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
**Continued on page 6**

MURRAY E. GARRISON, 46, who retired March 1 from Geophysical Resources Corp., is addressed at 1717 E. 2nd St, Long Beach, Calif.

CHARLES R. GATTERER, 46, gives his new address as 683 Florida St, San Diego, Calif.

MISS NINETTA DAVIS, 20, is living at 415 E. 146 Ave, No. 265, Denver, Colo.

G. F. KAUFMANN, 51, who retired in 1959 from Standard Vacuum Oil Co., gives his address as Douglass Dr. N.D., P. O. Box 112, Yukon Heights, N. Y.

WALTER P. THOMSON, 21, lives at 1342 Jones St., San Francisco 9, Calif.

ALBERT M. TURNER, 21, chemical engineer for American States Paper Corp., is stationed at Eglin AFB, Fla., may now be addressed at Box 28, C.C.G.C., Canonsburg, Pa.

WALTER P. THOMSON, 21, lives at 1342 Jones St., San Francisco 9, Calif.

JOSEPH A. RUYN, 72, pensioner now for Allied Chemical Corp., may be addressed at 40 Rector St., Rm. 628, New York N. Y.

R. B. TAYLOR, 49, new address is the Canadian Geological Survey, Ottawa, Ontario, Canada.

VINCENT R. LeBAR, 36, has moved from Minneapolis, Minn. to 320-35, Cali, California, S. A.

E. F. GALLAGHER, 26, regional drilling superintendent for Continental Oil Co., may be addressed at Las Palmas de Muxton, Box 1224, Lafayette, La.

WASHINGTON, D.C.

JOHN W. HAMILL, 59, is living at 4240 Shattuck Ave, Colfax, Calif.

J. S. MARTIN, 22, is residing at 1116 15th St., N.W., Washington, D.C.

A. R. FLINK, 22, gives his address as 4 Hickory Trail, Lake Mohawk, Sparta, N. J.

GAIL G. GREGORY, 34, is owner of Grandy Valley Co., with address 115 North 7th St., Des Moines, Iowa.

JOHN P. JERSIN, 37, chief engineer for Cerro de Pasco Exploration Corp., P.O. Box 312, Yorktown Heights, N. Y.

ARTHUR J. SIBER, 37, division manager of Mitsui Mining Co., Ltd., has moved from Tucson, Ariz. to Ave. I, Boulder City, 1, Box 1372, El Paso, Tex.

JOHN B. HOLTZAD, 45, has moved fromWithin Falls, Texas to 912 Van Horn, Dallas 15, Texas.

JOHN F. FINN, 42, formerly with Standard Oil Co. of California, retires March 1 from General Petroleum Corp., is addressed at 5721 E. 2nd St., San Diego 16, Calif.

JOSEPH R. SOPER, JR., 44, secretary-treasurer of Cancrude Oil & Gas Co., at Kayford, W. Va., has moved to 1065 William St., Victoria, Texas.

RICHARD F. HAGEMANN, 48, is division petroleum engineer, Production Department, Shell Oil Co. His address is 180 Inglewood Dr., Pittsburgh 34, Pa.

HOWARD E. YOUNG, 49, staff petroleum engineer, Production Div., is transferred by The Ohio Oil Co. to 2900 Brighton Blvd., Denver 2, Colo.

JOHN P. FLINN, 40, a mining and metallurgical engineer with 14 years experience in the copper industry, is transferred to El Paso, Tex. at 290 Denver Club Bldg., Denver 2, Colo.

by parcel post.

**THE MINES MAGAZINE • APRIL, 1960**
THE MINES MAGAZINE • APRIL, 1960

CLASS NOTES

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

1892-1930
HENRY E. KING, '03, is now in a
suitation in the Los Angeles area. Mr.
King writes that her husband's health has
been fine since his operation two years
ago. The Kings live at 1600 Hill Dr.
Los Angeles 22, Calif.

W. B. RHODES, '03, may be
addressed Box 37, Coloma, New South,
Mexico City 16, Mexico.

WALLACE LEE, '04, advises that his
new address is c/o Kansas Geological
Survey, Lawrence, Kansas.

E. E. THUM, '06, is editor of
Mines Project with home address 12049
Brewer Rd. East Cleveland 12, Ohio.

ALFRED F. RICHARDS, '06, has
been transferred from Billings, Mont, to c/o
Shell Oil Co., Box 845, Roswell, N. M.

ERNEST S. GEARY, '12, is living at
7th St., Safford, Ariz.

EARL A. STRONG, '14, chief engi-
neer for Cerro de Pasco Corp., may be
addressed at Box 37, Dockton, Park Ave.,
New York 22, N. Y.

G. F. KAUFMANN, '21, who retired in
1939 from Standard Vacuum Oil Co.,
has moved to 212 S. Harrison, Des Moines,
Iowa.

MAXWELL L. EUF'MER, '25, formerly
consulting work, may be addressed
by Central Engineering Projects, U. S.
Army, Washington, D. C.

JOSEPH P. BACCA, '22, employed in
the geological laboratory at University of
California, Berkeley, has moved to 1224
Jeannette St., Des Moines, Iowa.

ANTHONY J. JOHNSON, '22, is
working for the Arizona Highway Dept.,
engineer for the Arizona Highway Dept.,
Globe, Ariz.

JOSEPH R. SOPER, JR., '44, secretary-
treasurer of Gibson-Joseph Construction
Co., has moved to 2825 Forest St., Denver
27, Colo.

MAXWELL L. EUF'MER, '25, formerly
consulting work, may be addressed
by Central Engineering Projects, U. S.
Army, Washington, D. C.

JOSEPH P. BACCA, '22, employed in
the geological laboratory at University of
California, Berkeley, has moved to 1224
Jeannette St., Des Moines, Iowa.

JOSEPH A. RYAN, '23, patent lawyer
for Allied Chemical Corp., may be ad-
dressed at 200 E. 14th Ave., No. 205,
Denver 2, Colo.

MERLE O. DANNETT, ’25, has
resigned from the U. S. Army and is living
at 246 26th St., Del Mar, Calif.

JS. G. BENSON, '29, C. E. bio-
chemist for Kansas Natural Gas Co., lives at
8220 Stockdale, Stockton, Calif.

HERMAN K. BURCH, '30, is living at
1 Phelps Dodge, Box 1372, El Paso,
Texas.

ROBERT J. ARNIM, '31, assistant
general manager of Colorado Fuel & Gas
Co., at Kayford, W. Va., has been
promoted to assistant division superin-
tendent. His mailing address is 214 W.
Farmington, N. M.

ARTHUR Y. BARNEY, '31, consulting
engineer and professor of petroleum engi-
neering at the University of Alberta,
Saskatoon, Alberta, Canada.

JOHN P. FINN, '34, formerly with
Standard Oil Co. & Gas Co. at San Mateo,
Calif., may now be addressed c/o Pan American
Argentina Oil Co., Cauíla de Corrientes 379,
Comodora Rivadavia, Argentina, S. A.

SAMUEL GIFFEN, '34, may be ad-
dressed at 290 Denver Club Bldg., Denver
2, Colo.

Dr. MILES S. STRONG, '36, is
on assignment to the U. S. Army in Europe,
acting as liaison officer. The address is
in 181 E. Querai, Littleton, Colo.

MARTIN C. RENOY, '36, is plant
manager for Maguire Carbide Corp., with
mailing address P. O. Box 487, Battle Mountain, Nev.

J. C. FLETCHER, '36, is manager of
production for Imperial Oil Co., of Can-
ada, with address 7700 Share St., Rosedale,
Calif.

JACK D. DUREN, '48, is division
engineer for the (J. P. Weil, Inc., is living
at 311 Sixth St., Ovid, Colo.

MURRAY G. GARRISON, '16, who re-
died March 1 from Gainesville, Fla. and is living
in California, is addressed at 3721 E. 2nd St.,
Long Beach, Calif.

CHARLES R. GAUTHIER, '16, who re-
died November 2 in Las Vegas, Nev., has moved to
Hayward Lake, Idaho.

DOUGLAS A. RYAN, '21, patent lawyer
for Allied Chemical Corp., may be ad-
dressed at 40 Rotor St., Ritz, 626, New
York 6, N. Y.

ALBERT M. TURNER, '21, chemical

JOSEPH R. SOPER, JR., '44, secretary-
treasurer of Gibson-Joseph Construction
Co., has moved to 2825 Forest St., Denver
27, Colo.

B. M. MILLS, '23, assistant district
engineer for the Arizona Highways Dept.,
has moved from Wilcox, Ariz, to 208 E.
W. 26th St., Tucson, Ariz.

VINCENT R. LeBAR, '36, has moved
to Bakersfield, Calif.

JOHN P. GOLDEN, II, '39, is regional
director of Colorado Oil & Gas Co., at
Farmington, N. M.

ARTHUR N. WINSOR, '40, has moved
to the works manager, Phelps Dodge
Corp., at Kayford, W. Va.

DR. GEORGE H. FANCHER, '30, who
was retired from the U. S. Bureau of Mines
in 1939 from Standard Vacuum Oil Co.,
was appointed manager of the Colorado Oil & Gas
Co., at Kayford, W. Va., has been
promoted to assistant division superin-
tendent. His mailing address is 214 W.
Farmington, N. M.

JOSEPH Q. BERTA, '41, former
engineer of Colorado Oil & Gas Co., has
been appointed manager of the Colorado Oil & Gas
Co., at Kayford, W. Va., has been
promoted to assistant division superin-
tendent. His mailing address is 214 W.
Farmington, N. M.

G. W. HOFFMAN, JR, has been
named district manager of the Colorado School of Mines Research Foundation, lives at 25 Everett
Dr., Denver 21, Colo.

BERNARD G. RECHT, '42, a deputy
superintendent of Colorado Oil And Gas
Conservation Commission. His address is
1510 E. Querai, Littleton, Colo.

MARTIN C. RENOY, '36, is plant
manager for Maguire Carbide Corp., with
mailing address P. O. Box 487, Battle Mountain, Nev.

J. C. FLETCHER, '36, is manager of
production for Imperial Oil Co., of Can-
ada, with address 7700 Share St., Rosedale,
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K. C. Forcade, '36
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Keyes 4-2255

Denver, Colorado

Dr. Howard E. Itten, '36
President

Empire Oil Company

6050 Camp Bowie Blvd., Ft. Worth, Texas

WILLIAM CROWE KELLOGG, '45
Kellogg Exploration Company

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2020 Farnsworth Bldg., Kansas City, Missouri

Ronald K. DeFord, '21
Graduate Assistant

Geological Engineering

The University of Texas

Austin 12, Texas

Earlougher Engineering

Philadelphia Consultants—Grae Analysis

316 E. 21st St.

P. O. Box 494

Dallas, Texas

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Harry J. Wolf, '37

Mining and Consulting Engineer

3 Glover Street

Little Neck, N. Y.

Ben F. Zwick, '29

Manager, Oil and Gas Dept.

CHIANGSAI TAIWAN NEW YORK CORP.

165 Broadway

New York, N. Y.
ECONOMICS FOR THE MINERAL ENGINEER

The current books on the market have been written from the industrial point of view. They are inadequate for the training of the professional engineer as he is primarily interested in the economic problems of the industry. The book is designed to cover three subjects: (1) the basic economic principles; (2) the economics of mining; and (3) the economics of the mineral industry. Each chapter is devoted to one subject, and the chapters are arranged in such a way as to make the book suitable for a one-semester course.

The book is written in a straightforward manner, without the use of mathematical notation. It is intended for use by engineering students, and it is also suitable for reference by practicing engineers.

The book is divided into three parts. The first part is devoted to the basic economic principles. It is intended to provide a foundation for the second part, which is devoted to the economics of mining. The third part is devoted to the economics of the mineral industry. It includes a discussion of the economics of the world mineral industry, and also a discussion of the economics of the U.S. mineral industry.

The book is divided into 10 chapters. The first chapter deals with the basic economic principles. The second chapter deals with the economics of mining. The third chapter deals with the economics of the mineral industry. The fourth chapter is devoted to the economics of the world mineral industry. The fifth chapter is devoted to the economics of the U.S. mineral industry. The sixth chapter is devoted to the economics of the U.S. mining industry. The seventh chapter is devoted to the economics of the U.S. mineral industry.

The book is written in a straightforward manner, without the use of mathematical notation. It is intended for use by engineering students, and it is also suitable for reference by practicing engineers.
At Camp Bird Mine Near Ouray

A new 500-ton-per-day concentrating mill is being constructed at the famous Camp Bird lead-zinc-silver 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.)

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

At 500-ton-a-day concentrating mill is being constructed by Western Range 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 30 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 evi- dence from recent developmental work that the company can operate the property economically despite the generally depressed conditions of the industry. The Camp Bird Mine, which has been owned by the same English-controlled firm since 1962, was under lease to other interests from 1928 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 Exploration, Extension, Utah and Pacific Corp., and American Climax Petroleum Corporation.

Uranium Industry Faces Uncertainties, Weller States

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

Weller stated that our present supply of natural uranium justifies 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-certainties is the price.

(Continued on page 29)

KiSSLER'S

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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.

Pharmaceutical applications were among the first uses for lithium. Since 1955 consumption forecasts have placed lithium 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 137°F, and a boiling point of 1317°C. The element is the lightest metal known, weighing only 3 pounds per cubic foot. (For comparison of physical properties, see Charts 1 and 2.)

The metal is ductile, malleable and is soft enough 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; reacting in most metals 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 alkyl group. Stannic hydroxide, stannic chloride, stannic oxide, and the U. S. Bureau of Mines.

For more information on the production of lithium and lithium compounds, contact the Du Pont Co., and American Metal Climax, Inc.

By NEIL O. JOHNSON, '33

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 1953 with a degree in mining engineering.

Mr. Johnson's 15 years service with the Du Pont Co. was interrupted in 1952 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; mining engineer and later as well superintendent for Hoyp Mountain Gold Mining & Milling Co., and as field representative for the Dorr Co. He joined Foote Mineral Co. in January 1959 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.

Lithium and the automobile is undoubtedly the most obvious, but it could also be used in other applications. Lithium is used in the aerospace industry, particularly in high performance electronics. It is also used in the manufacture of batteries, where its high energy density makes it ideal for applications requiring a lightweight and compact power source.

In addition to its use in batteries, lithium is also used in the production of lithium glass, which has several unique properties. Lithium glass has a lower coefficient of thermal expansion than traditional glass, making it ideal for use in high-temperature applications such as furnace insulation. It also has a higher thermal conductivity, which makes it useful for use in heat exchangers and other heat transfer applications.

Lithium is also used in the production of lithium metal, which is used in the production of many different materials. Lithium metal is used in the production of lithium batteries, which are used in a variety of applications, including portable electronics, electric vehicles, and space applications. Lithium metal is also used in the production of lithium cathodes, which are used in the production of lithium-ion batteries. Lithium is also used in the production of lithium oxide, which is used in the production of lithium carbonate, a key raw material in the production of lithium-based batteries.

Lithium is also used in the production of lithium chloride, which is used in the production of lithium-based chemicals. Lithium chloride is also used in the production of lithium hydroxide, which is used in the production of lithium-based polymers. Lithium is also used in the production of lithium nitride, which is used in the production of lithium-based ceramics. Lithium is also used in the production of lithium sulfide, which is used in the production of lithium-based catalysts.

The uses of lithium are diverse and expanding, with new applications being developed all the time. Lithium's unique properties make it an ideal material for use in a variety of different applications, from batteries to high-temperature glass to aerospace electronics.
proved to be more effective and cheaper than other ceramic bodies. Lithium bromide and chloride have brines for air conditioning. Lithium chloride and deliquescent compounds when used in the absorbent useful in aluminum, magnesium and titanium joining. 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 capacity; and in the manufacture of certain pharmaceuticals is the use of lithium metal dispersions and isoprene to a "natural" synthetic rubber. Butyllithium as catalysts in the polymerization of butadiene and isoprene, for example, raising the boiling points of the resulting polymers to convert them to "natural" synthetic rubber.

As for nuclear properties, the most significant is the importance is the use of lithium metal dispersions and isoprene to a "natural" synthetic rubber. Butyllithium as catalysts in the polymerization of butadiene and isoprene, for example, raising the boiling points of the resulting polymers to convert them to "natural" synthetic rubber.

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 pegmatitic spodumene, lepidolite, 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; however, their extent is unknown at the present time. Canadian sources of lithium are in Quebec, Ontario, Manitoba, and the Northwest Territories. The pegmatite bodies are intruded 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 spodumene and cerium-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 pegmatite bodies.

THE MINES MAGAZINE • APRIL, 1960
times before they are discarded; box points are replaced

Ore beneficiating plant. (Photo courtesy of Southern Railway Co.)

The ore is dumped directly into a 26-inch Traylor gyratory crusher where it is reduced to approx­

imatitudes. In 1943 and 1944 Bolivar conducted a deep pros­

A motorgrader is used to maintain the haul roads and pull a 2,000-gallon capacity water wagon to wet down roads during the summer.

The ore beneficiating 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 15/16-inch rock is then split into three sizes on the Tyrock screen. The plus 1½-inch portion is crushed, open stage, to minus 15/16-inch and rejects the minus 1½-inch from the secondary. The minus 15/16-inch has been washed and is then crushed to the desired 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 conveyer system (including a Merckel Weigher and conveyor system) 15 yards ahead of the 5-foot x 12-foot Marcy rod mills. It is then ground, classified, and sent to the flotation mill using various flotation methods into the various salable products.

The spodumene concentrate is filtered using Dorr equipment and washed prior to shipment. The concentrate is then shipped to Foiite's lithium processing plant at Sun­

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 480 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 tailing effluent is treated with Ferri-Floc and titanium dioxide to obtain a water quality that permits direct loading from plant to railroad cars. Mica concentrates are centrifuged and marketed without drying.

Maintenance

Maintenance functions are conducted in a large, permanent shop. Three vehicle bays, large enough to accommodate the 3½-yard shovels, are equipped with a 300-foot open-eave air refining, (400 feet travel) containing two 5-ton capacity electric hoists. Other major shop equipment includes a 125-ton air hydraulic press, a 125-ton dragline for removal of engine and welding frames, and two 300-ton electric cranes. A high intensity roll-type magnetic separator, Railroad shipments to Foiite's lithium processing plant at Sun­
The Balance of Payments Problem

By JOHN J. McCLOY

The A3J Vigilante—new Navy attack weapon system designed and built by North American Aviation, Inc. to counter the destructive capabilities of the Soviet Union’s latest ICBM, has recently been released in a lithium alloy named X-2029 which is far tougher than conventional alloy steels and can withstand continuous usage with the temperature over 400°F. Other alloys with lithium as an essential component are also being developed.

The warehouse facilities consist of a metal building and its compounds. This, combined with an active construction program, has resulted in a fully integrated domestic producer of lithium metal and its compounds. The challenge to the United States is to maintain this position as a principal supplier in the world market.

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, D.C., that I am so concerned with the prominence which seems to have been given to this single question as an influence on our foreign trade and defense policy that I am impelled to talk about it.

Certainly it is well for those who are knowledgeable as to examine this situation, if for no other reason than to apprise its true relation to our vital interests. In spite of the publicity it has received, I respect 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 defense from NATO, those who would do away with foreign aid, those who would beg for 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 had to have a balance. But up until 1951 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.

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**The Balance of Payments Problem**

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**The Balance of Payments Problem**

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In 1958 it amounted to $3.4 billion; moreover, this
payments suddenly increased, and very markedly so.

the world to meet the full needs for international
•——it is stronger than ever. And to meet any external
Imbalance Increases
in its exports and an increase in its imports. In 1957
had this sudden increase in the imbalance of our foreign
held by all nations.
Gold
billion, almost half the total money

1958 some very important changes began to
take place. With the onset of a world recession, minor
the intercountry payments suddenly increased, and very markedly so.

—1959, it is true, is a peak year—influenced among other things by

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more than offset by heavy military spending abroad, plus a small amount of foreign aid which is not tied to military needs. That is, of course, a typical margin of private foreign investment. The result today adds up to a sizable deficit in our total foreign payments. What really matters is the rate of growth of these latter items. In all points of view the most beneficial move would be to expand Western trade outside Europe. Such a move is probably not to come about because the full extent necessary to solve the whole problem.

Exports were clearly depressed over much of 1958 and 1959, for the United States, Western Europe, and Western Hemisphere. In recent months shipment have been very encouraging, and I think we shall see such improvements as substantial moves to better balance of payments. This is to be hoped for, but it is not in the cards. The current weakness is heavy military spending abroad, of private foreign investment. The result today adds up to a sizable deficit in our total foreign payments. What really matters is the rate of growth of these latter items. In all points of view the most beneficial move would be to expand Western trade outside Europe. Such a move is probably not to come about because the full extent necessary to solve the whole problem.

The administration is alive to the facts and needs embodied in the balances-of-payments problem. It has taken a number of steps that are traditional, but in this way to meet such a problem: the budget is being balanced, a policy of tight money is being pursued, and the United States is making efforts to encourage larger imports of goods and services. These moves have been made in the Free World but not to the Communists as well, that the United States is beginning to think of the world as a single unit and will be a leader in that sense. Once started down this path, there is no telling where we might end, except that the chances for a major role in the Commonwealth would have been brightened immeasurably.

The plain truth is that the United States has not had all sense. We still sell more abroad than any nation in the world. We are more wealthy and in many respects more powerful now than at any time in the past. 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 that we have lost your place as the leading auto manufacturer, the Treasury has furnished some doubt as to the economic and political conditions. This means that Russia has back on your commitments to NATO. Is it any wonder, then, they'll be asked, "is the Free World beginning to question whether you can provide the leadership we all so surely need?"

Free World Needs Our Leadership

Certainly the Free World continues to need our leadership—aggressive, whole, and constructive. To meet the challenge is of course a serious and difficult task. But if we do not, there will be great danger that the economic and political conditions in the world will be submerged into a morass of mutual unemployment and relative economic depression. There has been a tendency for many firms to look upon exports as merely an overflow from an expanding market abroad. There has been a tendency for many firms to look upon exports as merely an overflow from a productive process. There has been a tendency for many firms to look upon exports as merely an overflow from a productive process. There has been a tendency for many firms to look upon exports as merely an overflow from a productive process. There has been a tendency for many firms to look upon exports as merely an overflow from a productive process.

The need is not for less aid; if anything it is for more. More aid must be forthcoming, and we must seek to 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. It is not only a part—I believe I also see a well-defined reply to the challenge.

To accomplish this consolidation of Free World strength we need aid. But we should use aid in a way that would end to the incipient economic schism which is developing in Europe. The need is for less aid; if anything it is for more. More aid must be forthcoming, and we must seek to 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. It is not only a part—I believe I also see a well-defined reply to the challenge.
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 Jämtland 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 700 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 and the plant, which has a total of 240 feet in height, three storage silos, and a concentration plant, and the work in the galleries is in full swing.

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.

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 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 nationalism among foreign countries.

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 specialty in engineering than is done in other professions like lawyers and doctors."

To achieve the training as an engineer, Mr. Brinckerhoff states that the basic engineering course be accelerated and adequate electives be made available for the student's preference. The latter elec-
tives suggested are general courses in geology, mining, metallurgy, industrial chemistry, metal fabricating, petroleum engineering, and engineering of non-metallic 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, the student would be granted the degree of Bachelor of Science. 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 industries. The solution probably lies between the total reorganization of mining engineering courses to include the entire field of metals, non-metallals, and fuels—their transformation and 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 broader engineering course in the initial stage and specialization as the final stage."
**THURSDAY, APRIL 21, 1960**

**8:00 a.m.**
— Ladies and Gentlemen—Exhibit Hall, Hilton Hotel.

**9:00 a.m.**
— Introduction of Prominent Guests.

**9:30 a.m.**
— Robert L. Druva, Stearns-Morse Co., Denver, Presiding.

**9:45 a.m.**
— "Setting Up and Equipping a Metal-Silver Mine"—Robert S. Palmer, Executive Vice President, Golden Oil & Uranium Co., Denver, Presiding.

**10:00 a.m.**
— "New Agricultural and Mining Ideas"—Robert S. Palmer, Executive Vice President, Colorado Mining Association, Denver, Presiding.

**10:45 a.m.**

**11:00 a.m.**
— "Our Industrial Commission"—Truman A. McCoy, Boulder, Presiding.

**11:30 a.m.**
— "Our Atomic Energy Program"—Henry C. Anderson, Associate Director, Brookhaven National Laboratory, Upton, N.Y.; Dr. Albert E. Seep, Denver, Chairman.

**11:45 a.m.**

**12:00 Noon**
— **FRIDAY NOON LUNCHEON**
— Junior Assembly Room No. 1, Hilton Hotel.

**2:00 p.m.**

**2:15 p.m.**

**2:30 p.m.**

**3:00 p.m.**

**3:45 p.m.**
— "Marine Geophysical Surveying"—Grant Harvey, Union Carbide and Carbon Corp., New York City.

**4:00 p.m.**

**4:30 p.m.**

**5:00 p.m.**
— **FRIDAY AFTERNOON**
— Junior Assembly Room No. 2, Hilton Hotel.

**6:45 p.m.**
— "Our Industrial Commission"—Truman A. McCoy, Boulder, Presiding.

**7:00 p.m.**
— **FRIDAY DINNER**
— Grand Ballroom—Hilton Hotel.

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FROM THE EXECUTIVE MANAGER'S DESK

There seems to be a growing 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?

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

Plans are in the making to include a special issue on a topic devoted to Mines Alumni, another to Metallurgy, a Special Mining issue devoted to Mines Alumni; and to revive the Letters to the Editor page. We are already planning to add this page to the Magazine, to include news of the CSM Foundation, and to revive the Letters to the Editor page. We are already planning to add this page to the Magazine, to include news of the CSM Foundation, and to revive the Letters to the Editor page.

To increase the volume of the Class Notes, we have capitalized the names of the individuals concerned. Next month's volume will be increased still more. The Table of Contents page has been restyled by placing it with the February issue. We increased the number of pages in March to 48, which is the most we can...
Explosions Research Applied To Mine and Quarry Blasting

By CLIFTON W. LIVINGTON, '33

The Breakage Process Equation

The breakage process equation recognizes the many factors influencing the results of blasting, but expresses them in relation to energy, mass, and time. Research has shown that there is a definite interrelationship between these factors, and that it is possible to describe in absolute units the relations between the energy of the explosive and the mass of material effectuated by blasting. Thus the formula represents future mining engineers, and if so, the calculations can be extended to include the operational problems of drilling, blasting, mucking, and handling. This technique has not yet been introduced to the United States mining and construction industries, but recently it has been successfully inaugurated at two large Canadian mining companies.

The following six phases are necessary to successful application of the technique:
1) Explosives selection.
2) Delay sequence.
3) Effect of residual stress and of statically induced stresses on the blasting process.
4) Effect of the newly evolved blasting practices upon slope-stability calculations.
5) Training program to acquaint mine supervisors and pit foremen with the principles involved.
6) Periodic inspection of operations to observe features related to the broad general field of rock mechanics.

THE BREAKAGE PROCESS EQUATION

\[
y = \frac{W}{B_{ABC}}
\]

where:
- \(y\) = volume of material broken by the explosive, cu ft.
- \(W\) = weight of the explosive, lb.
- \(B\) = stress-energy factor.
- \(A\) = energy assimilation number.
- \(B\) = materials behavior index.
- \(C\) = stress distribution number.

A great deal of work remains to be done to determine the natural laws that determine the form of the disturbance that passes outward from the explosion into the material. This work must be done before it can be measured in the field with certainty.

1) Density of yield.
2) Fracture process.
3) Acceleration, displacement, and velocity of the broken material.
4) fragrance of the broken material.
5) Degree of fragmentation of the broken material.
6) Air blast pressure and noise or disturbance.
Explosions, Research Applied
To Mine and Quarry Blasting

By CLIFTON W. LIVINGTON, '33

The equation applies not only to shock-type failure in blasting, but expresses itself in terms of relative behavior of materials, which apparently is accepted today with little reservation, although it now appears to have been formulated 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-fracturing substances.

2) The shear type, characterized of more plastic-fracturing substances.

3) The viscous-damping type, characteristic of compressible substances such as snow, which consists of a brittle-setting 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 shock wave reflection theory, which apparently is accepted today with little reservation, although it now appears to have been formulated on incomplete knowledge.

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 the aid of motion pictures and sound recordings:

1) Cavity growth.

2) Fracture process.

3) Acceleration, displacement, and velocity of the unbroken material.

4) Acceleration, displacement, and velocity of the fragment.

5) Degree of fragmentation of the broken material.

6) Effect of residual stresses and of statically induced stresses upon the failure process.

The following six phases are necessary to successful blasting application:

1) An appraisal of present blasting practices and a survey of past practices.

2) Experimental small-scale cratering program to establish blast parameters and the integration of this program with the normal production schedule.

3) Analysis of data obtained from step 2 and blasting calculations leading toward improvement of both blast planning and production.

4) Introduction of controlled blasting at selected places and adjustment of the normal production schedule. The following factors are considered during this phase:

5) Explosive selection.

6) Relocation sequence.

In physical and geologic properties of materials:

a) Operating scale.

b) Effect of residual stresses and of statically induced stresses upon the failure process.

c) Effect of the newly evolved blasting practices upon slope stability.

d) Training program to acquaint mine supervisors and pit foremen with the principles involved.

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d) Training program to acquaint mine supervisors and pit foremen with the principles involved.

Mining specialists are needed to attend to the broad general field of rock handling including the design, installation, and operation of primary and secondary material-handling equipment. This work is performed by people who have been trained in technical schools or have been trained on the job. A mining engineer should have a knowledge of the properties of rock and the nature of the work to be done, and should be able to design the equipment needed to handle it efficiently.

The Bureau of Mines has been given the task of developing and testing new methods of mining and of improving existing methods. This work is being done in close cooperation with mining engineers and other scientists.

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Production of Lightweight Aggregate

By ERNEST E. BURGH, '44

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 Material Service Corp. A plant processing 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 to Midwest markets. Operations were first started the

The deposit supplying raw material for this plant is the Union 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 150 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 15 feet in thickness with an average shale thickness of about 50 feet. The shale is drilled on 16 by 20-foot centers and blasted

with ammonium nitrate at an average ratio of about 3.0 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 haled "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 striping operations on evenings and weekends.

Shale Crushed in Two Stages

The raw shale is crushed in two stages. Stage one is a 16 by 22-ton single roller crusher and stage two is a Hammermill in closed circuit. Discharge from the crushers is screened to minus 3/4 inch and 3/4 by 5/8 inch fractions which are conveyed directly to kiln storage. The minus 5/8 by 3/4 inch are used extensively for concrete block. Coarse is 3/4 by 5/8 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 kiln storage for blending any required combination of fines, medium or coarse.

Concrete with Material

The necessary plant investment, material handling, 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.
Class of 1910 to Celebrate 80th 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. Carson, John H. East, Jr., Vincent K. Jones, and Emil J. Brudelini. The reunion had been indefinitely set for the May 26-27 affair include a breakfast with President John W. Vanderwalle at 8:30 a.m., May 26, at the Holland Hotel, in Golden, followed by a tour of the mines. The Saturday evening reunion will be held at 6:30 p.m., Thursday, April 21, at the Denver Press Club, 1330 Glamann.

The Denver Section sponsors a 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 Glamann.

Oil shale sessions will begin at 8 a.m., but that allows ample time for the attendees to attend the suppliers' cocktail party at 5:30 p.m. The dinner 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 Chatenberger, research engineer; J. W. Weyler, 5851 E. 23rd St., Denver; and C. E. Ford, research engineer.

Dr. Fancher comes to his new post after teaching at various colleges and universities, and he did not drop down to the level of University of Texas as professor of petroleum engineering in 1940, director of the Texas Petroleum Research in 1939, Mr. Fancher is the group of petroleum engineering department in.

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 method of permeability measurement which has been adopted by the American Petroleum Institute.

A consultant for many companies, Dr. Fancher served on numerous API committees, has been active on its Oil Compact Commission, and has received many academic honors. He is a member of Alpha Chi Sigma, Phi Lambda Upsilon, Sigma Gamma Epulson, Zeta Phi Beta, Phi Eta Sigma, and a member of the Omega Chi Alpha.

Torrey, '51, Sales Manager for Joy Manufacturing Co.

Herbert T. Torrey, a 1951 mining engineering graduate of the Colorado School of Mines, has been appointed sales manager for Joy Manufacturing Company's Mining and Metallurgical Division.

Dr. Fancher's success in promoting the Louisville drainage tunnel, his "ingenious and effective planning" of the shale test plant in Rifle, Colo., and his report for restoration of the over-worked mines of the country. In the intervening years before his return to the Bureau of Mines in 1939, Mr. Torrey was an assistant 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 a student at the University of Colorado, in Boulder.

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 Jumbo 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, allowing 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 grandchildren.

A. G. Setter, '32, 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 Carnegie-Illinois Steel.

A native of Joplin, Mo., Mr. Kinyon has been employed in various supervisory capacities at the American Smelting & Refining Co., the Balston Machine Co., and Carnegie-Illinois Steel.

He became a wire rope engineer at U. S. Steel's Pittsburgh Works in 1942. In 1945 he joined the American Smelting & Refining Co. as assistant superintendent of wire and wire products and in 1944 was named assistant superintendent of the plant. Two years later he became assistant superintendent of the Panic Works of U. S. Steel's Carnegie-Illinois Steel Co., in Birmingham, Ala.

In 1952 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 in 1955, he was named first as mining engineer and later as advertising manager for Denver Rock Drill Co.

From 1924 to 1928 he was strip-mining superintendent for Lewis Mountain Coal Co., Shamrock, Pa., which at that time was the largest strip-mining operation in the country. In the intervening years before his return to the Bureau of Mines in 1939, Mr. Kinyon was employed as an assistant superintendent of many coal and gypsum mines as well as being a consulting engineer for a year.

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

In his 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.

Mr. and Mrs. Setter live with their two daughters 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

Contract Miner for Alaska Jumbo Mining Co.

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

The Mines Magazine • April, 1960
Visitors to the Alumni Office

During the past month we had a number of alumni stop by at the Alumni Office to discuss some interesting matters. Some were interested in the Alumni Office, some were interested in the Alumni Association, and some were interested in the Alumni Magazine. A quick search of the records will be made to see if all dues have been paid. The alumni who have not paid their dues will be sent a notice by mail to call at the office when you are in Golden. By the way, we have been receiving mail orders from alumni in foreign countries. John has spent considerable time in Greenland, and should enjoy the climate.

RUSSELL M. CORN, '57, who is associated with the Oil Co. in North Carolina, is now assigned with the same company to a new branch office in 1484 W. 56th Pl., Arvada.

DOROTHY R. FOUNTAIN, '50, her husband, Elmer (L. Anderson) and their three children are in Golden. L. Anderson is a branch manager of a Union oil branch office and will return to Libya, address here is Box 693, Tripoli, Libya, in May after a business trip to Lakeview. Mrs. Fountain and her family always have enjoyed living in Golden. She now resides at 810 S. 3rd Ave. route home, Luke stopped at Blanche Castle to pick up a shellac gift for Mrs. Scott, a gift for Dr. Oliver, and a gift for Mr. Scott.

PHILIP R. HAMMOND, '48, assistant manager, Laayette Division, Hercules Powder Co., stopped in the office, but unfortunately, his car broke down on 28th St.ítica. Dr. Hammond and his wife, who is living at 201 Churchill Drive, Golden, are planning to move to Lakewood.

EDWIN W. PIKEER, '54, is still doing advanced work at the University of Colorado, where he is also an instructor in the Engineering School. His address is 330 S. 42d Ave., Denver.

JOHN R. ROSS, '52, is still with The California Co., as a petroleum engineer, 8607 South Lee St., Littleton, Colo.

RICHARD M. WELLS, '52, manager Mining Products Sales, Colorado Fuel and Iron Corp., Denver, came in to discuss the relationship of the CSAM Foundation and the Alumni Office. Lee feels as do I that there is a mutual interest that can be explored. The 120th anniversary is being developed within Europe but now in the Western Hemisphere. This is the 5th year that the Bureau of Mines, Division of International Minerals & Chemical Corp., (Canada) Ltd. to assure "long

The California Co., as a petroleum company, has given six million dollars to the 120th anniversary. Mr. Wilson P. Wurll, manager, Nuclear Metals Division, cast iron, which is the National Lead Corp., Washington D. C., at the office with his son William P. Wurll. Bill is a freshman in Mines and is a member of the Mines Early American football team. Bill has been employed by the Pittsburgh Plate Glass Co., and is now a student at the University of Pennsylvania. He is a mechanical engineering student and is interested in the field of mining.

The technique, called dubbing, employs a cast iron lining for the mine shafts. The lining is made of cast iron and is common with the use of cast iron tunneling. Stephen J. Becher reported on the athletic and academic program at Mines and answered questions.

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

Dr. E. L. McDaniel, a 1952 mechanical engineering graduate of the Colorado School of Mines, recently spent five months with a friend prospecting for uranium in north of Kim in Los Alamos County, New Mexico. The two men found no uranium but they did find adventure—a blizzard that blew snow to the height of three stories and an avalanche that buried them for several days. They were 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.

New Mining Technique Uses Cast Iron Lining in Shaft

A new mining technique has been developed in which a cast iron lining is used for mine shafts. This technique, called dubbing, employs a cast iron lining for the mine shafts. The lining is made of cast iron and is commonly used in the mining industry. More specifically, the technique involves the use of cast iron tunneling. Stephen J. Becher reported on the athletic and academic program at Mines and answered questions.

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FROM THE LOCAL SECTIONS

 Sections Outside U. S. A.

 CANADA

 Colbyg Section
 Pres.: R. F. Ziemler, 97
 Sec-Treas.: A. C. Page, Jr., 74
 Luncheon meetings held 1st Monday of
 each month at the Colbyg Petroleum
 Club; visiting alumni welcome.

 LUNCHEON SECTIONS OUTSIDE U. S. A.

 TULSA SECTION

 Luncheon held on May 24.

 TULSA SECTION

 Luncheon held on May 24.

 THE MINES MAGAZINE • APRIL, 1960

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 THE MINES MAGAZINE • APRIL, 1960

 37
LOWELL C. ATCHISON

Henry W. Lehman

Garland Henry Shefelbine, a 1935 graduate of the Colorado School of Mines, died in New York City on April 16, 1960, at the age of 60.

He was born in New York City on April 11, 1900, and grew up in that city, where he was educated.

At the age of 20 he entered service in the United States Navy, and was discharged in 1922.

He then entered the mining industry, and in 1931 he was employed by the Gold Dredging Company as a geologist.

He was promoted to the position of geologist in 1936, and in 1939 he was made superintendent of the Colorado School of Mines.

In 1941 he was made a resident engineer for the United States Government, and in 1945 he was made superintendent of the Colorado School of Mines.

He was a member of the New York Mining and Metallurgical Society, the American Institute of Mining Engineers, and the American Chemical Society.

Survivors include his wife, Edith, and their children, E. W. Lehman, Jr., and E. W. Lehman, Jr., of New York City, and Mrs. Mary B. Lehman, of New York City.

G. H. Shefelbine

Robert E. Ryan

Manchester, Me.

A resident of Manchester, Me., has died at his home in that city on April 16, 1960, at the age of 80.

He was born in New York City on April 11, 1900, and grew up in that city, where he was educated.

At the age of 20 he entered service in the United States Navy, and was discharged in 1922.

He then entered the mining industry, and in 1931 he was employed by the Gold Dredging Company as a geologist.

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Survivors include his wife, Edith, and their children, E. W. Lehman, Jr., and E. W. Lehman, Jr., of New York City, and Mrs. Mary B. Lehman, of New York City.

OTHER OBITUARIES

Lowell C. Atchison, a 1925 graduate of the Colorado School of Mines, died in denver on April 16, 1960, at the age of 80.

W. T. "Bill" Atchison, a 1935 graduate of the Colorado School of Mines, died in Denver on April 16, 1960, at the age of 70.

Harry E. Ryan, a 1905 graduate of the Colorado School of Mines, died in Denver on April 16, 1960, at the age of 85.

William E. Ryan, a 1905 graduate of the Colorado School of Mines and a member of the American Institute of Mining Engineers, died in Denver on April 16, 1960, at the age of 85.

John R. Bloomfield, a 1915 graduate of the Colorado School of Mines and a member of the American Institute of Mining Engineers, died in Denver on April 16, 1960, at the age of 85.

Eugene R. Brant, a 1915 graduate of the Colorado School of Mines and a member of the American Institute of Mining Engineers, died in Denver on April 16, 1960, at the age of 85.

G. H. Shefelbine, a 1935 graduate of the Colorado School of Mines, died in New York City on April 16, 1960, at the age of 80.

F. W. "Bill" Shefelbine, a 1935 graduate of the Colorado School of Mines and a member of the American Institute of Mining Engineers, died in Denver on April 16, 1960, at the age of 80.

H. E. "Ted" Shefelbine, a 1935 graduate of the Colorado School of Mines and a member of the American Institute of Mining Engineers, died in Denver on April 16, 1960, at the age of 80.
20. The group was given a detailed gineers toured a construction site of the Societj' of American Military En­
School of Mines student chapter of the Titan missile base on the bombing 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 campus on chartered bus at 0730 hours and returned at 1200 hours.

Over 30 members of the Colorado School of Mines student chapters 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 fabrication and coordi­ning 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 campus on chartered bus at 0730 hours and returned at 1200 hours.

According to the Army Corps of Engineers, the responsible agency for the missile base construction, the "pre­cision technical requirements for the construction of the propellant loading system which represents the key to the operational capability of the complete launch 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 -418° 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 hydrocarbon fluids in the liquid oxygen system will be backfilled.

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 shfit­ting are kept to a minimum. Simul­taneously with tunnel completion, the cut is backfilled over the tunnels. Even though some of the facilities are completed and equipped, the entire cut will be backfilled.

The Titan missile base construction 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 Mili­nary Engineers was 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. DeLaue on Nuclear Radiation, and other noted speakers in a 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 Engineer­ists activities at Fort Carson.

Mines same members receive the control structure of the Titan Missile complex. These structures will be underground in the completed facility.

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 Lance Bivens 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 selflessly of his time," F. A. "Heine" Foss, president of the Golden Chamber of Commerce, stated in making the nomination. "His engineering background is a 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, 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.
OREDIGGER SPORTS

Two Track Meets Held in Steinhauser Fieldhouse

In the first indoor track meet held in Steinhauser Fieldhouse since 1942, DU's Claudia outpaced Coach Joe Perry's Mines track squad (Feb. 27) with a 59 5/6 to 53 1/6. Dan Mathews broke the high jump record by 5 1/4 with his 6 ft. 3 3/4 in. jump. On March 19 the Mines tracksters earned a second place in the triangular indoor track meet held in the Mines field house. CSU took first place with 55 1/2 points, Mines was second with 47 1/2 points, and DU was third with 33 points. Rog Osborne won the 44-yard run for Mines with a 21 1/2 second, establishing a new field house record for this event. The previous time was 56.3 sec. was established in 1939.

CAMPUS HEADLINES

BEAUTY AND BEAST CONTEST

The results from the second annual "Beauty and the Beast" contest sponsored by the Mines Student Association and Phi Omega, national service fraternity, were announced at the sell-out of tickets. The contest was open to Mines and CSU students. The winner was selected by popular vote and the date was also announced. The contest was held in the Student Center on March 23.

LETTERS TO THE EDITOR

S. L. McCLAREN, '54, wrote recently:

"Since I graduated from Mines in 1954, I seem to have become completely 'lost'. I have now returned to the Denver area and have re-established 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 not unusual. Since I graduated from Mines and accepted employment in association with Shell until November 1954, after which date I returned to Colorado and the General Engineers, being stationed primarily at Ft. Belvoir, Va. and Ft. Leonard Wood, Mo. My discharge from the Army in 1956, I followed the example of many of my other comrades and returned to school. I attended the University of Oklahoma for the Law School. Even while in Law School I found my engineering background to be advantageous. I was able to defray my living expenses by instructing in statistics, kinetics and fluid dynamics during the first year.

WALTER T. TYLER, '57, wrote from Paramaribo, Surinam, that he had been living at the Palace Hotel with his wife and daughter, but he expects to move into the new house he has rented. The house will be ready for travel over Wednesday the 2000 miles will re-quest six days and will involve travel by river steamer, unimproved jungle road, and finally trail with about 35 waterfalls and rapids to negotiate. Rather than travel this route, Walt will await radio word from the over-water steamboat, and then fly to the airport in Paramaribo. Base camp will be at the beach at Beavervale, and the trip will be a great experience.

Walt included a map of the area, but said "if you don't have a map on the map you will never travel the jungle. They are still building the road to Paramaribo, and the government hopes to open the deep jungle by 1959, but I am afraid this will not be true." The Tyler's went to Surinam with Prof. and Mrs. HARRY J. WOLF, '03. Mrs. Wolf will continue to live at the Palace Hotel, but the Tyler's have rented a house at Ongtenseweg No. 71, Paramaribo, Surinam, S. A. where they are at their base camp. (We certainly hope you have success in this venture.)

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 new house he has rented. The house will be ready for travel over Wednesday the 2000 miles will require six days and will involve travel by river steamer, unimproved jungle road, and finally trail with about 35 waterfalls and rapids to negotiate. Rather than travel this route, Walt will await radio word from the over-water steamboat, and then fly to the airport in Paramaribo. Base camp will be at the beach at Beavervale, and the trip will be a great experience.

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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, missiles and space ships, nuclear reactor construction, high-speed aircraft, missiles and space ships.

A new line of hydraulic test bench which can be used to check required parts in the shop and trouble-shoot operating conditions in the field is available from the Berylometer Corporation of Chicago. Operation of the instrument requires only 200 and can be handled on foot in no time at all. In using the machine, the operator maintains a steady rate of speed and type of material are determined with the instrument readings. Rapid weight determinations can be run in 10 to 20 minutes. Under ordinary conditions, profiles can be computed at the rate of three-quarters of a mile per day at a maximum of 50 feet.

Hydraulic Test Bench

A low cost hydraulic test bench which can be used to check required parts in the shop and trouble-shoot operating conditions in the field is available from the Berylometer Corporation of Chicago. Operation of the machine requires only 200 and can be handled on foot in no time at all. In using the machine, the operator maintains a steady rate of speed and type of material are determined with the instrument readings. Rapid weight determinations can be run in 10 to 20 minutes. Under ordinary conditions, profiles can be computed at the rate of three-quarters of a mile per day at a maximum of 50 feet.

Electrical Blasting Caps

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

In multiple blasting, the Coal King delay electrical blasting caps detonate complete rounds of permissible explosives without causing the shocker to return to the face between blasts.

- Developed Standard Mounted Operation at Floor Level and has Wire-Lowering of Unloaded Rope. It has been designed to lift, lower, and hold loads with extremely-responsive safety features as “dead-man” power throttle, dynamic brake for controlling free-falling, and mechanical load-holding lock. The new hoist has been extra-"versely field tested by Thor in mining and construction operations.

Hydraulic Test Bench

A low-cost hydraulic test bench which can be used to check required parts in the shop and troubleshoot operating conditions in the field is available from the Berylometer Corporation of Chicago. Operation of the instrument requires only two rolls and can be handled on foot in no time at all. In using the machine, the operator maintains a steady rate of speed and type of material are determined with the instrument readings. Rapid weight determinations can be run in 10 to 20 minutes. Under ordinary conditions, profiles can be computed at the rate of three-quarters of a mile per day at a maximum of 200 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 control housings.

The new utility hoist incorporates such safety features as “dead-man” power throttle, dynamic brake for controlling free-falling, and mechanical load-holding lock. The new hoist has been extensively field tested by Thor in mining and construction operations. Operation of the instrument requires only two rolls and can be handled on foot in no time at all. In using the machine, the operator maintains a steady rate of speed and type of material are determined with the instrument readings. Rapid weight determinations can be run in 10 to 20 minutes. Under ordinary conditions, profiles can be computed at the rate of three-quarters of a mile per day at a maximum of 200 feet.

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During 18 months' service in a West Virginia coal mine these aluminum mine cars showed no sign of corrosion, reported Reynolds Metals Co. reports.

New WKE Office Building Opened in Hibbing, Minn.

Officals of Western-Knapp Engineering Co., design, engineering and construction specialists, headed by Bentz A. Samuelson, Hibbing manager, and Robert F. Engell, assistant general manager, Frank Francois, 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 worldwide-wide services in projects 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 concentrations for the country's leading producers: general contracting development of ore and minerals, plants, armories, schools, churches, radar stations, town, Chicago and New York as well as Hibbing. Company sales last year amounted to nearly $50 million.

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A-C Electromagnetically Operated System for Crushers

Allis-Chalmers has introduced an electromagnetically operated system for crushers to eliminate the close setting of their gyratory crushers equipped with Hydroset adjustment of main shaft and crusher mantle.

The indicating system is used in conjunction with the hydraulic adjustment of the main shaft of the crusher as well as the main shaft of the crusher. Aluminum cars today show no sign of corrosion, reported Reynolds Metals Co. reports.

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Magna are as a 10,000 psi headstock of the hydraulic adjust­ment and move up or down with this cylinder, as the magnets move, an electric probe permanently fastened within the cylinder'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 Alco-Chalmers magnetic probes in the Superior and Hydrocone lines.

**Electronics Firm Joins Geophysics**

Varian Associates, an electronics firm located at Palo Alto, Calif., has been elected to membership in the So­ciety of Exploration Geophysicists, it was announced this week by the society's president. "As a member of the technical staff, Varian joins with other companies and individuals in promoting the science of geophysics, especially its application to oil and mineral exploration," the society said.

The firm is located at 333 Third Ave., New York, N. Y., 10016.

**Where Are These Miners?**

Here is a list of "Miners" whose current addresses are unknown to the Alumni Office. You can help us make our records complete by checking over the list, and mailing cards to the names of any of those that you know.

Thank you.

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**ADVERTISERS' LISTINGS**

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**THE MINES MAGAZINE**

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**THE MINES MAGAZINE**
WIDE RANGE OF SIZES THROUGH 10"!
ALLOY OR RUBBER COVERED PARTS!
HIGH HEAD APPLICATIONS!

There is a Wilfley Sand Pump to meet your specific requirements in the transfer of solids. Wilfley's wide range of sizes, capacities, and interchangeable parts give you versatility in the handling of sands, slimes, sludges, slurries - abrasives of all types.

Whether you need belt driven, overhead V-belt driven, or direct driven sand pumps, Wilfley has them. Wilfley Sand Pumps guarantee lower pumping costs, higher output and maintenance-free service. Write, wire or phone for complete details.

Every installation is job engineered for maximum pumping economy.

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