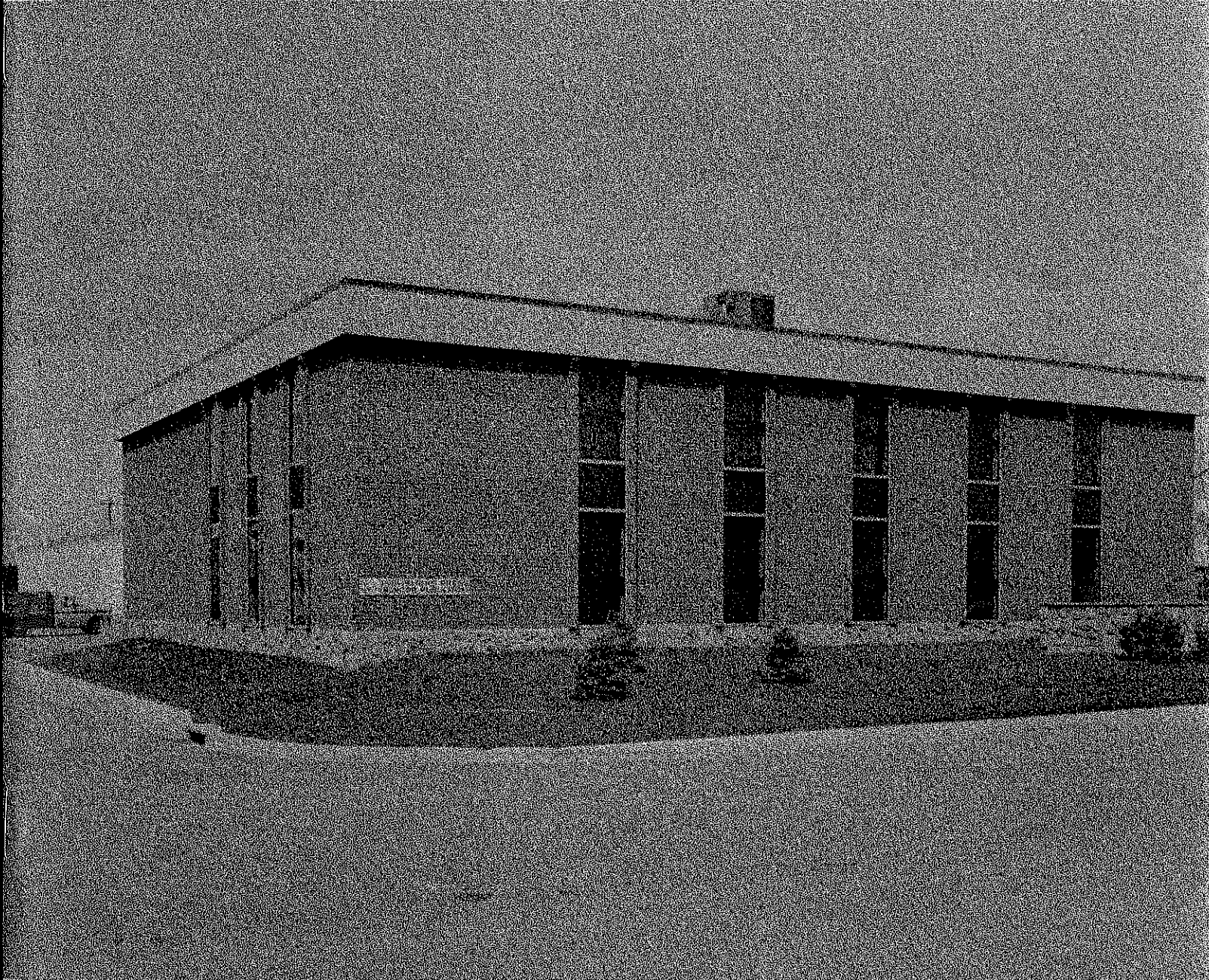


The
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Magazine

September, 1970



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Society of Metals

6:00 p.m. Tuesday Oct. 3, 1970

Whitehall Room — Sheraton-Cleveland

Mines Luncheon

Society of Petroleum Engineers

12 noon Wednesday Oct. 7, 1970

Colorado Room — Rice Hotel
Houston, Tex.

Mines Breakfast

Society of Mining Engineers

7:30 a.m. Thursday Oct. 22, 1970

Stouffers Riverfront Inn

200 South Fourth St., St. Louis

THE MINES MAGAZINE

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Calendar

Trans/expo International, Soldiers
Field, Chicago, Sept. 18-20.

Symposium on Automation in Heat
Treating (ASM), Statler Hilton
Hotel, Cleveland, Ohio, Sept.
21-22.

Wyoming Geological Association
Symposium and Field Trip, Cas-
per, Wyo., Sept. 21-23.

Consumer-Related Industry, U. S.
Dept. of Commerce, Washington,
D. C., Sept. 21-25.

1970 Mining Convention, spon-
sored by American Mining Con-
gress, Hilton Hotel and Brown
Palace, Denver, Colo., Sept.
27-30.

11th Annual Convention, sponsored
by Pan American Federation of
Engineering Societies, Buenos
Aires, Argentina, Sept. 27-Oct.
3.

International Commodities Confer-
ence, New York Hilton Hotel,
Sept. 28-30.

Society of Petroleum Engineers of
AIME Annual Convention, Hous-
ton, Tex., Oct. 4-7.

SPI Midwest Conference, sponsored
by Society of Plastics Industry,
Playboy Club Hotel, Lake
Geneva, Wis., Oct. 6-9.

Fall Technical Conference of Amer-
ican Society of Photogrammetry
and American Congress on Sur-
veying and Mapping, Denver Hil-
ton, Oct. 7-10.

1970 Metals Show, sponsored by
Society of Metals, Public Audi-
torium, Cleveland, Ohio. ASM
headquarters at the Sheraton-
Cleveland, Oct. 19-22.

52nd ASM Materials Engineering
Congress and Exposition, Cleve-
land, Ohio, Oct. 19-22.

SME Fall Meeting and AIME World
Lead Zinc Symposium, Kiel Audi-
torium, St. Louis, Mo., Oct.
21-23.

8th Annual Reliability Engineering
& Management Institute, spon-
sored by Univ. of Ariz. and
General Electric Co., Tucson,
Ariz., Nov. 2-11.

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MANAGER, The MINES Magazine, Golden, Colo. 80401.

The MINES Magazine

Volume 60

September, 1970

Number 9

Front Cover

The MINES MAGAZINE is now being published each month in this com-
pletely new air conditioned building beautifully designed for efficient produc-
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in the vicinity of the Spa Motor Inn.

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DR. ARTHUR J. McNAIR, CLARI Project director, and Lynn Rubright, research staff member, inspect acetate overlay sheets compiled from quadrangle maps on land use features presently completed by the inventory project. Dr. McNair is a visiting professor at CSM's Basic Engineering Department from Cornell University, and Lynn Rubright is presently instructor in the Geography Department at Colorado State University.

Project CLARI on Schedule



DR. McNAIR COMPARES TRANSFERRED LAND-USE INFORMATION to the base reference Lamar Quadrangle map. The transferred data is then fed into CSM's computer for storage and recall at a later date for the total inventory of Colorado's land use and environmental resource. The project, granted by Colorado State Department of Natural Resources is planned for completion in March of 1971.

PROJECT CLARI (Colorado Land Use and Environmental Resource Inventory) which is presently under study on the Colorado School of Mines campus, is on schedule and planned for completion in March of 1971. The project was granted by the Colorado State Department of Natural Resources.

According to Dr. Arthur J. McNair, project director and visiting professor from Cornell University, the State of Colorado has been divided up into 2,837 "cells," each cell being 10 kilometers (approximately six miles) on a side.

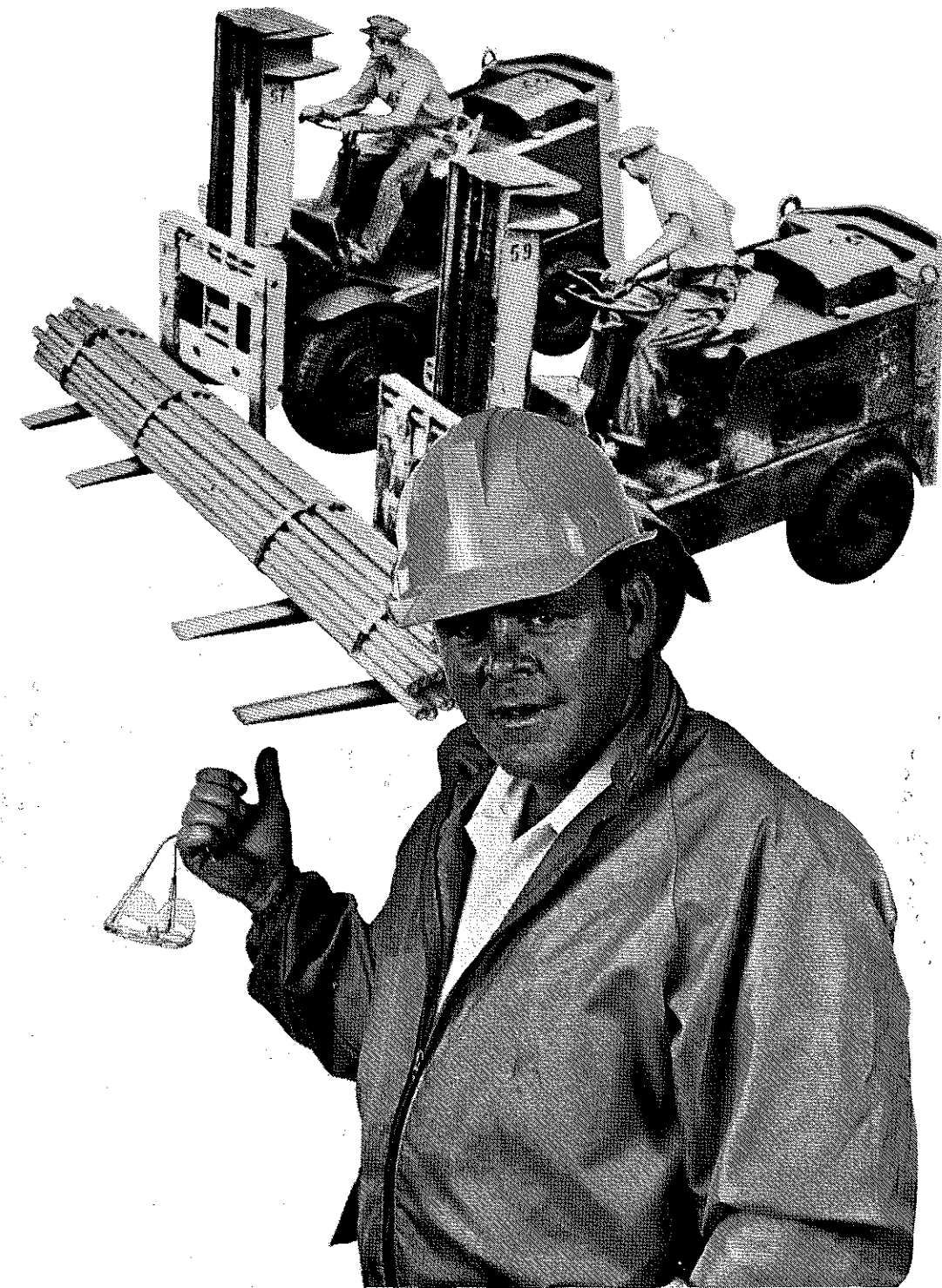
Within these "cells" over 180 land use and environmental resource items will be inventoried, under three major headings, 1) area and mass of the land being used, 2) linear features upon the surface, and 3) point data of small area or features but still necessary for the inventory.

With the use of quadrangle topographic maps, the CLARI project team has gathered and completed 30 individual land-use items from four of the 14 maps which cover Colorado. The four areas completed are the Lamar, Greeley, Pueblo, and Leadville quadrangle maps. Four other areas are presently under study which are the Vernal, Moab, Sterling, and Durango quadrangle maps.

In addition to the land use items, over two-thirds of the state's elevation and participation statistics have been gathered and over half of the state's linear features such as railroads, highways, pipelines, and lake and stream shorelines have been plotted.

In addition to the present reference data under study, letters have been forwarded to each of the state's county commissioners with supplementary data at this time ar-

(Continued on Page 6)



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Thomas Turchan Always Ready to Fight For American Selling Price*

I THINK the majority of elected officials are intelligent, vigorous and dedicated in reaching decisions."

But Thomas Turchan—the American Cyanamid vice-president (chemicals sector) who has just begun his third straight one-year term as president of the Synthetic Organic Chemical Manufacturers Assn. (SOCMA)—also thinks citizens and industries should be intelligent, vigorous and dedicated in giving those elected officials information they need to make good decisions.

Providing such information—aggressively and tenaciously—has become a major activity of Turchan, who is leading his industry's defense of the American Selling Price (ASP) customs valuation system, which Congress has been asked to repeal.

Important to U.S.: "It's not that we feel so strongly about ASP just because it's important to U.S. producers of benzenoid chemicals. We also believe the whole country can no longer make trade decisions on the basis of political or humanitarian considerations without reference to reciprocity, as we began doing after World War II, when it was acceptable and necessary. Today we're faced with a dangerous weakening of our international balance-of-payments position."

And so begins the logical and persuasive presentation Turchan has ticked off many, many times for business and civic groups and Congress.

This time the occasion is a private luncheon in a French restaurant in New York. The 58-year-old Turchan has arrived in a Cyanamid limousine from the company's Wayne, N.J., headquarters. He orders food knowledgeably, drinks coffee with it ("Easterners never do that, do they?") and spins tales of his childhood, youth, career and travels—with chuckles and almost total recall.

"My father was an itinerant coal miner. My parents left Czechoslovakia around 1900, stopped in Pittsburgh for a few years and then went West. I was born in Walsenburg, Colo., in an adobe house—my older sister was born in a coal camp tent. We settled down in Rock Springs, Wyo., where I went to school.

On the Way Up: A chance encounter with three geophysicists encouraged him to go to college—he had been driving a truck and working in a coal company store for three years after completing high school. In '35 he finished Colorado School of Mines with a degree in metallurgical engineering.

Project CLARI on Schedule

(Continued from Page 4)

riving from the state's 63 counties. Another mailing to all communities over 100 population requesting information related to the city's water and sewage plants, airport landing fields and other allied data are presently being prepared.

Once each specific item is completed the record or inventory is placed on the memory storage bank of the Colorado School of Mines computer for future recall. When a specific item is then requested from the computer, the read-out is in a data sheet or a map composed of the "cells." In addition, the read-out map may designate any area requested from state wide, to a specific county or group of "cells."

Dr. McNair has commented "the CLARI Project staff is now around 25, with the staff members composed of every educational background and from instructors in geography at CSU to graduate and undergraduate students from both local and national colleges and universities."



THOMAS P. TURCHAN, Met.E '35, who has been named general manager of American Cyanamid Company's Organic Chemical Division. Formerly general manager of Cyanamid's Industrial Chemicals Division, he has been with the company since 1952.

What followed was a string of jobs and tries at leasing mines. That sent him all over the globe—the Philippines, Ontario, England, and to British Guiana, where he joined Cyanamid in '52 as manager of its bauxite operation.

He married Lucille Bywater in '42. They now live in Rumson, N.J. A daughter lives with her husband in Chicago and does biology research. A son, Thomas Jr., was graduated from Yale, joined the marines, went to Vietnam, was wounded within a week, got malaria twice and is now at Harvard Business School.

"Am I proud of him! He's not like those long-haired demonstrators. He was ready and did his duty."

Thomas Sr. is ready to do his duty, too, which may be to testify further against repeal of ASP when new hearings on the trade bill begin in a month or two.

"We can go along with the bill, if ASP is kept out of it for separate treatment."

What does he think of a company that would keep quiet about repeal of ASP for a concession on oil or something else?

"One issue has nothing to do with the other, and each should be decided on its own merits. If any company should consider such an exchange, it would be short-sighted indeed."

"As for an alternative to ASP, it would have to be something worked out with care and objectivity before we could endorse it. Remember, Thomas was a doubter from way back."

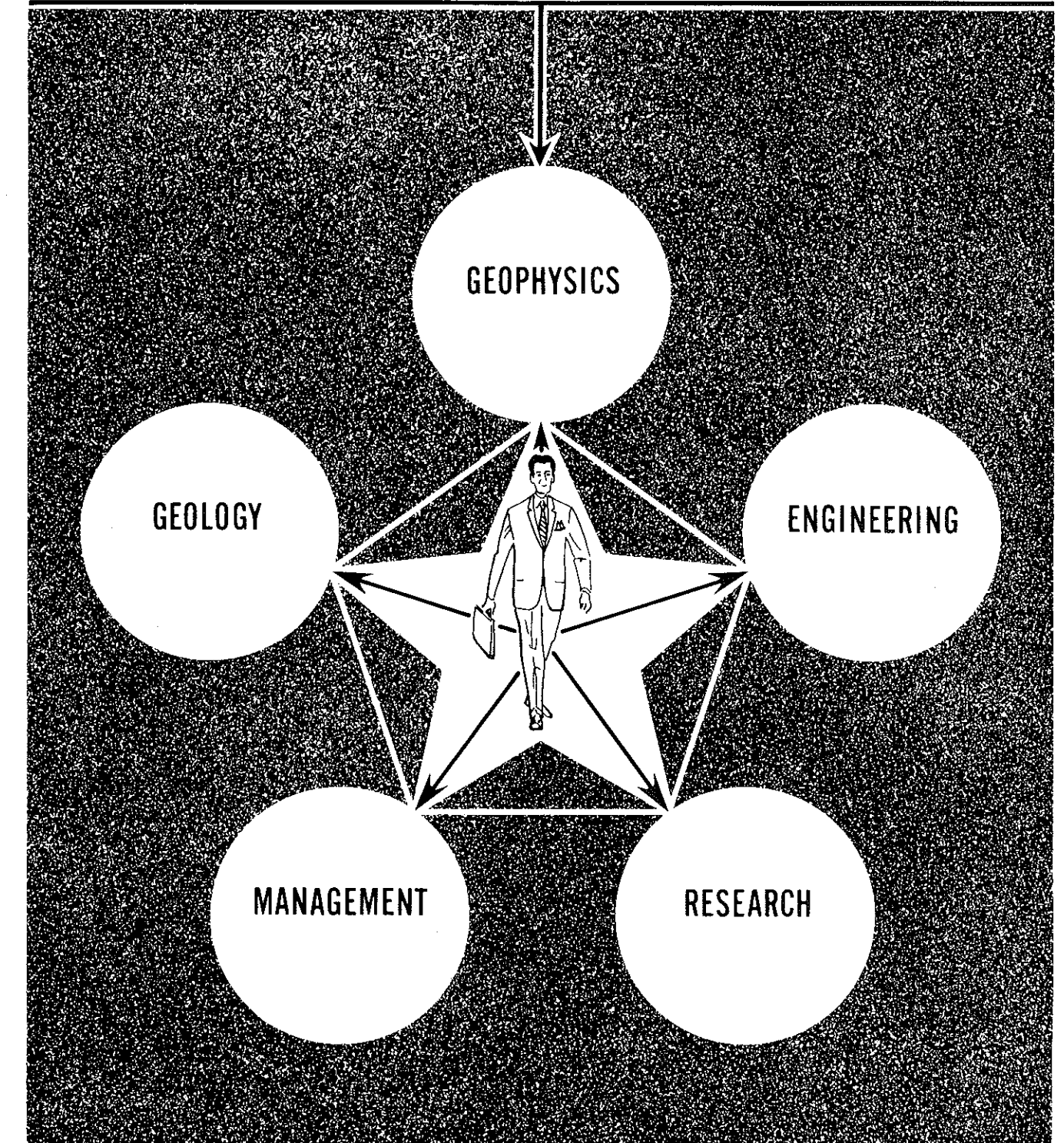
*Reprinted courtesy of Chemical Week, Feb. 4, 1970.

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structure as well as finishing and insulation of it is almost exclusively dependent upon portland cement, lime, gypsum, ceramics and all industrial minerals.

Unfortunately the entire minerals processing industry is accepted by the public as an activity without conscious thought—much like seeing or walking is to a person—until trouble signs appear. Then the industry attempts to use crash remedies instead of sensibly planned programs it should have had in effect all the time.

That's the situation today. The public—that's you and me as well—in spite of its own penchant for distributing garbage throughout the environment, is fed up with industrial pollution.

This pollution takes the form of smoke, dust, noise, unsightly surroundings, dumps, pits, health and safety problems. And probably more than anything else, it takes the form of destruction of the area we used to class as "out in the country to hunt, fish or commune."

The blame for this falls disproportionately on the mining and mineral processing industry. But in fairness, it hasn't done much to change this image. More often than not there are alterations in process, planning and, particularly, operating philosophy to reduce these disturbing factors. Often these can be done with little cost to

operations; sometimes an alert company can make a profit in the alteration.

For example, nearly every city and town has sand and gravel pits on the outskirts that have taken over what used to be the young hunter's haven—at least that's how it's remembered even if it was the city dump. Private property or not, it is now an area of unsafe ponds, unsafe high banks, and an unsightly criss-cross of roads. Proper planning in several cases now provides public recreation areas by replacing top soil, grading of banks, and layout of picnic areas. In the few areas in which this was done the result was a much needed city recreation area.

Company costs to do this were minimal, but their "image" was vastly improved. Not all operations can be handled as easily but the sorrowful part is that few operators are trying. Unless profit is our only god in life, we should never use the cliché, "not profitable."

Planning requires personnel oriented to these thoughts who are willing to experiment and plan. To get the specialists for this planning will require everything from company suggestion incentive plans to employing trained mineral industry engineers.

Trained personnel are in short supply but every company already has someone that can start the effort. Somehow it is necessary to reverse the processes of industrial apathy, public indignation and student non-involvement and convert them to industrial enthusiasm; public cooperation and student involvement.

The public's attitude toward pollution is adamant. Either operators in the mining industry will plan for the changed attitude or the economics of legislatively dictated crash programs and oppressive administration will close your business. Here is an attempt to detail some of the factors that should be considered, written from a vantage point in mineral industry education.—J. R. Hoskins.

*This is the introduction to an article written by J. R. HOSKINS (Head, Mining Engineering Dept., College of Mines, University of Idaho) for the Nov. 1969 issue of Mining Engineering.

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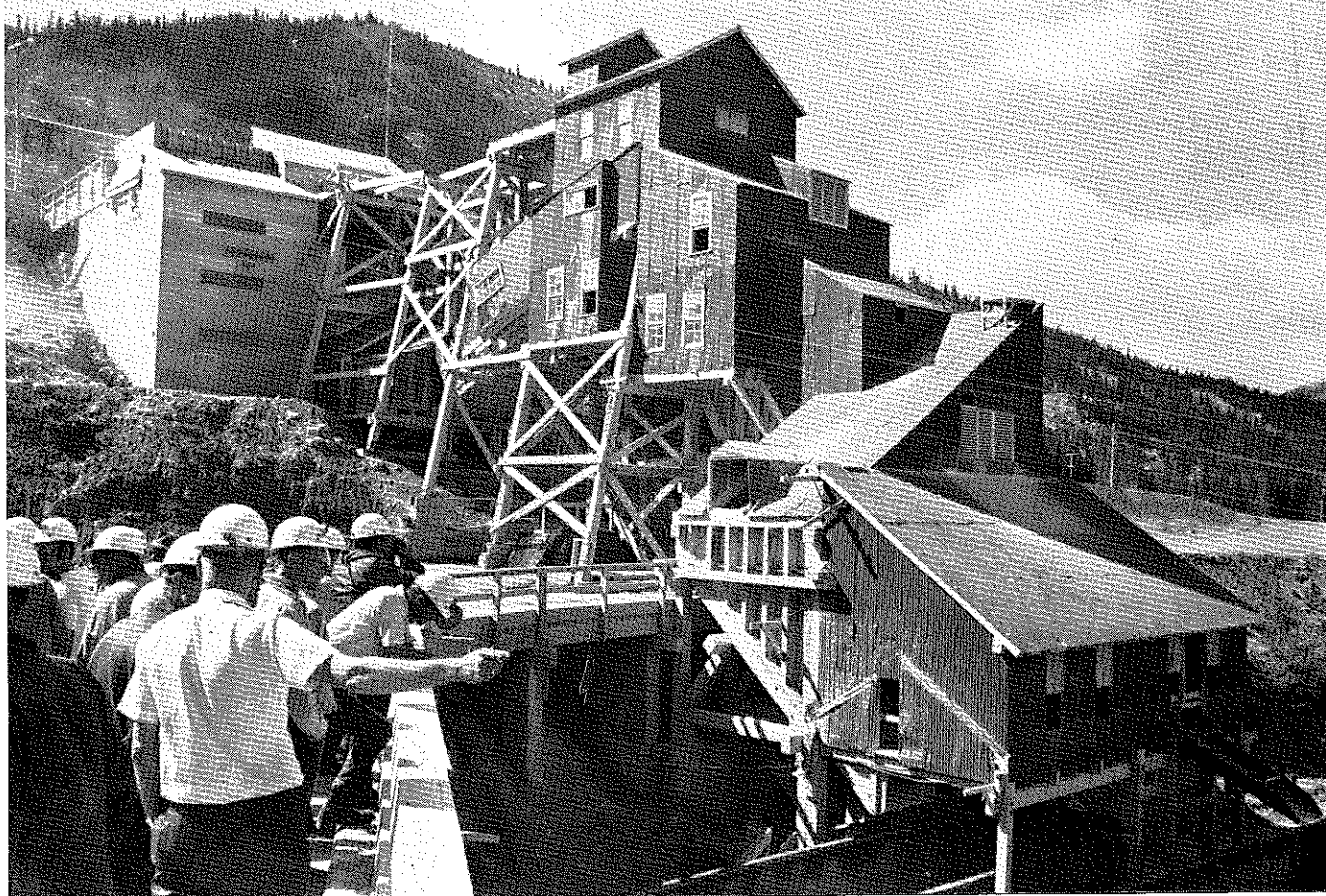
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COLORADO SECONDARY SCHOOL TEACHERS AND ADMINISTRATORS view the Monarch Quarry facilities for limestone prior to their tour of the CF&I Steel Corporation, Pueblo, where the quarry's limestone promotes the production of steel. A total of thirty-six students attended the six-week long course which included a one-week tour of the Colorado mining facilities. Expenses were furnished by the mining industry and the course was coordinated by the Colorado Mining Association and the Colorado School of Mines. The teachers received six-semester hours credit for their studies.

"Raw Materials Essential to Growth Of All Economic Systems"—Boyd

DR. JAMES BOYD, M.Sc. 1932, and D.Sc. 1934, chairman of the board of Copper Range Co., returned to the Colorado School of Mines where he served formerly as dean of faculty, to address a graduation luncheon July 17 of secondary school science teachers participating in the 1970 Field Summer Mining-Metallurgy Course, which was cosponsored by the Colorado School of Mines and the Colorado Mining Assn.

Dr. Boyd, who received master of science and doctor of science degrees from the Colorado School of Mines, told high school instructors that raw materials are fundamental to society and economic systems progress in relation to the availability of low-cost raw materials.

"Perhaps one of the most disconcerting phenomena of modern society, particularly in the United States," Dr. Boyd said, "is the small amount



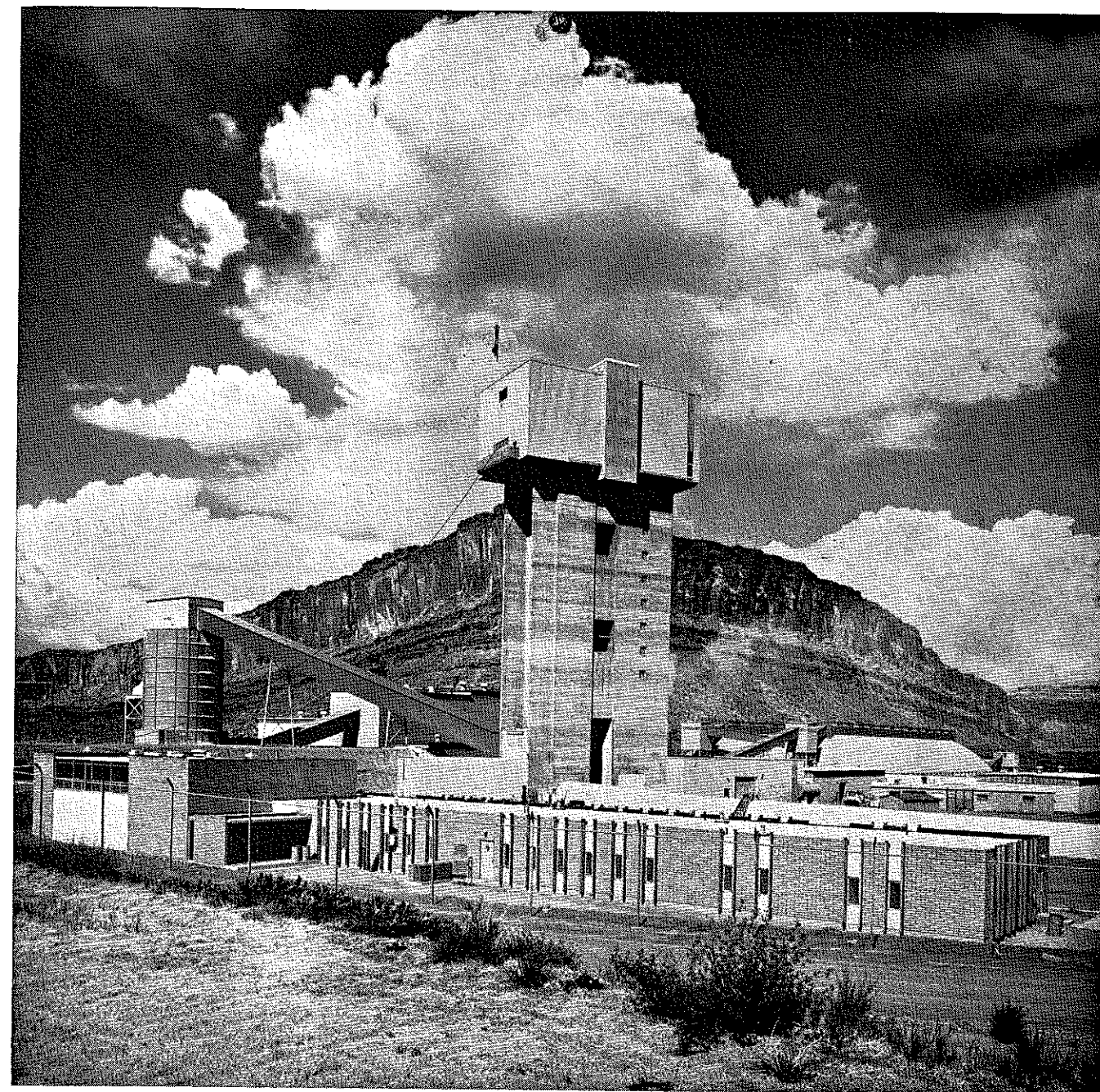
Dr. Boyd

of fundamental economics instilled into the students in our secondary schools, which permits some of them to go through college without a clear understanding of the very simplest principles of economics. To be able to understand the importance to society of science and engineering, it is essential that there be a clear concept of those principles.

"It has taken many generations for every nation that has reached an advanced stage of civilization to lift itself above the mere levels of subsistence. As long as a society depended upon muscle power to provide its food, shelter, and clothing, the people who constituted that society had to work from dawn to dusk every day of the week to eke out the simplest form of living. Man had to learn to supplement his muscle power with brain power, utilizing artificial energy and tools to convert materials into useful products.

"It was only when his productivity increased to permit him to provide beyond his immediate needs that he was able to find sufficient leisure time to permit him long enough periods for contemplation to conceive the development of a modern society. In such a society each member does for

(Continued on Page 12)



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Raw Materials Essential

(Continued from Page 10)

other individuals those things which he is best able to do in return for what they can do for him. This may sound like the simplest form of communism, but in a Democratic or Republican form of government, the stimulation for such services comes from incentives or rewards for hard work or imaginative mental processes.

"It is only as societies advance that it is necessary to create the fiscal and monetary mechanisms by which people trade their energies and create the incentives to do work beyond that required for immediate needs. Man therefore needs raw materials derived from the forests, farms, mines, oil wells, or seas, on which to expend his energies, supplemented by tools, to create something more rapidly than he would be able to do with his own hands.

"Raw materials, then, are the essential ingredients, or the fundamental building blocks, of all economic systems, and those economic systems grow in proportion to availability of raw materials at relatively low prices. It is the objective, then, of the people to whom you have been listening in the last few weeks, to provide raw materials in abundance at the lowest possible cost. The lower the cost, the more plentiful can be the products available to those who need or want them. The mineral producers contribute materially to the well being of man and to lifting humanity from the grinding poverty of mere subsistence.

"I am sure that you have learned here the excitement involved in the search for places in the earth's crust where nature has concentrated raw materials in sufficient quantities to permit them to be extracted at a profit. You have learned of the interest and stimulation of being able to extract these materials cheaply and in large quantities. You have heard the metallurgists tell how they find the best possible use for these materials.

"I have a son who is engaged in fundamental research—admittedly not in the materials field as his father is, but in biochemistry. He obviously did not get from me the stimulation to enter this field. I know it was the enthusiasm of his high school science teacher which motivated him to go into this highly important field, in which he is happily and busily engaged as a professor at the University of California.

"We, in the mineral industries, and our associates who have come here to lecture you in these past few weeks, similarly hope that we have communicated to you our enthusiasm for our industry—the feeling of usefulness which comes over us as we engage in our daily activities. We

World's Largest Metallurgical Gas-Based Sulphuric Acid Plant

PLANS are well advanced to build the largest metallurgical gas-based sulphuric acid plant in the world at Copper Cliff, Ontario, in the heart of Canada's nickel belt.

The new plant is to be entirely financed by Inco at a cost approaching \$20,000,000. It is being undertaken, coincidentally with expansion of the iron ore recovery plant and the construction of a new nickel refinery here, to eliminate the iron ore recovery plant complex as a potential source of air pollution, not only from sulphur dioxide, but also from dust. All dust must be removed as a prerequisite to sulphuric acid production.

The sulphuric acid plant is part of an environmental control program costing about \$40,000,000, which is being undertaken by International Nickel in the Sudbury area. In another phase of the program, a 1,250-foot-high stack, with associated precipitation equipment, is being constructed in Copper Cliff at a cost of \$15,000,000.

The plant will have a production capacity of 2,300 tons of sulphuric acid a day, and will be built as an adjunct to CIL's present sulphuric acid complex. The fourth plant in the complex, the new installation will increase production of sulphuric acid from Inco smelter gases at Copper Cliff to a total of 5,000 tons per day.

Canadian Industries Limited has started engineering of the new project, but tenders have not yet been called and no contracts have been

trust that you will be able to stimulate and motivate the next generation to follow in our footsteps in providing the necessary brain power to undertake the difficult task of providing raw materials in ever increasing quantities. Society is constantly expanding—not only in numbers but in needs. If all members are to live a relatively comfortable life, society will need raw materials, and also the brain power to produce and use them.

"For myself, I fell 75 feet into a mine shaft when I was three years old (some of you may wish I had stayed there), but from that day to this my life has been exciting and interesting. If I have made the smallest contribution in supplying raw materials to a society that begins with them, then I have perhaps made the world a little better for my having been there. In this you can share by conveying that commitment to those who must follow us in the future. I hope you will return to your class-

rooms with the enthusiasm I am sure has been generated by my associates in the industry."

awarded. Completion is scheduled for the second half of 1972. Markets for the output of the new plant will be largely in the export field, and the operation will include a number of strategically placed distribution depots to be built at an additional cost. These will be serviced from Copper Cliff by unit trains. At least one of the depots will be on tide water, giving year-round access by sea to world markets.

CIL inaugurated in 1967 the first unit-train shuttle service to transport sulphuric acid from the Copper Cliff works, and this service will also be utilized in connection with the new plant.

A pioneer in Canada in the production of sulphuric acid and liquid sulphur dioxide from sulphur-bearing gases, CIL completed its first unit on the Inco site to manufacture acid from this raw material in 1930. Since that time, recovery of sulphur values from Inco's smelter gases has been expanded at an ever-increasing rate.

Manufacture of liquid sulphur dioxide began on the Inco site in 1952. Sulphuric acid operations there were expanded in 1957, 1963, and 1967. The plant that came into production in 1967 with a capacity of 1,400 tons per day was at that time the largest of its kind in the world. In contrast, the new plant will have a daily capacity of 2,300 tons. This steady expansion is the result of collaboration between Inco and CIL and a continuous program of process development and marketing and distribution innovation.

The 32 high school science teachers taking the six week course entitled, "A Total Concept of the Mining Industry," received six-semester credit hours which may be applied towards credits required for a graduate degree or renewal and reinstatement of earth science and administrative teaching certificates. As a part of the course the teachers took an extensive five-day 1,000 mile field trip through the mining areas of Colorado. The most spectacular trip within the mines was through the Idarado Mine, where the group traveled a total of five and one-half miles through a mountain. Entering at a level 1200 feet below the top of the mountain and then passing through mine shafts to a depth of 2900 feet below the surface, the group was able to avoid a 64-mile trip around the mountains by highway.

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Sure — Business Can Survive, But —

By Norman V. Lovett*

THERE is no question that business—the life blood of American enterprise can survive—if business leaders, government bureaucrats, labor officers and academic professionals are only interested in its mere survival. The real question is not can it survive, but whether free enterprise will survive, prosper and grow.

Only businessmen can answer this latter question, because if business is to enhance its position in the world—business leaders will have to change. These required changes may be in management style, personal value systems, commitment to purpose and/or philosophy of operations. Whatever is needed in the manner of individual change, we can rest assured there will be change. It follows then, that the response to the question of business survival rests squarely on the shoulders of people. The persons who are most totally involved in business must determine just how strong their individual desires are for business to be truly the dynamic vital entity that it can and should be. Positive changes that will be required, and are already overdue, cover a number of responsibilities and activities.

Human Resources—must be recognized by word, act and deed to be "the most important asset" of any firm or organization. While in many instances this fact is acknowledged and given some lip service—it now must be employed, maintained, developed, rewarded, respected, and accounted for. Recognizing the human resources factor at its true and honest value, must certainly come more clearly into focus when one understands what businesses really are. Business enterprises exist for **people**, are used by **people**, and in last analysis, are **people**. **People** are the customers, the employees, the suppliers, and the servicers.

Sorting through the real factors in business — men, money, materials, time and space, men stand out as the only animate element. All other elements can only be identified as func-

tions of people, because in themselves they have no capacity to create, render judgment, plan, move, produce or reproduce themselves.

We must conclude that people are the most important asset and as they think, develop, are capable of performing and are organized rests the future of business. This realization is the beginning of needed change.

I suggest that to implement this change in philosophy and perspective we should start with understanding that man is a unique entity requiring individualized consideration and as such presents many problems and challenges. Man's worth in business will be recognized only when the human asset is individually accounted for on the balance sheet. When corporate presidents and profit center managers are made responsible and accountable for all the assets entrusted to them, will the vital human resource be respected for its contribution. Therefore, capitalizing man and recording him on the balance sheet as a "capital asset" is the direction and a reasonable goal. When this goal is achieved management will be able to do a proper business planning job and render more meaningful decisions. The people impact on business effectiveness will be more fully realized.

Fortunately today, it is encouraging to find that some progress is being made in accounting for manpower.^{1,2}

Planning—must become a sophisticated disciplined way of business life. We are constantly reminded that things today are different than they were a year or decade ago. We can assume, in fact we can be assured, that things will be different in the future. Reflecting on this truism we have but two alternatives to follow. Change will occur and we can react to it or preferably we can be leaders and cause the changes to occur within our control and within a favorable time span. Reacting to change is like playing catch-up which is a losing proposition, at best.

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To add a dimension to planning in addition to the usual marketing, product, financial, capital assets, real estate and facilities—we must consider human resources. If planning only considers the inanimate elements, total success of goal achievement is not possible. A system for acquiring, placing, developing, promoting, motivating, rewarding, and involving people to enhance their asset worth and to obtain a maximum performance return must be created and implemented.

Planning and then implementing the human resource changes, the requirement for increasing human resource value and involving the human resource to the maximum of its value is essential for the future.

Organization—structures must stimulate a total return in excess of the individual inputs. Each individual is a unique entity—no two people have the same physical, emotional, intellectual, mental, or motivational characteristics to the same degree and in the same relationship. So it seems that the traditional military line-staff groupings of people, which is followed by most businesses, may not be the linkage which will mold individual resources together to accomplish stated objectives. Organization style must be flexible, changeable and dynamic, for it is the framework of the environment. The environment caused by the organization type can be stifling to outstanding performance.

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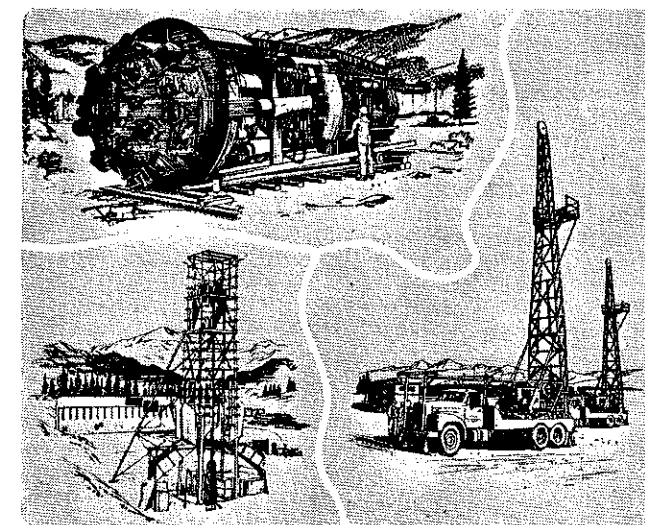
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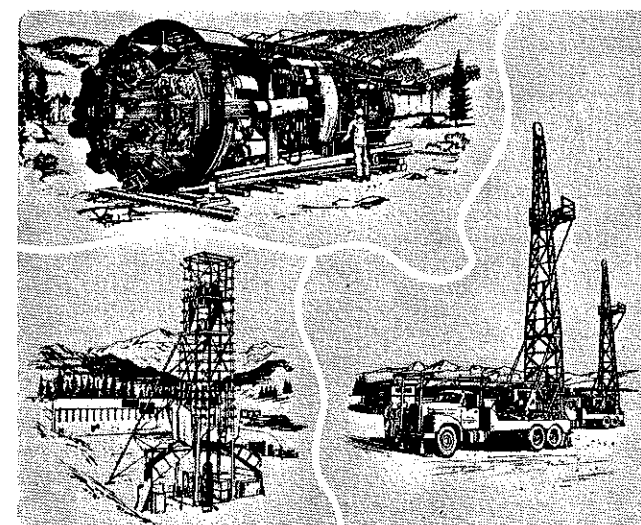
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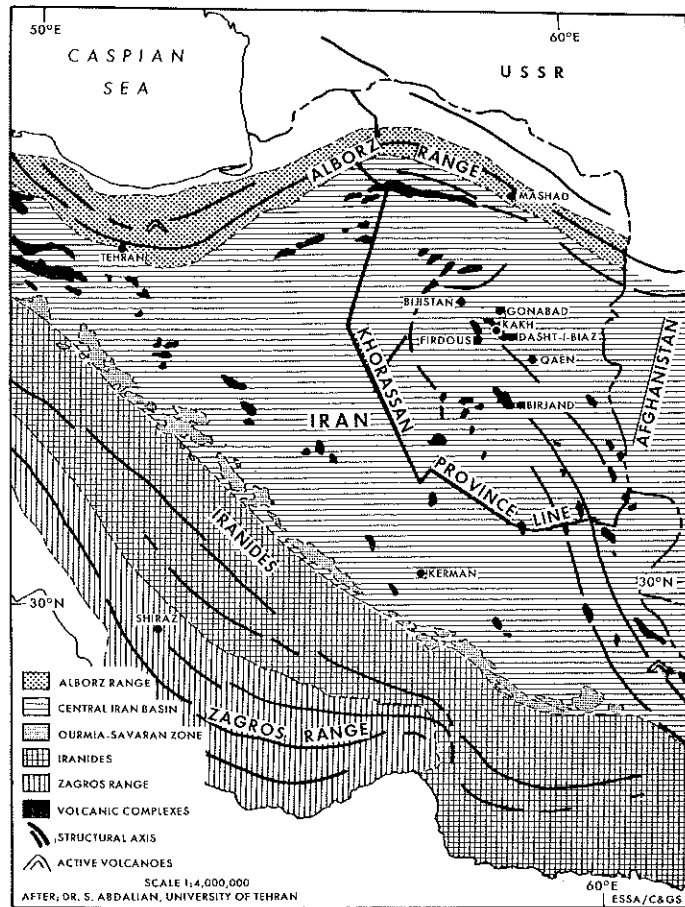
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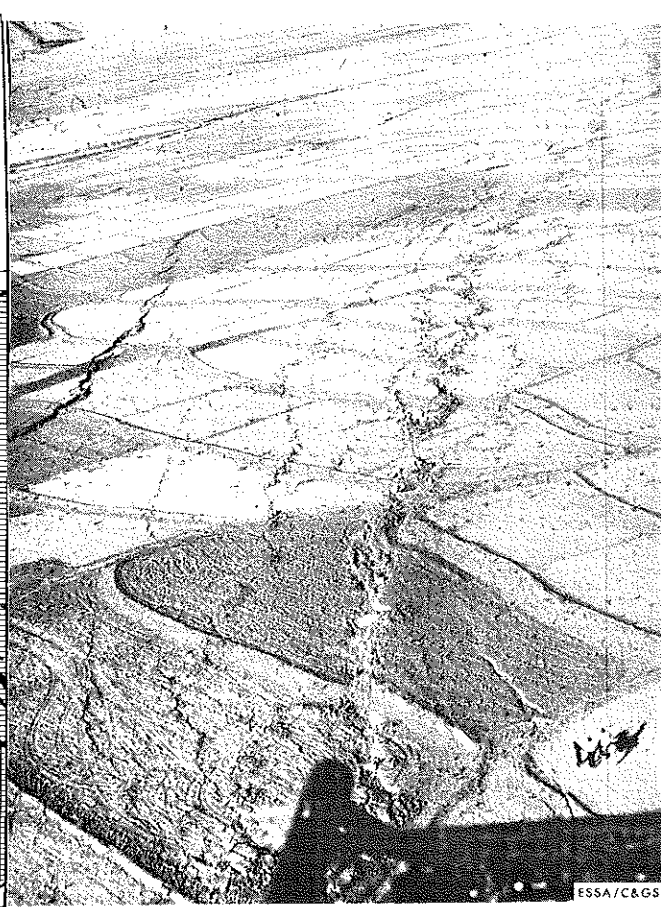
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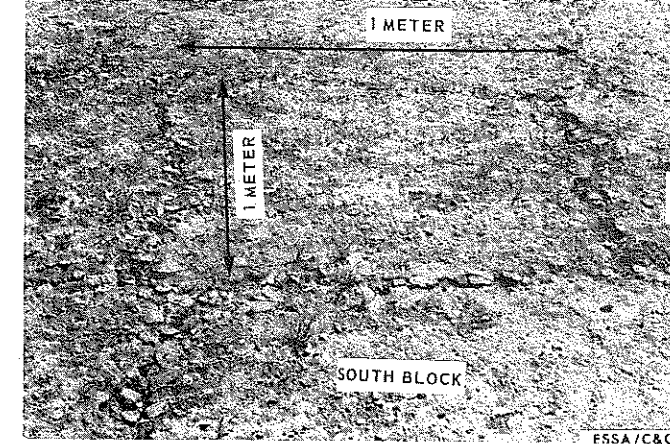
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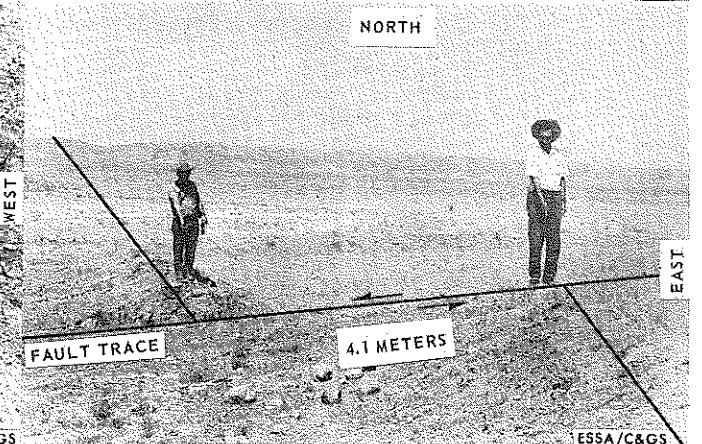
Geologic-tectonic map of northeast Iran.



Surface faulting in the basin, as seen from an aerial view looking west. North is to the right.



Tension cracks and pressure ridges east of Dasht-i-Biaz.



Maximum lateral fault movement measured east of Dasht-i-Biaz.

phic rocks, and is overlain with continental deposits of Devonian to Oligocene age.

The Ourmia-Savaran zone borders the central Iran region on the south. It represents a thin, elongated zone of great tectonic movement and manifests itself as an area of intensive eruptive and volcanic extrusives. Great thicknesses of volcanic rocks and typical cones may be observed. These volcanic manifestations occurred from Upper Cretaceous age to the present. This tectonic zone is the result of major vertical movement along the edge of a continental basin which underwent great orogenic processes.

(For those interested in more details of Iranian geology, a suggested reference is "Geological Map of Iran, 1:2,500,000 with Explanatory Notes" published by the National Iranian Oil Co. in 1959.)

Surficial Effects Associated with the Dasht-i-Biaz Shocks.—The primary geological effect of the earthquake was a zone of faulting that developed along an old Cretaceous-Jurassic fault. Offset streams and scarps in alluvium outline this previously mapped fault, and indicate it has been active in recent time.

The fresh surface fracture extends continuously from the east flank of the Kuh-i-Siah Range, easterly into the salt desert of Quaternary and recent deposition. (See Figure 2). An en-echelon fault pattern was observed in alluvium and colluvial deposits. On the west extension of the fault, slickensides were observed in rock as the trace passed through zones of breccia. Orientation of the slickensides was not determined. Pressure ridges, mole tracks, and tension cracks (See Figure 3) are indicative of strong lateral movement in alluvial deposits.

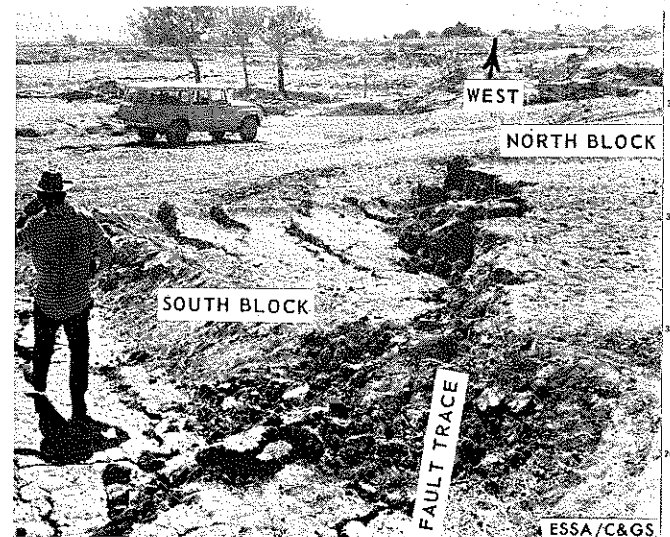
The maximum displacement observed on the strike-slip fault was left-lateral at a point approximately 1½ kilometers east of Dasht-i-Biaz. Here, earthen dikes crossing the fault zone were offset 4.1 meters (See Figure 4). West of Dasht-i-Biaz the south side of the fault appeared to have dropped approximately 1 meter relative to the north side (See Figure 5). On the east end of the fault the apparent vertical displacement may be reversed to a lesser degree. It was difficult to separate true vertical displacement from slumping and settling as a result of lateral displacement.

The fault varied from a single irregular fissure to a fracture zone 100 meters (330 feet) wide in the Dasht-i-Biaz vicinity where numerous tension cracks were evident. Approximately 2 kilometers southwest of the village of Dasht-i-Biaz the fault bifurcates. The main branch continues generally westward in the direction of Firdous, and the less prominent rupture can be traced 2 kilometers toward the northwest.

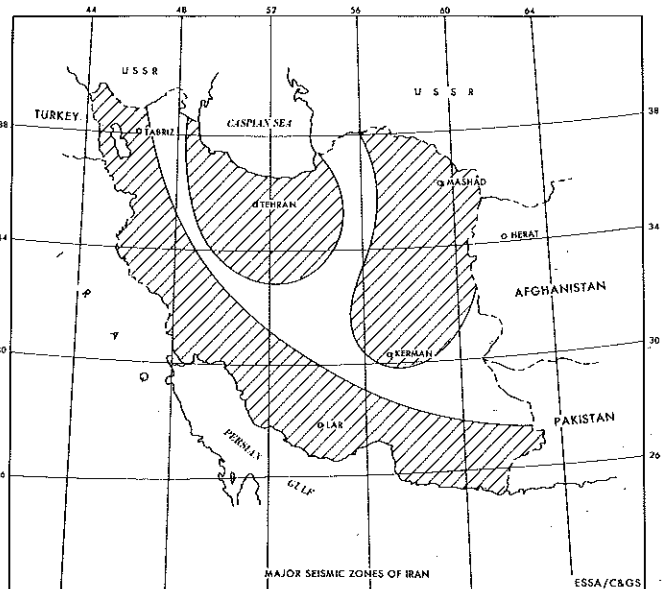
Extrapolation of the two fault branches, west toward Baghan and northwest to the north on the other leg toward Kakh, could account for the severe damage in these two areas. However, it should be pointed out that there was no visible surface evidence of faulting in these areas.

Progressing easterly, the fault cuts through an agricultural region where there are few roads and no settlements of significance. The measured fault length was 25 kilometers. Inaccessibility by vehicle off the west end of the surface fault and a time limitation factor curtailed a more complete analysis of possible fault extensions, both to the west and east.

Tocher (1958) has shown a relationship between fault length, L (measured in kilometers), and magnitude M_s :



Maximum vertical fault movement measured west of Dasht-i-Biaz.



Major seismic zones of Iran.

AN INVESTIGATION OF

Dasht-i-Biaz, Iran Earthquake

By Kenneth C. Bayer¹

On Aug. 31, 1968 at 10:47:37.4 G.M.T., the Khorassan Province of northeastern Iran was shaken by one of the most destructive earthquakes in Iranian history. The epicenter of the earthquake was about 250 kilometers south-southwest of Mashad, approximately 10 kilometers east of the measured surface fault. Its magnitude (M_s) was 7.3. A field investigation revealed that a number of villages were extensively damaged or destroyed, resulting in about 10,000 fatalities and 60,000 homeless residents.

Surface fractures were noted in several areas. Maximum horizontal displacement was a left-lateral movement of 4.1 meters east of Dasht-i-Biaz. The measured fault length was 25 kilometers. Inaccessibility to part of the area and a time limitation factor curtailed a more complete analysis of the possible fault extensions, both to the west and east.

The extensive property damage is attributed principally to poor construction in the region. However, the location of some of the villages on alluvium with a shallow water table was a contributing factor in some instances.

In particular, this paper analyzes the regional intensities, the effects on local structures, and the fresh surface faulting phenomenon resulting from the earthquake. Also presented are the results of the investigations on the temporal, spatial, and magnitude characteristics of all recorded seismic activity, before, after, and including the major event.

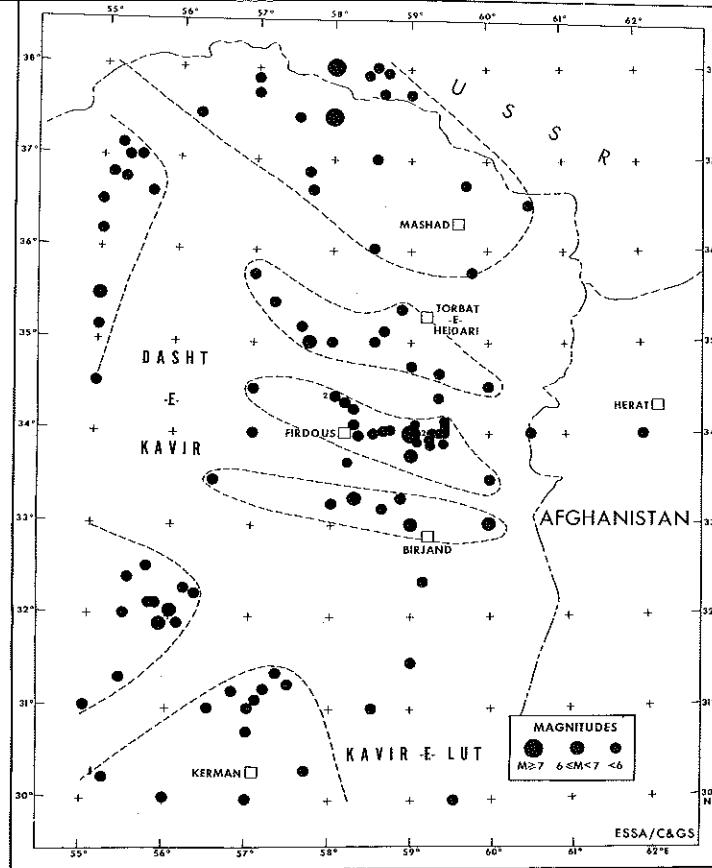
GEOLOGIC SETTING

THE DASHT-I-BIAZ EARTHQUAKE of Aug. 31, 1968, occurred in the high central plateau region of east-central Iran (See Figure 1). This region of central Iran constitutes a continental basin environment and is relative-

ly stable compared to the adjacent tectonic unit (Abdalian, 1962). Devonian to recent continental deposits are found throughout this region of low relief. Metamorphic formations are lacking; however, volcanic eruptive complexes of Upper Cretaceous to Miocene age are scattered throughout this region.

The Alborz Range of the great Alpid Belt borders the central Iran region to the north. This range constitutes a basement complex of Precambrian igneous and metamor-

¹Environmental Science Services Administration, Coast and Geodetic Survey, Rockville, Maryland 20852
²Faculty of Engineering, Kabul University, Kabul, Afghanistan
³Department of Mechanical and Aerospace Engineering, Illinois Institute of Technology, Chicago, Ill.



Seismicity map of northeast Iran, 1900 to October 1, 1968.

Tocher (1958) has shown a relationship between fault length, L (measured in kilometers), and magnitude M_s :
 $M_s = 5.65 + 0.98 \log_{10} L$

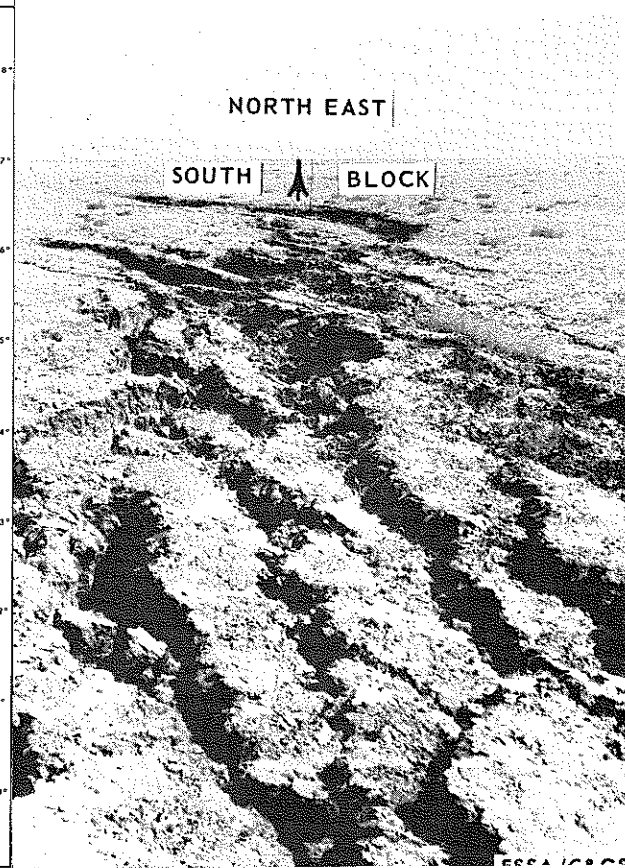
For our measured length, $L = 25$ kilometers. The magnitude equivalent is 6.9, or 0.4 magnitude unit lower than the C&GS value. Tocher (op. cit.) cited the fact that different geological regions may very well have different relationships. It may, in this case, indicate that the fault length was not completely traced and that the figure is low by a factor of 2 to 3, or, that the fracture length relates to depth of hypocenter, crustal material, etc.

Aftershock activity extended east of $59^{\circ}15'E$. Mokaram and nearby villages sustained moderately severe damage. Spectacular en-echelon fissures opened in the alluvial plain west of Salaiani and south of the main fault. This fissure pattern was approximately $N 30^{\circ} E$ and extended into the village (See Figure 6). Due to a shallow water table, water flowed from the fissures in this region.

SEISMIC HISTORY

Iran occupies an active section of the Alpidic seismic belt and is subject to frequent shallow earthquakes. These occur in three fairly well-defined zones (See Figure 7): (1) The most extensive zone is a strip roughly 100 kilometers wide abutting the Turkish and Iraq borders. It runs east, parallel to the Persian Gulf, to Pakistan; (2) a zone in north-central Iran below the Caspian Sea, which includes the disastrous Buyin-Zahra earthquake in 1962; and (3) the Khorassan zone of northeast Iran, which includes the region affected by the Aug. 31, 1968, earthquake.

Ambrasseys (1961) reports that seismic activity has persisted in northeastern Iran since ancient times and has documented devastating earthquakes in the Khorassan Province as early as 818 A.D. Figure 8 depicts the seismicity of the region within coordinates 55° to 62° east and 30° to 38° north, based on a search of the C&GS magnetic tape file of epicenters. This file contains all instrumentally located earthquakes since 1900 which have been reported in the standard references (Gutenberg and Richter, 1949; B.C.I.S.; and I.S.S.) and the C&GS files. Out of a total of 106 events which have been plotted Figure 8, only 14 occurred during the 1900-1949 time span; the remaining 92 represent activity in the last 19 years. It should not be



Fault fissures west of Salaiani, south of the main fault.

assumed that the increase in number of events recorded corresponds to an increase in frequency of occurrence. It is probably due to more efficient monitoring, using lower magnitude threshold, of seismic activity in remote regions.

The epicenters plotted in Figure 9 show a pattern which loosely correlates with faulting delineated in the Annual Iranian National Reports (1961, 1963-65). The epicenter of the Aug. 31 earthquake lies along the trace of a known fault between Firdous and Birjand.

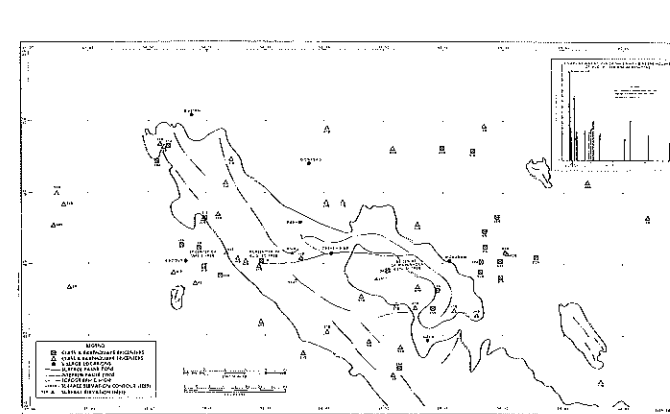
A search through the C&GS data file did not reveal any major earthquake of Class B (7.0 is equal to or less than M is equal to or less than 7.7), in the Firdous-Birjand area prior to the Aug. 31 event. However, the frequency of moderate shocks of the Class C type (6.0 is equal to or less than M is equal to or less than 6.9) are to be expected. Thirteen events were recorded as Class C since 1936 or one approximately every $2\frac{1}{2}$ years.

In many ways the Aug. 31, 1968, earthquake was similar to the devastating earthquake of magnitude $7\frac{1}{4}$ which centered 125 kilometers west of Tehran on Sept. 1, 1962. The felt regions have nearly the same areal extent, but occupy quite different areas of the country. (Figure 10). Both earthquakes were shallow and accompanied by fresh faulting on well-known fractures. The fault line in each case extended in a nearly east-west direction with the same type of horizontal movement (left-lateral, i.e., the north block moved to the west or left). The observed and projected length of the 1962 fault is equivalent to the length of the 1968 fault; however, the horizontal displacements of the latter were greater. At some points, displacements of over 4 meters were measured compared to the reported 2-meter displacement in 1962 (Report on the Great Buyin-Zahra Earthquake of Sept. 1, 1962). In 1963, the loss of life was placed at 10,000 which approximates the number killed by the 1968 Dasht-i-Biaz earthquake. Adobe-type construction was common to both affected areas, and this was the major reason for the large number of fatalities.

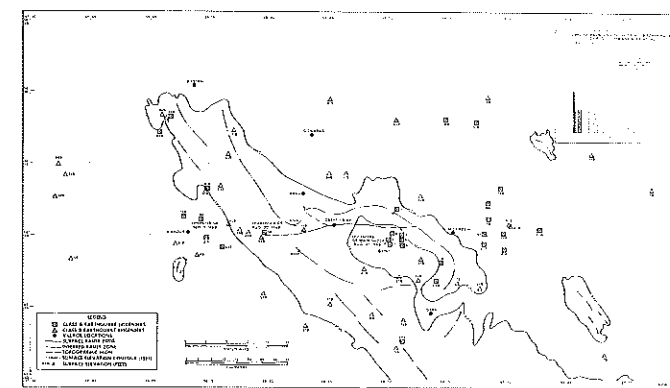
CURRENT SEISMICITY

Earthquake activity associated with the Aug. 31 shock is discussed in two parts:

a) **Class A Earthquakes:** Within this category a standard hypocenter solution for the earthquake and recorded



Map of computed epicenters, August 30 to October 1, 1968.



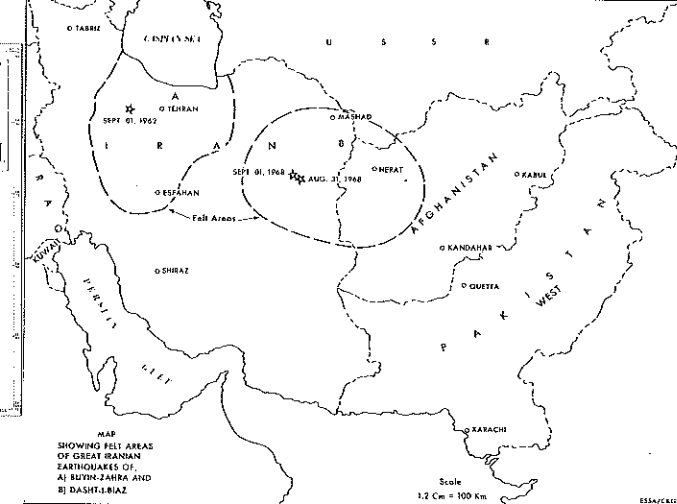
Various epicenters as computed from the main earthquake of August 31, 1968.

foreshock and aftershocks have been determined. Focal depths followed by an R were artificially restrained to the listed value during computer processing. Magnitude refers to estimates of average surface-wave magnitude (M_s) and mean body-wave magnitude (M_b). Twenty-two earthquakes, based on a minimum of five station arrivals, are plotted on Figure 9.

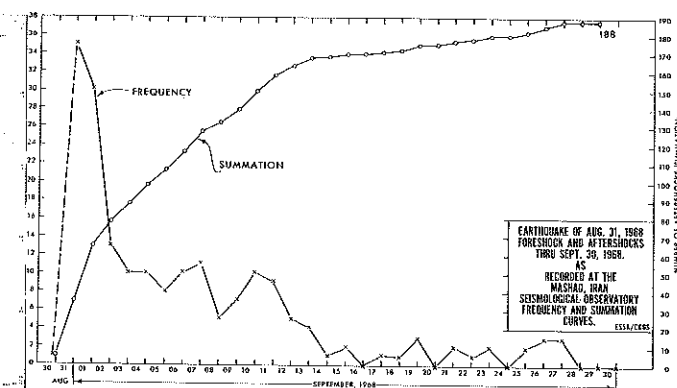
b) **Class B Earthquakes:** In this classification aftershocks were determined using less than five station arrivals. The S-P time for the WWNSS at Mashad was used in each of the 40 locations (See Figure 9) to give the computer an origin time for the initial iterration. Only two shocks were depth restrained to 15 kilometers. The standard Jeffreys-Bullen travel times (Jeffreys-Bullen, 1940) were used. Data from Kabul, Afghanistan at approximately 9° was the most distant station used.

The space-time distribution of the computed epicenters (See Figure 9) shows some intriguing features. The epicenter of the foreshock is located approximately 15 kilometers west of the measured surface fault, and the epicenter of the principal event lies approximately 10 kilometers east of the fresh strike-slip movement along a previously mapped fault. Considering the more reliable Class A aftershock activity; the first three aftershocks of the main earthquake followed at hourly intervals and were located east of the main epicenter beyond the zone of visible surface faulting. On the following day a magnitude 6.3 aftershock, located 90 kilometers west of the main epicenter and possibly centered beyond the limit of initial rupture on the fault, virtually destroyed the town Firdous. Aftershocks throughout Sept. 1 were concentrated off the west extension of the fault zone in the Firdous area. The center of aftershock activity, then, apparently shifted back to the eastern portion of the strained region at 34° north latitude and $59^{\circ}30'$ east longitude.

Six hypocenter solutions were made of the principal event of Aug. 31, 1968, using various groups of input data.



Map showing felt areas of the great Iranian earthquakes of (A) Buyin-Zahra and (B) Dasht-i-Biaz.



Foreshock, principal event, and aftershocks, as recorded at the Mashad Observatory, August 30 to October 1, 1968.

All P data with residuals of ± 6.0 seconds were removed from the input data through a previous analysis. The station data from Mashad, Iran and Ashkhabad, USSR, at 2.3° and 3.9° , respectively, were used in all solutions to monitor the residual times at close-in distances.

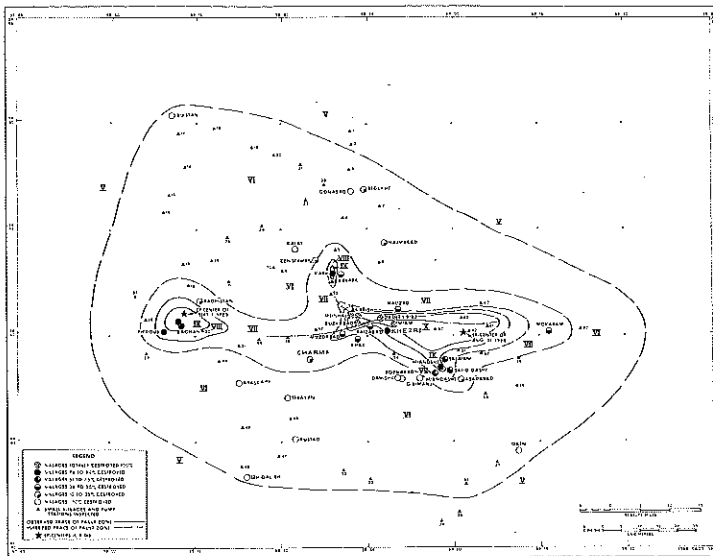
Solution 1: P data were used from all distances and the program solution was free to compute. A total of 121 stations were used, with a standard deviation of 2.1. This is the most unsatisfactory solution, in that the relatively fast USSR travel times forced the location too far to the north, or approximately 10 kilometers north of the center of the other five solutions and away from the fault zone.

Solution 2: P data were restrained in the 5° to 20° distance range and the program solution again was free to compute. A total of 105 stations were used, with a standard deviation of 2.3. This epicenter is 12 kilometers south and west of Solution 1, placing the epicenter approximately 7 kilometers southeast of the surface fault.

Solution 3: P data were restrained in the 5° to 30° distance range and the program solution was free to compute. Ninety-five stations were used, with a standard deviation of 2.3. This epicenter is 10 kilometers south of Solution 1 and 11 kilometers east-south-east of the surface fault. All three solutions computed above the datum plane and as a result were restrained by the machine and placed at normal depth.

Solution 4: P data were restrained in the 5° to 20° distance range. Forty-nine relatively late stations were additionally restrained. Their average residual was 3.3 seconds. Fifty-one stations were used in this computation, with a standard deviation of 1.3. The depth computation was 32 kilometers. The epicentral location is 10 kilometers south-southwest of Solution 1, and 7 kilometers east-south-east of the surface fault.

Solution 5: P data were restrained in the 5° to 20° distance range. Seventeen relatively late stations were added to the program, leaving 32 of the 49 from Solution 4 re-



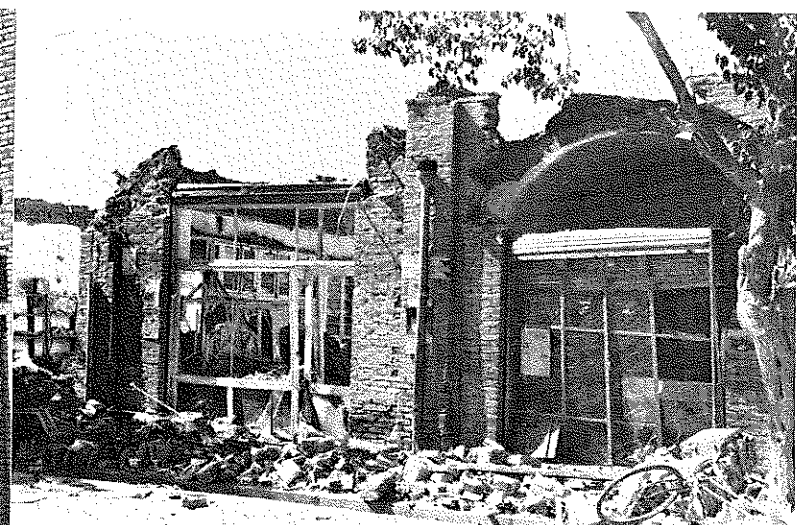
Isoseismal map of the Dasht-i-Biaz earthquake of August 31, 1968, and aftershocks. Percentage of destruction is shown according to the legend.



Destroyed home near the Muslim Shrine in Kakh.



Two-story building damage in Firdous.



Single-story building damage in Firdous.

strained. Their average residual was 3.5 seconds. Sixty-eight stations were used in the computation with a standard deviation of 1.4. The epicentral location is 14 kilometers south of Solution 1 and 13 kilometers southeast of the surface fault. Focal depth is 18 kilometers.

Solution 6: P data were again restrained in the 5° to 20° distance range. Twenty-two relatively late stations were additionally restrained, with an average residual of 3.6 seconds. The total number of stations used was 79, with a standard deviation of 1.6. This epicenter is 12 kilometers south of Solution 1 and 9 kilometers southeast of the surface fault. Focal depth computed above the datum plan and was restrained by the machine to normal depth.

Solutions 1, 2, and 3 are standard hypocenter determinations. Solutions 4, 5, and 6 are refinements exercised toward obtaining a better understanding of space and time characteristics. The C&GS reported epicenter is plotted as No. 7 (Figure 11). The standard deviations decreased from 2.2 seconds to an average of 1.4 seconds. Exclusive of Solution 1, all epicenters were located within a circle of 1.6 kilometer radius (Figure 11). Further analysis could be attempted using station corrections and additional study of seismograms in selected areas.

The foreshock of Aug. 30, 1968, with five station readings, is listed as a Class A earthquake. Depth was restrained to 15 kilometers with azimuthal control of only 180°. The location of the foreshock is shown in Figures 9 and 11.

An estimate of aftershock activity was obtained from a study of the WWNSS station at Mashad. This station, at 2.4° (267 kilometers) from the center of activity, has short-period instruments operating at a gain of 12,500 at one cycle per second. Using S-P time, a numerical count of the local events was tabulated and plotted in Figure 12.

An analysis of the Mashad seismograms indicates that most of the aftershock activity occurred during a two-week period following the main earthquake. During the first three days an average of 26 events occurred daily. A daily average of 10 occurred during the remainder of the two-week period. During the last weeks of September the frequency of aftershocks decreased to a fairly uniform rate of two events each day. Although each area must have its own elastic rebound criteria, it is proposed that aftershock studies be made as soon as possible after the occurrence of a large earthquake. Instrumental studies initiated after a two-week period may only be measuring a level near the background seismicity of the region.

NOTES ON CONSTRUCTION OF AN ISOSEISMAL MAP
The principal product of the field investigation, the isoseismal map (Figure 13), is based on the Modified Mercalli Intensity Scale. The map represents the collective effects of the Aug. 30 foreshock, the Aug. 31 earthquake,

and its aftershocks. However, no attempt has been made to assign intensities to individual shocks. In other words, the map is a measure of the integrated damage caused by a magnitude 7.3 earthquake, one foreshock, and corresponding aftershocks.

Over 40 major villages were inspected and the earthquake effects evaluated prior to leveling and cleanup work by bulldozers in the area. Some streets had been made passable by heavy road equipment, but villages were still untouched by these machines and remained deserted as we progressed with our analysis. In addition, 60 single-family settlements, pump stations, and other small compounds were evaluated via helicopter and land vehicle. Tim limitations did not permit a comprehensive damage-fatality analysis. These data are shown on the isoseismal map (Figure 13). On the last day of inspection the heavy road equipment had started to level the towns we had previously surveyed.

As shown in Figure 13, the intensity values assigned to the damaged area varied from VI to X. Intensity V, "felt by nearly everyone," covered a vast area and is not included on the map. It should be added that the "nose" between Kakh and Baghistan was inferred from topographic and structural control. This is an area of competent sedimentary rock of high relief. Due to the inaccessibility of this mountainous region, only helicopter reconnaissance was carried out. It is interesting to note, on using the formula of Gutenberg and Richter (1942) for converting magnitude to intensity, that a Modified Mercalli intensity X is obtained for a magnitude 7.3 earthquake.

$$M_s = 1.3 + 0.6 I_{max}$$

$$I_{max} = \frac{M_s - 1.3}{0.6} = \frac{7.3 - 1.3}{0.6} = 10$$

The initial earthquake of Aug. 31, 1968, was felt strongly in Mashad at 260 kilometers (156 miles), and Herat, 290 kilometers (174 miles) distant. Fresh cracks were observed at the Customs House in Taybad, 180 kilometers (110 miles) from the epicenter. Seiches in swimming pools were authoritatively reported in Lashkargah, Afghanistan, at a distance from the epicenter of 575 kilometers (345 miles).

Five villages, Dasht-i-Biaz, Meinhaj (Beinabach), Buzkabad, Karish, and Miam, were assigned an intensity rating of X. All five were totally destroyed and situated very close to the surface fault. Miandasht and Khezri were listed with an intensity IX rating, however, and were located in the epicenter area of the initial earthquake of Aug. 31, 1968. Baghan, near Firdous, was given a IX intensity and is located adjacent to the epicenter of the second large earthquake of Sept. 1, 1968. Kakh, the remaining village with an intensity IX, was not located near the

epicenter nor the surface fault. As previously noted, it may be on a fault extension. Extremely heavy damage was sustained due to its location on alluvial deposits in conjunction with a shallow water table.

BUILDING DAMAGE AND ENGINEERING ASPECTS General Comments

The typical family dwelling and commercial house in this region is a one-story adobe mud structure with a domed roof. The houses are built on the surface of the ground without footings. The material used is sun-dried clay or indigenous earth, oftentimes mixed with straw and hand-formed into molds, approximately twice the size of the standard oven-baked brick generally used in the United States. Walls, either as part of the house or enclosing the cultivated fields, average two feet in thickness. Native clay and/or earth infrequently mixed with a small amount of lime or cement constituted the mortar used in construction. The domed roofs consist of equivalent materials used for the vertical walls; however, construction methods varied. The inner curved wall was the usual sun-dried brick. At times, two layers of brick, covered with an outside layer of mud and water mixture, resulted in a dome thickness of from 1 to 2 feet (See Figure 14). Quite frequently the dome consisted of an inner layer of brick, then a substantial thickness of branches, leaves, and straw (for summer cooling). Another layer of brick smoothed over with an outer coating of mud resulted in a dome thickness of about two feet. Wood or steel beams, for strength, were not noted in this type of construction.

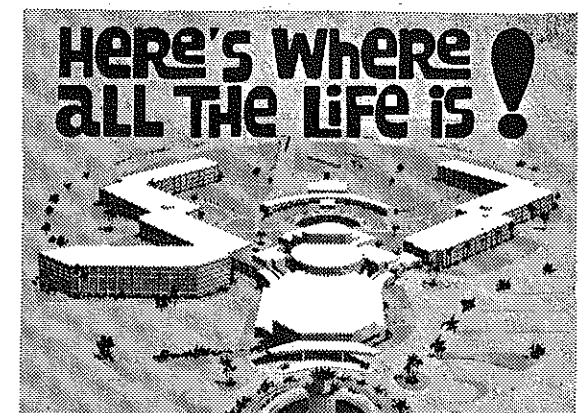
In the towns of Firdous and Kakh, two-story buildings were prominent. Generally, they were commercial establishments at ground level and residences on the upper level (See Figure 15). Construction in which kiln-dried brick walls were reinforced with wood or steel beams was more substantial. Although badly cracked and bent out of shape, and certainly beyond repair, this type structure did not collapse. Several of the commercial buildings had plate-glass store fronts (See Figure 16). Fifty to seventy-five percent of the glass was broken. Broken glass was observed both inside and outside the buildings and fragments were scattered out to a maximum of two meters from the window frames. At times, entire glass panels would be intact, with no cracks, while adjacent panels would be totally shattered.

The tallest structure observed was a smoke stack (chimney) located several kilometers from Firdous, on the road to Ayask. The tapered chimney is about 40 meters high with a 4-meter diameter base. It did not collapse for several reasons: (1) It was located south of Firdous, where shaking appeared to be less severe; (2) It was not located on alluvium, but on more competent clays and bedrock;

(3) As it is part of the ovens used for making kiln-dried brick, the best material in the vicinity was quite naturally utilized; (4) The walls were solid, interlaced, kiln-dried brick with a sand and cement mortar. Several bricks had been knocked off the very top of the chimney; however, only a few minor cracks were observed throughout the structure.

Analysis of Damaged Villages

Of the five villages totally destroyed only Dasht-i-Biaz and Miam were located both on alluvium with a high water table (15 feet) and close to the fault zone. No buildings or walls were left standing in these two settlements after the earthquake. The rubble was highly fragmented and pulverized. Vegetation, including trees, was either buried out-right or broken from impact and buried. Streets, al-



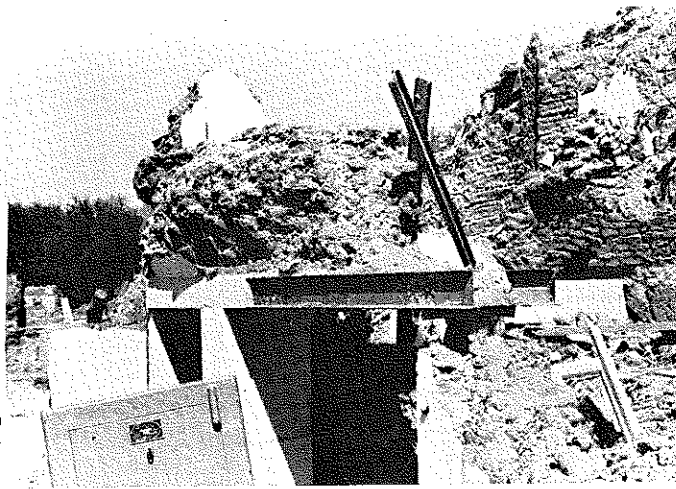
SATURDAY EVENING POST CALLED IT "THE TIFFANY OF THE STRIP"

... you'll find it the most complete resort hotel in Las Vegas
... One-hundred-fifty acre vacation wonderland ... Featuring the spectacular Folies Bergere in the spacious Theatre Restaurant ... Entertainment's most exciting names in the Blue Room ... Epicurean adventures in the Gourmet Room, truly one of America's fine Restaurants ... Romance in intimate La Fontaine Lounge ... The most luxurious rooms and suites in Las Vegas ... Complete convention facilities and expertly trained personnel ... Sparkling swimming pool in lush tropical setting ... Health Clubs ... Tennis courts ... 18-hole Tropicana Championship Golf Course

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CLASS OF '22



Damage to Muslim Shrine in Kakh.



Multi-story building damage in Kakh. Steel I-beams were used in construction.

leys, etc., could not be outlined on inspection. It was estimated that 50% of the 4000 inhabitants in Dasht-i-Biaz perished. In the smaller village of Miam, 86 of the 425 residents were killed.

Fortuitously, the main shock occurred when many of the local populace (mainly farmers) were working in the fields. It occurred during their normal "siesta break," and had they not been in the fields trying to ready their products for the market, many additional lives would undoubtedly have been lost.

The other villages totally destroyed were Buzkabad, Meinhaj (Beinabach), and Karish. They are located in the shallower part of the basin and on the west surface termination of the fault. Although an area of low rolling hills, these three populated areas were bracketed by two adjacent fault zones. The main east-west fault zone was relatively wide in this area with numerous fissures and some dip-slip (vertical) movement noted. The water table, although not measured, was reported to be shallow, on the order of 20 feet. Considering that rubble was highly fragmented, pulverized, and scattered in all directions and that all buildings were totally destroyed, even a well-designed structure would probably have sustained severe damage in this particular area.

Baghan, located northeast of Firdous, is entirely removed from the known zones of faulting. It is, however, located approximately two kilometers southwest from the epicenter of the large aftershock of Sept. 1, 1968. The major damage in the Firdous-Baghan area occurred as a result of this earthquake. The terrain around Baghan is flat and consists of alluvial deposits. Over 90% of the town was destroyed, but loss of life was relatively low, about 10% of the 3,000 population. Construction again was almost entirely single-story mud bricks.

Kakh is a fairly large-sized village with a population of 8,000. Approximately 4,000 of the population perished as a result of the earthquakes. Kakh is located on unconsolidated sediments at the mouth of a narrow gorge and old river bed.

No recent surface faulting was noted in the immediate area. In Kakh, destruction was most severe in a narrow band 2 to 3 kilometers in width passing from south to north through the center of the city. Houses on the fringe area west of the village were badly cracked, but did not collapse. The largest and most substantial building in Kakh is the Muslim Shrine, located approximately 1 kilometer southeast of the center of town. Kiln-dried bricks were used, interlaced and bonded with a sand-cement mortar. Vertical walls were thick, up to 3 meters, and the entire structure located on a bluff where the water table is apparently relatively deep (See Figure 17). The center dome, although badly cracked and beyond repair, did not collapse. Several adjoining walls also withstood

the vibrations; however, the rubble inside and surrounding the center dome was several meters deep.

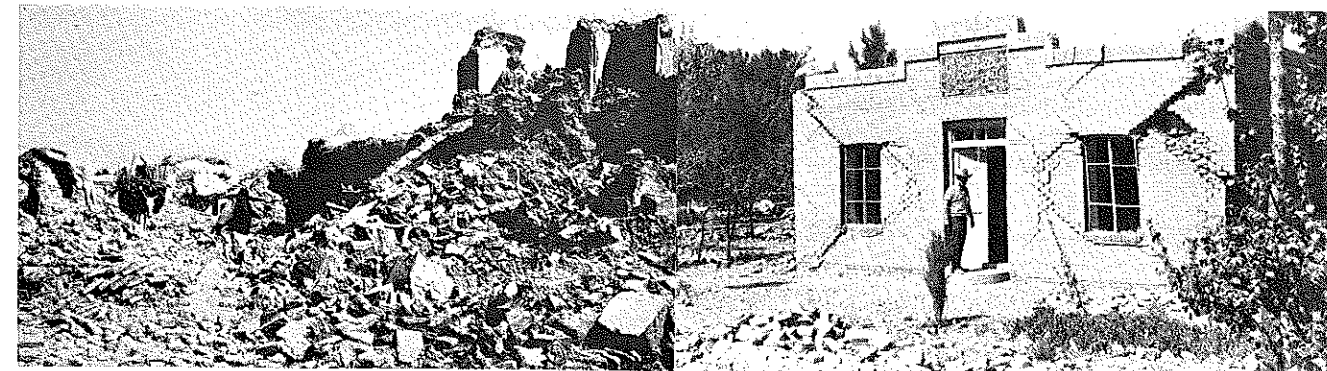
Kakh and Firdous are two cities in which steel beams were occasionally used in construction. In Kakh, three such cases were noted, all in two-story structures. In the first two inspected, the I-beams were used as cross-members, and curved beams as an archway. Damage was total in both cases, and it was noted that the steel beams merely rested on vertical brick walls or, in the case of the curved members, simply stood without a solid footing. A close inspection of the steel beams revealed no evidence of the members being joined to each other for rigidity. The third and only other structure with steel beams was also a two-story structure. It was damaged beyond repair (See Figure 18). The cross-members were bolted to a steel framework composed of similar steel beams. The steel beams were dangerously bowed due to the second-story weight, and no attempt was made to enter the building for a more thorough inspection.

Although still standing, some trees along the main north-south street of Kakh had fresh breaks in the bark on the sides facing the compound walls and adobe houses. The trees were spaced between the unpaved road and the compound mud-brick walls of local residences. These walls are from 2 to 3 meters in height. There were broken mud bricks in several of the trees, generally in forks of the main trunk, at heights of 7 to 8 feet. Assuming the walls were at the same or higher elevation that the mud bricks in the trees, it is probable that they lodged in the tree forks as the walls collapsed outward.

Kakh is situated within a steeply descending mountain valley that opens to the north. To the south the valley narrows and leads to a mountain pass connecting Kakh to the fault region near Dasht-i-Biaz. Within Kakh, damage increased rapidly with decreasing elevation and depth of water table. Local residents reported a loud series of rumbling noises, immediately preceding the main shock, as being quite distinct from the later sounds of falling buildings.

An on-site investigation of small villages a few kilometers east and west of Kakh (See Figure 13) indicated that damage to buildings was considerably less than in Kakh itself. These villages were located on bedrock at higher elevations, east and west of the main gorge leading from Kakh toward the main east-west surface fault. Low-level helicopter reconnaissance disclosed no major damage to small settlements, at higher elevations on more competent bedrock, located in this gorge and branching tributaries.

The four main villages, Miandsht, Miandash, Salaiani, and Safid-Dasht, in the central part of the basin present a different and perhaps more unique problem. Immediately west of these villages a wide zone of tension cracks (See Figure 6) was observed that extended irregularly to



Building damage in Khezri.

Damage to Polic Academy in Khezri.

the northeast (toward the main fault). Several of the fissures ran directly through the village of Salaiani. The largest fissures were 2 meters across and 3 meters deep.

Neither multi-story nor reinforced structures were noted in these four villages. Damage was very heavy, ranging from about 70% to 90%. However, few casualties occurred (12 fatalities of 943 population), since most inhabitants were outside working in the fields at the onset of the earthquake. As in other areas, rubble and debris were found without any directional trend. Therefore, a direction of motion for the seismic waves could not be ascertained.

Within the basin, and particularly in the Salaiani-Miandash area, there is a series of shallow well openings, from 30 to 50 meters apart, with interconnecting horizontal tunnels. These well openings, called "qanats," are 2 to 3 meters in diameter and extend to the shallow water table, about 5 to 7 meters in depth. Thus water could be retrieved from the vertical shafts all along the continuous underground system. As a result of the intense zone of fissures which developed in the Salaiani-Miandash area, the shallow well system ran dry and water accumulated in the fissure zone crossing the well complex.

Throughout the basin there are deeper wells, 30 meters deep and greater, used principally for irrigation purposes. Gasoline or diesel motors are utilized to lift the water to the surface. These irregularly spaced wells appeared to be undamaged, as the water was clear when pumped into the small concrete reservoirs.

At Khezri, 200 of the 4000 population were killed and 80% of the town razed. The village is situated well into the basin on loose sediments and relatively close to the fault. The water table is at a depth of 6 to 7 meters. The dwellings that remained standing were well-designed single-story structures with flat thin roofs and a sand-cement mortar. Although total collapse was not observed in buildings of this type, they were damaged beyond repair (See Figure 19). About half of the plate-glass windows in a single-story commercial establishment were broken. Mud-brick rubble from collapsing walls and homes covered all street and alleys and the interior of partially destroyed structures (See Figure 20).

Firdous, with a population of over 14,000, was the largest town in the area of major damage. About 75% of the town was destroyed and 1300 of its residents fatally injured. The northeast quadrant was the most heavily damaged. Trees were often buried in debris, and exposed portions were badly skinned and scarred. Uprooted trees were not noted. Most of the fatalities resulted from the initial earthquake. However, the principal structural damage occurred on the following day when the largest aftershock centered in the Firdous-Baghan area. Two-story buildings constructed with good-quality brick, cement mortar, and in some cases steel beams, were partially collapsed and damaged beyond repair. It was evident that partial collapse of floors was due to the absence of any type of rigid framework. In the commercial stores with glass-paneled display windows, over

half of the glass was broken and glass fragments were strewn both inside and outside the stores.

Telephone poles on the main streets of Firdous were reinforced concrete pylons, about 12 meters above ground, tapered toward the top, and well anchored into the ground. None was broken or down, but several were chipped around the base. On side streets and alleys, untreated wooden telephone poles were in complete disarray, some leaning against buildings and others broken, but held upright by badly tangled wires at the top. Wires on the telephone poles, in particular the wooden poles, were badly twisted and in some instances broken.

The small villages of Faizabad and Muzdabad are located less than 3 kilometers south of the surface faulting. Faizabad is located at the edge of the alluvial plain adjacent to the greatest surface rupture. Muzdabad, at the entrance to the pass between the two mountain ranges, overlooks the plain from low rolling hills. There were 58 deaths reported from a population of 515. About 50% of the dwellings were destroyed, and those remaining were extensively damaged.

Khak, a small village southeast of Muzdabad, reported 10 fatalities from a population of 180. The village is located on hilly terrain south of the fault.

Mokaram and the surrounding villages of Achoney, Hassainabad, Hatomobad, and Baktshobad, are situated east of the alluvial valley. There was no indication of surface faulting. However, many of the aftershocks occurred in this vicinity. Although no fatalities occurred, many were injured and severe property damage (40% to 50%) was sustained.

Kalata, located in the foothills 3 kilometers east of Kakh, is underlain by more competent material than Kakh. Although 40% of this small village was destroyed, only 10 of the 350 people perished.

Baghistan, northeast of Firdous and near the epicenter of the large aftershock on Sept. 1, is located on flat terrain underlain by bedrock. This town of approximately 4000 residents was 25% destroyed. Most of the remaining adobe houses sustained cracks and other damage. The death toll reached 60 in this village.

Charma, a village of 2700 inhabitants, is located in the mountains south of the fault. Thirty deaths were reported and property damage was estimated at 25%.

Asadabad is a small village which lies within the alluvial basin. No fatalities were reported among 288 inhabitants, but 20% of the adobe houses collapsed. Those remaining exhibited cracked walls and damaged roofs.

ACKNOWLEDGMENTS

This investigation was made while the author was on temporary duty status in Kabul, Afghanistan, initiating a program in seismology, during the installation of a world-wide (WWNSS) set of seismograph instruments. Special recognition to Dr. Lorne E. Heuckroth^{2,3} and Rajab A. Karim³, the other members of the three-man team who made the field trip exceed expectations, is gratefully acknowledged.

(Continued on Page 26)

"Wanting more food from the ocean is one thing. Getting it is another," says Art Tuthill of International Nickel.

"Extracting food from the ocean in large quantities takes special machinery.

"Special machinery to get the food.

"Special machinery to process the food.

"Special machinery to transport the food.

"And most important, special machinery that can stand up to the sea.

"Machinery made of materials that will last. Reliable materials priced reasonably enough to make large, intricate machinery self-sufficient and financially practical.

"That's my job at International Nickel," says Tuthill. "Working with the marine industry, interpreting their needs to our researchers. In an effort to develop special materials that will resist the sea's extreme pressures and corrosion.

"We already have alloys of copper and nickel, nickel alloy steels and certain stainless steels, that fulfill these requirements.

"Nickel maraging steel enabled Lockheed's *Deep Quest* to dive to a record depth of 8,310 feet withstanding fantastic pressure and stress.

"Copper nickels have made desalination possible at reasonable costs. And are beginning to find a home in all kinds of boats that work the sea. Fighting hard against salt water corrosion.

"And special grades of stainless steel assure the sanitary conditions necessary for processing the catch.

"We have the materials now. And the faster they're made into machines the sea can't destroy, the faster the relief

for the one billion underfed people of the world."



Nickel helps other metals resist heat, cold, impact, pressure, abrasion, corrosion... to advance engineering in vital fields—power, desalination, electronics, transportation, aerospace.

We're doing everything we can to produce more nickel. Searching around the world—Indonesia, Australia, Guatemala, Canada. We've found ways to extract nickel from ores thought too poor to mine a few years ago.

We count our blessings and respect our surroundings. From nickel ores, we recover platinum, palladium, twelve other commercially useful elements.

Make iron pellets for steel. Convert smoke in our stacks to chemicals for other industries. On sand left from processing ore, we grow meadows of hay.

We are explorers. We're in 18 countries. Miners, researchers, market builders—we bring opportunity to underdeveloped lands, new technologies, new payrolls, new tax income. Nickel in the ground is useless. We put it to work.

INTERNATIONAL NICKEL

Machines the sea can't destroy.

Lockheed's *Deep Quest*

Oil Shale Group Resumes Research and Development Work in Western Colorado

COLONY Development Operation, a four-company joint venture, has announced it will resume oil shale research and development field activities in Western Colorado late in August, with Atlantic Richfield Co. as operator.

These activities in removing oil from shale will be conducted at a 1,000-ton per day experimental plant and mine on Parachute Creek near Grand Valley, Colo.

Startup will mark the beginning of the field operations in the two year development program which is expected to cost more than \$10 million, a spokesman said.

The program is to demonstrate operability and determine costs of the TOSCO II process which is based on the principle of solid to solid heat transfer for separating oil from shale, according to John S. Hutchins, Colony manager. It also is directed toward environmental studies of a commercial oil shale industry.

The Colony joint venture includes Atlantic Richfield Co. and Sohio Petroleum Co., each holding 30 per cent; and The Oil Shale Corp. and The Cleveland-Cliffs Iron Co., each with 20 per cent. Atlantic Richfield Co. became a 30 per cent participant and operator in March, 1969, by purchas-

ing interests from each of the other three companies.

Hutchins stressed that, in addition to the present program related to cost and technology, other economic factors such as taxes, inflation and import controls will influence decisions to launch commercial systems in the years ahead.

Cleveland-Cliffs, operating under a contract with the venture, will mine oil shale for the program.

"Close control of the environmental impact of shale oil production will be emphasized," Hutchins said.

"Our task is to demonstrate an economically attractive commercial system which will provide for protection of the environment so as to preserve air and water quality and to provide for acceptable restoration of the surface," he said.

"Government air and water quality standards will be met or surpassed. Continuing research will aim at establishing self-sustaining revegetation to enhance native conditions.

Hutchins detailed some environmental work under way or completed to provide control and background data.

Air quality will be monitored continually by laboratory technicians at the plant site.

Special devices which include cyclone separators and a wet scrubber are being installed in the plant's stack to control emission of dust.

A two-chamber incinerator is being installed to eliminate open burning. One chamber burns material; the other chamber burns smoke to eliminate virtually all emission.

Detailed water chemical checks on area creeks will guard against degeneration of water quality during the operation.

Extensive revegetation work is being carried out under the direction of Dr. L. A. Schaal, consulting agronomist, of Grand Junction, Colo. Growing plants on top of spent shale will prevent erosion and blend its appearance with native surroundings.

Continuing greenhouse tests with the spent shale, which is like a virgin soil, have identified promising shrubs and grasses, both native and imported.

Chemical analysis of spent shale shows that it is comparable to the natural talus slopes in the area except that the hydrocarbons have been removed.

Studies have been extended to successful range plantings at the plant site. Dr. Schaal is preparing a report, to be published later in the year, on the results of his work, Hutchins said.

Elmer R. Wilfley, '14

Wilfley Centrifugal Pumps
Denver, Colorado

Dasht-I-Biaz, Iran Earthquake

(Continued from Page 23)

The author would like to express his appreciation of the USAID Mission in Kabul, Afghanistan for assisting in travel preparations, and for supplying a four-wheel drive vehicle and a driver; to the United States Engineering team, under contract to USAID, for defraying the traveling expenses; to Dr. R. Limatianen and Mr. J. Ryan of the U.S. Embassy in Tehran, Iran; to Messrs. Murphy, Jordan, and Gordon, C&GS, for their constructive comments and review of this article; and to Mr. J. Coffman, C&GS, for his helpful editorial comments.

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Research in Yugoslavia Handicapped By Lack of Money and Equipment

PURE research in Yugoslavia's energetic academic community is being sorely handicapped by a lack of money and equipment, according to a Columbia University mining engineer.

The appraisal was made by Prof. Stefan H. Boshkov, chairman of the School of Mines at Columbia's School of Engineering and Applied Science. During a three-week visit to Yugoslavia and several days in Bulgaria, at the request of those governments, Prof. Boshkov gave a semester-length course in mining which averaged out to nearly four hours of lectures a day.

It was the first such tour behind the Iron Curtain for a Columbia professor, and one of the very few made there by any American engineer since World War II.

Negotiations for Prof. Boshkov's assignment were initiated in 1967 by the Yugoslav-American Commission for Educational Exchanges in Belgrade. Eventually, several other agencies took part in the arrangements, including the Fulbright Program for the Institute of International Education; the Bulgarian Ministry for External Affairs; and the U. S. State Department, among others.

Prof. Boshkov's lecture trail began at the University of Zagreb in Yugoslavia, where his topics included rock mechanics and ground control: the design of surface and underground mining structures. Dr. Boshkov is an internationally-known authority in that field.

His talks at Zagreb became an integral part of the first post-graduate program ever given at a Yugoslav university for mining engineers, an indication of growing academic activity.

Aside from his academic duties, Prof. Boshkov visited a number of scientific institutions in Yugoslavia, including the University of Bor, whose mining faculty is part of the University of Belgrade. Bor is also the largest copper mining district in Europe.

All their research, he said, is problem-oriented because there are no funds, or equipment, for pure research. Researchers, he added, must be ingenious and resourceful because

they have to build their own tools. He described how one professor spent nearly three years grinding his own lenses for a photo-electric apparatus for stress determination in models of mines.

"American books on science and engineering are in great demand," he added, but highly over-priced behind the Iron Curtain. What Yugoslav engineers usually do, he continued, "is to wait a few years after the U.S. publication, until the Russians can translate the books, and sell them at a fraction of the U.S. price."

Most of the East European instrumentation he saw, Prof. Boshkov said, is far below the calibre of American equipment, and also usually purchased from the Russians.

However, he added, most of the heavy mining equipment, such as trucks, that the Yugoslavs use is American-made. The Bulgarians also use some American equipment, but there are problems that make that practice difficult. He explained how a Bulgarian mine purchased two Ingersoll-Rand drills, but got them in too small a size.

"They then had to wait," he said, "at least six months before they could get U.S. replacement parts from Austria."

Prof. Boshkov was particularly impressed by the friendship toward America expressed by the people he met in Yugoslavia. "Yugoslavs," he said, "are very fond of Americans,

and want to be like us. As a mark of friendship, they seldom ever search American tourists crossing the border."

The Yugoslavs, he added, were very impressed with the Apollo moon landings, and when American astronauts Neil Armstrong, Edwin Aldrin and Michael Collins visited Yugoslavia, "it seemed as if half of Belgrade turned out to welcome them."

The Columbia engineer also found a good deal of private enterprise flourishing in Yugoslavia. As an example, he gave the Mining Institute in Belgrade, which services the national mining industry and pays its own way by private contracts, with no government subsidies.

On the Bulgarian leg of his tour, Prof. Boshkov went to Sofia, where he was born in 1918, and where he was reunited with his mother, whom he hadn't seen since he left Bulgaria 31 years ago to study at Columbia University.

His mother, he said, still lived in the same house, built by his grandfather 70 years ago, but as a sign of progress, part of it had been hacked off to make room for an apartment building next door.

The four-day visit there was sponsored by the Committee on Friendship and Cultural Relations of Bulgaria's Ministry for External Relations, which scheduled Prof. Boshkov for both day and night meetings during his short stay in the country.

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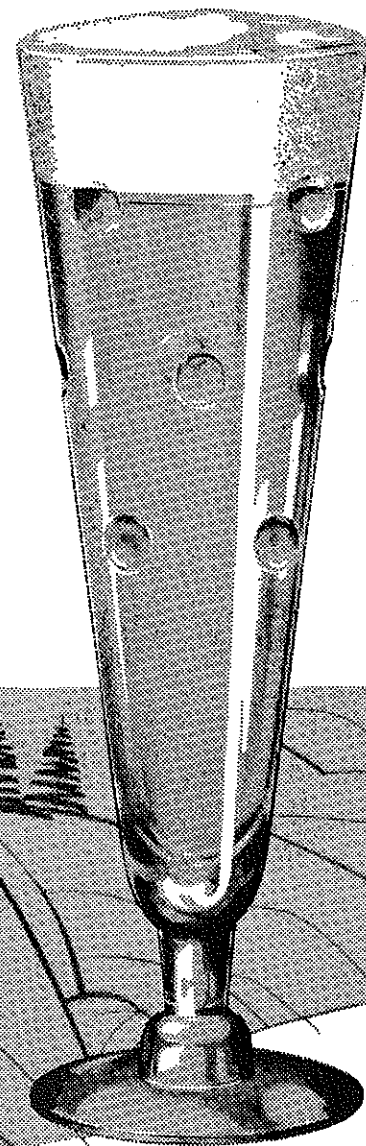


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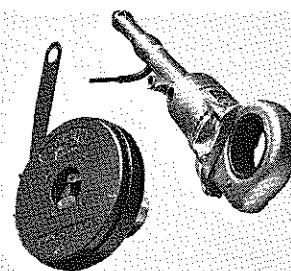
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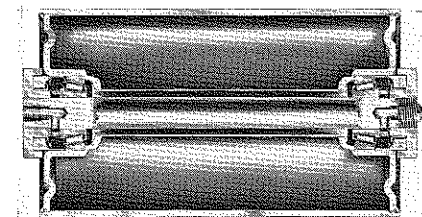
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With the Manufacturers



Portable Power Wrench (556)

Collins Machinery Corp., Monterey Park, Calif. 91754, is marketing a new application for their versatile Amaz-O-Thred® Portable Power Tool. Amaz-O-Wrench is a precision mechanism that adapts Amaz-O-Thred's power to turning 1/4" to 2" dia. pipe, conduit, bolts, etc. It features a patented design for automatic chucking, i.e. chucks, centers, and turns. Circle 556 on Reader Service Card.



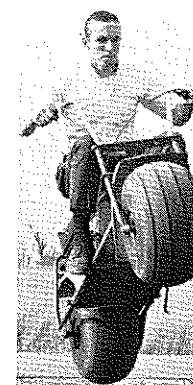
Conveyor Idlers (562)

Barber-Greene Co., Aurora, Ill., introduced a completely new series of heavy-duty roller bearing belt conveyor idlers incorporating design improvements that allow virtually unlimited idler life by overcoming the major causes of bearing failure.

Truly a revolutionary design, the five-pass labyrinth seal has two zero clearance faces, a nylon face seal and a Buna "N" lip seal, both lubricated for minimal wear. There is no meal-to-metal contact. Circle 562 on Reader Service Card.

Hydrostatic Transmission (565)

A revolutionary new infinitely variable hydrostatic transmission featuring a unique "divided power" concept that provides operating efficiencies of 85 per cent or more has been introduced by Hydra Power, Inc., 4670 W. 54th St., Chicago, Ill. 60632. Designed for stationary industrial applications, the new transmission provides constant output horsepower and infinitely variable speed and is available in a series of sizes from 7 1/2 to 75 HP, rated at 10,000 hours minimum service. Circle 565 on Reader Service Card.

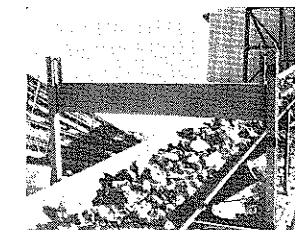


Bob-Tach System (560)

A quick-change system for changing attachments on its loaders has been introduced by the Melroe Division of Clark Equipment Co., Gwinner, N. D. 58040. The Melroe Bob-Tach system permits the operator to change attachments in seconds, without leaving the machine. Circle 560 on Reader Service Card.

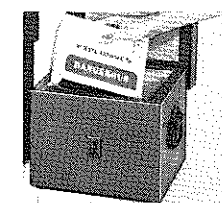
El Burro (563)

After studying the all-terrain vehicle market, Worth Industrial Processing, Lexington, Mich. 48450, researched, tested, developed, and marketed the four season all-terrain vehicle, "EL BURRO." This inexpensive, two-wheel fun machine combines dependability, power, performance, and maneuverability to create one of the best buys on the go-anywhere vehicle market. Circle 563 on Reader Service Card.



Metal Detector (564)

A new concept in the detection of "tramp metal" mixed with iron ore or other metals on belts conveying ore to the crusher has been developed by Tectron Engineering, 3017 S. Halliday St., Calif. These new Tectron Metal Detector Coils save many, many thousands of dollars in down time for each piece of metal detected on the belt before it can enter and damage the ore crusher. Circle 564 on Reader Service Card.



Mini-Mags (558)

Mini-Mags are small, portable magazines designed for the safe transportation and storage of explosives and other hazardous materials. Designed and manufactured by Explosives Engineering Corp., 1830 S. Baker, Ontario, Calif. 91761., Mini-Mags are safer and more rugged than ordinary day boxes. They incorporate the same quality standards used in EEC's line of large steel magazines. Circles 558 on Reader Service Card.

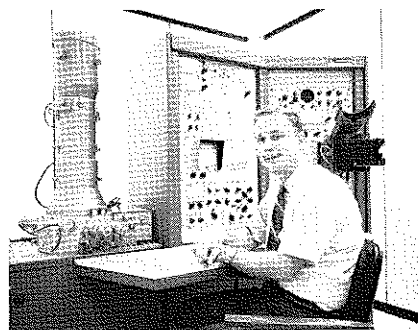
Dowtherm Inhibitor (561)

A new product, labeled Dowtherm 209 Inhibitor, is being marketed by The Dow Chemical Co. The product, designed for use in solutions of Dowtherm 209 coolant, ethylene glycol or water for truck, bus and off-highway equipment, provides an added margin of corrosion protection during the summer months when users dilute the coolant with water. Circle 561 on Reader Service Card.

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Plant News



John Wehrung, laboratory director, at the Scanning Electron Microscope.

Scanning Electron Microscope At Sperry Rand Laboratory

The Space Support Division of the Sperry Rand Corp. is offering Scanning Electron Microscope (SEM) services at its Microanalysis Laboratory in Rockville, Md., on a machine-hour basis.

The SEM has a useful magnification range from 20X to 50,000X and is capable of examining, with little or no special preparation, surface details of almost any kind of specimen in such diverse fields as Biology, Microelectronics, and Material Science. A photograph which faithfully represents the surface features of the sample can be provided within a few seconds at any stage of the examination.

Companies which find the investment required for the installation of a SEM prohibitive are using service laboratories to great advantage in their basic research, product development, and manufacturing control programs. The Sperry Rand Microanalysis Laboratory can also serve such companies by providing machine time, including a professional operator, to a representative of the company, or can successfully provide SEM services by mail.

Company Changes Name

International Nuclear Corp. shareholders voted to change its name to Inexco Oil Co. The company is a principal independent oil exploration and production organization.

"For some time oil has been the area of greatest growth of the company," said Pres. Erving Wolf, "and the new name will reflect our principal activities." In 1969, the company made three major oil discoveries—the Hilight field in Wyoming, which was last year's largest oil find in that state, and the Golden Spike and Ladder Creek fields in eastern Colorado. It is also actively exploring for oil in areas as disparate as Texas, Oklahoma, Louisiana, Alabama and the Canadian north.

Pullman Strengthens Position In Non-Ferrous Minerals

The Swindell-Dressler Co., a division of Pullman Incorporated, has strengthened its position in the non-ferrous metals and minerals processing industries by entering into an agreement whereby Pullman will acquire the F. C. Torkelson Co. of Salt Lake City, Utah.

Union Pacific and German Firm To Develop Uranium Deposits

The Natural Resources Division of Union Pacific Railroad and Urangesellschaft MBH & Co. KG of Frankfurt/Main, West Germany, have announced the signing of a joint venture agreement to explore and develop uranium deposits in the Crossroads area of the Southern Powder River Basin, 18 miles northwest of Douglas, Wyo.

Union Pacific will be the operator and Urangesellschaft will provide experts to cooperate with UP's personnel in the field. According to its contributions to the exploration expenditures, Urangesellschaft may earn up to a 50 per cent interest in the properties.

Methanol Plant in Libya

Occidental Petroleum Corp. and the Libyan National Oil Corp., owned by the Libyan government, will construct a 1,000 tons per day methanol plant as a joint venture.

This plant, to be located near Benghazi, Libya, will utilize Libyan natural gas and will be part of a petrochemical complex in which this vital Libyan natural resource will be used. Bids for construction of the new plant are expected to be issued later this year with construction estimated to begin in 1973.

Methanol is a form of industrial alcohol used in the manufacture of plastics, paints, formaldehyde and other industrial purposes.

Boyles Core Drilling System Adds to Efficiency, Lowers Cost

Boyles Bros. Drilling Co., headquartered in Salt Lake City, Utah, has introduced an entirely new core drilling system that has been proven to substantially reduce costs and increase efficiency.

The new system combines a wireline core barrel mechanism for use at surface locations, and a unique hydraulically placed and retrieved core barrel mechanism for drilling up-holes from underground locations.

The wireline portion of the system includes a new core barrel latching head, overshot retriever and stabilized core barrel outer tube. Although the core barrel latching head is designed with fewer moving parts than any other system, it has nearly eliminated mislatching, will work equally well in all possible drilling positions and is simple to maintain.

MacGregor Awarded Degrees For Leadership in Mining

Ian MacGregor, chairman and chief executive officer of AMAX, has been awarded honorary doctorate degrees by Denver University and Mont. College of Mineral Science and Technology in recognition of his contributions to the metals and mining industry and the cause of conservation. The separate awards were made at the end of a week that included AMAX's first nationwide, companywide Conference on Environmental Control and Ecology, held in Denver, June 2 and 3.

Mt. Isa Copper Concentrator

McKee Pacific Pty. Ltd. of Melbourne has been awarded a contract for the design and engineering of a new copper concentrator for Mount Isa Mines Ltd. of Queensland, Australia.

The contract to build the new copper concentrator at Mt. Isa follows a decision by Mount Isa Mines to increase its copper capacity from 100,000 tons a year to 150,000 tons between now and mid-1974, involving additional hoisting capacity, concentration and smelting facilities at a total cost of about \$70 million.

Pickands Mather Buys Zircoa, Producers of Zirconium Oxide

Pickands Mather & Co. of Cleveland, Ohio, has purchased 100% of the outstanding capital stock of Zirconium Corporation of America (Zircoa).

Zircoa, located in nearby Solon, Ohio, is one of the nation's leading producers of high-purity zirconium oxide and related products, including ultrahigh-temperature refractories. Its major markets include the chemical, ceramic, metallurgical, electronic, nuclear and aerospace industries.

Much of Zircoa's growth has resulted from its success in developing products to meet the rigid requirements demanded for some of today's most advanced aerospace, military and industrial applications. Zirconia, which can withstand temperatures up to 4600° F. in an oxidizing atmosphere, has the highest temperature resistance and is the most chemically inert of all commercially available refractory materials. This makes it ideally suited for use in rocket nozzles, nose cones for space vehicles, high-temperature air heaters for wind tunnels, and industrial refractories.

Zirconia is also the first new die material introduced to the metal extrusion industry since the early 1930's, and is now used in producing extruded brass, copper, tungsten and titanium. Other important industrial applications include fuel cells, electronic capacitors, chemical compounds, ceramic colors, and refractories for the more advanced metallurgical processes such as continuous casting and vacuum degassing.

Catalogs and Trade Publications

STRAIN GAGE SYSTEM (670)

A new 4-page brochure explaining the field and laboratory applications of the Bison Model 4101 Soil Stress Strain Gage System is available from Bison Instruments, Inc., 3401 48th Ave., Minneapolis, Minn. 55429. It describes procedures, operation, measurements and selection of proper size of expendable sensors in the use of the Strain Gage. Also, complete specifications of the Model 4101 are included. Circle 670 on Reader Service Card.

CLEANING SYSTEM (671)

A new two-page data sheet describing its Liqua-Blaster high-pressure cleaning system has been published by Partek Corp., P. O. Box 18312, Houston, Tex. 77023. The new brochure contains a full description of three Liqua-Blaster models: 105, 106 and 110, with 5000 psi to 10,000 psi working pressure range. Each major component of the Partek Liqua-Blaster is described individually, with complete specifications on the trailer- or skid-mounted power units. Circle 671 on Reader Service Card.

AXLE POCKET GUIDE (672)

A ready reference guide for application of trailer axles, including specifications of Rockwell-Standard axles, is being offered by the Automotive Divisions of North American Rockwell Corp., Clifford at Bagley, Detroit, Mich. 48231. Covering the complete line of Rockwell-Standard axles, booklet SP-6932 contains information valuable to trailer manufacturers and trailer specifiers. The brochure, available in standard three-hole 8½ x 11 or pocket size, presents data on axle ratings, tube size, bearing cone, bearing cup, brake size, standard track, hub and drum, wheels, standard options and standard wheel bearing adjustment. Circle 672 on Reader Service Card.

HORIZONTAL FILTERS (673)

"Horizontal Filters" is a revised four-page illustrated brochure (Bulletin No. HRF-1) by Dorr-Oliver Inc., Stamford, Conn. 06904, for the process industries. The bulletin explains the design simplicity and structural ruggedness of the Dorr-Oliver horizontal filter that combines continuous vacuum operation with utilization of gravitational force to provide the sharpest separation of mother liquor and wash liquors. Included in the bulletin is a discussion of the mechanical and operational features that produce highest capacity per square foot, lower cake moisture and higher wash rates and efficiencies, while eliminating media washing requirements. Circle 673 on Reader Service Card.

GLASS SAND OPERATION (674)

A detailed account of the operations of Midcontinent Glass Sand Company at Roff, Okla., is the subject of Denver Equipment Division's latest bulletin, M4-B139. Topics discussed by the bulletin are the early history of the company, geology of glass sand deposit, mining methods, hydraulic transportation, processing, water and utilities, reagents, personnel, and marketing. Included in the bulletin is a flow-sheet of the entire operation. The plant treats 950 tons per day by scrubbing and flotation. Sand processed by the company is used to make flat glass, beverage bottle glass, fruit jars and glasses, packer ware, tableware, cement, sodium silicate, and foundry sand. Circle 674 on Reader Service Card.

HARRIS CUTTING TIP (675)

Bulletin #691003 from the Harris Calorific Co. explains how a new Harris cutting tip for oxy-acetylene and oxy-fuel gas cutting, the Thrif-Tip, will reduce costs by allowing standardization on one tip. The 2490 Thrif-Tip fits seven different makes of torches. Harris, Oxweld, Airco, Purox, Victor, NCG and Smith. Standardizing on Thrif-Tips reduces inventory and permits buying in larger quantities less frequently. The tip gives cutting performance equal to other standard tips but has a patented seat and adaptor that fits it to other torches. (The Harris Calorific Co., 5501 Cass Ave., Cleveland, Ohio 44102.) Circle 675 on Reader Service Card.

"CRISIS-TRANSPORTATION" (676)

Caterpillar has produced a 48-page booklet on transportation problems in the United States. The booklet, "Crisis-Transportation," graphically portrays the current status of highway, air, and mass transportation systems. In discussing the progress that has been made, the booklet takes the reader on a pictorial excursion of present facilities and the outlook for the future. It reviews such advanced transportation systems as the Bay Area Rapid Transit, Penn Central's Metroliner and the success of Interstate highways. The booklet concludes by recommending ways for the reader to become active in the support of transportation programs in his own community. (Caterpillar Tractor Co., Advertising Division, Peoria, Ill. 61612.) Circle 676 on Reader Service Card.

Send Us Your Bulletins

Send your publications to The MINES Magazine, 2177 W. 7th Ave., Denver, Colo. 80204, for review in these columns. To all MINES readers these publications are FREE, and may be ordered by giving index number. On requesting publications from manufacturers, please mention the MINES Magazine.

BOTTOM CUTTERS (677)

A new two-page bulletin (C-73) from Joy Manufacturing Co., Pittsburgh, Pa. 15222, illustrates and describes its 16RB-3 bottom cutters. The cutters, which feature high capacity and low chassis heights, are for seam heights up to 40 inches. A table details individual specifications for the three models in the line. Complete specifications common to all machines are also included as well as a dimensional drawing of a typical machine. Circle 677 on Reader Service Card.

METAL COATING (678)

A new metal coating that resists wear as well as a high-chrome stainless steel is covered in a new bulletin (208) from Metco Inc., Westbury, N. Y., 11590. The coating is produced by a specially formulated nickel-chromium-aluminum powder that is melted and applied by a flame spray gun. The molten particles are atomized in the process and deposited onto a surface to form the coating. Bond strengths are unusually high as are the coating thicknesses that can be applied. The new powder, Metco 451, was formulated for use with the Type N metallizing process. With this low-cost process, the application of a coating requires no special operator technique, no exhaust equipment, no compressed air, and no extensive auxiliary equipment. Circle 678 on Reader Service Card.

AMBERLITE IR-120PD (679)

A new bulletin (IE-170-70) on Amberlite IR-120PD cation exchange resin is available from Rohm and Hass Co., Philadelphia, Pa. 19105, manufacturer of chemicals, plastics and fibers. Amberlite IR-120PD is the first commercially available partially dried, free-flowing premium-quality, high-capacity cation exchange resin. It is designed for ease of transfer into equipment for use in water softening, demineralization and chemical processing applications. The bulletin reviews the important features, physical and hydraulic characteristics and suggested operating conditions for Amberlite IR-120PD resin. Other topics described in the bulletin are sodium and hydrogen cycle operation and acid regeneration. Circle 679 on Reader Service Card.

ENGINEERING SEISMOLOGY (680)

A Bibliography of Engineering Seismology with a newly updated section on vibrations from mining and quarry blasting is available from W. F. Sprengnether Instrument Co., manufacturers of seismological, geophysical and engineering instruments. Included also are some 300 references on engineering properties of rocks and soils and ing and quarry blasting is available from W. F. Sprengnether Instrument Co., 4567 Swan Ave., St. Louis, Mo. 63110.) Circle 680 on Reader Service Card.

YOUR CAR AND CLEAN AIR (681)

The total amount of hydrocarbons and carbon monoxide from automobiles already has passed its peak in the nation's air, according to a new national report issued by the Automobile Manufacturers Association, Detroit, Mich. 48202. Printed in a 16-page booklet, entitled "Your Car and Clean Air," the report states that automotive output of these two pollutants will continue to decline as newer vehicles replace older cars without controls. This will occur despite anticipated increases in the vehicle population. Circle 681 on Reader Service Card.

VARIABLE SPEED TRANSMISSIONS (682)

A revised and updated 24-page catalog (207B) describing the five sizes of one HP to 15 HP Specon VARI-CHAIN Variable Speed Transmissions has been released by the Industrial Prod-

ucts Division of Fairchild Hiller Corp., Winston-Salem, N.C. 27105. Detailed selection procedures for various applications are included along with complete rating and ratio tables. Available controls, such as remote, vernier, remote vernier, lever, electrical, pneumatic and hydraulic, plus accessories are outlined. Principles of operation, automatic chain tensioning and chain wear indicator features as well as other features are illustrated and described, as are 10 styles and over 150 assembly arrangement configurations. Circle 682 on Reader Service Card.

BELT CONVEYOR SCALE (683)

National Controls, Inc., P. O. Box 1501, Santa Rosa, Calif. 95403, has recently developed a standard single idler electronic belt conveyor scale complete with flow rate display at a sales price of less than \$2,000. The advanced features of this scale assure years of accurate and reliable performance: The rugged welded steel scale framework is connected to the weigh bridge by specially designed flexure plates; and the remote display and control box uses all solid state components. Circle 683 on Reader Service Card.

TRACTOR SCRAPER (684)

A new 12 page, 4 color catalog of the Cat 613 Self-Loading scraper is now available. The 613 is completely roadable, permitting rapid, inexpensive transportation between jobs. With even the largest tire options the machine still only measures 8 feet wide. The weight is no more than 17,300 lbs. per axle. Circle 684 on Reader Service Card.

HYDRAULIC ROTARY (685)

Bulletin 50 (Acker Drill Co., Inc., Scranton, Pa. 18501) describes the new 4-speed Hydraulic Rotary, Model MP, which is designed to handle a variety of exploration work. It is powered by hydraulic rotary drill head—ideal for soil sampling, auger borings or core drilling projects. Many optional features. Over-all capacity 5-in. holes to 150 ft, or 3-inch core drill holes to 1000 ft. Available in 6-ft. or 11-ft. travel. Circle 685 on Reader Service Card.

ENGINEERING SEISMOGRAPH (686)

A new six page bulletin describing the MD-1 Engineering Seismograph for non-destructive subsurface exploration of soil, rock and water is available from Solltest, Inc., 2205 Leo St., Evanston, Ill. 60202. The lightweight engineering seismograph and its accessories are illustrated and described. Accessories include a radio link and dart which climate the need of connecting cables in the field, and a seismic geophone intergrator, which makes it possible to investigate to greater depths. Diagrams showing the use of the seismograph and charts outlining the rippability of rock for excavation purposes are included in the bulletin. Circle 686 on Reader Service Card.

PROXIMITY SWITCHES (687)

Proximity switches with flameproof and explosion-proof capabilities are offered for mining, chemical processing and other industrial applications by Siemens Corp., 186 Wood Ave. S., Iselin, N.J. 08830. The switches are designed for use in applications involving switching processes without mechanical or electrical operation such as in the control of automatic hauling equipment. Circle 687 on Reader Service Card.

HEAVY-DUTY IDLER (688)

A new catalog has just been issued by The Ehrsam Co., Abilene, Kans. 67410, covering their line of heavy-duty belt conveyor idlers. The idlers, designated Series 125, have 1¼ inch shafts and bearings which exceed CEMA loadings. They also incorporate a triple, positive contact neoprene seal that assures complete bearing protection with minimal friction loss. The Series 125 idlers are available in six and seven in. roll sizes. The new catalog gives sizes and dimensions for: Equal Length Troughing Rolls; Flat Carriers and Returns; Rubber Cushion Impact Idlers; Self Aligning Idlers with Equal Length Rolls and Self Aligning Flat Carriers and Returns. Circle 688 on Reader Service Card.

BETTER AIR POWER SYSTEM (692)

Ingersoll-Rand Co., Corning, N.Y. 14830, has just issued a new and informative booklet on Engineering a Better Air Power System. Included are illustrations, graphs, diagrams, an Ingersoll-Rand compressor selection table, information on aftercoolers and air dryers. Four pages of friction loss tables are included for those who are checking or designing an air system. Circle 692 on Reader Service Card.

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Personnel Placement

THE COLORADO SCHOOL OF MINES ALUMNI PLACEMENT SERVICE functions as a clearing house for alumni and former students who wish to receive current information about employment opportunities for which they may qualify. It also serves the oil, gas, construction and related industries and many government agencies by maintaining current listings of openings they have for qualified engineers, technical and management personnel.

Companies needing qualified men with degrees in Geological Engineering, Geophysical Engineering, Metallurgical Engineering, Mining Engineering, Petroleum Engineering, Petroleum Refining Engineering, Engineering Physics, Engineering Mathematics, and Chemistry are invited to list their openings with the CSM Alumni Placement Service, Guggenheim Hall, Golden, Colorado.

Listed below are coded references to the graduates of the Colorado School of Mines who were available for employment at the time this issue of *THE MINES MAGAZINE* went to press.

Client's Code Number	Degree	Age	Marital Status	No. of Children	Preferred Fields of Work	Locality Preferred	Languages Spoken
MN 18	Mining	44	M	2	Mining-Metals Mill	Colorado	English
MN 34	Mining	39	M	1	Mining Geology	Western USA/Foreign	English/Spanish
MN 36	Mining	30	M	1	Open Pit or Underground	West, Northwest U.S.	English
MN 37	Mining	29	M	2	Production	Rocky Mountain or Western U.S.A.	English
MN 38	Mining	25	M	0	Mining— Open Pit or Strip	Domestic or Foreign	English
MN 42	Mining	23	S	—	Exploration, Prospecting	Australia	English
MN 43	Mining	27	M	0	Exploration, Geology and/or Research	Colorado	English/German
MN 45	EM-MSc	51	M	1	Mine Superintendent	U.S.A.	Spanish/English
MN 46	Mining	36	M	6	Exploration Development	S.W.-U.S.A. or Alaska	English
MN 50	Metallurgy	29	M	1	Mineral Processing Production or Engineering	Rocky Mountain States	English
MN 51	Metallurgy	26	S	0	Met. Engineering	Foreign	English
MT 47	Metallurgy	33	M	3	Mill Operation	West. U. S.	English
MT 48	Metallurgy	35	M	2	Development, Project Management	Colorado	English/Spanish
MT 50	Metallurgy	29	M	1	Mineral Processing Production or Engineering	Rocky Mountain States	English
MA 05	Mining—Math	26	M	3	Operations research, Systems analysis Prefer Management	Open	English
GE 34	Geol. Engr. Civil Eng.	39	M	3	Production—Mining or Non-metallic Processes	Open	English
GE 36	Geology	43	M	1	Production—Mining or Non-metallic Processes	Western U.S.	English
GE 38	Geology	35	M	2	Mineral Prop. Evaluation Mine Manag. & Planning	Western USA/Foreign	English
GE 40	Geol. Engr.	43	S	—	Exploration, Engineering or Research Geologist	Western U.S.A. or Foreign	English
GE 41	Geol. Engr.	39	M	3	Exploration Geologist	U.S.A. or Foreign	English
GP 15	Geophysics	49	M	3	Petroleum Expl.	Rocky Mountains	English
GP 17	Geophysics	34	M	1	Geophysics	Colorado	English
GP 18	Geophysics	23	S	0	No Mgmt. Trainee	Rocky Mountain	English
GP 19	Professional Engineer	24	M	0	Mineral Exploration	Southwest U. S. or South America	English
GP 21	Geophysical Engineering	39	M	3	Dynamics & Acoustics	U.S.A.	English
PE 15	Petroleum	24	S	0	Reservoir Engr.	Rocky Mtn. Region	English
PE 16	Pet. Eng.	27	M	2	Prod. Engr.	Rocky Mtn., Canada or Alaska	English
PE 17	Pet. Eng.	34	M	4	Pet. Engr.	Open	English
PH 02	Physics	23	S	0	Engineering Physics	Rocky Mtn. Region	English
PH 04	Engr. Physics	27	M	0	R. & D. Engr. Marine Engr.	Coastal except N.E.	English
PR 11	Masters in P.R.E.	30	M	2	Management Systems	U.S.A.	English
PR 12	Chem./Ptrlm. Refining	22	S	0	Chemical-Petroleum Refining Industry	Open	English/French
PR 14	Petroleum Refin. Engineer	39	M	5	Petroleum Refining or Chemical Engineering	Rocky Mountain	English

Mineral Industries

"Curtains of Water" Protect Australian Miners

Australian coal miners could soon be protected by "curtains" of water from one of the greatest dangers of their profession—the roll-on force of an underground explosion.

The "curtains" are laid from 20-gallon plastic tubes suspended from the ceilings of mines.

In the event of an explosion the force generated is sufficient to break the tube and release the water as a shower through which the explosive force has to pass.

The water breaks up the explosive force thus eliminating the danger from heat and gases. The manufacturers claim the "curtain" will prevent a chain reaction of explosions and localize damage.

The tubes have been tested and approved for use in coal and shale mines. Their use has satisfied the safety regulations of Australian State mines departments.

NSF Rock Flow Study May Aid Mine Safety

"Too little is known about the mechanical properties of natural materials such as rocks and soils," according to two University of Colorado professors. This ignorance is felt with special keenness by people who tunnel or mine with heavy rock above their heads.

Under a National Science Foundation grant of \$76,200 the two Civil Engineering professors will apply recent advances in mathematical and stress analysis techniques to these problems. Using a device they have designed, they will squeeze rocks at up to 25,000 pounds per square inch (25 KSI). The two researchers are Dr. Hon-Yim Ko and Dr. Kurt H. Gerstle, both members of the Civil Engineering faculty of the CU College of Engineering.

Already tested in prototype form, the unit will have substantial advantages over research devices used in the past, since pressure will be transmitted hydraulically to the rock samples, thus minimizing frictional and other characteristics which have limited the general applicability of previous research of this type.

With the better data from the new apparatus plus the sophisticated computerized analysis methods now possible, the results of the investigation should be of interest not only for deep mining and tunneling but for many types of excavations and foundations where natural rock is used as construction material.

Uranium-Bearing Ore Reserves in Wyoming

The Cleveland-Cliffs Iron Co., Getty Oil Co. and Skelly Oil Co. have announced delineation of uranium-bearing ore reserves resulting from joint exploration efforts in one area of the Powder River Basin of Wyoming.

In the discovery area in-place reserves of 1,250,000 tons containing 4,200,000 pounds of U₃O₈ at a depth of 150 feet, or less, have been outlined.

Exploitation of these deposits requires additional reserves to warrant construction of an economically-sized mill and development of a profitable market for the sale of U₃O₈ in yellowcake to private interests.

Similkameen Mining Co. Develops Copper Property

Similkameen Mining Co., Ltd., a wholly-owned subsidiary of Newmont Mining Corp., has announced that it has officially notified the government of British Columbia of its intention to put into production its mining properties located near Princeton, British Columbia.

Company officials said they have not completed the financing of the project and that they could give no estimate of the time required to complete the construction program at the site until they had made the final financing arrangements. The over-all cost of the project will be approximately \$75 million. J. H. Parliament, Similkameen's executive vice president, said the company is moving ahead on key contracts and several contracts have already been let. Some work in the field is underway.

Ore reserves at the two properties, which are located on either side of the Similkameen River, are estimated at 76 million tons, averaging 0.53 percent copper, all of which can be mined by open pit methods. Plans call for construction of an ore concentrator with a capacity of 15,000 tons of ore per day.

Copper Flotation Order Goes to Denver Equipment

Bechtel-W.K.E. have awarded Joy Manufacturing Co.'s Denver Equipment Division the complete flotation machine contract for the Bougainville Copper Project of the Conzinc Rio Tinto Group. Included are six banks of 18 cell No. 600H D-R* DENVER Rougher Flotation Machines and nine banks of 13 cell No. 30-100 D-R* DENVER Cleaner Flotation Machines.

The rougher flotation cells will be some of the largest mechanical cells operating anywhere in the world and two No. 300 DENVER Flotation Mechanisms will be used for each 600 cu. ft. cell. The saving in floor space using the large cells is considerable since each cell will only occupy about 125 square feet. Horsepower requirements compare with many smaller competitive cells having about two-thirds the flotation capacity. The No. 30-100 cu. ft. DENVER Flotation Cells will be used for cleaning and scavenging.

Bougainville Copper Pty. Limited is owned two-thirds by Conzinc Rio Tinto of Australia Ltd., and one-third by New Broken Hill Consolidated Ltd., and the Administration of the Territory of Papua and New Guinea have an option to take up 20 per cent of the equity. The Panguna porphyry copper deposit has estimated ore reserves of about 760 million tons with an average grade of .47 per cent copper and 0.4 cwt. gold per ton.

Ore Body at Camp Bird Mine Now Being Processed

Federal Resources Corp. has begun mining and milling of ore from a new ore body at its Camp Bird mine near Ouray, Colo.

The ore contains lead, zinc, silver and copper, according to Nels W. Stalheim, president. The ore is being processed through the 500-ton per day mill owned by Federal located on the property. The mine is owned by Camp Bird Colorado, Inc., a wholly-owned subsidiary of Federal Resources Corp.



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Technical Societies

Commodities Conference Sept. 28-30 in New York

Sept. 28 will mark the opening session of the three-day International Commodities Conference at The New York Hilton Hotel.

Purpose of the Conference is to provide a forum for the exposure and discussion of major issues facing the world-wide commodities industry. By bringing together members of the international community of professionals who use and are affected by commodities futures markets, the Conference will also serve to underscore the importance of futures markets to corporation executives who are not making full use of hedge protection opportunities.

Engineering Conference Being Held in Argentina

The Pan American Federation of Engineering Societies, (UPADI), the body that represents engineering in the Americas, will hold its XIth annual convention in Buenos Aires, Argentina from Sunday, Sept. 27 through Saturday, Oct. 3, 1970. Engineers who are members of a society member of Engineers Joint Council are eligible to attend any or all of the meetings.

The XIth Convention promises to be the most exciting and rewarding to date. Professional, business and government leaders from all the Americas will attend. Engineering policy and involvement in the problems of America will be presented, discussed, and formulated. The UPADI Convention and its attendant Congresses provide a unique opportunity for professional contacts with the engineering leadership of North, Central and South America.

Power Metallurgy Has Bright Future

ALBERT P. GAGNEBIN, president of The International Nickel Company of Canada, Limited, predicts that powder metallurgy will gain popularity during the Seventies because it is economically efficient, technologically sound and ecologically neutral.

Mr. Gagnebin made his prediction during a speech at the welcoming luncheon of the 1970 International Powder Metallurgy Conference on July 13 in New York City.

The powder metals industry has been growing at the rate of 15 to 20 per cent a year during the past decade, Mr. Gagnebin told his audience, adding that that rate is expected to continue well into the next decade.

"In the Seventies," Mr. Gagnebin said, "powder metallurgy will prove invaluable to those industries on the

frontiers of engineering. They will need alloys with properties that only powder metallurgy will be able to provide.

"The applications of powders," Mr. Gagnebin said, "are limited only by the imagination. We have seen powders used successfully in animal feed, fungicides, magnets, filters, bushings, batteries, tire studs, coinage, cutting tools, welding electrodes, powder metallurgy parts for the automotive, aircraft and consumer industries, greases, and on and on—a list that we could amplify for most of the afternoon. . . . Hundreds of new applications are waiting to be found. And they will be found through the research and engineering groundwork such as is being presented here this week.

"As part of a 1.1 billion dollar expansion program in Canada," Mr. Gagnebin continued, "we are now constructing a large modern nickel carbonyl pellet and powder refinery in Copper Cliff, Ontario. This refinery, due to go on-stream in 1972, will have a planned annual powder capacity of 25 million pounds of nickel powder. This, coupled with an expansion now under way at our Clydach (Wales) refinery, will mean a five-fold increase in our powder-producing capability since 1968. This, I think you will agree, is a fair testimonial to our faith in the growth potential of your industry."

International Nickel, Mr. Gagnebin explained, is not only committing a plant to this future, but people as well. Twenty metallurgists are now working on powders, in contrast with only one 12 years ago, he said.

In addition to the large technical

Program Completed for SPE Meeting Oct. 4-7 in Houston

TECHNICAL program featuring more than 150 papers and emphasizing environmental and pollution problems within the oil industry has been approved for the 45th Annual Fall Meeting of the Society of Petroleum Engineers of AIME. The SPE Fall Meeting will be held Oct. 4-7 at the Albert Thomas Convention and Exhibit Center in Houston, Texas.

The program for the SPE meeting was formulated from more than 300 papers submitted to the Society for possible presentation. The selection of the final program for the meeting was made by the SPE Program Committee headed by J. Ed Smith, Consulting Services Inc., Amarillo, Texas.

The SPE program will be divided into 28 technical sessions, which will be conducted over a 3-day period. Registration will begin on Sunday, Oct. 4, and the technical sessions will open on Monday, Oct. 5. Highlights of the meeting will be sessions on "Oil Spill Pollution Control," "Petroleum Technology and Pollution Control," "Offshore Operations," "Environmental Geology," and "Economics and Finance." In addition a special session on "Supplying the Energy Requirements for the '70's" will feature key management personnel from some of the nation's leading oil companies as speakers. Participants in this session will be announced at a later date.

Other sessions at the SPE meeting will cover topics such as well logging, reservoir prediction, automation and computer control, education and professionalism, gas storage, thermal recovery, reservoir simulation, drilling and rock mechanics, and well completions.

In addition to the large technical

Trans/Expo in Chicago

A vast array of equipment, including introductions of new designs for over-the-road operation will be exhibited at TRANS/expo International, Soldiers Field, Chicago, Sept. 18-20. The exposition is the largest outdoor showing of trucks, trailers and related equipment in the world.

Trucks, truck-tractors, semi and full trailers, bodies and all kinds of vehicle equipment will be exhibited and demonstrated by the leading manufacturers in highway transportation.

Address Changes

1920-1939

Cortez P. Hackett, '23, 950 S.W. 21st Avenue, Apt. 1109, Portland, Ore. 97205.
Nevin F. Wetzel, '34, 1945 So. 13th East, #19, Salt Lake City, Utah 84105.
Albert C. Harding, '37, 71 Magnolia, Casper, Wyo. 82601.
Alan E. Hall, Mgr., '39, Sun Oil Int. Devel. Div., 1845 Walnut St., Philadelphia, Pa. 19103.
Kenneth B. Hutchinson, '39, P.O. Box 54, Crestone, Colo. 81131.

1940-1959

H. D. Thornton, '40, 5025 Cascade, Corpus Christi, Tex. 78413.
Christian G. Kuehn, '41, Rt. 4, Box 694, Eugene, Ore. 97405.
Chas. E. Muller, '42, Lafayette Towers, Apt. 502, 21st & Lehigh, Easton, Pa. 18042.
Stanley H. Stocker, '42, Tyler, Tex. 75701.
Thomas H. Cole, '43, 700 T.W. Patterson Bldg., Fresno, Calif. 93721.
L. Comm. Frederick L. Doty, '43, 803 Terrace Pl., Peekskill, N.Y. 10566.
Enrique J. Ruiz-Williams, '45, 4608 N. Federal Highway, Ft. Lauderdale, Fla. 33308.
Philip B. Hammond, '48, 100 California St., San Francisco, Calif. 94111.
Lee M. Matthews, '48, Marathon International Oil Co., 539 S. Main St., Findlay, Ohio 45840.
Anthony M. Dizeuzo, '48, 6515 Fenton St., Arvada, Colo. 80002.
J. D. Alderman, '49, 4628 N. 15th Ave., Phoenix, Ariz. 85017.
Robert J. Black, '49, 41 Lucinda Ave., Wahroonga, N.S.W., Australia 2076.
L. B. Curtis, '49, 27 Heather Lane, Mahwah, N.J. 07430.
Norman H. Nordby, '49, 5070 Juniper, Littleton, Colo. 80120.
Robert D. Sloan, '49, 2020 Alameda Padre, Serre Santa Barbara, Calif. 93103.
Lawrence A. Garfield, '50, 15005 Tari Court, Colorado Springs, Colo. 80908.
Rustam H. Jrami, '52, P.O. Box 492, Pasadena, Calif. 91102.
Kurt O. Linn, '52, 13 Yalgum Road, City Beach, W.A., Australia 6015.
James H. Ogg, '52, 6936 Parfet St., Arvada, Colo. 80002.
Robert J. Andersen, '54, % Texas Instruments Italia, Via Edoardo 26, Milano, Italy.
Carl F. Cross, II, '54, 9138 White Oak Ave., Munster, Ind. 46321.
Edward W. Heath, '54, 593 N. Central Expressway, Richardson, Tex. 75080.
Patrick J. Early, '55, 3756 Mimosa Court, New Orleans, La. 70114.
Thomas O. Mohr, '56, 2020 Ford St., Golden, Colo. 80401.
Dr. Don L. Warner, '56, P.O. Box 781, Rolla, Mo. 65401.
Cecil I. Craft, Jr., '57, Geocom, Inc., 3311 Richmond Ave., Houston, Tex. 77006.
John E. Hoffman, '57, 602 First St., Golden, Colo. 80401.
James L. Bachman, '58, 18300 W. 4th, Golden, Colo. 80401.

1960-1970

Cpt. Charles B. Travis, '63, 4117X Townhouse Rd., Richmond, Va. 23228.
George A. Dunham, '59, Rt. #2, Box 62, Grundy, Va. 24614.
Dr. William N. Lawless, Jr., '59, 97 W. 5th St., Corning, N.Y. 14830.
Steven L. Milne, '59, % N. Jack Ronzio, 809-19th Street, Golden, Colo. 80401.
Donald L. Bredehoff, '60, 2515 Santa Barbara Dr., Pinole, Calif. 94564.
Donald H. Stegeman, '61, 2010 N. Broad, Galesburg, Ill. 61401.
A. S. Bakr, '62, 1200 Glenhurst Dr., Lodi, Calif. 95240.
Gary Lee Hutchinson, '62, 1 DeForest Rd., New City, N.Y. 10958.
John R. O'Donnell, '62, 3128 10th St. N.W., Calgary 43, Alberta, Canada.
William R. Pittman, '62, 1700 So. Birch St., Casper, Wyo. 82601.
Dr. Francis J. Furman, Jr., '63, 117 Andover Circle, Oak Ridge, Tenn. 37830.
Charles N. Speltz, '63, 21 Owen St., Eureka Springs, Ark. 72632.
Lt. Floyd S. Ito, '64, 2542 E. Puritan Circle, Anaheim, Calif. 92806.
Eugene M. Dickerhoof, '66, 1132 Hollywood Ave., Oakland, Calif. 94602.
Thomas E. Dimelow, '66, % Pan American Petr., P.O. Box 1410, Fort Worth, Tex. 76101.
John C. Ferrell, '66, Route #3, Sterling, Colo. 80751.
Richard E. Hague, '66, 18904 Smoothstone Way, Gaithersburg, Md. 20760.
Merritt M. Hluman, '66, 105 Rock Island St., Gouverneur, N.Y. 13642.
Stephen Boyd Self, '66, P.O. Box 506, Craig, Colo. 81625.
William D. Van Arnam, '66, 1813 Cobourg Court, Apt. A-3, Baltimore, Md. 21234.
Robert D. Carson, '67, R.R. #2, Pittsburg, Kans. 66762.

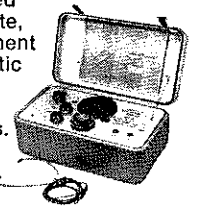
Alberto R. Cisneros, '67, 716 Ramona, Sunnyvale, Calif. 94087.
Stephen P. Collins, '67, 860 Mottsiff Lane, Helena, Mont. 59601.
Danny Ken Harper, '67, 6477 Atlantic Ave., Apt. 254-S, Long Beach, Calif. 90805.
James D. Bundy, '68, 944 So. Poplar, Casper, Wyo. 82601.
Marion C. Chambers, Jr., '68, % Technical Service Dept., 30 Algonquin Rd., Des Plaines, Ill. 60016.
William G. Doepken, '68, 613 W. 8th St., Leadville, Colo. 80461.
Lt. Gerald W. Grandey, '68, 4949 Manitoba Dr., Apt. 601, Alexandria, Va. 22313.
Paul G. Hansen, '68, % Adams, Corthell, Lee, Winco & Assoc., 503 E. 6th Ave., Anchorage, Alas. 99501.
Thomas E. Irwin, '68, P.O. Box 853, Four Seasons Estate, Leadville, Colo. 80461.
Jay A. Manning, '68, 1042 N. Wells, Pampa, Tex. 79065.
William T. Reish, '68, 8915 So. Gessner, Apt. #1, Houston, Tex. 77036.
Neal E. Schmale, '68, 1132 Pittsfield Lane, Ventura, Calif. 93003.
Earl N. Wagner, '68, 1514 So. Shelley Dr., Deming, N.M. 88030.
Ronald J. Cooper, '69, % Continental Oil Co., 1800 No. Ashwood, Ventura, Calif. 93003.
Gary Gehloff, '69, Alcoa, 1505 Wales, Maryville, Tenn. 37801.
Larry D. Hartman, '69, 1383 W. 103 Road Pl., Denver, Colo. 80221.
William D. Heagney, '69, 1201 Spruce St., Apt. 211, Morgan City, La. 70386.
Richard C. Heard, '69, 5331 E. Asbury, Denver, Colo. 80222.
Christopher K. Loomis, '69, 2989 Canyon Crest, Apt. C, Riverside, Calif. 92507.
Stephen M. Nicolais, '69, 6409 Eastbourne Ave., Baltimore, Md. 21224.
Michael A. Acosta, '70, 802 W. 17th, Pueblo, Colo. 81003.
Mr. David R. Allison, '70, 8255 W. 66th Dr., Arvada, Colo. 80002.
Mohammed Fahad Al-Farhan, '70, P.O. Box 362, Riyadh, Saudi Arabia.
David R. Allen, '70, 13530 Loscoches Rd. E., El Cajon, Calif. 92021.
Mohamed A. Al-Sofi, '70, Prince Fahd, P.O. Box 502, Al-Khobar, Saudi Arabia.
Gary L. Andes, '70, Route #2, Brooklyn, Iowa 52211.
Jerry W. Archer, '70, 1314 Avenue D, Billings, Mont. 59101.
Mrs. Colleen M. Arkley, '70, 1317 So. Josephine, Denver, Colo. 80210.
David W. Armstrong, '70, 3301 W. 73 Ave., Westminster, Colo. 80030.
Stephen L. Ashton, '70, 27 Country Club Dr., Monte Vista, Colo. 81144.
Nathan I. Banker, '70, 1264 Ogden St., Denver, Colo. 80218.
Charles W. Barksdale, '70, 440 Morrison, Pueblo, Colo. 81003.
Terry C. Barnes, '70, 2052 Crestvue Circle, Golden, Colo. 80401.
Michael R. Barr, '70, 1230 Arrowhead Dr., Irving, Tex. 75060.
Gail A. Batman, '70, Route 1, Box 68, Pierce, Colo. 80650.
Terry D. Bauer, '70, 3240 E. Mexico Ave., Denver, Colo. 80210.
Eric A. Bayley, '70, 3148 Victor, Aurora, Colo. 80016.
Kirk D. Bell, '70, Route #2, Castle Rock, Colo. 80104.
Omar M. Ben Zarty, '70, Suk-Arbaa No. 4, Tripoli, Libya.
Dale E. Bingham, '70, 545 Meadowlark Dr., Lakewood, Colo. 80226.
Robert J. Bisdorf, '70, 6762 Brookline Dr., Hialeah, Fla. 33012.
Charles R. Blanks, '70, 3040 Zenobia, Denver, Colo. 80212.
Mrs. Claudia L. Blauer, '70, 7860 Platte Canyon Rd., Littleton, Colo. 80120.
William C. Block, '70, 2222 1st Avenue N.E., Cedar Rapids, Iowa 52401.
Anton W. Bosch, '70, 8303 Depew Way, Arvada, Colo. 80002.
Daniel G. Brooks, '70, 1796 So. Urban Way, Denver, Colo. 80228.
Richard L. Brooks, '70, 190 Washington Ave., #3, Golden, Colo. 80401.
Paul L. Brown, '70, 8124 Blewett St., S. San Gabriel, Calif. 91777.
Leroy F. Burson, '70, P.O. Box 278, Walsh, Colo. 81090.
Daniel S. Carroll, '70, 2500 E. Jewell, Denver, Colo. 80210.
Bart P. Caruso, '70, 1624 Rosarbor Dr., St. Louis, Mo. 63141.
Robert E. Childress, '70, 670 Pearl, Apt. #7, Denver, Colo. 80203.
Wing-On Chu, '70, 3 Fl., 8 Mt. Butler Rd., Hong Kong.
Howard G. Clark, III, '70, 124 Prospector Park, Golden, Colo. 80401.
Allen R. Cockle, '70, P.O. Box 587, Ouray, Colo. 81427.
Gary J. Colalizzi, '70, 3915 Bruce St., Apt. 105, Alexandria, Va. 22305.
John G. Collins, '70, 2765 So. Adams, Denver, Colo. 80210.

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Alumni Headliners

R. W. Crabtree of Hercules, Inc. Retires With 36 Years Service

ROBERT W. CRABTREE, director, nitrogen products, in the Explosive Division of Hercules Incorporated's Explosives and Chemical Propulsion Department, retired Aug. 1 after 36 years of service to the firm.

Mr. Crabtree joined Hercules' Explosives Department in 1934 as a sales service representative in Arizona, working from the company's San Francisco office. He was named resident manager of explosives sales in the Los Angeles office in 1948.

In 1953 he became division manager of nitrogen product sales, and in 1955 was appointed manager of nitrogen chemical product sales, with headquarters in Wilmington.

Mr. Crabtree became sales manager, chemical sales, in the Synthetics Department in 1964, and assumed his present position in 1966.

Mr. Crabtree was born in Reno, Nev., and received his degree in mining engineering from the Colorado School of Mines.

His future home will be in Modesto, Calif.

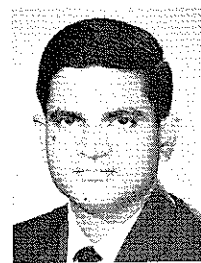
Pothast Marries; Receives Degree From Harvard

KENT POTHAST, E.M. 1960, received his M.B.A. degree from Harvard Business School June 11, 1970. He was married on June 13, 1970 to Miss Peri Lee Gardner in Colorado Springs.

Kent and his bride visited the campus before leaving for England where Kent will be employed as a Management Consultant with the firm of Urwick, Orr & Partners Ltd.—Baylis House, Stoke Poges Road—Slough, Buckinghamshire, England.

The newlyweds will honeymoon for six weeks in Europe before Kent begins work in England.

The Pothast's U.S. address will be c/o Mrs. Anna Bielfeldt, P.O. Box 164, Teril, Iowa 51364.



Lawrence

G. A. Lawrence Leaves India For Position With Galigher

GEORGE A. LAWRENCE, Met.E. 1959, has moved from Bombay, India, to Salt Lake City where he is employed as a sales engineer for the Galigher Co. His responsibilities include the sale of Agitair flotation machines and accessories. He was previously employed as a senior sales engineer with Dorr-Oliver (India) Ltd. at Bombay.

Mr. Lawrence hopes to renew his acquaintance with Mines alumni in Salt Lake City and has renewed his membership in the CSM Alumni Assn.

Breeding Exploration Director Of W. R. Grace & Co. Division

WILLIAM H. BREEDING, E.M. 1939, has been appointed director of exploration and development of the Ore & Mining Division of W. R. Grace & Co. He also becomes assistant vice president of the newly-formed Natural Resources Group.

Mr. Breeding joined Grace in 1964 and most recently was in charge of placer operations of Grace's majority-owned subsidiary, Estalsa S. A., in Bolivia. He will continue to be in charge of all placer mining, including operations, for the Ore & Mining Division.

In his new capacity, Mr. Breeding will be responsible for all exploration and development efforts of W. R. Grace & Co.'s Ore & Mining Division, and will also supervise exploration by subsidiaries operating in Australia, Canada, the Western U. S. A., Turkey and various countries in Latin America.



Davidson

Bert Davidson Becomes President Of the Churny Co., Inc.

BERT B. DAVIDSON, JR., P.E. 1959, has become president of the Churny Co., Inc. He was formerly president of J. S. Hoffman Corp., Moonachie, N. J.; president of Davidson / Fleming, Inc., Owensboro, Ky., and assistant to the vice president, Container Division, W. R. Grace Co., Cambridge, Mass.

As president of Churny Co., Mr. Davidson plans to expand the meat and dairy products firm to a national operation. Churny produces and imports perishable items, such as cheese, specialty meats and prepared foods, for dairy and delicases.

Ryan Joins Mineral Surveys As Operations Manager

GEORGE S. RYAN, Geol.E. 1953, has joined the staff of Mineral Surveys, Inc. as operations manager for the ground phase of MSI contract work. For the past 17 years he has been with The Anaconda Co., most recently as senior geophysicist in Tooele, Utah.

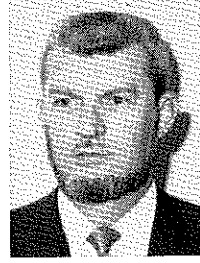
MSI, a subsidiary of Scintrex Ltd., Toronto, Canada, is located in Salt Lake City, Utah. The company handles sales and rentals of Scintrex, Ltd. equipment and also runs contract surveys in all types of mineral geophysical work, including airborne surveys.

Gist Joins Humble Oil At Baytown, Tex. Plant

RONALD L. GIST, B.Sc. (C. P.R.), has accepted employment as an engineer in the Technical Division of Humble Oil and Refining Co.'s Baytown Plant, located in Baytown, Tex. He is assigned to Environmental Control and Treating Section.

Mr. Gist graduated in 1970 from the Colorado School of Mines with a bachelor of science degree in Chemical Engineering. He was a student member of the American Institute of Chemical Engineers, Tau Beta Pi (honorary), and Sigma Gamma Epsilon (honorary).

Mrs. Gist is the former Sally J. Rager, daughter of Mr. and Mrs. G. H. Rager, 12475 W. 31st Ave., Lakewood, Colo. He is the son of Mr. and Mrs. R. N. Gist, 13583 W. 24th Pl., Golden, Colo.



Ryan

Stefan P. Choquette Awarded \$750 PESA Scholarship

STEFAN P. CHOQUETTE, a senior at the Colorado School of Mines, was one of three students selected to receive the Petroleum Equipment Suppliers Association Scholarships for 1970-71. The three students, who will receive their \$750 scholarships this month, will be honored in special ceremonies at the Membership Luncheon during the Society of Petroleum Engineers 45th Annual Fall Meeting in Houston Oct. 4-7. SPE co-sponsors the selection of the scholarship winners with PESA.

Mr. Choquette, son of Mr. and Mrs. A. Paul Choquette of 359 Bannock St., Denver, is a Petroleum Engineering student at the School of Mines and expects to graduate in June, 1971. During the fall semester he earned a 3.57 grade-point average out of a possible 4.00, and his overall grade-point average is 3.58. Choquette, who ranks twelfth in a class of 256, is currently serving as chairman of the Colloge Union Advisory Board at the School of Mines, president of the school's AIME student chapter, and secretary of Scabbard and Blade, a national ROTC honor society.

D. C. Campbell Becomes President Of Financial Programs, Inc.

DONALD C. CAMPBELL, Met.E. 1945, prominent Denver investment banker, has been named president of Financial Programs, Inc., manager/distributor of four mutual funds, and concurrently was named a vice president of FPI's parent company, the Gates Rubber Co.

The announcement was made by Charles C. Gates, Jr., president of the nation's sixth largest rubber manufacturing company.

After graduation from the Phillips Exeter Academy, Campbell received an E.M. degree from the Colorado School of Mines in 1945 and subsequently attended the University of Denver Law School. Later he became president of Electronic Network, Inc., and a vice president of Trinidad Community TV (CATV) before becoming president of Denver Electronic Supply Corp. After these companies were sold, he was named president of Central Investment Corporation in 1962. The acquisition of Central Investment Corp. by the diversified Dillon Companies, Inc. created the Dillon Capital Corp. and Campbell was named its first president.

Financial Programs, Inc. serves 170,000 shareholders in all 50 U. S. states and 30 foreign countries. Assets under management exceed \$550 million. FPI is the distributor/manager of four funds—Financial Industrial Fund, Financial Industrial Income Fund, Financial Dynamics Fund and Financial Venture Fund—and has two subsidiaries, Financial Trust and Financial Assurance, Inc.

Dr. Larsen Named Manager Of Research & Development For Bunker Hill Company

DR. ANDREW H. LARSON, former CSM professor of metallurgy, has been appointed manager of research and development, Bunker Hill Co.

Dr. Larson joined The Bunker Hill Company on August 1, 1968 as a Senior Research Metallurgist. Before he came to work for Bunker Hill, Dr. Larson was a professor of Metallurgical Engineering at the Colorado School of Mines, a Production Specialist at Dow Chemical Company, an Associate Professor of Metallurgical Engineering at the University of Missouri (Rolla), and had held various engineering positions with other companies.

Dr. Bement Visting Professor Of Nuclear Materials at M.I.T.

DR. ARDEN L. BEMENT, Met.E. 1954, manager of Battelle-Northwest's Fuels and Materials Department, has been appointed Visiting Professor of Nuclear Materials at Massachusetts Institute of Technology for the Academic Year 1970-71.

The appointment was granted jointly by the Department of Nuclear Engineering and the Department of Metallurgy and Materials Science at M.I.T. The appointment was made under the auspices of Battelle-Northwest and AEC's Staff-Faculty Interchange Program.

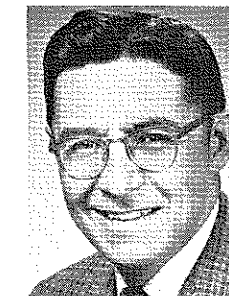
Dr. Bement's assignment will include teaching graduate courses in Metallurgy for Nuclear Engineers and in Nuclear Fuels. He will also supervise graduate research.

Dr. Bement joined Battelle-Northwest in 1965 when the Institute assumed operation of the laboratory for the Atomic Energy Commission. Since his original employment at the Hanford Project under General Electric in 1954, he has been highly instrumental in research programs dealing with the effects of radiation to fissionable and non-fissionable metals and alloys.

Dr. Bement received his Metallurgical Engineering degree from the Colorado School of Mines and his Master's degree from the University of Idaho. He was awarded his PhD in Metallurgical Engineering by the University of Michigan.

He is a member of the Richland City Council; a member of the faculty of the University of Washington at the Joint Center for Graduate Study in Richland, and has taught at Columbia Basin College. He is also a member of the American Society for Metals, the American Nuclear Society and the American Society for Testing and Materials. He is a Fellow of the American Institute of Chemists.

He is the author of numerous technical articles and publications.



Burgh

Burgh Made General Manager Of Marblehead Line

ERNEST BURGH, E.M. 1944, has been promoted to general manager of Operations. Marblehead Lime is a subsidiary of General Dynamics, and the largest producer of industrial lime in the nation.

A graduate of the Colorado School of Mines, Mr. Burgh has been with Marblehead for nine years. During this time, he has served in various managerial production capacities, most recently as Group Production Manager.

Mr. Burgh's new responsibilities will embrace all of Marblehead's limestone quarries and manufacturing plants.

George W. Wunder Appointed Director of Technology For Anaconda Company

GEORGE W. WUNDER, E.M. 1936, has been appointed director of technology for The Anaconda Company. He comes to Anaconda from New Jersey Zinc Co., where he has been executive vice president in charge of operations.

Mr. Wunder received a degree in Mining Engineering from the Colorado School of Mines in 1936. He joined U. S. Smelting, Refining and Mining Co. and served 12 years at their operations in Utah, with time out in 1941-1946 for service as an officer with the U. S. Army Corps of Engineers in the South Pacific.

He joined National Lead Co.'s Titanium Division in 1948 and held management positions at the company's operations in Tahawus, N. Y., and Cincinnati, Ohio. He formed and became manager of its Nuclear Metals Division in 1957. In 1965 he was appointed managing director of the company's magnesium project, set up to determine the economic feasibility of producing magnesium metal from the brine of Great Salt Lake in Utah. He left National Lead to become executive vice president of New Jersey Zinc Co. in 1967.

As director of technology, a new position, Mr. Wunder will direct Anaconda's research and engineering activities. His office will be located at corporate headquarters in New York. His home is in Port Washington, N.Y.

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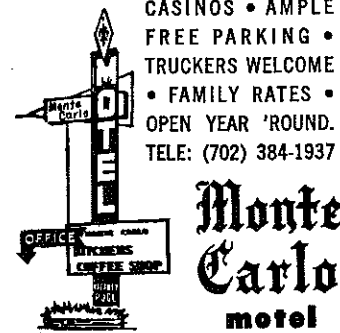
W. H. Wahl Joins MSME, Heading Mech. Engineering

WILLIAM H. WAHL, E.M. 1958, production manager for the Spreckels Sugar Co.'s modern \$20 million beet processing plant at Chandler, Ariz., has quit that post to join Mountain States Mineral Enterprises, Inc., Tucson, as head of the mechanical engineering section.

Mr. Wahl has had 12 years' experience in engineering for the mining and process industries, seven of these including wide experience in mine surveying, estimating and selection of material handling equipment. Previously, he was chief chemist, supervising 30 technicians, in charge of a Woodland, Calif., factory quality control laboratory and a member of the city planning staff of Richmond, Calif.


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B. A. Maas New Manager Rural Marketing for Standard

B. A. (BEN) MAAS, JR., P.R.E. 1950, is new manager of rural marketing in a realignment of the American Oil Co. consumer marketing department, to achieve greater customer orientation. He had been manager of asphalt sales in the commercial marketing department.

Mr. Maas joined the parent Standard Oil Co. (Indiana) in 1951 as a sales trainee at Denver. Later that year he was named superintendent of construction and automotive equipment in Cheyenne, and then returned to Denver in 1955 in a similar position. He was made regional engineer in Kansas City in 1957, chief engineer of planning and projects in the marketing design and engineering department in Chicago in 1961, and district manager at Casper in 1963. Mr. Maas returned to the general office at Chicago in 1965 as manager of asphalt sales for American Oil Co.

He was graduated in 1950 from the Colorado School of Mines with a degree in Petroleum Refining Engineering. He is a member of the American Society of Military Engineers. Prior to his employment with Standard, he served as petroleum refining engineer in a refinery in Kansas.

B. G. Newton Chief Geologist For Pan American Petroleum

B. G. NEWTON, Geol.E. 1952, will become chief geologist, Pan American Petroleum Corp. He was formerly division geologist in the New Orleans Division.

Mr. Newton joined Pan American in 1952 as a junior geologist in Casper, Wyo. He was named district exploration superintendent at Casper in 1961 and district exploration superintendent in Pan Am's Denver Division in 1965. In 1966 Newton was named division geologist in the New Orleans Division.

A native of Liberal, Kan., Mr. Newton received a Geological Engineering degree in 1952 from the Colorado School of Mines. He is a member of the A.A.P.G. and Tau Beta Pi, an engineering honor society.

McKinstry Joins Dow Chemical

KARL A. MCKINSTRY, who received a Ph.D. degree in Chemical Engineering from Colorado School of Mines in 1970, has joined The Dow Chemical Co. at Midland, Mich., in the Hydrocarbons and Monomers Research Laboratory.

H. C. Meabon Appointed Senior Planning Associate For Marathon Oil Company

HAROLD P. MEABON, M.Sc. 1965, has been appointed senior planning associate in the planning coordination division of Marathon Oil Company. Mr. Meabon, who had been Gulf Coast district petroleum engineer, assumed his new responsibilities on May 16.

Mr. Meabon joined Marathon in 1952 following his graduation from Pennsylvania State University with a Bachelor of Science in petroleum and natural gas engineering. He subsequently served in various engineering positions for the company in Nebraska, Wyoming, Colorado and Texas, prior to being named Gulf Coast district petroleum engineer in February 1968.

He is a registered professional engineer in Colorado and Texas and a member of the Society of Petroleum Engineers. In 1965, he was awarded a Master of Science from Colorado School of Mines, where he was the first student ever to earn a degree through night study only.

Kackman Manager of Kaiser's Industrial Minerals Dept.

ARNOLD H. KACKMAN, E.M. 1954, a mining engineer with 16 years' experience in mineral industries projects, has been appointed manager of Kaiser Engineers' Industrial Minerals Department. He replaces Kenneth E. Olsen, who was recently appointed resident vice president of the organization's Australia-New Zealand projects.

His most recent assignment was project manager for a \$10 million aggregate plant designed and constructed by Kaiser Engineers at Radum, California. It is the newest and most highly automated sand and gravel plant in the nation.

A graduate of the Colorado School of Mines, Mr. Kackman has a particularly extensive knowledge of cement plant engineering, construction and operations. He is a member of the American Institute of Mining, Metallurgical and Petroleum Engineers.

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Class Notes

1932

Nelson E. Trumbull, P. E. 1932, recently has suffered a stroke which has resulted in a permanent disability.

1938

G. Marsh Chapman, Geol. E. 1938, who was previously located in Cleveland, has been transferred by his company to Los Angeles where he is a sales representative, Catalyst and Ceramic Division, the Henshaw Chemical Co., division of Kewanee Oil Co. The Marsh office address is: 6500 E. Washington Blvd., Los Angeles, Calif. 90022.

Allan P. Nesbitt, E. M. 1938, has retired from the Corps of Engineers, U. S. Army. Allan may be addressed as follows: Construction Engineer, Construction Branch, Division of Contracts and Standards, Department of Public Works, 400 King County Courthouse, Seattle, Wash. 98104.

1942

Joseph D. Gilbert, Met. E. 1942, wrote that he is still working as chief metallurgist for Dana Corp.'s Perfect Circle Division, "which is the largest supplier of components for the transportation industry." However Joe has moved to Colorado City, Colo., where his address is P. O. Box 185. Colorado City is a new community that is developing South-West of Pueblo at the foot of the San Isabel Mountains.

1950

Brok Tarbell, P. E. 1950, who is vice-president of White Shield Gas and Oil Co. of Tulsa, was injured in an airplane accident last August 1969. He wrote in July 1970; "I'm just recently out of the hospital. I'm able to be back at work on a limited scale. It's a long story!" Chuch Westfall, '52, who is also with White Shield, has been kind enough to keep us informed of Brook's progress over the year that he has been in the hospital.

1953

George L. Freeland, Geol. E. 1953, formerly an exploration geologist with Shell Oil Co., has been awarded a National Research Council Post-Doctoral Research Assistantship at ESSA's Atlantic Oceanographic Laboratory in Miami, where he will work on plate tectonics and continental drift in the Marine Geology and Geophysics Section under Dr. Robert S. Dietz. He is currently completing his Ph.D. work in Geology at Rice University in Houston. His new address is: 365 Harbor Court, Key Biscayne, Fla. 33149.

Edgar D. Turner, P. E. 1953, who was division manager of the Western Offshore Drilling and Exploration Co. in Anchorage, Ak has moved and we do not have his new address.

1958

Robert B. Barker, Met. E. 1958, wrote, "I was recently promoted to the position of plant manager for the Dow Chemical Co.'s numerical control precision machining facility located at Stapleton Airfield in Aurora, Colo.

1963

Cecil T. Caves, E. M. 1963, has been employed for several years with Olin Corp. at Saltville, Va. Cecil just informed us that he has been given a leave of absence by the Olin Corp. to pursue graduate studies leading to an M.B.A. degree at the University of Virginia, effective September 1970. His new address is: Apt. C-4, University Gardens, Charlottesville, Va. 22904.

1964

John W. Lindemann, Geol. E. 1964, formerly with Navarro Exploration Co. in Windhoek, Southwest Africa, has recently moved to London where he will pursue advanced studies at the Royal School of Mines of the Imperial College. He and his wife may be addressed at: 8-Savona Close, Thornton Hill S.E. 19, London, England.

Richard W. Webb, P. E. 1964, who has been an engineer with Marathon Oil Co. in Anchorage, has been transferred to Wichita. At this time we do not have his new address.

1966

Jonathan DuHamel, Geol. E. 1966 & M. Sc. 1968, recently accepted a position with Phelps Dodge Corp. in Douglas, Ariz. He will be involved in exploration for porphyry copper deposits. Until Jonathan is permanently located, he may still be addressed as follows: Jonathan E. DuHamel, 19 Evelyn St., Oakville, Conn.

1968

Steve W. Hackett, Geop. E. 1968, who was formerly with Union Oil Co. at their Anchorage office, has now been transferred to Portland, Ore., where his address is: 950 S.W. 21st Ave., Apt. 1109, Portland, Ore. 97205.

1974

Charles Cropper, 1974, who has completed two and a half years at Mines is with the Peace Corp. in Simo Diaz, Sergipe, Brazil, where he is working on rural electrification. He expects to return to Mines in June 1972 and should be able to graduate in three semesters.

G. C. Weaver, '26

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CONSULTANT

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CARLSBAD, NEW MEXICO

Letters

Dear Col. Fertig:

All is well here at Kaiser Engineers. I expect to be moving to Perth, Western Australia within a few weeks to begin work on the "Helmet" Project which K. E. is undertaking on behalf of Hamersley Iron.

Best regards,
Dick Pitney, E.M. 1960

P. O. Box 925
Casper, Wyo. 82601
Aug. 17, 1970

Dear Wendell:

Just a short letter to let you know that I have had a change of scenery and affiliation. After nineteen years with various oil companies, I have become a consultant, so I am now a geophysical consultant specializing in seismic interpretations.

My new address is: 2044 Fairview Avenue, Casper, Wyo. 82601. Please pass this new address on to the editor of the Mines Magazine.

Sincerely,
George H. Warburton,
Geol.E. 1951

Dear Wendell:

I appreciate your noticing the news release on our taconite work here in Rapid City. I'll look forward to the next issue of the Mines Magazine with great interest.

My work so far on the South Dakota taconites has been unfunded and represents my own interest in rotary kiln-electric furnace processing of ores. With the low cost coal, gas and labor in our locality I do feel this project should attract the regional interest of those interested in iron and steel.

Best regards,
Leonard E. Olds, Met.E. 1949
Associate Professor
S. D. School of Mines
Rapid City, S. D.

August 3, 1970

Dear Wendell:

I finally got tired of the winters in the St. Louis area and have moved to El Paso, Texas.

We have been here about a month now and I feel better, the wife likes it here, we're getting acquainted fast—so we think we will retire here.

I turned over all my CSM files to Mr. E. W. Markwardt, 104 E. Monroe, P. O. Box 98, O'Fallen, Ill. 62269, who may try to reactivate the St. Louis Section again. When the Lead Belt (our old gang) Miners retired and scattered, we had no more meetings. Hope some of the younger Miners can get together again.

I intend to look up some of the CSM Miners of the El Paso section soon. Best regards.

Sincerely,
H. A. Dumont,
1300 Avalon, Apt. D
El Paso, Tex. 79923

In Memoriam



Arthur E. Falvey

ARTHUR EDWARD FALVEY, E.M. 1934, 60, died suddenly in Sheridan, Wyo., July 29.

Services were held July 31 at the Adams Funeral Home in Buffalo, Wyo., with the Rev. C. O. Galbreath officiating. Burial was in Evergreen, Colo.

Mr. Falvey was born on April 13, 1910, in Bloomfield, Neb., and grew up in Omaha. He married the former Lillian Erickson in Denver on June 3, 1932.

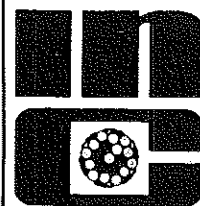
After graduating from the Colorado School of Mines in 1934 as a Mining Engineer, he worked as an engineer in Idaho Springs for several years. For 16 years he worked for the Minerals and Chemical Co. in Georgia.

During World War II, he worked for the government as an engineer and later was employed by the U. S. Bureau of Mines for 10 years. He and his wife then moved to Buffalo in October, 1969 where Falvey had been employed as a safety engineer for Eagle Western Construction at Lake De Smet.

He is survived by his wife, Lillian of Buffalo; and two sons, Donald A. Falvey of Evergreen and Henry T. Falvey of Conifer; his mother, Mrs. Elsie W. Pool of Buffalo, and five grandchildren.

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F. T. "Tom" Ise, '55
J. H. "Pepe"
Petersen, '57
John R. "Jack"
McMinn, '42
Fred G. Van Matre,
'56
Jeff J. Wood, '54
Robt. J. Lickus, '58

Robin J. Corbett

ROBIN J. CORBETT, P.E. 1948, died in Denver on June 20 following a short illness from kidney failure.

Born July 30, 1921, in Oakland, Calif., Mr. Corbett entered Mines in September 1941 and received his Petroleum Engineering degree in 1948. He was honored as the outstanding graduate in his option; was an energetic student leader as well as a fine scholar, was senior class president, and was a member of Sigma Gamma Epsilon and Tau Beta Pi honorary fraternities. During World II, he served in the Army Air Corps as a B-29 pilot.

From graduation through 1968, Robin was production manager for Sharples Oil Co. After Sharples dissolved its production operation, he joined C. A. Norton and Associates as a petroleum consultant. He was a member of SPE of AIME and API.

He is survived by his widow, the former Miriam Bax of Morrison, Colo., whom he married Oct. 17, 1952; three children, Corey J., Randy J., and Elizabeth R., all of Morrison; and two brothers, Morley of Walnut Creek, Calif., and William of Saratoga, Fla.

Robin will be remembered by his classmates and many other close friends as a dedicated professional engineer. His keen wit and perpetual good humor made him a delightful companion who could relax and spin a tale in keeping with the finest tradition of Mines.

The family suggests donations to Kidney Foundation, 426 Metropolitan Bldg., Denver, Colo. 80202 for those wishing to make a contribution in his memory.

George H. Wigton

GEORGE H. WIGTON, E.M. 1913, died May 7 at Presbyterian Medical Center in Denver. Services were held May 11 at Fairmont's Chapel in the Pines.

Mr. Wigton was born Dec. 14, 1888 in Hastings, Neb. His family moved to Denver in 1890 and he attended Denver public schools. In 1907 he graduated from East High School and in 1913 he received his E.M. degree from the Colorado School of Mines. He was a member of Tau Beta Pi engineering fraternity.

Mr. Wigton's first mining experience was at the Camp Bird Mine near Ouray, Colo. After that he specialized in extractive metallurgical engineering. In 1915 he married Frances Anne Irion of Denver.

Until 1916 he was a member of the research department of Anaconda Copper Mining Co. at Great Falls and Anaconda, Mont. Subsequent positions included 21 years as metal-

lurgist for Chief Consolidated Mining Co. at Eureka, Utah; three years as superintendent at Dayton Consolidated Mines at Silver City, Nev.; two years as superintendent at Getchell Mine, Winnemucca, Nev., and 13 years as metallurgist for Sherwin Williams Co. at Coffeyville, Kans. He retired in 1959 and returned to Denver, where he lived at 740 Fairfax St.

Mr. Wigton was a member of the Legion of Honor of AIME to which organization he had belonged since 1914.

Mr. Wigton is survived by his wife, Frances Anne Wigton, Denver; two daughters: Mrs. Brown Lokken, Columbia Falls, Mont., and Mrs. B. W. Haff, Idaho Falls, Idaho; five grandchildren, and one great grandchild.

Cleveland O. Moss

CLEVELAND O. MOSS, E.M. 1902 died June 9 at a hospital in Del Mar, Calif. Services were at St. Peter's Episcopal Church and interment in Mt. Hope Cemetery.

Born Apr. 1, 1877 in Ottumwa, Iowa, Mr. Moss received his E.M. degree in 1902 from the Colorado School of Mines. From 1902 to 1928 Mr. Moss was engaged in surveying, geological examinations, and mining in Colorado, Utah, Arizona, California and Nevada. He also was the engineer for an iron mining company in Brazil and chief chemist for its electric, iron, and steel plant. From Sept. 1, 1928 to Mar. 1, 1949 Mr. Moss was employed by Shaffer Oil & Refining Co. and its successor, Deep Rock Oil Corp., as production engineer, superintendent, and chief petroleum engineer. From Mar. 1, 1949 to April 1, 1956 Mr. Moss was a consulting petroleum engineer in Tulsa, Okla.

He was a member of AIME, American Petroleum Institute, Independent Petroleum Association of America, Engineers Club of Tulsa, CSM Alumni Assn., etc.

Survivors are his widow, Helen Hodge Moss of Del Mar, Calif.; two sisters, including Mrs. Leverett Adams of La Jolla, and a brother.

Morton E. Frank

MORTON E. FRANK, E.M. 1906, passed away Feb. 9, 1970 after a short illness. A loyal alumnus of the Colorado School of Mines, Mr. Frank did much to keep the Great Lakes Section alive. In 1966 he attended the 60th reunion of the Class of 1906 in Golden.

Mr. Frank is survived by his wife, Mrs. M. E. Frank, 6929 Crandon Ave., Apt. 21, Chicago, Ill.

Campus Headlines

Naval Research Grant

The Colorado School of Mines Geophysics Department has received a \$3,000 research grant from the Office of Naval Research entitled "State-of-the-Art Review of Through-the-Earth Communications." Principal investigator for the project is Dr. George V. Keller.

The research will consist largely of a critical literature survey of approximately 500 literature citations in English, French and Russian languages pertinent to the study. Three topics will be covered: studies of crustal structure; studies of electrical properties of rocks; and studies of the propagation of electromagnetic fields.

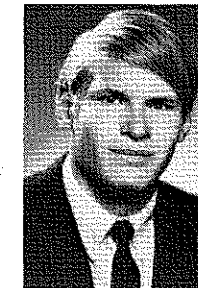
1800th Cadet Commissioned

A SIGNIFICANT milestone was reached on Aug. 8, 1970 by the Colorado School of Mines when Charles R. Miller, a 1970 graduate, was commissioned a Second Lieutenant in the U. S. Army Corps of Engineers by Colonel Cecil C. Baldwin, professor of Military Science. Lieutenant Miller is the 1800th officer commissioned through Mines' Reserve Officer Training Corps since its inception in 1918.

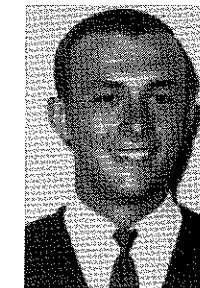
The son of Mr. and Mrs. C. R. Miller of 1898 Yarrow Street, Lakewood, Colo., Lt. Miller graduated with a degree in Metallurgical Engineering and completed the four year Senior ROTC program at Colorado School of Mines on Aug. 8.

Due to its progressive engineer-oriented curriculum, the ROTC program at Mines enjoys the support of both faculty and students and is considered an example to other universities throughout the United States. During the four year course, which is taken a few hours per week along with other academic subjects, each ROTC student learns the essential elements of military discipline, leadership principles, customs of the service and the role of the military in today's world.

Although at virtually every other university in the nation only a small percentage of the graduates are selected for a commission in the elite Corps of Engineers, all cadets at Mines are offered this branch. The Corps, which uniquely has both military and civil missions and is the world's largest earth operations organization, recognizes the foremost position of Colorado School of Mines in mineral sciences.



Heck



Dughman



Doyle

Gridiron Playoffs Wyo. All-State

SECOND year Colorado School of Mines head football coach Marv Kay has announced that three Wyoming High School All-State football players will be attending CSM this fall.

The players, William L. Heck of Casper, Terry Lee Dughman of Thermopolis and Richard T. Doyle of Sheridan will receive Colorado School of Mines Special Tuition Awards for the 1970-71 academic year.

William Heck attended Natrona County High School and earned a total of five sports letters, two in football, one in wrestling, and two in

track. During his junior year, Bill received recognition on the All-State second defensive football team as a tackle, and in his senior year was placed on the first team All-State offensive, and both on the offensive and defensive teams for the Southern All-Conference AA football conference. An outstanding tackle, he is six-foot three-inches and weighs 203 pounds, and graduated in the upper third of his class.

Terry Dughman attended Hot Springs High School and earned five letters in sports, two letters in football as a tackle, two letters in basketball, and one letter in track. During his senior year in football he received special recognition on the All-State second defensive team as a tackle. In addition Terry was All-Conference both offensively and defensively and was team captain. He is six-foot three-inches and weighs 195 pounds.

Richard Doyle attended Sheridan High School, graduating in the upper 20 per cent of his class. He earned a total of seven letters in football, wrestling, and track. In football Richard received both All-Conference and All-State first team recognition defensively and offensively as a tackle. During his senior year he was also co-captain of their team. An outstanding athlete at six-foot two-inches and 210 pounds.

Head coach Marv Kay during this summer thus far has recruited eleven football athletes who will receive special tuition awards for the 1970-71 academic year. These incoming gridiron players have all received either All-Conference or All-State recognition from their area. Two of the students are from California, two are from Colorado, one from New Mexico, three from Texas and three from Wyoming.

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DOW GIVES SCHOLARSHIP. Roland Fischer (right) of the Dow Chemical Co.'s Rocky Flats Division is shown presenting a \$500 scholarship check to Dr. A. W. Schelchten, vice president for Academic Affairs at the Colorado School of Mines. The gift will be used in the Metallurgy Department. This is part of Dow's AID program for colleges and universities throughout the country. In 1968 Dow gave 1.6 million in material and money for educational institutions. Dow operates the plant near Golden for the Atomic Energy Commission.

24 Students Earn Diplomas

THREE students at Colorado School of Mines received Mines' coveted sterling silver diploma which is awarded to seniors for having completed four and one-half years and 21 students completed their work for their Bachelor of Science degrees awarded after completing four years at the end of the academic summer school.

The graduates are as follows:

PROFESSIONAL COLORADO

Colorado Springs: Ronald Joseph Jamison
Northglenn: John Randolph Roper
Pueblo: James Dale Harmon...

BACHELOR OF SCIENCE COLORADO

Colorado Springs: Thomas J. Slade
Denver: Colleen Marie Arkley, 1317 South Josephine; Charles Ray Miller, 1898 Yarrow
Golden: Lewis Lynn DeLong; Robert Bruce Moffett

Lakewood: Roger Van Dok, 12125 W. Ohio Place
Littleton: Charles William Bloomquist, 6577 S. Gallup
Pueblo: Michael Anthony Acosta; Guy William Schlink
Wheat Ridge: Douglas Jay Ruckel, 3755 Holland

BACHELOR OF SCIENCE OUT-OF-STATE

Arizona: James Andrew Miller, Phoenix
California: Richard A. Kessler, Los Angeles
Iowa: Donald Erik Spiller, Des Moines
Missouri: Peter Julian Ryer, Kirkwood
New York: Gary Herbert Garlough, Colton
Oklahoma: Mark Victor Patton, Tulsa
Oregon: Sandra Ann Wilson, Medford
Washington: Peter Vernon Cawfield, Kalama
Canada: Robert Thurne Parks, Newcastle, Ontario.

Saudi Arabia: Mohammed Fahad Al-Farhan, Riyadh; Mohamed Abdul-Kareem Al-Sofi, Al-Khobar.

Sun Oil Presents \$500 Scholarship

MINES has just received a \$500 scholarship in petroleum engineering from Sun Oil Co.'s North American Exploration and Production Group with headquarters in Dallas. The recipient of the scholarship, to be during the 1970-71 academic year, will be selected by the school.

Cecil J. Dearman of Dallas, Sunoco's Exploration and Production supervisor of College Relations, presented the scholarship.

During the presentation Dearman said that Sun Oil is aware of the growing need for highly qualified scientific and professional personnel. "The company is pleased to be able to participate in a positive aid program," he said.

\$2500 Check From Amax

H. T. Schassberger, Western Exploration manager of AMAX Exploration Incorporated, recently presented a one-time \$2,500 check from the American Metal Climax Foundation, Inc. The check was presented to further the excellent work of the geochemical exploration section of CSM's Geology Department.

CSM Geophysics Receives Grant

THE CSM Geophysics Department has received a \$38,000 grant from ESSA, U. S. Department of Commerce, for additional earth strain studies. Principal investigator will be Dr. Maurice Major of the geophysics department.

A network of 12 strainmeters was previously built in the vicinity of present sites in December of 1968. These instruments produced data on the residual strains associated with the underground nuclear explosions BENHAM and JORUM. Data from the multicomponent sites have proven significantly more useful than the single component units in interpreting the total strain.

The new grant will bring about the construction of three additional horizontal instruments with a recording house at site "Scotty's," and two horizontal instruments to be added to the "Ely" site. A vertical strainmeter will also be built at one of the multicomponent sites.

The School of Mines will maintain the gathering of all data from the instruments until March 1, 1971. The data, besides being pertinent to certain problems confined to the vicinity of the sites, will also contribute to earthquake prediction studies now involving a larger network of strainmeters presently being operated by ESSA and the Colorado School of Mines.

William Crowe Kellogg, '43

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Dr. Alfred Petrick, Jr. Appointed Mineral Economics Coulter Professor

DR. ALFRED PETRICK, JR., has been appointed as the permanent Coulter Chair Professor of Mineral Economics at the Colorado School of Mines in Golden. This appointment will become effective the first of September following Dr. Hubert E. Risser, visiting professor from the University of Illinois, who occupied the chair during the 1969-1970 academic year.

Dr. Petrick was born in Mount Vernon, N.Y., and attended Columbia University, receiving his A.B. and B.S. degrees in 1953, and an M.S. in mineral engineering in 1962. Following this Dr. Petrick attended the University of Denver and received his M.B.A. in economics in 1966, and his Ph.D. in economics in 1969 from the University of Colorado.

His employment began with the Ingersoll-Rand Co. of New York as a sales engineer in 1953; in 1954 he became employed by the U.S. Atomic Energy Commission in Grand Junction as a project engineer; in 1957 he moved to Bauxite, Ark., and later to Guyana, South America, as a mining engineer for the Reynolds Mining Corp., and in 1962 became employed by the U.S. Bureau of Mines in Denver as an industrial economist on mineral economics projects.

Dr. Petrick belongs to the following professional societies, American Institute of Mining, Metallurgy and Petroleum Engineers, American Economics Association, and is a Registered Professional Engineer in the State of Colorado. He is also a member of Phi Gamma Delta and Theta Tau.

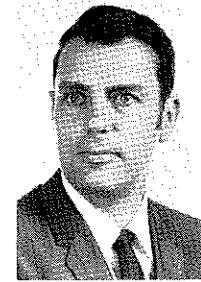
From 1945 to 1947 he served in the U.S. Army Air Force and was discharged at the rank of sergeant.

Dr. Petrick resides at Route 4, Box 689 in Evergreen, Colorado, with his wife, Ruth, and two children, Elizabeth age 13, and Andrew age 7.

The William J. Coulter Chair of Mineral Economics was founded in 1969 by the Viola Vestal Coulter Foundation. Mr. Coulter served as Vice President of Operations for Climax Molybdenum Company until his retirement in 1953, and was founder and President of the Viola Vestal Coulter Foundation until his death in 1965.

This chair makes possible a new professorship with a salary sufficient to attract a leading professor for the Mineral Economics Department at CSM.

Mrs. William J. Coulter, who succeeded her late husband as president of the Coulter Foundation, said, "The Coulter Chair in Mineral Economics at Mines will fulfill the dreams of Mr. Coulter for the furtherance of the school's program and the development of additional knowledge in this field. Mineral engineering was his vocation and the training of mineral



Petrick

engineers always interested him keenly.

"Mr. Coulter was one of the founders many years ago of the program under which a Mines' graduate is sent annually for further training at the Harvard Business School. The Trustees of the Coulter Foundation join me in wishing the Colorado School of Mines great success in the appointment of Dr. Alfred Petrick, Jr. as Coulter Professor in Mineral Economics."

1970 Homecoming Oct. 30-31

THE 1970 HOMECOMING will be celebrated on Friday, Oct. 30th, and Saturday, Oct. 31st. The Homecoming Committee is busy planning the program, and it will be sent to each of you individually. Now we'll discuss only the major events and changes which will be made in the program for Saturday, Oct. 31st.

At 7:30-12:00 a.m. Alumni Registration at the College Union. 8:00 a.m. to 9:00 a.m. the Ranch Wagon Breakfast will be served for Alumni and friends at the College Union. This excellent breakfast offers a chance to meet your friends early in the day and make plans to take part in all the activities. A special table will be reserved for each Honor Class.

10:45 a.m. Homecoming Parade. This event has been moved to this time in order to allow the visitors to attend the Barbeque and Alumni Reception to be held in the Integral Club at noon. This event is sponsored by the Senior Class as well as the Alumni.

12:00 Noon Barbeque and Alumni Reception. The Barbeque sponsored by the Senior Class and Reception to be held at noon is important because each of you will have an opportunity to meet Dr. Guy T. McBride Jr., the new President of the Colorado School of Mines, at that time.

1:30 p.m. Homecoming Football Game, Orediggers vs Western State.

4:30 p.m. Informal reception with coffee and doughnuts will be held in the College Union after the game.

Research Grant From Kennecott

DR. JOHN P. HAGER, CSM Metallurgy Department, has been assigned a \$13,000 research project grant from Kennecott Corp. based in Salt Lake City.

The project, entitled "A Mass Spectrometric Study of the Fundamental Properties of Reactions Involved in Copper Smelting and Refining," will be conducted during a one year period on the CSM campus.

This research project was prompted due to previous research which resulted in direct application of mass spectrometer techniques in thermodynamic measurements. Direct application of this process can now be applied to numerous copper alloy systems.

In addition, results obtained from previous research have provided information required for insight into the possible mechanisms of rhenium oxide volatilization and their related vapor transport reactions.

There will be no program planned for this event.

5:00 p.m. Fraternity and Dormitory Open Houses. It is hoped that the many Alumni who are here will attend the fraternity and dormitory open houses where buffet dinners will be served.

8:30 p.m. Homecoming Dance will be held.

Honor classes will be those who graduated in 1950, 1955, and 1960. Members of these classes will receive notices, and our office will assist you in making arrangements for a dinner or cocktail party on Friday evening preceding the Homecoming Pep Rally. We need your assistance to do this, and we hope that you will let us know promptly as that will help us plan for a successful Homecoming.

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ROTC Scholarships at Mines

COLONEL Cecil C. Baldwin, professor of Military Science at the Colorado School of Mines, has been notified by the Headquarters of the Fifth U. S. Army that three returning School of Mines students have been awarded three-year ROTC scholarships.

They are, Ronald H. Bissett, son of Mr. and Mrs. Robert J. Bissett, 5115 South Washington, Littleton, Colo. Ronald will be a sophomore in Chemical, Petroleum Refining Engineering; Mark G. Janczewski, son of Lt. Col. and Mrs. G. Janczewski, Qtrs. 4509J, U. S. Air Force Academy, Colo. Mark will be a sophomore in Mathematical Engineering; John M. Lambe, son of Mr. and Mrs. John P. Lambe, 2311 McRae Road, Spenard, Alaska. John will be a sophomore in Geophysical Engineering.

In addition to the above scholarships, the following freshmen students from diversified areas will be enrolled at Mines in September as ROTC four-year scholarship winners: Thomas P. Alston, son of Mr. and Mrs. Norman R. Alston, 8936 Mettler Drive, El Paso, Tex.; Robert L. Byrd, son of Mr. and Mrs. Robert C. Byrd, Apt. DO No. 85, Parral, Chihuahua, Mexico; Michael D. Cola, son of Mr. and Mrs. Joseph Cola, 12 Grant Street, Derry, N. H.; Paul E. Dorr, son of Mr. and Mrs. John H. Dorr, Box 891, Steamboat Springs, Colo.; Robert E. Dunne, son of SSM and Mrs. Robert V. Dunne, HHC, USARSUPHAI, APO San Francisco; David H. Hendrix, son of Mrs. June E. Hendrix, 1916 North 4th Street, Yakima, Wash.

586 CSM Summer Students

A TOTAL of 586 students attended summer courses this year at Mines with 304 students registered for the summer field session, 258 for campus semester courses, and 24 for intensive English. These sessions allow the student to take field, laboratory, and classroom courses for full credit.

The summer session program is divided into three independent units, the summer field session a six-week period for required field and labora-

tory courses in basic, geological, geophysical, metallurgical, mining, petroleum, chemical and petroleum refining engineering, chemistry, mathematics and physics.

The on campus summer courses offer required subjects to the students in fields such as chemistry, mathematics, and physics. In addition the intensive course in English for foreign engineering students enrolled at CSM is also offered during the normal summer school session.

Book Reviews

Petroleum Geology

"Sourcebook for Petroleum Geology" compiled by R. H. Dott Sr. and M. J. Reynolds is available from the American Assn. of Petroleum Geologists, Box 979, Tulsa, Okla. 74101 for \$18 (25 per cent discount to AAPG-SEPM members). The book has 471 pages and is presented in two parts: Part I.—Genesis of Petroleum, and Part II.—Secondary Migration and Accumulation of Petroleum.

Dust You Can't See

A new safety training film on respiratory protection for coal miners has been produced by Mine Safety Appliances Co., Pittsburgh, Pa. 15208. The 13-minute color movie, "Dust You Can't See," is available for safety meetings by the coal mining industry. The film's message is directed to the mask wearer, and is interestingly presented by a crop-dusting pilot who relates the hazards of his job to those of the coal mining industry.

Special Studies 29

"Tertiary Volcanic Rocks of Needles Range, Western Utah" (Special Studies 29) is available for \$2 from the Utah Geological Survey, 103 Utah Geological Survey Bldg., Salt Lake City 84112. In its conclusions the paper states that "utilization of ignimbrites as stratigraphic units in determining the Tertiary structural geology in the east central Basin and Range province is highly successful. The ignimbrites serve as perfect horizontal marker beds, and, once the stratigraphy within an area is worked out, they allow the investigator to determine with considerable accuracy the sequence of events in that area."

Westward Ho! 1898

"Westward Ho! 1898" by Carrie Winthrop is the title of a book published by the Exposition Press Inc., 50 Jericho Turnpike, Jericho, N. Y. 11753, \$5.

This autobiographical novel provides readers with a lively journey from horse-and-buggy days to the Space Age. Writing with unusual perception and vigor, Beth recalls the exciting, often humorous, incidents of traveling about the West with her successful mining engineer father, her mother and twin sister. Readers will be entertained and moved by this story of the development of America's West and of a human being. All of the incidents are actual happenings, giving the book its wholly lifelike quality. Carrie Winthrop is the author's pseudonym.

From the Local Sections

Section news should be in the Alumni Office by the 20th of the Month preceding Publication.

SECTION	PRESIDENT	VICE-PRESIDENT	SECRETARY-TREASURER	TIME AND PLACE OF MEETING
Alabama Birmingham			Wm. Haynes, '54	On call of the president.
Alaska Anchorage			Ken Clodfelter, '51 2492 E. 49th Ave. Anchorage, Alaska 99502	
Arizona Arizona	Guerton E. Jackson, '52	W. E. Saegart, '53	James D. Sell, '55 2782 W. Holladay St. Tucson, Ariz. 85706	Annual Meeting, Dec. 7, 1970, Western Motel, Tucson.
California Bay Cities	Carl Foget, '61	Dave Strandburg, '61	Tom Aude, '62 54 Woodford Drive Moraga, Calif. 94556	Meetings held on call of the Secretary.
Santa Clara Valley Sacramento	Gail Penfield, '56		Stanley Y. Ogawa, '53 F. B. Sweeney, '57 6619 Auburn Blvd., Citrus Heights	
San Joaquin Valley Southern California	R. A. Ganong, '47 Bob Snyder, '67	Marsh Chapman, '38	B. A. Ellison, '61 Bob Goverski, '64 (Sec.) Phone: 213 — 349-4155 Clark Wollenwoeber, '63	Dinner every second Thursday of every second month (May 14, July 9, Sept. 10). Luncheon meeting held third Tuesday of each month, Denver Press Club, 1330 G's Farm Pl.
Colorado Denver	A. E. "Ted" Seep, Jr., '68	Hal Kellogg, '55	Jack Dressel, '50	Regular meeting at noon, second Tuesday of each month at the Shrine Temple, 1315 K St. N.W.
Grand Junction District of Columbia Washington	Arch F. Boyd, '26 A. A. Wyner, '25	Robert H. Sayre, '34 Louis DeGoes, '41	Robert F. Barney, '35	
Illinois Great Lakes	C. R. Fitch, '49 7915 Exchange Ave. Chicago 17, Ill.			Meetings called by secretary. Contact secretary for date of next meeting.
Kansas Wichita	Francis Page, '39		James Daniels, '51 307 Schweitzer Bldg., Wichita, Kans. AM 5-0614.	Regular luncheon meetings — last Wednesday of the odd-numbered month except July.
Louisiana New Orleans	Charles Tyler, '53	Joseph L. DuBois, '50	Monte Richard, '60 Pan American Petr. Corp. P.O. Box 50879 New Orleans, La. 70150	Regular luncheon meetings at Lafayette Petroleum Club on fourth Thursday of each month.
Lafayette	John J. Wallace, '51	Edward J. Gibbon, '68	Stephen D. Chesebro, '64 P. O. Box 51345 Lafayette, La. 70501.	
Minnesota Iron Ore Range	Paul Shanklin, '49		E. W. Markwardt, '32 104 E. Monroe St. O'Fallon, Ill. 62269	
Missouri St. Louis	John M. Suttie, '42 Continental Dr, Butte			
Montana Butte	Paul V. Fille, '40	H. R. Fitzpatrick, '36	James H. Bright, '52 1450 E. 2nd St. Reno, Nev. 89502	Meetings held four times per year at call of the Secretary.
Nevada Northern Nevada	John Magraw, '53		N. E. Maxwell, Jr., '41 405 S. Church St. Aztec, N.M. 87410	Special meeting at the call of the president.
New Mexico Carlsbad	Lou Amick, '50	Al Lolett, '50	E. T. Benson, '33 1175 Broadway, New York, N. Y.	Meetings on call every month or six weeks from September to May, usually at Uptown Mining Club, 49th and Park Ave.
New York New York	Robt. B. Kennedy, '38	Board of Governors: Ralph Hennebach, '41 C. D. Michaelson, '32 C. Bellm, '34 R. B. Kennedy, '38	Raymond M. Schatz, '35 Battelle Memorial Institute Columbus	Meetings held on call of president. Regular meetings held every Tuesday at noon, YWCA, 411 S. Johnston St. After September, group will meet every Friday.
Ohio Central Ohio	Harold M. Knudsen, '59	Theodore Solim, '53	Charles Strong, '58 Box 336, Bartlesville, Okla.	Regular meeting held at call of the president.
Oklahoma Bartlesville	G. T. McIntyre, '30	Bill Fredrick, '56	Jerry McLeod, '57 1706 East 60th Pl. Tulsa, Okla. 74105	Meetings held at call of the president.
Oklahoma City	Ed Johnson, '49 844 First Nat'l Bldg.		Wendell Cloepfil, '62	On call of the president.
Tulsa	Todd C. Storer, '47	D. H. Griswold, '30	David P. Rihl, '58 Dravo Corp., Pittsburgh and Terrace Rd., Carnegie, Pa. 15106	Meetings held first Wednesday of each month (noon), Cafe "B," Golden Triangle YMCA, 4th and Wood Sts., Pittsburgh.
Oregon Lower Columbia River Basin	Michael DiLembo, '58	Arthur Most, Jr., '38 1345 Woodland Cr., Bethlehem	Irwin M. Glasser, '43 Humble Oil & Refining Co. Corpus Christi, Tex. 78401	Luncheon Meeting — First Wednesday of each month at the Petroleum Club.
Pennsylvania Eastern Pennsylvania	Samuel Hochberger, '48		L. G. Truby, '48 4320 O'Keefe Dr. El Paso, Texas 79902	Meetings held on last Wednesdays of January, March and May. Special meetings on call.
Pennsylvania-Ohio	Vincent G. Gloia, '56		James K. Applegate, '66 Marathon Oil Co. 2300 W. Loop, South	Luncheon meetings held at 12 noon on first Thursday of each month at White Horse Cellar, 1211 Fannin St.
Texas Coastal Bend	Ray Gouett, '52	Charles R. Russell, '54	Al Wynn, '65 4313 Princeton, Midland, Tex. 79701	Meetings held in Jan., Mar., May, Sept., and Dec.
El Paso	Peter A. DeSantis, '51	William F. Dukes, '50		
Houston	Ronald E. Diederich, '57	Edward B. Reynolds, '66		
Permian Basin	Hal Ballew, '51	Harry B. Hinkle, '59		

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Fertig Attend Alumni Meeting Of Pacific Northwest Section

The Pacific Northwest Alumni Section of the Colorado School of Mines held its second meeting of the year Aug. 7, 1970 at the Black Angus Restaurant in Bellevue, Wash.

Miners and their wives were honored with the presence of Col. and Mrs. Fertig. A business meeting concluded by section president, Sidney Peyton '54, was held with election of officers being the main order of business—Col. Richard O. Barnes '55, president and Robert R. Cederstrom '60, secretary-treasurer. Following the business meeting, Col. Fertig addressed the group concerning the growth and development of the school.

Miners present were: William C. Douglass '11, Dewey A. Dutton '21, Raymond Lee '23, Willis H. Fenwick '36, Lt. Col. Allan P. Nesbitt '38, Arthur R. Kesling '40, Colin L. Fox '41, Frank L. Johnson, Jr. '45, William Allen, Jr. '47, Robert L. Kerwin '53, Col. Richard O. Barnes '55, Lowell I. Thomas '59, Robert R. Cederstrom '60, Charles C. Hammerberg '61, and John R. Plavan '67.

—Robert R. Cederstrom '60, Sec.-Treas.

* * *

Two expectant mothers were visiting together, discussing their doctors' pet answers. "Well, at least in our case, they can't say: 'It's all in your mind.'"

Anchorage Alumni Section

On Aug. 1, 1970 Mrs. Fertig and I had the pleasure of meeting with the members of the Anchorage Chapter of CSM Alumni. The full report on the meeting and a list of those in attendance will be presented later. However I did want to take this opportunity to thank the members there for their courtesies extended during the visit and the successful meeting which was organized by Ken Clodfelter. Reggie Lee has been carried as corresponding secretary but Reggie, who is working for Union Oil, is out of the city so much of the time that Ken Clodfelter has agreed to take over.

In addition to this August meeting the group had a luncheon on June 4th which was well attended.

It is a pleasure to welcome this new section to our list. —WWF

Los Angeles Alumni Section

On July 20, 1970 eight of us gathered for a Mines meeting in Anaheim, Calif. Don Snyder had arranged the meeting but at the last moment was unable to attend. Those who were there seemed to enjoy the meeting and the exchange of information concerning what is happening on the campus.

Those in attendance were: Richard C. Clark '67, Al Lee '50; Ernest Berkman '58, Hap Elikor '40, Clark Wollenweber '63, Ross Reed '37, and Marsh Chapman '38.

St. Louis Alumni Section

H. A. Dumont, who has been a long-time president of this section, has moved to El Paso, Tex., and has sent all of the records to E. W. Markwardt, 104 E. Monroe St., (P. O. Box 98), O'Fallon, Ill. 62629. I hope to see him during the Annual Society of Mining Engineers Convention which will be held in St. Louis on Oct. 21 to 24 inclusive. I have asked Markwardt, '32, to assist in hosting the annual Mines breakfast during the SME Convention. —WWF

Alumni Dinner Meeting Aug. 7th in Seattle

A group of about 20 Alumni assembled on Aug. 7th for a dinner meeting while Mrs. Fertig and I were in Seattle. Sidney Peyton, retiring president, will send a report on the meeting together with a list of those in attendance. This was a particularly pleasant meeting since the Miners and their wives made up an interesting group ranging from Bill Douglas of 1911 to a more recent graduate of 1967. This was an excellent cross section of the men who have attended Mines.

During the meeting Dick Barnes, 1955, was elected president, and Bob Cederstrom, 1960, secretary-treasurer. This was a most unusual election as both men were present at the time when they were elected. —WWF

Alumni Party at Coors

The Annual Alumni Party was held in the Coors Hospitality Center at 7:30 p.m. Friday, Sept. 11. As in former years the party was arranged by Fritz Brennecke, CSM director of athletics.

17 Salt Lake City Alumni Hear Talk by Slothower

On the evening of Aug. 13, the Salt Lake City Section of the Colorado School of Mines Alumni Association held their summer meeting. Seventeen alumni attended including one wife and one guest. Ben Slothower showed slides and gave a talk about his recent safari in Mozambique, Africa.

The section is planning to hold another meeting (an outdoor affair) sometime later in September.

Earlier this year, new officers were elected. John Weber was elected president and Gregory Hoyl, secretary-treasurer.

Charles R. Johnson, '49

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Albert C. Harding, '37

Partner, Black Hills Bentonite Co.
Casper, Wyoming
Box 1, Mills, Wyoming

Quips

One day, while on a bus en route to the weekly Wednesday luncheon meeting of our Soroptimist Club in the tea room of one of our big department stores, a vivacious seatmate carried on a one-sided conversation for several blocks.

I heard about her interests, her family, her operations, then as I stood up to get off at the next stop, she asked eagerly, "Oh, are you leaving right when we were having such a good talk? Where are you going to shop?"

"I'm going to the Soroptimists' luncheon."

She grabbed my arm. "How glad I am I met you. Quick, give me your address. Where's your office? I've been hunting one a long time—my feet are killing me, and I want them taken care of right away."

—Pearl Anoe

* * *

Leaning into the gale that whipped across the valley, a visitor asked a farmer:

"Does the wind blow this way all the time?"

"Nope," replied the rancher, pointing. "Sometimes it blows that way."

* * *

A bore is someone who talks when you want him to listen.

* * *

"This apartment looks expensive. Do they ask a lot for the rent?"
"Sure do! They asked for it about five times last month."

* * *

I believe in punctuality. Even though it makes me awfully lonely.

* * *

"The only reason that girl is at this party is that she's looking for a husband."

"So am I."

"But I thought you had one."

"I do, but I spend most of my time looking for him."

* * *

Competition is what makes all the good television shows come on at the same time.

* * *

Mother: "What are you crying about, Bobbie?"

Son: "Daddy stepped off the ladder and put his foot in a bucket of paint."

Mother: "That's nothing to cry about, it sounds funny. You should laugh."

Bobbie: "I did."

* * *

Time may be a great healer, but it is a lousy beautician.

* * *

Sam: "Man, is my girl friend smart! She has enough brains for two people!"

Joe: "She's just the girl for you."

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A telephone repairman was working in an ultra-modern business building, one that had no windows. When he finished, he tried to find a way out of the office, but without windows to guide him, he felt trapped. Finally he came to an office where a young woman was typing.

"How do I get outside?" he asked.

Without looking up from her typewriter, she replied, "Dial 9."

* * *

Two expectant fathers were nervously pacing the floor in the waiting room of a maternity hospital. "What tough luck," grumbled one. "This had to happen on my vacation!"

"You think you've got troubles?" replied the other. "I'm on my honeymoon."

* * *

The teenage lad slid reluctantly into the barber's chair, glaring at the man as if he were the executioner. "Are you the guy who cut my hair the last time I was in here?" he asked suspiciously.

"That's hard to answer, son," sighed the barber. "I've only been here a year."

* * *

"Hey, Jack, whatcha clipping out of the paper?"

"It's an item about a man who got a divorce because his wife went through his pockets every night."

"Whatcha gonna do with it?"
"Put it in my pocket."

* * *

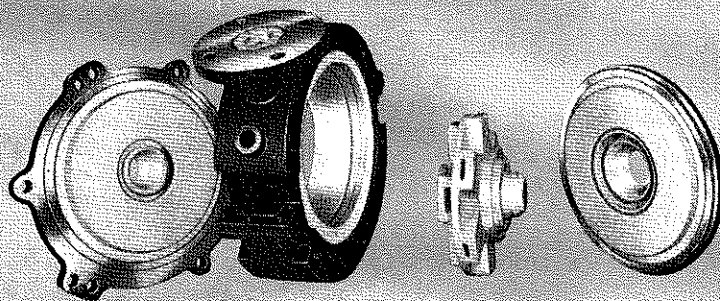
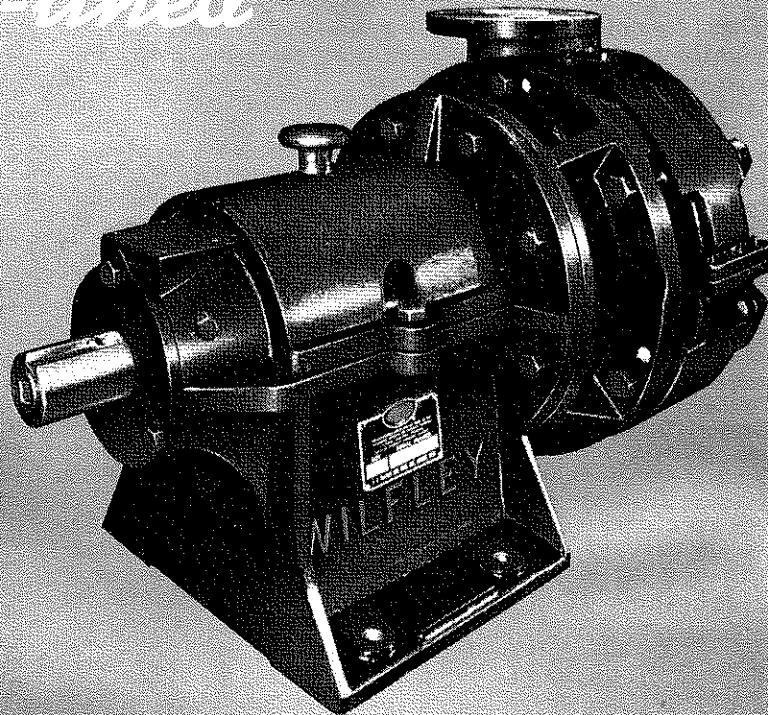
A farmer took no chances at the start of hunting season. He painted "cow," "horse," "bull" and "pig" on the sides of his farm animals. It worked—sort of. No stock was killed but his farm tractor was riddled with bullets. It had on its side the nameplate "John Deere."

SECTION	PRESIDENT	VICE-PRESIDENT	SECRETARY-TREASURER	TIME AND PLACE OF MEETING
Dallas-Ft. Worth	Harold E. Potter, '27	Dewey D. Bowling, '49	Peter A. MacQueen, '50 P.O. Box 2050 Ft. Worth, Texas 76101	Meeting held on call of president.
South Texas			William A. Conley, '19 1515 Haskins Rd. San Antonio	Meetings held at 7 p.m. on first Thursday of February, May August, November at Old Town Inn, 416 8th St., San Antonio.
Utah Four Corners	See N.M. for officers		Gregory H. Hoyl, '68 1356 Kennecott Bldg. Salt Lake City, Utah 84111	Four meetings annually on dates set by officers.
Utah Salt Lake City	John Weber, '66		Robert R. Cederstrom, '60 11011 N.E. 9th St. Bellevue, Wash. 98004	Meetings on call of president; annual August picnic.
Washington Pacific Northwest	Richard O. Barnes, '55		Arden Bement, '54	
Eastern Washington			George S. Rogers, '59 3209 Aspen Drive Casper, Wyo. 82601	
Wyoming Central Wyoming				
Canada Calgary	Richard C. Stegfried, '50 Canadian Superior Oil Ltd. 703 6th Ave., Calgary Tel.: 287-4110 Local 429			Calgary Section meets for a noon luncheon on the 3rd Monday of Sept., Nov., Jan., Mar., May—at Calgary Petroleum Club. Visiting alumni invited to attend.
France	Resident or visiting alumni may contact Bernard Turpin, '60, 33 Rue de la Tourelle, 92-Boulogne, France.			
Libya	R. E. Palmer, '61, Corresponding Secretary, c/o American Overseas Petroleum, P. O. Box 693, Tripoli, Libya.			
Peru	Martin Obradovic, '53			Meetings first Friday of each month (April thru December), 12:30 p.m., Hotel Crillon. Other meetings on call
Philippines Baguio	Francisco Joaquin, '26			
Philippines Manila	J. R. Kuykendall, '41	Jesus Jalondoni, '40	M. E. Natividad, '40 c/o Northern Motors United Nations Ave., Manila	Meetings held at noon, second Tuesday of each month.
Puerto Rico	Resident or visiting alumni may contact L. L. Hagemann, '60, Apt. 17, El Monte Apartments, Avenida Munoz Rivera, Hato Rey, Puerto Rico.			
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