classification.

The exhibit of diamond drilling tools by the Christensen Diamond Products Company attracted engineers and hardrock "miners" who were given an opportunity to examine these new tools and discuss their use. Bystanders were amused, however, at the evident disappointment of several lady visitors who had not been prepared for the entirely ungemlike appearance of the industrial diamonds.

The U. S. Army, Corps of Engineers, had an interesting display of scale model bridges and some of the basic infantry weapons. On view were models of a wooden trestle bridge and the famous Bailey bridge. Weapons shown were the calibre 30 light machine gun, the Browning Automatic Rifle, and the "tank-busting" Bazooka.

At 9:30 A.M. directly across from the Field House in an open lot, the George E. Failing Supply Company and the Lane-Wells Corporation cooperated in an exhibition of oil drilling techniques which drew a large crowd. Using a Failing 1500-SS Holemaster portable rotary drill, a crew from the George E. Failing Company drilled a hole approximately thirty feet deep, meanwhile answering many questions about their impressive, truck-mounted rig. Then, with the hole drilled, Lane-Wells experts sunk a short piece of casing and gave a demonstration of gun perforation. This demonstration was repeated at intervals during both days of the celebration.

Many other exhibits equally as interesting as those mentioned were shown in the Field House. There were rock drilling tools, oil field, refining and milling equipment, explosives and detonating hook-ups, laboratory ceramics and many more.

The exhibitors (listed below) deserve a great deal of credit for the excellence of their displays and for their willingness to cooperate with *Mines:*

Abrams Aerial Survey Corp.; Allen Bearings Co.; American LaFrance Foamite Corp.; Baker Oil Tools; Black, Sivalls and Bryson, Inc.; Card Iron Works; Carter Oil Co.; Christensen Diamond Products Co.; Colorado Builders' Supply Co.; Colorado Iron Works Co.; Coors Porcelain Co.; Denver Fire Clay Co.; E. I. duPont de Nemours & Co., Inc.; Eastman Oil Well Survey Co.; Gardner-Denver Co.; The Geolograph Co.; George E. Failing Supply Co.; General Electric Co.; Independent Pneumatic Tool Co.; Ingersoll-Rand Co.; International Cementers, Inc.; J. J. Monaghan, Inc.; Joy Mfg. Co.; Landes, Zachary & Peterson; Lane-Wells Co.; Lufkin Foundry and Machine Co.; Mine Safety Appliances Co.; Morse Bros. Machinery Co.; Oil Well Supply Co.; Peterson Co.; S. M. Jones Co.; Skilsaw, Inc.; The Colorado Fuel & Iron Corp.; The Mine & Smelter Supply Co.; The National Fuse & Powder Co.; The Stearns-Roger Mfg. Co.; The Texas Co.; Univ. of Denver, Bureau of Industrial Research; U. S. Army, Corps of Engineers; U. S. Bureau of Mines; U. S. Bureau of Reclamation; U. S. Geological Survey; Vulcan Iron Works; Western Machinery Co.; Worthington Pump & Machinery Corp.

Fire-Fighting Demonstration

At 8:30 A.M. the American La France Foamite Corporation staged a spectacular fire-fighting demonstration which showed the effectiveness of modern fire-fighting equipment. In an open place between the Field House and the Physics Building, American LaFrance experts quickly extinguished small gas fires using various types of small portable equipment. Then gasoline was poured into a large, water-filled pit which had been dug for the demonstration. Firemen ignited the gas and then, using a water spray and pumping truck, extinguished the fire in about six minutes. Gasoline was then poured in a second time and ignited and the firemen attacked the forty foot flames with Foamite. The heavy, milky, liquid smothered the fire in a matter of seconds and the spectators were properly impressed.

Principal Address

The speaker of the day was Mr. Paul V. Keyser, well known petroleum engineer and head of Socony-Vacuum Laboratories' lubricating department. Mr. Keyser spoke at the General Assembly in the Golden Theatre at 10:30 A.M. to a capacity audience.

Title of his address was, "The Changing Status of the Engineer in Industry and Our Democratic Society." The main theme in Mr. Keyser's speech was the idea that the engineer must do more than that which is merely required of him. The speaker pointed out that there is increasing need for men with engineering training and the engineer's way of thinking in municipal and governmental affairs as well as in industrial management.

"The engineer has not lived up to the challenge presented to him," said Mr. Keyser and he went on to point out the three prevalent faults which tend to prevent the engineer from assuming his proper importance in society. Engineers, according to the speaker, are prone to become "complacent and professionally introspective" and to "put methods and means before ends."

The speaker concluded with a seven-point program for the young engineer who wants to attain real prominence in his profession: "1. Decide upon an objective in life. 2. Force yourself to deal with people who are not your professional associates. 3. Every day do something foreign to your normal routine. 4. Continue your education, never stop learning. 5. Participate in civic affairs. 6. Learn how to express yourself. 7. Practice self-appraisal."

Mr. Keyser's ease of manner, his excellent delivery, and the interest of his subject combined to make his address highly enjoyable and informative.

Presentation of Awards

Following the address by Mr. Keyser, was the presentation of awards to outstanding *Mines* students.

Mr. M. L. Robertson, President of the Colorado Engineering Council, presented that organization's silver medal for the Outstanding Senior Engineer to Charles W. Irish. Certificates of Merit were given to the runners-up for this honor, John R. Weyler, Martin S. French and Hubert E. Berninghausen.

Named as the Outstanding Sophomore by Sigma Gamma Epsilon was Lloyd Best who received an award of twenty dollars.

Leon E. Borgman was given a suitably inscribed slide rule as the Outstanding Freshman by Tau Beta Pi.

The technical paper awards were sponsored by Kendrick-Bellamy Co., Fred M. Manning Drilling Co., Inc., and proceeds from the E-Day Program Booklet.

First prize of fifty dollars went to John H. Bassarear for his paper on Taconites. Second prize winners were Robert D. Turley, who wrote on the origin of geodes and Robert N. Hendry, whose paper described a system of gravity mucking. Hendry received thirty dollars and Turley was given a Brunton compass. The twenty dollar third prize went to Stewart Chuher, who wrote on aerial magnetometer surveying.

S. S. G. Luncheon

At noon on Friday, the Student Society of Geophysicists gave a luncheon at the Holland House in Golden. Luncheon guests heard an excellent address by Dr. Thomas C. Poulter, Associate Director of Research, Stanford Research Institute.

Assembly for High School Students

At 1:00 P.M. approximately 150 high school students assembled in the Mining Building where members of the *Mines* faculty briefed them on the degrees offered at *Mines* and at other Colorado schools. Principal address at this assembly was given by Professor Paul Keating who spoke amusingly and to the point on the subject, "What Is Engineering?"

The assembly concluded with the awarding of *Mines* scholarships to the three high-scoring high school students in the examination which had been given earlier in the day. They are Lewis T. Reynolds, South High; Ronald K. June, East High; and Daniel W. Richardson, Jr., Wheat Ridge High.

Technical Sessions

Beginning at 2:00 P.M. and continuing throughout the rest of the afternoon an excellent program of technical sessions included addresses, motion pictures and discussion periods covering every major aspect of the minerals industry.

Petroleum Exploration and Exploitation

The first speaker in this section was Mr. P. E. Fitzgerald of Dowell, Inc., whose subject was, "The Use of Plastics in Drilling and Production of Modern Day Oil Fields." Following Mr. Fitzgerald, Dr. Theodore A. Link, a Canadian consulting geologist described, with the aid of slides, the "Theory of Transgressive and Regressive Reef (Biotherm) Development and Origin of Oil."

Mining and Mineral Exploration

"The Mining Industry and the Geologist" was the subject chosen by Dr. Rodgers Peale, consulting geologist and first speaker of this session. After giving a general picture of the mining industry as it is today, Mr. Peale drew from his experience and offered some good advice to the young geologist.

Following Mr. Peale, Mr. O. W. Bilharz, president of the Bilharz Mining Co., Inc., spoke on "Mining in the Tri-State Area." Mr. Bilharz told of some of the things that had happened to him during his long experience as a mining engineer. He described the difficulties he had encountered getting started in mining and pointed out some of the ways of overcoming the ordinary difficulties which a mining engineer meets. This down-to-earth narrative made interesting listening and was thoroughly enjoyed by the audience.

Coal Mining Engineering

The first speaker in this session was Mr. G. R. Harris, president of the Hayden Coal Co., who discussed some "Practical Problems of Coal Mining."

A film shown through the courtesy of the Joy Mfg. Co., provided the second part of this session. Entitled "Trackless Coal Mining," the film showed various pieces of Joy automatic coal mining equipment being applied under different mine conditions.

Metallurgical Engineering

The first paper to be read in this session was by Dr. D. Gordon Craig, Mill Chief of the New Jersey Zinc Plant. Mr. Craig's paper was entitled, "General Metallurgical Problems as Encountered at the Gilman Plant."

Following Mr. Craig, Mr. Thomas P. Fahey of the American Smelting and Refining Company spoke on "The Smelting of Concentrates."

Petroleum Refining Engineering

"Fluid Catalytic Cracking and General Processes" was the title of the first paper in this session. It was prepared and read by Mr. Wyatt L. Walker of the Continental Oil Co.

Second speaker was Mr. J. H. Dea, Chief Lubrication Engineer, The Texas Co., who described "The Manufacturing of Greases and Their Uses."

Geophysical Engineering

A paper entitled, "Geophysics and Geophysical Exploration for Petroleum" began this session. It was prepared and read by Dr. M. M. Slotnick of the Humble Oil and Refining Co.

Second speaker was Mr. H. Wayne Hoylman of the Fairchild Aerial Survey Co. Mr. Hoylman presented a very interesting paper entitled "The Airborne Magnetometer and Aerial Prospecting."

Aerial Surveying

Mr. Talbert Abrams, President, Abrams Aerial Survey Corp. was the speaker at this session. Mr. Abrams, one of the pioneers in the field of aerial surveying, described the development of the techniques and some of the work being done in the field.

Listeners were particularly interested in the speaker's views on world economics backed up by his travels in sixty-four countries since the war.

(Continued on page 24)

THE FUNCTION OF PETROLEUM ENGINEERING DEPARTMENTS AND THEIR RELATION TO MANAGEMENT

By
D. V. CARTER*

(Continued from April, 1950)

Important matters which greatly affect morale and the effectiveness of an organization and its subdivisions-interdepartmental relationships are:

(1) Managerial leadership
(2) Managerial fairness
(3) Employee fairness.

Managerial Leadership

is the crucial element in any organization or subdivision of any organization,—for example: a department. In the beginning management was responsible for the founding of an enterprise. Its fortunes thereafter were directly related to the skill and ability of its leaders. Management, in order to cope with the many problems, not only to maintain and continue its existence in business, had to avail itself of every legitimate means and of every opportunity to expand its activity to promote its growth. Growth and expansion of an individual's business, a partnership, or a corporation or company, is not a happen-so. It is true that fortunate "breaks" or opportunities present themselves, sometimes, when least expected. Likewise over a period of time we all know undesirable events, conditions and circumstances tend to balance out the fortuitous opportunities, which means that over a period of time these cyclic effects trend toward an algebraic zero. Therefore we can assign the reason for the existence, and perhaps in most cases the growth, of a commercial enterprise to be due to sheer ability in the broadest sense. Sheer ability as used herein constitutes all the attributes necessary to the internal good health of a business plus good relationship with all it has dealings with and the performance of a public service. It is a fundamental premise that executives, management and department heads possess self-starting ability.

As time goes on new talent must be supplied for continued business health. Personnel depreciation is as real as the depreciation of physical facilities or the depletion of an oil and gas reservoir. It could be said then that managerial leadership must perpetuate itself if the business in question is to continue its existence. Managerial leadership can very well be compared to the mainspring of a watch—it must be elastic but it must not snap.

Managerial Fairness

may be defined as the commercial application of the "Golden Rule" applied with business acumen. Managerial fairness not only includes the creation of policy within and without the company and its public relationship, but what we are here concerned with—the fair treatment of its employees. To achieve a high degree of managerial fairness is no mean accomplishment. On it depends, to a great extent, the morale of its employees. In the broadest sense, it is the cornerstone of satisfactory employer-employee relationship.

Employee fairness is an equal responsibility to managerial fairness. Here again employee fairness may be defined as the "Golden Rule" applied with business acumen and common sense. The thoughtful and considerate technical employee does realize that the proper employment of management, technical skill and capital with the aid of others is necessary if they are to gain a satisfactory livelihood and the public to be benefited. Under our free enterprise system promotion is dear to the hearts of all participants of their organizations. Again it can be said that promotion throughout an organization is our free enterprise way of replacing personnel depreciation and for staying abreast of expansion needs.

Of late years all of us have been aware of the attention focused on the matter of fair compensation. It affects all from the top "boss" to the latest and most inexperienced employee. Its solution is always the application of the "Golden Rule." All concerned should apply the "Golden Rule" in their thinking and consideration of this pertinent matter. We must always keep in mind that only so much is available for maintaining the continuance of the establishment in business, for capital rent—dividends and adequate compensation for the efforts of all the employees, management included. The same holds true for the man in business for himself. Management, like all employees, has a real boss—the stockholders. Management has to realistically "make good" just as employees do. Managements are competitive as are employees. Thus we see that in reality there is no difference in principle between the obligations of management and employees—they must both make good if they are all to continue in business.

The writer has long held to the opinion that the employer and the prospective engineer employee should consider and examine each other on a fifty-fifty basis. Managements of progressive organizations realize that employment of engineers is strictly a mutual affair. The prospective technical employee considers the company's reputation for fairness in dealing with promotion, his opinion of its management, particularly as it affects its ability to stay in business and provide promotional opportunities. The matter of compensation and salaries is important but not paramount. The engineer and prospective engineer-employee are looking very hard at managerial policy concerning supervisory and work relationship as well as adequate dual remuneration as discussed before.

In the beginning man was in business for himself, consequently he was an independent thinker from necessity for his existence. Then it is only natural that as mass effort has grown into what we now know as the corporate form of business organization, differences should arise. This brings us to the point emphasized earlier in this paper that a very important part of the technical engineer's compensation comes in the form of accomplishment—as it does with anyone who takes pride in his skill of accomplishment.

In order to provide a satisfactory plan for both employer and engineer, the minimum of supervisory control and the maximum of freedom in carrying on his work is desirable. It is desirable because man inherently is freedom loving. Under these conditions the able survive and the inefficient and those lacking initiative will prove to be only mediocre or perhaps fail. Adequate instruction, advice and support are requisites to the smooth operation of any well managed petroleum engineering department. How-

(Continued on page 30)

* Chief Petroleum Engineer, Magnolia Petroleum Company.

Presented before the joint meeting of Texas Section, A.I.M.M.E. at College Station, Texas, December, 1947, and published by permission.

THE GEOLOGICAL MUSEUM AT "MINES"

By J. HARLAN JOHNSON, '23
Professor of Geology and Curator of the Geological Museum Colorado School of Mines

Period May to November 1949

Interest in the museum is continuing steadily. The number of visitors is increasing, while students are using it more and more.

In the early spring, the museum was able to purchase several tall exhibition cases. This enabled some additional exhibits to be put on display.

New Exhibits

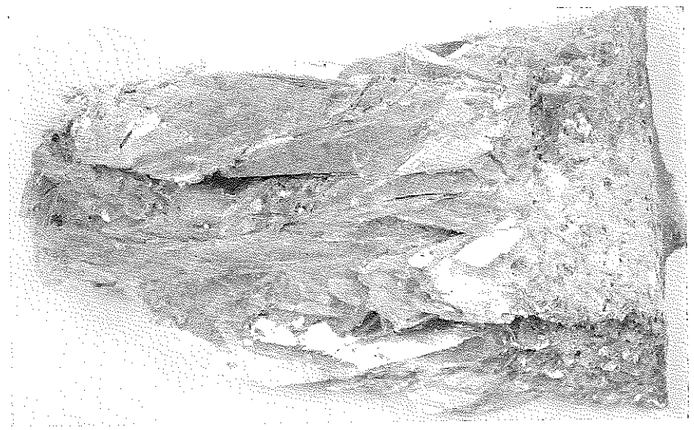
During the period a number of new exhibits were prepared and placed on display. These include:

1. A selected series of specimens from the Maguire Ore Collection, purchased for the museum through the assistance of H. J. Van der Veer, '30.
2. A suite of minerals, ores, and rocks from the Braden Copper Company's Teniente Mine, at Sewell, Rancagua, Chile.
3. A suite of specimens illustrating structural features of the Hartz Mountain ore deposits of Germany.
4. The Randall Mineral Collection, one of the historical private mineral collections of Colorado, now loaned to the Museum.
5. Additions to the series of exhibits of the minerals of the important metals. These exhibits contain examples of all the common minerals of the metal and some of the rarer ones. There are several specimens of the more common or important mineral to show different colors, form, etc. The latest additions to this series are those for gold, silver and aluminum.

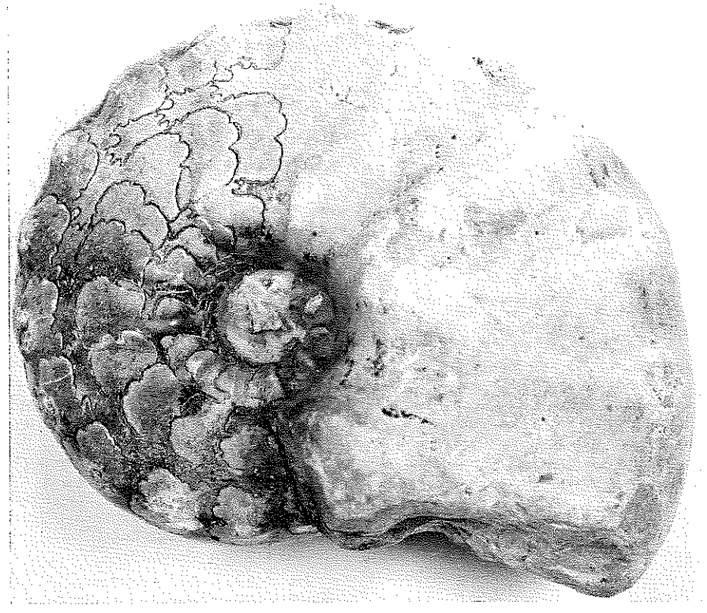
The curator spent the summer of 1949 in Japan, Okinawa, Saipan, Tinean and Guam. He visited a number of Universities and several museums in Japan.

Gifts Received May to November, 1949

A number of gifts were received during this period. They are listed below. We are glad of this opportunity to publicly acknowledge these gifts and to thank the donors. Such gifts are of great assistance as the museum depends largely on them for the growth and improvement of its collections.



▼ Figure 1—Synthetic Mica from the Colorado School of Mines Research Laboratory.



▼ Figure 2—Cretaceous Ammonite from Peru. Gift from Isaac Tafur, ex-'49.

May 1949

Wm. F. Dukes '50—Chrysocolla from North Table Mountain, Golden, Colorado.
Virgile Easterwood '49—Gypsum from Carlsbad, New Mexico.
W. W. Scott '49—Calcite from Carlsbad, New Mexico.
International Minerals and Chemical Corporation—a suite of materials from their Carlsbad Plant.
Andrew Wolikowski '50—Fossil leaves from near Coal City, Illinois.

June 1949

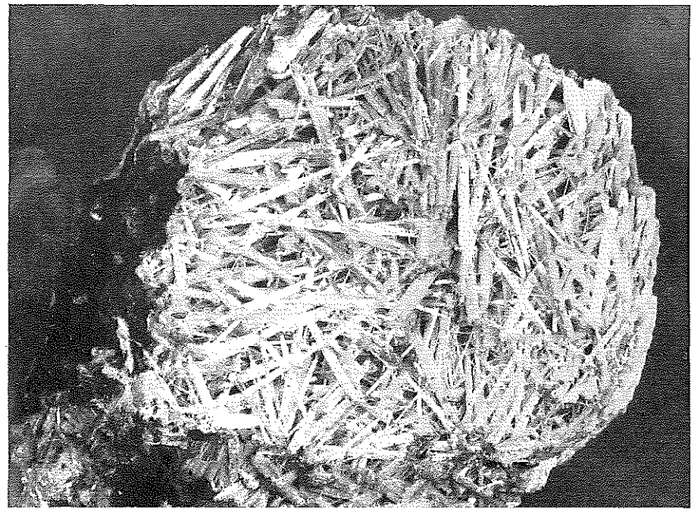
E. H. Stevens, ex. Faculty—Tetrahedrite from Sonora, Mexico.
Dr. L. W. LeRoy '33—Collection of type specimens illustrating his article on "Voidal concretions in western Venezuela."
Edward W. Cowperthwaite '13—Native gold from Smuggler Union Mine, Telluride, Colorado, and native copper and silver from Michigan.

July to September 1949

G. E. Woodward '33—Cinnabar from Nevada.
C. W. Campbell '47—A suite of museum specimens from the Charcas District, Mexico.
S. Power Warren '13—Fossil shark teeth from Florida.
R. C. Holmer '38 — Schroeckingrite, Wamsutter, Wyoming.
C. N. Bell II of Golden, Colorado—Native gold in quartz from the King Lease, Inc., Camp Bird Mine, (W-254 Stope W.-2 level) Ouray, Colorado.
George His '52—Calcite crystals—Page County, Virginia.
Wm. F. Dukes '50—Calcite and selenite from El Paso County, Colorado.

October 1949

Myron Kiess '25—Schroeckingerite from Wamsutter, Sweetwater Company, Wyoming.
Don Kochersperger '43 — Placer tin from Chorolque, Boliva.



▼ Cerussite crystals—Tasmania.

J. W. Hill '49—Asphalt etc. from Kansas Oil Pools.

Kenneth B. Larson '51—Collection of vanadium minerals from Peru.

R. C. Holmer '38—Windkanter and fossil wood from 40 miles north of Wamsutter, Wyoming.

F. L. Michaels '25—Slab of Ordivician fossils from Covington, Kentucky.

Paul A. Head '51—A polished slab of silicified wood surrounded by algae from Eden Valley, Wyoming.

Frank Weishaupl '49—Blue Halite from Carlsbad, New Mexico.

Dr. Warren O. Thompson—University of Colorado—Eocene algal limestone from near Springville, Utah.

E. M. Paris '40—Vanadium minerals from S. W. Colorado.

Morgan J. Davis of the Humble Oil and Refining Company, Houston, Texas—A group of museum specimen of crystallized gypsum with sand inclusions from Kenedy Company, Texas.

J. Harlan Johnson '23—Shells from the Marianas Islands.

November 1949

Dr. E. H. Stewens of Rapid City, South Dakota—Pierre fossils from South Dakota.

Edward M. Warren '50—Nahcolite from the Bureau of Mines Oil Shale plant west of Rifle, Colorado.

W. P. Hewitt of Santa Eulalia, Mexico—Ore specimens from Chihuahua.

Radlenath Segal graduate student at C.S.M.—a fossil tree trunk from the Somerset Mine of the Calumet Fuel Company, through the courtesy of the mine superintendent, Mr. S. C. Harvey.

Museum Needs

Minerals from Mexico, Central America, Idaho, Arkansas and Georgia are very poorly represented in our collection, as are minerals of antimony and cadmium.

Fossils of Cambrian, Silurian, Mississippian, Permian, Triassic, Jurassic and Eocene are badly needed, both for our study collections and for exhibits.

Fossil trilobites, sponges, graptolites, and stronatopora of any age from any locality.

CENTURY OF MINING DUCK TOWN BASIN

(Continued from page 19)

The drilling and blasting of a complete slice round produces about 300 tons of ore per man shift. In the primary breaking, about 0.18 pounds of dynamite is used per ton of ore broken. The secondary breaking, in the slusher drifts, consumes about 0.35 pounds of dynamite per ton of ore trammed.

In the future it is planned to develop the stopes for diamond drill blast hole stoping along the lines of the typical pattern shown in Figure 6. The mining of a stope with a longitudinal length of 180 feet between pillars and with widths up to 300 feet is possible, because of the fairly strong foot and hanging walls and the development of the controlled undercut.

The history of the 100 years of mining in the Ducktown Basin has shown the ultimate faith of mine owners and managers in the wealth of the ores of the Basin, even during lean years. Their goal has always been to improve working conditions in the mines and plants, and efficiency of operations. This is true today, with the completion of the new circular Boyd manway shaft this past year. This year, the sinking of the vertical circular Central Ore Hoisting Shaft has been started. Through this shaft, in years to come, all of the ores mined in the Basin will be hoisted.

Acknowledgments

There is not space or time, in this paper, to discuss the many improvements in mining and plant operations; so, in conclusion, acknowledgments are in order for information and data gathered from Professional Paper 139, Geology and Ore Deposits, Ducktown Mining District, Tennessee, by W. H. Emmons and F. B. Laney; and "Ducktown Back in Raht's Time," by R. E. Barclay. Also, appreciation is extended to the management of the Tennessee Copper Company for permission to publish this paper.

ENGINEERS' DAY

(Continued from page 21)

Barb Dance

Friday's activities came to a close with a dance sponsored by the Barb Organization which was held at 9:00 P.M. in Guggenheim Hall. It was a fitting close to a very enjoyable day.

Saturday, April 22

The E-Day program for Saturday began at 9:00 A.M. with the reopening of the Exhibit Section in the Field House. The day was warm and fair, as had been the previous day, and a large crowd was gathered to watch the Drilling and Mucking contests which began at 9:30 A.M.

Drilling Contest

Eight two-man teams sponsored by student organizations competed in the drilling contest which was sponsored by Theta Tau. Using equipment loaned by the Worthington Pump and Machinery Corp., the students made the rock dust fly and honeycombed a heavy boulder with holes. A team composed of Richard Preston and Robert Shipley, representing Sigma Pi Epsilon, carried off drilling honors and a ten dollar prize.

Mucking Contest

Seven husky students competed in the mucking contest sponsored by the *Mines* Chapter of A.I.M.E. The object was to load a 20 cubic foot ore car, push it down a length of track, and back to the starting point and dump it—all at break-neck speed. It was a nip and tuck battle but Bob Shipley once again showed his prowess by winning the ten dollar prize with a time of four minutes and twenty-three seconds — and that was going some!

Drawings for door prizes ended the activities for the day and there were many prizes ranging from hair cuts to shrimp dinners—all donated by the Golden merchants.

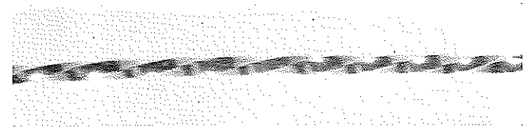
At 4:30 P.M. the doors of the Field House closed and the Sixteenth

(Continued on page 39)

DUCTILE CAST IRON

A New Engineering Material☆

By WILLIAM H. SPARR, '39
Pittsburgh Technical Section
Development & Research Division
The International Nickel Co., Inc.



▼ Photograph shows the extreme ductility of the spheroidal graphite cast iron. Shown is a bar of ductile iron cut from the wall of an eight inch diameter ductile cast iron pipe. It has been twisted cold through 1260 degrees.

Although gray iron is a complicated alloy, it may be considered simply as being made up of graphite flakes in a ferrous background, and it is commonly referred to as graphite flakes dispersed throughout a "steel" matrix. That the latent properties of this matrix are altered extensively by the graphite present is evident in a comparison of the properties of gray cast iron and cast steel. The properties of the gray iron are dependent on the structure, not only of the matrix, but also of the graphite; and for a given matrix structure, the properties of the iron may vary rather widely with the amount, distribution, size, and shape of the graphite.

Graphite Structure—Flake Graphite

While graphite is generally considered to enhance certain properties, including machinability, damping capacity, thermal shock resistance, and wear resistance, it has always been considered to effect a great depreciation of the ductility, toughness, and strength potential of the matrix. This is due primarily to the shape of the graphite, which crystallizes in the form of flat plates distorted by the matrix forming simultaneously. Such shape not only constitutes a severe notch effect on the matrix wherever it occurs, but from the strength standpoint, is equivalent to a crack. Thus a potential tensile strength of a pearlitic matrix of perhaps 125,000 psi may be discounted by as much as 75% by the presence of graphite flakes to a level in the vicinity of 30,000 psi depending, of course, on the size and distribution of the flakes and the amount of graphite present. The discount of the potential toughness and ductility of the matrix is far greater; when values for elongation can be found for gray iron, they are seldom seen to exceed a scarcely detectable 0.50%, and control of the flake structure has little effect towards reducing this tremendous discount.

Graphite flake structure similarly affects the elasticity and stiffness of the matrix, which would follow Hooke's law of proportionality of stress to strain at a value of 30 million psi were it not for the graphite flakes. They not only discount the potential value of the matrix to about 20 million for a small amount of graphite (low carbon iron) randomly distributed and to as low as about 10 million psi for a large amount of graphite (high carbon iron), but they also cause the apparent modulus to decrease steadily with increasing strain. Because of this effect on the stress-strain relationship, there is no apparent yield strength measurable in flake graphite iron.

The amount of flake graphite present has a pronounced effect on the discount of the matrix potential. This is expressed in practice by the use of larger amounts of steel in the furnace charge in an attempt to reduce the total carbon in the iron. However, there is a limit from the process standpoint to this means of attempting to approach the level of properties latent in the matrix.

The distribution of the graphite flakes throughout the matrix has considerable effect on the discount of the matrix potential. Dendritic graphite forms a continuous network and thus a direct line of weakness across a section along which fracture can proceed easily, scarcely hindered by the high strength matrix. The distribution is influenced by several factors, but it can be most practically and simply controlled by inoculation to provide a random distribution of the flakes. This means of control becomes increasingly effective as the amount of graphite present is reduced, but its influence in reducing the effect of the graphite flakes on the matrix reaches a limit at random distribution.

The size of the graphite flakes also affects the discount of the matrix potential; and although this is controllable to some extent by the amount of graphite present, it is more closely associated with cooling rates, which in castings is usually fixed by section size. The lower order of properties towards the center of heavy sections of gray iron, associated with the larger flakes at the slower cooling rates, is well known. The extent of this effect is complicated by the influence of mass on the matrix itself.

The shape of the graphite in gray iron, as mentioned earlier, is primarily responsible for the depreciation of the potential properties in the matrix. This basal plane shape is one for which the ratio of surface area to unit volume is very large and thus exceedingly detrimental to the continuity and therefore the mechanical properties of the matrix. Consequently, control of the shape of the graphite to one of a lower ratio of surface area to unit volume would seem effective and desirable to more nearly approach the potential of the matrix. Heretofore this is about the only factor influencing the properties of gray iron over which no predictable nor effective control has been possible.

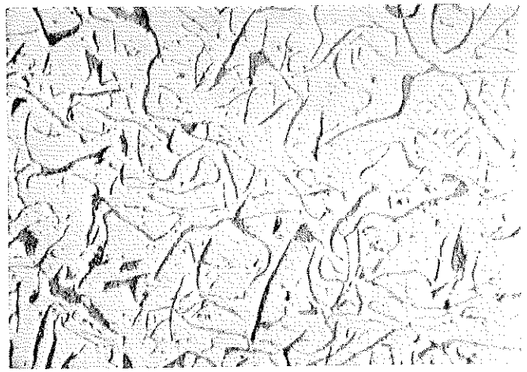
Spheroidal Graphite

However, at the annual meeting of the American Foundrymen's Society in Philadelphia on May 7, 1948, H. Morrogh of the British Cast Iron Research Association revealed in his paper entitled "Production of Nodular Structure in Cast Iron" that cast iron with the graphite in the spheruliticform could be obtained under limited conditions by treatment with cerium. In the discussion of this paper by T. H. Wickenden of The International Nickel Company, Inc., it was announced that a new cast engineering material[1] possessing high strength, high elastic modulus, and a substantial amount of ductility had been developed and that the process for making this new material is based on the introduction into the iron of a small but

☆ Talk before the Baltimore and York Chapters of the American Society for Metals, Waynesboro, Pa., October 12, 1949.

[1]Patented by The International Nickel Company, Inc., U.S. Patents Nos. 2,485,760 and 2,485,761.

▼A—As melted and cast, without processing.



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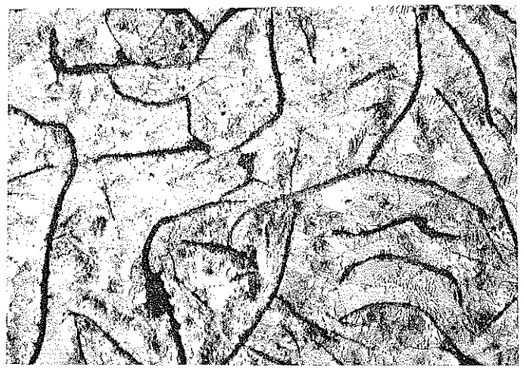

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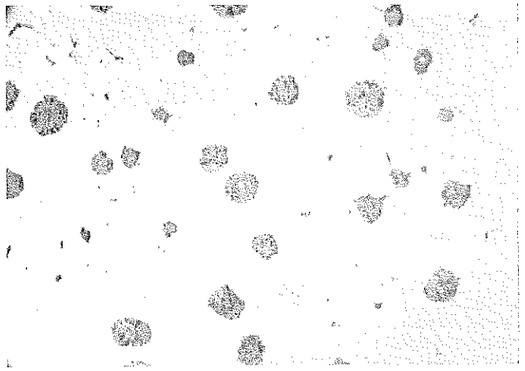
▼B—As melted, processed and cast.



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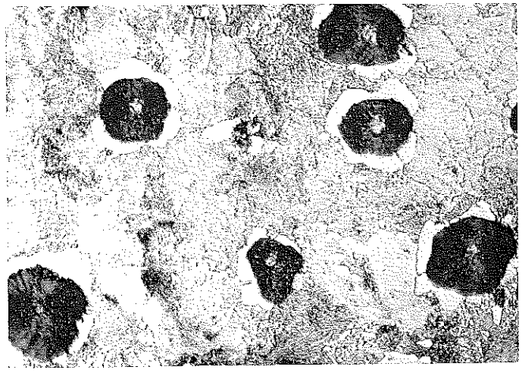

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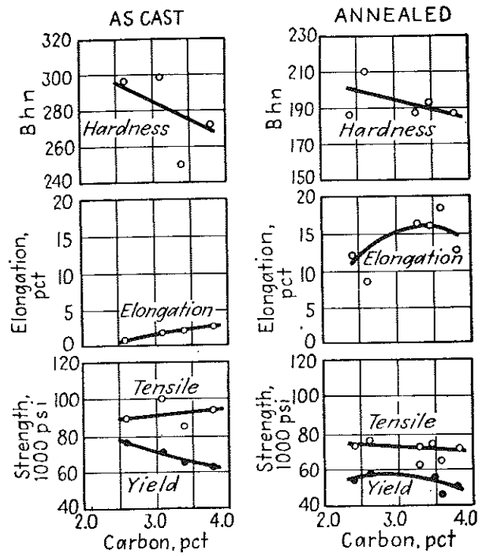
▼Figure 1—Transformation of gray iron to ductile cast iron, showing the change of graphite from flake to spheroid.

effective amount of magnesium or magnesium containing alloy, an effective addition of which produces a conversion of graphite to a spheroidal form in the initial as-cast condition resulting in an increase in strength to a value several times that of the base iron. This was a result of a number of years of basic studies on cast iron in the laboratory of The International Nickel Company, Inc., out of which came the discovery of means whereby deep-seated changes can be caused in the formation of graphite in cast iron, one of which is its formation wholly in the form of spheroids free from the flake form so familiar in gray iron. An example of this conversion of the graphite from the flake to the spheroidal form is shown in Figure 1 for a heat of high carbon cupola iron, the base chemistry of which is 3.6% carbon and 2.4% silicon. Figure 1 A shows the unetched and etched microstructure of the iron as melted down with the familiar graphite flakes and pearlitic matrix. Figure 1 B is the same iron after processing to transform the graphite to the spheroidal form. These micrographs reveal the as-cast structure without any heat treatment, showing the graphite as dispersed spheroids, each partially sheathed in ferrite in a pearlitic matrix. The mechanical properties corresponding to these structures are shown in Table I.

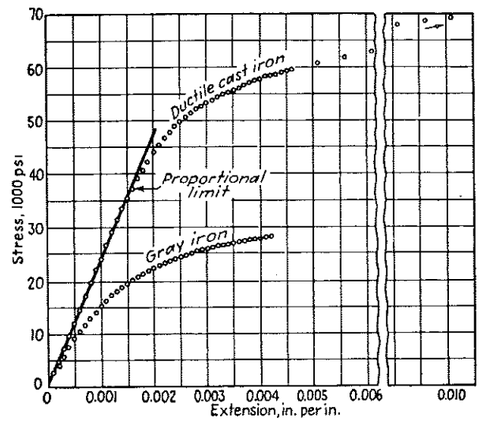
This graphite is definitely not "nodular" as the word is known and used to refer to the form of temper carbon obtained on annealing white iron in the production of malleable. Such temper carbon, resulting from the diffusion and agglomeration of amorphus carbon following the breakdown of iron carbide, is distinctly nodular in appearance as contrasted with the crystalline graphite spheroids of spheroidal carbon cast iron.

Thus with a means of controlling the shape of the graphite to the form of spheroids, the minimum surface area for a given volume is attained, so that the amount and size effects of the graphite, so potent in gray iron, are minimized; and the sharp notches of flake graphite are eliminated. Instead of a continuous or semicontinuous network of graphite, there occurs a complete continuity of the matrix with no easy paths for fracture to follow. Consequently spheroidal graphite Ductile Iron shows a white steely fracture in contrast to the black fracture of nodular graphite black heart malleable, and in contrast to the dull, dark fracture of flake graphite gray iron.

As a result of converting the shape of the graphite from flake to spheroidal, the potential properties of the matrix are much more nearly approached. As an actual example of the effect on the discount of the matrix potential by control of the shape of the graphite from the flake to the spheroidal form, during the development work several years ago in translating the production of Ductile Iron from the laboratory stage to the commercial level in a production foundry which was producing a 3.3% carbon, 2.4% silicon, soft cupola iron of about 25,000 psi tensile strength in light sections, adequate for the washing machine parts being made, some of this iron was taken off and processed, without interfering in any way with normal operations, to produce a spheroidal graphite Ductile Iron which had 75,000 psi tensile strength in 3″ sections with an elongation of 12%.



▼Figure 2—Influence of carbon on mechanical properties of 1" section in as-cast and in annealed condition.



▼Figure 3-A—Comparison of stress-strain curves of plain gray iron (3.45% C, 2.10% Si) and ductile cast iron 3.7% C, 1.8% Si).

The effect of the amount of graphite, when in the spheroidal form, is rather inconsequential, the mechanical properties of Ductile Iron being relatively insensitive to variation in carbon over the range 2.5% to 4.0% and showing excellent values in the medium and high carbon range, as can be seen in *Figure 2*. This lack of sensitivity to the amount of graphite present provides an important advantage from the process viewpoint in that fluidity, castability, and solidification characteristics are all excellent at the higher carbon ranges, near the eutectic. Machinability in this carbon range is also excellent.

As might be expected from the effect on the tensile properties, a similar effect on elasticity and stiffness is found. Spheroidal graphite has so little effect on the modulus of the matrix that there is a straight-line relationship between stress and strain up to high levels of stress, thus enabling the measurement of yield strength in Ductile Iron, as shown in *Figure 3*. The amount of spheroidal graphite has little influence, discounting the matrix modulus of 30 million psi from about 10% (26,500,000 psi) at a carbon level of 2.5% to about 20% (24,600,000 psi) at a carbon level of 3.6%.

Although mass influences the properties of the matrix, which are dependent on structure, grain size, etc., as it does in steel, it also influences the graphite structure in gray iron by increasing the flake size in larger sections and little control can be exercised over this. Spheroidal graphite, however, is influenced very little by mass, and consequently the mass effect in Ductile Iron is almost entirely its influence on the matrix. *Figure 4* shows the influence of section thickness on the mechanical properties of Ductile Iron.

The effect of spheroidal graphite on certain other properties of the matrix are as might be expected, in view of the effect on the mechanical properties. For example, the low damping capacity of the matrix is only moderately increased by the spheroidal

Comparison of Mechanical Properties of Cast Iron Containing (1) Flake and (2) Spheroidal Graphite

Condition	Tensile Strength, Psi	Elong., Pct[1]	Izod-AB[2] Impact, Ft-lb
Flake graphite.....	17,000	<0.2	22
Spheroidal graphite.....	120,000	3.0	97

[1] Measured on 2-in. gage section, 0.505 in. diam.

[2] Modified Izod impact test developed by the International Nickel Co., utilizing an unmachined, unnotched 1.2-in. diam arbitration bar.

Table I

Growth Test Data Obtained at 1600°F.

Type of Material	Graphite Form	Composition, Pct C	Si	Ni	Cr	Growth, Pct Increase in Length	Depth of Oxide Penetration, In.
Gray Iron	Flake	3.5	2.5	....	....	12.1	0.50
Chromium Iron	Flake	3.6	1.9	0.9	1.3	2.8	0.083
Ductile Cast Iron	Spheroidal	3.5	2.4	1.8	.....	2.1	0.026

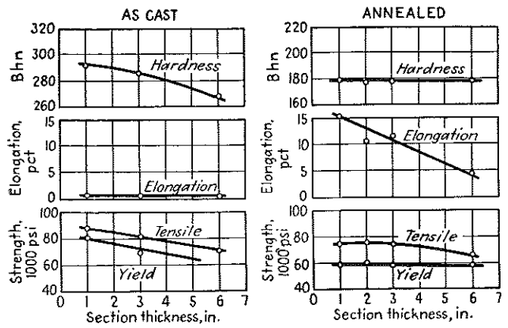
Table II

Range of Properties Obtainable from Ductile Cast Iron, As Influenced by Phosphorus and Manganese Contents. Tests Conducted on 0.505 Tensile Bars.

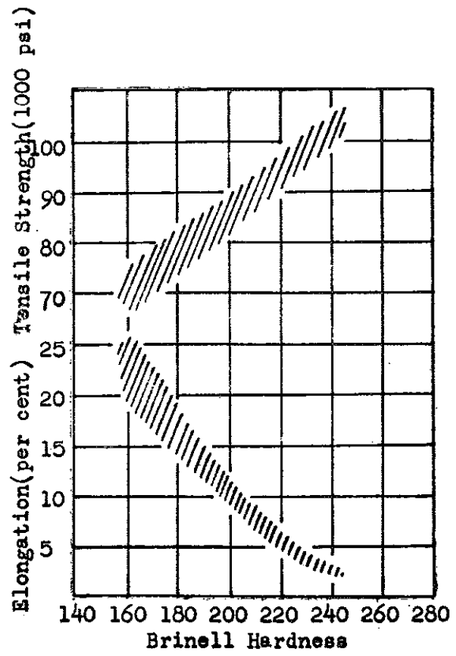
Base Iron Composition	Yield Strength (0.2 pct offset), 1000 Psi	Tensile Strength, 1000 Psi	Elong.,[1] Pct	Bhn
3.2-3.6 C, 1.8-2.5 Si, 0.3 max Mn, 0.05 max P.....	50-60	77-98	5.0-10.0	225-240
Same as above except higher Mn and P.....	75-80	85-90	0.5 min	260-300
3.2-3.6 C, 1.8-2.5 Si, 3.6 Ni, 0.10 Mn, 0.04 max P..	91	120	2.5	310

[1] Measured on 2-in. gage section, 0.505 in. diam.

Table III



▼ Figure 4—Influence of section thickness on mechanical properties of a cupola iron containing 3.27% C, 2.40% Si, 2.01% Ni, 0.62% Mn, 0.15% P, 0.055% Mg and 0.010% S. The annealed iron was slow cooled from 1700° F., held 5 hours at 1275° F., then air cooled.



▼ Figure 4-A—Relationship between elongation, tensile strength and hardness in completely fed sections of one inch of as-cast ductile iron with proper chemical composition.

graphite in contrast to the greater damping effect of flake graphite. This provides, incidentally, an easy means of distinguishing between the two types of graphite, as the spheroidal graphite iron rings when struck.

Because of the continuity of the matrix with spheroidal graphite, Ductile Iron affords no easy paths for penetration of internal oxidation which is generally considered to be the cause of the growth of flake graphite gray iron subjected to service at elevated temperatures. The results of growth tests in which 1" diameter bars, 3" long were given 100 cycles of alternately heating at 1600° F. for 1½ hours and air cooling for 1 hour are shown in *Table II*. The spheroidal graphite Ductile Iron surpassed even a nickel chrome heat resisting type of flake graphite iron, both with respect to growth and depth of oxide penetration.

The shape of the graphite, i.e., flake or spheroidal, probably has less effect on machinability than does the structure and thus the properties of the matrix. On the basis of equivalent hardness levels, Ductile Iron is as free machining as gray iron, but on the basis of equivalent tensile or transverse strength, it far surpasses the machinability of gray iron. The machined surface of Ductile Iron tends to be smoother and exhibits less tearing than does that of gray iron.

Wear is another factor somewhat difficult to evaluate and is governed perhaps considerably more by factors such as matrix structure than by the shape of the graphite. Comparative wear tests so far indicate that the mechanical wear resistance of iron containing spheroidal graphite is at least as good as that of an iron of the same chemistry containing flake graphite.

The shape of the graphite also seems to have little effect on weldability. Ductile Iron is readily arc welded in the same manner as gray iron using the newer types of rods for machinable welds such as Ni-Rod or similar types. In using such rods, the graphite spheroids do not revert to flake graphite, but instead, merely float off into the molten zone.

Production

In the announcement of the commercial development of this material, it was pointed out that successful production of spheroidal graphite is not qualified by limitations on carbon, silicon, sulphur, or phosphorus levels.

Ductile Iron is easily produced with practically any base iron in any well-controlled foundry in all types of melting equipment without concern for special raw materials or special equipment.

Contrary to many reports of initial investigations of this material, which started as a result of its announcement, production of Ductile Iron is completely without hazard, consistently reproducable, economical, and fully commercial. Evidence to this effect seems adequate in that it is produced in 41 commercial foundries, one single order has involved 250 tons of castings, and production has hit 50 tons in one day in one foundry. In the shop of a producer of heavy equipment, 50,000 lbs. has been poured in one mold. In another foundry as many as 1,200 castings have been made off of one pattern. These, incidentally, were 19-pound axle housings on four separate orders. Some 15,000 castings for similar application, plow shares, have been made of varying pattern designs.

The production and application of this material is continually accelerating, and such statistics are quickly outdated, so it is well to qualify these figures as of September, 1949.

It is considered that gating and risering should follow the practice used for low carbon, high strength gray iron, although a considerable variety of castings of complicated shape have been made successfully with gates and risers designed for malleable iron, gray iron, and steel. The casting qualities of the material are excellent with about the same fluidity as gray iron of similar base composition. It has a tendency toward piping, and if improperly fed, may collapse inwardly rather than form internal shrinks, which provides rather simple inspection.

Matrix Structure

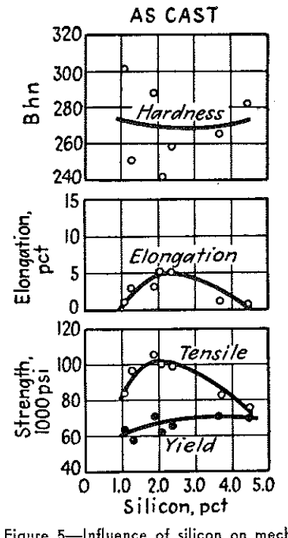
Besides the effect of graphite on the matrix, the properties of the matrix itself can be altered in a manner similar to that for steel to affect the net properties of the iron. As is well known, this is manifest largely in the cooling rate, which is a function of section size unless heat treatment is applied. Matrix structures ranging from low strength mixtures of ferrite and pearlite to the higher strength pearlite and still higher strength acicular structures are obtained by increasingly faster cooling rates. In normal foundry practice, cooling rates are generally governed by section size. However, the balance between carbon and silicon contents and nominal balanced alloy additions can serve and are utilized to obtain these structures when the cooling rate is necessarily fixed, i.e., to obtain the higher strength structures associated with faster cooling rates, in larger sections which cool more slowly. With further alloy additions, and with sufficient nickel, the austenitic structure, familiar in the Ni-Resist types of cast irons, may be retained.

These same matrix structures can, of course, be produced in Ductile Iron, but in the absence of the harmful effects of flake graphite, the properties of these matrix structures themselves are considerably more nearly approached. With the elimination of the variables in the effect of graphite on the matrix, a relative relationship is found between hardness, tensile strength, and elongation, approaching those relationships found in the matrix itself. Consequently, hardness can be used as an index of the properties of properly made Ductile Iron. For example, in the case of steel, to which the matrix might be considered equivalent, tensile strength bears a fairly constant ratio to Brinell Hardness Number, generally taken within scatter band limits as being 500. In properly made Ductile Iron this ratio is also a constant within a normal scatter band expectancy. Although this has been determined from the results of a great number of commercial heats to be approximately 410±35, the exact extent of the scatter band is still not statistically limited, but it is likely that it will be found to be considerably less than ±35.

Thus these properties may be defined and correlated with the various familiar ferrous structures which may be obtained either by suitable heat treatment (cooling rates) or by suitable alloying, neither of which affects the shape of the spheroidal graphite, and may be plotted conventionally along the smooth curves, or rather bands, in the manner of familiar property charts. It is emphasized that the values mentioned for the various structures are all within bands of reasonable scatter.

For example, a pearlitic matrix in Ductile Iron may be obtained as-cast, having high tensile strength in the vicinity of 100,000 psi with elongation around 2½% at a hardness level of perhaps 235 BHN. *(See Fig. 4A.)*

From this structure we can depart in either direction along these curves, depending on heat treatment (cooling rates) or alloying, to different structures with different properties. We might move up to the acicular structure, being considerably higher in strength and hardness (perhaps 170,000 psi and 420 BHN) and lower in ductility than the pearlitic structure. We might move in the other direction along the curves down to a completely ferritic structure with no combined carbon present to realize a maximum ductility of perhaps 25% elongation with moderate strength of about 70,000 psi at a hardness level of 160 BHN. This ferritic structure may be obtained as-cast or by annealing at the subcritical temperature of about 1275° F., after the material has reached a temperature of 1650° F. on heating, to breakdown the matrix structure.



▼ Figure 5—Influence of silicon on mechanical properties of 1" sections in the as-cast condition.

Composite structures between these may be obtained by suitable alloying or suitable heat treatments such as annealing or normalizing and tempering or quenching and tempering, just as associated with steel, to obtain composite levels of properties. By suitable alloying, austenitic structures may be obtained as-cast which have tensile strengths of better than 60,000 psi at elongation values of better than 10% and with high impact strength.

In Ductile Iron the elements introduced by the raw materials of cast iron, such as manganese and silicon, exert their full alloying potentialties just as in steel, the manganese acting as a hardening element and pearlite stabilizer and the silicon as a ferrite hardener. In addition, the effect of phosphorus is appreciable in lowering ductility and toughness through the formation of a brittle phosphide network, just as in steel. The effect of manganese and phosphorus on the mechanical properties of Ductile Iron can be seen in *Table III*, while the influence of silicon over a wide range is illustrated in *Figure 5*.

Thus it is obvious that the production and utilization of Ductile Iron involves considerably more than merely the introduction into the iron of any magnesium alloy. The proper one of a number of such alloys is required in order to achieve the different objectives of structures and properties which may be necessary for a particular application. These objectives may range from the maximum ductility of the ferritic structures to the maximum tensile strength of the acicular structure, together with varying degrees of machinability, wear, or heat resistance, etc. As can be appreciated, a multitude of combinations of properties are required to suit a multitude of different applciations.

Application

It should be evident that in many ways Ductile Iron closes the gap which has existed between cast iron and steel. Applications in all types of machinery parts, such as crankshafts, heads, pistons, housings, frames, etc., are multitudinous and readily suggest themselves from the properties discussed and published. Its ductility indicates that its thermal shock resistance may surpass that of the high carbon castings heretofore used frequently in such service and suggests such applications as pig molds, ingot molds and glass molds, where it is already in service, and railroad car wheels. Because of its superior growth and oxidation resistance, it is finding application in parts serving at elevated temperature, such as grate bars, furnace parts, engine parts, etc. In maintaining properties to heavy sections in a manner similar to steel, it has found application in such heavy castings as anvil blocks and metal working rolls.

In the final analysis, some of the factors governing the selection of a material to meet the engineering requirements of a given application may be considered as properties, economics, availability, and fabrication. Ductile Iron shows important advantages with respect to each of these factors, and with the information and data available, potential applications are indeed a tantalizing challenge to the engineer.

TECHNICAL SOCIETIES AND ASSOCIATIONS MEETINGS

Additional National Petroleum Council Members Named

Secretary of the Interior Oscar L. Chapman announced the appointment of five new members of the National Petroleum Council. Secretary Chapman stated that the additional appointments were made to give more adequate representation to particular segments of the petroleum industry.

The Council, created in 1946, is an advisory body to the Secretary of the Interior on petroleum matters. The last quarterly meeting of the Council was held in Washington on April 26.

The members appointed are: Ralph K. Davies, American Independent Oil Company, San Francisco, California; Warwick Downing, of Denver, Colorado; James P. Dunnigan, Producers Refining Company, West Branch, Michigan; Harry Leyendecker, Independent Refiners Association of America; Sid W. Richardson, of Fort Worth, Texas.

NATIONAL REPRESENTATIVES OF AGRICULTURE, LABOR, AND INDUSTRY STRESS NEED FOR MORE UNDERSTANDING AT CARLSBAD, N. M., ANNUAL FORUM

More realistic and greater collaboration between business management, labor, and agriculture is needed to make America strong enough to face its future problems according to the concensus of representatives of those fields at the annual Carlsbad Forum on Agriculture, Labor, and Industry which concluded a two-day session recently at Carlsbad, New Mexico.

Speakers from all over the United States stressed the urgent need for greater understanding between the various segments of the American economy if this nation is to withstand future conflicts between the democratic and totalitarian ideologies.

In summing up the viewpoints raised by speakers at the conference, Prof. Henry M. Busch, head of the social science department at Cleveland College of Western Reserve University, pointed out that forum participants agreed that good management-labor relations were good human relations and their benefits extended throughout our entire economy.

D. A. Hulcy, vice president of the United States Chamber of Commerce and head of the Lone Star Gas Company of Dallas, Texas, reminded the forum that the great issues of the country basically are not determined by Congress or executive administration and cannot be passed on to others. Such issues must be met by the individuals and groups involved in a manner that recognizes that everybody, actually, in this country is "in the same boat," and will rise and fall together economically.

At the same time, Robert Oliver, regional director for the CIO at Dallas, Texas, charged that many interests were opposed to planning as a means for improving our economic system. He declared that a planned economy does not necessarily mean a controlled economy, and called for more collaboration in economic planning as a means of averting depressions and raising the standards of living for individuals.

Oscar B. Jesness, chief of the agricultural economics division of the University of Minnesota, warned that all economic groups in the country would lose many of their rights if their demands were out of proportion to the rights of other groups.

Industrial peace, without strikes or use of force, is important not only to union labor but all segments of the American economy such as farmers, consumers, and the unorganized working class according to Glen B. Wall, research analyst for the International Brotherhood of Electrical Workers, Washington, D. C., who cited the experience of his own union in helping maintain a "strikeless" industry.

Ralph C. Smith, assistant director of the Los Alamos Scientific Laboratory of Los Alamos, N. M., told the forum how atomic research is a symbol of what is needed in American life.

John W. Knorr, cotton farmer of Roswell, N. M., called for a new farm and food program that recognized the need of American people for a better diet, laying the stress on more proteins and reducing the trend to the Oriental diet of cereals.

Charles T. Estes, assistant to director of the Federal Mediation and Conciliation Service, Washington, D. C., told the forum that actually much unity of purpose and interest existed between the various segments of the American economy, but lack of realistic communication channels between them prevented greater understanding.

Panel discussions during the forum attempted to develop a program for improving relations between agriculture, labor, and management.

Presiding officers of the forum sessions included Dorrance D. Roderick, publisher of the El Paso Times; Jack Sitton, editor of Carlsbad Daily Current-Argus; T. M. Cramer, vice president of United States Potash Company of Carlsbad; and G. T. Harley, manager of the potash division, International Minerals & Chemical Corporation, Carlsbad.

FUNCTION OF PETROLEUM ENGINEERING DEPARTMENTS

(Continued from page 22)

ever, it must be constantly kept in mind that petroleum engineers are as a group educated and ambitious and are therefore appreciative of the opportunity to develop and demonstrate their prowess of their profession.

Then there is the case of the petroleum engineer who possesses the skill and ability and means and is otherwise so constituted that he prefers to go it alone—usually after an apprentice period or longer in the employ of others. As has been stated previously the engineer who enters this highly competitive petroleum business on his own or associates himself with partners is a good thing for the business. He, like the employee of a major company who strives for and receives promotion, is replacing the depleted personnel ranks of independent operators. Thus a balance is maintained between company and individual operators and competition is insured and maintained.

Conclusions:

(1) Petroleum engineering has definitely established itself as a recognized and necessary profession and vocation and an integral part of the oil and gas business.

(2) Opportunities for promotion within large organizations are unlimited. Many executives came up through the petroleum engineering route either directly or after serving a turn in supervisory and management positions. Many engineers prefer to enter the producing and drilling business on their own—here too opportunity is unlimited.

(3) Opportunities are great for those inclined to research work.

(4) More and more engineers so inclined and possessing the ability will fill supervisory positions throughout an organization as well as executive and management level.

(5) Competition and the ever increasing need for personnel with a scientific and engineering background and a proper understanding of the business, demand and will continue to demand the employment of scientists and engineers throughout all levels of the oil and gas business.

(6) Management will be wise to provide the environment necessary for a sense of job accomplishment.

(7) Mutual consideration and the application of the "Golden Rule" in all matters on the part of both management and the engineer-employee will greatly assist in the furtherance of desirable relationship.

(8) You can rest assured that alert management is looking hard at what they consider promising engineering personnel. Likewise management should realize that engineering personnel is examining management personnel rather closely. Engineers are gauging management policies and changes in management as they may, in their opinion, affect and influence their future.

(9) Management should recognize accomplishment.

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(Continued on page 34)

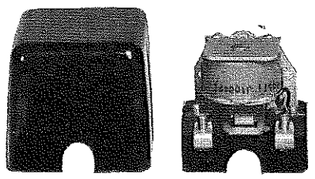
WITH THE *Manufacturers*

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.

Improved Voltage-Type Accelerating Relay (713)

An improved voltage-type accelerating relay, designed specifically for starting single-phase, capacitor-start, and capacitor-start capacitor-run motors, has been announced by General Electric's Control Divisions.



According to engineers, the new relay is particularly applicable where adverse atmospheric conditions exist or where it is desired to have remote control which can be incorporated into an explosion-proof case.

Designated as CR1057-J, the relay will find its most common application in the control of hermetically sealed refrigerator compressor motors. It can be furnished with or without cover, can be wired from top or bottom, and all parts are corrosion resistant. Extensive life tests prove that the relay easily withstands the most severe vibrations encountered in compressor application.

The voltage principle employed eliminates voltage drop at motor terminals usually encountered with current-type relays. Extremely wide differential between pickup and drop-out voltage gives positive operation of the control desipte wide variations in line voltage. The relay meets all Underwriters' Laboratories specifications. Contact rating is 50 amperes at 115 volts and 30 amperes at 230 volts. In normal operation, the contact handles start-winding current only.

New "Wet Water" Capsule (714)

A new "Wet Water" capsule for on-the-line treatment of ordinary water or sea water to increase its effectiveness in

putting out fires has just been announced by Mr. Miner W. Allen, President of Aquadyne Corporation, 220 East 42nd Street, New York 17, N. Y.

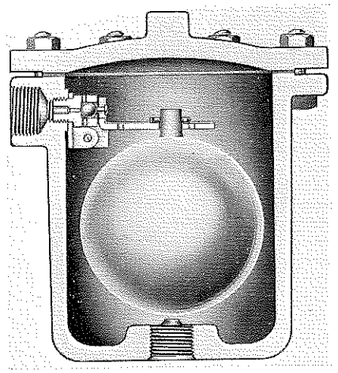
The capsule is a solid composition weighing three pounds and containing highly concentrated active blends of wetting elements especially selected for fighting fires. It is multiphase and instantly missible with water at all normal temperatures through a wide pH range.

Each capsule produces 1,000 gallons or more of multiphase "Wet Water" (reduces surface tension from 72 dynes to 30 dynes) from any source of ordinary water or sea water at a treatment cost of 6½ mills per gallon—approximately one-fifth the cost ordinarily prevailing.

Crane Automatic Vent and Drain Valve Improved (715)

By using a simplified ball-type seating mechanism instead of the customary disc, Crane Co. has improved its automatic vent and drain valve to assure more accurate seating and longer life.

The valve is easy to install in water or oil piping systems to remove entrapped



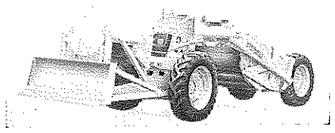
air, or in compressed air systems to remove water and oil. Operation is fully automatic. The cycle of filling and emptying keeps repeating with each accumulation.

A complete range of sizes is available to take care of all air requirements up to 150 lbs. per sq. in., and water up to 125 lbs. per sq. in. Body and cap of the valve are cast iron, the float copper. The ball seat is Exelloy, and the ball is of hardened stainless steel.

The air vent and the water drain valve is only one of the complete line of valves, fittings and pipe manufactured by Crane Co., 836 So. Michigan Ave., Chicago, Illinois. Literature is available on request.

Tournapull Available With Dozer Blade (716)

A bulldozer blade attached to the



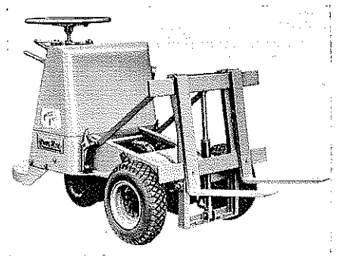
Model D Roadster Tournapull is being announced by R. G. LeTourneau, Inc., Peoria, Illinois earthmoving equipment manufacturer. The dozer blade is suspended in front of the Tournapull, cable-activated and is electrically-controlled by a switch mounted on the dash control panel.

The blade has a bowl length of 6'8¾", height of blade and bowl is 32½". Its cutting edge is reversible, with hard-surfaced, replaceable tips, and can be raised 3' above the ground.

Equipped with bulldozer the D Roadster Tournapull Scraper can be used either as a dozer or scraper. Since all tools are on one rig, no time is consumed in changing from dozer to scraper operation, the manufacturer points out. It can also push load other D's in fleet operation, and can be roaded under its own power over the highway between scattered jobs.

New Fork Lift for Moto-Bug (717)

A hydraulic lift attachment for the MOTO-BUG has been designed by the Kwik-Mix Company of Port Washington, Wisconsin. Development of the lift was revealed in a new catalog recently released by the company announcing a number of improvements for the handy power wheelbarrow.



Adding the fork lift feature to the MOTO-BUG greatly increases the unit's usefulness in special handling problems, particularly in industrial plants, shops

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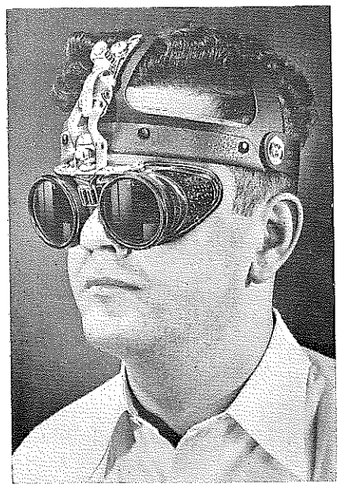
and in construction work. The manually operated hydraulic pump lifts a capacity load of 500 pounds. Forks tilt to the rear to assure better load balance and are adjustable to a minimum width of 33 inches for clearing narrow aisles and doorways.

New Headrest Goggle (718)

A headrest goggle for gas welders, cutters, burners, brazers and furnace men with new, simple means for making it easily adjustable to any head size is announced by American Optical Company, Southbridge, Mass.

The company has adapted the "free-floating" headgear long used on AO welding helmets for use on the goggle. A slight twist of a knob adjusts the goggle to the wearer's head size, and it may be instantly changed to the "off-guard" position by a flick of the wrist. The mechanism is enclosed in a fibre tube for insulation and to prevent hair pulling.



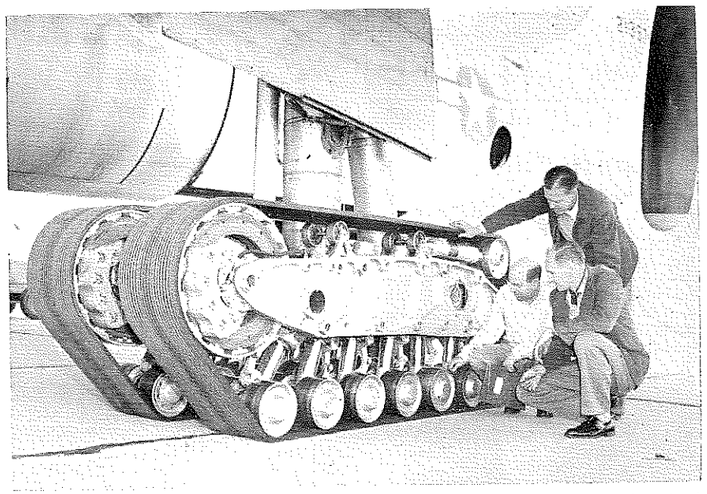
Designed to be worn over eyes or personal glasses, the goggles have well ventilated, indirect side shields to keep out sparks, metal splashes and stray light rays. The new headrest goggle may be obtained with either Noviweld or Noviweld-Didymium lenses in several shades; replaceable cover lenses are provided to protect these more costly filter lenses.

New Zinc Alloy (719)

Zinc, in the past a weak metal of little use in engineering, now can be made as strong as brass, according to a General Electric scientist.

Dr. R. H. Harrington, of the G-E Research Laboratory, has developed a new alloy composed principally of zinc, with small quantities of copper and beryllium added, which has approximately the same strength and electrical characteristics as brass. The alloy is said to be considerably cheaper than brass.

Called "zncube" (pronounced "zin-cue-be"), from the chemical symbols for its makeup, the alloy has about eight times the useful strength of any zinc alloy now in use, Dr. Harrington said. A foot-long strip of ordinary zinc 1/16 of an inch thick will droop slowly from its own weight when held horizintal at one end. With the addition of a small percentage of copper and beryllium, however, zinc takes on a springy, resilient quality.



World's largest bomber, the B-36 is undergoing experimental tests with caterpillar-type track landing gear at Fort Worth, Tex. One of the two main gears (above) is being inspected by Convair engineers prior to initial flight. The rubber belt tracks, the single disc brakes (left) and the brake bogies all were manufactured by the Goodyear Tire & Rubber Co. Each belt is 16 inches wide, 275 inches in circumference and has a thickness of one inch except for an additional one-inch "V" in the center which fits into the bogie wheel slot. The belting is reinforced with brass-plated steel cable. The track gear is designed for a maximum average of 57 pounds pressure per square inch on the landing strip, compared to a pressure of 156 pounds per square inch exerted by the conventional wheel-type gear on a B-36 at the same gross weight.

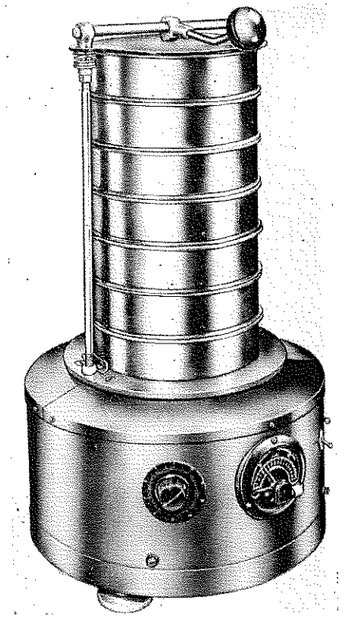
New Test Sieve Shakers (720)

The Syntron Co., 705 Lexington, Homer City, Pa. have a new vibrating, test sieve shaker for laboratory screen analysis work.

Small in size, easily portable and quiet in operation they operate on common 110 volt, A.C. convenience power outlets. The vibrating action of the Shaker is produced by the Syntron patented electromagnet drive energized by rectified, half-wave A.C. current—3600 vibrations per minute from 60 cycle. There are no bearings, gears, belts or pulleys, etc. to maintain and replace—no lubrication required.

Amplitude of vibration is regulated by a rheostat located in the front of the base cabinet—readily accessible for quick and easy setting. A reset timer provides accurately timed test periods. The Sieve Shaker is mounted on three adjustable feet that permit perfect leveling to the spirit level on the base rim.

It is simple and easy to place the six 8" diameter sieves in the shaker—or to remove them. Just put the nested sieves in place and lock by pulling down on the handle. To remove, just push the handle up—releasing the locking pressure and take them out.



PLANT NEWS

New Address for Syntron's New York Sales and Engineering Office

Syntron Company, Homer City, Pa., manufacturers of vibratory material Handling equipment, portable power tool equipment and allied items, announce the removal of their New York Sales and Engineering Office, from its old address in Long Island City to 1860 Broadway, New York 23. Telephone facilities have already been installed and the new number is Judson 6-1507.

G-E Equipment Gives Peerless Most Modern Pump Lab

Electric equipment recently installed at the Indianapolis plant of the Peerless Pump Division, Food Machinery Company, has given that company what is believed to be the most up-to-date pump laboratory in the world. Supplied by General Electric, the equipment in general consists of dynamometers, adjustable voltage power supply, and control.

Engineers at Peerless will use the apparatus in extensive testing of centrifugal pumps at the laboratory to further the company's manufacturing and developing program.

Technical Grads Train with G-E for Atomic Energy Work

The first ten technical graduates have reported at Hanford Works in the state of Washington, to begin the newly-installed General Electric Company rotational training program, believed to be the first program of its kind at any U.S. atomic energy plant.

According to D. W. McLenegan, of the Technical Personnel Office at the plutonium manufacturing plant, approximately 50 promising young technical graduates at a time ultimately will receive training through this latest innovation in personnel recruiting and training for work in the nation's atomic energy program.

General Electric, prime contractor to the U. S. Atomic Energy Commission for the operation of Hanford Works, has for more than 60 years had a similar rotational training program for newly-employed engineers at most of its manufacturing plants throughout the country. Although officially named the Student Engineering Program, it is known throughout engineering circles, and to its more than 18,000 alumni, as the GE "test" course.

Wm. Bishop Named Auditor for New Sales District

General Electric's newest and twelfth Apparatus Department sales district, established March 1 with headquarters at St. Louis, will be known as the Mid-States District, it was announced by G. F. Maughmer, manager of the district.

Concurrently, Maughmer announced the appointment of William Bishop as District Auditor for the territory which includes all sales areas in the company's St. Louis, Kansas City and Omaha regions. In addition to those at St. Louis, Kansas City and Omaha, there are company offices at Sioux City, Iowa; Lincoln, Nebraska; Wichita, Kansas; Springfield, Illinois; Memphis, Tennessee; and Little Rock, Arkansas.

Western Machinery Company Consolidates

Harry N. How, President of Western Machinery Company, has announced the consolidation of the firm's Western-Knapp Engineering Division with its equipment manufacturing Division. The merging of activities of the two organizations creates a new division of the firm to be known as the Wemco Division.

Business activities of the newly formed Wemco Division will be to: (1) manufacture and market the metallurgical equipment line known to industry as Wemco Products, and, (2) design and/or construct metallurgical and mineral processing and beneficiation plants.

Ralph B. Utt, formerly General Sales Manager, has been named General Manager of the Wemco Division. Western Machinery Company home offices are at 760 Folsom Street, San Francisco, California.

Hewitt-Robins Declares Dividend

Directors of Hewitt-Robins Inc. has declared the regular quarterly dividend of 25 cents per common share, payable June 15, 1950, to stockholders of record May 25, 1950.

Directors also elected Ellis B. Gardner, Jr., Assistant Controller of the corporation. L. J. Clifford, Assistant Secretary, was not reelected to that post. All other officers were reelected.

Hewitt-Robins Financial Report

Hewitt-Robins Inc. has reported 1949 net income after all charges of $628,765, equal to $2.25 per share of capital stock outstanding, as compared with $737,767, or $2.65 per share in 1948. Net sales for the year ended December 31, 1949 totaled $19,792,292, as compared to $19,623,002 for 1948.

The company's financial position was reported as improved during the year. In his annual report, Thomas Robins, Jr., president, said that as a result of reduced inventories the company had approximately one million dollars more in cash at the end of 1949 than it did at the close of 1948 and that net current assets at the year end amounted to $6,263,750, an increase of $109,000 during the year.

American Brake Shoe Merges Canadian Subsidiaries

American Brake Shoe Company announces the consolidation of all operations of its Canadian subsidiaries into one Corporation, the Dominion Brake Shoe Company, Ltd., a wholly owned subsidiary which operate all the Canadian plants of the parent company. The operating assets and business of Joliette Steel Limited and Ramapo of Canada, Ltd. were acquired by Dominion Brake Shoe Company, Ltd. The operating divisions will be the Brake Shoe Division, Joliette Steel Division, Canadian Ramapo Division, American Brakeblok Division, and Kellogg Division.

Dominion Brake Shoe Company, Ltd. will make its principal office at 1405 Peel Street, Montreal, P. Q., Canada. It will continue to operate plants located at Lindsay, Niagara Falls and St. Thomas, in Ontario, and at Joliette, Quebec.

Walter A. Huber Appointed General Manager of Roeblings Wire Rope Division

Walter A. Huber

Charles R. Tyson, president of John A. Roebling's Sons Company, announced that Walter A. Huber has been appointed general manager of the Wire Rope Division.

Mr. Huber assumed his new duties on April 1. He is a national figure in the wire rope industry. For the past nine years, he has served as manager of preformed wire rope sales for the American Chain and Cable Co., Inc., and prior to that had served as assistant to the president and sales manager of the wire rope division of the Jones and Laughlin Steel Corp. He has been secretary of the Wire Rope Institute for the past ten years.

Link-Belt Elects Davidson Vice-President

Link-Belt Company has announced that at a recent meeting of the Board of Directors, Mr. David E. Davidson was elected vice-president for sales with headquarters at executive offices, 307 N. Michigan Ave., Chicago (1). All officers who served last year were re-elected.

D. E. Davidson

E. P. Berg

Mr. Davidson, a mechanical engineering graduate of Armour Institute of Technology (now I.I.T.), has been general manager at the company's Pershing Road plant, Chicago, since 1947. He entered the employ of the company's Caldwell plant, Chicago, in 1924 in the shop.

Announcement is also made that Mr. Eugene P. Berg, formerly assistant general manager, has been appointed general manager of the Pershing Road plant, to succeed Mr. Davidson.

Mr. Berg, a mechanical engineering graduate of Purdue, began his Link-Belt career by working in the Pershing Road shop during vacations, 1929 to 1937.

R. D. Moody '36, Named Manager of Allis-Chalmers' Los Angeles District

R. D. Moody, manager of Allis-Chalmers San Francisco district since July, 1947, has been named manager of the Los Angeles district succeeding C. W. Schweers, who has been appointed manager of the company's New England region with headquarters in Boston.

Moody is succeeded as San Francisco manager by James A. Longley, Jr., who has been a sales representative in that office since March, 1946.

A graduate of the *Colorado School of Mines,* Moody was employed by the Mineral Engineering Co., Los Angeles, and the Riverside Cement Co., Riverside, Calif., before joining Allis-Chalmers in May, 1938. He was connected with the company's Knoxville and Chattanooga offices before transferring to San Francisco.

O. V. Tally Named Manager of Allis-Chalmers' Midwest Region

Otho V. Tally has been named manager of Allis-Chalmers Midwest region succeeding Benjamin F. Bilsland, who is retiring July 1 after more than 30 years of service, according to an announcement by J. L. Singleton, vice president and director of sales of the company's general machinery division.

Tally, whose headquarters are in Chicago, was formerly manager of the St. Louis district. He is succeeded there by Baldwin G. Witty, formerly a sales representative in the company's Chicago office.

Allis-Chalmers Financial Statement

The Allis-Chalmers Manufacturing Company in the annual report to stockholders disclosed March 16 a profit for the year ended December 31, 1949, of $18,755,461 as compared with a profit of $15,441,523 for the previous year.

Walter Geist, Allis-Chalmers president, said in the annual statement to stockholders that "the year 1949, despite the effect of the coal and steel strikes on our national economy, was the biggest peacetime year in the history of the company."

Total sales billed in 1949 amounted to $351,097,878 as compared with $328,101,328 in 1948. The division of the 1949 sales billed and other income amounting to $352,282,215 is: materials and operating expenses, $213,018,700 or 60.4 per cent; wages and salaries, $99,888,251 or 28.4 per cent; all taxes, $20,619,803 or 5.9 per cent; retained for working capital, $12,556,484 or 3.5 per cent; and dividends, $6,198,977 or 1.8 per cent.

Goodyear Stockholders Approve New Pension Plan and Re-elect Directors

Stockholders of the Goodyear Tire & Rubber Company at their annual meeting recently overwhelmingly approved a new pension plan which provides company-paid benefits for 30,000 hourly-rated employees and 14,000 salaried employees. The plan, which provides minimum pensions of $100 per month, will become effective April 1, subject to approval of the Commissioner of Internal Revenue.

At the same meeting, all directors of the Company were re-elected. They are: A. G. Cameron, R. S. Damon, R. DeYoung, T. M. Girdler, E. B. Greene, J. C. Hunsaker, Howard L. Hyde, P. E. H. LeRoy, P. W. Litchfield, John P. McWilliams, Robert G. Payne, B. A. Polsky, George A. Sloan, C. F. Stone, E. J. Thomas, Lewis B. Williams and R. S. Wilson.

1950 Officers Chosen for Goodyear Board

P. W. Litchfield was re-elected chairman of the board and chief executive officer of the Goodyear Tire & Rubber Company at a meeting of directors which followed the 51st annual meeting of stock holders recently. Mr. Litchfield has been chief executive officer of Goodyear since 1926 and has served continuously as a director of the company since 1906.

E. J. Thomas, president of Goodyear, was also re-elected and Howard L. Hyde, who has been general counsel and assistant secretary, was elected general counsel and vice president. Other executive officers re-elected include R. S. Wilson, P. E. H. LeRoy, R. DeYoung, H. M. Linforth, R. P. Dinsmore, F. W. Climer, vice presidents; Z. C. Oseland, treasurer; W. D. Shilts, secretary; C. H. Brook, comptroller; H. W. Hillman and J. F. Bennett, assistant treasurers; W. M. Mettler, Assistant Secretary; H. D. Hoskin, H. L. Riddler and J. E. Caldwell, assistant comptrollers.

Goodyear Declares Dividends

Directors of the Goodyear Tire & Rubber Company recently declared regular quarterly dividends of $1 a share on the common stock and $1.25 per share on the $5 preferred stock of the company. Both dividends are payable June 15 to stockholders of record May 15.

Goodyear Board President Gets Swedish Decoration

Insignia of the Royal Order of Vasa, First Class, recently conferred on P. W. Litchfield, Goodyear Tire and Rubber Company's Board Chairman, by King Gustav of Sweden, was formally presented to the Akron Industrialist on March 27, by the Swedish King's representative, Consul General G. Oldenburg.

The European Constitutional Monarchy honored Mr. Litchfield for his interest during many years in developing close business relations of mutual business benefit to both Sweden and the United States, Oldenburg said.

The Royal Order of Vasa was originated in 1772. It is awarded by the King of Sweden to Swedish subjects and Citizens of other countries for merit and outstanding service in the fields of industry, commerce, economics and the professions.

International Minerals Announces Expansion Program in Florida

One of the most important expansion and development programs ever to be undertaken in the Polk county, Fla., phosphate fields was announced recently by Louis Ware, president of International Minerals & Chemical Corporation, before a joint meeting of the membership of all civic clubs in Bartow.

Principal projects in International's new program, which when completed will represent an investment of approximately $4,000,000, include: 1. Plans for the erection of a new office building as headquarters for the company's Florida phosphate operations. 2. Purchase of a site for location of the new office building, the property being acquired for this purpose consisting of a 60-acre tract just south of Bartow's city limits. 3. Plans for construction of a new plant for the manufacture of multiple superphosphate and phosphate chemicals, including dicalcium phosphate for animal feed and chemical purposes. 4. Plans for the construction of a new large sulphuric acid plant. 5. Plans for the construction of a new, modern machine shop, warehouse and service center to serve all of the company's Florida operations and which will be located at the Noralyn mine. 6. Plans for erection by the company of a new Phosphate Division analytical laboratory.

R. P. Thomas Appointed Market Survey Specialist by International Minerals

Dr. R. P. Thomas, professor of soils at the University of Maryland, has been appointed market survey specialist for the plant food division of International Minerals & Chemical Corporation, according to an announcement by Louis Ware, president. Dr. Thomas' current assignment on International's staff covers the agronomic phase of plant food market studies under the supervision of Maurice H. Lockwood, vice president in charge of the plant food division.

FUNCTION OF PETROLEUM ENGINEERING DEPARTMENTS

(Continued from page 30)

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PERSONAL NOTES

(Continued from page 8)

F. G. Van Stratum, '48, Petroleum Engineer for Continental Oil Company, has been transferred from Lance Creek to Casper, Wyoming, where he receives mail at his residence, 1033 So. Melrose Street.

James E. Woodburn, '31, Supervisor for Seismograph Service, Ltd., is now being addressed Box 69, Basrah, Iraq.

L. David Wosk, '24, is addressed 3605 Landa Street Los Angeles 26, Calif.

Capt. Jerome Zohn, '47, has a new address in Spokane, Washington, to W.O. R.C., Geo. Wright Air Base, P. O. Box 686.

WEDDINGS

Kochersperger - Hacker

Mr. and Mrs. Glen Hacker of Byram, Connecticut, have announced the marriage of their daughter, Joy, to Donald Kochersperger on December 26, 1949.

The couple are now at home in LaPaz, Bolivia, where Mr. Kochersperger, '43, is district superintendent for Cie. Aramayo de Mines en Bolivie. Their mailing address is Casilla 674.

(Continued on page 44)

CATALOGS AND TRADE PUBLICATIONS

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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.

(5479) AIR COMPRESSOR. Form 3150 by Ingersoll-Rand, 11 Broadway, New York 4, N. Y. Twenty pages describing and illustrating the XLE electric-driven compressor. Photographs and text point out design improvements and construction features and show the unit in various installations.

(5480) PULP DENSITY INFORMATION. Bulletin No. S1C-B1 by Denver Equipment Co., 1400 17th St., Denver 17, Colo. Describes pulp density scales giving advantages of design. Included is a very useful chart giving data on pulp densities within the ranges of 1.35 to 1.85 specific gravity.

(5481) RUBBER-LINED PUMPS. Bulletin 08B-7311 by Allis-Chalmers Mfg. Co., 982 S. 70th St., Milwaukee, Wisc. Sixteen pages describing and illustrating the new SRL and SRL-C rubber-lined pumps designed to handle abrasive liquids containing solids in suspension. Gives construction and design features, capacities, dimensions and instructions for selection, installation, operation, and maintenance of pumps.

(5482) "HARDINGE HIGHLIGHTS," March, 1950, by Hardinge Co., Inc., York, Pa. The first issue of a new company magazine. Features, in this issue an illustrated story of the installation of three clarifiers in the Columbus, Ohio, water plant.

(5483) V-BELT DRIVES "Gates Industrial News," March 1950, by Gates Rubber Co., 999 South Broadway, Denver, Colo. Four pages describing and illustrating various problem-solving applications of V-belt drives on compressors, a lathe, conveyor belt and hammer mill.

(5484) ALUMINUM PRODUCTS. "Alcoa Aluminum News Letter," March 1950, by Aluminum Company of America, 654C Gulf Bldg., Pittsburgh 19, Pa. Eight pages describing various aluminum products. Interesting article in this issue tells about the new aluminum alloy coins being minted in Italy.

(5485) CLARIFLOCCULATOR. Bulletin 0801 by The Dorr Co., 570 Lexington Ave., New York 22, N. Y. Eight pages describing and illustrating a new unit that provides clarification and flocculation in the same tank. Operating principle of the unit is explained and information is provided on types and sizes, fields of application and advantages.

(5486) "TOMORROW'S TOOLS — TODAY!" First Quarter, 1950, by Lane-Wells Co., 5610 South Soto St., Los Angeles 11, Calif. A 40 page illustrated company magazine containing articles and items of technical and general interest. In section 3.1 of the Packer Handbook, which is a regular feature, is described the use of packers in acidizing operations. Also included is an index of technical articles published in the magazine during 1938-1949.

(5487) RECONDITIONED MACHINERY. Bulletin 501 by Morse Bros., Machinery Co., P. O. Box 1708, Denver 1, Colo. A 32 page illustrated catalog listing numerous items of reconditioned mine, mill, machine shop, and woodworking shop equipment.

(5488) "POPULAR HOME," Spring 1950, by United States Gypsum, 300 W. Adams St., Chicago 6, Ill. A 16 page company magazine offering illustrated articles and items on home building and interior decorating with the accent on the use of materials manufactured by the Company.

(5489) TRACKLESS COAL CUTTER. Bulletin C-33 by Joy Mfg. Co., Henry W. Oliver Bldg., Pittsburgh 22, Pa. Describes and illustrates the 10-RU trackless coal cutter, giving information on construction, operation, maintenance and various advantages. Photos show unit in operation and drawings give specifications.

(5490) "NICKELSWORTH," Vol. XVI, No. 3, by the International Nickel Co., Inc., 67 Wall St., New York 5, N.Y. Eight pages describing and illustrating interesting applications of nickel and nickel alloys. Items in this issue concern use of nickel in pickling equipment, water reservoirs, extraction towers, construction, sail boats and others.

(5491) "ANALYTICAL REAGENTS." A 170 page catalog listing analytical reagents and other laboratory chemicals manufactured by Mallinckrodt Chemical Works and stocked and distributed by The Mine and Smelter Supply Co., 1422 17th St., Denver 17, Colo. With prices.

(5492) CONVEYORS. Form No. 612 by Pioneer Engineering Works, Minneapolis 13, Minn. Fifty pages describing and illustrating conveyor equipment. Tables and charts give complete information on sizes, dimensions, capacities, specifications and horsepower. Included are conveyors, belts, framesections, idlers, drives, belt tighteners, backstops, motor mounts and all other conveyor accessories.

(5493) INDUSTRIAL HOSE. "Gates Industrial Hose Reporter," April 1950, by Gates Rubber Co., 999 South Broadway, Denver, Colo. Four pages describing and illustrating applications of air, water, steam and grain handling hose. Contains list of all types and sizes of hose made and gives locations of all distributors in Rocky Mountain area.

(5494) BORTZ DIAMOND BITS. Bulletin No. 44-A by Sprague and Henwood, Inc., Scranton 2, Pa. Four pages describing and illustrating "Trucast" bortz diamond bits, including standard coring, solid non-coring, flush joint casing, single tube reaming shell and double tube reaming shell bits.

(5495) DIESEL-ELECTRIC "SWITCHRULE" by General Electric Co., Schenectady, N. Y. A useful slide rule made of heavy cardboard which gives speed and capacity of Diesel- electric locomotives on various grades. Also gives speed-tractive effort curves for various weight locomotives.

(5496) "RARIN'-TO-GO," March 1950, by The Frontier Refining Co., Cheyenne, Wyo. A 12 page, illustrated company magazine containing articles and items of interest to employees and distributors. Included with this issue is a list of independent dealers in seven Rocky Mountain states.

(5497) FLOTATION. Bulletin 482 by Morse Bros. Machinery Co., Denver, Colo. Twelve pages describing and illustrating "Jetair" flotation machines. Explains operation, gives construction features and shows installations for various types of ores all over the world. Data on capacities also provided.

(5498) TEST SIEVE SHAKERS. Folder by Syntron Co., Box 220, Homer City, Pa. Describes (with photos) "Vibrating test sieve shakers and standard screen scale testing sieves." Explains advantages of the units and gives specifications and capacities.

(5499) TARIFFS. "ATL Topics," March 1950, by The American Tariff League, 19 West 44th St., New York 18, N. Y. Contains information on foreign trade and the tariff set-up. This issue discusses developments in the ECA program, the import-export balance, and a coming meeting of an international tariff and trade organization.

(5500) ADJUSTABLE SPEED DRIVES. Bulletin GEA-5334 by General Electric Co., Schenectady, N. Y. Twenty-four pages explaining the advantages of adjustable speed drives and giving technical information on several units. A comparison chart compares the performance features and characteristics of all drives discussed.

(5501) "ON TOUR," March 1950, by The Union Oil Co., Union Oil Bldg., Los Angeles 14, Calif. A 24 page illustrated company magazine. This issue features a very interesting article on the construction of the new Tacoma Narrows bridge in the state of Washington.

(5502) FOUNDRY DUST CONTROL. Four page illustrated bulletin by Aquadyne Corp., 220 East 42nd St., New York 17, N. Y. Explains a system of dust control through the use of a "wet water" arrangement involving the use of the Aquadyne "Hydroblender."

(5503) LIME SLAKING AND GRIT REMOVAL. Bulletin No. 7281 by The Dorr Co., 570 Lexington Ave., New York 22, N. Y. Four pages describing and illustrating the Dorreo slaker. Gives operation, construction features, sizes and capacities, and advantages. Photographs show typical installations.

(5504) STREET AND HIGHWAY ACCIDENT DATA, "Main Street" by The Travelers Insurance Co., Hartford, Conn. A 32 page booklet giving statistics on auto accidents and illustrating driving "don'ts" with a series of very amusing cartoons.

(5505) EARTH-MOVING EQUIPMENT. "Le Tourneau Co-Operator," Febr.-March 1950, by R. G. Le Tourneau, Inc., Peoria, Ill. Sixteen pages describing and illustrating heavy, earth-moving equipment and showing the equipment as applied to various types of jobs. Also included are items on proper operation and equipment maintenance.

(5506) DIESEL-ELECTRIC SWITCHERS. "Diesel-Electric Switchers in Industrial Plants" by A. B. McMillan, published by General Electric Co., Schenectady, N. Y. An 8 page illustrated article discussing the use of Diesel-electric industrial locomotives and explaining why they give better performance and more economical operation. Tables, charts and statistics provide technical information.

(5507) "FLUOR-O-SCOPE" April 1950, by The Fluor Corp., Ltd., 2500 S. Atlantic Blvd., Los Angeles 22, Calif. This issue of the Fluor Company magazine displays the results of a new editorial policy and a completely revamped format. It is a much improved publication and gives excellent coverage of Fluors far-flung activities.

(5508) DIESEL ENGINES. Form 12725, by The Caterpillar Tractor Co., Peoria 8, Ill. A 16 page illustrated booklet contains complete information on models D397, D336, D275 and D364 Diesel engines. Covers outstanding advantages and qualities and contains specification and performance charts.

(5509) DIAMOND BITS AND REAMER SHELLS. Bulletin D-35 by Joy Mfg. Co., Henry Oliver Bldg., Pittsburgh 22, Pa. Eight pages describing and illustrating "Truco" diamond bits and reamer shells. Includes data on coring bits, blast-hole bits, casing bits and shoes and reamer shells. Also included is a list of Joy service depots throughout the world.

(5510) THE CARBORUNDUM CO. 1949 ANNUAL REPORT. Twenty pages containing information on the Company's progress during '49, listed under the following headings: Financial Report in Brief; President's Summary; Financial Results; Sales Program; Production Facilities; Product Development; Industrial Relations; Balance Sheet; and Statement of Income. Also included is information on company officials and locations of offices and plants.

(5511) "MANUAL OF ELECTRIC INSTRUMENTS." GET—1087A by General Electric Co., Schenectady 5, N. Y. 150 pages with numerous illustrations containing descriptions of the fundamentals of construction and operating principles of all major types of electric instruments such as thermocouples, synchroscopes, frequency meters and electric telemeters. Price $1.00.

(5512) "NICKEL TOPICS," March 1950, by The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y. A 12 page illustrated magazine describing and illustrating various uses of nickel and nickel-alloys in jaw crushers, castings, electric tools, gas turbine, universal joints and many others. Also includes list of stock and service centers for "Inco" products.

(5513) "THE BEACON," March 1950, by The Ohio Oil Co., Findlay, Ohio. A 36 page employee magazine containing illustrated articles and items devoted mainly to company affairs and employee personals. This issue contains the fourth of a series of articles on the Hoover Report.

(5514) DOUBLE TUBE COREBARREL, Bulletin No. 175 by Sprague and Henwood, Inc., Scranton 2, Pa. Describes and illustrates Series "M" double tube corebarrel giving advantages of the equipment and information on its use. A parts list is also provided.

(5515) "GE WELDING ARCS." Bulletin GEO-20-B by General Electric Co., Schenectady 5, N. Y. Sixteen illustrated pages describing new twists in welding and various uses of welding products. Included is Part XLIV in an excellent series of articles entitled "Production Processes . . . Their Influence on Design."

(5516) "MINERAL INFORMATION SERVICE." April 1, 1950, by California Dept. of Natural Resources, Division of Mines, Ferry Bldg., San Francisco 11, Calif. A monthly news release concerning the mineral resources and industry of California. This issue contains articles on the discovery of jadeite in California; the chlorine caustic industry; gem minerals and others.

(5517) "PROGRESS NEWS." March 1950, by The Gates Rubber Co., 999 South Broadway, Denver, Colo. A 28 page illustrated employee magazine containing articles and items concerning company progress, employee organizations, personals and sales.

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734 Cooper Building
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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 Committee of the Colorado School of Mines Alumni Association was held in the Alumni office, 734 Cooper Building, Denver, on Monday, April 17, 1950.

The meeting was called to order by President James Colasanti at 7:35 P. M.

Roll Call

Members present: James Colasanti, President; A. George Setter, Vice President; Robert W. Evans, Secretary; Carl I. Dismant, Robert J. McGlone. Committee chairmen: Earl L. Durbin, Edwin F. White, Harry L. McNeill, Robert Spalding. Frank C. Bowman, Executive Manager.

Members absent: Malcolm E. Collier, Treasurer; Harvey Mathews. Committee chairmen: Addison B. Manning, Roger M. Schade, Charles O. Parker, Lynn W. Storm, Herbert Heckt.

The minutes of March 20, 1950, were read and approved.

President Colasanti called for the Treasurer's report and reports of standing committees as follows:

Treasurer's Report

Mr. Bowman reported in Mr. Collier's absence.

Financially, the association is in good shape. For the 25% budget period 30.7% of the anticipated receipts have been received and 22% of the budgeted expenditures have been spent. For this period the association shows a net profit of $5,413.27.

Moved by Mr. McGlone the report be accepted; seconded by Mr. Setter; passed.

Alumni Endowment Committee

Mr. Bowman reported for Mr. Schade.

During March 1950, $68.00 was received and $172.43 spent, leaving a balance in the Endowment Fund as of March 31, 1950, of $1939.41.

The Placement Fund showed receipts of $286.16 during March and disbursements of $471.31. As of March 31, 1950, the fund shows a cash balance of $1167.83.

Moved by Mr. Dismant the report be accepted; seconded by Mr. McNeill; passed.

Athletic Committee

Mr. Bowman reported in Mr. Manning's absence.

Receipts to the Loan Fund in March amounted to $23.00, making a total of $869.95 in the checking account, $4760.37 in the savings account and $523.00 in outstanding notes.

The annual "M" Awards dinner will be held on Thursday, April 20, 1950 at the Mines Cafeteria. Announcements have been sent to all local alumni.

Moved by Mr. Evans the report be accepted; seconded by Mr. Dismant; passed.

Capability Exchange Committee

Mr. Durbin reported there had been much more activity in March than there had been in February. During March there were 18 calls for men, 23 recommendations made, and 2 placements reported; 1323 letters were mailed; 434 men are on the active list, and 71 calls for men remain unfilled.

Letters have been written to all men on the active list requesting their files be brought up to date.

Letters have been written to all former employers who have used the placement service.

Letters will be mailed to determine the interest that may be aroused by the publication of a semi-monthly bulletin previously discussed.

Moved by Mr. Dismant the report be accepted; seconded by Mr. McGlone; passed.

Instruction Committee

Mr. McNeill reported that the committee had not met as a whole, however procedures are beginning to shape up. A session will be held with Dean Signer and then with members of the faculty.

Present graduating engineers are better polished than they have been in the past. Dr. Coolbaugh started this trend toward more polished engineers and Dr. Parker carried on through with this course of action.

T. W. Nelson, '34 of Magnolia Petroleum Company in Dallas has been added to the committee. He is interested in the post-graduate school.

Methods of getting suggestions for bettering the courses at the school was discussed.

Moved by Mr. Setter the report be accepted; seconded by Mr. McGlone; passed.

Budget & Finance Committee

No report.

Legislation Committee

No report.

Membership Committee

Mr. Setter reported that dues have been coming in very well this year. Letters have been sent out to delinquents with the hopes of speeding up the outstanding dues.

As of March 31, 1950, there were 1159 annual members, 194 life members and 63 associate members.

(Continued on page 37)

Prof. Clark B. Carpenter

was presented a plaque at a recent meeting of Sigma Gamma Epsilon fraternity commemorating his 25 years of service. He is Grand President of the professional engineering fraternity.

The dinner meeting was given in honor of Prof. Carpenter and 14 new members.

Norm Domenico, '48, showed kodachromes of seismic and gravity work on the Seward ice field in Alaska. Working with students from California Institute of Technology, where he received his masters degree, Domenico spent three months determining that the depth of the Seward ice was 2000 feet. He has returned to *Mines* to study for his doctorate.

Silver Diplomas

to be given at graduation this year will show a change in the heading from the School of Mines of the State of Colorado to Colorado School of Mines.

The body of the unique "sheepskin" will be essentially the same with a few minor changes in wording. All signatures at the bottom of the diploma will be omitted except those of the president, the secretary of the board of trustees, the dean, and the head of the graduating department.

Pictures of the new diploma and a complete list of changes and additions will be available as soon as the master diploma is received by the school engraver, Carson L. Doss.

Dr. F. M. Van Tuyl

head of the geology department at *Mines*, has written an article entitled, "Petroleum Geology." It is written in semi-popular style and will be the opening chapter of a book to be published by the Interstate Oil Compact Commission. An introduction to historical and structural geology, a discussion of the origin and occurrence of petroleum, and a summary of the methods by which oil is found make up the article.

The book is being published to improve oil-producing practices by educating producers in the possibilities of secondary recovery and other modern engineering methods. Copies of the book will be available from commission officers in the Capitol Building, Oklahoma City, Oklahoma.

The Annual Military Ball

of the ROTC unit at *Mines*, sponsored by the local chapter of Scabbard and Blade, honorary military fraternity, was held in the Silver Glade room of the Cosmopolitan Hotel, Denver, the latter part of March.

Highlight of the affair was the announcement of promotions of cadet officers to command the ROTC unit at the annual formal inspection on April 18. Twenty-five Colorado men were among the fifty-three receiving promotions.

New Equipment

for the experimental mine at Idaho Springs has been received by the mining department. The machinery, valued at about $1500.00, was given to the school on a loan basis.

The equipment was secured largely through the efforts of Edwin F. White, '36, manager of the Denver Machine Shop, distributors in this area of LeRoy-Cleveland mining equipment.

Included in the equipment are a Reverse Air Feed Sinker, a Model 83 seven-foot air column, an S-11 Stoper, and a 35-pound wet sinker drill. Other machinery will be forthcoming as soon as it can be installed in the mine.

Results of the Recent Student Election

show Robert Menk of Denver is next year's student body president. Menk, who is also president of the Barbs, becomes president of the Associated students and their governing body, the Student council. He defeated Paul Hodges who will serve as vice president of the student body.

Dick Bench of Glendale, California, is the newly-elected athletic representative.

Mines' Athletic Fund

was the recipient of a $500 gift from the Student council's account as donated by the governing group.

The council felt that because of an excess in their books the gift should be given to the financially needy athletic fund.

The amendment to the constitution concerning representation on the Athletic council was read and approved for the second time.

The student board of publication's financial obligations have been done away with, and in the future all of the board's finances will be handled through the Student council's account.

Following the policy of previous years the editor and business manager of The Oredigger and Prospector will be awarded a one third share in the profits of their respective publications.

The budget committee made the following recommendations which were approved: First, the assistant student treasurer will receive $10 per month for a twelve month period. Second, the salary of the publications' photographer will be raised to $25 per month for a nine month period and an assistant photographer will be given $10 per month for the same length of time.

ALUMNI BUSINESS

(Continued from page 36)

The committee will talk to the seniors in the very near future.

Mr. Setter reported that he is too busy to efficiently discharge his duties on the committee and would appoint a vice chairman to handle the membership campaign.

Moved by Mr. Evans the report be accepted; seconded by Mr. Dismant; passed.

Nominations Committee

No report.

Public Relations Committee

Mr. White reported there was no financial statement available at the present time on the dinner for Dr. Parker. The dinner was a great success.

(Continued from page 39)

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

Louis DeGoes, '48, President; George Playter, '30, Vice President; Clyde Osborn, '33, Secretary; James N. Peros, '38, Treasurer. Visiting Miners contact Secretary, c/o Western Machinery Co., 762 Folsom Street, San Francisco, Calif., Exbrook 2-4167.

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.

CENTRAL WYOMING SECTION

Herbert Schlundt, '43, President; Lynn D. Ervin, '40, Secretary-Treasurer, c/o Stanolind Oil & Gas Co., Casper, Wyoming. Meetings, first Saturday, March, June, September, December.

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

Names of Officers and notice of Meetings to be announced later.

GREAT LAKES

Francis W. Mann, '43, President; R. D. Fernald, '37, Vice President; Stanley Ohlswager, Ex-'49, Secretary. Meetings: Fourth Friday, January, April, October. Visiting Miners contact President, c/o Standard Oil Co. (Ind.), Pipeline Dept., 910 So. Michigan Ave., Chicago 1.

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 Houston Section held their regular monthly luncheon at the Houston Club Tuesday, April 4th. A capacity crowd of 30 attended, among whom were two newcomers who were introduced: Herbert Barnes '49, and William Alkire '48, both with Shell Oil Company.

The regular *Miners* attending were as follows:

Jim Pittinger, '49; John Tuttle, '49; Irwin M. Glasser, '43; James L. Ballard, '25; Carl F. Beilharz, '25; Geo. R. Brown, '22; Vernon Redding, '40; Glenn E. Bader, Ex-'27; R. K. Tracy, '28; Lester Truby, '48; Stanley A. Wickstrom, '38; Donald M. Davis, '25; McKay G. Donkin, '29; Raymond A. Kerr, '36; Jack B. Ferguson, '30; Donald I. Gahagan, '27; K. Pat Hurley, '22; Albert L. Ladner, '27; Julian K. Pawley, '40; L. E. Wichmann, '21; Kenneth R. Bowie, '30; Howard K. Schmuck, '40; Charles E. Redmon, Jr., '39; Herbert Treichler, Jr., '40; W. B. Barbour, '37; R. J. Arnold, '49; Myron C. Kiess, '25; Samuel C. Sandusky, '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.

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.

PENNSYLVANIA-OHIO SECTION

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

SOUTHERN CALIFORNIA

John Biegel, '39, President; A. J. Heiser, '43, Vice President; C. J. Cerf, '41, Treasurer; Franklin S. Crane, '43, Secretary, c/o Oilwell Supply Co., 934 North Alameda St., Los Angeles. Telephone: MUtual 7311.
Scheduled meetings second Monday of January, April, July and October, at Officers' Club, 2626 Wilshire Blvd., Los Angeles, 6:30 P.M. Phone Secretary for reservation.

The Spring meeting of the Southern California Section was held on April 10, 1950, at a new location, "The Officers Club," at 2626 Wilshire Blvd., Los Angeles, Calif.

The meeting was presided over by John Biegel, our newly elected Prexy. Committee reports were read and approved and other business taken care of by the group.

The speaker of the evening was Mr. George Thomson, Special Agent, Federal Bureau of Investigation, who gave an interesting talk on the Bureau, its history, activities and other particulars.

Many new faces were in evidence, including Dick Moody from San Francisco; he is now the new District Manager of the Los Angeles area for Allis-Chalmers Manufacturing Co. Robert P. Obrecht was a guest from the San Francisco region.

Those present were:

Bill Boyle, '12; R. C. Walker, '48; Gower Waters, Ex-'09; P. M. Howell, '38; J. Ballagh, '10; H. C. Armington, '07; F. A. Foley, '49; R. G. Godfrey, '38; N. M. Nichols, '40; K. W. Ward, '43; H. D. Campbell, '42; C. A. Spicer, Ex-'05; C. A. Rockwood, '12; W. D. Abel, '06; H. C. Eddy, '09; J. E. Warnecke; H. J. Wallace, '04; H. R. Kilgore, Ex-'08; J. P. Pinger, Ex-'10; Wm. F. Dugan, Ex-'12; Sid French, '08; W. A. Gardiner, Ex-'05; R. M. Fullaway, '16; R. W. Fullaway, Guest; F. L. Stewart, '43; Otto C. Whitaker, Guest of Sidney Small, '17; R. L. Housman, Ex-'21; A. M. Turner, '21; Merle Jackson, Ex-'22; H. L. Young, '39; J. A. Kavenaugh, '38; W. Levy, '48; R. F. White, '18; I. M. Charles, '21; J. H. Bolstad, '43; E. E. Dawson, '38; Ben H. Anderson, '34; J. R. Slover, Ex-'37; S. L. Jackson, '36; W. W. Clure, Ex-'29; W. Z. Bancroft, '36; Wm. V. Beggs, '37; T. E. Giggey, '35; R. W. Heindel, '32; R. W. Crabtree, '31; H. E. King, '03; E. C. Curzon, '23; Wm. C. Wattles, '03; R. S. Brummett, '26; E. W. Westervelt; W. C. Prigge, '42; F. A. Brown, '21; V. P. Pentegoff, '28; J. G. Hathaway, '42; John Biegel, '39; F. S. Crane, '43; Rufus M. Smith, '29; A. J. Heiser, '43; Robert P. Obrecht, '34, Guest.

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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.

Marcus G. Geiger, '37, President; Frank E. Johnson, '22, Vice President; Leroy M. Otis, '14, Secretary-Treasurer, Muirkirk, Maryland.
Scheduled evening meetings called for the third Thursday of every other month at the Continental Hotel, Washington, D. C. Special meetings arranged when warranted.

ENGINEERS' DAY

(Continued from page 24)

Annual Engineers' Day was over.

Conclusion

To Martin S. French, his student committee, and the faculty advisor, go the gratitude and commendation of all who attended the E-Day celebration. The fine program and the smooth handling of the activities spoke clearly of hard work and careful planning. Committee members were:

Martin S. French ..... Chairman
Walter M. Chapman ..... Vice Chairman
Louis M. Hovart ..... Exhibits
Jasper N. Warren ..... Advertising
Howard A. Anderson ..... Registration
Frederick T. Quiett ..... Activities
Joseph R. Driear ..... High School Exams
H. E. Berninghausen ..... Publicity
Wayne F. Bohanan ..... Geophysics
Emory V. Dedman ..... Ass't Geophysics
Harry L. Shively ..... Coal Mining
Ross M. McDonald ..... Metal Mining
Arthur Meyer ..... Mining Geology
William H. Everett ..... Metallurgy
Robert H. Muench ..... Metallurgy Ass't
Glenn W. King ..... Petroleum Production
John V. Newhouser .... Petroleum Geology
Warren S. Dronen .... Petroleum Refining
Carl F. Yuenger ..... Ass't Pet. Ref.
Gordon L. James ..... Ass't Pet. Ref.
George M. Ball .... Engineers' Day Dance
Franklin F. Clark ..... Faculty Advisor

CONTRIBUTORS TO PLACEMENT FUND

(Continued from page 6)

Preston Grant, Ex-'33
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C. E. Stiefken, '41
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Ardris Haig, '36
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G. Keith Taylor, '23
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Billy F. Dittman, '49
W. Fred Gaspar, '43
Louis Hirsch, '49
H. A. Bruna, '41
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R. S. Bryson, '49
Ernest E. Braun, '49
C. D. Frobes, '24
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T. E. Phipps, '49

ALUMNI BUSINESS

(Continued from page 37)

The Annual Banquet, preceding Commencement at Mines, will be held Thursday, May 25, 1950, at Daniels & Fisher's. Two speakers for the dinner were suggested: Maple T. Harl, Chairman of the Board of the Federal Deposit Insurance Corporation, and George T. Harley, Manager of International Minerals & Chemical Corporation. It was suggested that it be left to the committee to decide on the speaker.

Moved by Mr. Evans the report be accepted; seconded by Mr. Dismant; passed.

Publication Committee

Mr. Bowman reported for Mr. Heckt.

Financially, the magazine is in good shape. For the 25% budget period 27.5% of the budgeted income for the year has been earned and 18.1% of the alloted expenditures have been spent.

The April magazine should be ready for mailing around April 20.

There is plenty of material on hand for the May issue.

(Continued on page 41)

Book Reviews

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

The Road Ahead, America's Creeping Revolution

By John T. Flynn, The Devin-Adair Co., New York. 1950. 160 pages. $2.50.

Here is a book which has an excellent chance of becoming the instrument for the crystallization of that large body of public opinion which stands in opposition to the leftward trend of our government in matters political and economic, particularly the latter.

Aside from its other values, this book will serve a useful purpose in that it takes *a stand unequivocally and without pretense on an issue, the finer points of which have too long been surrounded with the mists of abstraction and emotionalism.* The author names names without regard to position or prominence and without apology or evasion. Readers on any side of the political fence will be forced to admire his refusal to hedge on the issues he discusses.

Drawing a forceful parallel between political and economic developments in this country and the rise of Fabian Socialism in Britain, the author traces the swing away from pure capitalism which has characterized recent U. S. developments in the theory and practice of national economics. He names the persons and organizations responsible for this trend and he describes just how it is being accomplished.

Calling for positive action, Mr. Flynn sets forth a series of steps to be taken against the anti-capitalistic trend now existent and readers will like the freshness of his approach.

For many a reader who has been wandering about in a confusion of doubt and bewilderment in matters political and economic, this book will serve as a literary catalyst, resolving loose thinking into a solid core of strong conviction and, indeed, it is about time.

Prosperity Unlimited

By Carl Wilken, lithographed, Sioux City, Iowa. 1947. 158 pages. 31 Charts. $3.00.

The author of this very interesting book is a farmer, a very articulate one to be sure, but a farmer, nonetheless, with all the farmer's innate respect for and faith in agriculture *per se.* This fact is quite evident to the reader as he peruses the opinions and ideas set forth in the book.

The basic tenet of Mr. Wilken's economic theories is his unshakable belief in the paramount position of agriculture in the national economy. Quoting Ben Franklin he says that there are only three ways for a nation to become wealthy, i.e.: war, exploitation, and agriculture, and he assembles some powerful evidence in support of this idea. In consequence, he adds, "there is only one answer to our economic problems. We must maintain farm prices at parity if we wish to have the foundation for full employment and prosperity."

In the area of world trade, the author decries the blindness which brings a constant stream of imports of "cheap" foreign goods into this country. Says Mr. Wilken, 'A pound of copper in Chile at 8 cents per pound may cost less, but it will also reduce the exchange market for manufactured goods in exact ratio. Industry, instead of having a market for 17 cents of finished goods for each pound of copper it uses, will have a market for only eight cents. *If this policy forces the Arizona miner out of a job, then industry will have to pay taxes to keep him on relief out of the 8-cent market in Chile.*"

Thus the author exposes the fallacy of "cheap" imports. He points out, also, the dangers to the development of domestic industries which are a consequence of hyper-importation.

"Free enterprise," says Mr. Wilken, "must have a 'governor' if we are to escape the 'boom and bust' cycle and this 'governor' should be stable prices." He insists that, "a stable price level does not remove the incentive to produce but protects it. Industry must realize that profits should be made through efficiency in production rather than the up and down swing of the price level."

All of these ideas are presented with much factual and statistical material to support them but their principal force comes rather from the obvious sincerity and conviction of their author. Many readers will disagree with the writer's economic theories but they will be hard put to refute them as forcibly and as factually as they are presented. The phenomenon of a new economic theory being presented interestingly and in simple language will draw loud cheers from those who have suffered through weighty, wordy tones on economy which say less in ten pages than this little book says in one paragraph.

Out of My Later Years

By Albert Einstein, Philosophical Library of New York, New York, 1950. 282 pages. $4.75.

Perhaps the most interesting feature of this book consists of Einstein's comments on the nature of scientific thought and on the human mind as an instrument of comprehension.

There is reality; at least our intuition tells us so. And there are concepts of reality and "constructs" of the mind which may or may not correspond to reality. "On the stage of our subconscious mind," says Einstein, "appear in colorful succession, sense experiences, memory pictures of them, representations and feelings" and the "totality" of this "is such that by thinking it can be put in order." This is a fact, he says, "which leaves us in awe but which we shall never understand." "One may say," he continues, "the eternal mystery of the world is its comprehensibility," and again, "In guiding us in the creation of such an order of sense experiences *success in the result is alone the determining factor.*"

He speaks of "primary concepts, intimately connected with typical complexes of sense experiences," of a secondary and a tertiary layer tied less and less directly to the sense experiences and so on toward a system "of the greatest conceivable unity." "We do not know whether this ambition will ever result in a definite system." He has hope that it may, but in the meantime "Today's systems of concepts contain deep-seated incongruities." He proceeds to outline the progress so far.

"No one must think," he says, "that Newton's great creation can be over thrown in any real sense." Though we have made "important progress since the time of Newton, we still have no formulation of physics from which the whole complexity of investigated phenomena and of partial theoretical systems of a successful kind could be logically deduced."

He proceeds historically to the "notion of the material point," as fundamental to mechanics, to trouble with the theory of light as its "wave" character was revealed, to the very successful theory of the electro-magnetic field, and, to the unresolved conflict between the "field" and the "material point" concepts. Newton's theory could no longer explain the whole of physical reality.

Then as to relativity, Einstein speaks of the Maxwell-Lorentz Theory, how its success brought confidence that the electromagnetic equations for empty space are valid, along with the statement that light travels in space with a certain constant velocity C. It was necessary to recognize the law of a constant velocity of light for all inertial systems. "By this procedure time lost its absolute character and was included with the special coordinater (X.Y.Z.) as of algebraically (nearly) similar character."

Notions of anything like a fixed frame of experience for "absolute motions" had to go. Also the sense of time as a separate entity, flowing on at a uniform rate, regardless of anything else. And in their place came notions of space that may somehow be curved or warped, of measuring rods becoming shorter as their speed increases, measurements of time; also that change according to some law, and, all this inexplicable without the use of ingenious mathematics.

No doubt this set of concepts is successful in many aspects. The bystander may ask: "Are they merely tools to employ in using the forces of Nature? As we use them, will we develop an intuition as to their meaning and relation to reality?"

The relation $E = Mc^2$, is one of these concepts. That some corrolary of it is successful, we have Hiroshima to witness.

Einstein speaks of "those parts of the general relativity theory which can today be regarded as final" but adds that they still leave two logically unconnected parts, gravitational and electro-magnetic, in a total field, nor have they explained the atomistic structure of matter.

There are difficulties with the quantum theory also. As to that, he says, "Probably never before had a theory been evolved which has given a key to the interpretation and calculation of such a heterogenous group of phenomena." Still he thinks it is "apt to beguile us into error in our search for a uniform basis for physics" and this because of incompleteness as an "outcome of the statistical nature of the laws."

He concludes his scientific discussion as follows: "Some physicists, among them myself, cannot believe that we must abandon, actually and forever, the idea of direct representation of physical reality in time and space, or that we must accept the view that events in nature are analogous to a game of chance. It is open to every man to choose the direction of his striving; and also every man may draw comfort from Lessing's fine saying, that the search for truth is more precious than its possession."

"The whole of science," Einstein states, "is nothing more than a refinement of every day thinking." Some of his thinking on other subjects is of a familiar "every day" sort, and some is like his scientific thinking. For instance, in regard to ethics, he says, "If we can agree on some fundamental ethical propositions, then other ethical propositions can be derived from them." "Ethical axioms are found and tested not very differently from the axioms of science. Truth is what stands the test of experience."

As to religion, he believes a "religiously enlightened" person has freed himself as well as he can from the "fetters of his selfish desires" and has aspirations "to which he clings because of their superpersonal value." Again, "Science can only be created by those who are thoroughly imbued with the aspiration toward truth and understanding. This source of feeling, however, springs from the sphere of religion."—"Science without religion is lame, religion without science is blind." He says, however, "Teachers of religion must have the stature to give up the doctrine of a personal God."

As to government, he believes in socialism and a planned economy, but he says, "A planned economy as such may be accompanied by the complete enslavement of the individual."—"How can the rights of the individual be protected and—a counter weight to the power of bureaucracy be assured?"

He believes that the only means to insure peace is a super-government, a world government. It should come by agreement, but this is hardly possible, human passions being what they are. More likely it will come by conquest.

He is ardently for freedom, of the individual to follow his creative bent. He is for tolerance, and deplores race prejudice against the negroes, and of course as against Jews. As regards this latter prejudice it is remarkable that he can be as objective as he is. He is a humanitarian. His wish is for the good of mankind.

One who reads this book will be spending his time among great and original ideas and in the company of an inspiring personality.

Reviewed by L. W. Storm, '02

Industrail Materials Handling

By I. M. Footlik, C. F. Yarham and J. F. Carle. Lincoln Extension Institute, Inc. Cleveland, Ohio. 1950. $4.75.

The rather ambitious aim of this excellent new book is to make a science out of industrial materials handling, or, as the publishers put it, "to establish a basic philosophy for thinking and acting objectively in effecting savings of money, time and effort in the industrial handling processes by the application of the new analyses, equipment and procedures to existing needs."

One very interesting phase of this new approach is a newly devised set of symbols used to represent handling equipment, motions and men on Flow Process Charts and plant layout.

An idea of the coverage may be gotten from the following chapter headings: Development and Scope of Materials Handling; Fundamentals of Materials Handling Operations; Selection of Materials Handling Equipment; Handling Equipment—Floor Operated; Handling Equipment—Miscellaneous; Conveyors; Overhead Handling Equipment; Power Industrial Trucks; The Ford Truck; Pallets and the Pallet System; Unit Loads; Plant Layout; How to Make a Materials Handling Analysis; A Typical Industrial Solution; and Materials Handling Organization.

Industrial, personal, educational and research institutions, professional societies —everyone interested in industrial technology will welcome this fine book which, for the first time, attempts to bring together all the basic information in this, industry's greatest cost-saving area.

Introduction to Theoretical Igneous Petrology

By Ernest E. Wahlstrom, Professor, Department of Geology, University of Colorado. John Wiley & Sons, Inc., New York. 1950. 365 pages, illustrated. $6.00.

Written primarily in answer to the need for a basic textbook for the study of igneous petrology, this book is designed to provide for the reader the background necessary for the understanding of fundamental concepts and the awareness of trends of thought in the field.

Noting the ever-increasing emphasis on the quantitative aspects of petrology, the author has stressed the quantitative approach to the subject. He presents a survey of the theory and practice of geophysics and of physical chemistry—especially the phase rule.

The text is clear and concise and the many excellent line drawings and tables add to the clarity of the subject matter. Students will be grateful for Dr. Wahlstrom's wisdom in submitting the manuscript of this work to his students for criticism. The results of this plan are evident in the unusually detailed explanations. A further aid to the understanding of this text is the Appendix which explains some "Physical-Chemical Concepts Useful To Petrologists."

One of the great difficulties in the study of igneous petrology, particularly in its theoretical aspects, has been the fact that practically all of the worthwhile literature on the subject is scattered widely throughout a vast body of technical papers and journals and in bits and pieces in various textbooks not primarily devoted to the subject. The average student (or anyone else, for that matter) does not have the time to seek out and absorb all of this scattered information.

Moreover, many students find the highly technical language and the complex mathematics involved in the literature on the subject completely beyond their ken.

This excellent book goes a long way toward remedying that situation and will fulfill a great need both in the classroom and for those concerned with the practical application of petrological knowledge.

ALUMNI BUSINESS

(Continued from page 39)

All material for the 1949 Yearbook and Directory and all but the last 20 pages have been printed.

The 1949 Index should be ready for mailing with the April issue.

The June issue will be the Special Commencement Number.

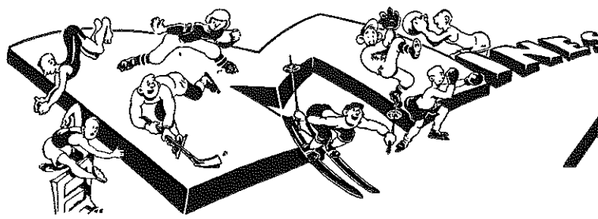
The 15th Annual Petroleum Number is planned for publication in September. Letters are being written to obtain articles and advertising.

Moved by Mr. Dismant the report be accepted; seconded by Mr. McNeill; passed.

Research and Investigation Committee

Mr. Spalding reported for Mr. Storm.

(Continued on page 43)



Sports MARCH

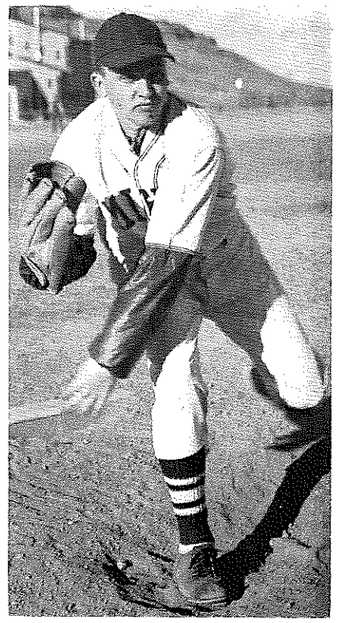
By BILL ANDERSON

Baseball

The Mines Baseball team opened the 1950 Season at Golden by dropping a heartbreaking 13-15 decision to the Denver University nine on March 31, 1950. Mines jumped into a 5-0 lead at the end of one inning as the first six men in the batting order hit safely. At the end of three innings, the Orediggers sported a 9-3 lead only to lose out in the late innings of play. Catcher Fred Hohne, Second Baseman John Volosin and Pinch Hitter Ralph Anderson powered balls out of the park for home-runs. Jack Weyler's running catch of a low sinking liner in the 5th inning provided the game's fielding highlight.

Mines again lost to DU in a return game the following day by a 1-6 score as Art Dollaghan, the Pioneer's pitching ace, silenced the Oredigger's bats with a neat five-hitter. Sophomore Tom McLaren, a right hander, pitched a creditable game in his first college appearance.

On April 4, the Mines squad journeyed to Colorado Springs to win a thriller from Colorado College by a 6-5 score. Lefty Joe Alberts was working with a 5-0 shutout going into the 6th inning, when his wildness enabled C.C. to tie up the ball game. Norman Korn, Mines' first baseman proved to be the man of the hour coming through with a home run in the seventh inning to ice the victory for the Orediggers. Korn and Weyler were the hitting stars for the Blasters, garnering four and three hits respectively out of the eight hits collected by the entire Mines team.



▼ "Lefty" Joe Alberts, Senior Pitcher Colorado School of Mines—Spring, 1950.

On April 7 and 8, the Mines team dropped two slugfests against Colorado University by scores of 6-18 and 9-29. Gerry Bond, Joe Alberts and Ralph Anderson walloped homers against the Buffs.

Something new was to have been added to the sports program at Mines with the inauguration of a Sunday doubleheader with Western State, which was scheduled on April 16. The double bill was rained out, however, so the Mines nine will have to wait until May 14 for a Sunday game scheduled at the Lowry Airbase.

Mines lost to the Regis Rangers on April 19 by a 8-15 score. Neither Joe Alberts nor Hurley Pepper, Mines' two top pitchers, could check the Regis hitting spree.

Track

The Colorado School of Mines track team opened their season with an indoor dual meet at the D.U. fieldhouse on March 18, losing to the talented Pioneers by a score of 82¼ points to 30¾ points. Paul Vaughan, Mines distance ace won both the mile and the two mile runs. Roy Essary also accounted for a first place with his throw of 44′ ½″ in the shot put. The summary follows:

50 yd. Dash — Tesone (DU), Barnes (DU), Senter (DU). Time 5.5.
440 yd. Dash — Benich (DU), Weber (DU), Brown (Mines). Time 51 seconds
8:80 yd. Dash — Teel (DU), Goodwin (DU), Dickinson, (Mines) Time 2:04.9.
Mile Run—Vaughan (Mines), Montgomery (Mines), Kovar (DU) Time 4:49.8.
Two-mile Run—Vaughan (Mines), Flemming (DU), Zakhmi (Mines) Time 10:44.5.
50-yd. Low Hurdles—Hiserman (DU), Beardsley (Mines), Webb (DU) Time 6 seconds flat.
High Hurdles — Martin (DU), Webb (DU), Gaulke (Mines) Time 6.5.
One-lap Dash — Senter (DU), Bitzer (Mines) Time 17.7.
Shot Put — Essary (Mines), Precaido (DU), McCarthy (DU). Distance 44 ft. ½ in.
Pole Vault—Cook (DU), tie for second, Champion (Mines) and Gibson and Servatius, both Mines. Height 11 ft. 6 in.
High Jump—Tie between Biffle and Finberg, both DU. Tie for third between Adams, Connelly and Irish, all Mines, and Martin (DU). Height 5′ 10″
Broad Jump—Biffle, (DU), Cook (DU), Tesone (DU). Distance 23′ 7″
Eight-lap Relay—Denver (Wever, Holbrook, Senter, Benich). Time 2:32.

Paul Vaughan placed third in the college mile run in the Colorado University invitational indoor meet at Boulder, finishing behind Fitzmorris of C.U. and Jewell of Colorado State, in a blanket finish with 5 yards separating Vaughan from the winner. This was the first occasion in two seasons that the Oredigger marathoner had placed lower than second.

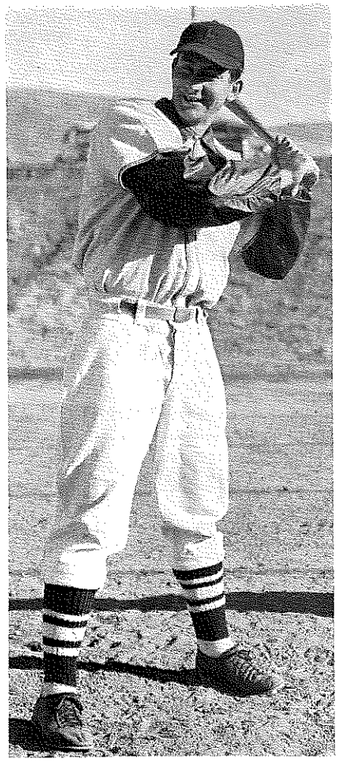
The dual meet scheduled with Colorado State on April 15 was postponed until Tuesday, May 2, due to heavy rains.

Tennis and Golf

The outlook is none too bright for the spring minor sports program at the Colorado School of Mines, as both the number one and two men on the tennis team have graduated and the golf team finds itself with no returning letter winners. Tennis Coach Keith Bowen has five returning lettermen who are finding tough going to make the six man squad. Newcomers, Chuck Stewart and Don Moore are presently rated number one and two. Returning lettermen are Bill Chu, Milt Aldrich, Roy Pixler, Cliff Stockwell, and Dick Zoerb.

The 1950 Mines Tennis Schedule is as follows:
April 15—Colorado State College at Colorado Mines.
April 21—Regis at Colorado Mines.
April 22—Colorado Mines at Colorado College.
April 29—Colorado Mines at Regis.
May 6—Colorado A. & M. at Colorado Mines.
May 12—Denver University at Colorado Mines.
May 19-20—Conference Meet at Colorado Mines.

The 1950 Mines Golf Schedule is as follows:
April 15—Colorado Mines at Colorado College.
April 21—Fitzsimons at Colorado Mines.
April 27—Colorado College at Colorado Mines.
April 28—Regis at Colorado Mines (tentative).
May 12—Colorado Mines at Regis (tentative).



▼ Norman Korn, Senior 1st baseman, Colorado School of Mines—Spring, 1950. All-conference past two seasons.

In the tennis opener against Colorado University the Orediggers failed to win a match. Charles "Red" Lewis and Pat Mercier are presently rated number one and two on the Mines Gold team.

Spring Football

The Mines spring football drills were climaxed by an intrasquad game on April 14, at Brooks Field. Head Coach, Fritz Brennecke, divided the squad into two teams—one composed of last year's squadmen and varsity letter winners and the other, last year's freshman squad. The veterans' team defeated the frosh of 1949, 19-6 with all scoring coming in the second half. The varsity's first touchdown was set up by a 28 yard pass from Bob Jacobsen to Max Settlemyre. A 5 yard plunge by Ed Ziolkowski gave the winners a brief 6-0 lead in the third quarter. The frosh came back minutes later to score on an 8 yard pass play, Bill Morgan to blocking back, Jason Johnson. Varsity returnees were ahead to stay shortly before the end of the third quarter, on a pass from Bob Jacobsen to Max Settlemyre good for 18 yards and 6 points. Dick Barnes added the extra point from placement. The outstanding play and run of the day came in the last period when Ray Govett intercepted a Bill Morgan pass and lateraled to Dave Brown, who went 56 yards for the remaining varsity points. Outstanding in the line for the varsity team were Settlemyre at end, center Adam Thomas, and guard Gerald Jefferies. The frosh line play was lead by Bob Howard a rugged 186 pound guard from Toledo, Ohio, end Ken Dunn, and tackle George Schmidbauer. Backs earning commendation were fullback Ed Ziolkowski, blocking back John Conners returning from the 1948 team and wing back Dave Brown. Jason Johnson, a fine blocking back prospect and Bill Morgan starred for the losers. While spring practice was not wholly satisfactory due to the number of varsity performers of 1949 who were excused and the weakness of last year's freshman team, Coach Brennecke is not pessimistic concerning next year's outlook as only three first string regulars were lost by graduation and casualties due to scholastic failures are thus far lower than anticipated.

▼ Front row, left to right: Hurley Pepper, Coach Karamigios, and Fred Hohne. Middle row, left to right: Gerry Bond, Paul Musgrove, Joe Alberts, Dick Bench, Howard Loenshal, John Volosin, Bob Wilson, Stewart Chuber, Russell Nelson, and Dave Wilson. Back row, left to right: Bob Einarsen, William Wilson, Tom McLaren, Eugene Smith, Terry Quiett, Jack Weyler, Ralph Anderson, Wallace Arnold, and Bruce Wentner.

ALUMNI BUSINESS

(Continued from page 41)

Cataloguing of the alumni is being continued. At the present time this research shows a high percentage of Mines Men are in high positions in business and industry.

Classifications according to classes will be the next project.

The aim of this research will be to show the public how good Mines Men really are and to show the State Legislature that there is some purpose in the Colorado School of Mines.

This committee will collaborate with the Instruction committee.

Moved by Mr. McGlone the report be accepted; seconded by Mr. Setter; passed.

General Report

Mr. Bowman reported that every thing had been covered in the previous reports.

Special Business

An application for Associate membership was presented from Donald Harrison Blair of Albuquerque, New Mexico. He met all the required qualifications and had submitted the necessary fees. Moved by Mr. Setter the application be accepted; seconded by Mr. McNeill; passed.

Adjournment

No further business appearing the meeting was adjourned at 10:00 P.M.

MINES ALUMNI BANQUET
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THURSDAY EVENING
MAY 25, 1950
MAKE RESERVATION NOW

WEDDINGS

(Continued from page 34)

Hochberger - Weiss

Mr. and Mrs. Nathaniel Weiss have announced the marriage of their daughter, Jane, to Samuel M. Hochberger on February 5, 1950, in New York.

Mr. Hochberger, of the class of '48, is sales engineer for Atlas Powder Company. The couple are residing at 1232 South 9th Street, Allentown, Pa.

Krohn - Pellillo

On April 23, 1950, Edmond A. Krohn and Miss Evelyn Pellillo of Denver were united in marriage. They are now residing at 2215 Race Street, Denver 5.

Mr. Krohn of the class of '43, is associated with the Robinson Brick and Tile Company of Denver.

BIRTHS

Mr. and Mrs. Thomas A. Hoy announce the birth of their third child, Robert Hugh, on January 17, 1950. Janet Ann is three and a half years of age and Thomas, Jr. twenty-one-months.

The Hoys have recently returned to Denver to make their home, he having been transferred from New York. Mr. Hoy is technical service representative, Explosives department, E. I. duPont de Nemours & Co. The family is residing at 1337 Chase Street, Denver 14.

A daughter, Corinne Valerie, arrived at the home of Mr. and Mrs. Andre Marin on February 15, tipping the scales at 7 lbs., 10 oz. This is their second child, the first being a son.

The family home is 1914 Belle Terrace, Bakersfield, Calif. Mr. Marin, '45, is geologist for Western Gulf Oil Company.

Mr. and Mrs. Douglas Ball welcomed a daughter into their home on February 26 whom they have named Anna Gail. They have three sons. The baby's paternal grand-father, Max W. Ball, '06, is especially proud of his first grand-daughter.

Douglas, '43, is associated with his father as oil and gas consultant with offices at 1025 Vermont Avenue, Washington, D. C.

Mr. and Mrs. William W. Scott are the parents of a daughter who arrived February 26. Mrs. Scott is the former Marian Marica of Golden. Mr. Scott, who was graduated last May, is petroleum geologist with the Union Oil Company at Newcastle, Wyoming.

Mr. and Mrs. Arthur E. Calabra, '48, announce the arrival of "a future 'Miner'" Richard Lee, on October 9 of last year. The family are residing at 4234 Decatur Street, Denver 11.

Robert T. Krueger, '34, has listed his son, Robert Edward, in the class of '71 at *Mines*. The baby arrived on September 30, 1949 and is much thought of by his three sisters.

Mr. Krueger is Engineer for the U. S. Bureau of Reclamation. The family is now residing in their new home at 8500 West 10th Avenue, Denver.

Mr. and Mrs. G. W. Hoffman, Jr. announce the birth of Katherine Ann, December 30, 1949, weighing 6lbs., 5 oz. She has a big brother, all of one year. Mrs. Hoffman is the youngest daughter of Dr. and Mrs. F. M. Van Tuyl of Golden. Dr. and Mrs. G. W. Hoffman of Idaho Springs are paternal grandparents.

Mr. Hoffman, '48, is employed by Continental Oil Company with a new address in care of the company, Ponca City, Oklahoma.

A request has been received to enroll the son of Mr. and Mrs. Robert C. Arnim in the class of "1970" at *Mines*. He arrived at the home of his parents on January 5, 1950 but his name was not given in the request.

Mr. Arnim of the class of '50 is petroleum engineer, specializing in mud control, for Baroid Sales division, National Lead Company. The family home is 2325-B Chester Lane, Bakersfield, California.

Mr. and Mrs. Phil H. Garrison welcomed into their home on February 9 their fourth child, a 6-pound, 1-ounce daughter whom they have named Sharon Alene.

Mr. Garrison, '39, is Seismograph Field Supervisor for Stanolind Oil and Gas Company with mailing address Box 3092, Houston 1, Texas.

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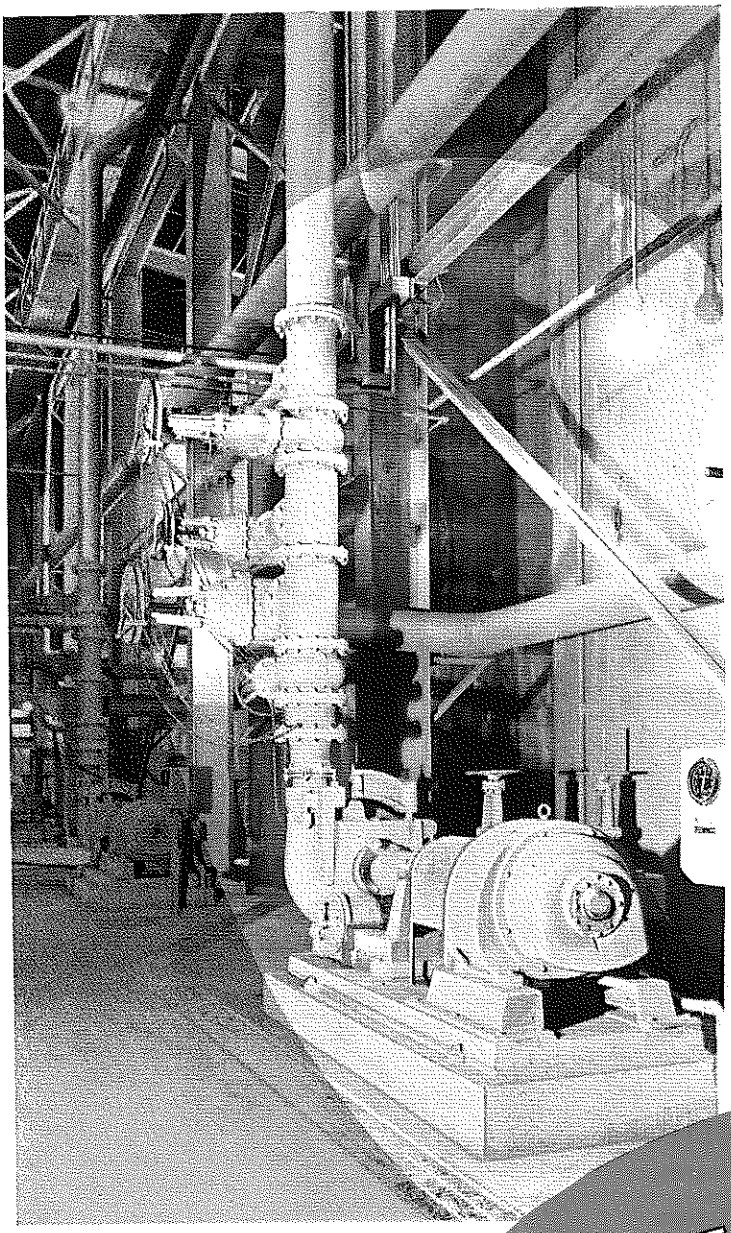

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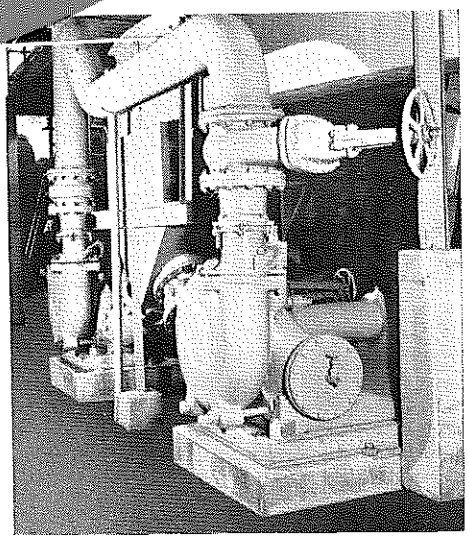

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