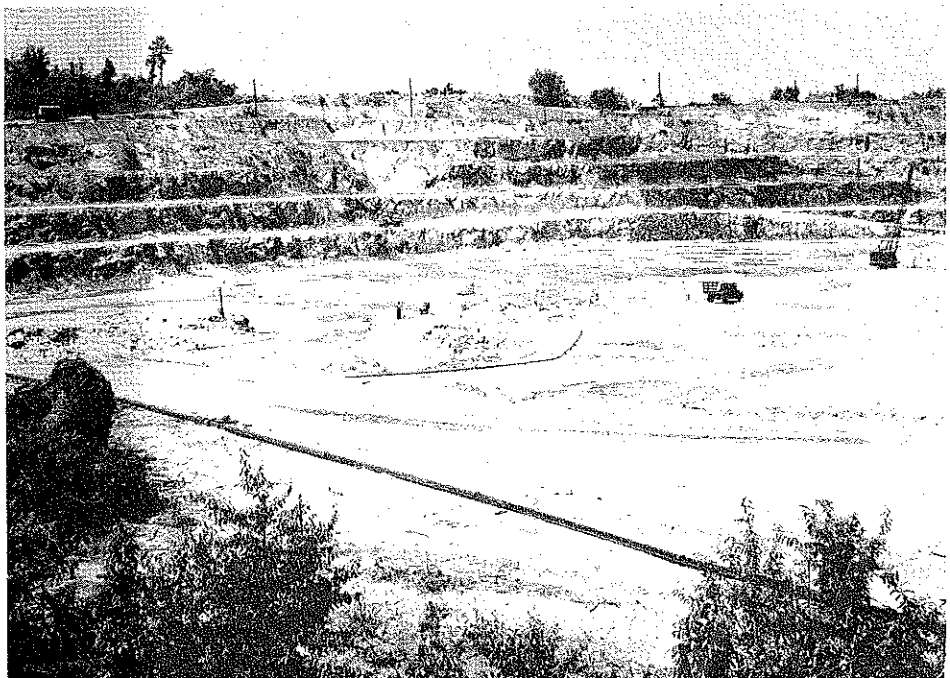
THE MINES MAGAZINE

APRIL 1960

- Lithium Mining Operations
- The Balance of Payments Problem
- New Swedish Lead Mine Crushing Plant
- Mineral Engineering Education
- National Western Mining Conference Program
- Explosions Research Applied to Mine Blasting
- Production of Lightweight Aggregate



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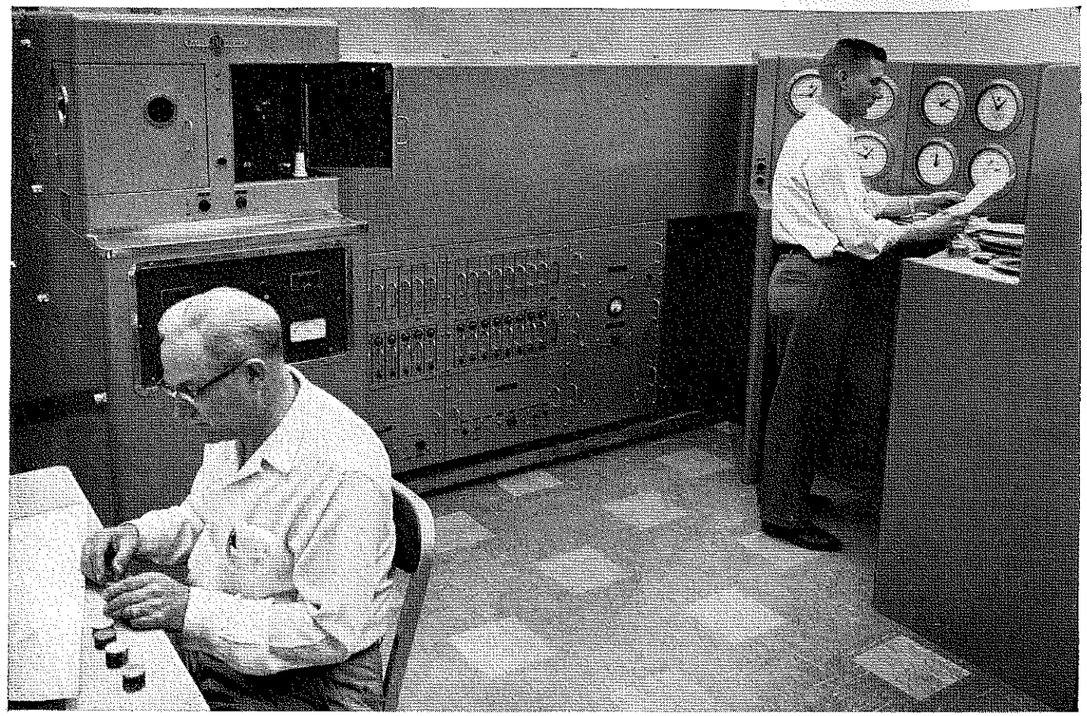

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Volume L April, 1960 Number 4

CONTENTS—

DEPARTMENTS—

FRONT COVER—

Scene in Foote Mineral Company's open-pit lithium mine, Kings Mountain, N. C. (See article on page 11.)

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BREWSTER CONANT, '50, is investment analyst for Mitchell, Hutchins & Co. of Chicago. His address is 962 Dobson, Evanston, Ill.

WILLIAM H. EVERETT, '50, has moved from Ontario, Calif. to 128 Lincoln St., Pueblo, Colo.

HANDREN K. FITZGIBBONS, '50, may be addressed c/o ARAMCO, Dhahran, Saudi Arabia.

EDWARD E. HOWARD, '50, has moved from Albuquerque, N. M., to 6642 Kipling St., Arvada, Colo. He is now associated with G. M. Wallace & Co. as a sales engineer in Denver.

FRANK J. MURPHY, '50, is area petroleum engineer for The California Co. at Rangely, Colo.

JAMES M. MURPHY, JR., '50, party chief for Phillips Petroleum Co., lives at 1409 Macklyn Lane, Bartlesville, Okla.

EDMUND F. VORMWALD, '50, may be addressed c/o ARAMCO, Box 796, Ras Tanura, Saudi Arabia.

1951

THOMAS J. CARNEY was recently re-elected chairman of the Jefferson County Republican Central Committee in Golden, Colo. His election was considered a victory for the "liberal-progressive" faction of the party over the "conservative" element.

CARL L. BIENIEWSKI, formerly of Milwaukee, Wis., is geological engineer for the U. S. Atomic Energy Commission. His mailing address is P. O. Box 901, Grand Junction, Colo.

PETER A. DE SANTIS is assistant superintendent for the AS&R Co. A.V. Plant at Leadville, Colo.

VINCENT F. MALONE is mining superintendent for Lone Star Steel Co. with mailing address Box 67, Daingerfield, Texas.

RALPH B. SCOTT, x-'51, has accepted a position with Northwestern National Bank of Minneapolis, Minneapolis 2, Minn., as assistant director of Industrial Development. He was formerly with Northern States Power Co. of Minneapolis.

1952

WILLIAM L. CLINKENBEARD may be addressed c/o Esso Research and Engineering Co., P. O. Box 121, Linden, N. J.

E. W. DAVIS is a graduate student at the Colorado School of Mines, with mailing address 67 Prospector Park, Golden, Colo.

DR. SALAHI H. DIKER, geophysicist for Empire Geophysical, Inc., has been transferred from Fort Worth, Texas to Denver, Colo. His mailing address is P. O. Box 7865, Denver 15, Colo.

NICHOLAS J. GREENAWAY, JR., may be addressed at 501 Mahoning Location, Hibbing, Minn.

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MONTIE C. MacMURROUGH is division geophysicist for Pacific Northwest Division, Standard Oil Co. of Calif. His address is 14419 SE 14th St., Bellevue, Wash.

JAMES E. MASSEY, mill foreman for Trace Elements Corp., lives at 1124 Breeze, Craig, Colo.

EUGENE L. McDANIEL lives at 7225 W. 20th Ave., Lakewood, Colo.

JOSEPH P. McDANIEL is district geologist for Susquehanna-Western, Inc. His address is 1483 W. Alaska Pl., Denver 23, Colo.

WILLIAM R. MATTHEWS is production engineer for The California Co. with mailing address Box 713, Brookhaven, Miss.

ROBERT M. POZZO is a student at Harvard University Graduate School of Business Administration. His address is 938 Belmont St., Watertown 72, Mass.

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Lt. JOHN R. BEERS's new address is Hq. USAREUR Eng. Div., I & M Branch, APO 403, New York, N. Y.

LEON E. BORGMAN is studying for his Ph.D. degree in statistics at the University of California. His address is 1116-A 8th St., Albany, Calif.

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HOWARD C. KAYLOR, product manager for Parkersburg Rig & Reel Co., has been transferred from Coffeyville, Kans. to Houston, Texas. His mailing address is P. O. Box 13295, Houston 19, Texas.

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JAMES W. COOKSLEY, JR., is field geologist for Southern Pacific Co. at Needles, Calif. His P.O. Box number is 324.

MARIO GUERRA'S address is Box 603, Golden, Colo.

B. E. HARTMANN has moved from Ft. Smith, Ark., to Grand Junction, Colo. He picks up his mail care of General Delivery.

R. F. HATFIELD has moved from Palo Alto, Calif., to Bldg. 209, Apt. 11, Stanford Village, Menlo Park, Calif.

SAMUEL L. McCLAREN has moved from Tulsa, Okla., to Denver, Colo., where he joined the law firm of Holme, Roberts, More & Owen, 1700 Broadway, Denver 2, Colo.

DANIEL J. NELIPOVICH, geophysicist for Humble Oil & Refining Co., may be addressed c/o Esso Exploration Guine Inc., P.O. Box 39, Bissau, Portuguese Guine, West Africa.

LOUIS L. PHANNENSTIEL, department head for Union Carbide Nuclear Co., is living at 1004 Palmer Ave., Glenwood Springs, Colo.

(Continued on page 39)

PROFESSIONAL DIRECTORY

BOOK REVIEWS

Economics for the Mineral Engineer

By Edmund James Pryor, Pergamon Press, London, 1958.

Reviewed by M. A. Klugman, assistant professor, Geology Department, Colorado School of Mines.

Economics for the Mineral Engineer is a systematic step-by-step consideration of the exploration, development and operation of a mining property. It is written specifically for students of the mineral industries, but it is a good text for any person connected with the industry.

It treats in the main the major and most common factors in the various stages of development, but it also includes many of the exceptions as well as relatively minor factors which nevertheless have an important effect on the over-all stage.

A book of this type is difficult to put together as a unit without it becoming too general and alternately too detailed. The author has succeeded in writing a book which is subject to neither of these objections. For those who wish greater detail, he has included additional references at the back of the book, in addition to the references used in the text. An extensive glossary is also included at the back.

In writing the book the author has kept economics, the most important factor in the mineral industry, to the fore. Whatever problems arise in the mineral industry, they are always governed by economics. With this in mind, he has covered the following fields:

A general introduction outlining the approach used in the book and discussing some basic considerations.

Prospecting, sampling and valuation covering in brief the approach and governing factors. It also includes some pertinent remarks on such things as reliability of sampling, fraud and error.

Accounts and organization include the records that should be kept, some of the reasons why and brief illustrations of how to set them up. The chapter also includes sections on company structure, and taxation and share value. In the words of the author, "This is not a treatise on accounting" but sumply an outline showing the organization.

Managerial structure treats in brief but informative sections all of the pertinent factors involved in management.

In a chapter titled "Marshalling the Data," the author illustrates the importance of knowing the facts, understanding short-comings, and thus having a "hand on the pulse" of the operation at all times. This includes making improvements and changes when necessary.

More complete treatment is given to mill operations. Here not only are the normal practices of operating a mill covered, but also such critical factors as labor relations, managerial methods, operational research and safety are discussed.

New construction, not only additions, but also a new plant, is well covered.

The marketing of the product is the final stage in the step-by-step approach used by the author. Both cases, where a mine operates its own smelter and where a mine does not operate its own smelter, are discussed with regard to ore concentrates and where necessary contract negotiations. Special cases (for example, asbestos) are discussed, and also metal pricing methods for the various products. Also included are some definitions of commercial terms, methods of packing, by-products and custom plants.

The last two chapters might be termed general. The first considers managerial skills such as personal relations, personal outlook, psychology in industry and others. The second, titled "Generalities," includes subjects such as camp amenities, legal matters, and technical writing.

At all times the author has stressed the importance of quick and accurate accumulation and assessment of the technical and financial facts.

Tantalum and Niobium

By G. L. Miller, Academic Press Inc., 1959, (figures, diagrams, photographs), price $21.

Reviewed by D. R. Williamson, Colorado School of Mines Research Foundation, Inc.

This book is the sixth volume in the "Metallurgy of the Rarer Metals" series —a product of Butterworth's Scientific Publications of London. Like the earlier volumes, it very largely is a presentation of metallurgical information—particularly of physical metallurgy data.

The history, occurrences, consumption and uses of the metals are all described in the first 67 pages. Although the discussions appear to be only background for the body of the book, the author presents a good selection of details and summaries. The reader should be reminded, however, that in these first chapters much more information was omitted than was included. Extraction, separation, purification, and production of stock are allotted the next 250 pages. The remaining 388 pages of text describe fabrication, properties, corrosion, alloys, and compounds. Three appendices, totaling 35 pages, present chemical-analysis procedures, metallographic techniques, and thermodynamic data.

The author necessarily acted largely as a compiler of information, reporting much material with which he is not personally intimately familiar. In any such extensive work, this procedure inevitably results in statements that are not precisely correct. The author states that he wishes he had been able to rewrite some chapters. It is true that the precision and clarity of some passages are not so good as might be, and that some errors, both of statement and omission, are made. But it is also true that so extensive a coverage could not be made perfect within a practical period of time. As the author states in the Preface: "For the first time the whole of the science and technology of tantalum and niobium has been covered . . ." Such a valuable compilation of material is not injured by minor errors. Direct assistance from some of the best informed men in England, Europe, and the United States helps to bring most of the material up to date and authoritative.

Nearly 70 per cent of the references have publication dates of 1950 to 1959 inclusively. Personal communications yielded unpublished data, particularly about present day laboratory investigations. The bibliography of approximately 700 items might very well be, as is claimed, ". . . all the published work from the time of von Bolton . . ." (about 1900-1910). It is divided into 15 parts—one being placed at the end of each chapter and appendix. In each of these sections, the references are listed by number in the order they are mentioned in the preceding text. Repetitions are common. Such an arrangement is very awkward for most purposes. The system is not used in the other volumes of the series.

The book measures 1⅝ by 5½ by 8½ inches, and it is the largest of the series. All the volumes are set in Monotype Baskerville type, and the modern Decimal Heading System is used for classifying divisions. The type size, spacing, and general make-up are good, but the paper is too white, and it is too hard and has too high a gloss to be comfortable for extended reading. The book probably is too lengthy, inclusive, and technical to be a basic text. It is more in the nature of a source book, containing much technical information that will be of great value for professional persons in several fields for many years to come.

Petrology

By Gurdan Montague Butler, University of Arizona Bulletin, Vol. XXX, No. 1, 1959.

Reviewed by M. A. Klugman, assistant professor, Geology Department, Colorado School of Mines.

This publication treats the megascopic identification of rocks in a competent concise manner. The treatment of material is from an elementary level with a logical step-by-step approach. Several of the terms used are not commonly used by the professional geologist, but their use in this book serves to clarify the subject to the beginner.

The definition of some of the rock-types may be open to criticism by some, but it must be remembered that this is an elementary book.

The sequence of material included is: igneous rocks—their origin, mineralogical composition, and texture; stratified rocks —clastics, chemical precipitates, and organic rocks; metamorphic rocks—definition of metamorphism, regional metamorphic rocks, contact metamorphic rocks, contact metamorphism of clay rocks and limestone rocks.

Over all the book represents a good text for beginning geology and for amateur rock collectors. It is well presented and simply worded and most definitions are clearly explained.

Oil Property Evaluation

"Oil Property Evaluation" by John M. Campbell has just been published by Prentice-Hall, Inc., Englewood Cliffs, N. J. The author, Dr. Campbell, has a Ph.D. in chemical engineering, is now chairman of the School of Petroleum Engineering at the University of Oklahoma, and is a former development engineer with E. I. du Pont de Nemours & Co.

The book presents a detailed analysis on the calculation of reserves and the prediction of future reservoir performance; outlines a comprehensive discussion of oil economics; discusses the quantitative application of the tools used to obtain data, including decline curves, electric and radioactivity well logs, core analysis, geological data, and the various formation testing devices; give a close-up look at the estimation of costs and the evaluation of petroleum processing facilities, and has a section devoted to economics and the analysis of profitability.

1959 ACI Book of Standards

The 382-page, 1959 edition of the ACI Book of Standards is the most recent compilation of current ACI standards, recommended practices, and specifications. Fifteen ACI Standards are compiled under one cover, incorporating such subjects as building code requirements for reinforced concrete; winter concreting; hot weather concreting; selection of proper proportions for concrete; and the measuring, mixing and placing of concrete.

Other standards cover test procedure to determine relative bond value of reinforcing bars; evaluation of compression test results of field concrete; design and construction of concrete pavements and concrete bases; design and construction of reinforced concrete chimneys; application of portland cement paint to concrete surfaces; minimum requirements for precast concrete floor and roof units; application of mortar by pneumatic pressure; and construction of concrete farm silos.

The book, of 6 x 9-in. format, is available at $5 per copy from the American Concrete Institute, P. O. Box 4754, Redford Station, Detroit 19, Mich.

Minerals Exploration Program

The Office of Minerals Exploration has issued a pamphlet in question and answer form on the Minerals Exploration Program.

This pamphlet relates to the OME program of Federal assistance in financing exploration for domestic mineral deposits. Under this program the Government will pay up to 50 per cent of the cost of exploration which uses recognized and sound procedures including standard geochemical and geophysical methods to obtain pertinent mineralogical and geological information.

The pamphlet is published in handy pocket size for ready reference. It covers questions most generally asked about the program. Copies may be obtained from OME, Department of the Interior, Washington 25, D. C., or from any of the field offices as follows:

OME—Region I—South 157 Howard Street, Spokane 4, Wash.
OME—Region II—420 Custom House, 555 Battery Street, San Francisco, Calif.
OME—Region III—Federal Center, Building 20, Denver 25, Colo.
OME—Region V—Room 2-B, Post Office Building, Knoxville 2, Tenn.

1958 Minerals Yearbook

The latest Bureau of Mines' Minerals Yearbook, a comprehensive three-volume record of activities and developments in the Nation's mineral industries during 1958, has just been published, the Department of the Interior announced.

One of the largest ever issued, the 2,779-page edition also is the first since 1941 to be completed in the year immediately following that covered. Its publication is the culmination of an intensive Bureau program, designed to overcome a yearbook backlog that resulted because of urgent assignments during World War II and the Korean emergency.

An essential reference work for scientists, statesmen, and businessmen, as well as educators and students, the 1958 yearbook contains a wealth of facts on mineral production, uses, distribution, imports and exports, employment and injuries. Its three volumes are: Volume I—Metals and Nonmetals; Volume II—Fuels; and Volume III—Area Reports (a detailed review of mineral activities in the 48 States and also the offshore areas of the United States).

In addition, each volume includes summaries of important statistical information, discussions of significant technological developments, detailed statistics on world mineral production, and accounts of outstanding industrial developments both at home and abroad.

Copies of the 1958 Minerals Yearbook can be obtained ONLY from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at the following prices:

Volume I—Metals and Minerals, Except Fuels, $4; Volume II—Fuels, $2.25; Volume III—Area Reports, $3.75.

Individual chapters comprising each volume also are available separately from the Superintendent of Documents at prices ranging from 5 cents to 35 cents. The Minerals Yearbook is not sold by the Bureau of Mines.

Tungsten-Molybdenum Separation Process Described by Bureau

"Fused-salt-bath electrolysis," a new and simpler method recently developed by the Bureau of Mines for selectively extracting tungsten and molybdenum from domestic mineral concentrates, is described in a technical publication just released by the Department of the Interior.

The process, which has aroused wide industrial interest, promises to reduce costs of producing acceptable-grade tungsten and molybdenum-metal powders from scheelite concentrates containing both metals. Heretofore, separation of the molybdenum from such concentrates has required expensive treatment.

NEWS OF THE MINERAL INDUSTRIES

▼A new 500-ton-per-day concentrating mill is being constructed at the famous Camp Bird mine near Ouray, Colo. The mill will be located on the site of the old mill building, shown lower right center in picture. (Photo courtesy of The Mining Record.)

500-Ton Mill Being Built At Camp Bird Mine Near Ouray

A 500-ton-per-day concentrating mill is being constructed by Western-Knapp Engineering Co. at the famous Camp Bird lead-zinc-silver mine near Ouray, Colo. C. P. Tremlett, vice president of the English-owned Camp Bird Colorado, Inc., said completion of the new flotation mill is scheduled for Sept. 15.

The new mill is designed to specifically handle ores from the Camp Bird property. Ores of the Ouray area are relatively complex, often containing lead, zinc, silver, gold and copper. A crew of about 50 men are now working at the Camp Bird mine, and production from the mine is planned to reach mill capacity as rapidly as possible.

Tremlett stated that the decision to build the mill was taken as a result of evidence from recent developmental work that the company can operate the property economically despite the generally depressed condition of the industry. The Camp Bird Mine, which has been owned by the same English-controlled firm since 1902, was under lease to other interests from 1926 to 1956, when the owners took the property back under direct supervision.

American Metal Climax Consolidates Offices

Frank Coolbaugh, president, Climax Molybdenum Co., has advised us that American Metal Climax, Inc., has announced the consolidation of its New York corporate and division offices in the American Metal Climax Building at 1270 Avenue of the Americas, New York 20. AMCO Division comprises the Climax Molybdenum Co., Mining and Exploration Division, Southwest Potash Corp., and American Climax Petroleum Corp.

Uranium Industry Faces Uncertainties, Weller States

Uranium is one of the most important investments our country has ever made. This was the assertion of Gordon Weller, executive vice president of the Uranium Institute of America, in testimony before the Joint Congressional Committee on Atomic Energy in Washington recently.

Weller stated that our present supplies of uranium now justify our long-range capabilities as a leading industrialized nation of the world. But Weller declared that uncertainties face the domestic industry. He stated that one of the most immediate un-

(Continued on page 29)

Foote Mineral Company's Lithium Mining Operations At Kings Mountain, N. C.

By NEIL O. JOHNSON, '33

NEIL O. JOHNSON

Lithium History and Properties

The element lithium has been known to man since 1817, the year of its discovery by Johan Arfwedson. Modern day requirements and technological advances have made it extremely important in many fields, with the production of lithium metal and compounds advancing from the separation of a few salts in laboratories (circa 1850) to an industrial production of millions of pounds of lithium hydroxide monohydrate in 1959. Consumption continues to grow. One 1975 consumption forecast envisions two hundred million pounds of the monohydrate equivalent.

Lithium itself is classed in the alkali metal group, having an atomic number of 3, an atomic weight of 6.94, a density of 0.534, a melting point of 179°C., and a boiling point of 1317°C. The element is the lightest metal known, weighing only 33 pounds per cubic foot. (For comparison of physical properties, see *Charts 1* and *2*.) The metal is ductile, malleable and is soft enough so that it can be cut with a knife; and it reacts violently upon contact with water; all of which makes it useless as a structural component in itself. Its high heat capacity and wide liquid range, its low viscosity and vapor pressure indicates a potential use as a heat transfer agent.

Uses of Lithium

Presently lithium metal is used as a scavenging agent, an alloying metal, as a catalyst in certain organic reactions including polymerization, and in the preparation of organic products. High purity copper is obtained by the addition of lithium metal in its final stages of smelting and refining. It alloys with many of the common metals such as lead, aluminum, zinc, beryllium, copper, magnesium and tin to name a few; resulting in most cases in a stronger, lighter alloy.

Lithium also combines with a large number of the non-metallic groups (including the halogens, sulphur, nitrogen, carbon, hydrogen and others) to form many compounds, and with organic ions which create an even greater number of compounds.

Currently lithium chemicals have a much wider use than the metal. The most important among these are the hydroxide, carbonate and halides; lithium hydroxide being the largest. About 30 per cent of all automotive greases now contain lithium in the form of lithium stearate. Lithium-base greases are truly all-purpose greases, being water resistant and maintaining effectiveness over a wide range of temperatures.

The carbonate finds most of its use in the porcelain, glass and ceramic industries. In porcelain enamels for steel and aluminum, lithium reduces viscosity, permits thinner, more fluid coats which can be fired at lower temperatures, imparts higher gloss, greater impact strength and acid resistance.

In glasses, lithium reduces viscosity, increases strength, and improves electrical properties. It lowers the viscosity and increases the weathering resistance of glazes and imparts thermal shock resistance to

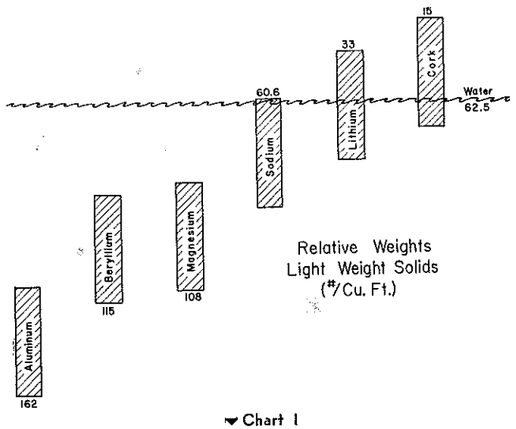
THE AUTHOR

Neil O. Johnson, manager of Foote Mineral Co.'s Kings Mountain operation, supervises the mining and beneficiating activities at Foote's open pit lithium mine, including the production of chemical and ceramic grade spodumene, mica and other by-products. He has had over 25 years experience in the mining, milling, engineering, and construction industries.

Born and educated in Denver, Colo., Johnson attended the Colorado School of Mines graduating in 1933 with a degree in mining engineering.

Mr. Johnson's 15 years service with the Du Pont Co. was interrupted in 1942 when he was called to active duty with the U. S. Army Corps of Engineers. Other previous experiences include working on the Twin Lakes Water Tunnel in Colorado; as mining engineer and later as mill superintendent for Hog Mountain Gold Mining & Milling Co., and as field representative for the Dorr Co. He joined Foote Mineral Co. in January 1956 as operations manager at Kings Mountain, N. C.

A registered professional engineer, he is an active member in the Army Reserves with the rank of lieutenant colonel, a member of AIME, American Ordnance Association, and the Colorado School of Mines Alumni Association. He is a graduate of the Industrial War College, a business administration graduate of LaSalle Extension University, and is the author of several bulletins for AIME and the U. S. Bureau of Mines.



▼ Chart 1

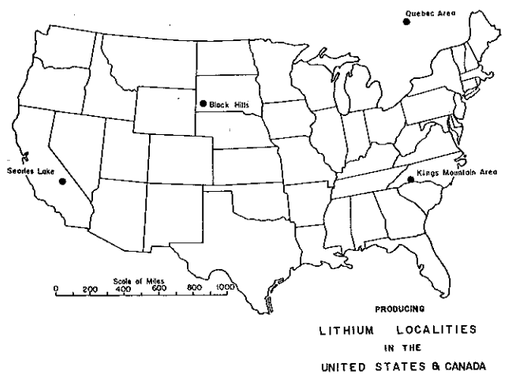
ceramic bodies. Lithium bromide and chloride have proved to be more effective and cheaper than other deliquescent compounds when used in the absorbent brines for air conditioning. Lithium chloride and fluoride in welding and brazing fluxes are characterized by low melting points, high boiling points, and high solvent power for metal oxides. They are especially useful in aluminum, magnesium and titanium joining.

Other uses include lithium hydroxide as an additive in alkaline storage batteries to increase cell life and capacity; and in the manufacture of certain pharmaceuticals. A comparatively recent application of great importance is the use of lithium metal dispersions and butyllithium as catalysts in the polymerization of isoprene to a "natural" synthetic rubber.

As for nuclear properties, the most significant is the differing neutron-absorbing cross sections of the two natural isotopes, lithium 6 and lithium 7. Lithium 6 has a high cross section and can absorb neutrons. In certain nuclear reactions it can be converted to tritium and helium. Presumably Li^6 is valuable in strategic applications since the Atomic Energy Commission has treated chemicals purchased from the major producers for extraction of the Li^6 isotope. Lithium 7 has a low cross section and does not absorb neutrons as readily. This, combined with the heat properties, makes the isotope an excellent material for nuclear coolants.

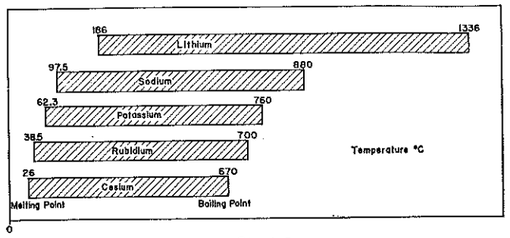
Occurrence

Among the 145 or more known lithium bearing minerals, only 17 are considered for commercial ex-



▼ Chart 3

Liquid Range Of The Alkali Metals



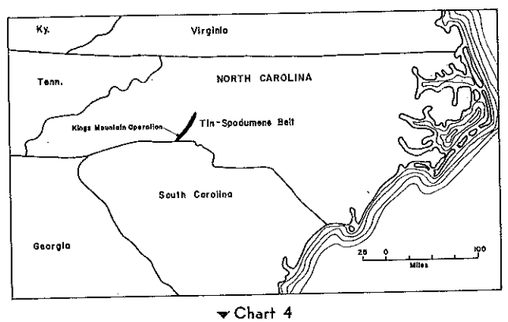
▼ Chart 2

traction, five of which (spodumene, lepidolite, petalite, amblygonite and zinnwaldite) are ore minerals at present. Spodumene—the lithium aluminum silicate, lepodolite—the lithium mica, and amblygonite—the complex phosphate, are the most important commercially. Petalite is not found in commercial deposits in North America, but is of importance as an ore from foreign sources.

Lithium bearing minerals occur mostly in pegmatites, although they are known to occur in other host rocks, none of which are of commercial importance. Pegmatites are defined as holocrystalline rocks of variable grain size, frequently coarse, and whose major constituents include minerals typical of igneous rocks. In general, pegmatites are very complicated and create many baffling problems to people in exploration and production who must deal with ore reserves.

Pegmatites containing lithium ore minerals are found extensively throughout the world. There are known deposits containing petalite, spodumene, lepidolite, and some amblygonite in Europe and the U.S.S.R. In Africa pegmatites bearing lithium minerals occur in Southern Rhodesia and Southwest Africa. South American pegmatites offer possibilities as a source of lithium ore; however, their extent is unknown at the present time. Canadian sources of lithium are in Quebec, Ontario, Manitoba, and the Northwest Territories.

The largest known sources of lithia in the United States are the Black Hills of South Dakota, Searles Lake, and the tin-spodumene belt of the Carolinas (see *Chart 3*). The largest single source is in lithium bearing pegmatites in the tin-spodumene belt of North Carolina. Here a narrow sinuous zone roughly 30 miles long by less than one mile in average width, strikes northward from Gaffney, S. C., to Lincolnton, N. C. (see *Chart 4*). The pegmatites occur in weakly metamorphosed sediments bordered on the northwest by the Cherryville quartz monzonite.



▼ Chart 4

The pegmatite bodies are intruded along the zones of weakness within the gneisses and schists. The largest pegmatite dikes are those filling the northeasterly trending fractures in areas of mica and hornblende gneisses and schists. These pegmatites range in size from small stringers less than foot-wide to large bodies over several hundred feet in width and over 2,000 feet in length.

To the southeast of Kings Mountain is the largest known concentration of pegmatite bodies in the entire tin-spodumene belt. Several large closely spaced ore bodies crop out within an area two miles long and one-half mile wide. The largest of these pegmatites is over 1,500 feet long and up to 350 feet in width. Another averages over 90 feet in width and has been traced along the strike for over 3,000 feet.

Local History

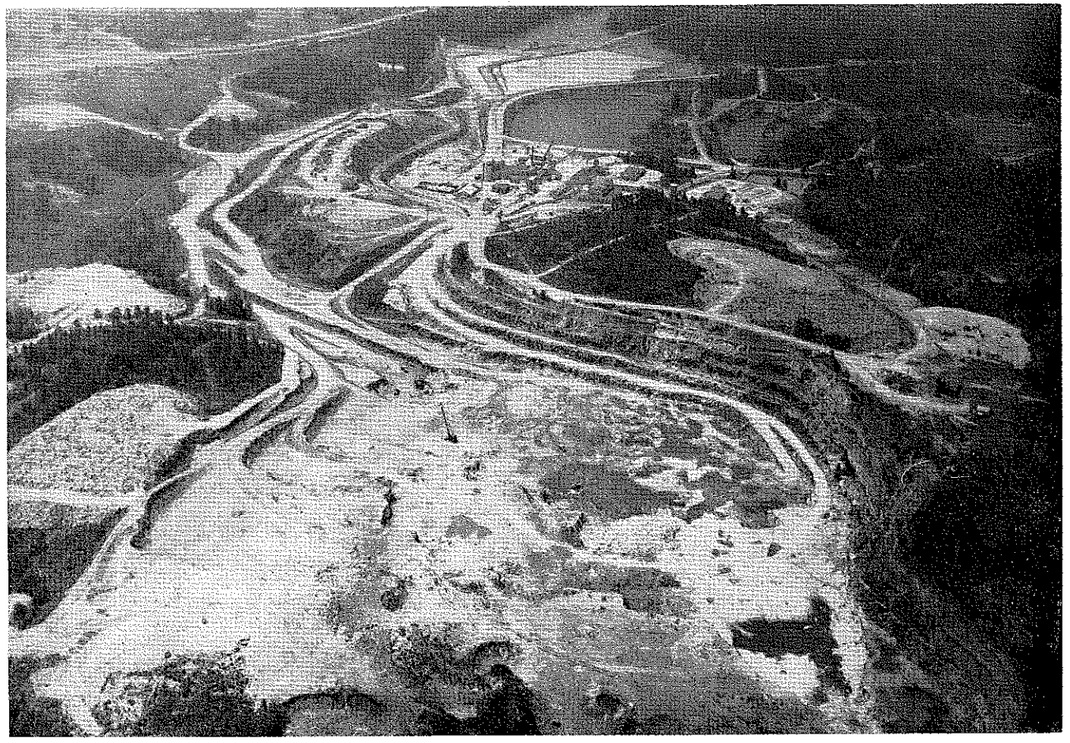
Before 1940, operations in the tin-spodumene belt were confined to small scale, intermittent tin-mining. During the period 1938 to 1940, the U. S. Geological Survey investigated the area as a source of domestic tin. Their comprehensive study revealed the spodumene potential of these pegmatites. However, the location created very little interest since there was only a small market for lithium or its ores. This same region had been visited by Foote Mineral Co. officials in 1936; but, at that time, the commercial market for lithium chemicals was not sufficiently great to justify an investment in a major raw material source.

In the early 1940's, the Solvay Process Co. acquired property lying approximately one and one-half miles south of the present city of Kings Mountain. A flotation plant was erected and the company began producing spodumene along with a limited amount of feldspar This production period lasted from 1942 to 1945, with less than 15,000 short tons of spodumene concentrate produced.

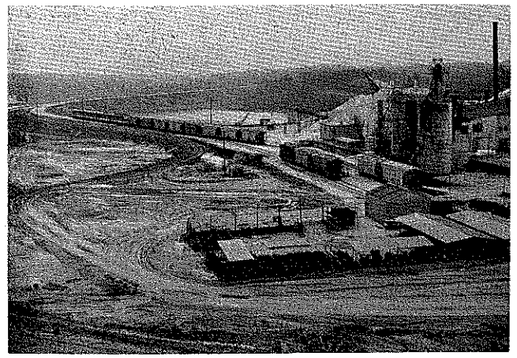
Foote Mineral Co., which had been in commercial production of lithium chemicals since 1934, was the principal consumer of the spodumene produced by Solvay at Kings Mountain. By 1948 the market for lithium chemicals had advanced to a point where the company felt that it must give serious consideration to a long-term source of lithium ore. Areas in Canada, South Dakota and North Carolina were investigated including the then inactive spodumene-bearing deposits of the Solvay Process Co. Solvay's property was acquired in October, 1950.

In July 1951, after installing a new crushing plant and completing extensive renovation work in the flotation plant, Foote Mineral Co. began producing spodumene concentrates. Since that time, the original plant has been almost completely replaced and enlarged at a cost of $3,000,000. The mill operated continuously on a seven-day week, 24-hour day basis from July, 1951 to July, 1958. At that time a six-day week was adopted. In March, 1959 the plant was converted to a multi-product operation, producing mica and ceramic-grade spodumene in addition to the regular chemical-grade spodumene.

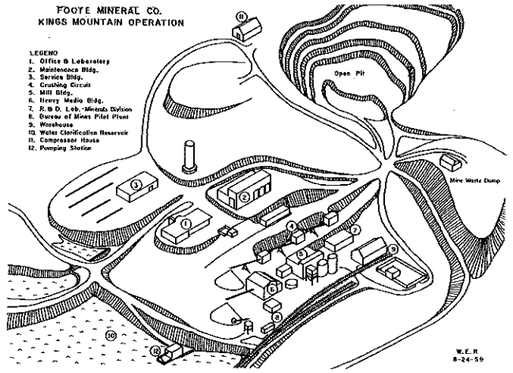
Foote Mineral Co. now controls at least 50 per cent of the present indicated ore reserves in the tin-spodumene belt. The ore bodies are close to the concentrating facilities. Since Solvay first began operations, four drilling programs have been completed. The information from each drilling program has added data to the size, shape, tenor, and distribution of the pegma-



▼ Aerial view of open pit and general plant area.



▼Covered hopper cars used to ship spodumene concentrates from ore beneficiating plant. (Photo courtesy of Southern Railway Co.)



▼Schematic drawing.

tites. In 1943 and 1944 Solvay conducted a deep prospecting program, during which 17 inclined diamond drill holes, and two vertical churn drill holes for a total of 10,000 feet were completed. Shortly after Foote acquired the property, an additional 1,000 feet of drilling was contracted. The information from these vertical holes coupled with data collected by Solvay became the basis for formulating mining plans in the present pit area.

A third program was carried out from 1954 to 1956. This was a long range study designed to gather information for the current mining plan. Of the 24,000 feet drilled, most holes were vertical with a minor footage in 45° angle holes. The last drilling program, completed during the first half of 1959, was done by both contractor and company drillers. The additional 14,000 feet of drilling information was combined with data from the previous programs (total approximately 49,000 feet of drilling), furnishing a basis for the present computed ore reserve.

The present measured ore reserve is 20,747,297 tons averaging 1.53 per cent Li_2O, with an indicated reserve of 15,769,075 tons adjacent to the measured ore; for a total of 36,515,372 tons. This established ore tonnage does not place a limit on the ultimate worth of the deposit since additional drilling will enlarge this figure. The size and location of this deposit makes it the outstanding lithium ore deposit at the present time.

Mining

The results and compilation of data from the first three drilling programs were used in the formulation of plans to develop a 10-bench, 200-foot deep open-pit mine measuring 1,400 feet by 1,600 feet. The plans include the recovery of fringe ore bodies, bench entry layout, and waste-to-ore ratios for highly selective open pit mining.

Presently a 20-foot bench is used; thus permitting greater selectivity in the production of ore, and removal of waste. Four working benches permit continuous production. Mining and development are carried on simultaneously, with developed ore always available on at least two of the working benches. As each bench is completed a 30-foot berm is left, thus maintaining a pit wall slope of 33 degrees. This will be steepened to 50 degrees by the removal of alternate berms in the deeper benches.

At present, production is on a one-shift day, five-day week basis with direct supervision handled by the mine foreman. The mining engineer assists the foreman in daily planning, makes monthly mine maps, keeps all records and conducts engineering studies as time is available.

Drilling and Blasting

Gardner-Denver Air Trac Crawlers mounting DH-99 drills and 8-foot long sectional steel are used for all blast hole drilling. Both 2½ inch and 3 inch detachable bits are used. A stationary 1300 CFM Gardner-Denver Compressor supplies air to the drills through a permanent 6 inch main air header encircling the pit. From the Victaulic coupled main header, 4 inch airlines are easily moved to the area to be drilled.

Drilling layout of the 2½ inch holes in ore is usually spaced 6 feet apart with a 5-foot burden, while the 3 inch holes in waste are generally spaced 9 feet by 7 feet. All holes are sub-drilled 4 feet for a total depth of 24 feet. The average drilling rate for 3 inch holes is 25 feet per hour, while for the 2½ inch holes it is 35 feet per hour. Fewer holes and cheaper blasting agents are used when the larger holes are drilled. Tungsten carbide bits are employed in all types of material.

Blasting is carried out with 60 per cent ammonia, 60 per cent gelatin dynamites (either 2 or 2½ inch x 12 sticks), prilled ammonium nitrate, primacord, and millisecond delay electric blasting caps. The shots are detonated by a Du Pont CD-48 blasting machine. Electric blasting caps ranging from 25 ms up to 400 ms delay are used to reduce vibration, control the throw of material, and improve fragmentation. Since residential areas are close to the mine, all blasts are kept relatively small, 125 holes being the maximum blasted in one shot. Air concussion is minimized by using 6 to 8 feet of stemming. Secondary breakage, when necessary, is achieved using a steel alloy dropball with a 1½ yard Osgood rubber mounted crane equipped with a 60-foot boom. This wheeled unit can be moved from one bench level to another in a short time.

Mine Equipment

Presently, ore and waste are loaded by two 38B Bucyrus-Erie shovels equipped with 1½ yard buckets. Another #6 Northwest shovel with same size bucket is kept in the pit as a standby unit to be used when either of the other shovels is down for maintenance and repairs. Because of the selective mining methods used, the size of the shovel is limited. Because of the abrasiveness of the ore, spare buckets are built-up constantly. Adapters and box points are used on the buckets. The adapters can be built up two or three times before they are discarded; box points are replaced nearly every week. Maintenance of the shovels, except welding and electrical service, is provided by the operators. An oiler is assigned to each two machines and assists in minor repairs to the shovel and Osgood mobilcrane.

Three sizes of trucks are used to remove material from the pit. Ten-ton Euclids are used for ore almost exclusively; waste is removed by 15- and 22-ton Euclids. The length of haul for the ore trucks is approximately one mile round trip. Haul distance for the waste trucks varies from one to two miles round trip. Approximately one-half of the non-lithia bearing rock is sold to a commercial stone quarry which operates a crushing and sizing plant adjacent to the pit.

Roads are generally kept on a less than 10 per cent grade except for short distances which may be steeper. Two D-8 bulldozers are used for clean-up around the shovels after blasts, limited road work, clean-up on dumping areas, and general work around the plant. A motorgrader is used to maintain the haul roads and pull a 2,000 gallon capacity water wagon to wet down roads during the dry season.

Auxiliary mine equipment includes a 1½-ton flat bed truck equipped with grease guns and fuel tank for servicing shovels, trucks, and bulldozers; a 1½-ton flat bed truck for servicing drills, hauling bits, drill steel, air lines, and other spare parts as required; a 1-ton truck especially equipped for hauling powder and for supervisory use. A portable air compressor is used by the powder crew to clean holes before loading and blasting. A portable welding machine and welder from the Maintenance Department are used in the pit for shovel repairs and other miscellaneous welding. Shovel bucket build-up and other necessary work on equipment takes place in the shop.

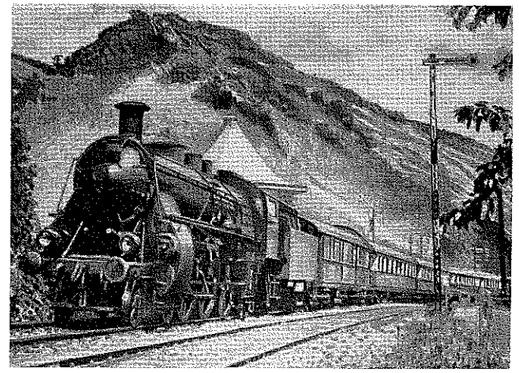
Crushing

The mine ore is dumped directly into a 26-inch Traylor gyratory crusher where it is reduced to approximately 6 inches. When necessary, small amounts of black waste rock are removed manually on a picking belt after primary crushing. The ore is further crushed to under 1½ inches by a secondary 4¼-foot Symons Cone crusher. The tertiary section of the crushing plant consists of a 5 foot x 12 foot double deck Tyrock screen, 48-inch spiral classifier and a 3-foot Allis-Chalmers Hydro-cone crusher. The minus 1½-inch rock from the secondary crusher is split into three sizes on the Tyrock screen. The plus ½-inch portion is crushed, open stage, to minus ½ inch and rejoins the minus ½ inch plus ¼ inch. The minus ¼-inch material is washed in the spiral classifier with the sands going to a common conveyor belt to the crushed ore stockpile. From this stockpile the material moves either to the heavy media process building or to the flotation mill, depending upon the production demands.

Milling and Shipping

After the crushed ore from the stockpile passes the automatic conveyor system (including a Merrick Weightometer), it enters feed bins ahead of the 5-foot x 12-foot Marcy rod mills. It is then ground, classified, and separated by conventional flotation methods into the various saleable products.

The spodumene concentrate is filtered using Dorr internal drum filters and dried in a Ruggles Cole type dryer, fired by natural gas. Ceramic grade spodumene is produced from the dry, chemical grade product by screen sizing and magnetic separation on a Carpco high intensity roll-type magnetic separator. Railroad shipments to Foote's lithium processing plant at Sunbright, Va., are by hopper cars. A recently built 7,400-foot spur line connects the plant with the main line of the Southern Railway System. These facilities, adjacent to the spodumene concentrate storage silos, permit direct loading from plant to railroad cars. Mica concentrates are centrifuged and marketed without drying.



▼The first industrial use of lithium metal was as an alloying element. This is the famous Rheingold Express in 1928, the pride of the German Railways. Like many glamorous activities, this one depended on humble but important factors—the durability and precision of the bearings in the trucks. During the 1920's an imaginative experiment in applied metallurgy introduced lithium as a replacement for tin in lead bearing alloys. Known as Bahnmetall, these alloys were used extensivey on German Railways for anti-friction bearings. They contained only 0.04% of lithium but even this slight addition imparted enhanced mechanical properties: great hardnoss, especially at high temperatures; increased deformation resistance; and improved wearing qualities.

Mine Auxiliaries

Power, furnished by the Duke Power Co., is brought into the plant area at 44,000 volts at two transformer stations and is stepped down to 2,300 volts and 440 volts. One station supplies the mine while the other supplies the mill and general plant area.

The quantity of fresh water available is limited, therefore, all process water is recirculated and reused. The mill tailings effluent is treated with Ferri-Floc and the solids retained behind tailings dams. The decanted water is pumped by barge pumps to a 5,000,000-gallon clarification pond from which it is pumped to the plant by turbine type stationary water pumps. Fresh creek water, used for make-up, is stored in a 55,000,000-gallon reservoir, also equipped with a stationary pumping station. Boiler and compressor cooling water, together with the water used in the office and other service buildings, is purchased from the city of Kings Mountain.

Maintenance functions are conducted in a large, permanent shop. Three vehicle bays, large enough to accommodate the 1½-yard shovels, are equipped with a 38-foot span overhead traveling bridge crane (100 foot travel) containing two 5-ton capacity electric hoists. Other major shop equipment includes a 125-ton air operated hydraulic press, exhaust system for removal of engine and welding fumes, and two 300-ampere electric welders. Office area for maintenance supervision and records is located in the shop. Maintenance and con-

struction responsibilities are under the Plant Engineering Department. The maintenance supervisor reports directly to the plant engineer.

A modern service building not only provides individual lockers and showers for hourly employees and foremen, but also a large room which serves as a combination lunch room and place to hold meetings, including safety and training programs.

The warehouse facilities consist of a metal building and a fenced area for large parts and supplies which can be stored outdoors.

The laboratory personnel (consisting of a plant chemist and three technicians) prepare samples and analyze all incoming ore, outgoing products, and tailings. Samples are filtered, dried, crushed, and pulverized. If necessary, they are screened in the control laboratory located near the mill. Lithia analysis and other analytical procedures are carried on in a modern analytical laboratory. All spodumene samples are fused to convert the ore to soluble beta-spodumene. The residue is digested in acids and diluted to proper concentrations. The alkali metals are analyzed on a Beckman Model B Spectrophotometer with a flame attachment. Mica determinations are made by specific gravity separation in heavy liquids.

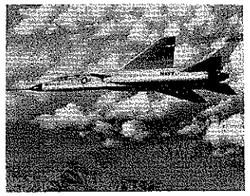
By-Products

In addition to chemical-grade spodumene, by-products produced at Foote's Kings Mountain Operation include high grade mica concentrate, ceramic-grade spodumene, and commercial stone. Mica sold to grinders is used in roofing material, paint pigment, wallboard joint cement, rubber manufacture, welding rod coatings, plastics and numerous other applications. Ceramic-grade spodumene is used in the manufacture of glass, porcelain enamel, ground coats, as a constituent in ceramic body fluxes and glazes, and in low-expansion, heat shock resistant bodies. Amphibolite rock produced as a by-product of the open-pit mining operation is sold to Superior Stone Division of American-Marietta Co. for use as commercial stone.

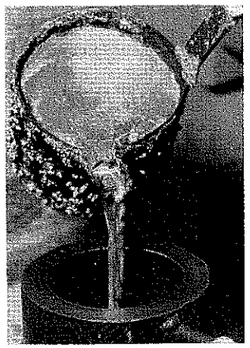
Other potential commercial by-products presently under investigation includes beryl, feldspar, and quartz. The largest known domestic source of beryl is located in the tin-spodumene belt. Much development work remains to be done, from the recovery of beryl concentrates to finished beryllium products. Currently the U. S. Bureau of Mines has a pilot plant located on the property. The objective of this cooperative program is to evaluate the technical and economic problems involved in the recovery of beryl from this ore. Beryllium metal use has grown quite rapidly during the last decade, and like lithium, it appears to have a very attractive future. The unusual metallurgical and nuclear properties of beryllium would seem to indicate that it will find increasing use in nuclear energy and in missile and space vehicles.

Future of Lithium

Figures published by a research institute predicted that by 1975 major uses of lithium would be in air conditioning, glass manufacture, metallurgy, and organic reactions. The use of lithium in solid propellants, nuclear, and thermonuclear power is also foreseen. Lithium compounds in such applications as welding and brazing mixtures, hydride manufacture, organic synthesis, air conditioning, lubricating greases and porcelain enamels will inevitably increase. In the present glass industry, lithium is confined to optical glasses, specialty glasses and television picture tube glass.



▼The A3J Vigilante—new Navy attack weapon system designed and built by North American Aviation, Inc. To counteract the destructive environment of supersonic flight, metallurgists have recently developed an aluminum-lithium alloy named X-2020 which is far tougher than conventional aircraft alloys and can withstand temperatures up to 400° F. Other alloys with lithium as an essential component are being developed.



▼Molten lithium metal being poured into cylindrical mold. Lithium's wide liquid range—over 1100 Centigrade degrees—indicates a potential use as a heat transfer agent.

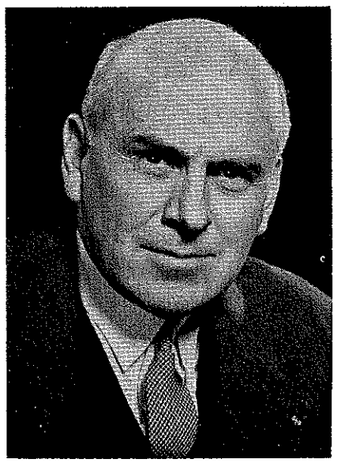
Present consumption is therefore limited; but it has been estimated that industry will require at least 45,000,000 pounds of lithium hydroxide monohydrate equivalent by 1975. Present consumption of lithium metal in metallurgy has been estimated at less than 500,000 pounds. However, lithium is proving to be a valuable alloying material for the light metals and its use in aluminum and magnesium will most certainly increase as lithium-containing light metal alloys are further developed. Lithium additions to fused salt baths tend to lower melting temperatures, decrease viscosity and increase electrical conductivity. These properties indicate that lithium may be valuable in electrolytic processes used for the winning of certain metals which are produced from molten salts. The increase in current density which lithium contributes to molten salt systems may permit increases in production rate and higher efficiencies.

Lithium metal is currently being used as a steel addition agent in the production of specialty steels. In this use, lithium tends to degasify the metal and improve metal cleanliness—thus improving properties and decreasing rolling loss. Lithium metal may find eventual application in nuclear and thermonuclear power, either as a heat transfer agent in nuclear powered aircraft or as a coolant because of its excellent neutron absorbing properties. It may be used as a tritium source when the deuterium-tritium reaction is being carried out.

And the supply of lithium will be adequate to meet these increased demands. With the acquisition and development of the Kings Mountain spodumene properties, the construction of new plant facilities at Sunbright, Va., and the new lithium production facilities at other operating localities, Foote Mineral Co. is a fully integrated domestic producer of lithium metal and its compounds. This, combined with an active lithium research program, places the company in a dominant position as a principal supplier in the constantly expanding market.

The Balance of Payments Problem*

By JOHN J. McCLOY



JOHN J. McCLOY

I would like to say something about a subject which is preoccupying many minds at present—our balance-of-payments problem. There have been a number of speeches and comments on this subject, particularly since the Monetary Fund and World Bank meetings held this fall in Washington, but I am so concerned with the prominence which seems to have been given to this single factor as an influence on our foreign and defense policy that I am impelled to talk about it.

Certainly it is well for those as knowledgeable as you are to examine this situation, if for no other reason than to appraise its true relation to our vital interests. In spite of the publicity it has received I suspect that the problem is still very little understood and, misunderstood, it has some very dangerous aspects. For a nation's balance of payments mirrors its many basic trends and policies.

In our case the deficit has been seized upon by anyone who has a particular devil to exorcise. Those who would withdraw our defenses from NATO, those who would do away with foreign aid, those who would seek a return to protectionism, those who would like to return to that misnomer of "fortress America"—all have been using our imbalance of international payments as an argument for their cause.

Actually, the basic elements of the problem are not overly complex. For some years now (ever since 1950) the United States has been spending more dollars abroad than other countries have chosen to spend here in the United States. In that sense our international payments have long been out of balance. But up until 1958 the imbalance was not great—it averaged about $1 billion a year—and for the Free World this was healthy. You all remember the talk not too long ago of the dollar shortage. That talk had a real basis in fact.

* Address presented at annual dinner of The Investment Association of New York in New York City, Dec. 15, 1959, and published with the permission of The Chase Manhattan Bank.

THE AUTHOR

John J. McCloy, chairman of the board of directors of the Chase-Manhattan Bank, is a former president of the International Bank for Reconstruction and Development (World Bank) and a former U. S. High Commissioner for Germany.

Born March 31, 1895, Mr. McCloy received his B.A. from Amherst in 1916 and his LL.B. from Harvard Law School in 1921. He was in the U. S. Army from 1917 to 1919, serving as a captain in the field artillery with the A.E.F. in France. He served as assistant secretary of war during World War II.

Mr. McCloy is chairman of the board of Chase International Investment Corp., chairman of the Advisory Committee on Commercial Bank Preparedness, a director of the Federal Advisory Council of the Federal Reserve Bank, chairman of the board of trustees of the Ford Foundation, and a director of American Telephone & Telegraph Co., Allied Chemical Corp., Metropolitan Life Insurance Co., and Westinghouse Electric Corp.

His other affiliations include active membership in such organizations as American Bar Association, American Society of International Law, Council on Foreign Relations, International House, U. S. Savings Bond Advisory Committee, and trusteeships on many educational and culutral institutions.

Awarded the Distinguished Service Medal and the Grand Cross of the Order of Merit of the Federal Republic of Germany, Mr. McCloy is a grand officer of the Legion of Honor of France and a grand officer of the Order of Merit of Italy. He has received numerous honorary degrees from universities in the United States and Germany.

There *was* a dollar shortage throughout the world, and by running an imbalance in its payments with other countries the United States made it possible for the rest of the world (and particularly Western Europe) to rebuild its foreign exchange reserves of gold and dollars. World trade and production could not have increased as it did without this. Dollars have been regarded as good as gold—a very important fact, since there is not enough gold in all the treasuries of the world to meet the full needs for international reserves.

Imbalance Increases

But in 1958 some very important changes began to take place. With the onset of a world recession, minor though it proved to be, the imbalance in our foreign payments suddenly increased, and very markedly so. In 1958 it amounted to $3.4 billion; moreover, this imbalance was accompanied by a sizeable outflow of gold—$2.3 billion, to be exact. Likewise, a substantial imbalance has continued throughout 1959, when the total may amount to as much as $4 billion. The outflow of gold this year has been reduced to approximately $1 billion, in part because high interest rates in the United States have encouraged foreigners to keep the dollars they accumulate invested here.

Banker to the World

Sizeable deficits in our balance of payments—even deficits of $3 to $4 billion annually—do not place the United States in any immediate tight spot. There is no question about the internal strength of our economy—it is stronger than ever. And to meet any external drain we still have the largest gold reserve in the world, some $19½ billion, almost half the total monetary gold held by all nations.

But the United States has also become the world's leading banker. Central banks alone hold reserves in the form of dollar deposits or short-term investments of more than $9 billion in the United States. And if we add the dollar deposits and short-term investments of other foreign entities (individuals, corporations and banks), the total comes to about $19 billion. So, like any banker, we have many claims against our assets, and it is vitally important that our creditors continue to retain complete confidence in us.

The plain fact is that a balance-of-payments deficit of $3 to $4 billion yearly, if allowed to persist, is too much. It increases the claims against the United States at too rapid a rate, and it causes our creditors justifiably to take a close look at how we are managing things.

Well, how *are* we managing things? Why have we had this sudden increase in the imbalance of our foreign payments? The immediate cause is not hard to discern. After 1957 the United States experienced a decline in its exports and an increase in its imports. In 1957 our exports amounted to more than $19 billion, and our imports were about $13 billion. We had a favorable balance on trade alone of $6 billion. Admittedly that was a peak year—influenced among other things by the Suez crisis.

Balance Still Favorable

Nevertheless, it looks as though our exports in 1959 may not run to more than $16½ billion, while imports will have climbed above $15 billion. Our favorable balance on trade, then, will have been cut to less than $1½ billion.

Of course, this balance on trade is still favorable, and more so than many countries in the world can claim today. What are the elements, then, that actually bring about the adverse balance in our total foreign payments? As you know, there are a whole host of services that we exchange with other countries—travel, shipping, banking, insurance and the like. For Britain these are net earners of foreign exchange, but for us they add up to pretty much of a standoff—we pay out as much as we earn.

But then there is still another set of transactions, a set that has assumed unusual importance for the United States in the post-war years—transactions that reflect vital commitments of a political, military and economic character. These, of course, are our foreign aid, the expenditures we make abroad on our military bases, and our private foreign investment. These all add up to a huge sum in excess of $10 billion annually.

I think it is of great importance that knowledgeable people in investment circles and industry particularly should understand just what is involved in financing these various commitments abroad. Some of these commitments do account for a sizeable net outflow of dollars, but others do not.

Take first the matter of economic aid. This now amounts to about $2.6 billion annually if we include in the total approximately $1 billion of loans made by the Export-Import Bank, the Development Loan Fund and other government agencies. There has been a persistent terndency to single out such aid as the culprit behind the scenes in the current imbalance of our foreign payments.

The facts, however, do not justify this placement of blame, for the great bulk of such aid always has been tied specifically to United States exports. Thus if we cut back on the aid, we simply cut back on exports. As a matter of fact, a growing amount of such aid in recent years has taken the form of surplus farm commodities, and if we fail to ship these abroad they merely pile up on our own doorstep.

There has been a portion of economic aid dollars, it is true, which has not necessarily been spent in the United States. So far as I can gather, this has not represented a major amount—perhaps no more than a fourth of the total. Recently the administration ruled that where possible this aid, too, should take the form of United States exports. A great hue and cry has been raised over this action, and our government is accused of deserting the liberal trade policy which it has fought so long to bring into effect on a worldwide basis.

Prudent Step in Present Circumstances

I am afraid we must admit that tying loans and grants to exports in theory is a backward step. But it is also a step which, given the full range of our commitments abroad, seems to me to be prudent in the present circumstances. It does not mean that we shall cut out any and all aid that fails to be tied to United States exports. Some essential aid, for example, takes the form of commodities which the United States does not ship abroad on a net basis. Sugar and rubber are cases in point. But the amount left over in this category should be relatively small.

Let us now look at military aid—an outlay as large as its economic counterpart. Here I refer to shipments abroad of military and related supplies under the various mutual defense treaties which the United States has with other countries. In 1958 this aid amounted to $2½ billion. The entire sum took the form of U. S.

exports; so again if we cut back on aid, it would seem we automatically cut back on exports. There appears to be no immediate relief here for the balance of payments.

There are those who would argue against this point of view, however, contending that if we cut back on aid we might get some of the recipients to pay dollars for the military equipment they need. I am afraid that the prospect for this is not very promising. The countries that can really afford to pay for weapons in the United States are already doing so on an increasing scale. Germany is a case in point. It is countries that cannot afford payment—Turkey, Iran, Pakistan, Taiwan and Korea among them—that receive much of the aid.

United States' Burden Is Heavy

Yet we must recognize also that these countries are undertaking a considerable defense effort on their own, and that the Western World benefits greatly from the forces they are able to muster. In spite of all this, the burden of military aid, as well as economic aid, has fallen very heavily on the United States for a number of years. I would certainly agree that the time has come for other nations in the West to shoulder a larger share, and in the process of redistributing the load we should keep an eye open for any impact on our balance of payments.

That brings us to the second category of special payments which I singled out earlier—payments in support of our own military establishments abroad. These establishments lie at the very heart of our defense policy, but there is no denying that they are one of the major elements in the current imbalance in our foreign payments.

Military Costs Abroad

Last year the United States spent about $3.4 billion on the maintenance and support of its military bases abroad; this year the sum is likely again to exceed $3 billion. None of this is tied to exports from the United States, and the countries receiving the dollars are free to use them as they choose.

For what do the military services spend these huge sums? Well, they need to pay U. S. troops in Germany, Britain, Japan and other nations, who in turn exchange dollars for currencies of those countries. Last year such troop expenditures accounted for about $900 million of the total. Another $1,100 million went for jet fuel, motor gasoline, fresh foodstuffs and other supplies bought at the most convenient locations. Still a further $800 million was paid out for local services necessary to support and maintain the bases. And so on down the line. These dollars are spread out all over the world. Nevertheless, more than half the total goes to Western Europe, with Germany, France and Britain the major recipients. Another $450 million flows to Canada, while Japan is the chief recipient in the Far East.

Before we consider what if anything might be done about these defense expenditures, let me complete this survey with a brief look at the final category of special outlays which enter into our balance of payments: namely, private foreign investment. Again it has been the policy of our government to encourage the flow of private investment abroad, and over the past decade business has made a substantial response.

From 1956 through 1958 our private foreign investment ran close to $3 billion. This year, however, the flow has been cut back and may amount to no more than $2 to $2½ billion, in part because high interest rates have made the United States a less attractive place to borrow from. Nevertheless, one of the significant developments in recent years has been the revival of portfolio investment.

Many Calls for Aid

A large number of foreign governments have been coming to the United States for money, including Belgium, Italy, Austria and Japan, to name a few of them. You may recall that only last week Credit Foncier of France floated $50 million of dollar bonds, part of which were bought by American accounts, to help finance French municipal housing. In addition, Canadian municipalities have long looked to the New York market for substantial funds, and of course you all know of the purchase of Canadian and European industrial secuities by Americans.

Very few of the dollars arising out of transactions like these are spent directly for exports from the United States. Likewise a part of the *direct* investment made by United States business in branches and subsidiaries abroad is not tied to exports but initially represents a transfer of dollars to pay for plant and equipment in other countries.

At the same time, in judging the full impact of foreign investment on our international balance sheet, we cannot forget the earnings received from such investment which create needed foreign exchange when they are brought back to the United States. These repatriated earnings also have been growing and now come to the quite large total of $2.6 billion a year. One could say, then, that from a balance-of-payments view our private foreign investment to a considerable extent merely represents a ploughing back of earnings received from previous investment.

In one other sense, however, some of the direct investment abroad could in the future have an adverse impact on the United States balance of payments. Many American companies are now establishing facilities in Western Europe, encouraged by the relatively low costs there, as well as by the development of the Common Market. Certain of these companies also are coming to regard Western Europe as a principal base for their exports to other areas.

All this, of course, could in the future act to hold United States exports at a lower level than that at which they might otherwise be. I believe it is important to recognize these factors in assessing certain bills which are now before Congress with the objective of adding further stimulus to private foreign investment through special tax incentives. If such bills were to be adopted, it would seem to me to be advisable to limit any special incentives to the encouragement of investment in the under-developed countries.

Areas of Investment

Today very little of United States foreign investment flows to areas like Southeast Asia and Africa. Rather the great bulk is directed to Canada and Western Europe, and to some of the more advanced countries of South America. I would question whether, as a matter of public policy, we should seek to stimulate artificially investment in heavily industrialized countries abroad, particularly in the face of our present problems.

Restating the balance-of-payments problem in very general terms, our nation now has a small, favorable balance on its trade with other countries, but this is

more than offset by heavy military spending abroad, plus a small amount of foreign aid which is not tied to exports, and in most recent years by a net margin of private foreign investment. The result today adds up to a sizeable deficit in our total foreign payments. What can and should be done about it? From all points of view the most beneficial move would be to expand exports. I think this can be done, but probably not to the full extent necessary to solve the whole problem.

Exports were clearly depressed over much of 1958 and early 1959 by the business slowdown in Western Europe. In recent months shipments have been reviving, and I think we shall see such items as cotton, aircraft and even machinery moving out in larger volume in 1960. In this regard it is important that we continue to press other nations to remove discriminatory restrictions that still stand against United States exports. Some nations have made a good start on this, but much remains to be done.

A New Look at Markets

More will be required, however, than a mere passive acceptance of an expanding market abroad. I suspect that American business will have to take a fresh, hard look at export markets and seek more vigorously to cultivate them. There has been a tendency for many firms to look upon exports as merely an overflow from the domestic market. Products have not been tailored specifically for customers abroad; nor have marketing and servicing facilities been adequate.

Moreover, through many postwar years American producers held an advantage in being able to quote earlier delivery dates. Now this advantage is gone. The plain truth is that the United States has not had to fight for exports as have many countries in Western Europe. Those days are gone forever.

You are all familiar, of course, with the complaint that the United States has priced itself out of world markets. Certainly the inflationary move of the 'Fifties did us no good, and with some products—steel and automobiles, for instance—we no longer hold the competitive position we once possessed. But this nation has not priced itself out of world markets in any overall sense. We still sell more abroad than any nation in the world; we are spending far more than any of our friends on the search for new products and new ways of doing things.

World trade is never a static thing. It is made up of an ever-changing mix—a mix in which the nation that develops something new gains an advantage. I am sure that we shall be shipping abroad over the next five years a whole host of items that have never entered into world trade before.

Yet, with all of this, the adverse position in our balance of payments has flashed a warning signal. It has told us that a nation which lacks discipline; which shuns hard, honest work; which looks for the easy way out through government largesse—is a nation that is heading for trouble, no matter how great its initial power. Certainly the United States is no exception. It is more essential than ever that we avoid the easy path of inflation; that we hold our costs, our government budgets and our prices under effective control.

It is an awareness of this need, more than any other, which has caused the eyes of the nation to focus on the current debate in steel—a recognition that the interests of all the people, and not merely those of the individual disputants, are directly involved.

The administration is alive to the facts and needs embodied in the balance-of-payments problem. It has taken already a number of steps that are traditional to meet such a problem: the budget is being balanced; a policy of tight money is being pursued; and interest rates are held high to encourage an inflow of funds. All these are important, but we can't be content to let matters rest. Every avenue needs to be explored.

What more, then, can be done, other than expanding exports, to bring further relief for the balance-of-payments problem? Clearly the answer does not lie in cutting foreign aid. Nor does it lie in moving backward to new forms of protectionism. Either of these moves would be a signal, not only to the Free World but to the Communists as well, that the United States is unwilling to pay the price or bear the burden of world leadership. Once started down this path, there is no telling where we might end, except that the chances for world domination by the Communists would have brightened immeasurably.

U.S. in Curious Yet Critical Position

One of the political leaders of Europe told me recently that the United States today stood in a most curious yet critical position. "Here you are," he said, "more wealthy and in many respects more powerful than ever. Your national income has never been greater, your people have never been better off. Yet in the eyes of the world you are weaker. The Russians beat you into outer space and then to the moon. For a third of a year the most basic of your heavy industries lies idle. Now you are losing gold; the statements of your own Treasury head have furnished some doubts as to the strength of the dollar; and you are threatening to pull back on your commitments to NATO. Is it any wonder, then," he added, "that the Free World is beginning to question whether you can provide the leadership we all so sorely need?"

Free World Needs Our Leadership

Certainly the Free World continues to need our leadership—aggressive, forceful and constructive—and no matter what the problem with our balance of payments, we must exercise it. No other nation has the resources, the basic strength and the outreach to take over the responsibility from us. It is up to each and all of us to demonstrate that our nation has the will and the moral fibre to meet our great obligations.

The world we lead today is vastly different from that of a decade ago—due in great measure to the far-sighted policies which our nation has pursued in the past. Rather than a weak Europe, threatened from within and without, we see a vigorous community, exploring new political and economic forms, and growing more rapidly even than we.

In Asia and Africa new nations have climbed to their knees but continue to need a helping hand if they are ever to rise to their feet. And to the south of us our neighbors also show progress, but again they require not only inner discipline but also outside assistance. We have, therefore, not only an East-West problem but, as Sir Oliver Franks puts it, "a North-South" problem: the old adjustment between the "haves" and the "have-nots."

There is certainly no room for complacency in all of this. The European world has been more than rehabilitated and is at present imbued with a new spirit of energy. The other world, however, the Communist world that would bury us, also has been hard at work.

And today we find ourselves confronting a monolithic, dynamic force that is more assertive than ever of its eventual triumph.

Confronted with this heavy and unrelenting challenge, and with the changes that have been wrought in the West, the time has come for a new look at the political and institutional arrangements we have in effect for strengthening the Free World. I have in mind particularly the arrangements for marshalling the resources necessary for defense and economic aid.

Aid Program Must Be Extended

There was a time when the major problem involved allocating resources which the United States largely could make available. OEEC was developed and later NATO and SEATO. As time went on, the United States undertook a broader aid program and Britain joined with others in the Colombo Plan. Nor should we forget the aid which France, even when hard pressed, gave to her overseas territories.

All of this is to the good. But it has led today to a scattered, disparate use of available resources. No longer is the United States the sole nation with a considerable margin of strength to throw into the balance. Western Europe has come to the point where it too can shoulder substantial responsibility for economic and military aid. The problem is how to join all the available resources, including brains, in a common pool which can be effectively allocated among all the pressing needs.

We have to check the disparate forces. We have no institutional arrangement today which can accomplish this. NATO, OEEC, the Colombo Plan—none of them is broad enough. What is needed is an organization which joins North America to Europe to deal with the problems of the Atlantic world as well as its relations with the less developed lands. It could be a regional organization both in terms of politics and economics. An organization of this compass could then look to the whole range and weight of economic forces throughout the Free World and see that they are effectively deployed and held in balance.

It would not be too much to ask, in these circumstances, that Western Europe take over the financing of part of the local expenditures the United States incurs in maintaining military establishments within the European area. This would certainly go a long way to assist our balance of payments. And in return we might expand shipments, under both military and economic aid, of items our nation is best qualified to produce and export. Here is an example of the type of coordination which the Free World must undertake if it is actually to realize the progress that will be required. Moreover, it would tend to coordinate not only our economic, but also our political, direction.

Over-All Plan Needed

The need is not for less aid; if anything it is for more. And we of the Western Hemisphere and the Europeans are quite rich and strong enough to afford it. But we have moved to the point where a greater measure of over-all planning and coordination must be introduced into the process. Balance-of-payment factors cannot be ignored, but they would be dealt with automatically in such a coordinated effort. They would take their place as a concomitant of a Free World's consideration of its joint problems. They would not dictate policy but be submerged into it.

To have it otherwise would be to unlearn all the lessons of the Twentieth Century, assimilated at such pain and at such great cost. I have faith that the peoples of the West will grasp this truth, and that one way and another we shall make the adjustments that permit us to move forward.

New Forms Essential

To accomplish this consolidation of Free World strengths we need new forms. It is time that we should use our good offices to put an end to the incipient economic schism which is developing in Europe. The so-called sixes and sevens, which have arisen, it seems, through a combination of French hesitancy and British traditionalism regarding a Continental coalition, embody the beginnings of a political division which would start Europe in precisely the opposite direction from that in which it should now be traveling.

New forms are needed to cope with the problems not only of Europe but of Britain, America and the Western Hemisphere. The composition of economic problems in Europe was very well worked out in the post-war period through the operation of OEEC, and some such form should be set up to deal with similar problems of the entire Atlantic world. With such an organization the matter of our imbalance of payments might have been anticipated and composed.

In this case our deficit would have been set in a perspective which would have reduced its significance as a factor in our whole defense policy (which it threatened to become recently, when the early withdrawal of our forces or a substantial portion of them from Europe apparently was contemplated as a means of alleviating the imbalance). New organizational forms are needed to consolidate our Free World strength and make more distinct our whole posture toward both the underdeveloped world and the Communist powers.

And now let me sermonize a little:

The nation and the Free World still face heavy challenges. To meet these we must have a new statesmanship and new forms, but it is even more important that we exert new disciplines—or perhaps revive old ones.

We shall not match and overcome the challenge of the new spirit and mass energy of the Sino-Soviet bloc, with its vast resources of material and manpower, by continued emphasis on increased leisure on our part. It will require the statesmanship I have been speaking of, buttressed by an intensive, inspired and continuous effort on the part of the ordinary citizen to make himself both more knowledgeable and more productive, if we are to preserve what we might call the good life on this increasingly finite planet. We may have to postpone for a while the flight to suburbia and security if we are to cope with some of the imperatives with which the modern world confronts us.

I hope I have not struck too pessimistic a note. I do not intend to, for though I see a well-defined challenge ahead—of which our balance-of-payments problem is only a part—I believe I also see a well-defined reply to it.

What it demands is the expenditure of greater thought, energy and persuasion. I see that Drew Pearson has collaborated in the writing of a book dealing with the forces which are playing about the world and it is called, I believe, "USA—A Second-Class Power?" We are far from a second-class power. We only could be!

New Swedish Lead Mine Has Novel Crushing Plant

By
American-Swedish News Exchange

A new lead mine, estimated to produce 150,000 tons of ore, or 9,000 tons of pure lead, annually, has just been opened up by the Boliden Mining Co. at Vassbo, a village in the sparsely populated Idre district in the northwestern part of central Sweden. It is an interesting enterprise in several respects, perhaps mainly on account of the new crushing method introduced, but also because of the long history behind the discovery of the deposit.

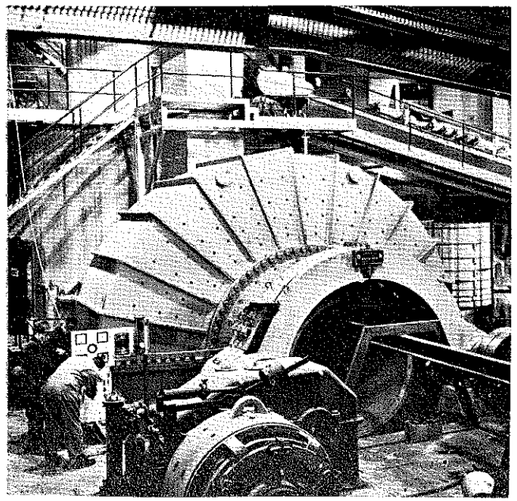
A find of a stray piece of ore over 60 years ago indicated the presence of a lead deposit, but not until 1951 did geologists succeed in localizing the body. It is situated about 11 miles from the place where the first ore piece was found. The body extends in an almost horizontal line 80 feet below the surface of the soil, and measures 6,000 by 300 by 18 feet. In 1957, Boliden decided to work the deposit.

Now there rises above the mine a pithead building 280 feet in height, three storage silos, and a concentration plant, and the work in the galleries is in full swing.

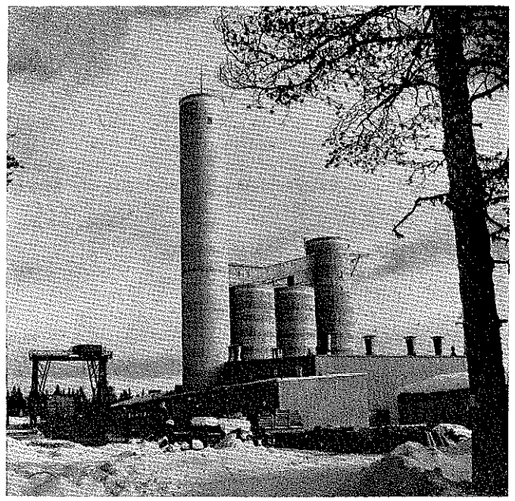
Idre being situated in a remote boggy tableland, there is no direct communication by rail, and therefore the entire concentration process is handled at the mine. The crushing plant, located at a depth of 240 feet below ground, is of a new design, invented in the United States, but hitherto never put to practical use. It utilizes the blocks of ore themselves, plus water, as crushing media, thereby saving high-grade expensive steel as used in conventional mills.

After crushing, the ore—which has a lead content of 6 per cent—is concentrated by other modern methods and is conveyed by trucks to the nearest railway station in the form of granular ore, containing 80 per cent of lead.

Investments in the new mine, which will employ some hundred men, are close to $4 million. The Vassbo mine will supply about one-quarter of Sweden's requirements of lead, at present totaling 40,000 tons a year.



▼The crushing plant at the recently opened Vassbo lead mine belonging to the Boliden Co. The mill uses the ore blocks themselves combined with water as crushing media, thereby saving expensive high-grade steel parts as used in conventional crushing plants. Based on an American idea, it is the first in the world of this type. The mine is calculated to yield 9,000 tons of pure lead per annum, or almost one quarter of Sweden's requirements.



▼The recently opened lead mine at Vassbo near the Norwegian frontier in central Sweden and belonging to the Boliden Co, runs in a horizontal layer underground. All that can be perceived on the surface are the 230-ft. pithead building and the storage silos, all built according to the Swedish Promentor-Concreto hydraulic moving-form method, and the ore concentration plant.

An Analysis of the Problem
Mineral Engineering Education for the Future

By COL. WENDELL W. FERTIG, '51

A solution to the problem of keeping engineering education abreast of the times was presented by Charles Brinckerhoff, president of The Anaconda Co., at the annual meeting of the Education Committee, Society of Mining Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, which was held Feb. 14 at the Statler Hilton Hotel in New York City.

In his address entitled "Education for the Future Mining Engineer," he pointed out the shift from vein mining with its attendant high costs to the large scale low-grade operations requiring fewer trained mining engineers. After reviewing this rather dismal picture of domestic mining operations, he said further that the opportunities for U. S. mining engineers in foreign countries were limited by the rise in nationalist aspirations. As a result, Mr. Brinckerhoff said: "We need engineers with more training, capable of specializing or of developing eventually into administrative work in any branch of the extractive industries.

"There are several steps to be taken in modernization of this field of engineering education. First, it needs a new name to indicate the broad scope of this new educational effort and training. The word "Engineer" standing alone to indicate the profession is itself sufficient. It is no more necessary to indicate the speciality in engineering than is done in other professions like lawyers and doctors."

To achieve the training as an engineer, Mr. Brinckerhoff suggests that the basic engineering course be accelerated and adequate electives be made available for the student's preference. The latter electives suggested are general courses in geology, mining, metallurgy, industrial chemistry, metal fabricating, petroleum engineering, and the engineering of nonmetallic minerals. These courses are in addition to a number of subjects of a cultural nature to broaden the engineer and prepare him for a responsible place in social and civic life. Such courses would include English composition, public speaking, economics (as applied to markets and today's business world, which would include the role of labor and capital in industrial operations), sales engineering, training in one or more foreign languages, and a course in the theory of cost accounting and financial control. When completed in three years of accelerated training, with the school year divided into three semesters of four months each, a degree as an engineer would be granted. Branch specialization would require another two years.

In closing his address, Mr. Brinckerhoff said: "I believe that there is a very great need for better trained engineers. Those in charge of engineering education must develop programs better suited to the drastically changed situation in the extractive industry and broaden the mining engineering course to include the entire field of metals, non-metallics, and fuels—their recovery from the natural state and their preparation for markets.

"Student enrollment in our engineering schools will increase when those teaching mining engineering offer programs tailored to the needs of the modern world. This means a broad engineering course in the initial stage and specialization as the final stage."

This problem is so important that its proper solution may well hold the key to continued world leadership, and it is a challenge to leaders of both industry and education, for the solution must lie in a wedding of the practical needs of the former and cultural desires of the latter. Mr. Brinckerhoff's views place a large portion of the responsibility upon those in charge of engineering education. Yet he has asked that the student cover a range of subjects in an accelerated three-year course that would dumbfound those educators charged with curricula preparation. The suggested training might well bear the same criticism as applied to many accelerated Armed Service courses—bits and pieces of information but no education. The solution probably lies between the total revision of the curricula and the gradual shift in emphasis from the practical courses to those presenting a basic understanding of principles involved.

At a time when industry is facing a shortage of mineral engineers in the foreseeable future, the lengthening of the course of specialized training to five years would serve to increase the difficulty at a critical time. To change the method of training so abruptly would result in serious disruption in the supply of trained engineers. Therefore it would seem that a transitional period of gradual change would be preferred and would accomplish the desired end of developing an educational program designed to produce better mining engineers.

(EDITOR'S NOTE: Since this problem is so important, we expect to devote space to this subject in the next several issues. In May, Dr. John W Vanderwilt's address, "The Real Problem—Mineral Engineering Manpower," given as the opening address of the AIME convention held in New York City on Feb. 15, will be discussed. In a later issue, the changes that are being made in the Mines curricula for the coming school year will be reviewed.)

National Western Mining Conference Program

THURSDAY, APRIL 21, 1960

8:00 a.m.

Registration—Exhibit Hall, Hilton Hotel.

PLEASE REGISTER!

Advance Registration Card holders pick up your Badges at Advance Registration Desk, Exhibit Hall, Hilton Hotel.

Ladies, please register at Ladies' Desk, Exhibit Hall, 15th Street side, Hilton Hotel. Purchase tickets at Ladies' Desk for Ladies Party on Saturday night, Junior Ballroom, Hilton Hotel.

Please purchase Luncheon and Banquet tickets early.

TWO SECTIONS ON THURSDAY MORNING

General and Special

General Section will be held in the Grand Ballroom of the Hilton Hotel.

Special Section will be held in Assembly Room No. 3 of the Hilton Hotel.

ADMISSION TO SESSIONS AND EXHIBITS BY BADGE ONLY

Luncheon — Junior Ballroom, Hilton Hotel, (Thursday). Speakers: J. Roy Price, Asst. Director for Resources and Production, Office of Civil and Defense Mobilization, Office of the President, Washington, D. C. Dr. Lauchlin M. Currie, Vice President, The Babcock and Wilcox Co., Atomic Energy Division, New York City. R. J. Anderson, Assistant to the Director, Battelle Memorial Institute, Columbus, Ohio. Introduction of Prominent Guests.

FIRST MORNING SESSION
GRAND BALLROOM
HILTON HOTEL

8:30 a.m.

Pre-Session — Motion Picture, "Wyoming and Its Natural Resources" — United States Bureau of Mines.

9:00 a.m.

Walter E. Burleson, President, Colorado Mining Association, Opening of Convention.

"Forward with the Mining Industry" — Robert S. Palmer, Executive Vice President, Colorado Mining Association.

Business Session.

THURSDAY MORNING
APRIL 21, 1960
GENERAL SECTION
GRAND BALLROOM
HILTON HOTEL

9:25 a.m.

H. W. C. Prommel, Treasurer, Colorado Mining Association, Denver, Presiding.

"Turkey Creek Uranium Ore Body South of Colorado Springs" — K. B. Nowels, Consultant, Colorado Springs, Colo.

9:45 a.m.

Robert E. Simpson, Denver, Presiding.

"Beryllium Mineralization"—Einar C. Erickson, Chief Geologist, Marc-Inc., Tucson, Ariz.

10:05 a.m.

Hon. J. Price Briscoe, Idaho Springs, Presiding.

"The Principal Gold Deposits and Potential Gold Production of the United States" — A. H. Koschmann, U.S.G.S., Denver.

10:30 a.m.

Douglas Ball, Ball & Associates, Denver, Presiding.

"Cooperation Between Industry and the Atomic Energy Commission" — Jackson E. O'Connell, Sales Manager, G. M. Wallace & Co., Denver.

10:55 a.m.

William R. McCormick, President, Standard Uranium Corp., Moab, Utah, Presiding.

"Standard Uranium Corporation's Development in San Juan County, Colorado" —Russell L. Wood, Asst. General Manager, Standard Uranium Corp., Moab, Utah.

11:30 a.m.

Paul C. Henshaw, Gen. Mgr., Homestake Mining Co., San Francisco, Presiding.

"Alteration at Ambrosia Lakes" — S. Ralph Austin, Chief, Mineralogy and Petrology Laboratory, A.E.C., Grand Junction, Colo.

THURSDAY MORNING
APRIL 21, 1960
SPECIAL SECTION
ASSEMBLY ROOM NO. 3
HILTON HOTEL

9:15 a.m.

G. N. Brodie, Vice President, Denver Golden Oil & Uranium Co., Denver, Presiding.

"Mineral Economics and the Problem of Equitable Taxation"—Dr. Oscar E. Lentz, Asst. Prof. of Economics, Colorado School of Mines, Golden.

9:45 a.m.

Harvey L. Tedrow, Denver, Presiding.

"Setting Up and Equipping a Metallurgical Laboratory" — Hildreth Frost, Colorado School of Mines, Golden.

10:15 a.m.

J. Marvin Kleff, Leadville, Colo., Presiding.

"The Place of Geology in Mining Exploration" — Dr. Michael A. Klugman, Colorado School of Mines, Golden.

10:45 a.m.

Alfred G. Hoyl, Denver, Presiding.

"Geochemistry, with Special Reference to its Recent Progress in Russia" — Harold Bloom, Colorado School of Mines, Golden.

11:15 a.m.

Warren C. Prosser, Denver, Presiding.

"The Photostress Meter and Its Underground Application"—Niles E. Grosvenor, Colorado School of Mines, Golden.

11:30 a.m.

Carl I. Dismant, Denver, Presiding.

"Gold Placer Drilling Techniques"—K. D. Kaasch, Minerals Production Co., Grand Junction, Colo.

THURSDAY NOON LUNCHEON
APRIL 21, 1960
JUNIOR BALLROOM
HILTON HOTEL

12:00 Noon

ENERGY RESOURCE LUNCHEON

Arthur C. Gregory, Attorney at Law, Denver, Presiding.

"Our Government and Mining" — J. Roy Price, Asst. Director for Resources and Production, Office of Civil and Defense Mobilization, Office of the President, Washington, D. C.

"Nuclear Fuels and the Energy Gap" —Dr. L. M. Currie, Vice President, The Babcock and Wilcox Co., New York City.

"United States in 1975"—R. J. Anderson, Assistant to the Director, Battelle Memorial Institute, Columbus, Ohio. Introduction of Prominent Guests.

THURSDAY AFTERNOON
AND EVENING
APRIL 21, 1960

4:50 p.m.

Cocktail Party—University Club. Courtesy Supply and Equipment Firms. (MEN ONLY). Admission by Membership Badge or Ticket.

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LADIES' COFFEE HOUR
10 A.M. to 2 P.M., Hilton Hotel

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THURSDAY AFTERNOON
APRIL 21, 1960
GENERAL SECTION
GRAND BALLROOM
HILTON HOTEL

2:00 p.m.

Frank E. Briber, Stearns-Roger Mfg. Co., Denver, Presiding.

"Recent Advances in Milling and Mill Design" — Robert L. Druva, Stearns-Roger Mfg. Co., Denver.

2:25 p.m.

G. T. Rummel, LaSalle Mining Co., Grand Junction, Presiding.

"A General Survey of the Status of Radiation and Radioisotope Utilization in Industry, Medicine, Agriculture, and Research" — Richard R. Tarrice, Stanford Research Institute, Menlo Park, Calif.

3:00 p.m.

Fred A. Brinker, Gen. Mgr. Western Divn., Vanadium Corp. of America, Durango, Colo., Presiding.

"Use of Sodium Chlorate in Uranium Refining" — Robert P. Rice, Technical Sales Dept., American Potash & Chemical Corp., Los Angeles.

3:25 p.m.

William L. Jude, Supt., Empire Zinc Divn. New Jersey Zinc Co., Gilman, Colo., Presiding.

"Expanded Research Program for Lead and Zinc"—Dr. Schrade F. Radtke, Research Director, American Zinc Institute, Lead Industries Association, New York City.

4:00 p.m.

Charles R. Butler, Durango, Presiding. (Mgr. Walter Duncan Mfg. Co.)

"Summitville Recent Exploration" — John B. Rigg, Denver.

4:30 p.m.

A. A. McCoy, Boulder, Presiding.

"Small Business Investments"—Canton O'Donnell, Chief, Investment Divn., Small Business Administration, Denver.

THURSDAY AFTERNOON
APRIL 21, 1960
SPECIAL SECTION
ASSEMBLY ROOM NO. 3
HILTON HOTEL

2:00 p.m.

DeWitt C. Deringer, Jr., Vice President, Norbute Corp., Golden, Colo., Presiding.

"Quantitative Method for Gamma Assaying of Uranium Ores in Situ"—Robert F. Dreullard, Geophysicist, and Ross L. Kinnaman, Chief, Geophysical Services Branch, United States Atomic Energy Commission, Grand Junction, Colo.

2:30 p.m.

A. M. Mastrovich, Climax Uranium Co., Grand Junction, Colo., Presiding.

"Gamma-only Assaying for Disequilibrium Corrections" — Philip H. Dodd, Chief, Special Projects Branch, and James H. Scott, Geophysicist, A.E.C., Grand Junction, Colo.

3:00 p.m.

Marling J. Ankeny, Director, United States Bureau of Mines, Washington, D. C., Presiding.

"Bureau of Mines Inspection of Uranium Mines on Indian Land" — James Westfield, Asst. Director, Health and Safety, United States Bureau of Mines, Washington, D. C.

"Observations" — Ronald E. Bales, Asst. Director, Health and Safety, Occupational Health Station, Salt Lake City, Utah.

Title Not Available—Curtis A. Nelson, Director, Divn. of Inspection, United States Atomic Energy Commission, Washington, D. C.

3:30 p.m.

Harrison S. Cobb, Boulder, Colo., Presiding.

"Our Industrial Commission"—Truman C. Hall, Chairman, Industrial Commission of Colorado, Denver.

4:00 p.m.

Walter E. Burleson, President, Colorado Mining Association, Salida, Colo., Presiding.

"Mining Engineering Education" — John Moss Jones, Colorado School of Mines, Golden, Colo.

4:30 p.m.

George H. Teal, Boulder, Presiding.

"New Agricultural and Mining Ideas" —W. B. Schipper, Denver.

THURSDAY EVENING
APRIL 21, 1960
ASSEMBLY ROOM NO. 3
HILTON HOTEL

7:45 p.m.

OIL SHALE SECTION

Dr. Charles H. Price, Denver Research Institute, University of Denver, Presiding.

"Where An Oil Shale Industry Stands Today"—Dr. Tell Ertl, Consulting Engineer, Grand Valley, Colo.

"The Oil Shale Industry of Tomorrow" —John Savage, Savage Oil Shale Development Company, Grand Valley, Colo.

"The Aspeco Process of Oil Shale Retorting"—Dr. Thomas D. Nevens, Denver Research Institute, University of Denver.

"Shale Oil"—a 30 minute motion picture in color, produced by Radio and Television Department, University of Denver.

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6:00 p.m.

Colorado School of Mines Alumni Association Dinner for Miners and wives — Denver Press Club, 1330 Glenarm Place, Denver.

Wyoming University Alumni Association—Petroleum Club, Denver.

FRIDAY MORNING
APRIL 22, 1960
GENERAL SECTION
GRAND BALLROOM
HILTON HOTEL

General Section — Grand Ballroom — Hilton Hotel.

Special Section — Assembly Room No. 3—Hilton Hotel.

8:15 a.m.

Pre-Session — Motion Picture, "These Blasted Hills," United States Bureau of Mines.

8:45 a.m.

LEAD AND ZINC SECTION

Edward H. Snyder, President, Combined Metals Reduction Co., Salt Lake City, Utah, Presiding.

"A Progress Report on Lead and Zinc" —Clark L. Wilson, Chairman, Emergency Lead-Zinc Committee, Salt Lake City, Utah.

"The Mining Industry's Program"—Miles P. Romney, Manager, Utah Mining Association, Salt Lake City, Utah.

9:30 a.m.

John Wise, General Manager, Idarado Mining Co., Ouray, Colo., Presiding.

"Silver—The Precious Metal With a Future"—H. B. Johnson, Manager, Sunshine Mining Co., Kellogg, Idaho.

10:00 a.m.

James E. Dunn, Manager, Pinnacle Exploration, Inc., Gunnison, Colo., Presiding.

"Columbium at Powderhorn, Colorado, with Notes on Similar African Occurrences"—Dr. Robert M. Grogan, Development Dept., DuPont Company, Wilmington, Delaware.

10:30 a.m.

Hervey Mathews, Vice President, Stearns-Roger Mfg. Co., Denver, Presiding.

"New Metallurgical Developments in Europe"—F. A. Forward, Metallurgical Engineer, University of British Columbia, Vancouver, B. C.

11:00 a.m.

F. M. Oreborn, General Electric Co., Denver, Presiding.

"Our Atomic Energy Program"—Henry C. Anderson, Atomic Power Equipment Dept., General Electric Co., Los Angeles, Calif.

11:30 a.m.

James L. Lake, General Manager, Colorado Plateau Operations, Union Carbide Nuclear Co., Grand Junction, Colo., Presiding.

"Trends in Uranium Processing" — A. E. Ruehle, Uranium Divn., Mallinckrodt Chemical Works, Saint Charles, Mo.

FRIDAY MORNING
APRIL 22, 1960
SPECIAL SECTION
ASSEMBLY ROOM NO. 3
HILTON HOTEL

9:00 a.m.

A. I. Johnson, Keystone, S. Dak., Presiding.

"One of Wyoming's Greatest Energy Sources"—E. L. Bayles, Pacific Power & Light Co., Portland, Ore.

9:30 a.m.

John W. Hill, Mgr., Worcester Mines, Grand Junction, Colo., Presiding.

"New Uranium Mill Construction in Karnes County, Texas"—John B. White, Jr., Manager, Susquehanna Engineering Co.

10:00 a.m.

J. Paul Harrison, General Manager, American Smelting & Refining Co., Denver, Presiding.

"New Methods of Driving an Upraiser" and Film—J. Borgenhard, Managing Director, Alimak Corp., San Francisco, Calif.

"Gold Placer Mining in Moffat County" —James M. Pughe, Craig, Colo.

10:30 a.m.

C. H. Reynolds, Gen. Supt., Continental Materials Corp., Grand Junction, Colo., Presiding.

"The Use of Digital Computors in Surveying"—Grant Harvey, Union Carbide Nuclear Co., Rifle, Colo.

11:00 a.m.

Wayne C. Hazen, Kerr-McGee Oil Industries, Inc., Boulder, Colo.

"Use of Radioisotopes in the Mineral Industry"—Fred L. Smith, Manager, Mining Div., Colorado School of Mines Research Foundation, Golden, Colo.

11:30 a.m.

Robert Henderson, Gen. Mgr., Western Operations, Climax Molybdenum Co., Golden, Colo., Presiding.

"Basic Studies in the Search for Ores" —Dr. Charles H. Behre, Jr., Professor of Economic Geology, Columbia University, New York City.

FRIDAY NOON LUNCHEON
APRIL 22, 1960
JUNIOR BALLROOM AND
ASSEMBLY ROOM NO. 3
HILTON HOTEL

12:00 Noon

JOINT LUNCHEON—Denver Chamber of Commerce and Colorado Mining Association.

John C. Davis, III, President, Denver Chamber of Commerce, and Robert Henderson, General Manager, Western Operations, Climax Molybdenum Co., Presiding.

"The Economic Future of Atomic Energy"—Dr. Paul F. Genachte, Director, Atomic Energy Divn., Chase Manhattan Bank, New York City.

"The Role of Gold in International Liquidity"—Oscar L. Altman, Advisor, Research and Statistics Dept., International Monetary Fund, Washington, D. C.

Introduction of Prominent Guests.

6:45 p.m.

GOLD AND SILVER BANQUET
Grand Ballroom—Hilton Hotel

General Jess Larson, Washington, D. C., Toastmaster.

Albert E. Seep, Denver, Chairman.

Introduction of Honored Guests.

Awards of Merit by George O. Argall, Jr., Editor, *Mining World*, San Francisco, Calif.

Entertainment—University of Colorado College of Music.

Speaker: U. S. Senator Lyndon Johnson of Texas.

FRIDAY AFTERNOON
APRIL 22, 1960
SPECIAL SECTION
ASSEMBLY ROOM NO. 3
HILTON HOTEL

2:00 p.m.

Frank J. Windolph, Asst. Gen. Supt., Climax Molybdenum Co., Climax, Colo., Presiding.

"New Haulage Methods"—E. R. Borcherdt, Mining Consultant, San Francisco, Calif.

2:30 p.m.

Douglas V. Watrous, Idaho Springs, Colo., Presiding.

"Large Diameter Rotary Drilling of Vertical Shafts" — William I. Wohlfeld, Hugh B. Williams Mfg. Co., Dallas, Texas.

"Operations of Self-Propelled Down-Hole Shaft Boring Machines" — S. C. Berube, Hughes Tool Co., Houston, Texas.

3:15 p.m.

C. O. Parker, President, Denver-Golden Oil & Uranium Co., Denver, Presiding.

"Preliminary Blasting Experiments with Ammonium Nitrate-Fuel Oil Mixtures" — James O. Milmoe and T. R. Young, Colorado School of Mines Research Foundation, Golden, Colo.

3:45 p.m.
R. R. Williams, Jr., Mgr. of Mines, Colorado Fuel and Iron Corp., Pueblo, Colo., Presiding.
"What Tomorrow's Open Pit Mine Will Look Like"—J. L. Vint, President, Unit Rig & Equipment Co., Tulsa, Okla.
4:15 p.m.
FLUORSPAR SECTION
Adrian Dorenfeld, Roberts and Associates, Los Angeles, Calif., Presiding.
"Fluorspar Reserve Situation in the United States"—Donald B. Saxby, Chief Geologist, The Minerva Co., Eldorado, Ill.

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6:45 p.m.
GOLD AND SILVER BANQUET

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FRIDAY AFTERNOON
APRIL 22, 1960
SILVER ROOM—HILTON HOTEL
2:00 p.m.
PROGRESS REPORT ON THE URANIUM INDUSTRY
General Jess Larson, Attorney At Law, Washington, D. C., and Leigh M. Jones, General Manager, Western Machinery Co., Denver, Colo., Presiding.
"Mining"—Donald T. Delicate, Supt., Homestake Mining Co., Grants, N. Mex.
"Advances in Treatment of Uranium Ores"—H. L. Hazen, H. L. Hazen, Inc., 777 Grant, Denver.
"Milling"—David P. Marcott, Vice President and General Manager, Cotter Corp., Canon City, Colo.
"Exploration"—Jack L. Robison, Gen. Mgr., Gunnison, Colo.; George E. Morehouse, Grand Junction, Colo.
"Radiation"—Robert G. Beverly, Union Carbide Nuclear Corp., Grand Junction, Colo.
"Marketing" (or "Uranium Market Forecasts")—Patrick J. Selak, Manager, Nuclear Engineering Development, Kaiser Engineers, Oakland, Calif.
"Investment Possibilities" — Thomas Vogenthaler, Susquehanna Western Inc., Riverton, Wyo.
"Finance"—Walter K. Gutman, Shields & Co., New York City.
4:00 p.m.
Max W. Bowen, Vice President & Gen. Mgr., The Golden Cycle Corp., Colorado Springs, Colo., Presiding.
"Underground Mining Methods and Costs at Climax Uranium Co."—Philip Donnerstag, Supervisor, Exploration and Development, Climax Uranium Co., Grand Junction, Colo.
4:30 p.m.
Karl F. Meyers, President, Shirley Basin Development Co., Casper, Wyo., Presiding.
"The Wyoming Uranium Picture"—Roy Peck, Riverton Ranger, Riverton, Wyo.

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6:45 p.m.
GOLD AND SILVER BANQUET

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SATURDAY MORNING
APRIL 23, 1960
GENERAL SECTION
GRAND BALLROOM
HILTON HOTEL
9:00 a.m.
RARE AND CRITICAL MINERALS SECTION
Dr. Paul H. Cardwell, Dow Chemical Co., Midland, Mich., Presiding.
"Manganese"—F. A. McGonigle, Howe Sound Co., New York City.
"Tungsten"—T. E. Tietz, Lockheed Aircraft Corp., Sunnyvale, Calif.
"Tungsten" — Ray G. Sullivan, Vice President, Minerals Engineering Company, Grand Junction, Colo.
"Yttrium"—C. R. Simmons, General Electric Co., Cincinnati, Ohio.
"Vanadium—Manufacture and Application of Vanadium Products"—T. W. Merrill, Director of Product Research, Vanadium Corp. of America, Cambridge, O.
"Titanium"—Ward W. Minkler, Manager of Technical Service, Titanium Metals Corp., of America, New York City.
10:30 a.m.
LEGAL SECTION
William G. Sumners, Esq., Denver, Presiding.
W. Howard Gray, Esq., Gray and Horton, Reno, Nev.
Charles J. Traylor, Esq., Grand Junction, Colo.
George W. Nilsson, Exec. Vice President, Mining Association of Southern California, Los Angeles, Calif.
11:00 a.m.
Alan M. Simpson, President & Gen. Mgr., Beaver Mesa Uranium, Inc., Grand Junction, Colo., Presiding.
"Developing an Orebody in Ambrosia Lake"—Harold Powers, Hidden Splendor Mining Co., Grants, N. Mex., Chief Engr. & Geol., New Mexico Division.
11:30 a.m.
J. F. Brenton, Manager of Administration, Union Carbide Nuclear Co., Grand Junction, Colo., Presiding.
"Grand Canyon Operations of Western Gold and Uranium"—Max E. Kofford, Chief Geologist, Western Gold & Uranium, Inc., Grand Canyon, Ariz.
SATURDAY MORNING
APRIL 23, 1960
SPECIAL SECTION
ASSEMBLY ROOM NO. 3
HILTON HOTEL
8:30 a.m.
Pre-Session—Motion Picture, "The Big Z"—Courtesy of the Canadian Government.
9:00 a.m.
INDUSTRIAL MINERALS SECTION
T. O. Evans, Chief Mining Engineer, Haystack Mountain Development Co., Previtt, N. Mex., and W. C. Peters, Westvaco Mineral Development, Denver, Presiding.
"Phosphate Developments in the Rocky Mountain Region"—V. E. Larsen, Mineral Development Dept., Food Machinery Corp., Grants, N. Mex.
"Exploration for Cement Raw Materials" — Charles Mallette, Exploration Dept., Ideal Cement Co., Fort Collins, Colo.
"Beneficiation of Coal for Coking Use"—Parke O. Yingst, Colorado School of Mines, Golden, Colo.
"Industrial Minerals and Their Promise for Development in Western States"—B. J. O'Neill, Stanford Research Institute, Menlo Park, Calif.
10:30 a.m.
BERYLLIUM SECTION
Michael D. Lyons, President, Beryl Ores Co., Arvada, Colo., Presiding.
"Beryllium—Present and Future Market Situation"—David N. Hershberger, Treasurer, Brush Beryllium Co., Cleveland, Ohio.
"Lake George Beryl Deposits"—Charles C. Hawley, U.S.G.S., Denver; and Don Peaker, Pueblo, Colo.
"A Field Instrument for Quantitative Determination of Beryllium"—E. E. Wilson and W. W. Vaughn, U.S.G.S., Denver.
"Beryl Developments in Nevada"—James D. Williams, Mt. Wheeler Mines, Inc., Salt Lake City, Utah.
SATURDAY NOON LUNCHEON
APRIL 23, 1960
DENVER CHAMBER OF COMMERCE BUILDING
1301 Welton St., Denver
12:00 Noon
GOLD LUNCHEON
Merrill E. Shoup, President, The Golden Cycle Corp., Colorado Springs, Colo., Presiding.
"Gold Mining Looks at the Future"—L. L. Huelsdonk, General Manager, Best Mines Co., Inc., Downieville, Calif.
SATURDAY AFTERNOON
APRIL 23, 1960
ASSEMBLY ROOM NO. 3
2:00 p.m.
TAX SECTION
Frank Cavanaugh, Esq., Denver, Presiding.
Laurence P. Sherfy, Esq., Tax Committee, American Mining Congress, Washington, D. C.
SATURDAY MORNING
Parade of Denver and Indianapolis Baseball Teams, dedicated to the National Western Mining Conference.
SATURDAY AFTERNOON
Opening Game, Denver Bears versus Indianapolis, Bears' Stadium, W. 20th Ave. and Decatur St.
Game starts at 2:00 p.m. and will be completed in time for the "World-Famous" Sowbelly Dinner at the Rainbow Ballroom, Fifth Ave. and Broadway. Both Baseball Clubs will appear at the Sowbelly Dinner.
SATURDAY EVENING
APRIL 23, 1960
6:15 p.m.
RAINBOW BALLROOM
38 West 5th Avenue, Denver
SOWBELLY DINNER
Toastmaster—James K. Groves, Esq.
"Reflections of the Mining Industry"—Honorable William A. Black, Judge of the District Court, Denver.
Remarks—Honorable Alan Bible, U. S. Senate (D. Nev.)
Distinguished Guests:
Gov. Steve McNichols of Colo.
Ed Edmondson, Congressman, Okla.
State Senator Ranger Rogers
"Smat" Smith
Red Fenwick
Awarding Safety Plaques: Colorado Industrial Commission.

Wyo. Mining Assn. Convention June 9-11, Jackson Lake Lodge

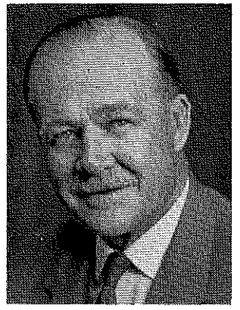
Wyoming Mining Association will hold its Fifth Annual Convention June 9-11 at Jackson Lake Lodge in scenic Grand Teton National Park.

Thursday, June 9
8 p.m. Annual Business Meeting

Friday, June 10
10 a.m. First Convention Session
12 noon Luncheon Meeting
1 p.m. Ladies Luncheon
2 p.m. Second Convention Session
6 p.m. Outdoor Barbecue Dinner

Saturday, June 11
10 a.m. Third Convention Session
12 noon Luncheon Meeting
2 p.m. Recreation Activities and Geology Tour
6:30 p.m. Cocktail Party
8 p.m. Annual Dinner, Entertainment and Dance

FROM THE EXECUTIVE MANAGER'S DESK



COL. WENDELL W. FERTIG

There seems to be a general feeling that THE MINES MAGAZINE can be improved both in quality and appeal. To this, your Executive Committee agrees most heartily, and to me, as Executive Manager falls the job of carrying out those general instructions.

To this point everything is in order, but then the question arises, just what do you mean by improvement in quality? Should there be more articles on metallurgy, geology, geophysics, petroleum engineering, or petroleum refining, rather than the strong emphasis on mining and its problems? Do you want to have the problems of education, research, and finance discussed?

Now turning to appeal, would this changing emphasis increase the appeal to you as an individual reader or alumnus? Should we increase the amount of space devoted to Class Notes, Local Sections, Campus Headlines, Oredigger Sports, Plant News, and Technical Societies? We are already planning to add this page to the Magazine, to include again News of the CSM Foundation, and to revive the Letters to the Editor page.

Plans are in the making to include a special issue of the magazine devoted to Geology and Geo-Physics, another to Metallurgy, and a third to special activities in the adjacent states. Colorado is usually quite well covered in the Special Mining Issue, published the month following the National Western Mining Conference held here in Denver. What else should be added?

Answers Are Needed From You

You see I have asked lots of questions, and now I need answers from you. Your suggestions and letters will be published in full, if space permits, or in part, unless you specifically request that they are *not* to be used in the Magazine. Being selfish in our outlook, your suggestions will bear more weight if you are an active member or if your letter is accompanied by the check needed to restore you to the active list.

As to income, we live on dues and advertisements placed in the Magazine. The former is fixed by the number of men who have graduated from Mines and who are interested in continuing their association with the School and with their fellow alumni. It can be expanded, although only slightly, by including those former CSM men who are eligible for associate membership in the Association. We will welcome them, when their application has been received, after being duly signed by two actives.

Revenue From Advertising

Within the framework of the restrictions imposed by our charter of organization, the only other revenue we have is obtained through the media of advertising in THE MINES MAGAZINE. That has fallen off during the last few years, for advertising is a cut-throat business where sentiment is lost early.

Therefore, to regain the advertising needed to carry out our plans, it is essential that our readers, and particularly our alumni, make it clear to the business world that CSM Alumni buy supplies from those companies which support the Magazine by continued advertising. It might even be worthwhile to set up a Roll of Honor for those fine manufacturers and service companies that have supported us over the years, so that everyone will be aware of this support.

Changes Made in March Issue

Have you looked at the March issue and compared it with the February issue? We increased the number of pages in March to 48, which is the most we can support on the present volume of advertising. If there are to be more pages, help us obtain more advertising.

To increase the readability of the Class Notes, we have capitalized the names of the individuals concerned. Next month readability will be increased still more by using an extra space to separate each item. The Table-of-Contents page has been restyled by placing the index of contents on the right side of the page, and officers and committee chairmen have been listed on the left. The picture that has graced that page for the past two years will be changed next month.

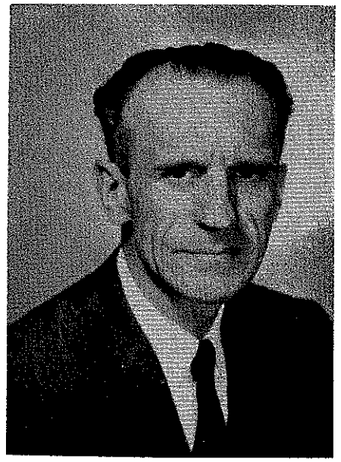
Tags and Carry-Overs Eliminated

All articles in the March issue were edited so that short tags or carry-overs to later pages were discontinued. More emphasis was placed on Oredigger Sports and a short article on the new Gymnasium and the sports program was included. We plan to continue stressing the changes here at CSM in physical plant, in curriculum, and in their approach to research and graduate work. These areas have suffered from lack of adequate coverage in the past.

The new cover which we have on the April issue will be used throughout our Golden Anniversary Year with the exception of the October issue which will mark 50 consecutive years of publication of THE MINES MAGAZINE and will be devoted to highlights of some of those momentous times.

Explosions Research Applied To Mine and Quarry Blasting*

By CLIFTON W. LIVINGSTON, '33



CLIFTON W. LIVINGSTON

So many factors influence blasting results that theories and rules are usually dismissed as impractical; the practice prevailing today is arrived at by cut and try. Usually the first step is to experiment with drillhole patterns and spacing until an arrangement is found that gives best results. The next step is to experiment with different types of explosives and sequences of blasting until the most satisfactory degree of fragmentation is achieved and until no further reduction in cost is immediately apparent. Improved fragmentation is generally attributed to the type of powder used, the sequence in which the holes are blasted, or the use of millisecond delays.

Various types of drill rounds have been evolved in tunneling operations, underground development headings, and stoping, and various patterns of blasting in open pit mines and quarries. These practices usually are carried from mine to mine or from district to district, and great skill is excercised by those experienced in the art of blasting.

When the first atomic bomb was dropped, the status of blasting as an art rather than a science at once became apparent. The advice of mining people and explosives manufacturers was sought on a number of matters requiring a knowledge of how rock fails when subjected to impact or explosion. Unfortunately the information was not available, but fortunately research on explosions began and was directed toward discovering the fundamentals of behavior not only of rocks, but also of other materials of the earth's crust, including the oceans of the earth and the atmosphere above. At present, the search continues and has been extended to include the rarified atmosphere hundreds of miles above the surface of the earth where elementary particles of matter are widely separated.

Types of Failure

When experiments were made under controlled test conditions with brittle-acting substances, it became apparent that the old crater theory of blasting described in Peele's *Mining Engineer's Handbook* did not apply. The former concept gave way to the shock wave reflection theory, which apparently is accepted today with little reservation, although it now appears to have been founded on incomplete knowledge.

Evidence recently has been obtained to demonstrate that at least three types of failure occur in blasting:

1) The shock type, characteristic of brittle-acting substances.

2) The shear type, characteristic of more plastic-acting substances.

3) The viscous-damping type, characteristic of composite substances such as snow, which consists of a brittle-acting elastic solid containing air-filled voids.

Evidence also has been accumulated to demonstrate that behavior of a given material is not constant and that brittle substances can be caused to deviate from ideal elastic behavior at high energy levels. Within certain specified limits, one material can be caused to behave like another. A concept known as "the theory of relative behavior of materials" was evolved, and from this the breakage process equation was developed. The equation applies not only to shock-type failure in blasting but also to shear types and viscous-damping types of failure.

THE AUTHOR

Clifton W. Livingston obtained an E.M. degree at the Colorado School of Mines in 1933 and an M.S. geological engineering degree in 1942 from Michigan College of Mines and Technology.

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For the present, it must suffice to observe the mutual interdependence of the following phenomena and the depth ratio, which is related mathematically to the energy level and which can be measured in the field with certainty:

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NEWS—INDUSTRIES

(Continued from page 10)

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Grand Junction AEC Office Needs Mining Specialists

The Grand Junction Operations Office of the Atomic Ennergy Commission is interested in employing persons with combined experience in examining and evaluating mining properties, estimating ore reserves, and analyzing mine production and cost data. A knowledge of geology and mining engineering is required. Experience in the uranium industry is desirable, but not required.

Positions to be filled carry an initial salary rate of $7,510 or $8,810 per annum. Appointees receive the normal Federal employee benefits, including vacation and sick leave, and optional low-cost life insurance coverage.

Further information and application forms may be obtained from the Personnel Branch, Atomic Energy Commission, in Grand Junction, Colo.

Bureau Report Describes Casting of Molybdenum

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(Continued on page 34)

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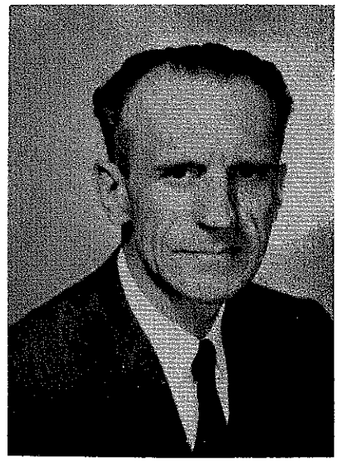

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(Continued on page 34)

Production of Lightweight Aggregate

By ERNEST E. BURGH, '44

ERNEST E. BURGH

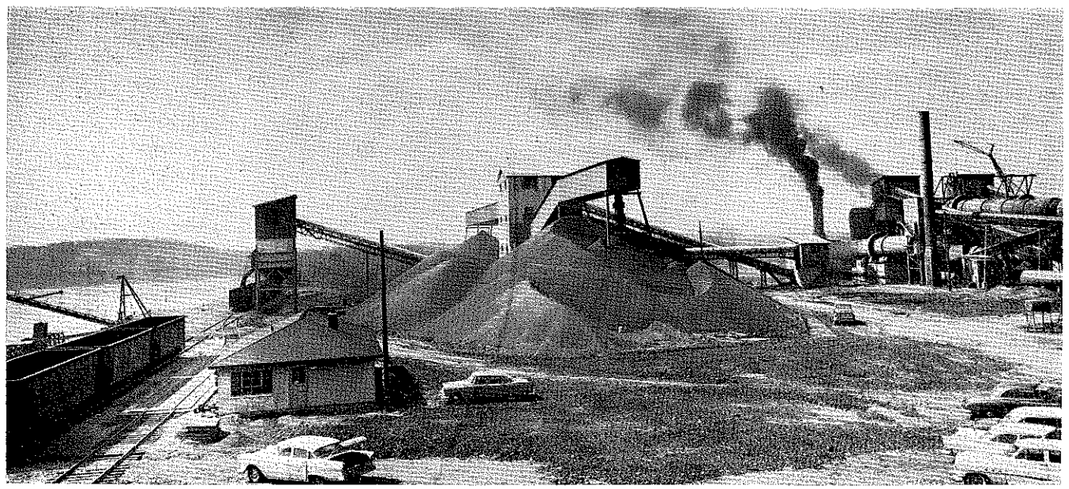
One of the fastest growing industries in the United States is the production of lightweight aggregate. One of the largest and most modern producers is the Materialite plant of Material Service Corp. This plant processes shale by thermal expansion in rotary kilns to lightweight spherical aggregate particles with many qualities superior to conventional heavy aggregate.

The plant is located about 5 miles east of Ottawa, Ill. adjacent to arterial highway, rail and river routes to Midwest markets. Operations were first started the latter part of 1957. After several months of shakedown operations and expansion of local markets, the plant is now operating at near capacity.

The deposit supplying raw material for this plant is the Canton Shale member of the St. David Cyclothem of the Pennsylvanian System. It outcrops along the north side of the Illinois River Valley east of Ottawa and is thickest (up to 60 feet) in the plant area. The shale is gray to dark gray thin-bedded with laminae less than 1/16-inch thick.

Quarrying Operations

Quarrying operations require a combination stripping and loading unit which is a 5-yard walking dragline. Overburden varies from 10 to an arbitrary limit of 35 feet for an average shale thickness of about 50 feet. The shale is drilled on 18 by 20-foot centers and blasted



▼ General view of plant site showing stockpile area for finished material and loading facilities.

THE AUTHOR

Ernest E. Burgh, a 1944 graduate of the Colorado School of Mines, is assistant to the vice president of operations for Marblehead Lime Co. and acting manager at the Ottawa, Ill. plant.

Marblehead Lime Co., a division of Materials Service Corp., operates several high-calcium lime, dolomitic lime and deadburn dolomite kilns and manages the lightweight aggregate operation at Ottawa. Recently, Materials Service Corp. became a division of General Dynamics.

Mr. Burgh was born in Alaska, received his grade and high school education at Nome, and after two years at the University of Alaska transferred to Mines where he received his E.M. degree in 1944. After two years of service in the Navy, he worked five years at the Bureau of Mines Experimental Oil Shale Mine at Rifle, Colo. He was then employed for three years by Mississippi Lime Co. at its Ste. Genevieve, Mo. plant.

From Missouri Mr. Burgh returned to the Rocky Mountain Area as a consultant in partnership with L. M. Buhler, a 1944 Mines graduate. In 1957 he was employed by Material Service Corp. as assistant plant manager at its Thornton Quarry operation, transferring to Marblehead Lime Co., in January 1959.

with ammonium nitrate at an average ratio of about 3.6 yards per pound of explosive. This ratio is sufficient to create enough fractures for moderately easy digging with the dragline without actually displacing the shale. Generally a strip area about 150 feet wide and an 80-foot blasted 'cut' is maintained for loading and hauling operations.

Haulage is done with 22-ton end dump trucks. One way haul from the pit to plant site is about 1.4 miles. Three to four trucks are necessary to maintain an average production of about 2100 tons per 8-hour shift. Quarry operations are on a 5-day schedule with stripping operations on evenings and weekends.

Shale Crushed in Two Stages

The raw shale is crushed in two stages. Stage one is a 36 by 72 single roll crusher and stage two is a Hammermill in closed circuit. Discharge from the crushers is screened to minus 3/8 inch and 3/8 by 3/4 inch fractions with plus 3/4 inch recirculated through the secondary. The minus 3/8 or 'fines' fraction and the 3/8 by 3/4 or 'coarse' fractions can go directly to kiln storage or to raw storage.

Kiln storage consists of four 400-ton feed bins sufficient for about 16 hours operation. Raw storage is a covered building of about 15,000-ton capacity with a reclaim tunnel for filling kiln storage bins on weekends. Fines are conveyed directly to kiln storage. Coarse is either recrushed through the secondary circuit or conveyed directly to kiln storage dependent on feed requirements.

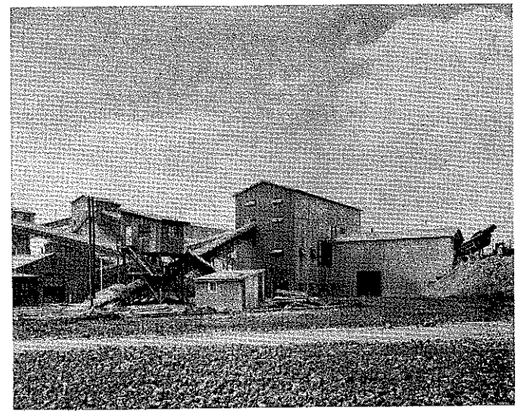
Adjacent to kiln feed storage are two 400-ton coal bins for kiln firing. Coal is reclaimed from a 5,000-ton stockpile, crushed to minus 1-inch and is conveyed to storage on the evening shift on the same conveyors that handle raw shale.

Raw Material Fed to Kilns

Raw material is fed to two 11-foot-3-inch by 160-foot rotary kilns. Two sizes of feed are used: Fines are minus 3/8 inch and coarse a blend of 3/8 inch by 3/4 inch and fines. Amount of feed to the kilns is controlled by poidometer feeders and generally averages 35 tons per hour. The kilns are rotated at speeds up to 120 RPH.

Very close control for feed and combustion conditions must be maintained to permit maximum production of acceptable product. Kilns are highly instrumented including RPH, draft, temperature and power input indicators to keep the operator cognizant of operating conditions. Hourly readings are recorded by the operator to supplement continuous recorder charts.

For optimum weight, strength, and appearance the raw shale must be heated to near 2000°F. Fuel is coal and/or natural gas. The shale particles bloat to produce a sound spherical-shaped particle. This particle is



▼ General view showing raw material crushing and screening building and raw storage building.

actually a collection of tiny hollow pores encased within a continuous non-porous skin yielding a product weighing an average of about 1500 pounds per yard.

Product Rescreened

The expanded shale product from each rotary kiln discharges into a 10-foot by 110-foot rotary cooler. The product is then rescreened to three sizes: fines, medium and coarse. Fines are minus 3/16 inch and mediums are 3/16 inch by 7/16 inch both of which are used extensively for concrete block. Coarse is 7/16 inch by 7/8 inch used primarily for structural aggregate.

Finished material of three grades is stockpiled. Loading facilities are arranged for truck loading, rail loading and barge loading with reclaim tunnels and bin storage for blending any required combination of fines, medium or coarse.

Concrete with Materialite

Some of the properties of concrete made with Materialite are up to 40 per cent lighter weight, strengths equal to conventional aggregate concrete, excellent dimensional stability and workability, and up to four times better insulating values than sand and gravel concrete. Use of lightweight aggregate, particularly for structural concrete results in savings in reinforcing and amount of concrete.

The necessary plant investment, material handling, burning, etc. naturally make lightweight aggregate more costly to produce than natural aggregates. However, the increasing popularity and acceptance of lightweight aggregate in concrete blocks and in precast and cast-in-place lightweight structural concrete bids fair to tax the production facilities of this new venture by Material Service Corp.

ALUMNI NEWS

Class of 1910 to Celebrate 50th Reunion This Spring

Plans for the return of the Class of 1910 to Golden for their fiftieth reunion this spring are well under way, according to a local planning committee of John B. Carman, John H. East, Jr., Vincent K. Jones, and Emil J. Bruderlin.

Activities definitely set for the May 26-27 affair include a breakfast with President John W Vanderwilt at 8:30 a.m., May 26, at the Holland House in Golden, followed by a tour of the Mines campus. Thursday evening the reunion class will attend the Alumni Association banquet at the University Club.

On Friday, May 27, those returning members of the 1910 class will be honored at Commencement, along with the graduating seniors. Other get-togethers will be planned by the class for the two days, and a cocktail party and buffet is tentatively set for Wednesday night. Details are being sent to the Class as they are finalized.

It is hoped that a large percentage of the 25 known living members of the 1910 class will be able to return for their reunion.

Class Reunions Planned

CLASS OF 1900—60th Reunion

Although the class does not have a scheduled reunion this year, C. C. Malmstrom, 684 Jones Rd., Yuba City, Calif., writes that he is going to try to be at Commencement this year. (We'll be expecting you, Clarence.)

CLASS OF 1925—35th Reunion

Ivan S. Salnikov, whose address is Scarswold Apartments, Garth Road, Scarsdale, N. Y., will advise concerning arrangements being made for the 35th Class Reunion.

Clark Barbe and Frank Laverty may be contacted locally as arrangements develop.

CLASS OF 1935—25th Reunion

Arrangements for the 25th Reunion of the class of 1935 are being handled by a committee composed of Albert M. Keenan, 8893 W. 19th Ave., Denver 15; Otto L. Schmitt, 869 Medea Way, Denver 9; and Paul W. Smith, 1151 So. Williams St., Denver. Program will be furnished directly to the members of the class of '35.

CLASS OF 1950—10th Reunion

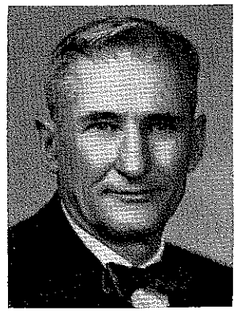
John J. Weyler, 5851 E. 23rd St., Tulsa 14, Okla. has been requested to designate someone in his class if he cannot, due to distance involved, handle the details of the 10th reunion of the class of 1950. Ron Lestina, 202 Majestic Bldg., Denver, can be reached for details as plans develop.

Denver Section Sponsors Mining Conference Dinner

The Denver Section will sponsor the annual dinner for those alumni attending the National Western Mining Conference and for their regular members. The dinner will be held at 6:30 p.m., Thursday, April 21, at the Denver Press Club, 1330 Glenarm Pl.

Oil shale sessions will begin at 8 p.m., but that allows ample time to attend the suppliers' cocktail party at the University Club, have dinner with us, and then go to the oil shale meeting. Bring your wife and join us for a fine steak dinner ($3.50 each). Bar service will be available, and we will have the upstairs dining room to ourselves.

Dr. Fancher, '30, to Direct Sinclair Research Laboratories



Dr. George H. Fancher, who received his D.Sc. degree from the Colorado School of Mines in 1930 and who is a former graduate professor and chairman of petroleum engineering at the University of Texas, was named vice president in charge of the production research department of Sinclair Research Laboratories, Inc.

Associated with Dr. Fancher in the group of scientific personnel which will administer the enlarged research program will be Bruce F. Grant, laboratory manager; Dr. Virgil J. Berry, Jr., director of the petroleum engineering research division; James F. Johnson, director of the exploration research division; C. E. Ford, director of the general engineering research division; Dr. Alfred Chatenever, research associate, and Dr. Stephen E. Szasz, research associate.

Dr. Fancher comes to his new post with an outstanding record in education and research.

After teaching at various colleges and universities, he went to the University of Texas as professor of petroleum engineering in 1935, becoming graduate professor in 1940, director of the Texas Petroleum Research Committee in 1949, and chairman of the petroleum engineering department in 1956.

In research, he developed methods of core analysis now in widespread use in the petroleum industry; developed a patented process for cracking heavy oils at low pressure, and developed a standard method and unit for permeability measurement which has been adopted as Code 27 of the American Petroleum Institute.

A consultant for many companies, Dr. Fancher has served on numerous API committees, has been active on Interstate Oil Compact Commission committees, and has received many academic honors. He is a member of Alpha Chi Sigma, Phi Lambda Upsilon, Sigma Gamma Epsilon, Iota Alpha, Pi Epsilon, Sigma Xi, Tau Beta Pi and is an honorary member of Omega Chi Epsilon.

Torpey, '51, Sales Manager For Joy Manufacturing Co.

Herbert G. Torpey, a 1951 mining engineering graduate of the Colorado School of Mines, has been appointed district sales manager for Joy Manufacturing Company's Mining and Construction Division, San Francisco office. He replaces L. C. "Dusty" Rhodes, a 1922 Mines graduate, who has been granted an extended leave of absence.

Mr. Torpey will manage sales and service of Joy's line of equipment for metal and hardrock mining and heavy construction industries in California, Hawaii, Alaska, and the western parts of Washington, Oregon, and Nevada.

Mr. Torpey began his career with Joy in 1951. He has represented Joy in the Duluth, Minnesota and Butte, Montana areas. For the past seven years, he has been affiliated with the San Francisco district sales office.

During World War II, Mr. Torpey served in the European theater with the U. S. Army Corps of Combat Engineers. He lives in Daly City, Calif.

Marshall, Rankin, Geffen Join Alumni Association

It is our pleasure to announce the election of Donald J. Marshall, x-'45, Charles H. Rankin, x-'30, and Sam Geffen, x-'42, to associate membership in the CSM Alumni Association.

John H. East, '10, Retires As Bureau Regional Director

John H. East, Jr., who received his E.M. degree from the Colorado School of Mines in 1910, retired Feb. 29, 1960 (just two days after his 70th birthday) as Denver Regional director of the U. S. Bureau of Mines. Since "retirement" he has already begun a new career as a consulting engineer.

Highlights of Mr. East's work with the Bureau of Mines include his success in promoting the Leadville drainage tunnel, his "ingenious and efficient plan" for the oil shale test plant at Rifle, Colo., and his report for restoration of the war-ravaged mines of Europe. On Sept. 5, 1958 he received the Department of Interior's Distinguished Service Medal with a citation commending him for building an esprit de corps unsurpassed in the Bureau organization. He also was the recipient in 1953 of the Colorado School of Mines Distinguished Achievement Award presented to Mines Alumni for significant achievements in the mineral industries and allied fields.

After graduating from high school at Rising City, Nebr., Mr. East studied electrical engineering a year (1905-1906) at Colorado Agricultural College. He stayed out of college a year, then transferred to Mines in 1908. Graduating from Mines in 1910 as a mining engineer, he spent several years as an engineer and assayer for various companies in the Western States. He joined the mine rescue service of the Bureau of Mines in 1915. Eighteen months later he left the Bureau to become safety engineer for Oliver Iron Mining Co., Hibbing, Minn.

From 1917 to 1922 he was foreman and then superintendent of a 10,000-ton per day copper producing property operated by Chile Exploration Co., Chuquicamata, Chile. Returning to the United States, he was employed first as mining engineer and later as advertising manager for Denver Rock Drill Co.

From 1924 to 1928 he was stripping superintendent for Locust Mountain Coal Co., Shenandoah, Pa., which at that time was the largest anthracite stripping operation in the country. In the intervening years before his return to the Bureau of Mines in 1939, Mr. East was superintendent of many coal and gypsum mines as well as being a consulting engineer for a year. He was appointed Denver Regional director of the Bureau in 1949.

Mr. and Mrs. East live at 611 E. 11th Ave. in Denver. Their son, Jack, is manager of a radio station in Pueblo, Colo.

J. A. Briggs, '33, Manager Of New Cornelia Branch

James A. Briggs, a 1933 mining engineering graduate of the Colorado School of Mines, was recently appointed manager of the New Cornelia Branch of Phelps Dodge Corp. at Ajo, Ariz.

After graduating from Mines, Mr. Briggs worked a couple of years as a contract miner for Alaska Juneau Mining Co. From 1936 to 1941 he was employed as a mining engineer at United Verde Branch, Phelps Dodge Corp. During World War II, he served as an officer both in this country and overseas.

Following his discharge from the Army in 1946, Mr. Briggs was employed in various supervisory capacities at the Morenci Branch of Phelps Dodge, being promoted in 1952 to assistant chief engineer.

After two years (1955-57) as mine superintendent at Phelps Dodge's New Cornelia Branch, he was named general superintendent. Since Jan. 1, 1960 he has been manager of the property.

Mr. and Mrs. Briggs live in Ajo, Ariz., and have two children and two grandchildren.

A. G. Setter, '32, Appointed Assistant to General Manager

A. George (Tony) Setter, '32, has been named assistant to the general manager and technical sales consultant for the Industrial Sales Division of Western Machinery Co. of San Francisco.

In this new capacity he will consult with Western Machinery Co. operations managers located in Denver, Salt Lake City, Spokane, and Phoenix on mining and metallurgical problems and on material handling in connection with the beneficiation of sand and gravel.

Tony, his wife Kay, and their two daughters have lived in Grand Junction and will continue to make this their home. Tony helped organize and served as president of the Grand Junction Alumni Section and is the past chairman of the Colorado Plateau Section of AIME.

E. C. Kinyon, '35, Appointed General Superintendent

Edward C. Kinyon, a 1935 mining engineering graduate of the Colorado School of Mines, has been appointed general superintendent for the Torrance Works of U. S. Steel's Columbia-Geneva Steel Division.

A native of Joplin, Mo., Mr. Kinyon attended public schools in Elmhurst, Ill. After graduating from Mines, he was employed by the Braden Copper Co., J. A. Roeblings Co., the Balatoc Mining Co. and Carnegie-Illinois Steel.

He became a wire rope engineer at U. S. Steel's Pittsburgh Works in 1941, and was named assistant superintendent of wire and wire products in 1945. Two years later he became the department's superintendent, and in 1955 was named superintendent of sheet finishing.

Active in technical groups and in community activities in Contra Costa County, Calif., Mr. Kinyon resides with his wife, Clara, and son, Robert Edward, at 1120 Homestead Ave., Walnut Creek, Calif.

Visitors to the Alumni Office

During the past month we had a number of visitors, and nearly all signed the Visitors' Register. Some did escape without record, due to the excitement caused by their visit. As more of you drop in to see us, we will develop a routine method of greeting. Visitors Register will be prominently displayed, and while it is being signed, a quick search of the records will be made to see if all dues have been paid. Regardless of the outcome of that search, our welcome will be sincere, for hope springs eternal. We want you to make it a point to call at the office when you are in Golden. By late May we will be in our new quarters in Guggenheim. Until then you will find us at 1612 Illinois St., directly across the street from the Petroleum Building.

JOHN F. ABEL, JR., '56, whose permanent address is 100 Maple Street, Littleton, Colo., is taking his wife on a long European vacation. John has spent considerable time in Greenland, and should enjoy the change.

RUSSELL M. CORN, '57, who was with Kerr-McGee Oil Co. in North Carolina, is now assigned with the same company in Golden. His home address is 8847 W. 54th Pl., Arvada.

LEROY L. FOURNIER, '50, his wife, Eleanor (Eli Anderson) and their three children are in Golden on home leave from his position as district petroleum geologist, American Overseas Petroleum Co. Luke will return to Libya, address there is Box 693, Tripoli, Libya, in May after a visit with his mother, in Maine. The family appears to have enjoyed living in Turkey and later in Libya. En route home, Luke stopped at Blarney Castle to pick up a shillelagh as a gift to Grandpa Anderson.

PHILLIP R. HAMMOND, '48, assistant sales manager, Explosives Division, Hercules Powder Co., stopped in the office, but unfortunately, I did not get to talk with him. Phil is still living at 201 Churchill Dr., Carrcroft, Wilmington, Del.

EDWIN W. PEIKER, JR., '54, is still doing advance work at the University of Colorado, where he is also an instructor in the Engineering School. His address is 330 S. 42nd St., Boulder, Colo.

JOHN R. ROSS, '52, is still with The California Co., as a petroleum engineer. His home address is 6617 South Lee Ct., Littleton, Colo.

RICHARD L. SCOTT, '42, manager Mining Products Sales, Colorado Fuel and Iron Corp., Denver, came out to discuss the relationship of the CSM Foundation and the Alumni Assn. Lee feels as I do that there is a mutual interest there that will draw the two organizations much closer together in the future. Lee's home address is still 1128 So. Jackson, Denver 10, Colo.

GEORGE W. WUNDER, '36, manager, Nuclear Metals Division, National Lead Co., New York, called at the office with his son William P. Wunder. Bill is a freshman at Mines this year in the Mining Option. George's home address is 38 Hewlett Lane, Port Washington, N. Y.

George Clarke, '23, Host At Luncheon for Alumni

George Clarke, a 1923 graduate of Mines and vice president and division manager of the American Petroleum Corp., gave a luncheon on March 10 at the Oklahoma City Petroleum Club. Sixteen alumni and three local high school seniors were present. Fritz Brennecke reported on the athletic and academic program at Mines and answered questions.

E. L. McDaniel, '52, Finds Adventure in Prospecting

E. L. McDaniel, a 1952 geological engineering graduate of the Colorado School of Mines, recently spent five days with a friend prospecting for uranium north of Kim in Las Animas County, Colo.

The two men found no uranium but they did find adventure—a blizzard that blew snow so deep the Army had to be called in to clear snow-clogged roads, temperatures 11 degrees below zero, and law officers who mistook them for cattle rustlers.

Before moving to Lakewood, McDaniel was employed for several years as a field geologist in Venezuela. He and his friend want to move to Alaska this spring to prospect for gold, silver and other minerals.

NEWS—INDUSTRIES

(Continued from page 29)

using rotating molds lined with graphite. Authors E. D. Calvert, S. L. Ausmus, S. A. O'Hare, and A. H. Roberson believe that such spuncast tubes or cylinders can be prepared on a commercial scale by industry. More complex molybdenum forms, such as pipe tees, were cast in stationary molds, but they did not approach the simpler spun-type shapes in surface appearance or internal soundness. The Bureau is continuing its research in molybdenum casting, hoping that satisfactory complex forms can be created and that techniques suitable for use by industry will result.

New Mining Technique Uses Cast Iron Lining in Shaft

A mining technique proven in Europe but new in the Western Hemisphere is being imported by International Minerals & Chemical Corp. (Canada) Ltd. to assure "long-term efficiency and safety" in the operation of its potash mine now under construction in Saskatchewan.

The new technique, called tubbing, employs a cast iron lining for the mine shaft. It is a vertical application of cast iron vehicular tunneling commonly used under rivers and lakes.

The 300-foot lining, weighing 3,000 tons, will be used between the 1200- and 1500-foot levels of the shaft to wall off water-bearing Blairmore sands.

The German firm of Haniel & Lueg, mining engineers who specialize in such work abroad, where tubbing has been used successfully in many deep shaft mines, will direct installation of the cast iron liner.

Company officials describe the potash ore deposit, located 3100 feet below ground near Esterhazy in Saskatchewan, as the "largest known deposit of high grade potash ore."

The shaft is now down to the 1200-foot level, where the Blairmore sands are being consolidated by freezing. Freezing was also employed to consolidate the glacial till before sinking the first 300 feet of the shaft.

The "tubbing" to be used in the Blairmore area actually will consist of 65 rings, each five feet high, 18 inches thick, and 18 feet in diameter. Each ring is made up of 11 segments.

Mineral Resource Films Seen by Millions of People

Motion pictures produced by American industry in cooperation with the Bureau of Mines were shown nearly 228 thousand times last year, giving more than 12 million people throughout the 50 States a better understanding of their nation's mineral resources.

Attendance at group showings of these films—loaned without charge by the Bureau of Mines to educational institutions, industrial firms, technical societies, business and civic clubs, and similar organizations—was 12,251,000.

During 1959, Bureau motion pictures dealing with the several metals, nonmetallics, and mineral fuels again were in heavy demand, as were its productions depicting the natural resources of various states. Last year's most popular film, which tells the story of uranium, was viewed by more than half a million people at 11,500 group showings.

(Continued on page 43)

ALUMNI BUSINESS

Executive Committee Meeting Of Mines' Alumni Assn., Feb. 25

The regular monthly meeting of the Executive Committee was held on Feb. 25, 1960 at the Research Foundation in Golden. President Edwin H. Crabtree called the meeting to order at 7:50 p.m.

Members present were: Edwin H. Crabtree, president; James A. Mullinax, secretary; Harvey Mathews, executive committee; S. M. del Rio, executive committee; Wendell W. Fertig, executive manager; Ron Lestina, chairman athletic committee; Bob Bolmer, chairman publications committee.

Members absent were: John M. Petty, vice president; Robert H. Waterman, treasurer.

The officers of the 1960 Executive Committee were read as follows: Harvey Mathews (two more years to serve), Robert Evans (one more year to serve), and S. M. del Rio (three more years to serve).

The minutes of the meeting of Dec. 21, 1959, were read and approved.

The highlights of the minutes of the Annual Business meeting of Jan. 28, 1960, were read and approved.

A recommendation was made that class agents be appointed in each option beginning with the year 1947. Action was not necessary but names will be recommended to Troy Crowder.

The report of the Special Committee for the Revision of name of the Mines Alumni Endowment Fund was deferred until the next meeting.

It was announced that Otto Highfield has agreed to accept the job as Advertising Manager for the Mines Magazine on a 33⅓% commission basis. Highfield will pay his own expenses and materials. The 33⅓% commission will be paid after the 15% agency deduction. If a prospective client needs layout work and requests Highfield to do this work, he will be paid 10% by the Alumni Association to perform the layout work. House accounts are exempt from commission. 33⅓% will apply only to new accounts. It was moved by Mr. del Rio and seconded by Mr. Bolmer that Executive Manager be authorized to execute the agreement with Highfield to solicit ads for Mines Magazine per agreement discussed, Motion approved.

Brochures for soliciting ads by mail or personal call are now being printed and should be available by March 10th.

The January, 1960 Financial report was reviewed. Mr. Roll explained that $400 in red in January, 1959 due to the move to Golden by the Alumni office and excess help to get office organized. He also called attention to $260 in black in January, 1960. Motion made by Lestina and seconded by del Rio that Financial statement of January, 1960 be accepted. Motion approved.

Motion was made by Mr. Mathews, seconded by Mr. del Rio that Executive Manager, Wendell W. Fertig, be appointed as Assistant Treasurer to co-sign checks as required for proper conduct of office affairs. Motion passed with comment that By-laws call for such an appointment.

A motion was made by Harvey Mathews, seconded by Mr. del Rio that all checks bear the signature of the President or the Secretary with the co-signature of either the Treasurer or the Assistant Treasurer. Motion carried. Signature cards for various accounts were obtained.

Colonel Fertig was directed to take necessary action whereby most return could be obtained on savings accounts established by the Alumni Association.

Motion was made by Mr. Mathews, seconded by Mr. Lestina that Executive Manager Fertig be paid an annual salary of $5400 plus $1800 travel expenses yearly. An accounting to be rendered of the $1800 to the Executive Committee. The salary and expenses to be effective February 1, 1960 and subject to yearly approvals thereafter by the Committee. The yearly salary and expenses will continue as long as Mr. Fertig devotes full time to job or until he so desires to hire part time help at which time a new agreement of salary will be executed. Motion carried.

President Crabtree will ask Mr. Ben Essig to accept the chairmanship of the Alumni Endowment Committee and appoint his five man committee. No other action taken on rest of committees. Motion made by Colonel Fertig and seconded by Mr. del Rio that President Crabtree's appointment of Committee Chairmen, as listed below, be approved. Motion passed.

- Athletic Committee—Ron F. Lestina
- Alumni Endowment Committee—Ben Essig
- Budget & Finance Committee—Robert H. Waterman
- Nominations Committee—(To be appointed later in the year)
- Public Relations Committee—Warren Prosser
- Instruction Committee—(Still Open)
- Membership Committee—Ken Nickerson
- Publications Committee—Robert L. Bolmer
- Research & Investigation Committee—Oran L. Pack

A letter of request was read from Mines senior Lennox Hagemann for a loan of $750 to complete this year of school. Letters from Mr. Steinhauer and Fritz Brennecke read recommending loan requests. Request referred to Mr. Lestina, athletic committee chairman, for immediate answer to Hagemann through Executive Manager. Motion made by Mr. Mathews, seconded by Mr. Lestina that a loan of $750 be made immediately to Mr. Hagemann under the same conditions of repayment as the loans made by the School. Motion passed.

Mr. William McClain requested loan in indeterminate amount to do advanced study in England—probable travel expense of $700 plus expenses for family while there. Suggestion made to Colonel Fertig that no further consideration be given the loan until the exact amount of loan needed by McClain be determined. Consideration will be given to making the loan out of the Alumni fund.

The secretary presented the applications of Donald J. Marshall x-'45, Charles H. Rankin x-'30, and Sam Geffen x-'42 for Associate Membership. Upon motion and seconded, the applications were unanimously approved.

Discussion took place on proposed new home of Alumni office on second floor of Guggenheim in the two old math rooms. Will proceed to occupy space as soon as it is available.

Request granted to Executive Manager to spend $26.20 for 200 new rate cards increasing ad charges from $150.00 to $190.00 for full page ads in Magazine for new clients.

Plans for the Magazine were discussed and Colonel Fertig gave the proposed schedule for the year: 1960

- March—Usual
- April—Usual
- May—Special Mining Issue (National Western Mining Conference)
- June—Annual Commencement Issue
- July—Salute to Wyoming Mineral Industry
- August—Consider use of graduate theses
- September—Usual
- October—Golden Anniversary Issue
- November—Annual Petroleum Issue
- December—Usual

1961 (Annual thereafter)

- January—Special Metallurgy Issue
- February—Usual
- March—Special Mining Issue (National Western Mining Conference)
- April—Usual
- May—Special Geology-Geophysics Issue
- June—Annual Commencement Issue
- July—Devoted to operations in some adjacent state
- August—Theses
- September—Usual
- October—Usual
- November—Annual Petroleum Number
- December—Usual

Suggested by Mr. Nickerson that a suitable graduate thesis be included in each Magazine issue to enhance sales appeal of Magazine. No action taken. (Executive Manager will consider.)

Consideration given to changing the size of directory to that of the AAPG Bulletin so that ads of standard size can be used. This will improve chances of getting more ads. Exact date of publication was not named.

Alumni Trophy—A traveling award wrestling trophy has been agreed on between C.S.M. and USAFA. The trophy is awarded annually and is to be retained by the winning team each year until the next wrestling meet. A motion was made by Colonel Fertig and seconded by Mr. del Rio that the necessary $17.50 be given to Mr. Lestina to pay Mines' share of cost of trophy.

The Alumni Association will suggest to the Denver Section that a dinner be held on the evening of April 21 (Thursday) during the National Western Mining Conference which convenes April 21-23.

The Placement Service will receive assistance in every way possible from Dean Burger to improve the service.

The next meeting scheduled for March 17 at Stearns-Roger, Denver, at 7:30 p.m.

The meeting was adjourned by President Crabtree at 10:40 p.m.

FROM THE LOCAL SECTIONS

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

ALABAMA

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

ARIZONA

Arizona Section
Pres.: Bob Thurmond, '43
V. Pres.: Gene Klein, '43
Sec.: John H. Bassarear, '50
c/o Pima Mining Co., Box 7187, Tucson
Annual meetings: First Monday in December; 3rd Sunday in May (annual picnic).

Four Corners Section
See New Mexico for officers

CALIFORNIA

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

Southern California Section
Pres.: W. C. Prigge, '42
V. Pres.: R. E. McGraw, '53
Treas.: J. R. Leonard, '42
Sec.: M. C. McKinnon, '52
9826 Corella Ave., Whittier

COLORADO

Denver Section
Pres.: Ed. Haymaker, '41
V. Pres.: M. John Bernstein, '47
Sec.-Treas.: Douglas Rogers, '48
AC 2-9911
Luncheon meetings held every 3rd Tuesday noon of each month at the Denver Press Club, 1330 Glenarm Pl.

Four Corners Section
See New Mexico for officers

Grand Junction Section
Pres.: John Emerson, '38
V. Pres.: Tony Corbetta, '48
Sec.-Treas.: Joe Hopkins, Ex-'37
1235 Ouray Ave., Grand Junction

DISTRICT OF COLUMBIA

Washington, D. C. Section
Pres.: Charles T. Baroch, '23
V. Pres.: Vincent G. Gioia, '56
Sec.-Treas.: Thomas E. Howard, '41
9511 Nowell Dr., Bethesda 14, Md.
Luncheon meetings held every 2nd Thurs. noon at Sphinx Club, 1315 K St., N. W.

ILLINOIS

Great Lakes Section (Chicago)
Next meeting on April 6; call Ray Watson, c/o Standard Oil Co., 910 So. Michigan Ave., Chicago 80, Ill.

KANSAS

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

LOUISIANA

New Orleans Section
Pres.: George Burgess, '49
V. Pres.: Emory V. Dedman, '50
Sec.-Treas.: Thomas G. Fails, '54
6334 Essex Ct., New Orleans 14

MINNESOTA

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

MISSOURI

St. Louis Section
Pres.: Earl L. H. Sackett, '33
Sec.-Treas.: E. W. Markwardt, X-'32
621 Union Ave., Belleville, Ill.

MONTANA

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

NEW MEXICO

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

NEW YORK

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

OHIO

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

Cleveland Section
Pres.: Charles Irish, '50
Treas.: Theodore Salim, '53

Pennsylvania-Ohio Section
See Pennsylvania for officers

OKLAHOMA

Bartlesville Section
Pres.: R. C. Loring, '37 and '39
V. Pres.: C. T. Brandt, '43
Sec.-Treas.: W. K. Shack, '51
4726 Amherst Dr., Bartlesville

Oklahoma City Section
Pres.: Lynn Ervin, '40
V. Pres.: Clayton Kerr, '30
Meetings the 1st and 3rd Tuesday of each month at the Oklahoma Club

Tulsa Section
Pres.: Parke Huntington, '26
V. Pres.: Jerry Diver, '52
Sec.-Treas.: Jim Newell, '52
2641 South 74th East Ave.
Tulsa 14, Okla.

PENNSYLVANIA

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

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

TEXAS

Houston Section
Pres.: Jack Earl, '53
V. Pres.: John C. Capshaw, '54
Sec.-Treas.: Nick Shiftar, '40
5132 Mimosa St.,
Bellaire, Texas

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

Permian Basin Section
Pres.: Van Howbert, '51
V. Pres.: Hal Ballew, '51
Sec.-Treas.: Tom McLaren, '52
4301 Mercedes, Midland
Luncheon meetings held first Friday of each month at the Midland Club.

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

UTAH

Four Corners Section
See New Mexico for officers

Salt Lake City Section
V. Pres.: Joe Rosenbaum, '34
Sec.-Treas.: Kenneth Matheson, Jr., '48
614 13th Ave., Salt Lake City

WASHINGTON

Pacific Northwest Section
Pres.: Wm. Douglass, '11
Sec.: C. Ted Robinson, '53
16204 S.E. 8th, Belleview

WYOMING

Central Wyoming Section
Pres.: John Newhouser, '50
Sec.: Adolph Frisch, '53
2805 O'Dell Ave., Casper

LOCAL SECTIONS OUTSIDE U. S. A.

CANADA

Calgary Section
Pres.: R. F. Zimmerly, '47
V. Pres.: J. S. Irwin, Jr., '54
Sec.-Treas.: G. L. Gray, '50
1304 4th St. S.W., Calgary
Luncheon meetings held 3rd Monday of each month in Calgary Petroleum Club; visiting alumni welcome.

PERU

Lima Section
Pres.: Richard Spencer, '34
V. Pres.: Hernando LaBarthe, '42
Sec.-Treas.: Norman Zehr, '52
Casilla 2261, Lima
Meetings first Friday of each month, 12:30 p.m., Hotel Crillon (April through December), or on call.

PHILIPPINES

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

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

TURKEY

Ankara Section
Alumni visiting Turkey contact either:
F. Ward O'Malley, '42, Explr. Mgr., Tidewater Oil Co., Kumrular Sokakb, Yenisehir Ankara; Tel. No. 21328.
Ferhan Sanlav, '49, Turkiye Petrolleri A. O. Sakarya Caddesi 24, Ankara; Tel. No. 23144.

VENEZUELA

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

Grand Junction Section
Grand Junction Section's dinner-dance was held Mar. 12, with Chuck and Shirley Woodard acting as host and hostess at a cocktail party in their home. They have just returned from a trip to the Islands, so Hawaiian Punch was served with Fulton and Kohler controlling the ingredients according to the pleasure of the guests. Dinner was roast beef at the Caravan Cafe.

The business meeting scheduled for April 23 conflicts with the new Colorado Mining Convention date on April 21-23 so a new date will be chosen according to availability of institutional speakers. Mark Shipman and John Emerson are making all arrangements for this meeting.

Shipman's Bar-B-Q on May 21 is still firm and will be announced later.

Jay Mayhew and Gordon Miner made arrangements for flowers for the funeral of G. Henry Shefelbine, '35. (See In Memoriam in this issue.)

Joe Hopkins, Jr., secretary

Bartlesville Section
Fritz Brennecke, CSM athletic director, reports that he attended a luncheon meeting on March 9 of the Bartlesville Section. He says that about 25 alumni were present and that he spoke on the following subjects associated with Mines: enrollment—about 1000 with some increase expected in 1960; placement—seems to be good, seniors are having no particular problem finding suitable jobs although the range of selection isn't as great as formerly; salaries—estimated they ranged between $500 and $600 per month to start; building program and the new gymnasium; development program—its benefits and the need for wide alumni participation in it; athletic picture at Mines and its outlook for the coming year.

Following the talk, a brief question and answer period was held and then movies of the Mines vs. Western State football game were shown.

Permian Basin Section
West Texas Permian Basin Section held it annual dinner-dance on Feb. 26th at the exclusive Midland Country Club. The dinner-dance was preceded by three informal cocktail parties held in their homes by Newt Page, '42; Charlie Cerf, '41, and Larry Melzer, '39. The night of the party followed a cold spell which kept several out-of-towners from coming, but the Midland alumni came out in force.

The dinner-dance was attended by the following Miners and their wives:

Bill Schneider, '36; Larry Melzer, '39; Charlie Cerf and Clint Edwards, '41; Newt Page, '42; John Ross, '43; Bill Owens, '45; Ervin Philpy, '49; Marvin Hewitt and Dick Siegfried, '50; Bob Arrendiell, Hal Ballew, Dick Bench, and John Dakin, '51; Tom McLaren, '52; Wally Arnold and Bill Traeder, '53; Don Van Orden, '56, and Bill Waldschmidt, x-faculty.

It was announced that at the April 1 luncheon meeting, the Mines-Adams State football game movie will be shown with a commentary prepared by Fritz Brennecke.

Luncheon meetings are held every first Friday at noon at the Midland Club, West Highway 80, Midland, Texas. All Miners visiting the Midland-Odessa area are cordially welcomed.

Tom McLaren, Sec.-Treas.

Tulsa Section
Tulsa Section held a dinner meeting on Feb. 24. Members discussed the reaction of Tulsa students presently at Mines and senior students of Tulsa high schools who are interested in attending Mines next year.

It was announced that Fritz Brennecke, CSM athletic director, would be a guest at our next meeting.

Richard F. Hagemann, '48, from Paris, France, was a guest at the meeting.

Members present were:

Parke Huntington, '26; Vernon Peterson, '30; R. C. Earlougher, '36; Jack Haley, '48; Brook Tarbel and Jack Weyler, '50; Jim Newell and Chester Westfall, '52.

Jim Newell, Sec.-Treas.

Fritz Brennecke reported briefly on Mines affairs to the Tulsa Section at its dinner meeting held March 9 at the Tulsa Petroleum Club. His color movie of the Mines football victory over Western State College and his running commentary on it were much enjoyed.

Other guests were Gene Tucker, senior class advisor; Chuck Boyle, head coach, and Senior Students Ken Smith, Jim Dunn and Curtis Parks, all of Will Rogers High School in Tulsa; R. J. Lewis, senior class advisor, H. J. Green, coach, and Senior Students Tom Deupree and Ted Larkin of Edison High School in Tulsa. They were introduced by Jack Weyler, who with Chester Westfall and Jerry Diver, invited them to the meeting.

Mines men attending the meeting were:

W. M. Gebo, '23; M. P. Huntington, '26; T. A. Manhart and Frank Purdum, '30; John Rupnik, '33; L. E. Elkins, '34; C. R. Holmgren, '38; John Ross, x-'41; N. S. Morrisey, '42; W. W. Owens, '47; J. D. Haley, '48; Lee Purdum, x-'49; Jack Weyler, '50; C. J. Diver, John Volosin, and C. H. Westfall, Jr., '52.

Reported by Parke Huntington

Denver Section
The Denver Section will hold an election of officers at their regular noon luncheon at the Denver Press Club, Tuesday, April 19. Please be present and vote. All members living in the Denver area will be given notice of this election by a letter from Ed Haymaker, '41, current President of the Denver Section.

The Denver Section will sponsor the annual dinner for those alumni attending the National Western Mining Conference and for their regular members. The dinner will be held at 6:30 p.m. Thursday, April 21, at the Denver Press Club, 1330 Glenarm Pl.

IN MEMORIAM

Lowell C. Atchison

Lowell C. Atchison, a 1925 graduate of the Colorado School of Mines, was killed Feb. 6 in an automobile accident near White Horse in eastern Colorado. Injured in the crash were his wife, Jerry, and daughter, Carla.

Born April 19, 1901, in Denver, Mr. Atchison attended South High School and the University of Denver. He received a degree in chemical engineering from Mines in 1925. One year later he married Jerry L. Stephens in Mildred, Kan.

Mr. Atchinson was employed as inspector in 1928 by the Missouri Highway Commission. He served a year as chief chemist for Crystal Oil Refinery; as chief chemist from 1929-1933 for West Texas Refinery, and as general manager from 1933 to 1935 of Petroleum Processing Corp.

Joining the Rio Grande Railroad in 1937 as chief chemist, Mr. Atchison was promoted in 1952 to assistant engineer of standards and research. In 1956 he became assistant director of research. He also was associated with Atchison Chemical Co. of Denver.

The author of numerous papers on diesel lubricating oil problems, refinery operations, diesel fuel and other related topics, Mr. Atchison is credited with introducing spectrographic analysis of fuels and lubricants for railroad use. He was a member of the Society of Automotive Engineers, American Chemical Society, and American Association for Advancement of Science.

Survivors besides his wife and daughter include his mother, Mrs. Ada Atchison of Denver; a sister, Mrs. Madelyn Armbruster of Portland, Ore., and two uncles, Roy and Theodore M. Chrysler of Denver.

Henry W. Lohman

Henry W. Lohman (all of his friends called him "Harry") died Jan. 15 in Santa Barbara, Calif., where he had resided since his retirement from active business.

Harry was born in New York City, Sept. 11, 1882, and received his early education there. He was encouraged by a friend to study mining, so in the fall of 1900 he enrolled as a freshman at the Colorado School of Mines. After completing his sophomore year at Mines, he decided to transfer to the Missouri School of Mines where he graduated with the class of 1904.

The next year he took his Master's Degree in mining at Columbia University. During the next few years he gained much valuable experience in various jobs in east Tennessee and Mexico.

He was married June 17, 1911 to the daughter of a prominent New York family, Lillora Hungerford, who survives him.

After his marriage Harry followed his profession continuously, exploring and operating in many parts of North and South America. At one time he was manager of the Colorado Gold Dredging Co. at Breckenridge, Colo.

The last 23 years of his active life were spent with the United Zinc Smelting Corp. of New York, operating mines in the Joplin Mining District with smelter in Moundsville, W. Va.

He retired Jan. 1, 1944 as president of this corporation which was controlled by Charles M. Schwab of Bethlehem Steel fame.

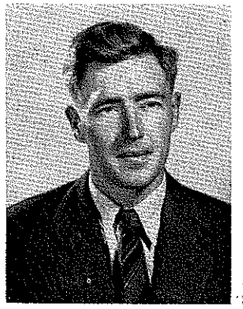
Reuben Wells Smith

Reuben Wells Smith, who attended the Colorado School of Mines from 1901 through 1903, died in El Paso, Texas, on Jan. 7 after a long illness.

Born April 27, 1882 in Golden, Colorado., Mr. Smith graduated from Golden High School and attended Mines and Colorado College. For a number of years he was an auditor for the Federal Reserve Bank of Denver. After his retirement three years ago, he made his home in El Paso.

Survivors include his wife, Ethel, of El Paso; two daughters, Mrs. H. E. McKinnies of Lakewood, Colo., and Mrs. Bernard Goldberg of Great Neck, N. Y.; a brother, Alvah E. Moody of Denver; six grandchildren, and 12 great-grandchildren.

G. H. Shefelbine



Garland Henry Shefelbine, a 1935 graduate of the Colorado School of Mines, was killed instantly Feb. 24 in a cave-in in the Ike Shaft of the Hidden Splendor Mining Co., located about 25 miles southeast of Moab, Utah. Mr. Shefelbine, general superintendent for Utah operations of the uranium mining firm, was making a routine inspection of the mine with the shift boss and mine foreman when the accident occurred. The other two men were not seriously injured.

Born Oct. 21, 1912 in Dorchester, Iowa, Mr. Shefelbine graduated from Dorchester High School and received his degree in mining engineering at Mines in 1935. After leaving Mines he worked a year for E. J. Pipes of Rapid City, S. Dak., as a contractor and builder.

From 1936 to 1937 he was engineer and sampler for the King of the West Mining Co., Lead, S. Dak., and for the next three years he was employed by Cia Aramago de Mines en Bolivie as engineer, shift boss and foreman in tin and tungsten mines. From March 1941 to December 1945 he was superintendent of New Mexico Consolidated Mining Co.'s Copper Flat Mine at Hanover, N. M., a 250-ton per day zinc operation. The next year and a half he was superintendent of the Plateros Mine operated by Fresnillo Co., Fresnillo, Sac., Mexico. From 1947 to March 1956 he was manager of a 450-ton per day metal mine and mill at Maniquipa, Chih. Mexico. He also acted as resident geologist, outlining exploration programs both underground and on the surface.

A resident of Moab for the past two and a half years, Mr. Shefelbine had been active in AIME.

Survivors include his wife, and two sons—one a freshman at Claremont College, Claremont, Calif., the other in preparatory school in Ojai, Calif.

William E. Ryan

William E. "Pat" Ryan, a 1905 graduate of the Colorado School of Mines and a life member of the Alumni Association, died Feb. 20 at General Rose Memorial Hospital. He had been in ill health during the last few years of his life.

Born May 31, 1883 in Denver, Mr. Ryan was educated in the Denver Public Schools. After his graduation from Manual Training High School, he enrolled at Mines where he received his E.M. degree in 1905. He was a member of Sigma Nu social fraternity.

For about eight years he was engaged in mining near Chihuahua City, Mexico, and was once held for ransom by Pancho Villa. Returning to the United States, he was superintendent of the Vindicator Mine in Victor, Colo. from about 1914 to 1922.

Moving to Boulder, Colo. in 1925, he entered the automobile business from which he retired at the age of 50. During the last ten years of his life he lived in Denver and was a member of the Fred Adams Investment Co.

Mr. Ryan is survived by his wife, Frances L. Ryan of Denver.

CLASS NOTES

(Continued from page 6)

GEORGE W. RICHARDS, formerly of Hillsdale, Mich., is living at Lance Creek, Wyo.

A. JOSEPH ROZADA is petroleum engineer for Creole Petroleum Corp. His address is c/o Creole Pet. Corp., Apartado 234, Quiriquire, Maturin, Edo Monagas, Venezuela, S.A.

RICHARD VEGHTE, district engineer for Trigood Oil Co., has moved from Newcastle, Wyo., to 3034 E. 1st St., Casper, Wyo.

GORDON H. WALDE is mine shift boss for Climax Molybdenum. His mailing address is Box 823, Leadville, Colo.

JEFFIE J. WOOD is exploitation engineer for Shell Oil Co., with mailing address 700 Alice Dr., Lafayette, La.

1955

CHARLES J. BOYCE, petroleum engineer for Pan American Petroleum Corp., lives at 804 S. 12th St., Worland, Wyo.

JAMES E. HARBISON is a first lieutenant in the U.S. Army with mailing address 548th Engineers Co., APO 259, New York, N. Y.

BOYD M. HARNDEN'S address is 5575 C.Y. Ave., Casper, Wyo.

EUGENE E. RISCH is a miner with Green Mountain Uranium Co., with mailing address Box 387, Jeffrey City, Wyo.

CHARLES H. STEWART, district engineer for Stekoll Petroleum Corp., lives at 1109 S. Baylor, Perryton, Texas.

1956

JOHN F. ABEL, JR., has moved from Evanston, Ill., to 100 Maple St., Littleton, Colo.

JOHN R. BLOMBERG is petroleum engineer for Mobil Oil Co. with home address 3411 Sycamore, Midland, Texas.

RALPH H. DOUGHERTY, trainee with U. S. Steel Corp., has moved from Whiting, Ind., to Apt. 502, 1380 E. Hyde Park Blvd., Chicago 15, Ill.

W. S. FREDERICK is geologist for Phillips Petroleum Co., with home address 748 8th St., Durango, Colo.

MERVIN L. GREENLEE, research metallurgist for Titanium Metals Corp. of America, lives at 224½ Earle St., Las Vegas, Nev.

RICHARD GUIZZETTI has moved from Coal City, Ill to 1015 11th St., Golden, Colo.

JAMES W. HOBBS, engineer trainee with Bay Petroleum Corp., may be addressed c/o Bay Petroleum Corp., P.O. Box 667, La Porte, Texas.

CHARLES A. KOHLHAAS has a new address: Box 2406, Hobbs, N. M.

CHESTER L. LOVE'S address is 2550 S. 17th East, Salt Lake City 6, Utah.

ANTONIO V. SEGOVIA is a graduate student at Pennsylvania State University. His address is 1427 S. Pugh St., State College, Pa.

1957

MICHAEL L. BARRY may be address c/o Esso Research and Engineering Co., P.O. Box 121, Linden, N. J.

HOMER BREAULT has moved from Elizabeth, N. J., and may be addressed c/o Esso Research and Engineering Co., P.O. Box 121, Linden, N. J.

JOHN I. COATS, aviator with the U.S. Army in Korea, gives his mailing address as 9980 W. 59th Pl., Apt. 3, Arvada, Colo.

RUSSELL M. CORN has changed his mailing address from Belmont, N. C., to Rt. 1, Box 569, Golden, Colo.

CECIL I. CRAFTS, JR., picks up his mail at P.O. Box 729, Alice, Texas.

ANTHONY R. PAGANO, metallurgical engineer with Lycoming Corp., lives at 46 Baxter Lane, Milford, Conn.

2nd LT. TIM C. THOMPSON writes that he is a "fixed and rotary wing aviator" in the Armed Forces "with one year to go." His address is 416th Signal Aviation Company, Fort Huachuca, Ariz.

WALTER W. TYLER'S new address is Dragtenweg 71, Paramaribo, Surinam, S.A.

1958

PETER J. CREIGHTON, design engineer for Esso Research and Engineering Co., lives at 114 Franklin St., Bldg. 5, Apt. M-1, Morristown, N. J.

MICHAEL DILEMBO has moved from Guernsey, Wyo., to 2820 Thomes Ave., Cheyenne, Wyo.

JON F. HAMLIN is design and test engineer for Garret Oil Tools Co., with mailing address 106 W. College, Longview, Texas.

EMMERSON KEMP, metallurgical engineer for Kaiser Aluminum & Chemical Co., lives at 4623 Lynhuber Dr., New Orleans 26, La.

LT. PAUL J. MEADEN'S address is Engr. Sec., Hq. 4 U.S. Army, Fort Sam Houston, Texas.

JAMES I. PRITCHARD has been transferred by the Martin Co. from Seattle, Wash., to Denver, Colo., where his address is 1465 S. Utica St.

1959

JAMES J. BRADLEY, x-'59, lives at 9951 Chireno, Dallas 20, Texas.

GENE E. BRANT hopes to receive his discharge from the Army on April 29. A former metallurgist for Dow Chemical Co., Brant gives his mailing address as 902 5th St., Greeley, Colo.

JOHN T. CHANDLER'S address is 739 N. Washington, Liberal, Kansas.

JOHN T. DONOHUE advises us his address is 1308 Cosgriff Court, Cheyenne, Wyo.

LT. DUANE I. GRAHAM, who was stationed in Alexandria, Va., has been sent overseas. His new address is 814 Engr. Co., Hanau, Germany, APO 165, New York N. Y.

C. HOWARD HAMILTON is research metallurgist, Missile Division, North American Aviation Corp. His address is 7504 E. 2nd St., Downey, Calif.

WARREN W. HILDEBRANDT, now serving in the U.S. Army, lists his mailing address as 644 W. 10th St., Loveland, Colo.

RICHARD L. LEA, employed by Engineering Consultants, Inc., lives at 1201 S. Sherman St., Denver, Colo.

RODERICK W. MacDONALD, now in the U.S. Army Corps of Engineers, gives his mailing address as Box 1211, Greeley, Colo.

LT. KARL E. NIELSEN'S address is STUOFF DET USAECR, EOBC #9, Fort Belvoir, Va.

KENNETH RUSSELL, formerly of Wellington, Colo., is student trainee with Westinghouse Electric Co., with mailing address Ardmore Blvd. and Brinton Rd., Pittsburgh 21, Pa.

ALI M. SAIDI is a student at Stanford University. His mailing address is P.O. Box 2663, Stanford, Calif.

OZBEK SARAN'S mailing address is Box 241, Golden, Colo.

JAMES D. SHAMBACH is research assistant, Experimental Physics Dept., Dynamics Corp. He lives at 5661 Beaumont Ave., La Jolla, Calif.

C. OGDEN SMITH, who worked as computer trainee for Geophysical Service, Inc., last fall in Rock Springs, Wyo., is presently on military leave from the company and is stationed at Fort Belvoir, Va., until May. His mailing address is Thompson Hay Path, P.O. Box 1053, Setauket, N. Y.

GORDON L. STEELE is a second lieutenant in the Army with mailing address Co. E 20 Bn. 1st Tng. Regt. Engr., Fort Leonard Wood, Mo.

JOHN L. STOUT, geologist for The California Co., lives at 1515 Harmon Ave., Apt. 3, Bismarck, N. Dak.

1960

THOMAS M. CARROLL'S mailing address is 2051 S. Clayton, Denver, Colo.

WILLIAM R. MORGAN, student engineer for Northern Illinois Gas Co., gives his address as Route 1, Box 188, Warrenville, Ill.

WILLIAM S. RANSOM, project engineer for U. S. Gypsum Co., has moved from Golden, Colo., to 3238 Ann St., Lansing, Ill.

DAVID LESTON WATSON, engineering trainee for Leston Watson Pile Driving Co. until his military obligation is completed, may be addressed at 8014 Inwood Rd., Dallas 9, Texas.

CAMPUS HEADLINES

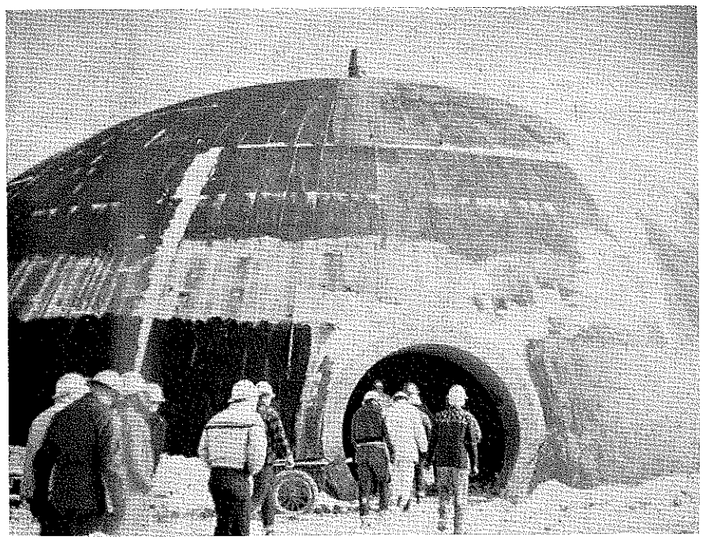
Mines Students Tour Construction Site Of Titan Missile Base at Lowry Air Field

Over 30 members of the Colorado School of Mines student chapter of the Society of American Military Engineers toured a construction site of the Titan missile base on the bombing range of the Lowry Air Field Feb. 20. The group was given a detailed tour of one of the six identical complexes making up the base and the component prefabrication and conditioning facilities at nearby Buckley Field. The students left the Mines campus on chartered bus at 0730 hours and returned at 1200 hours.

Acting as guide for the SAME tour was Lt. Col. Paavo Carlson, Denver area engineer of the Army Corps of Engineers and head of the construction supervision for the Titan base. Also making the tour with the students were Lt. Col. Bruce D. Jones, Mines PMST, Maj. John Mason, and Captains James L. Lammie and Frederick Hamlin of the Mines ROTC department.

▼ The Mines SAME members line up for their initial briefing on the Titan Missile complex at Lowry Bombing Range. In the background is one of the manway sections to be used in the cut and cover connecting tunnels.

Each complex making up the base consists of three missile launching facilities. The principle facilities of each complex are underground or hardened, and each complex includes elements which assure, insofar as possible, a self-controlled operation. The power house, control center, water supply and fuel facilities for each complex are underground and are interconnected with the launching facilities by personnel and utility tunnels.

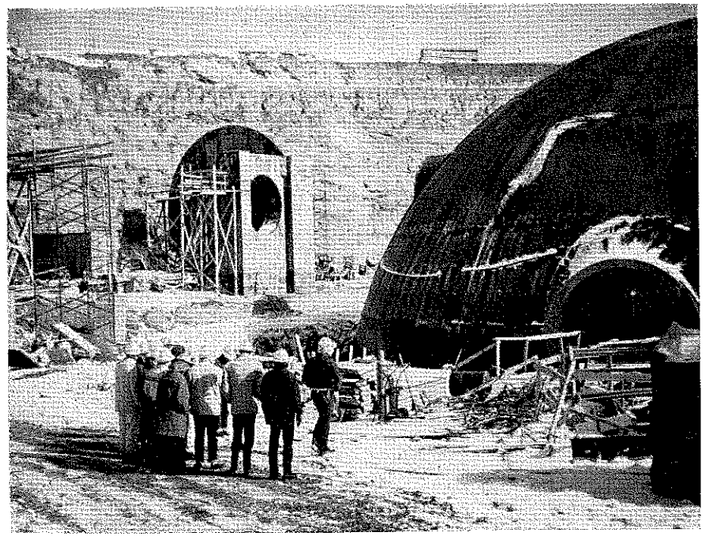


▼ Miners enter the reinforced concrete power plant dome at the Titan Missile complex. This dome, to be covered later, will house generating and control equipment for the facility.

The structures making up each complex are impressive in both size and design. The powerhouse and control center are hemispherically shaped and constructed of reinforced concrete. The diameter of the powerhouse and control center is 124 feet and 98 feet respectively. The missile launching facilities consist of reinforced concrete silos 40 feet in diameter and approximately 185 feet tall. Circular tunnels interconnecting the major facilities are constructed of corrugated steel.

A unique and critical requirement of the construction is that of shockproofing to withstand all nuclear blasts except a direct hit. The hemispherical shape of the major structures would allow them to take optimum shock without damage or failure. Also, the major mechanical and electrical elements are mounted independent of the enclosing structure as a further precaution against shock.

The facilities are being constructed in an open cut to a maximum depth of 60 feet; thus, tunneling and shafting are kept to a minimum. Simultaneously with tunnel completion, the cut is backfilled over the tunnels. Eventually, after all the facilities are completed and equipped, the entire cut will be backfilled.



▼ Mines SAME members examine the control structure at the Titan Missile complex. These structures will be underground in the completed facility.

According to the Army Corps of Engineers, the responsible agency for the missile base construction, the "precise technical requirements for the construction of the propellant loading system which represents the key to the operational capability of the complete launcher facility, provides a challenge to the contractor. Its component parts, such as pressure vessels, cryogenic vessels, valves, piping, expansion joints, and filters, must be manufactured to permit successful operation without malfunctions, even though subjected to variations in temperature varying from −297° F to +128° F. All portions of the system and its components must be absolutely cleaned of all foreign particles larger than 150-microns, as the pressure of hydrocarbons in the liquid oxygen system will result in violent explosions in launching systems and void the function of the facility."

After fabrication in a warehouse at Buckley Field, all component parts are dipped in and etched with hydrochloric acid to remove contaminats. Furthermore, to prevent corrosion during the construction stage, the components are dipped in potassium dichromate after the cleaning process. Finally, before removal to the construction site, the components are thoroughly inspected and, in some cases, the parts are Xray examined.

The major contractor, Morrison-Knudsen Co., Inc., began work on May 1, 1959, and is scheduled to complete the project by Aug. 30, 1960. However, the operational date is farther in the future, due to the time required for installation of the equipment and development of the Titan missile.

Mines SAME Selected For National Honors

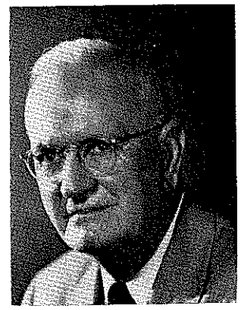
The Colorado School of Mines Post of the Society of American Military Engineers has been selected as a "Distinguished Post" for the year 1959. This is the fourth consecutive year that Mines has received this award for outstanding achievement, a record unequalled by any other of 59 SAME Student Posts in the United States. The award was given on the basis of interest, attendance, field trips, and meeting programs.

Some of the monthly programs included lectures by Prof. Lute J. Parkinson on Mining Engineering, R. J. Tipton on Engineering Ethics, Dr. R. L. DeLuise on Nuclear Radiation, and other noted speakers in a very wide field of topics.

The SAME field trips were very successful, with tours to the Rocky Mountain Arsenal, the Waterways Experiment Station in Vicksburg, Miss., and a visit to Corps of Engineering activities at Fort Carson.

Much of the credit for such a successful year goes to the SAME officers, Jerry P. Ilgenfritz, president; John J. Selters, vice-president, and Kenneth Larner, program chairman.

Prof. Clark B. Carpenter Nominated for Award



Clark B. Carpenter, professor emeritus of the Colorado School of Mines and mayor of the city of Golden, has been nominated by the Golden Chamber of Commerce to receive one of the Lane Bryane Annual Awards, presented in recognition of volunteer efforts that benefit the American home and community.

Two awards of $1,000 each are presented each year, one to an individual and one to a group, for outstanding non-remunerated efforts to improve their communities.

"We are most fortunate to have a dedicated man of Mr. Carpenter's caliber who will give unselfishly of his time," F. A. "Heinie" Foss, president of the Golden Chamber of Commerce, stated in making the nomination. "His engineering background is of great help to our municipal utilities. The esteem in which our neighboring cities hold him helps Golden's stature, and enables us to work together with these cities to solve our mutual problems."

While Mr. Carpenter has been mayor many improvements have been made, including everything from a new Ford St. bridge and a new trunk sewer line to the voting of a bond issue for a new municipal center, a new zoning ordinance and completion of new through streets.

Mr. Carpenter retired in 1953 as head of the department of metallurgy and dean of the graduate school. He received his first degree in 1915 from the University of Kansas and his master's degree in mining in 1922 from M.I.T.

(Continued on page 42)

OREDIGGER SPORTS

Two Track Meets Held In Steinhauer Fieldhouse

In the first indoor track meet held in Steinhauer Fieldhouse since 1942, DU's thinclads outpointed Coach Joe Davies' Mines track squad (Feb. 27) 59 5/6 to 53 1/6. Dan Mathewson of Mines bettered the old high jump record by 5/8 inch with his 6 ft. 3½ in. jump.

On March 19 the Mines tracksters earned a second place in the triangular indoor track meet held in the Mines fieldhouse. CSU took first place with 55½ points, Mines was second with 47½ points, and DU was third with 33 points. Rog Osborne won the 44-yard run for Mines with a time of 53.6 seconds, establishing a new fieldhouse record for this event. The previous time of 56.2 seconds was established in 1939.

Following are the results of the individual events:

Pole vault—1. Ryan (M); 2. Stroh (CSU), 3. Collins (CSU), 12′ 8″; High Jump—1. Matthewson (M) and Ellis (CSU) (tie), 3. Dickson (DU), 6′ 3″; Shotput—1. Brady (DU), 2. Villagrana (M), 3. Laipenieks (DU), 46′ 8″; Broad Pump—1. Keys (CSU), 2. Laipenieks (DU), 3. Ryan (M), 21′ 7½″; Mile Run—1. Schmidt (CSU), 2. Reckham (CSU), 3. Versaw (M), 4:45.6; 440-yard Run—1. Osborne (M), 2. Lawry (M), 3. Jagoda (CSU), :53.6 (new Fieldhouse record); 50-yard Dash—1. McCoy (CSU), 2. Harpole (DU), 3. Jenkins (M), 5:3; 50-yard High Hurdles—1. Austin (DU), 2. Kesey (CSU), 3. Ryan (M), 6.6; 880-yard Run—1. Williams (CSU), 2. Carlson (M), 3. Biddle (M), 2:11.8; 220-yard Dash—1. McCoy (CSU), 2. Scholes (DU), 3. Diehl (CSU), 22.3; 2-mile Run—1. Schmidt (CSU), 2. Wilson (M), 3. Versaw (M), 10:15.1; 50-yard Low Hurdles—1. Austin (DU), 2. Carnish (CSU), 3. Laipenieks (DU), 6.1; and 1-mile Relay—1. Mines (Lawry, Dunn, King, Osborne), 2. CSU, 3:49.5. Point totals—CSU, 55½; Mines 47½; DU, 33.

CSM Wrestlers Second In RMC Tournament

Oredigger grapplers copped the runnersup position in this season's RMC Wrestling Tournament. RMC champion for the 24th straight season was Colorado State College. Mines has occupied the third place spot in the tournament for the past three years.

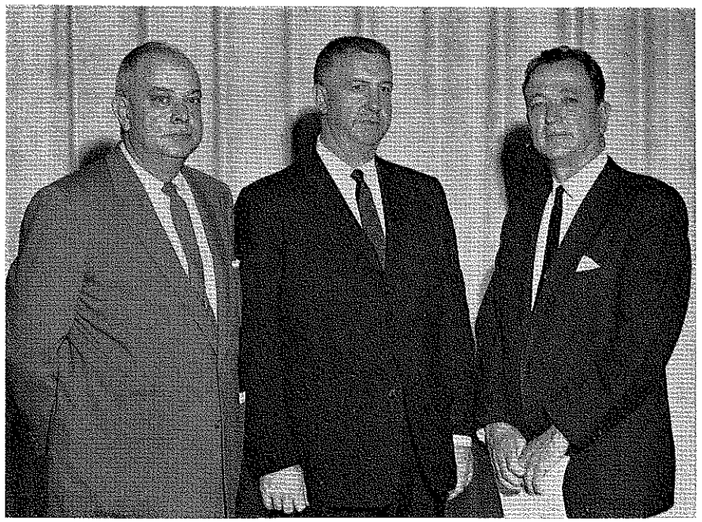
With one first place, four second places and three third places in the conference tournament, Mines tallied 58 team points to trail the CSC Bears with 77. Western State College finished third with 56, and Adams State College placed fourth with 18 points.

Glen Hasse of Mines, who in 1958 won the 130-pound bracket in the RMC Championship, was an RMC champion again in 1960—this time at 137.

Mines wrestling victories this year included wins over Colorado State University (24-6), Colorado University (24-5), and the Air Force Academy (26-5). The victory over the AFA Falcons gave the Orediggers possession of a traveling trophy which was initiated by the CSM Alumni Association and the Academy.

The NCAA Tournament Mar. 24-26 closed out this year's national wrestling season. (Results were not available when the Magazine went to press.)

On the Mines wrestling team this year were Glen Hasse, Don Meyers, Lyle Paulsen, Ron Helland, Tom Tisone, Ron Lease, Howard Christiansen, Marv Kay, Tom Perkins, and Ken Hecht.



▾ Shown above, left to right, are Dr. James D. Forrester, Dr. Truman H. Kuhn, and Dr. Richard A. Harvill. Dr. Kuhn received the University of Arizona's 75th Anniversary Medallion of Merit.

Dr. Truman H. Kuhn Awarded UA's Medallion of Merit

Dr. Truman H. Kuhn, dean of the faculty at the Colorado School of Mines, was awarded the University of Arizona's 75th Anniversary Medallion of Merit at a recent dinner of the UA College of Mines honoring some of its outstanding graduates. Dr. James D. Forrester, dean of the UA College of Mines, presented Dr. Kuhn to Dr. Richard A. Harvill, UA President, who made the presentation.

The ceremony took place on the eve of a formal Founders' Day convocation commemorating the founding of the university in 1885. Dr. Kuhn received the Doctor of Philosophy degree at the University of Arizona in 1940.

In addition to Dean Kuhn, other UA alumni receiving Medallions of Merit were: David C. Minton, Jr., '31, vice-president of Battelle Memorial Institute in Columbus, Ohio; Victor H. Verity, '27, Tucson mine manager and attorney; Albert C. Rubel, '17, president of Union Oil Co. of Calif.; Henry Eyring, '23, dean of Graduate College, University of Utah; Julian W. Feiss, '28, staff geologist, Kennecott Copper Corp.; John H. Gray, '41, assistant general manager, Miami Copper Co.; John A. Lentz, Jr., '33, manager, Morenci Branch, Phelps Dodge Corp.; Paul T. Allsman, '42, chief mining engineer, U. S. Bureau of Mines; Edwin B. Eckel, '30, chief of the Engineering Geology Branch, U.S.G.S.; Martin J. Hughes, '39, mine manager, Eagle Mountain Mine, Kaiser Steel Co.; Donald R. Jameson, '39, superintendent, Silverbell Mine, A.S.& R. Co.; Alvin J. Thompson, '27, director, New Mexico Bureau of Mines and Mineral Resources, Socorro, N. M.

(Continued on page 43)

CAMPUS HEADLINES

(Continued from page 42)

Beauty and Beast Contest Raises $333 for Student Aid

The Colorado School of Mines Student Aid Fund received $333.26 and Bob Hunt, a Pi Kappa Alpha sophomore, won a date to the Mines Junior Senior Prom.

Both the proceeds and the date resulted from the second annual "Beauty and the Beast" contest, sponsored by the Mines chapter of Alpha Phi Omega, national service fraternity.

Hunt won out over nine other candidates in the nickle-a-vote popularity contest to pick a date for Mary Woodbridge, a University of Colorado junior from Glendale, Calif. A member of Delta Gamma sorority, she served as CU's 1959 Homecoming Queen.

Miss Woodbridge and Hunt attended the Prom, March 12, at Denver's Petroleum Club and received a chauffeured Pontiac, placques, orchids and free dinners.

The Mines Student Aid Fund is a scholarship fund supported by the student body for deserving and needy students at Mines. At the present time, Dezee Hajdu, from Balatonmagyarod, Hungary, is the chief recipient of the student aid funds. He is a petroleum engineering junior. A former Hungarian freedom fighter in the Oct. 24 revolution, Hajdu came to Mines in 1957.

(Editor's Note: Alpha Phi Omega decided they did not want to expose this delicate young lady to the stares of the alumni who were not here to pay 5 cents for the privilege of voting.)

NEWS—INDUSTRIES

(Continued from page 34)

Three new industry-financed productions became available for distribution during the year: "Asbestos—A Matter of Time," sponsored by Johns-Manville Corp.; "Rubber From Oil," made in cooperation with the Enjay Co., Inc.; and "The Story of the Modern Storage Battery," a remake of an earlier film sponsored by the Willard Storage Battery Division of the Electric Storage Battery Co.

The Bureau's motion-picture library now contains 5,600 prints of 54 different film subjects, all in 16-millimeter sound and most in color, which are mailed on request from a main distribution center in Pittsburgh, Pa., or from cooperating film depositories in 40 states.

LETTERS TO THE EDITOR

SAMUEL L. McCLAREN, '54, wrote recently:

"Since I graduated from Mines in 1954, I seem to have become completely 'lost.' I have now returned to Colorado and would like to renew my connection with the Alumni Association and do my part to promote the activities of the school.

"As is the case with most graduates, my situation is considerably altered since I graduated from Mines and accepted employment with Shell Oil Co. I remained with Shell until November 1954, after which date I served two years with the Corps of Engineers, being stationed primarily at Ft. Belvoir, Va. and Ft. Leonard Wood, Mo. Upon my discharge from the Army in 1956, I followed the example of many of my other classmates and returned to school. I attended the University of Oklahoma's Law School. Even while in Law School I found my engineering background to be advantageous since I was able to defray my living expenses by instructing in statics, kinetics and kinematics as a teaching assistant in Oklahoma University Engineering School.

"Upon my graduation and receipt of my Bachelor of Laws degree in February 1959, I was admitted to the practice of law in Oklahoma. Shortly thereafter, my family (which now includes a wife, son, and daughter) and I returned to Denver. I was admitted to the Colorado Bar in September 1959, and I am now associated with the law firm of Holme, Roberts, More & Owen where most of my time is devoted to matters concerning the oil and gas industry which is an area which fits in nicely with my P.E. background.

"I should appreciate it if you would send me such information and/or forms which I might need to apply for alumni membership and receive information of the various local group activities. (Signed) S. L. McClaren"

Sam writes that his home address is 1644 Leyden St., Denver, Colo., while his office is at 1700 Broadway.

(Welcome home, Sam. Colorado is hard to beat.)

* * *

BENJAMIN ARKIN, '27, wrote us that he had sold the Arkin Petroleum Co. and retired. He has found that it is difficult to break away as he is being called upon to assist others in petroleum marketing and financing problems, as well as acting as a broker for petroleum products with chain stores and other large consumers.

"So far, I've been putting in more hours since retirement than ever before, but beginning April 3rd, I am taking a trip through the Republic of Mexico, and returning via the West Coast. The trip should take a minimum of six weeks."

(Good trip, Ben, may you see many of your old friends while in Mexico and California.)

* * *

WALTER W. TYLER, '57, wrote from Paramaribo, Surinam, that he has been living at the Palace Hotel with his wife and little daughter, but he expects to move into the jungle soon. The overland trip will be rough for the 200 miles will require six days and will involve travel by river steamer, unimproved jungle road, and finally trail with about 56 waterfalls and rapids to negotiate. Rather than travel this route, Walt will await radio word from the overland party and then fly to the airstrip near Marispasula. Base camp will be set up at Benzdorp, about a day's travel from the airstrip.

Walt included a map of the area, but noted that "on the map you will notice several airstrips. They are still in the planning stages. The government hopes to open up the deep jungle by their use, but I'm afraid this will take time."

The Tylers went to Surinam with Prof. and Mrs. HARRY J. WOLF, '03. Mrs. Wolf will continue to live at the Palace Hotel, but the Tylers have rented a house at Dragtenweg No. 71, Paramaribo, Surinam, S. A. while the men are at their base camp.

(We certainly wish you both success in this venture.)

* * *

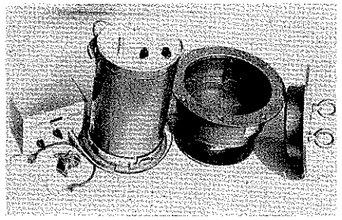
BLAIR L. SACKETT, '09, has just written that "my wife and I observed our 50th wedding anniversary on March 7th at a reception given by our daughter, Virginia Alsop, and sons, Earl and Paul Sackett, at our daughter's home in Salt Lake City."

Earl Sackett, '33, attended the anniversary, coming from Potosi, Mo., and Paul from Hilo, Hawaii. Mr. and Mrs. Blair Sackett still reside at 1762 Harrison Ave. in Salt Lake City.

(We congratulate you and wish you many more happy years.)

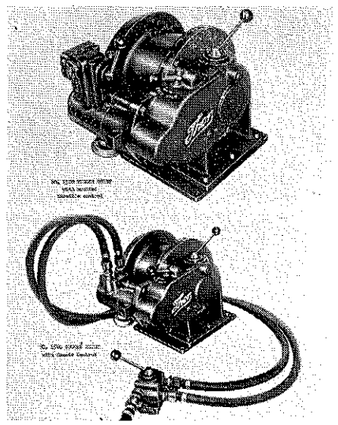
WITH THE MANUFACTURERS

Beryllium Detector



The "Berylometer" represents a major breakthrough in the field exploration of Beryllium, a metal used extensively in nuclear reactor construction. high speed aircraft, missile and space ship development. The portable detector weighs less than 25 pounds and can be carried easily into the field by a two-man team. Antimony 124, which provides the gamma radiation source and has a 60 day half-life, is sealed in a metal capsule (right). When in use, the shield is attached to the lower part of the five-inch photomultiplier tube (center). For measuring beryllium samples, there is either an impulse counter for quantitative assaying or earphones (both left). The Berylometer is manufactured and marketed in the U. S. by Nuclear Corp. of America's Western Division, Burbank, Calif.

Thor Tugger Hoist



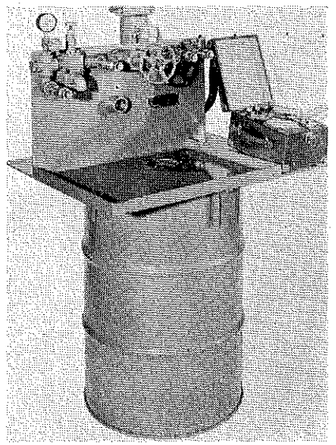
A new 1,500-lb. capacity air-operated tugger hoist with extremely-responsive dual control system has been developed for mining and construction applications by the Thor Power Tool Co., Aurora, Ill.

Neil C. Hurley, Jr., Thor president, said the new Thor No. 1500 tugger hoist is designed to lift, lower, and hold loads by air power or permit free-wheeling lowering of unloaded rope. It is built for operation at floor level and has wire-rope capacity of 280 feet.

The throttle control of the new No. 1500 tugger hoist is furnished standard mounted on the hoist, but can be removed and operated from a remote position by means of connecting hoses.

The new utility hoist incorporates such safety features as "dead-man" power throttle, dynamic brake for controlling free-wheeling, and mechanical load-holding lock. The new hoist has been extensively field tested by Thor both in mining and construction operations.

Hydraulic Test Bench



A low cost hydraulic system test bench which can be used to check repaired parts in the shop and trouble-shoot operating conditions in the field is slashing costly downtime of construction, road building, mining and heavy industrial equipment. Designed by Schroeder Brothers, McKees Rocks, Pa., manufacturers of hydraulic, electrical and pneumatic equipment, this double-duty "Barrel Bench" is supplied either as a built-up unit or in component parts for customer assembly.

The bench consists of a work table equipped with strainers, suction filter, micronic filters and drains, with which a standard 55-gallon drum can be used as a reservoir. Instrumentation is provided by a portable circuit tester measuring flow, pressure and temperature. Equipped with quick disconnects this tester may be removed from the bench and connected into the hydraulic system of the faulty equipment to pin-point defective pumps, valves or cylinders before any parts are removed. A pump drive unit, driven by either electric motor or internal combustion engine, completes the bench test assembly.

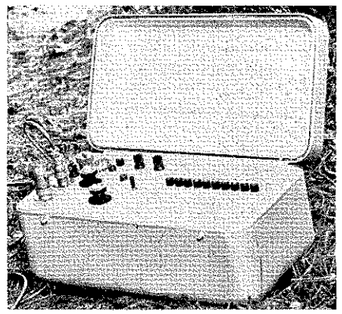
Electric Blasting Caps

Greater safety and economy in coal mining are the advantages of multiple firing of explosive charges with Coal King delay electric blasting caps now available from American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.

In multiple blasting, the Coal King cap detonates complete rounds of permissible explosives without requiring the shotfirer to return to the face between blasts.

Manufactured with iron leg wires insulated with white plastic, Cyanamid's new cap is available in a choice of 15 different timing periods that range in 25-millisecond increments from 25 to 375 milliseconds. Stiff paper tabs bearing numerical designation are threaded to one leg wire to permit easy identification of the delay period.

Engineering Seismograph



Reliable cost estimates without costly drilling are made available to mining engineers and producers of stone products obtaining subsurface information with a miniature engineering seismograph. Manufactured by Geophysical Specialties Co., 15409 Robinwood Dr., Hopkins, Minn., the patented 16-pound electronic instrument provides complete information for precisely determining depth to bedrock, the presence or absence of bedrock or other solid materials, and accurate identification of subsurface materials.

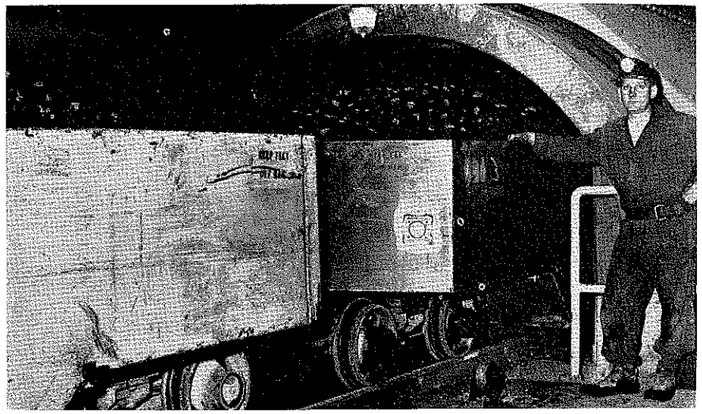
Operation of the instrument requires only two men and can be handled on foot in any type of terrain. In using the machine, seismic impulses are produced by a sledge hammer. An electronic counter circuit measures the time required for sound waves to travel from the blow of the sledge hammer through the earth to the instrument. Depth and type of material are determined with the instrument readings. Normal depth determinations can be run in 10 to 20 minutes. Under ordinary conditions, profiles can be completed at the rate of three-quarters of a mile per day at a station interval of 200 feet.

Hydraulic Pump Motor

A new line of hydraulic pump motors in NEMA frames 182 through 215 has been introduced by General Electric's Small Integral Motor Dept., Ft. Wayne, Ind.

The new motors, can be supplied with a flexible coupling that assures proper shaft alignment and virtually eliminates any unusual bearing loads that might result from misalignment of the motor and the pump shafts. The coupling has no rubbing surfaces to wear and requires no grease. It can be assembled easily and quickly.

PLANT NEWS



▼ During 18 months' service in a West Virginia coal mine these aluminum mine cars showed no sign of corrosion. Made by Watt Car and Wheel Co., Barnesville, Ohio, the cars were designed by Reynolds Metals Co.'s product development department.

Use of Aluminum Cars Cuts Operating Costs

A year-and-a-half test of 10 aluminum mine cars in a West Virginia coal mine indicates that the aluminum cars can cut mine operating costs and withstand rugged service, Reynolds Metals Co. reports.

The 17-ton cars, put into service in the fall of 1958, weigh nearly 50 per cent less than comparable steel cars. This saving in weight means that mine trains can pull up to 10 per cent more loaded cars per train, without increasing gross train weight.

Manufactured by Watt Car and Wheel Co., Barnesville, Ohio, the cars were designed by Reynolds Metals Co.'s product development department.

After a year and a half's service the cars today show no signs of corrosion, although they have been used to haul coal, slate, clay, wet sand and cement.

Not only have the 10 cars taken the bumps and jolts of day-to-day mine operation with no serious damage, but two cars involved in an accident with a mine engine required no maintenance afterwards.

The aluminum mine cars' ability to resist corrosion from the sulphur content of coal and to withstand rugged service indicates that the life expectancy of aluminum cars should be much longer than steel ones, and that maintenance should be almost negligible.

Another important advantage of the cars in underground operations is that aluminum is non-sparking, and thus the cause of mine explosions brought about in this manner is eliminated.

Each of the aluminum cars is 26 feet long, 7 feet wide and 4 feet deep. The weight of the cars is 7,580 pounds, compared with 11,680 pounds for steel cars of the same size.

The cars are made of alloy 6061-T6, mostly of one-half-inch plate. The 90 parts for each car were assembled and tack welded.

Sixty aluminized steel carriage bolts were used to fasten the steel trucks and draft gear to the body of each car.

Jasper Engineering Represents Denver Equipment in Hibbing

Denver Equipment Co. of Denver, Colo., has announced the appointment of the Jasper Engineering & Equipment Co. of Hibbing, Minn. as sales representative on the Minnesota iron range.

Dwight Jamar, president of Jasper Engineering & Equipment Co., stated his firm will be able to give on-the-spot sales and service for Denver SRL Pumps and Denver Samplers as well as sales and technical assistance on Denver Thickeners, Filters, and other items.

Denver Equipment Company is one of the world's largest suppliers of complete mineral processing equipment and has manufacturing subsidiaries in Toronto, London, Johannesburg, Lima, and Mexico City.

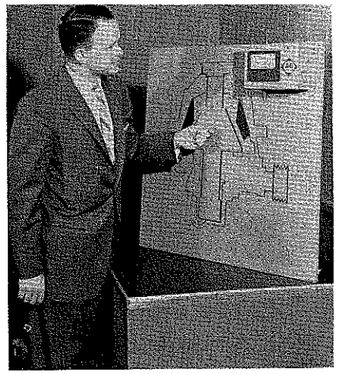
New WKE Office Building Opened in Hibbing, Minn.

Officials of Western-Knapp Engineering Co., design, engineering and construction specialists, headed by Bengt A. Samuelson, Hibbing manager, and Robert F. Engel, assistant general manager from San Francisco, were hosts at an open house and reception March 5, marking the official opening of the firm's new office building at 2727 13th Ave. East, Hibbing, Minn.

Western-Knapp Engineering Co. has grown from a nucleus of a few engineers offering limited service to expanding needs of industry 30 years ago to a present position as one of the country's leading organizations of its kind with world-wide services in project design, engineering and construction and major offices in San Francisco, Chicago and New York as well as Hibbing. Company sales last year amounted to nearly $50 million.

A 12-year record of experience in Hibbing and the Northern states area includes such projects as the development of iron ore concentrators for the country's leading iron producers; general contracting development of water treatment plants, armories, schools, churches, radar stations, power plants, harbor navigation facilities, grain handling and storage facilities.

A-C Electro-Magnetically Operated System for Crushers



Allis-Chalmers has introduced an electro-magnetically operated system for externally indicating the close side setting of their gyratory crushers equipped with Hydroset adjustment of the mainshaft and crusher mantle.

The indicating system is used in conjunction with the hydraulic adjustment of the mainshaft even while the crusher is in full operation.

Magnets are fastened to the movable cylinder of the hydraulic adjustment and move up or down with this cylinder. As the magnets move, an electric probe permanently fastened within the crusher's bottom shell assembly receives a signal and immediately and accurately registers the movement on a visual instrument mounted at any convenient location. The unit is calibrated to make adjustments for wear.

The setting indicator is being made available as optional equipment on all new Allis-Chalmers gyratory crushers in the Superior and Hydrocone lines.

Electronics Firm Joins Geophysicists

Varian Associates, an electronics firm located in Palo Alto, Calif., has been elected to membership in the Society of Exploration Geophysicists, it was announced by T. O. Hall, SEG president. "As a sustaining member Varian joins with other companies and individuals in promoting the science of geophysics, especially as it applies to oil and mineral exploration," Hall said.

Varian is the second sustaining member elected since this new grade was established.

The first was Empire Geophysical, Inc., a geophysical contracting firm in Fort Worth, Texas. "It is encouraging to our profession," Hall remarked, "that these leading companies demonstrate their confidence in geophysics by becoming allied with our society."

Varian Associates was founded in 1948 by Sigurd Varian and the late Russell Varian, inventors of the Klystron tube, and a group of associates. At that time Varian Associates had a staff of six, housed in a 30 foot by 40 foot rented building.

Today Varian employs over 2,000 people at its Palo Alto headquarters where its modern plant in the Stanford Industrial Park will total 550,000 square feet by the end of the year.

Varian is a large producer of its original product, the Klystron tube. But within its short history the company has also diversified its product line to include a broad base of products developed and manufactured by its instrument division, radiation division, and vacuum products division.

Crosslin Named Controller For Silver Steel Company

Estil C. Crosslin, Jr. has recently been appointed controller for silver Steel Co., 6600 Highway 85, Denver. Mr. Crosslin is presently coordinating the accounting departments of the three Silver Steel divisions, in Denver, Albuquerque and Salt Lake City. He has been with the Gulf Oil Co. since 1953. Mr. Crosslin holds a master of science degree from Tulsa University in management and accounting.

ADVERTISERS' LISTINGS

WHERE ARE THESE MINERS?

Here is a list of "Mines Men" whose current addresses are unknown to the Alumni Office. You can help us make our records complete by checking over the list, and mailing to Golden, Colo., the addresses of any of these that you have. DO IT NOW. Thank you.

Jewel, Gilbert E., '93
Parker, James H., '95
Atkinson, Walter J., '96
Strout, Fred McL., '96
Nye, Robert, '97
Warnecke, Carl M., '97
Johnston, Fred, '98
Roderiquez, J. C., '98
Stephens, Charles N., '98
Breed, Charles F., '01
Lovering, Ira G., '01
Foster, George C., '03
Fry, Louis D., '03
Franck, Robert P., '04
Terrill, Arthur C., '05
Gordon, John G., Jr., '06
Barker, Pierce E., '07
Corson, Norman G., '07
Golden, John P., '07
Clapp, Leroy P., '09
Farnham, Lynn C., '09
Jones, Ernest F., '10
Laughlin, Samuel L., '10
Andrews, Earl D., '12
Huntington, Walter C., '12
Richardson, Allan S., '12
Billyard, John R., '13
Hudson, Waller C., '13
Light, Victor A., '13
Nieman, Earl F., '13
Barney, H. A., '14
Beck, William L., '14
Hayden, Wallace H., '14
Smith, Albert W., '14
Taylor, Lemuel K., '14
McKnight, Hugh S., '15
Wilson, Harry R., '16
Leach, Paul R., '22
Litheredge, Roland T., '22
Starr, Frank J., '22
Benjamin, Milton J., '23
Sistermans, Frank, Jr., '23
Stortz, Frank J., '23
Bayless, Benjamin D., '24
McCune, Paul, '24
Reed, Charles E., '24
O'Toole, Arthur L., '26
Rolston, Clifford O., '26
Wood, Flavius C., '26
Bell, E. Sherwin, X-27
Samson, David T., '27
Taylor, Henry B., '27
Curry, William J., '28
Soltz, Gus D., '28
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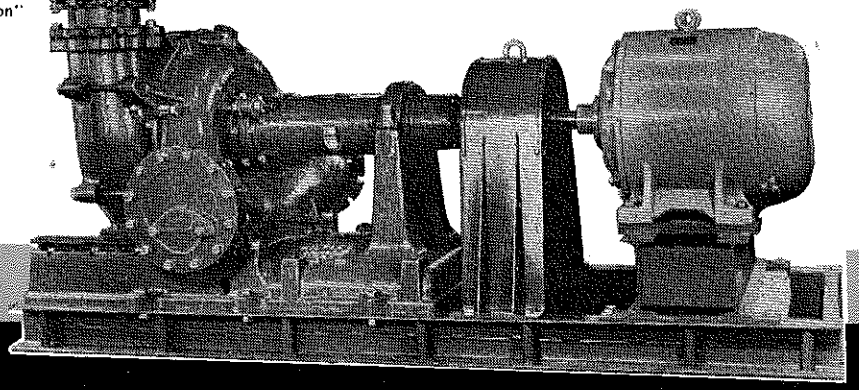

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