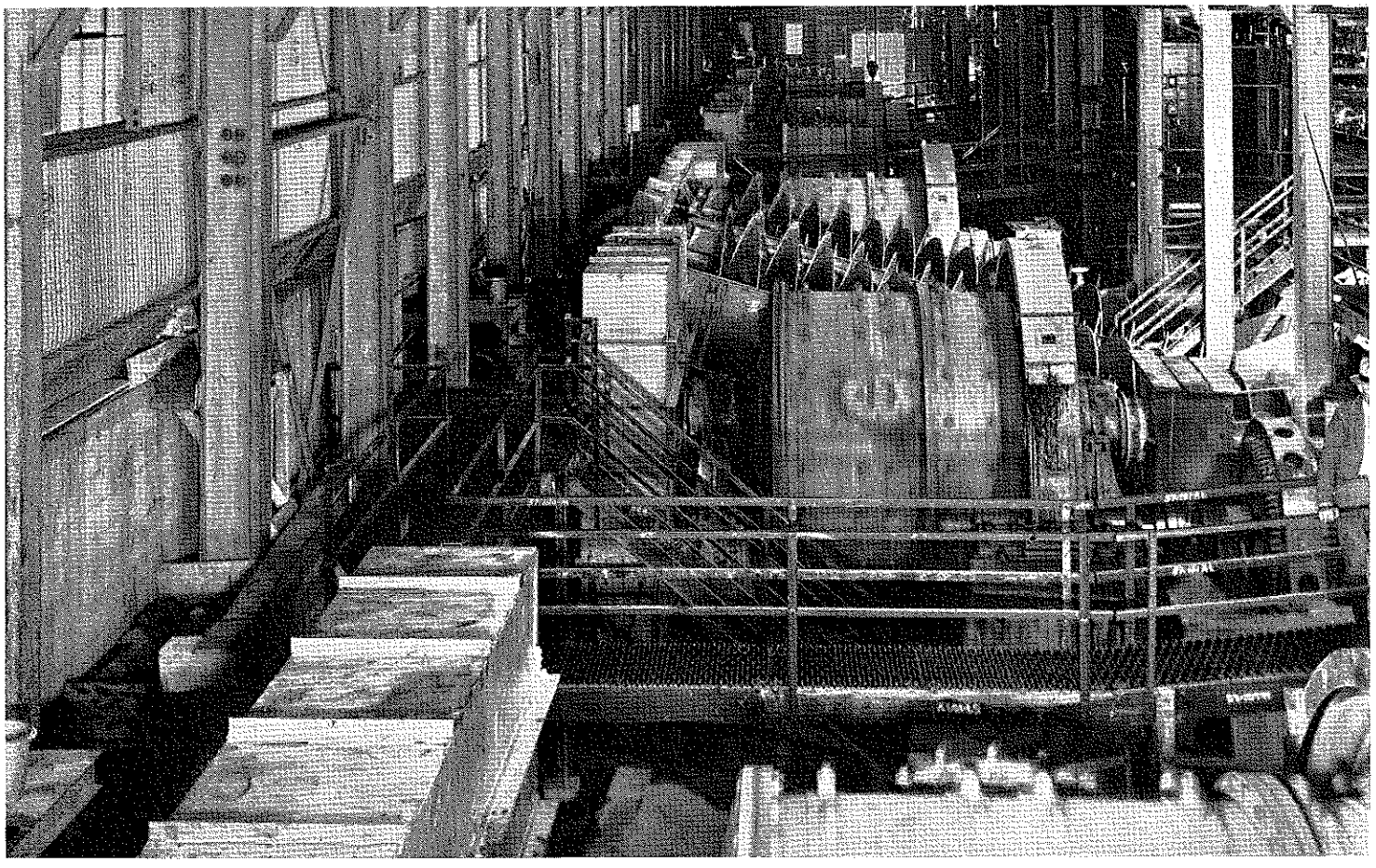
The MINES MAGAZINE

SERVING
The
MINERAL INDUSTRIES



FEBRUARY 1940 ◆ ◆ ◆ VOLUME 30 No. 2

The Mines Magazine

Official Organ of the Colorado School of Mines Alumni Association

FRANK C. BOWMAN, '01
Editor and Publication Director

JOHN H. WINCHELL, '17
Advertising

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DENT LEROY LAY, '35
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Vol. XXX — FEBRUARY, 1940 — No. 2

FRONT COVER ILLUSTRATION

Interior view of grinding section in Climax Molybdenum Co. mill at Climax, Colo. This is Colorado's largest milling plant and the world's largest Moly plant. The Marcy Ball Mills shown are 9 ft. x 9 ft.

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ENTERED AS SECOND CLASS MATTER AT THE POSTOFFICE AT DENVER, COLORADO, UNDER THE ACT OF CONGRESS OF MARCH 3, 1879. SUBSCRIPTION PRICE $3.00 A YEAR. SINGLE COPIES 50 CENTS. NO ADDITIONAL CHARGE FOR FOREIGN SUBSCRIPTION. PUBLISHED EVERY MONTH IN THE YEAR BY THE COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION. ADDRESS ALL CORRESPOND-

Colorado School of Mines Alumni Association

NEW MEMBERS JANUARY, 1940

ALUMNI

GLEN A. BRANDOW, '15, *Canandaigua, N. Y.*
FRANK A. BROWN, '21, *Hollywood, Calif.*
CHARLES W. BURGESS, '09, *Baguio, P. I.*
V. G. GABRIEL, M.Sc. '31, *Pasadena, Calif.*
M. A. JORGENSEN, '28, *Smelterville, Idaho*
JOHN C. KINGSTON, '35, *Flinton, Ontario, Canada*
FRANK J. LAVERTY, '25, *Denver, Colo.*
A. B. MARTIN, '23, *Butte, Montana*
JOHN S. MCGHEE, '26, *Whitmans, W. Va.*
VERNON M. PECK, '23, *Los Angeles, Calif.*
G. W. SCHELLENBURG, '12, *Berkeley, Calif.*
JOHN R. SHANLEY, JR., '15, *Long Beach, Calif.*
PAUL G. SHARP, '33, *Rivermines, Mo.*
WILLIAM K. WOOD, '31, *Bozeman, Mont.*

• Personal Notes

Robert K. Adams, '35, Open Hearth Observer for the Carnegie-Illinois Steel Corporation, resides at 4114 Hemlock Avenue, East Chicago, Ind.

Lewis D. Anderson, '39, Junior Engineer for the California Spray-Chemical Company, is now located at Signal, Via, Wikieup, Arizona.

B. M. Bench, '30, Geologist for The Geotechnical Corporation, has a change of office address to 1702 Tower Petroleum Bldg., Dallas, Texas.

E. C. Borrego, Ex-'27, has been transferred to Caripito, Venezuela, as District Superintendent of the Standard Oil Company of Venezuela.

Frank Cadena, '27, is associated with the Dravo Corporation, at Neville Island, Pittsburgh, Pa.

Michael C. Carosella, '34, accepted a position recently with the United States Vanadium Corporation in their refining plant at Laws, California.

M. A. Cook, '33, is now at Lowell, Arizona, where he is doing mill construction work. His address there is Box 3443.

John Davenport, '12, President and Treasurer of the Franklin Mineral Products Co., is receiving his mail at present at 1 Menlo Street, Brighton, Mass.

Jerry F. Dieckman, '39, is with the Union Oil Company of California, his mailing address being 1134 Commerce Building, Houston, Texas.

Ira J. Dilts, Jr., '39, is taking graduate work at the University of Colorado. His address at Boulder is 1005 Twelfth Street.

C. T. Draney, '32, Engineer for Bechtel-McCone-Parsons Corp., Consulting and Contracting Engineers of Los Angeles, is now in Portland, Oregon where he is being addressed at the Regent Apartments, 1915 N. W. Everett Street.

George G. Gallagher, '32, is Mine Superintendent for the Central Eureka Mining Company, P. O. Box 500, Sutter Creek, Amador County, Calif.

Harold W. Haight, '27, is Manager of the Standard Oil Company of Egypt, S. A., with address Sharia 22 Kasr el Nil, Cairo, Egypt.

Ward S. Hutchins, Ex-'38, Mill Foreman for the Parks Grain and Feed Company, resides at 2115 Central Avenue, Memphis, Tenn.

Michael Ivanoff, '25, has advised of a change of address to P. O. Box 151, Norman, Okla., but did not state with what company he is associated.

Wm. R. Kennedy, '38, Junior Petroleum Engineer for The Texas Company, has been transferred to Wichita Falls, Texas, with post office Box No. 600.

V. G. Kirilloff, M.Sc. '34, who, as Engineer for the Technopromimport Dept., Amtorg Trading Corporation, has been located in New York City, is returning to Russia where he will be addressed Usachevka 62, Apt. 536, Moscow.

A. P. Kleeman, '24, Vice-President of Franco Western Oil Company, has a new mailing address, Box 308, McKittrick, Calif.

B. W. Knowles, '08, Mining Engineer of Penticton, British Columbia, spent the Christmas holidays with his mother in Denver.

C. Z. Leonard, Consulting Geologist of Corpus Christi, Texas, has a change of address to Box 942.

Ross R. May, '12, Engineer for Platt-Rogers, Inc., resides at 2406-4th Avenue, Pueblo, Colorado.

John McAnerney, '35, is on vacation from his work in Alaska, and at present is at his home in New York City, 62 East 90th Street.

Laurence S. Melzer, '39, is now employed by the Stanolind Oil and Gas Company on a gravity meter party and receives his mail at 1302-10th Street, Woodward, Okla.

George D. Middleton, '31, is at Congress, Arizona, where he is conducting mining operations.

R. S. Munsell, '35, of Silver Peak, Nevada, was a Denver visitor during the Christmas holidays and on into January.

Walter D. Powers, '39, has a change of address to 849 So. Barnes Street, Pampa, Texas. He is Roustabout for the Stanolind Oil and Gas Company.

John Prout, '00, who for some time has been listed as "Address Unknown," has finally been located at 571 So. High Street, Denver, Colo.

William J. Rude, '34, is now being addressed at 54 Washington Avenue, Rutherford, N. J.

C. M. Schneider, '20, has a new residence address, 2520 Albion Street, Denver, Colo.

Two members of the class of '35, *F. F. Seeburger, IV* and *John Russell Tower,* have taken up aviation in earnest and are now flying cadets in the U. S. Air Corps. *Seeburger* has just been transferred from Randolph Field, Texas, to Langley Field, Va., while *Tower* has been sent to Randolph Field from Glenview, Ills., where he received instruction at the Chicago School of Aeronautics.

Bill Sparr, '39, has been transferred to the New York office of Ingersoll-Rand

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Annual Business Meeting of Alumni Association

The Festival Room of the Oxford Hotel, Denver, was the scene of the 5th Annual Business Meeting of Mines Alumni Association, Saturday evening, January 13, 1940.

A half-hour get-together was enjoyed by all, after which an excellent steak dinner was served.

The following members were present:

A. L. Mueller, '35; A. S. Adams, '27; R. J. McGlone, '27; George D. Hilding, '35; Donald Dyrenforth, '12; W. B. Patrick, '09; Carl I. Dismant, '31; Bruce B. LaFollette, '22; S. A. Garnett, '20; George W. Thomas, '26; R. F. Barney, '35; E. M. Howell, '30; T. F. Adams, '29; H. M. Williams, '32; Russell H. Volk, '26; M. H. Robineau, '23; P. A. Archibald, '35; Ralph E. Johnson, '33; D. L. Lay, '35; C. O. Parker, '23; R. S. Spalding, '33; W. P. Schoder, '22; Albert A. Klamann, '20; Harold L. Tefft, Ex-'32; J. T. Stubbs, '26; Allan E. Craig, '14; A. W. Buell, '08; Kenneth E. Hickok, '26; C. Lorimer Colburn, '07; Joseph P. Ruth, Ex-'21; John Mason, Coach; Jack Torpey, '40; T. C. Doolittle, Hon. '27; H. M. Connors, '22; A. George Setter, '32; Frank C. Bowman, '01; W. H. Paul, '96; J. Harlan Johnson, '23; James Boyd, '32; Fred Steinhauer, '99; W. B. Milliken, '93; J. W. Dudgeon, '13; Glenn T. Horlbeck, '36; W. H. Evans, '38; John W. Bucher, '02; F. E. Briber, '16; H. M. Cronin, '13.

At the conclusion of the dinner, President Volk called the meeting to order for the transaction of business. He first called for reports of officers and chairmen of committees which disclosed the splendid work accomplished during the past year.

REPORTS OF COMMITTEES

Frank J. Nagel, Chairman of the Capability Exchange reported that continuous work was done throughout the year in an effort to interest more employers in the Alumni Employment service. Many letters were sent to employers all over the world with encouraging results. Several new firms have been added to our list of those who call on the Capability Exchange when in need of men. Mines Men have taken more active interest in the Capability Exchange which has resulted in the placement of Mines Men in several important positions.

Often we have been faced with the difficulty of finding the right man for the position due to the fact that many have not registered their experience with our office or have failed to keep such records up to date. It is important that every graduate file his experience record with the Alumni office. While every graduate has been contacted for their experience record, our files are still incomplete.

During 1939 approximately 85 calls came to the Alumni office for men while only 29 Mines Men were placed. To fill the needs of the mineral industries requires men with a large variety of experience and therefore it is important for all Mines Men to see that their up-to-date record is on file in the Alumni office.

Malcolm E. Collier, Chairman of the Membership Committee reported that every Mines Man not a member of the Alumni Association was contacted several times by letter during the year in an effort to near the 100 per cent mark.

At the end of 1939 our membership in the Alumni Association showed as follows:

Life Members with magazine subscriptions paid for life..	13	
Life Members subscribing to magazine annually.....	134	
Life Members non-subscribers to magazine.....	75	222
Annual Members—Paid to 1943	1	
Paid to 1942	1	
Paid to 1941	54	
Paid to 1940	920	
Paid to 1939	137	1,113
		1,335
Associate Members		93
		1,428
Alumni, Non-Members	674	
Alumni, Magazine subscribers, non-members.....	8	

During 1939 a gain of 66 Alumni and Associate members was made.

William A. Waldschmidt, Chairman of the Junior Membership Committee reported as follows:

Junior Members enrolled January 1st, 1940.....	144	
Received in membership to June 1st.....	21	165
Transferred to regular membership by graduation.....		130
Members received at initiation meeting.....		35
December 13th, 1939		125
Total Junior Membership January 1st, 1940.....		160

Frank C. Bowman, Chairman of the Publication Committee reported as follows:

During the year 1939 Mines Magazine has published,
11 issues of 48 pages each (regular issues)
1 issue, 116 pages (special petroleum number)
1 Directory, 76 pages (Alumni Directory)

A larger variety of articles were published during 1939 than during 1938 due in a great part to the untiring efforts of Professor J. Harlan Johnson, a member of the publication committee. More illustrations were used and a large number of these were contributed and especially the front cover cuts.

The Special 116 page Petroleum Number was conceded by many publishers as one of the outstanding numbers published during the year and was certainly the finest number ever turned out by Mines Magazine. Many of the articles contained were reprinted by such magazines as the OIL WEEKLY. This fine number was made possible through the able assistance of your president Mr. Russell H. Volk and Mr. A. W. (Pop) Buell.

The more active interest of Mines Men from all parts of the world has been shown by the increased contributions, all of which have helped to keep your magazine at the top of the list of, so called college publications.

The recognition of the improvement of Mines Magazine has been reflected by the increased subscriptions from outside of the Alumni Association. During the year 183 one year, 2 two year, and 26 three year subscribers were added and about 300 extra copies of the special petroleum number were sold.

An index for the 1939 volume has been compiled by Professor J. Harlan Johnson, and this will be included as a supplement to the February 1940 magazine.

The Mines Alumni Directory was increased from 64 pages to 76 pages and the first color work was used in this publication.

	1938	1939
The budget for receipts was increased from	$10,000.00 to	$12,500.00
The budget for expenditures was increased from	7,100.00 to	9,100.00
	2,900.00	3,400.00
Total income	10,132.96	11,911.25
Total cost	8,144.01	9,673.42
	$ 1,988.95	$ 2,237.83

The receipts from miscellaneous sales, including, extra copies of magazine, directory, reprints, books, etc., increased from $153.52 to $581.97.

Over 25,000 reprints were sold and an increased number of extra copies of magazines. The last part of the year an increased effort was made to sell engineering books through the magazine and the results have been very encouraging, showing that it is possible to derive a considerable revenue from this source if Mines Men will buy their books through Mines Magazine. All Mines Men buy new books every year and it will not cost them any more to place their orders for such books with Mines Magazine.

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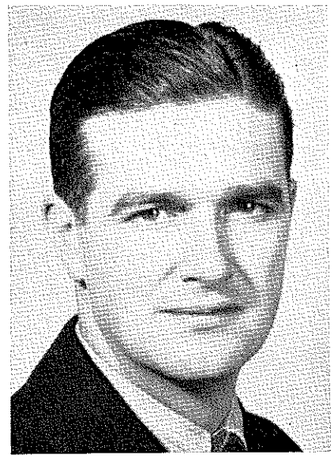
President's Message



E. J. Brook

Mr. Chairman, Fellow Alumni and Guests:

To say that I am extremely happy over the result of the election seems superfluous. But mingled with the personal satisfaction of being elected President of the Colorado School of Mines Alumni Association, there comes a deep sense of responsibility which goes with that high office. In my election as your President, I do not feel a personal victory, but rather do I sense a desire of our alumni group to accomplish something. While I deeply appreciate your confidence, as expressed by my election, the work of any officer is but half in his hands. The other half rests in the support and cooperation given him by each individual member. I am sure that your help and cooperation can be depended upon to aid this administration carry out its policies for the coming year.

I am genuinely encouraged to go into the tasks ahead of us because of the high calibre of the officers whom you have selected to serve with me. Mr. Bowman, our choice for vice-president, is an institution in the Association. Mr. Thomas, our treasurer, has a thorough understanding of the financial administration of our organization. Mr. Nagel, our secretary, Mr. Carstarphen, our new member of the Executive Committee, and Mr. Lavender of the Foundation Committee need no eulogy on my part.

In assuming these tasks for 1940 we can but pay tribute to those officers who have preceded us in the long history of the Association. Especially to the officers of 1939 we extend our gratitude and thanks. To Mr. Volk, one of the outstanding officers of all time; Mr. Wolf our retiring vice-president, long active in our councils; that grand figure Court Doolittle and George Setter our energetic secretary. We shall lean heavily upon them this year for advice and guidance in the many problems we face together. I wish to discuss some of those problems and other pertinent matters with you this evening.

Colorado Mines to we alumni who proudly claim her as our alma mater, is more than a group of aging, ivy-covered buildings in the foothills of Colorado. It is more than a faculty, more than a student body, more than an engineering school of international reputation, more than a group of alumni. No individual or group of individuals can ever be her peer, surpass her or be her master. Mines represents a force, an influence, inarticulate, yet ageless, ever-enduring in the life of each alumnus.

Our alma mater, thru the rich tradition in which she is steeped, thru that illusive, indefinable something, we, as undergraduates knew as "Mines Spirit" has cast a profound influence over the lives and character of all who sought knowledge and training at her feet. During the impressionistic years of youth these influences have left an indelible stamp upon the pattern of the life of each Mines Man.

It is therefore only proper that no group of individuals is more interested in the welfare of our alma mater than are our graduates. It is to their best interests to endeavor to safeguard and enchance its reputation, scholastic standing and position in the field of education.

The alumni of Mines are especially anxious to perpetuate its traditions, and are concerned with maintaining a student body which possesses those characteristics that distinguish the graduates of our school from others.

The Alumni Association is a vital need in the life of every graduate as an agency to perpetuate those friendships of college days in graduate life, to act as an ever vigilant guard over the reputation of our alma mater, to maintain its traditions, and to guide the graduate in his professional and business relations with other alumni.

When such an association is formed each member in contributing individual sacrifices to the welfare of the whole group expects the organization to perform certain functions from which he receives equivalent benefits for these contributions. He has every right to expect the cooperation of the other members for mutual benefits. He has the further right to expect definite, tangible results from the policies of the Association rather than slogans and sentimental appeals.

No officer or set of officers could or should attempt to dictate the policies of our organization. As members, this is *your* organization and you are the source from which all policies should eminate. As officers, we can but gather a myriad of your ideas into definite channels from which official actions, according to *your* wishes, are placed in our trust.

Our policies are of two sorts, internal and external. Our internal relations are concerned with the relation of each member to the organization and with the mechanical work and operation of your association. It will be the policy of this administration to be absolutely frank and open with our membership as to the business of the Association and its financial status at all times. If we make mistakes let us admit them and thru widespread knowledge of our problems, perhaps we can find a solution to them. Thru the pages of Mines magazine you will be informed of the actions of your executive committee and of association business at all times.

Our external relations are almost wholly devoted to cooperation with the school in work for the advancement and betterment of our Alma Mater. We shall devote every diligent effort to lend our wholehearted and unceasing cooperation to this very

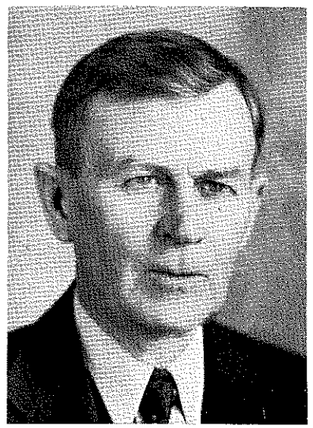
essential function of our organization. In return, we shall expect the cooperation of the school, in the solution of certain problems of this association.

The officers and committee members of this administration are chosen to carry on the work of the organization, and not for the honor of the position for which they are chosen. Our emphasis will be on work rather than honor. We shall be guided by two appropriate proverbs. The first from the Latin states, "Ne tentes, aut perfice" which translated means, "Either attempt not, or accomplish," and the second by Virgil "They conquer, who believe they can". It will not be the policy of our administration to promise things which we cannot fulfill.

I want this administration to be the mouthpiece of its members—your problems are Association problems. There are, and can be no factions in our association—our problems are the problems of all—our goal is one for which we all are striving. Our officers must be entirely selfless in the performance of their duties. The Association must not become the tool to satisfy any member's personal ambition.

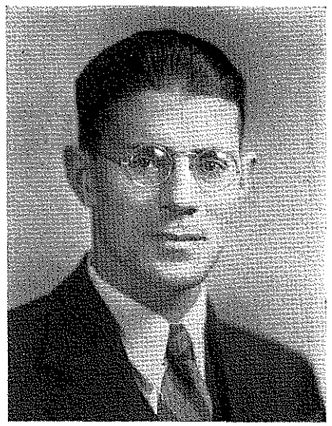
Your officers can accomplish nothing without your wholehearted cooperation and help, but, with all our members working together, I believe we can make definite progress this year. I hope our association can visualize new horizons for a new year. I sincerely trust we may reach these horizons. With your help I know we can!

Annual Business Meeting Alumni Association



FRANK C. BOWMAN
Vice-President

FRANK J. NAGEL
Secretary



GEORGE W. THOMAS
Treasurer

After reports were read, the president then asked all present to feel free to express themselves on anything pertaining to the work of the Association which would give constructive ideas to the officers and place them in a better position to serve the Association.

Coach John Mason was called upon to report on athletics at *Mines*. He announced that H. M. Williamson, a noted national authority on football, had awarded Lloyd Madden of *Mines* the Alternate Trophy for being the second most valuable football player in the United States. This placed Madden next to Nile Kinnick, the All-American from Iowa. Coach Mason then reported on the prospects for next year and the scholarship of the squad. He expressed his appreciation to the Alumni Association for the help given him in the work and gave praise to his able assistants, Doy Neighbors and Adam Esslinger. A rising vote of thanks was given Coach Mason for the fine job he has done at *Mines*.

James Boyd, chairman of the Nomination committee, was then called upon to give the results of the election of officers for 1940 which follow:

President—Edward J. Brook, '23, Glendale, Calif.

Vice-President—Frank C. Bowman, '01, Denver.

Secretary—Frank J. Nagel, '03, Denver.

Treasurer—George W. Thomas, '26, Golden.

Member, Executive Committee—Fred C. Carstarphen, '05, Denver.

Director, C. S. M. Foundation—H. M. Lavender, '16, Douglas, Ariz.

The news of Eddie Brook's election to the office of president was telephoned to him and immediately he gave his inaugural address by radio from his home in Glendale as published on preceding page.

Vice-President Frank Bowman was then introduced and the chair turned over to him. He thanked the alumni for their support and pledged his continued efforts to further the work of the Association.

The final treat of the evening was the showing of the football movies, *Mines* vs. Greeley and *Mines* vs. Chadron, Neb. Coach John Mason gave interesting comments on the games, pointing out both the good and bad plays which were shown. He stated that the movies had aided materially in coaching the team and thanked the Alumni Association for making the movies possible.

The meeting adjourned to the Club room at 11:15 and informal groups continued until a late hour.

ICELAND SPAR MINE IN NEW MEXICO

With Notes on the Properties and Uses of the Spar

By J. HARLAN JOHNSON, '23
Associate Professor of Geology, Colorado School of Mines

Generations of university students have studied Iceland spar in their courses in mineralogy and have looked at a few small pieces of the mineral, but it is doubtful if half a dozen of them have ever seen a deposit of it. Having had the good fortune to see one it seems fitting that the writer should share the interesting experience with others by describing it to them.

The one property about Iceland spar which most of us remember is its property of double refraction. Look through a piece at a line, dot, or printed object and one sees two of them instead of one. This making one see double when perfectly sedate and sober, impresses the mineral on the memory. Few people realize, however, that this property of double refraction makes the mineral valuable for lenses, prisms, etc., in various scientific instruments. In recent years the supply has been so meager as to more or less govern the market rather than the reverse, as is the case with most minerals. Unquestionably if larger supplies were available more of it would be used and more uses would be found for it.

Sources of Iceland Spar

Until about 1920 the world market was supplied from the mine near Helgustadir, Iceland. Since that time the material from that source has fallen off both in quality and quantity. More recently South Africa has been the principal source. From time to time small amounts have been produced near Greycliff, Montana, and Cedarville, California. The discovery of this deposit in New Mexico is indeed welcome and we hope it may be able to continue to produce for a long time.

The Properties of Iceland Spar

Iceland spar is a variety of crystalline calcite. Its composition is calcium carbonate ($CaCO_3$; CaO = 56 per cent; CO_2 = 44 per cent); its hardness 3, and specific gravity 2.71. It is a brittle mineral with vitreous lustre, white streak, and perfect rhombohedral cleavage. The pure Iceland spar is clear and colorless, but slight impurities give tints producing varieties of calcite which may vary grey and light brown to dark reddish-brown.

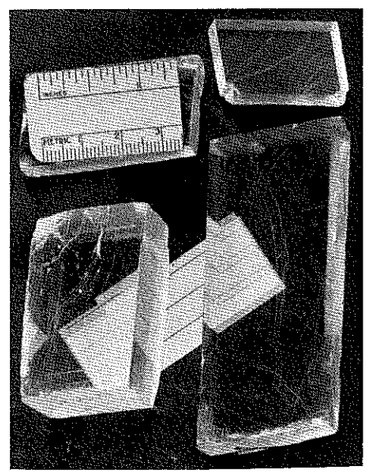
The special properties of Iceland spar which distinguish from the ordinary calcite are its absolute compactness and transparency, its perfect rhombohedral cleavage, and its high double refraction. Iceland spar crystallizes in the rhombohedral hemihedral division of the hexagonal system, most commonly as scalenohedrons, the sharp termination usually blunted by rhombohedral faces; but sometimes it may be found as hexagonal prisms terminated by flat negative rhombohedrons, or combinations of all three forms. The cleavage is parallel to the rhombohedral faces, and the crystals break up into rhombohedrons so perfect as to make more even and smooth faces than the original crystal faces. Twinning is not uncommon, and, as in all calcite, when the twinning plane is the obtuse rhombohedron it causes that polysynthetic lamellation which is so characteristic of calcite as seen under the microscope.

Uses

The most important use of Iceland spar is for the manufacture of Nicol prisms which are an essential part of every polarizing microscope, and which are also used in saccharimeters, photometers, dichroscopes, colorimeters, and polariscopes.

An ordinary light ray is extremely complex; its vibrations take place in all possible planes intersecting the ray as an axis. When such a light ray passes through a rhombohedron of calcite, however, it is resolved into two rays of plane polarized light, each vibrating in a single plane perpendicular to the other. Furthermore, the two rays have different indexes of refraction, which results in their following different paths through the crystal. This phenomenon can be observed by placing a cleavage fragment of calcite over a dot on a piece of paper. Two dots will appear and, upon rotating the crystal, one will revolve around the other. These two rays are commonly known respectively as the ordinary and the extraordinary.

The Nicol prism utilizes these properties in providing a source of plane polarized light. It is constructed of clear, flawless calcite in such a manner that the ordinary ray is reflected and totally absorbed within the Nicol while the extraordinary ray emerges as polarized light vibrating in only one plane. A cleavage rhombohedron of Iceland spar about three times as long as it is broad is cut diagonally along the plane connecting the obtuse dihedral angles of two opposite elongated faces, and the end surfaces are ground down until they are perpendicular to this newly formed plane. The two halves are then cemented together with Canada balsam, a transparent cement having



● Iceland Spar—New Mexico.

an index of refraction lying between the values of the indexes of the two rays common to calcite. The cemented Nicol is polished and then set in cork, blackened along the contact with the calcite in order to absorb light which is reflected to the sides.

Immediately upon entering the Nicol, any ray of white light is broken into two rays, the ordinary and the extraordinary. The ordinary ray has a higher index of refraction and, therefore, it is refracted to a greater extent than the extraordinary. As a result, it meets the Canada balsam at an angle so great that it is reflected from it and is absorbed by the blackened walls of the prism. The extraordinary ray, because of its lower index of refraction in this direction through the crystal, meets the Canada balsam at a lesser angle and passes through it without being appreciably affected. This ray emerges from the opposite end of the Nicol as plane polarized light with its vibration plane parallel to the short diagonal of the rhombic section of the prism, and polarized in the plane parallel to the film of Canada balsam. This vibration plane is rigidly fixed by the crystalline structure of the calcite. Modifications of this style of Nicol have been devised, but they all embody the principle of totally reflecting either the ordinary or the extraordinary ray.

By means of the petrographic microscope, which uses two Nicol prisms, the behavior of polarized light in traversing thin sections of minerals can be studied. The optical properties thus revealed provide an accurate means of identification for most minerals. Iceland spar, therefore, is of inestimable value in the scientific investigation of rocks and minerals. Nicol prisms or modifications of them are used in other scientific equipment which aids manufacturers in keeping a close check on the quality and uniformity of their products. Among these instruments are saccharimeters, which are used to measure the sugar content of a solution; colorimeters, which indicate the depth of color as compared with a standard; photometers, which measure intensity of light; dichroscopes, which reveal dichroism in crystals; polariscopes, and polarimeters, which are used in the study of polarized light; spectrometers, which are used in determining index of refraction; and spectroscopes, which are used in forming and examining spectra. Iceland spar is also used in the determination of crystal structure by X-ray analysis.

Recently the author heard rumors that a deposit of Iceland spar had been found in New Mexico and, never having seen an Iceland spar mine or even having met a person who had seen one, it seemed a good idea to go and visit it.

Location

The deposit, officially known as the Iceberg Lode Mining Claim is located in Sec. 31, T. 23 N., R. 11 E., Taos County, New Mexico, in the old Copper Mountain Mining District. It is about 30 miles south-southwest of Taos by road and approximately 55 miles north-northeast of Santa Fe. The operators are Messrs. E. M. Stanton and J. W. McCoy, of Santa Fe.

Geology

The deposit occurs in Pre-Cambrian rocks, mica schists and quartz mica schists. It occupies a tubular or conical space nearly circular in horizontal section along a fault plane. At the surface the deposit is approximately 20 feet in diameter. As of August, 1939, the workings had penetrated to a depth of from 20 to 25 feet along the southwestern side of the deposit. From the excavation it would appear that the deposit is plunging slightly to the south or southwest.

The calcite appears to occupy a former cavity in the schist. It has cleancut boundaries. The schist around the borders is altered to a clayey material. The calcite has developed as a mass of intergrown crystals of large size which completely fill the space and form a solid mass of mineral. The surface and near surface portions of the deposit which were visible at time of visit were discolored, more or less opaque, badly flawed, intergrown, and in some cases twinned, and were not suitable for optical use. Around the borders, crystals of calcite up to 1½ feet across grew out into the clayey decomposed schist. To date these have supplied all of the material marketed. The outer surfaces of most of these crystals are etched and coated with clayey material. The high grade material gives a clear ringing sound when struck, quite different from the dull thud of a badly flawed piece.

Origin

Tertiary vulcanism was active in the general region as shown by the abundant basic lava flows which cap the mesas along the Rio Grande Valley and which filled the old valley with a thick series of flows. Local mineralization is shown by the fact that within a radius of two miles of the Iceland spar deposit there are numerous prospect holes which have yielded specimens of gold, copper, tungsten, molybdenum and lithia minerals. In the opinion of the writer the deposit was formed by circulating warm waters, at least heated and mineralized by the cooling lavas, or the magma which fed them. These traveled along the fault plane and deposited calcite in the cavity along the fault, probably enlarging the cavity by attacking the rocks lining it. The highly altered rock and the character of the residual material around the borders of the calcite deposit support this view.

Methods of Mining

The softness and perfect cleavage of the spar add greatly to the difficulties of mining as they practically prohibit the use of explosives or violent hammering. Technically it could be said that the deposit is worked by open pit methods with considerable gophering around the edges. Work is done by hand with bars, light hammers and chisels. Only very small amounts of material are handled at a time.

After being extracted from the pit the calcite is carried to a work table where all colored or fractured material is immediately discarded. The balance is carefully cleaved in such a way that all imperfect material is removed from the clear flawless portions, and the latter is left in as large pieces as possible. This operation requires a high degree of skill and judgment. It was interesting to watch Mr. Stanton do it.

Needless to say the percentage of waste to marketable material is very large and unfortunately there is practically no market for the discarded material. Some of the second-grade material, clear but slightly flawed or containing bubbles may be sold to mineral dealers for schools, museums and mineral collectors.

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GRANULAR MATERIALS*

Particle Size Distribution

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WALTER H. DUMKE

A complete review on the subject of determining the particle size distribution of powders or finely dispersed materials, would obviously be beyond the scope of this paper. However, in view of the fact that there has been considerable interest shown in several important industries and in different phases of engineering research both in this country and abroad within the last decade, it is believed that a brief review of the methods, technique, and general principles involved would be timely.

The term "particle size distribution" is usually applied to the actual distribution by weight of various size particles of assumed diameter ranges, roughly from 1 to 100 microns. (A micron is .001 mm.) In the usual sense of the term we ordinarily think of particle size distribution with respect to very finely powdered materials, as specific examples: pigments, portland cement, samples of soil, etc. In the strictest sense of the words, "particle size distribution" applies equally to the percentages by weight or volume of average diameter size fractions of mixtures of aggregates having relatively larger dimensions. Thus in the mechanical analysis of sands and gravels by means of sieves or screens, we have an effective means of ascertaining size distributions. However, in general, such a mechanical separation is seldom referred to as such, but rather as a grading of aggregates expressed in terms of an empirical modulus.

Fineness of a granular material is expressed as specific surface—defined as "the number of square centimeters of surface area per gram of material". This term has received general acclaim and is found to adequately define the fineness of granular materials for most practical purposes.

*(This paper was presented before the Denver Technic Club, December 19, 1939.)

Some Practical Applications of Particle Size Distribution

The importance of the role which the distribution of particle size of various substances play in effecting the many definite physical characteristics of resulting mixtures has long been recognized. As an example of the practical application of particle size distribution, we have its valuable use in studies of soils. In hydraulic fill dams, there has occurred almost over night the development of a new technology of soils for the purpose of aiding the designing engineer. Such factors as permeability, ease and degree of compaction are undoubtedly related to the distribution of particle sizes. In this particular field, one can include the investigations on silt deposition and sedimentation in the great artificial reservoir formed by the Boulder Dam in the canyon of the Colorado River. Related to this general subject is the determination of the turbidity of city water supply and suspended solids in sewage.

In the manufacture of portland cement, the fineness of the raw materials and finished product is of importance. Chemical combination in the rotary kiln in producing cement clinker is dependent on the fineness of the raw materials and temperature employed. The final size distribution of the ground clinker in the production of portland cement influences to a great extent such properties as time of setting, water requirement, plasticity, workability, initial strength, heat of hydration, and other properties in which the builder or engineer is interested.

In the paint and rubber industry the use of inorganic pigments requires a knowledge of the effective size distribution. In the case of pigments to be used in oil vehicles, the oil requirement appears to be a definite function of the particle size distribution. The hiding or covering properties seem also to be so related. In the rubber industry, the distribution of particle sizes of certain pigments, i.e., carbon black, has a definite effect on the physical properties of finished rubber products.

In the manufacture of ceramics a knowledge of fineness of raw materials to be employed is of value. Since the manufacture of these materials is accomplished by fusion at elevated temperatures, the rate at which the process proceeds is necessarily a function of the relative fineness of these materials. In the consistency and moldability of clays before fabrication, such physical properties as porosity, thermal expansion, shrinkage and absorption are factors influenced by the initial fineness of the raw materials. In the metallurgical field, the effect of particle size distribution plays an important part particularly in various concentration methods, as a specific example, flotation processes.

Less important applications are the fineness of molding sands, in which the permeability, strength, refractoriness and surface finish are factors largely dependent on the particle size distribution; in the manufacture of sand paper, emery cloth, and grinding wheels; and studies in inert mineral fillers for a variety of purposes.

Methods

A brief review of the more im-

portant methods, general technique, and principles involved in determining particle size distribution will now be presented. The outstanding operations involved may be classified, in general, under the following headings:

(1) Sieving (mechanical separation).
(2) Microscopic measurement.
(3) Sedimentation and Elutriation.

(1) *Sieving.*—In the mechanical separation of a powdered material the fineness is determined by weighing the portion which fails to pass through a sieve having meshes of certain dimensions. In practice the limit of fineness which can be determined by this method terminates with the No. 325 mesh screen which has a mesh opening of .0017 inch (approximately 45 micron diameter). Since many of our fine materials of industrial value have a 90-95% No. 325 sieve passing, the method at once becomes too restricted for modern research on particle size distribution. Sieving is, however, the simplest acceptable criterion in the absence of more advanced methods requiring considerable apparatus and technique.

(2) *Microscopic Measurement.*—This method requires good microscopic technology to secure accurate magnification and sharp definition of particle image. Microscopic measurement is open to the objection that it involves tedious labor and many calculations; in fact, a single specific surface of a powdered material is a research project in itself. Considering the tedious labor and the many possible errors involved, this method has remained strictly in the research field. However, with expert technique, the microscope comes nearer in determining the true absolute surface area of a material than any other method developed to date.

One of the newest and most promising methods is that of micro-projection. With this method an image of the specially prepared slide is projected onto a ruled screen, from which the particle size distribution is calculated. This method is particularly useful for those extremely fine particles below 6 microns in diameter as occur in cements, pigments, and mine dust. The screen is generally made of material similar to tracing cloth upon which centimeter squares and fractions thereof are ruled. The magnification of the microscope is adjusted so that a micron distance on the stage of the microscope is equal to some definite distance on the screen. In this way the areas of different sized particles are easily measured and compared by observing their magnified areas as projected on the screen. To obtain the high magnifications required, oil-immersion objectives are used. Another method similar to the micro-projection method is with the use of an ocular net. The ocular net is a thin circular piece of glass upon which is a finely divided area ruled in the shape of a checkboard. This is placed directly in the microscope and the calibrations are made by observing the areas intercepted by the particles of the powder on the slide as they are projected on the ocular slide.

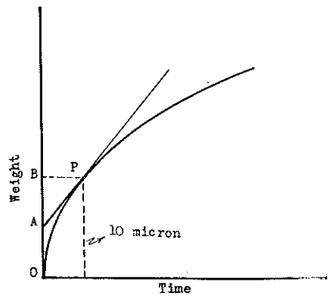
(3) *Sedimentation and Elutriation.*—Sedimentation methods utilize some suitable liquid suspending medium from which particles fall at different rates and are thus separated. The principle relation controlling the velocity of an isolated particle in a dilute medium is expressed in Stokes' law which gives the rate of fall of a small sphere in a viscous fluid. Stokes' law for the relation between size and rate of fall of a spherical particle in a liquid medium may be expressed as follows:

$$D^2 = \frac{18\,h\,n \times 10^8}{(s_1 - s_2)\,g\,t}$$

where

D—diameter of the particle in microns
n—viscosity of the medium in poises
s_1—specific gravity of the particle
s_2—specific gravity of the medium
g—acceleration due to gravity in cm/sec.^{2}
h—distance which particle has settled in centimeters, and
t—time required for particle to settle h centimeters, in seconds.

When a fine material is uniformly dispersed in a liquid and allowed to settle, the curve showing the weight of material settled out as a function of time is known as a "sedimentation curve", and from it a particle size distribution curve can be derived graphically or arithmetically. Figure I illustrates a graphical method of solution. From the conditions of the experiment the micron diameter corresponding to different times may be calculated from Stokes' law and marked along the time axis. For a particular diameter, as for example, 10 microns, a line is projected from the corresponding time axis to cut the sedimentation curve, say at P. Now a tangent to the curve at P cuts off a section of the Y axis which defines the weight of those particle sizes that have completely settled out in the time indicated by the point. The



● Fig. 1—Sedimentation curve

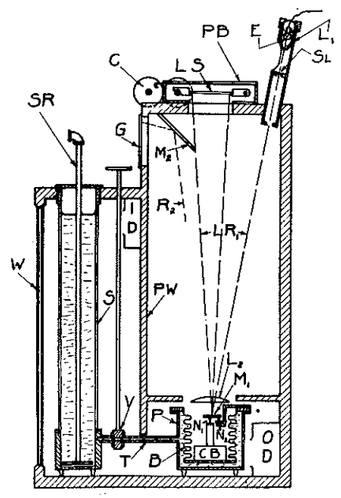
section OA indicates the weight of particles having micron diameters greater than 10 microns; AB, those having diameters less than 10 microns. In a similar manner, a series of tangents may be drawn for other particle diameters.

Sedimentation methods employ various kinds of apparatus which can be classified as follows: (a) sedimentation weighing devices, (b) apparatus measuring change in density or composition as settling takes place, and (c) those measuring turbidity, such measurement being made by the photoelectric cell.

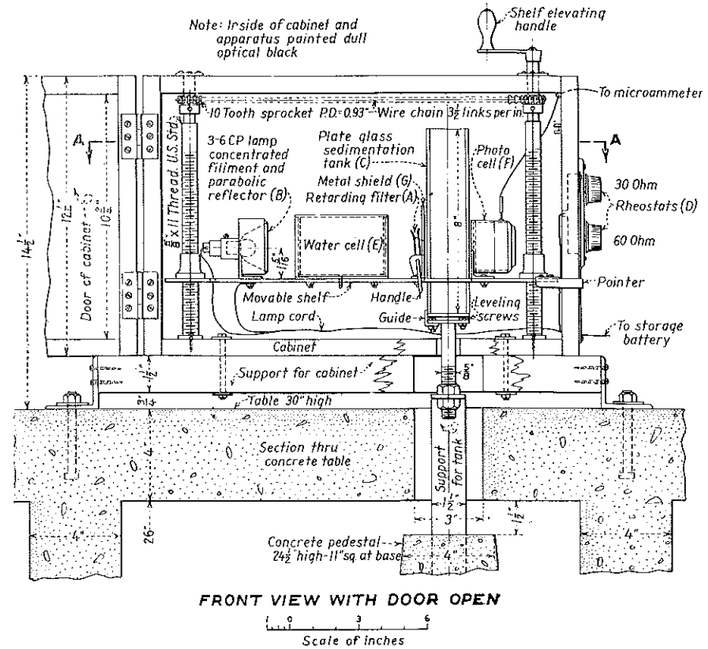
Various types of weighing devices have appeared in the literature in recent years. Bishop[1] of the Bureau of Standards has developed a modern weighing apparatus which incorporates many unique devices of particular interest. The material to be analyzed is dispersed in a liquid and introduced into a sedimentation cylinder. As the particles settle on the pan attached to the left arm of the balance, the beam is rotated counterclockwise, thus deflecting the image of the lamp from the opaque screen onto a photoelectric cell. This causes an increased current to flow, which after being amplified by a vacuum tube, operates the relay to start the motor connected with the drum resistance. The motor runs until enough resistance is cut out to increase the solenoid current sufficiently to restore the equilibrium of the balance and throw the light off the photoelectric cell. This is repeated automatically by the material settling from suspension. A record of the current flowing through the solenoid circuit then corresponds to a time weight record of the sedimentation of the sample. To measure the current on the solenoid circuit, a recording potentiometer is used to measure the drop in voltage at the potential terminals of a suitable shunt. The weight of material which

settles out as a function of time results in a sedimentation curve from which a particle size distribution curve is derived involving Stokes' law. While excellent results can be obtained, such a weighing device entails an elaborate and intricate mechanism as well as requiring expert operators, all of which greatly limits its use.

Apparatus which measure density changes in liquid suspensions as sedimentation takes place include the Riverside microneter[2] and the hydrometer. The microneter apparatus was developed at the California Institute of Technology in connection with the Riverside Cement Company. The microneter has satisfactorily met the specifications set up by this Company and has contributed extensively to the knowledge of particle size distribution in the cement industry. The principle of the apparatus is based on the measure of hydrostatic pressure just above the bottom of the column. The pressure on a unit area at the base would be equal to the weight of the column above it, which would be composed of the weight of the liquid plus that of the suspended particles. Obviously, when the particles settle past the point of pressure measurement, the pressure decreases. The microneter unit (Figure 2) consists of a glass walled sedimentation tube S, which contains a stirring rod SR. The tube is closed at the bottom by a brass casting, containing a small pressure-measuring orifice. This is connected to the pressure cell P by means of the tube T. The connection can be opened or closed by means of a valve V,



● Fig. 2—Sectional Diagram of Microneter Unit



● Fig. 3.

whose operating handle projects out through the top of the case. The pressure cell P is composed of a rigid outer case containing a metal bellows B. The change of pressure acting on the closed bottom of the bellows causes it to move. The pressure due to the normal column of liquid is counterbalanced by the mass CB which is fastened to the bottom of the bellows. The movement of the bellows is indicated by the tilting of a mirror M_1, to which are fastened three needle point supports. The tilting of the mirror is recorded by a beam of light whose source is a small globe E. The beam passes through the lens L_2 to the mirror M_1, then back through the lens which brings it to a sharp focus on the lantern slide plate LS housed in a light tight plate box PB. The photo plate rests in a carriage which is given a motion perpendicular to the plane of the paper through the medium of a clock shaft C and a train of gears. The beam of light which falls on the photo plate traces a time-weight sedimentation curve. The operating range of the beam of light is shown by the dotted lines LR. A battery of six units is usually housed in one case which has a set of windows running along the entire front so that the settling chambers can be inspected at all times. The clock shaft runs along the entire length of the case and drives the carriages of all the units. The entire case is operated in an air-bath thermostat. With this battery one skilled operator can complete 18 analyses per 8-hour day including preparing the sample, operating the machine, developing the plates, analyzing them, and calculating the results. The initial cost and skill of operation are perhaps the chief reasons which have limited this refined piece of apparatus in the industrial laboratories. As a research instrument it can be listed among the best.

Changes in turbidity caused by fine particles settling from a suspension has offered itself as a convenient means for surface measurement. The hiding power of a particle is directly proportional to its surface area, and when a beam of light is passed through a turbid suspension of opaque particles, the decrease in the light intensity is definitely related to its surface area. The turbidimeter, which is based on this principle, has become a well known instrument for obtaining surface area and particle size distribution of such important materials as portland cement. The Wagner turbidimeter[3] (Figure 3) measures the change in turbidity as sedimentation takes place in a suspension, such measurements being made by means of a light beam, passing through the sus-

pension and then falling on a photoelectric cell. The current generated in the photoelectric cell is measured with a microammeter and the reading indicated affords a measure of the turbidity of the suspension. The source of light is a 6-candle power electric lamp operated by a 6-volt storage battery. A parabolic reflector is mounted behind the lamp and is focused so that parallel light passes through the glass settling tank which contains a suspension of particles. Two rheostats serve to regulate the light to the desired intensity. A water cell placed in the path of the beam absorbs the larger part of the radiant heat. The lamp, water cell, and photoelectric cell are mounted on a shelf which is raised to any desired depth of the suspension in the settling tank. The function of the movable shelf is to shorten the time required to obtain the sedimentation curve of a suspension. Microammeter readings are observed at the proper depths and time intervals calculated from Stokes' law to correspond to particle diameters of 7.5 to 60 microns in increments of 5 microns. While the results obtained by this method are relative and based on specific assumptions of particle sizes, the ability to reproduce results, the short time required for test, and the nominal cost of the apparatus has led to a general adaptation of the instrument.

Another apparatus for measuring turbidity has recently been devised by A. Klein,[4] generally known as the suspension turbidimeter. This instrument provides a rapid determination for total surface area of a powdered material in which the turbidity of a suspension in castor oil is measured. The method does not involve Stokes' law, but consists in determining the mean effective cross sectional area of a suspended material under stationary condition, through the use of photoelectric equipment. No consideration of time of velocity is involved in the determinations. Once the value of an opacity factor has been determined for a particular type of material, the suspension turbidimeter immediately becomes a rapid means of controlling the fineness of any other similar sample. The Klein apparatus does not permit the determination of particle size distribution and in this respect differs from the Wagner turbidimeter. Incidentally, the suspension turbidimeter is limited to indentical optical restrictions as encountered with the Wagner apparatus.

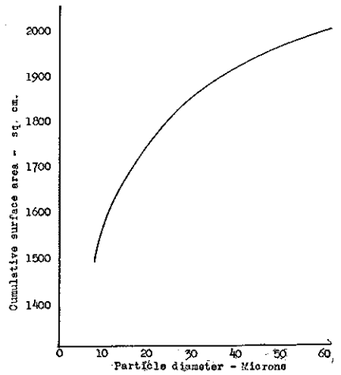
Another method for recording density changes as sedimentation proceeds employs the hydrometer adopted from soil analysis procedure. The hydrometer, depending upon the density of the suspending medium for its bouyancy, settles as the particles fall from suspension, and hence measures their weight in the liquid above the center of gravity of the bulb. The maximum particle size for this weight at the time of hydrometer reading is computed from Stokes' law. The apparatus is simple in construction, inexpensive, easily calibrated, and requires no great order of skill for its operation, and results can be duplicated with reasonable accuracy. Due to the large test sample required, some difficulty has been experienced in dispersing the particles in suspension. The use of this instrument avoids difficulties that have been experienced with other fineness methods when translucency in the small particles of some materials is encountered.

The pipette and burette are sedimentation methods in which direct measurements of changes in composition of the suspension are made. The settled particles are drawn off at predetermined times, the sample dried, and weighed. The pipette method is being used chiefly in determining particle size distribution in soils and molding clays.

A new feature which has been introduced quite recently in many grinding plants is that of air separation. The ground material is separated from its "flour fines" and the larger particles are returned to the mill for further grinding. In general, the principle of air elutriators is simple, in practical application perhaps somewhat complicated. Clean-cut separation of definite particle size ranges are obtained only with care and painstaking effort. Factors such as attrition due to high velocity of the air, turbulent conditions in the settling chamber, and electrostatic effects can not be overlooked when employing this method of separation.

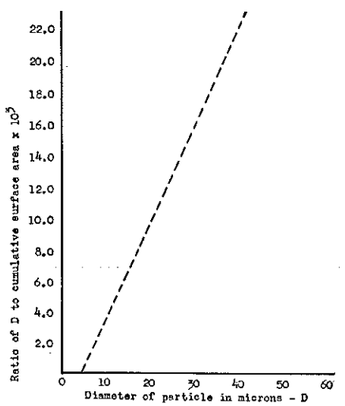
In recent years, several companies in the United States have placed on the market various types of instruments for determining particle size distribution and surface area of powdered materials, but practically all are based on Stokes' law and are modifications of apparatus described.

In the field of particle size distribution of portland cements some very interesting facts have been observed. It has been found that when a cement clinker is ground as a unit, it breaks down according to a fundamental law. When the particle diameter in microns is plotted against the cumulative surface area, as obtained by the Wagner turbidimeter, a curve which closely approximates a hyperbola is obtained. (Figure 4) A remarkable



● Fig. 4

fact is that this relation holds true for cements of widely different compositions, and ground in both commercial and laboratory mills in various parts of the country. As a result, if for any cement, ratios of particle size and cumulative surface area are computed from the experimental data and are plotted against the respective micron diameter, the plot represents a straight line (Figure 5). The



● Fig. 5

straight lines for the various cements do not cross each other, and do not radiate from a common point but the

(Continued on page 74)

NON-METALLIC MINERALS

By KENNETH E. HICKOK, '26

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This is the first of a series of articles on non-metallic minerals by Kenneth E. Hickok, that will appear in MINES MAGAZINE during 1940. The non-metallic minerals are of continually increasing importance to our national industrial progress. Our readers will be interested to become better acquainted with the use and importance of this branch of our mineral wealth.

Part I—Introduction

Non-metallic minerals have unobstrusively crept into our daily lives until we have come to accept them without much thought as to their production, treatment, marketing or use. We give little thought to the cement in our highways, the insulation in our houses, or the spark plugs in our automobile, and yet we would be seriously handicapped without these common non-metallic products.

More than seventy different non-metallic minerals are being commercially produced at the present time, not counting iron ore, petroleum products or coal. The value of the non-metallics produced yearly in the United States is about equal to the combined metallic production of gold, silver, copper, lead and zinc, in a like period of time.[1] The tonnage produced would probably be in excess of the combined tonnage of ores of the common metals.

The total number of men employed in the non-metallic industry could be conservatively estimated at several million and the field is continually expanding. The employment of more and more technically trained men in the non-metallic field has lowered costs with a corresponding increase in consumption. Research has materially increased the marketing possibilities of the non-metallics and apparently no end is in sight.

The non-metallic field offers an unusually rich opportunity to the mining, metallurgical, and research engineer because it is a continually expanding industry for which their training has particularly adapted them. Operators are beginning to realize the value of the technically trained man in management, production, research, treatment and marketing. This new realization is reflected in the number of graduate engineers employed in this field.

On the off chance that some of you who have perused this article thus far are not too familiar with non-metallics, I would like to offer a definition, even though it brings down the wrath of many who read it. In explanation, and to alibi myself to some extent, I would like to say that this is an industrial definition rather than chemical or geological.

Non-metallic minerals are naturally occurring minerals of sub-metallic or earthy luster which cannot be plastically deformed, are poor conductors of heat or electricity, and which are used industrially without conversion to a metallic constituent of the mineral.

To illustrate: Chromite is a naturally occurring mineral used as such in refractories. While this mineral is also used in the production of metallic chromium, it does have widespread use in its non-metallic form.

Pyrite, galena and many other sulphide minerals have a metallic luster, hence, are not considered as non-metallics even though one of the constituents, sulphur, is an important non-metallic.

Metals, without exception, can be plastically deformed at some temperature below their melting point. That is, they can be hammered, forged, pressed, shaped, or drawn through dies. This is not true of the non-metallics. They are brittle, hence, cannot be hammered, pressed, shaped nor drawn. In other words, the non-metallics cannot be plastically deformed at any temperature below their fusing point.

We have come to accept non-metallic mineral products with such nonchalance that one is prone to ask, "Why should non-metallic minerals concern me? I used to get along without concrete roads, without having my house insulated, and without the present high quality spark plugs for my car."

The reason that non-metallic minerals should concern you is that non-metallic mineral products directly affect our daily lives from the time we brush our teeth in the morning to the final snap of the light switch before we jump into bed. Without non-metallic mineral products life would be very, very dull and colorless.

If you will bear with me, I would like to enumerate some of the common non-metallic minerals, together with some of their uses wherein they contact our daily lives.

Natural abrasives are used to sharpen your pocket knife and razor. They are also used to grind the lenses of your glasses, microscopes and telescopes.

Asbestos, in the form of insulation, cuts your coal bill by keeping the heat in the house. And don't forget that every time you step on your automobile brake it is asbestos that stops the car.

Barite is undoubtedly present both inside and outside of most painted houses because barite is the base of most paints.

Bauxite makes the world a much more pleasant place to live because it is the ore from which we obtain aluminum. Lack of bauxite would cause the price of all metals to skyrocket because it is also the base of the common high temperature refractory used in smelting furnaces.

Borax helps to keep your shirt clean, also your teeth, because it is one of the basic ingredients in laundry powder, tooth powder and tooth paste. It is also used in deodorants and disinfectants, so if you do not "offend" you probably use borax.

Cement materials when converted into cement are so commonly used that it is impossible to think what life would be without it; no concrete highways, no sidewalks, no foundations for houses, no bridges. It is truly said that our present civilization is built on concrete.

Chalk, sometimes called whiting, is used by everyone of us daily in linoleum, window shades, tooth paste, cigarette paper, or putty, because it is the most common filler used in these articles.

[1] Minerals Yearbook, U. S. Bureau of Mines—1939.

Chromite, mentioned before, is not only the ore from which chromium is obtained but is, in addition, one of the best refractories for high temperature work.

Clays are in the same category as cement materials for, without clays, we would have no brick houses, no chinaware for our tables, no pottery, no porcelain, no sewer tile, and so on almost indefinitely.

Dimension stone is both ornamental and useful in churches, office and college buildings; it is also one of our last contacts with the outside world when our loving relatives set up a slab bearing the inscription, "Here lies So and So, Born Such and Such, and so on."

Crushed or broken stone is another of those things about which we think very little but without which we would be in sad shape. Rail service would be slow or intermittent without broken stone for ballast and smelters would shut down without crushed limestone for flux. Concrete aggregate would be prohibitive in price in many localities were it not for broken stone to take the place of sand and gravel.

Gem stones are so widely used both as adornment and investment that we are all familiar with them, at least by hearsay, if not closer contact. However, we overlook the fact that many common minerals frequently occur in gem quality if they were recognized as such.

Graphite, used by everybody in the world in the form of pencils is also one of the major items in the makeup of electric generators and motors. We even refine our gold in graphite crucibles.

Limestone, the wheel horse of industry, affects our daily lives in so many ways that it would require a good-sized library to tell all of them. A few uses are as flux, hydrated lime, quicklime, in chemical plants, tanneries, water purification, paper mills, and as a major cement material.

Lithium minerals are not in the "major class" but their use in air conditioning and as commercial dehumidifiers is increasing by leaps and bounds. Experimental work on glass containing lithium indicates that, possibly, the solution to the age-old problem of flexible glass may be there.

Magnesite is another of those high quality refractories but Mother Nature was a little skimpy when she passed around the magnesite so it is not as widely used as it would be if it was plentiful and low-priced. However, where its use is essential, there is no reliable substitute.

Manganese is familiar to most of us as one of the strategic materials for steel making but few realize that it is also an important non-metallic. How about that flash light? No manganese, no flashlight battery. If it wasn't for the use of manganese most glass would have a greenish tinge instead of being crystal clear. A few other uses are in lacquer and varnish as a pigment, insecticides, and in numerous chemicals. It is to be regretted that an industrial nation like the United States produces such a small percentage of this most necessary mineral.

Mica, the insulator, made radio possible. It is also used in many electrical appliances, but by far the biggest use is to impart that shiny finish to your wall paper.

Nitrates are produced in only one locality in the world, as a natural product. Chile had a monopoly on the world's nitrate industry until the world war cut off the supply. With the advent of the war, most countries built nitrate plants where it is produced artificially from the atmosphere. Since the war, the nitrate plants have continued operation much to the consternation and disgruntlement of the Chilean producers. However, nitrates are very necessary for fertilizers to grow our daily bread and other surpluses as well as to kill off our enemies.

Phosphate rock has a decided effect on our daily lives because it is probably the most widely used of all the commercial fertilizers. The higher the price of phosphate rock the higher the price of beef steak.

Potash, a most necessary war material is a mighty handy peace-time material, also. It is used in explosives, fertilizers, glass making, chemicals and a multitude of other ways. With increasing production from the New Mexico potash deposits, prices have been reduced and as a consequence its use has expanded into many fields where it was formerly too costly.

Pumacite under various trade names has become a household necessity. Old Dutch Cleanser, Sunbrite, Briteize, Lighthouse Cleaner and many other pumacite base scouring powders will be found on the shelf of practically every home in the U.S.A.

Salt, another non-metallic is consumed in considerable quantity by every man, woman, and child in the world. Strange as it may seem, human consumption is not the biggest use for salt. Much more salt is used by the packing industry than is consumed by human beings although a portion of this packing salt eventually is eaten along with the meat. Salt has such a wide variety of uses that it would be burdensome to enumerate them. However, we daily contact salt in dyes, laundry soap, glass, ceramic glazes, paper industry, and many others.

The sand and gravel industry has little of the romance of gold mining, yet the yearly value of the sand and gravel production is almost equal to that of gold. Mass production and mass consumption of sand and gravel have rather blinded us to the extremely important role these prosaic products play in our daily lives. Without them concrete would be a high-priced building material, so we would be paying exorbitant prices for bridges, highways, building, filter beds, and even gravel driveways for the home.

Sillimanite, together with its brothers, kyanite, andalucite, and dumortierite are by no means a rarity to you and me even though we don't realize it. Without sillimanite, the high quality spark plugs for the modern automobile would be impossible, at a reasonable price. The same properties that make it a good, high-temperature dielectric, also make it suitable for high temperature refractories, porcelains, glass tanks, furnace linings, and many other applications where severe service is met.

Sulphur is familiar to most of us as one of the ingredients in the sulphur and molasses mixture of our childhood days. This, however, would not account for the very considerable tonnage of sulphur that is produced yearly. The manufacture of sulphuric acid accounts for the major part of the sulphur produced and when we consider the limitless uses of sulphuric acid, it becomes evident that sulphur is in "long pants" industrially. Other common uses for sulphur are in vulcanizing rubber, insecticides, cattle feeds, fumigants, and fertilizers.

Talc, one of the bugbears in metalliferous ore concentration, actually has other uses than that of confounding the ore dressing expert. We daily come into contact with talc in paints, in paper, as a competitor of mica for roofing paper, and in the past few years it has been gaining favor as a constituent of ceramic.

Titanium is generally considered as one of the rare elements. This is a fallacy because titanium actually ranks high in relative abundance of the elements comprising the crust of the earth.[2] Many huge deposits of

[2] The Data of Geochemistry, Fifth Edition, by F. W. Clarke, U. S. Geological Survey Bulletin Number 770, pp. 22-36, 1924.

(Continued on page 74)

THE HUMAN EAR
Mechanism and Possibilities

By THOMAS E. PAYNTER

Professor of Electrical Engineering and Physics, Colorado School of Mines

Most college pyhsics text books contain a brief and often inaccurate description of the anatomy and functioning of the human ear. They draw up pretty analogs to support the resonance theory of pitch perception and miss most, if not all, of the beautiful examples of good "engineering" in aural mechanics. They misdefine pitch as a simple function of frequency.

This paper is written in an attempt to clear up some often repeated misinformation among engineers and others who have not had sufficient time to dig through the intricacies of the subject and arrive at the essence of contemporary research upon audition.

The ear is a highly specialized electro-mechano-psychological system. As a transducer converting mechanical energy into nervous impulses it is little short of astounding in its ultimate delicacy and sensitivity. It is without a doubt the most remarkable mechanical system in the human body.

A preview of the anatomy of the ear will serve as a foundation to indicate a few of the many ingenious applications of mechanical principles involved in hearing.

The hearing apparatus divides naturally into three chambers as shown in the diagram (figure 1). The outer ear, the auditory meatus, or external auditory canal is a tube 0.7 cm. in diameter and 2.5 cms. long, on the average, bounded on the inside by the tympanum which sets somewhat obliquely to the canal. The tympanum seals the middle ear against outside air pressure so that adjustments to barometric changes, which would distort the tympanum, must be accomplished by the eustation tube leading from the cavity of the middle ear into the nasopharynx. This eustation tube normally is closed so that the air confined in the middle ear acts somewhat as a shock absorber and affords some cushioning against sudden loud sound pressures.

The 2 cc. cavity of the middle ear contains the three curiously arranged ear bones: the malleus, incus and stapes. The most immediately apparent purpose of the ossicular chain is to conduct vibrations set up by the tympanum to the oval window into which the stapes seats snugly held by elastic ligaments. The ossicular chain moves integrally for sounds of moderate pressure. For sounds of more vigorous nature there occurs a partial disarticulation and the bones slide upon each other, thereby reducing the effectiveness of the lever arm between the drum and the oval window. The usual ratio of this lever arm, measured from the drum to the oval window, in which the stapes rocks like a bell-crank, is 5 to 4.

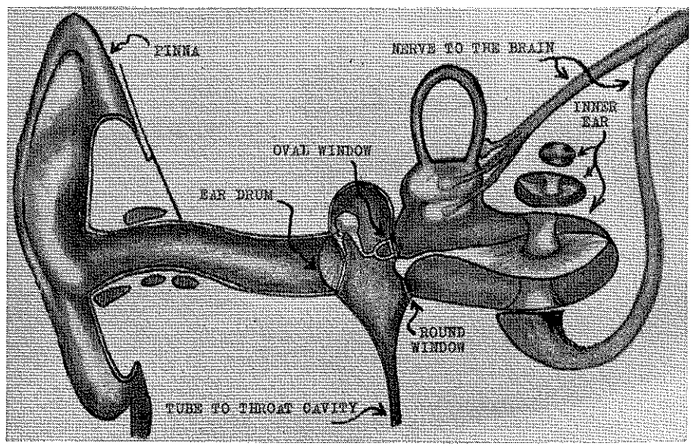
The ossicular chain is supported in place by tiny muscles which are themselves prevented from picking up lateral vibrations from the chain by confinement in bony canals. Such lateral vibrations, should they occur, would introduce distortion into the sound transmission. It is good engineering practice to enclose the muscles.

These muscles have another important function aside from support. They are capable of a contraction which tightens the tympanum, thus tuning it to the higher frequency sounds and simultaneously increasing the coupling of the ossicular system. Both actions favor the high and middle frequencies and attenuate the low tones of the audio spectrum. Some individuals have the ability to contract the middle ear muscles voluntarily, and almost all of us can feel the muscles contract spontaneously as they do for certain tones.

The discrimination against low pitched loud sounds has a protective effect upon the ear. Studies of ears injured by intense sounds such as firing a pistol near the ear of a guinea pig or subjecting the animal to pure tones of great volume, indicate that the low frequencies are the most destructive.

Quantitative studies of the differential action of the intraural muscles can be made upon the guinea pig lightly anesthetized (Fig. 2). The ensuing intoxication causes the muscles to contract rythmically and with each contraction the transmission of a 60 cycle per second bass note diminishes 40 decibels (sound power units). Middle frequencies are affected but little, and higher frequencies around 2000 cycles per second are actually improved.

The ossicular chain, since it acts as a lever arm, communicates the mo-



● The anatomy of the human ear.

tion of the tympanum with reduced amplitude but increased force to the oval window. The advantage of this is evident since the cochlea of the inner ear is filled with a relatively inert, massive and incompressible fluid: the perilymph. A gain in force is necessary when air-born vibrations are introduced into the liquid if losses by reflection are to be avoided. A similar practice is followed by engineers in submarine signalling when air vibrations are introduced into sea water.

Evidently then the tympanum, the ossicular chain and the oval window constitute an acoustic matching transformer whose purpose it is to connect the low impedance, or resistance of the air with the high impedance of the liquid within the inner ear for a maximum energy transfer. This function is exactly analogous to that of the electric matching transformer placed between two dissimilar circuits.

The acoustic impedance of the ear actually has been measured. Troger and other experimenters making use of a tube system bounded by the tympanic membrane produced standing waves in the system. By this means the impedance is found to be complex and in the nature of an elasticity, or to use the electrical terminology "capacitative" in character. The acoustic impedance is large for low pitches and reaches a minimum at 800 cycles per second. At this frequency the ear shows same impedance as the air itself so sound travels as easily through the ear mechanism as through the air and the energy transfer should be the greatest. This does not mean, however, that the ear is most sensitive for this pitch since there are other determining factors.

Still another way to find the transmission characteristics is to measure the mechanical resonance directly. To do this a hole was drilled through the temporal bone of a human corpse and a tiny mirror was attached to the handle of the malleus bone which is in contact with the tympanum. The ear was then stimulated by the sharp sound of an intermittent electric spark. The amplitude of the motion induced in the malleus was ascertained by the excursions of a spot of light reflected from the mirror. Measurements of the resonance frequency by different workers vary somewhat, usually ranging from 550 to 800 cycles per second. Experiments performed upon the cast by Laurie and Soul give 1200 to 1700 cycles per second as the resonant frequency.

Sometimes the auditory transformer is injured or destroyed by a puncture of the tympanic membrane or by a disease which wipes out the ossicular chain. As the result of such a misfortune hearing is definitely impaired. Such deafness is designated transmission or middle ear deafness. It may, in fact usually does, raise the auditory threshold 60 decibels. The lost transmission ability and impedance matching may be supplied artificially by using a bone-conduction hearing aid. Air born vibrations impinging on a microphone are applied after amplification to the mastoid process behind the outer ear by means of a special receiver. These vibrations find their way to the ultimate endoragans of hearing by the way of the head bones surrounding the cochlea.

Let us now turn our attention to the resonance theory of hearing which the famous Galileo worked out in the year 1638. To the person familiar with the singing echo produced in undamped piano strings by shouting a tone loudly into the piano, Galileo's resonance theory will find a ready acceptance. It seems but natural to such a person that some part of the hearing mechanism must be like the strings of a piano in that it has tuned elements which vibrate sympatheticall-ly with incoming tones. It is easy to visualize such elements connected by their respective nerve fibers to the pitch discriminating part of the brain. Indeed hystiological examination of the basilar membrane which runs throughout the twisted length of the cohlea shows it to be richly endowed with fibers, varying from about 1/190 to 1/50 inch in length. Many authors have regarded these as the long sought resonating elements and have tried to show that they were under varying static tension and thus actually tuned. However such tension cannot be demonstrated.

There is another seemingly corroborative bit of experimental evidence. Research workers have damaged definite parts of the basilar membrane and have found that the ear always becomes deaf for certain pitches but not necessarily for others. The converse is true so that an animal deaf to a certain pitch will be found to have its basilar membrane injured in a definite location. So accurate is the knowledge of this localization that a tone deafness may be predicted within ½ octave if the location of the membrane injury is known. Maps of the tone localization of the basilar membrane show the portion close to the oval window to be actuated by the high frequency and the extreme end near the tip of the cochlea to be driven by the low frequencies. Thus when a major chord is sounded the response of the basilar membrane is localized into spots of activity along its length. These distances correspond in a rough way with the separation between the keys to strike the chord on the piano. When two keys far apart, and hence greatly different in pitch, are struck, two points far apart on the basilar membrane leap into activity.

All this looks unquestionably like pure resonance action. However, there is much contrary evidence, much that is unexplainable by the resonance theory alone. When one recalls that the piano string which produces a deep bass note, may be 6 feet long and is heavily loaded with a winding of copper to slow its vibration rate, it seems not a little difficult to assume that one of the tiny fibers a fraction of an inch long in the basilar membrane can respond directly to such a string.

Some writers seek to explain by suggesting that the fibers "share" the mass of the basilar membrane surrounding them and possibly that of the liquid also thus they have their "effective" mass greatly increased. This seems somewhat absurd since it amounts to saying that everything vibrates for each bass note. Note that the liquid since it is incompressible would have to vibrate in its entirety if set in motion at any point. Fibers loaded so heavily and in such manner would become so highly damped as to be unresponsive to any given pitch; a resonant system to be most effective must be undamped. Experiments with sharp clicks show the ear to be much more than critically damped, which in accordance with the resonance theory would make it unresponsive to pitch.

The experiments with clicks have been most intrigueing and illuminating. Such sounds may be made aperiodic single pulses and may thus be regarded as containing all frequency components which should stimulate all the resonant elements, if such existed, equally. Yet two such clicks differing in no way except one sound pressure rises and declines more steeply than the other are heard as dull and bassy or sharp and high as the case may be.

If the electric currents which are always generated in the ear by the action of sound upon it are compared as to frequency characteristics, it will be found that the sharply rising and declining click has many high frequency components. The slow rising and declining, on the other hand, has low frequency components. Here two sounds having an inherently complete sound spectrum stimulate opposite ends of the basilar membrane and therefore are heard to have definite pitch characteristics. Resonance cannot explain this phenomenon.

What then is the explanation? If one thinks of the inner ear as an hydraulic system contained in a rigid vessel divided by an elastic partition, the basilar membrane, any vibration having a sharply rising gradient of pressure will meet with the stubborn resistance of the relatively inert and incompressible fluid contained in the cochlea. There will be a tendency for something to give way under the stress, and with a sharp gradient the fluid cannot do so because of inertia and so the basilar membrane does and thus allows the pressure wave to travel thru it and by virtue of its compliance passes the motion directly out to the round window. The round window is flexible and opens upon the air of the middle ear which does not impede its to and fro motion. Sounds of sharp gradient may be thought of as "short circuited" directly to the round window. It is very significant that the part of the basilar membrane involved is enervated to that portion of the cerebral cortex which perceives the sound as high in frequency. The mapping mentioned before has shown the part of the basilar membrane near the oval window to be the high pitch interpreted part.

When the oval window is actuated by a tone high in frequency the extremely rapid back and forth motions cannot shake the length of the fluid to the end of the cochlea but find it easier to pass through the basilar membrane near the oval window just as did the pulses with steep gradients. There is a nice balance between the inertia and resistance to motion of the liquid on the one hand and the compliance of the basilar membrane on the other.

Consider now what happens when a low frequency wave strikes the fluid in the tube. The changing pressures of this wave are slow and like the dual click find it relatively easy to move all the liquid up to the extreme end of the cochlea where there is a hole in the membrane known as the heliocotrema which permits easy egress of the wave to the other side of the partition and thence to the round window. For any given frequency between these two limits there will be a perfectly definite part of the basilar membrane disturbed more than is any other; the position and the amount of the disturbance is a function of the frequency. Note that there is nothing responding by the sympathetic vibration of a tuned element in the usual sense. This mechanism leaves the ear highly damped. The resolving power of the basilar membrane to two pressures close together is the highest of any in the human body hence pitch differences are easily perceived.

A very interesting effect not mentioned before is perhaps explained also by this hydraulic theory of pitch perception which was first observed by W. R. Miller and reported in 1914. A singer when required to reproduce vocally the pitch of a tuning fork lowered the pitch of his voice slightly when the fork was held near to his ear so that its sound intensity was augmented. The singer heard the louder tone as lower in pitch. This was the first hint that frequency is not the sole factor in the determination of pitch. Later work by Fletcher of the Bell Telephone Laboratories and others has shown conclusively that pitch and frequency are not identical. A change in quality or in loudness may alter the pitch of a tone. This alteration is different for different observers or may be different for the same observer on different days. The ear cannot be trusted to give the frequency of tones sounded singly.

A startling effect is produced when a listener tries to match the pitch of a 200 cycle pure tone sounded first very softly and then very loudly with another pure tone by manipulating the controls of an audio oscillator. To most listeners the 200 cycle tone seems to fall a minor third, its pitch to reach about 5/6 its former value when it is sounded loudly. In all these tests the listener tries to match a pitch with the reference tone just after the pitch tone has been stopped; no mistakes are usually made if he tries to match tones while both tones are being sounded since he can use the phenomenon of beats as a guide to an adjustment of concordance.

A set of curves made by plotting the perceived pitch of pure tones against their loudness yields the information that low frequency tones descend in pitch as their loudness increases and high frequency tones seem to rise. An 8000 cycle per second tone for example, rises about 14% in pitch for an increase in loudness amounting to 40 decibels. Mid-range tones remain relatively fixed rising somewhat then descending as the volume is augmented. For a long time these effects were unnoticed because they take place in the case of pure tones only and pure tones are rare. Note that Miller's observations were made by the use of a tuning fork, a source of comparative purity. When a tone rich in harmonics is sounded there is very little observable change in pitch as the volume shifts. Possibly this is because the many harmonics stimulate the basilar membrane in a place where the effect is slight, that is, in its central portion. These harmonics serve to tie the fundamental tone firmly to its actual pitch scale.

Suppose a listener tries to set a tone an octave above a loud 168 cycle per second tone he will probably select 300 cycles. However, if these two tones are souned simultaneously he is immediately aware of the mistake since they are very discordant. This is most fortunate in that it prevents a symphony orchestra from sounding out of tune every time a crescendo is taken. Softly or loudly the concert remains true.

Why should the ear misjudge the frequency of certain tones? The basilar membrane operates linearly for soft tones or for tones of mid-loudness. As a tone is increased in loudness a point is reached where the particular part of the membrane stimulated departs from linearity. Simultaneously the disturbance tends to spread out on either side actuating more and more of the adjacent membrane as the tone becomes louder and louder. The effect on hearing is exactly like that produced by sounding two or more adjacent tones. This line of reasoning suggests that the pitch perception should move equally toward the high and the low pitch end of the membrane, and so it should. Why then does the pitch remain single and move toward the low side for a loud low pitch and toward the high side for a loud high tone?

The answer lies in the fact that other parts of the ear such as the drum and the ossicles themselves become nonlinear at the same time the membrane becomes disturbed beyond its usual limits. The resonance of the rest of the ear then complicates the picture by skewing the spreading disturbance on the basilar membrane toward the low side for the low tone and toward the high in the other case. Thus there comes into play a skewed pitch perception in which the nervous

action follows specifically without "prejudice" the stimulus upon the end organs of the auditory nerves. The cerebral cortex, in its turn, is deceived by the configuration of the impulses coming to it and perceives an altered pitch.

I hinted at the beginning of this paper at the ear's great sensitivity. Just how sensitive is the ear? Just how little does the ear drum move when actuated by the faintest hearable sounds?

When a tone to which the ear is most sensitive, such as 2000 cycles per second, is sounded more and more softly the drum shakes through a decreasing amplitude until the motion vanishes, is invisible even under the closest scrutiny with a powerful microscope, yet a perfectly audible tone is still heard. Evidently the drum is still moving though the distance cannot be seen. How can this unmeasurably small distance be measured? Only one method is available, one often used by science to weigh the imponderable.

The ear drum is actuated by a much louder sound than the just hearable and the small but perfectly measurable excursions of the drum are measured. Then, assuming the effect to be linear, the motions of the drum for unmeasurable displacements are computed by extrapolation.

The most minute ripple in air disturbs the drum. The air particles when the softest sound is produced move less than 1/100,000,000,000 inch, this corresponds to a pressure change that might be produced by lowering the elevation of a barometer 1/30,000 inch at sea level. Yet the ear picks up this vibration as hearable sound. Inevitably this raises the question: How much below the remarkable sensitivity of the ear are the minute pressure fluctuations always present in the air as Brownian movements caused by thermal agitation?

Air particles act upon any exposed surface with tiny aperiodic pressure fluctuations due to the random element in the velocities of the individual particles. A good ear is remarkably close to hearing this random element. Experiments and computations by Sivian and White show that this thermal noise is about 86 decibels below a pressure of 1 dyne/sq. cm. pressure level. The average ear goes down to 76 decibels below, though in the case of persons endowed with particularly excellent hearing the level may go down to 85 decibels below the reference pressure which is only 1 decibel above the thermal agitation hiss. For the exceptionally good ear then, the ultimate sensitivity is reached. Any further increase in hearing ability would subject the victim of such good ears to a continual hissing sound like that of escaping steam. We must conclude from this that man has ears at least as sensitive as those of any other animal; an animal with more sensitive ears than those of man would be constantly plagued by a rushing hiss.

We have seen here something of the anatomy, of the peculiarities, and of the remarkable sensitivity of the ear. The ear is without doubt the most wonderful transducer of mechanical energy in the human body. No one can guess what even more amazing facts will be turned up by the sharp little tools and the more refined techniques of future research in audition.

● E. S. McGlone Promoted

Ed McGlone of the class of '23, was advanced another step by the Anaconda Copper Mining Company the first of the year, from the position of assistant general superintendent of mines to that of general superintendent. He succeeds James J. Carrigan who has been named manager of mines to fill the place made vacant by the resignation of William B. Daly who becomes consulting engineer for the company.

Mr. McGlone became associated with the Anaconda Copper Mining Company shortly after his graduation from *Mines*. His first work was for James L. Bruce, '01, in the engineering department of the Davis-Daly Company. He worked as a miner in the Tramway and later as a sampler in the Anaconda mine. He later returned to the Tramway as shift boss, then assistant foreman and finally foreman. He was transferred to the Badger mine as foreman for two years but again returned to the Tramway as foreman.

He became an assistant superintendent of mines in 1937 and was placed in charge of the Badger, West Colusa, Mountain View and St. Lawrence properties.

Ed was an outstanding athlete while at *Mines*. He was one of the greatest full-backs of which the football teams ever boasted and also starred in basketball and baseball, making all-conference in both of these. He has taken an active part in athletics since he first went to Butte having played in the famous old Butte Mines league. He played baseball in the days when the famous pitcher, Juney, was a member of the Anode team of Anaconda. He starred there on the gridiron with the Independent Football league of Butte. For 10 years he coached the Hub team in that league and maintains his interest in the sport to the present time as a commissioner for the league.

● In Memoriam

Dr. Herman Fleck

To his many friends among the School of Mines alumni and faculty, the news of the sudden death of Dr. Herman Fleck came as a distinct shock. Death was caused by a heart attack on January 10, 1940 at his home in Santa Monica, California.

Coming from an old and distinguished Germantown family and equipped with a brilliant mind and a splendid academic training at the University of Pennsylvania, followed by a post-graduate course in Germany, his work at *Mines* quickly stamped him as one of the leading educators of the State. He came to the School in 1902 as head of the Department of Chemistry which position he held for 10 years. During that time he proved an outstanding authority in the field, achieving a world-wide reputation both as a chemist and a scientist.

Early in his career at the School of Mines, his broad vision and progressive spirit convinced him of the importance which the rare metals, particularly radium, vanadium and uranium were to play in the arts and industries and much of the early developments in the chemistry and metallurgy of these metals can be attributed to the results of his research.

Dr. Fleck resigned his position on the faculty of the School in 1912 to engage in private practice. In 1926 he undertook an investigation of the soda deposits of Owens lake, California and shortly thereafter moved his family to Santa Monica, maintaining an office in Los Angeles.

Possessed of an indominatable courage, a sparkling humor and a brilliant analytical mind, he made a charming companion and was an inspiration to all who knew him. His untimely passing is to be profoundly regretted and to his widow, son and daughter goes the sincere sympathy of all whose good fortune it was to be accounted his friend.

—W. G. Haldane.

Working in Foreign Countries

By HARRY F. McFARLAND, '32
West Rand Co., Transvaal, Union of South Africa

Who has not dreamed of being a modern Marco Polo, travelling to far countries, meeting fascinating peoples, eating unusual foods and, finally, returning home to regale friends with delightful stories of mysterious far-away places?

Marco Polo, seven hundred years ago enchanted his friends with fantastic tales of strange countries. His friends listened, but they doubted his yarns describing customs and peoples encountered on his voyages. Today we know he told the truth. But the remarkable thing is that even today Americans may visit these places and, off the beaten track, find countries just as picturesque as in the days of Marco.

American technical graduates have a valuable product to offer. Foreign countries are ready to pay them for their ability. Foreigners have a quiet confidence in the American engineer's ingenuity and ability to accomplish the task set before him. Cecil Rhodes, when taken to task for employing American mining engineers in his De-Beers diamond mines in preference to his countrymen, replied: "American engineers understand the work."

Mines graduates especially, can in many instances combine business with pleasure and find their travels remunerative both in new experiences and in actual cash, if only they have the courage to break away from routine life.

I enjoy travelling. I have lived in several countries and on several continents. South Africa intrigued me. At first thought this country, 6,000 miles from America and comparatively unknown to Americans, seemed too far off the beaten path to consider as a possible field of employment. But, if one really wishes it, nothing is likely to be impossible. I was surprised to find that after I had made up my mind, it was comparatively easy to fulfill my desire to come to South Africa.

The main difficulty was to discover the correct procedure. It is for this reason that I am writing this article, so that those interested in coming here may not be held back by lack of knowledge of conditions and how to meet them.

I think it was Napoleon who said, "Ask of me anything but time." He considered that in war, the most important element was time. So it is to the young student considering Africa as a possible field of employment. Time is an important element. He should begin to plan his campaign early. At the beginning of his senior year or even toward the close of his junior year he should take the preliminary steps.

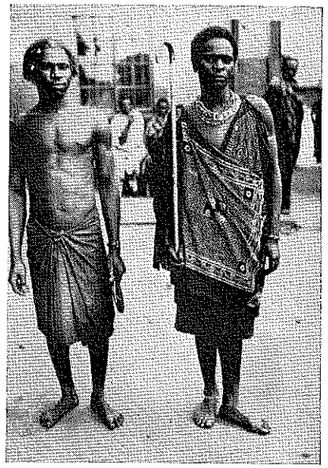
The first step is to obtain a permanent permit to enter the Union of South Africa.

The second step is to obtain an opinion from the Pthisis Board as to the possibility of obtaining upon his arrival in South Africa what is locally referred to as a "Red Ticket."

The permanent permit is obtained as follows:

The student should write to the Immigration Board at Pretoria, Transvaal, Union of South Africa, to the effect that he wishes to obtain a permanent permit to enter the Union of South Africa. He should give a general description of himself; age, education, condition of health, training, degrees, etc. The board will send him application blanks to complete. When these arrive, you must remember that two months are required for a roundtrip, they will indeed appear a formidable collection. I was obliged to furnish fourteen certified statements. The information is quite easy to furnish, but requires considerable time and effort to collect. The following documents attested by a Notary Public will probably be required:

1. Copy of birth certificate.
2. Copy of marriage certificate.
3. Copy of doctor's certificate stating you are free from communicable diseases.
4. Letter from Chief of Police saying that you have not been convicted of any crime nor come under the observation of the Police Department during past five years.
5. Letter from minister stating that you are of good repute (not required to be faithful churchgoer).
6. Letter from bank stating you have sufficient funds (probably $500) to prevent you becoming an object of charity.
7. Photograph, front and side view (8 of each).
8. American passport.
9. Statement of education.
10. Copies of diplomas, etc.



● Notme Mine Employees.

To the uninitiated, a permanent permit will seem an unsurmountable obstacle. In reality, it is rather simple to obtain, requiring only time and patience to assemble documents. Since each of these statements must be separately certified, I found it economical in both time and money to collect the above data and take them to the Notary Public to be certified at one time.

Second requirement:

"Red Ticket" is a local term for a certificate issued by the Pthisis Board, Von Brandeis and Bree Streets, Johannesburg, Transvaal, Union of South Africa. After a thorough examination, including an X-ray, the Pthisis Board states that you are free from respiratory diseases. Pthisis or "miners' consumption" in the early days on the Rand was the cause of a high mortality among miners. The ore and surrounding rock is almost pure silica of a very sharp nature. In the days of dry drilling and little

(Continued on page 74)

"MINES MEN" Snapped at the Colorado Mining Association Convention

Photos courtesy Denver Post

William G. Haldane, Prof. '01-'17 (known to Mines Men as "king Bill") Superintendent U. S. Vanadium Corporation, Uravan, Colo., (left), Henry M. Kaanta, '15, Consulting Engineer, Denver, (center) and Max W. Bowen, '24, Manager Mill Department, Golden Cycle, Colorado Springs, (right) discussing important topics in mining.

Denver, January 26th and 27th, 1940

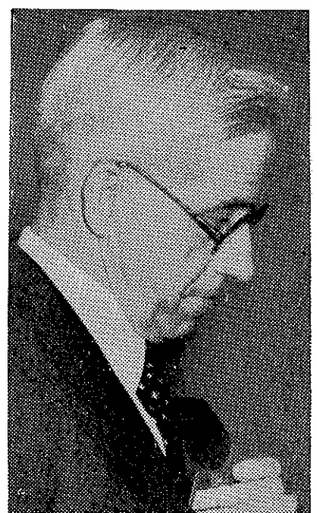
This convention was probably the most successful mining convention ever staged in Colorado. Long before the program was started, long lines of mining men were waiting to register. Men came from all parts of the country to take part in and listen to a very well planned program.

The Lincoln room of the Shirley-Savoy Hotel was packed to capacity for two days during all sessions while the hotel lobby and halls were taxed to capacity to take care of the overflow.

"Mines Men" took an active part and contributed largely to the success of this convention. Among these were Dr. M. F. Coolbaugh, President and J. Burns Read, Head of Mining at "Mines", Dr. Clark B. Carpenter, Professor of Metallurgy at "Mines", Dr. Charles W. Henderson, Hon. '30, U. S. Bureau of Mines, Max W. Bowen, '24, Manager Mill Department, Golden Cycle, A. H. Bebee, '15, Manager Mines, Golden Cycle, Cresson and U. G. M. Co., Cripple Creek, W. G. Haldane, (King Bill to Miners) Supt. U. S. Vanadium Corp., Uravan, Russell B. Paul, '02, Manager Mines, New Jersey Zinc Co., Dr. Francis A. Thomson, '04, President Montana School of Mines, Shrive B. Collins, '01, Treasurer Colorado Mining Assoc., Fred A. Brinker, '21, Denver Equipment Co., Charles L. Harrington, '12, Consulting Engineer, Idaho Springs, Charles O. Parker, '23, Assayer & Chemist, Denver, Warren C. Prosser, Ex-'07, Consulting Engineer, Denver. In addition to the above a long list of "Mines Men" were seen in attendance during the sessions. The Silver Banquet and the Sowbelly Dinner were crowded almost beyond capacity. All and all it was a huge success and Mr. Robert S. Palmer, Secretary, Colorado Mining Assoc. is to be congratulated for the great work he has done for the Mining Industry.

Papers on the subjects discussed will be published by the Association.

Alfred H. Bebee, '15, Manager Mines, Golden Cycle, Cresson Consolidated and U. G. M. Co., Cripple Creek, discussing the Cripple Creek Drainage Tunnel with President M. F. Coolbaugh of "Mines".



Russell B. Paul, '02, Vice-President and Manager of Mines, New Jersey Zinc Co., New York, has weighty matters on his mind.

BIG FUTURE IN NEW ALLOYS

Vast Possibilities for Development of Minerals Industry Are Seen by Dr. F. A. Thomson, President of Montana School of Mines.

(Excerpt from Denver Post)

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"But the mining schools now are shifting their emphasis, of necessity, from extraction to physical metallurgy—the use of the minerals we have and their utilization to create new metals.

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He considers the chromite situation startling in view of the fact that the United States now is importing between 300,000 and 400,000 tons of chromite ore a year and is producing less than 1,000 tons of such ore from domestic sources.

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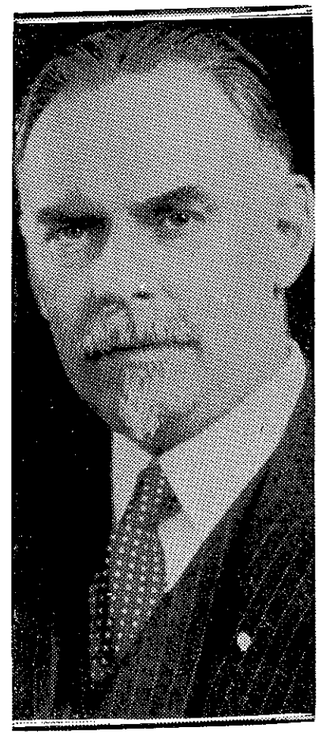

Dr. Francis A. Thomson, '04

CHROMIUM IS BEST ALLOY OF STEEL.

"Such a use would parallel the progress made in the utilization of our domestic potash deposits. Before the World war we depended almost wholly on foreign supplies for our potash."

Chromium, Dr. Thomson explained, is perhaps the outstanding alloy of steel today. It is used not only for armour plate, but for many steels of industry.

The United States has some small supplies of tin in New Mexico, Dr. Thomson said, "and there always is the possibility of developing new supplies unexpectedly."

Nickel is another metal for which the United States is almost wholly dependent upon foreign sources.

"There are enormous supplies in Ontario, however," Dr. Thomson said, "and it illustrates the friendship between the United States and Canada that we think of that supply as being open to us at any time."

Beryllium is another mineral of which the United States needs a domestic supply.

"Beryllium shows remarkable qualities in alloy with copper," Dr. Thomson said. "It hardens and toughens copper. The cost of beryllium now is limiting its use.

"There doubtless are other elements not now utilized which have enormous possibilities in the field of alloyage."

"MINES MEN" Snapped at the Colorado Mining Association Convention

Photos courtesy Denver Post

William G. Haldane, Prof. '01-'17 (known to Mines Men as "king Bill") Superintendent U. S. Vanadium Corporation, Uravan, Colo., (left), Henry M. Kaanta, '15, Consulting Engineer, Denver, (center) and Max W. Bowen, '24, Manager Mill Department, Golden Cycle, Colorado Springs, (right) discussing important topics in mining.

Alfred H. Bebee, '15, Manager Mines, Golden Cycle, Cresson Consolidated and U. G. M. Co., Cripple Creek, discussing the Cripple Creek Drainage Tunnel with President M. F. Coolbaugh of "Mines".

Denver, January 26th and 27th, 1940

This convention was probably the most successful mining convention ever staged in Colorado. Long before the program was started, long lines of mining men were waiting to register. Men came from all parts of the country to take part in and listen to a very well planned program.

The Lincoln room of the Shirley-Savoy Hotel was packed to capacity for two days during all sessions while the hotel lobby and halls were taxed to capacity to take care of the overflow.

"Mines Men" took an active part and contributed largely to the success of this convention. Among these were Dr. M. F. Coolbaugh, President and J. Burns Read, Head of Mining at "Mines", Dr. Clark B. Carpenter, Professor of Metallurgy at "Mines", Dr. Charles W. Henderson, Hon. '30, U. S. Bureau of Mines, Max W. Bowen, '24, Manager Mill Department, Golden Cycle, A. H. Bebee, '15, Manager Mines, Golden Cycle, Cresson and U. G. M. Co., Cripple Creek, W. G. Haldane, (King Bill to Miners) Supt. U. S. Vanadium Corp., Uravan, Russell B. Paul, '02, Manager Mines, New Jersey Zinc Co., Dr. Francis A. Thomson, '04, President Montana School of Mines, Shrive B. Collins, '01, Treasurer Colorado Mining Assoc., Fred A. Brinker, '21, Denver Equipment Co., Charles L. Harrington, '12, Consulting Engineer, Idaho Springs, Charles O. Parker, '23, Assayer & Chemist, Denver, Warren C. Prosser, Ex-'07, Consulting Engineer, Denver. In addition to the above a long list of "Mines Men" were seen in attendance during the sessions. The Silver Banquet and the Sowbelly Dinner were crowded almost beyond capacity. All and all it was a huge success and Mr. Robert S. Palmer, Secretary, Colorado Mining Assoc. is to be congratulated for the great work he has done for the Mining Industry.

Papers on the subjects discussed will be published by the Association.

Russell B. Paul, '02, Vice-President and Manager of Mines, New Jersey Zinc Co., New York, has weighty matters on his mind.

BIG FUTURE IN NEW ALLOYS

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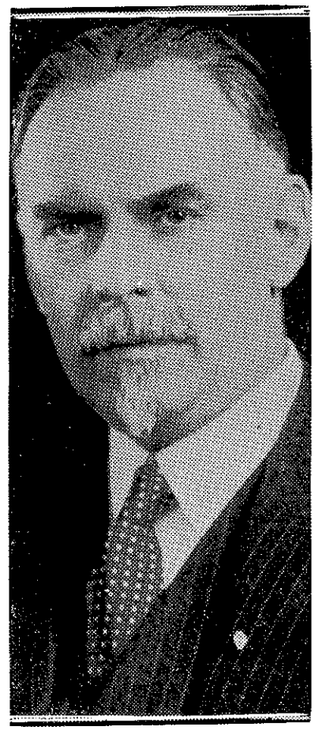

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Granular Materials—

(Continued from page 64)

points of intersection lie approximately on a straight line. A relation exists between the slope of a line and the total surface area—the greater the surface area, the less the slope. Consequently, it was possible to develop a formula[5] whereby the surface area could be calculated at any particle size by knowing the total specific surface of the sample. The calculated values are within the accuracy of the experimental results as obtained by the Wagner turbidimeter. However, the use of the formula for evaluating cumulative surface area fails completely in cases where grinding of the clinker has been accomplished by means of air separation.

A number of publications[6] have appeared yielding some valuable information on the effect of particle size distribution on the setting qualities of cements. It has been concluded that the minus 10 micron fraction is responsible for plastic workability and strength in early ages. At 7 days such a fraction develops approximately 78% of the strength of the original cement at one year. The 10-25 micron fraction has a fairly well defined time of set but lacks plasticity. The fraction coarser than 25 microns contributes next to nothing to the strength of the concrete during the first month following placing. However, at late ages this fraction does contribute in a small way to the strength of concrete. A cement was prepared in which everything coarser than 25 microns was rejected. Setting time was normal and about the same as the original cement. It had a superior plasticity, did not show any initial stiffening and concrete made with this cement was judged excellent.

Several large cement testing laboratories in the United States are conducting extensive programs concerning the addition of admixtures to cements. The early Romans used admixtures of various kinds in the retaining walls along their coast line, and after many years of standing are still in good condition. The name "puzzolan" was given to this type of admixtures which includes such materials as volcanic ashes, furnace slags, basalts, silts, clays, diatomaceous earths, and pumicites. Puzzolans have an affinity for free lime and in this manner prevent water leaching from concrete structures. Intergrinding puzzolan materials with cement clinkers presents an extremely difficult problem in determining particle size distribution and surface area of the resulting mixture. Due to partial transparency of many puzzolan particles, optical methods of measurements apparently fail. The hydrometer method is being used with a fair degree of success at the present time.

The problem of obtaining specific surface area of interground mixtures constitutes a problem yet to be surmounted. Also, the need for cooperative investigations making use of various types of equipment and instruments in order to ascertain the relative merits of each and comparison of test results would be of extreme value. Some of the many objections to the extent of application of Stokes' law as a mathematical basis for test must yet be overcome. The use of the Reynolds number touches on this subject. These and many other requirements give an indication of the possibilities of future investigation in this interesting field.

In conclusion, the writer wishes to thank Willis T. Moran, Associate Engineer, U. S. Bureau of Reclamation for supplying some of the material for this paper.

References

(1) D. L. Bishop, Bureau of Standards, J. of Research, vol. 12, Feb. (1934).
(2) R. T. Knapp, Ind. & Eng. Chem., Vol. 6, p. 66, Jan. 15 (1934).
(3) L. A. Wagner, Proc. A. S. T. M., vol. 33, part 2, p. 553 (1933)
(4) A. Klein, Proc. A. S. T. M., vol. 34, part 2, p. 303 (1934).
(5) Technical Memorandum No. 488, Bureau of Reclamation, Dept. of Interior (1936).
(6) Rordam, Rock Products, July 30, 1932.

Non Metallic Minerals—

(Continued from page 66)

titanium minerals dot the earths surface but it has only recently become of any importance commercially. Some of the important uses of titanium are as a pigment for paint and paper, in smoke screens and skywriting, and as an alloying agent in steel.

From this short list we see that the non-metallics play a very important part in our daily lives. Without them life would be difficult and would afford few of the conveniences that we class as absolute necessities.

Mass production, mass consumption, and technical research have lowered the cost of most of the non-metallics to the point where everybody can afford to use them in large quantities. However, it is up to the engineers to further lower costs and expand the field of uses for nearly all of the non-metallics.

The major non-metallics will be considered individually in some detail from the standpoints of production, benefication, processing, geographical distribution, political control, uses and market.

Working In Foreign Countries—

(Continued from page 71)

care, pthisis caused a very high fatality. Often men were not able to work longer than two years underground. The mines banded together to combat this menace. They adopted a measure of dust control and ventilation and, in addition, set up a bureau whereby any man wishing to work underground is required to pass a medical examination which includes an X-ray of his lungs. All men working underground are obliged to repass this examination every six months. In case they develop pthisis or pulmonary disease their permit or "Red Ticket" is revoked. The mine then gives men so disqualified a pension or cash settlement.

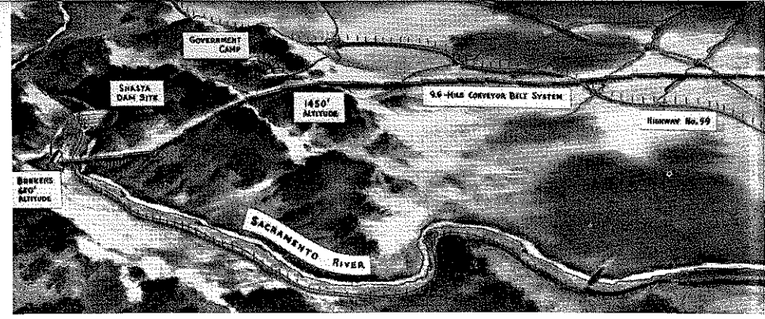
This pthisis examination can only be undergone in Johannesburg. To accommodate professional men who desire to come here, the Pthisis Bureau will give the prospective employee an *opinion* so that he may have some idea as to whether or not he can pass the examination given by the Board upon his arrival.

Procedure: Write to—Mr. Evans, Secretary of the Pthisis Board, Von Brandeis and Bree Streets, Johannesburg. Mr. Evans will send a medical form, together with instructions for taking full X-ray examination. The medical blanks are to be completed by a competent physician and returned to the Pthisis Bureau. Upon receipt of the medical examination, the board will give an opinion on the applicant. This opinion is not to be considered as binding upon the Board. In general, if the examination and X-ray have been honestly executed and no radical change in the person's health transpires, it is almost certain that the applicant will pass the Pthisis Board examination.

To obtain this opinion four or five months will be required. Hence, my warning to start early!

Of course, if there are students at Mines who have a checking account of more than $20,000 this advice does not apply as a trip to Africa is quite enjoyable, and would be as a pleasant

(Continued on page 87)



● **Reproduced above is artist's sketch of the world's longest conveyor belt system from Redding, California to Shasta dam, a distance of 9.6 miles, contract for which has been awarded The Goodyear Tire & Rubber Company of Akron, Ohio.**

1939 Applications of Electric Equipment to Material Handling

By R. H. ROGERS
Industrial Department, General Electric Company

World's Largest Conveyor System for Shasta Dam

In the construction of the new Shasta Dam in Redding, California, the Bureau of Reclamation will use a sequence of motor-driven conveyor belts 10 miles long—the longest system in the world. The belt will be used to bring gravel and sand to the concrete mixing plant near the dam site, from which electrically driven cableways will pick up the concrete and dump it in the forms.

The Shasta Dam Project is part of a program to supply water for irrigation, flood control, and power to California's semiarid Central Valley. The dam when completed will be second only to Boulder Dam in height and to Grand Coulee in length. Some idea of the size of this dam can be gained when it is realized that the concrete that will go into its construction would make a solid monument a city block square and slightly higher than the Empire State Building.

Because of the immense amount of material needed for this work it was decided to use a conveyor system instead of trucks or a railroad. The material will travel at the rate of 550 feet per minute on a conveyor system consisting of a series of twenty-five 36-inch belts each averaging two-fifths of a mile in length. Power will be supplied by twenty-five 200-hp, 1880-rpm, 4000-volt wound-rotor induction motors, and one 75-hp, 1800-rpm, 4000-volt motor. The control for this system will consist of 26 nonreversing magnetic control panels and five thrustor brakes, and accessories. This conveyor system will be twice as long as any previous installation of this type. It is estimated that 7,600,000 tons of gravel and 2,800,000 tons of sand will be moved at the rate of 22,500 tons every 24 hours.

Three cableways, being built by the Lidgerwood Mfg. Co. for the new dam, will be powered by three 500-hp General Electric variable-voltage equipments. The cableways will pick up the 5,610,000 cubic yards of concrete needed to fill the gap in the canyon across the Sacramento River. Time is saved by such a drive because the empty concrete buckets will be returned to the mixer at top speed. Considerable time is lost in the use of the conventional a-c direct drive as the motor runs under a light motoring load and cannot be speeded up above synchronism. Through the use of variable-voltage drive, large savings will be possible in interest, wages, power bills, maintenance, and overhead as well as the additional advantages of faster jogging operations and increased flexibility.

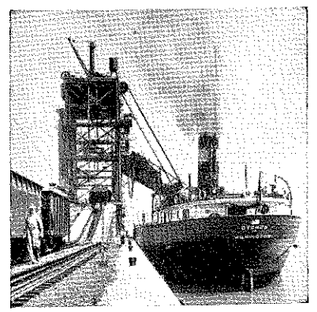
The Shasta Dam when completed will impound the waters of the Sacramento, Pit, and McCloud Rivers for a distance of 35 miles to create a conservation reservoir with a capacity of 4,500,000 acre-feet—enough to flood the city of Chicago to a depth of 35 feet. It is expected that the project will be finished in 1943.

Pennsylvania R. R. Installs Fast Car Dumper

A new car dumper recently built for the Pennsylvania R. R. by the Heyl & Patterson, Inc., is capable of emptying 60 cars an hour. The dumper is located at Sandusky, Ohio, where it is an example of the most modern methods of coal handling. A lift-and-turn-over type, the car dumper is built to handle 120-ton cars at a rate of 45 per hour or 90-ton cars at a rate of a-car-a-minute. The electrical equipment is conservatively designed to handle the full capacity of the dumper on a continuous basis and is so flexibly arranged that the dumper can still handle the maximum load even though a major piece of electrical equipment should fail.

In addition to the fact that the two motor-generator sets each rated 1275 kw at 720 rpm, which supply d-c power for the mule and cradle drives, as well as the auxiliary drives, makes it one of the most powerful dumpers built to date, every effort has been made to make the plant as nearly automatic in operation as possible. Car retarders are used in the mule pit, cradle and runback track to eliminate the necessity for car riders. Electric

(Continued on page 87)

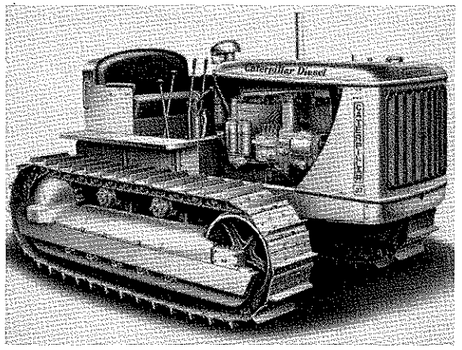


With the MANUFACTURERS

NEW EQUIPMENT

New 75-Drawbar Horsepower "Caterpillar" Diesel Tractor

Caterpillar Tractor Co., Peoria, Ill., has announced a new 75-drawbar horsepower Diesel D7 Tractor, engineered specifically to increase production and lower operating costs.



Operator Comfort Increases Production

To reduce operator fatigue, the new D7 tractor has "finger tip" steering. A light pull on the steering clutch lever is sufficient to steer the 23,500 pound machine. Actually, the only work done by the operator is the opening of a valve, as the steering clutches are operated hydraulically by a separate control unit driven from the upper transmission shaft. This low effort steering helps the operator to keep alert during his entire shift.

A streamlined hood and a driver's seat located high and well forward on the tractor, give a clear view of the work ahead and behind. A restful and durable seat with generous space has been provided. Small seats on both the left and right hand arms of the main seat provide a comfortable place from which the driver can operate rear-power-controlled equipment.

Increased Strength Throughout

In order to obtain the greatest possible strength and at the same time keep weight within the correct limits, welded steel construction is used extensively. The durability of gears, steering clutches and flywheel clutch has also been increased. Metallic facings for flywheel and steering clutches assure long-life and freedom from adjustment.

The new D7 Tractor is powered by a heavy-duty, four-cylinder valve-in-head, "Caterpillar" Diesel Engine. It has a bore and stroke of 5¾" x 8", and a full load governed r.p.m. of 1000. Belt horsepower is 87; drawbar, 75.

Rugged construction, effective sealing against dirt, freedom from operating adjustments, a lubricating oil cooler, statically and dynamically balanced five main bearing crankshaft, quick acting governor, accessibility and the ability to successfully burn a wide range of Diesel fuels are a few of the features which enable it to perform smoothly, dependably and economically.

Broad Range of Speeds Provided

The low-speed transmission provides 5 forward speeds ranging from 1.4 m.p.h. to 5.00 m.p.h.; while the high-speed transmission has speeds from 1.4 m.p.h. to 6.00 m.p.h. For each of the first four forward speeds, there is a corresponding but slightly higher reverse. It is possible to change from any of the first four speeds to the corresponding reverse speed by merely pushing forward on one lever, the flywheel clutch having been first disengaged. This feature is particularly advantageous in bulldozing.

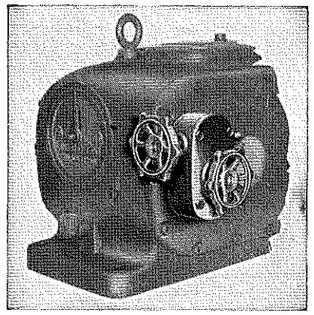
The new "Caterpillar" Diesel D7 Tractor is built with a background of more than 35 years experience in the design, construction and operation of track-type tractors. Detailed information may be obtained either from Caterpillar Tractor Company or from their representative Clinton & Held, 1737 Wazee Street, Denver, Colo.

Link-Belt Vernier-Control Variable Speed Transmission Announced

Announcement is made by Link-Belt Company, Philadelphia, that it is now in position to equip all sizes of the Link-Belt P.I.V. Gear variable speed transmission with vernier control, for installations where extremely fine control of speed changes is required.

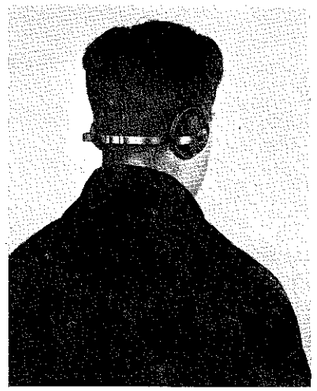
This vernier control can be supplied with either one of two ratios—7½ to 1 or 30 to 1, and is equipped with two hand wheels. One is for direct control; the secondary, or vernier type control hand wheel will provide either 30 turns or 7½ turns to one of the direct wheel, depending upon which ratio of worm-gear reduction set is furnished.

As vernier control is said to provide the fine sensitivity required for true micrometer adjustments of speed, the manufacturers are particularly recommending it for such services as—synchronizing the speeds of two machines; justifying for shrinkage and expansion of such products as textiles and paper; controlling feeders; on weighing operations; obtaining exact register; controlling the overlay of wire-covering on wire producing machinery; or wherever the uniformity of a product can be assured by such close speed regulation.



Link-Belt Company 40-page Book No. 1574 covering vernier and other types of P.I.V. Gear control, will be sent to any reader upon request addressed to the company at 2045 W. Hunting Park Ave., Philadelphia.

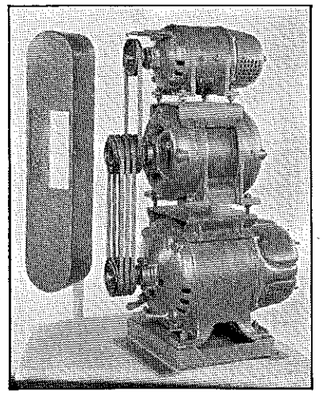
A New Product



New protection for welder's ears is a simple and practical device for preventing injury to the ears caused by entry of flying sparks or hot metal particles, consisting of two Ear Protectors made of close-woven, non-rusting screen with leather binding, which are held comfortably in place over the ears by an adjustable spring steel headband. The ear protectors are deeply cupped, ample in size to avoid cramping the ear, and permit complete natural ventilation and hearing. The headband is worn around back of the head, and does not interfere with the wearing of goggles, conventional welding helmets or any head covering, it is stated. The complete unit is said to weigh only 2 oz.

Bulletin No. CF-4, illustrating and describing "M. S. A. Welders' Ear Protectors" will be sent free on request to this publication, or direct to the manufacturer: Mine Safety Appliances Company, Braddock, Thomas & Meade Sts., Pittsburgh, Pa.

New Pyramid-Mounted Motor Generator Set



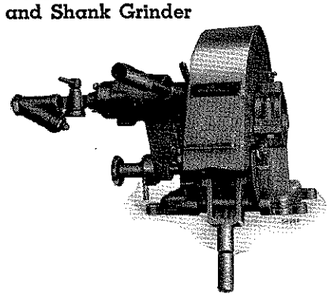
Saving in floor space, accessibility, and the use of machines of different speeds are outstanding features of a new Pyramid-Mounted arrangement of three-machine motor-generator sets developed at the Norwood, Ohio, Works of Allis-Chalmers Mfg. Company. The generator, motor and exciter, each a self-contained machine, are assembled one above the other, thus requiring floor space equal only to the generator mounting dimensions.

On top of the generator is placed the induction motor, securely attached with suitable base plate, and the exciter in like manner is mounted on top of the motor. The generator and exciter are driven by Texrope V-belts from the motor shaft, adjustment being provided in the motor and exciter base plates. Motor-generator sets of this type are at present available in sizes up to and including 10 kw.

Each machine of the set is self contained and readily removable as a separate unit. Therefore, in case of emergency, and where the particular piece of equipment which the M/G set operates is not required, any of the three machines could be readily removed and used for other purposes.

In the pyramid arrangement also, machines of different speeds may be used. Thus a direct current generator of standard speed may be used with a 25 cycle, 50 cycle (or any other frequency) induction motor by merely using the corresponding required speed ratio in the Texrope V-belt drives. The weight of a Pyramid Mounted Set is also said to be less than one of conventional mounting, due to the saving of material in the base.

Combination Drill Steel Cutter and Shank Grinder



● **The Ingersoll-Rand size 500 Combination Drill Steel Cutter and Shank Grinder.**

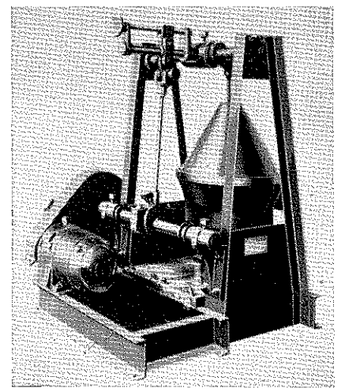
Ingersoll-Rand announces a new, Size 500, combination drill steel cutter and shank grinder. Designed to handle solid or hollow steels up to and including 1¼" hexagon, round or quarter octagon, it cuts the steel cleanly and squarely in only a few seconds without burning. A quick acting, self-locking vise holds the steel rigidly on both sides of the cut.

The unit can be readily changed from a cut-off machine into a shank grinder by removing the cut-off wheel and substituting a grinding wheel. As a grinder it can be used for squaring up striking faces of the shanks of drill steel, moil points, chisels and the striking end of rock drill pistons.

The machine is powered with an Ingersoll-Rand "Multi-Vane" Air Motor.

For further details address all communications to Ingersoll-Rand Company, 11 Broadway, New York City.

Improvements Made in Diaphragm Pump



Improved design of the Diaphragm Pump made by Hardinge Company, Incorporated, York, Pa., provides users with new operating advantages.

The mechanical design is such that the length of the stroke, or pump capacity, may be varied without stopping the pump, itself. The advantage of this feature is obvious in cases where even slight variations in required capacity occur.

In addition, the pump provides unusually rugged construction, insuring long service, and the bearings are so located that any splash on them from the pulp being pumped is eliminated, and danger of undue wear or abrasion is removed.

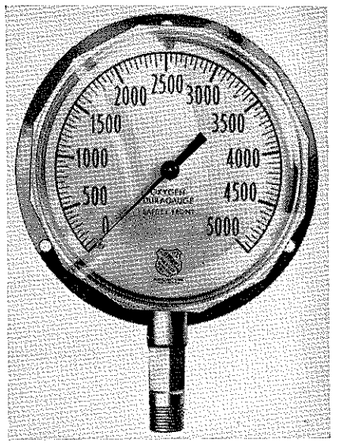
The lower valve is of smaller diameter than the upper valve and, consequently, may be easily removed through the upper one, for examination or replacement, when abrasive pulps are being handled.

The illustration shows the general arrangement of the pump which can be obtained with a motor drive unit, or arranged for belt drive.

Hardinge Diaphragm Pumps have been installed with rubber covering on the pump body and valves, or of some special material construction, for the handling of corrosive mixtures.

Most installations have been for handling underflow from thickeners, and many of these Hardinge Diaphragm Pumps are handling pulps running 60% or more, solids.

New Oxygen Duragauge



Ashcroft announces a new special oxygen Duragauge for high pressure oxygen service.

The case is a heavy brass casting with a safety solid front and a full open back.

The back of the gauge is sealed with moisture-proof paper protected by a thin brass disc. The mounting lugs on the case hold it away from the wall.

The Bourdon tube is Byrellium Copper, and the socket is forged bronze. No steel is used for the sake of safety. Accuracy is guaranteed to within ½ of 1%.

The gauge is also stream-lined, having the new, clear-as-crystal gauge cover of transparent plastic. This opens up the dial for easier reading. The plastic cover is safer than glass. Complete information on the new gauge may be had by writing the Ashcroft American Gauge Division of MANNING, MAXWELL & MOORE, INC., Bridgeport, Conn.

Plant News

New Lenses By Bausch & Lomb

The first commercial application of a special film coating to increase the light transmission of lenses has just been completed with the delivery of new projection

lenses to twenty-five Loew theatres in the larger cities. Lester B. Isaac, Director of Projection and Sound for Loew's Theatres, ordered the new lenses for the first showing of "Gone With the Wind," after exhaustive tests by Bausch & Lomb had disclosed that screen illumination could be stepped up from 15% to 40% depending upon the type and focal length of the lens used.

Marked improvement in image contrast and sharpness of focus has been reported by Rochester projectionists who have been testing the new lenses.

Officials of Bausch & Lomb said that the new lenses have been made available in advance of their scheduled date of introduction in order to aid Loew's in securing greater screen brilliancy for the technicolor production of "Gone With the Wind."

Bausch & Lomb combines two processes in its method of producing non-reflecting lens surfaces, both having the same effect but differing in principle. While the inner glass-air surfaces are coated with a metallic flouride, the outer surface is subjected to a corrosive process in which oxides of high refractive index are removed from the surface leaving a thin structure of silica.

In each case the coating is held to a thickness of a quarter of a wavelength of light. Since both the film and the lens reflect light it is necessary that the crests of the waves from one beam shall fall into the troughs of the other. Thus being out of phase the waves neutralize each other and reflection is eliminated. The missing radiation reappears in the transmitted beam which may contain as much as 99.6 per cent of the original radiation.

When a beam of light falls perpendicularly upon a glass-air surface from four to five per cent of the light is lost by reflection at each surface, the precise amount depending upon the color of the light and the type of glass used. A crown glass-air surface reflects about four per cent of incident light, whereas a flint glass-air surface reflects six per cent. The transmission in the first glass is 92 per cent; in the second 88 per cent. The Bausch & Lomb Super-Cinephor with its high aperture and the new glasses developed for its several elements will have its light transmission increased by approximately forty per cent, something of a revolutionary factor in projection optics.

Officials of the company stated that the new processes would eventually be applied to a number of instruments but that present production plans would be limited to a few in which complex lens systems promise a great increase in light transmission by the reduction of reflection.

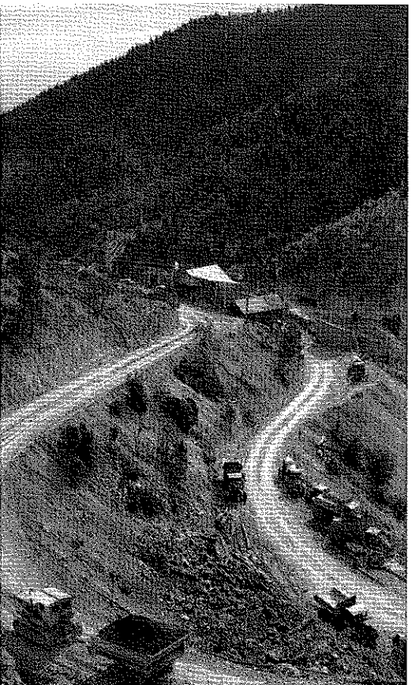
V-Belt Industry Announces Revised Ratings for Multiple Drives

Based on studies of belt life made by Allis-Chalmers Mfg. Company engineers, in conjunction with industry representatives, the power ratings of multiple V-belt drives have been revised to provide maximum belt life. Sheave diameters and correction factors are now standardized according to formulae based on results with multiple V-belt drives over a period of ten years. Overload factors are being arranged also to allow for the type of prime mover and driven machine.

The new ratings provide in many cases for a more compact drive and also for the longest belt life at the lowest initial cost.

Companies co-operating in the new standards include: The American Pulley Company, Browning Manufacturing Co., Inc., The Dayton Rubber Mfg. Company, R. & J. Dick Co., Inc., Dodge Manufacturing Corp., Fort Worth Steel & Machinery Company, The Gates Rubber Company, L. H. Gilmer Co., Goldens' Foundry & Machine Company, The B. F. Goodrich Company, The Goodyear Tire & Rubber Company, Inc., W. A. Jones Foundry & Machine Company, The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., The Medart Co., Pyott Foundry & Machine Co., Rockwood Mfg. Company, United States Rubber Company, T. B. Wood's Sons Company, Worthington Pump and Machinery Corporation.

● **Truck-Type Wagons and Caterpillar Tractors hauling gold ore to Mountain Copper Co. Ltd. Mill 17 miles northwest of Redding, Calif.**



1940 International Acetylene Association Convention to Meet in Milwaukee

The 40th Convention of the International Acetylene Association is to be held in Milwaukee, on April 10, 11 and 12, it was announced at the Association's office here today. Convention Headquarters will be at the Schroeder Hotel.

In announcing the selection of Milwaukee for this year's convention, the Secretary of the Association said that this city was chosen by the Officers and Directors because of its importance as an industrial and scientific center. Milwaukee is the home of a number of important and diversified industries, and is, of course, within convenient distance from other important industrial centers such as Chicago, Detroit, St. Louis, Cleveland and Indianapolis. Consequently, it was said, a record attendance of engineers, industrialists, and shop technicians is expected. Last year the meeting was held in Houston, Texas.

The program will include a scientific forum on oxy-acetylene cutting of metals, a series of round-table discussion meetings, and, on each of the three days of the convention, a group of technical sessions, at which will be presented many interesting papers by outstanding technical men and experts in applications of the oxy-acetylene process of welding, cutting, and heat-treating. Announcements of subjects and speakers are to be made at an early date.

New Work for Diesel-Electric Locomotives

Diesel-electric locomotives are being applied in a new type of work. Three industrial-type units are to be used in building the $16,000,000 Friant Dam marking the first application of this type of motive power to construction work. These locomotives will be supplied by the General Electric Company to the Griffith Company and the Bent Company, contractors for the California Central Valley project.

Two of the locomotives, operated in multiple by one engineer, will be used to move aggregate from the gravel bunkers to the concrete mixing plant, about two miles distant. This double unit will weigh 86 tons and rate 600 hp. The third, rated 300 horse-power and weighing 43 tons, will be used for switching and auxiliary service, and may also be used in tandem with the other locomotives when needed.

Friant Dam is the second major unit of the government-sponsored Central Valley project, which is classed as the largest reclamation enterprise in history. The dam will be located on the San Joaquin River about 20 miles north of Fresno. When completed it will provide storage for 520,500 acre-feet of water, 316,500 of which will be available for storage regulation of waters for delivery into the Friant-Kern and the Madera canals. With an aggregate length of nearly 200 miles, the canals will carry a new water supply to more than 40,000 acres of once-productive farmland abandoned for lack of adequate water.

Friant Dam will be 3430 feet long, 300 feet high, and 250 feet wide at the base, 20 at the crest. It will contain 1,850,000 cubic yards of concrete. The project is expected to be completed in three years.

CATALOG and TRADE PUBLICATIONS

(773) FACTS ABOUT GRINDING WHEELS. A handbook on grinding wheels by Norton Company, Worcester, Mass., containing 78 pages of information on grinding wheels, their characteristics to meet different requirements, tables of speeds and diameters and tables of recommendations for use with different materials. This is a valuable reference for all using grinding wheels. Mine & Smelter Supply Company, Denver, Colo. are Sales Representatives.

(774) CATERPILLAR DIESEL D7 TRACTOR. Form 1823 of Caterpillar Tractor Co., Peoria, Ill., shows the New Diesel D7 Tractor with complete specifications, showing capacity, speeds, dimensions, horsepower, drawbar pull and all other important information. Clinton & Held Co., 1637 Wazee St., Denver, Sales Representatives will gladly furnish any information you wish on this and other Caterpillar equipment.

(775) VERTICAL COMPRESSORS. Bulletin 765, Chicago Pneumatic Tool Company, 6 East 44th St., New York City, gives full description of Class V-CE compressor, two cylinder type with capacity 750 to 1400 C.F.M. and Class W-CE, four cylinder type with capacities 1735 to 2215 C.F.M., arranged for motor drive, belt drive or diesel drive direct coupled. Stearns-Roger Mfg. Co., Denver, are Sales Representatives.

(776) ELECTRICAL EQUIPMENT FOR MODERN BLAST FURNACE. A six page reprint by General Electric Co., Schenectady, N. Y.

(777) HOW TO MAKE CABLE JOINTS. GEA-2988 bulletin by G. E. Co., Schenectady, N. Y., gives detailed instructions for splicing rubber insulated, rubber sheathed cable, also for jointing braided cable, both rubber and varnished cambric. All details are illustrated by drawings.

(778) PERMITE ALUMINUM PAINT, where and how to use it. A 55-page handbook tells the whole story, published by Aluminum Industries, Inc., Cincinnati, Ohio. Aluminum Paint for every requirement and how to apply it. Hendrie & Bolthoff, Denver, Colo., are Sales Representatives.

(779) POSITIVE INFINITELY VARIABLE SPEED TRANSMISSION. Book 1574, by Link-Belt Co., 300 W. Pershing Road, Chicago, contains 40 pages of illustrations showing construction and dimensions of this gear, with tables giving horsepower and other information that the user may require. Shubart & Schloss, Boston Bldg., Denver are Sales Representatives.

(780) VIBRATING SCREENS. Bulletin 28 of Ajax Flexible Coupling Co., Westfield, N. Y., shows the many advantages of this new screen use for speed and accuracy when handling a large variety of products. Urquhart Service, 1501 Wynkoop St., Denver, are Sales Representatives.

(781) CAST MANGANESE-MOLYBDENUM STEEL, its advantages for vital parts of the Power Shovel are shown in the MOLY-MATRIX, by Climax Molybdenum Company, 500 Fifth Ave., New York, for December 1939. Specifications and strength of parts are given.

(782) OIL WELL EQUIPMENT. The National Supply Co., Toledo, Ohio, have issued the following bulletins: No. 254, National Unit Pumper Type TUL140G-JD14TP, an installation for shallower fields, safe load of walking beam 6170 lbs., specifications included; No. 256, Ideal Rotary Machine, FE17½, for moderate deep drilling, capacity 5000 ft. 4½" drill pipe, specifications, weights, dimensions given; No. 257, Consolidated Rig Type 50, 9 pages of illustrations and full description with ratings and power units on this new equipment; No. 260, National Unit Pumper TU304-HD30TB, twin crank for medium pumping service, for use with concrete base, specifications and full description given.

(783) METAL & WOODWORKING MACHINERY. Sec. B of Cat. 150 of Hendrie & Bolthoff, Denver, giving 141 pages of equipment and supplies for metal and woodworking. Every operator or plant should have this handy catalog.

(784) MAGNIFIERS AND READERS. In their new 17-page bulletin, Bausch & Lomb, Rochester, N. Y. describe and illustrate a very complete line of hand magnifiers and reading glasses. In this book you will find the very magnifier that you have been looking for to meet your requirements.

(785) 220,000 VOLT TRANSMISSION LINES. In a 36-page book, forty illustrations together with specifications give you a complete picture of the many high tension lines, showing types of construction and equipment in use. A work of art of practical application for the electrical engineer and power company. Published by Aluminum Company of America, Pittsburgh, Pa.

FOR YOUR CONVENIENCE

Send your publications to Mines Magazine, 734 Cooper Building, Denver, for review in these columns. Readers will please mention Mines Magazine when requesting publications from the manufacturer. Readers may order publications from this office by giving the index number.

(786) AUTOMOBILE FACTS. Published by Automobile Manufacturers Assoc., January, 1940, tells, among other interesting facts, about Motor Truck Aid to Oil Field Exploration.

(787) V-BELTS. Industrial News, Jan. 1940, by Gates Rubber Co., Denver, as usual contains many new applications of V-Belt drives which will be interesting to our readers, among others is an account of an Oklahoma Oil Well drilled to 14,582 feet in which the Gates Vulco Rope played an important part in the successful completion.

(788) SAFETY INSOLES FOR THE MINER. Bulletin CK-1 of Mine Safety Appliances Co., Braddock & Meade Sts., Pittsburgh, Pa., illustrates and describes this valuable protection for the miner.

(789) METAL SPRAYING BY THE POWDER PISTOL. In a series of reprints and bulletins, the Schori Process Corporation, 8-11 43rd Road, Long Island City, N. Y., explain this new and successful process for metallizing surfaces to protect them against corrosion by the use of powdered materials and metals blown and melted onto the surface to be protected, a very simple and effective method easy of application. You will be interesting in this new process which has a place for application in almost every operation.

(790) PORTABLE PLACER MACHINE. In a recent bulletin, The Universal Dredge Mfg. Co., Central Savings Bank Building, Denver, tell you about a new portable machine for small scale operations, testing placer properties, dredge 7 mill clean-up and many other uses.

(791) DEMING JET PUMPS & WATER SYSTEMS. Bulletin No. J-4900-A of Deming Company, Salem, Ohio, contains 20 pages showing the application of the Deming Centrifugal Jet Pumps with a single pipe jet to your water system problem for deep or shallow well installations. Tables giving full data are included with typical installations. Hendrie & Bolthoff, Denver, are Sales Representatives.

(792) GAS ENGINES. In Bulletin S-550-B13, Worthington Pump & Mchy. Corp., Harrison, N. J., tell about their gas engine operated on the gas produced from sewage sludge treatment. These units run from 15 to 1800 H.P. Figures and photos are given on operating plants.

(793) JACK BIT GRINDERS. Form 2554 of Ingersoll-Rand, 11 Broadway, New York, shows two new jack bit grinders and the many advantages that this new equipment will bring to you. 12 pages of illustrations and useful information are included.

(794) 1¼-YD. SHOVEL, DRAGLINE, CLAMSHELL, CRANE. Bulletin No. FBE 33-B-3 by Bucyrus-Erie Co., South Milwaukee, Wis., contains 32 pages describing modern improvements in the Bucyrus-Erie 33-B. Mechanical and structural details are fully explained and field views are included. Important data and information are included, also specifications and working ranges.

(795) DRY LAKE OF CHEMICALS. Link-Belt News, for January 1940 contains an interesting account about Searles Lake, in the Mojave Desert, Calif. Many other interesting articles are included in this issue, and especially another picture of Claire for your scrap book, we will leave the comments up to you, get your copy.

(796) SOCKETING WIRE ROPE. In a 14-page booklet by Union Wire Rope Corp., Kansas City, Mo., you can get all the necessary lessons in the correct socketing of wire rope. Methods are illustrated and tests given.

(797) MAGNETIC SEPARATORS. Bulletin 97A by Stearns Magnetic Mfg. Co., Milwaukee, Wis., illustrates the Scout Type Magnetic Separator and its application. Specifications and dimensions are given. Magnetic pulleys are shown.

(798) FLAME HARDENING CAST IRON. This and many other interesting subjects are treated in the 12 pages of Nickel Cast Iron News of International Nickel Co., 67 Wall Street, New York, for January 1940. The importance of nickel irons are illustrated.

(799) FLOTATION MACHINES. Bulletin F11-B5 illustrates the many important features contained in the Denver "Sub-A" (Fahrenwald) Flotation Machine as manufactured by Denver Equipment Co., Denver, Colo. Those with flotation problems will be interested in the information contained.

(800) ELECTRICAL EQUIPMENT, General Electric Co., Schenectady, N. Y., have issued the following: GEA-3179A, an adjustable, self-regulating Battery Charger, illustrations, data and operation; GES-2377, shows the use and advantages of electric heat in industry, illustration of many installations; GET-577B, Repointing Transformers in the Field, instructions; GEA-3330, Insulation for Polyphase Induction Motors, showing materials and application.

(801) REFINERY UNIT FOR SOLVENT DEWAXING. Illustrated and described in "INSULATOR" for Dec. 1939, by Armstrong Cork Co., Lancaster, Pa.

(802) GALVANIZED WATER TANKS. Bulletin T2-B1 of Denver Equipment Co., Denver, shows the advantage of the bolted steel tank. Tables of capacity and other data are given.

(803) INDUSTRIAL POWER TOOLS. Form IND-40 of the Delta Mfg. Co., Milwaukee, Wis., contains 42 pages illustrating tools (portable motor driven) for many purposes. Among these pages you will find some tool that you can use to advantage in your plant or operation. Hendrie & Bolthoff, Denver, Colo., are Sales Representatives.

(804) SHAKER CONVEYORS. Bulletin C-371 by Goodman Mfg. Co., Chicago, Ill., contains 24 pages, illustrating various types of this equipment, its application and advantages for use in moving mine material rapidly and quickly.

(805) WIRE ROPE INFORMATION. Practical information on the use and care of wire rope is told and shown in a 44-page hand book by A. Leschen & Sons Rope Co., St. Louis, Mo. Every user of wire rope should have a copy of this book as it will save him dollars and time.

(806) PORTABLE ELECTRICAL MEASURING INSTRUMENTS. Bulletin GEA-1784B, General Electric Co., Schenectady, N. Y., contains 28 pages illustrating many A-C and D-C portable instruments showing their accuracy and markings, prices are given, also main features and application.

(807) TAIL ROPE SHEAVES. Bulletin 76-D Sullivan Machinery Co., Michigan City, Ind., illustrates ball and roller bearing sheaves built especially for use in connection with scraper loading.

(808) CENTRIFUGAL PUMPS. Bulletin W-321-B13, Worthington Pump & Machinery Corp., Harrison, N. J., illustrates and describes a turbine driven Monobloc pump with capacities of 10 to 400 g.p.m. under heads from 10 to 240 feet and steam pressure up to 300 lbs. Dimension tables are given.

(809) SPEED ARC WELDER. Bulletin 910 of the Ideal Electric and Mfg. Co., Mansfield, Ohio, shows the construction and design of the Noel Speed Arc Welder, the reason of its high power factor, high efficiency and speed of operation that will reduce costs. Urquhart Service, 1501 Wynkoop St., Denver are Sales Representatives.

(810) WELDERS EAR PROTECTORS. Bulletin CF-4 of Safety Appliances Co., Braddock & Meade Sts., Pittsburgh, Pa., describes and illustrates the new welders ear protectors, which are light, durable and insure safety to the welder.

(811) MULTIZONE CLASSIFIER. Bulletin No. 2271 by The Dorr Company, Inc., 570 Lexington Avenue, New York, describes and illustrates a new type of Dorr Classifier, to be known as the Dorr Multizone Classifier, for better all around classification for separations up to and including 80 mesh. This equipment has been tested out for several years in this and foreign countries with excellent results. It requires, less attention, better control and greater flexibility under fluctuating conditions. You will want to add this bulletin to your reference library.

(812) MILLS, FLOTATION. The February Deco Trefoil, published by the Denver Equipment Company, Denver, contains much interesting material for your Engineering Note Book, a four-page article on Talc preparation for the market. Among other articles are, Mexico, Central America and South America; Mill Hints; Metals at Work; Non-Metal Notes; and other useful information.

(813) USEFUL ITEMS FOR THE MILL AND LABORATORY. Bulletin ESPB contains Inexpensive Items for use in the Mill and Laboratory that every operation can profit by using. Illustrations, descriptions and prices are given.

CAMPUS TOPICS

Denver Chapter A. I. M. E. Gives Banquet to Mines Students

Over one hundred Mines students heard George H. Rupp, chief mining engineer for the Colorado Fuel and Iron Corporation and President Coolbaugh speak at an informal barbecue dinner given for the student A. I. M. E. chapter, Thursday evening, January 25.

Speaking on the subject, "What Industry Expects of Graduate Engineers," Mr. Rupp stated that industry expects little from the new graduate, but it does ask that he have a knowledge of the fundamentals of engineering and the ability to work hard to gain the experience and confidence in himself that he needs.

Mr. Rupp expressed the great need in industry for new methods and new ideas. Never in the entire history of the world was there a greater need or greater opportunity for new discoveries and new products as there is today.

Industry needs the young man and his ideas which are not strangled by tradition. The need is for a "trained mind", a mind that can reason. It is the "pluggers" who do the work, not the brilliant men.

Engineers gravitate into three classes (1) technicians or research men, (2) the sales engineer and (3) the operating executive. For the operating executive, straight mechanical technical ability becomes of less and less importance as he goes along the line.

"Most young men are not fired," Rupp said, "because they are lacking in technical ability but because of some character defect, which causes them to lose out."

President Coolbaugh, in a short talk, stressed the great value in having "a disciplined mind." In comparing the training given a liberal arts student and that given an engineering student, Dr. Coolbaugh said that he felt that liberal arts students receive too broad an education; liberal art courses are not basic enough; the great tragedy of engineering is that members of the profession do not relate their knowledge to every day life, but think of it as a thing apart.

A Collection of 1200 Fossils

mainly of the Paleozoic Age, has been presented to the Colorado School of Mines by Mrs. Maybelle Barnett, wife of John T. Barnett, president of the Board of Trustees. This collection was purchased from Ottawa, Canada, and was originally assembled by Doctors Henry Marc Ami and Edwin Sowter, members of the Canadian Geological Survey.

Particularly rich in Crinoids, the collection contains a large number of forms which were not heretofore represented in *Mines'* collection. Much of the material is of museum quality and will be put on display. Later it will be added to the Mines Museum when it is opened to the public.

"This is one of the outstanding gifts of Paleozoic specimens the school has received," said Dr. Coolbaugh, "and will be a valuable addition to the present collection. The school wishes to express appreciation to Mrs. Barnett for this addition to the Geology department and the new museum."

The Educational Broadcasts

announced in last month's issue of *Mines Magazine* were begun Sunday afternoon, February 4. The series, "Man and Minerals," will be continued until June and will be presented each Sunday afternoon over K O A, General Electric station, Denver, at 3:45 o'clock, Mountain time.

The series will be presented by the departments of Petroleum Engineering, Mining Engineering, Metallurgy, Geology and Geophysics. The broadcasts will be in dialogue by faculty members and students of the School of Mines. The programs will be neither lectures nor of the ordinary quiz type but will be dramatic with emphasis on interest and educational value.

The broadcasts are being presented thru the cooperation of the Rocky Mountain Radio Council and its director, Robert B. Hudson. The same programs will be broadcast by transcription over radio station K I V P at Durango, Tuesdays, 6:00 P.M.; Grand Junction over K F X J, Sundays, 12:00 Noon; and possibly at Sheridan, Wyoming, at times to be announced later.

Mechanical Engineering Department

is the proud possessor of a new four-cylinder Hercules Diesel engine of the power unit type. The engine is to be used for instructional purposes in petroleum courses and other elective M.E. courses.

The engine has a three and three-fourths inch diameter cylinder and a four and one-half inch stroke. It runs at a normal speed of 1800 revolutions per minute and generates forty horsepower.

In purchasing this Diesel the School has shown recognition of the fact that diesel power is becoming more and more prominent in the field of industry.

Four New Courses

were added to *Mines* curriculum the beginning of this semester, to be given as electives. Prof. Keating will teach a gem course; Dr. Haff will teach a new geology course; Prof. Reed and Prof. Campbell will give a course in blue printing; and Prof. Mather will teach an economics course.

"Geology Applied to Engineering" is the new course by Dr. Haff. It demonstrates the application of geological principles to problems encountered in engineering and construction projects, damsites, foundations, tunnels, excavations, quarries, reservoirs and catchment basins, and the materials of construction are treated from the standpoint of geologic factors involved in the selection and examination. Methods of exploration, use of maps, sources of reference material and the function of the geologist in engineering work are also emphasized.

Prof. Mather's course, "Financial Organization and Investments," has not been taught at *Mines* for several years. It deals with the financial problems of corporations such as promotion, sources of capital, internal financing, underwriting, sale of securities incident to problems of expansion and reorganization. Special attention is also given to the principles of governing the investments of personal and institutional funds.

George T. Meredith

is a newly appointed member of the faculty at *Mines* as instructor in the Physics department. He succeeds Professor Paynter who has been transferred to the department of Electrical Engineering to fill the vacancy caused by the death of Professor Little.

Mr. Meredith received his Bachelor of Science degree at Colorado College and a Ph.D. degree from Colorado University. Until his appointment at *Mines,* he has been an assistant in the Physics department of the engineering school at Boulder.

Four Turkish Students

journeyed to Colorado and enrolled at *Mines* at the beginning of this semester. They had been studying at French universities but, by governmental decree all schools of higher education in France were closed, so the Turkish government sent their students to the United States to continue their studies. They were unable to enroll as regular students, however, on account of their lack of knowledge of English. Their time until next September will be spent in studying the language.

Sigma Phi Epsilon

held a special initiation last month for Col. Cleveland C. Gee, head of the Military and Tactics department. The initiation was followed by a banquet at which Col. Gee and his family were guests of honor. Also present were Prof. Harlan E. Short and Dr. C. A. Heiland and their families.

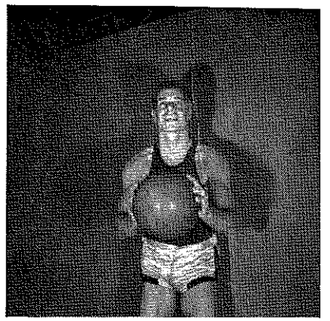
ATHLETICS AT MINES
Winter Sports
By WILLARD DOW, '42

Mines' basketball quintet captured their third consecutive conference win last week after three campaigns of victoryless play. The cool playing Blasters have their sights set on the Rocky Mountain conference crown, and hit or miss they, at least, won't be roosting on the doormat this season. After three weeks of conference firing the title chase appears to be strictly a three-team affair involving Mines, Montana, and C. C. with Western State and Greeley State playing the heckling roles. Mines has won three and lost three games in conference play.

Coach Doy Neighbors believes that the Miners are improving with every start and should win their share of games from now on. The Blasters have abandoned their firebrand type of play and are beginning to set up their plays in a slow, deliberate fashion. Neighbors seems to have found his best combination in Bousman and Talbott at guards, Shorty Hegglund and Rogers at the forwards, and Bob Comstock at the post. Hegglund is the only letterman on the starting five. Comstock hit his stride against Western State when he kept the strings hot by pouring twenty-nine points through the hoop. Rogers, sophomore from Arkansas, dominates the leading scorers of the conference with 59 points.

The Orediggers, highest scoring team in the conference, are idle until their February 9* contest with Greeley, probably the most crucial tilt of the season. This battle of two titans of the Rocky Mountain conference hard-wood circuit looms as the feature game of the season. A victory for the Miners would vault them into a definite title contending spot, while a Greeley State win would send them into the top conference position on a percentage basis.

Under the baton of Doy Neighbors the basketball team at Mines has swelled into a big-time sport symphony. This year the Blasters are winning their share of games instead of piling up long losing streaks. Mines basketteers can hold their own with any of the dunking demons in the conference.



H. A. ROGERS

L. J. TALBOT

Wrestling

However, the basketball team is sharing the spotlight with the wrestling crew, as the Mines' grapplers are odds-on favorites to walk off with a victory in the conference meet March 9 at Golden. Coach Mason has shaped this year's grunt and groan men into one of the strongest wrestling teams ever to represent Colorado Mines. Led by two conference champs, Gibson and Tashiro, the Orediggers completely trampled the strong Wyoming team early in the season and impressed press row dopesters as the team to beat in the R. M. C. conference. Mayhew, transfer from Kansas U., is one of the strongest men on the Blasters' squad and is probably the most scientific wrestler. Olin, heavyweight, is another powerful grappler who exhausts his men with bear-like holds. The Orediggers have matches scheduled with D. U., C. U., and Greeley State besides the conference meet.

MADDEN SELECTED AS ALL-AMERICAN

Mines' football hero took the spotlight again and received a beautiful trophy for all his efforts in the grid wars of the good old 1939 season. Lloyd Madden, the nation's leading scorer and halfback on the "Little All-America" team, received another All-America title when he was named as alternate All-American and the most valuable player on Williamson's rating selections.

Skiing

Mines' skiiers handed the regional teams a shiner last week when they walked off with the D. U. invitation meet to inaugurate the snow season in grand fashion. Captain Fred Nagel won the meet almost single-handed as he scored firsts in both the slalom and downhill events. Nagel has twice been intercollegiate champ of the downhill and slalom races, and it looks as if he'll repeat this year. Bob Hopper, sophomore, is a sensation on the boards after only a year's experience. Hopper has shown great improvement over last year and should take over Nagel's spot next year. Coach Phelps is giving instructions to beginners with the result that the Mines' ski club is growing stronger each year. He has a large squad of veteran snowmen this year, and if Nagel continues to display championship form this should be one of the most successful seasons in skiing history for the Miners.

Swimming

Mines' mermen, under the tutelage of Coach Stevens, opened the splashing season by dropping their first meet to Aggies. Aggies has the strongest squad in the region, however, so the defeat isn't too hard to take. Big Ed Bryan and Duhme channel the water in the best fashion for the

Miners. Coach Stevens has several new men to enter the aquatic wars this season, though, and after a little seasoning the Miners should swim with the best of them. The Blasters will face the newly formed C. C. swimming team February 3* in the inaugural meet of intercollegiate swimming history for Colorado College.

Hockey

After a late start Mines' hockey team will tangle with the strong Colorado College team February 3* at the Broadmoor Ice Palace. The C. C. sextet is undefeated in intercollegiate competition this year toppling such teams as Michigan and California. The Blasters have a veteran squad and some fine prospects coming up, but they have had very little practice this year. Last year's sensation in the crease, Joe Fussleman, will undoubtedly hold down the goalie position on this year's team. Ted Goudvis, another veteran, will probably be one of the big guns of the Blasters' artillery. Bill Shelton is the most promising of the first year men.

With the greatest football record in Mines' history as an inspiration, sports should enjoy a banner year at Mines, lifting the Orediggers from the doormat position to top spot in the athletic world of the Rocky Mountain conference.

*Editor's Note: Results will be given in March magazine.

Personal Notes—

(Continued from page 55)

Company, 11 Broadway, where he now receives his mail.

J. M. Spitler, '37, Product Metallurgist for the American Steel & Wire Company, has a change of residence address to 1794 Crawford Road, Apt. 48, Cleveland, Ohio.

William A. Wasley, '09, is now associated with the Mexican Candelaria Company, S. A., at "Contra Estaca", Sinaloa, Mexico.

John M. Weller, '26, Geologist of Burlingame, Calif., is doing work at Tonopah, Nevada, where he is now being addressed.

Harry J. Wolf, '03, Mining Engineer of New York City, has moved his offices from 34 East 11th Street to 501 Fifth Avenue.

It was noted in the December 11, 1939 issue of *Life* that *C. P. Yap,* '25, is making a name for himself as Manager of the Chungking Factory of the Chinese government at Chungking, China.

● Weddings

Mullen-Berrian

Mr. and Mrs. John Mullen decided during the Christmas holidays to make known their marriage which took place July 19 of last year. The bride is the former Miss Fern Berrian who for several years has been the chief nurse on surgical work at St. Anthony's Hospital, Denver. She and Mr. Mullen are both of Lakewood, Colorado, and have been friends since childhood.

The couple are now at home in Climax, Colorado, where he is ore checker for the Climax Molybdenum Company. Mr. Mullen, of the class of '39, attended *Mines* for two years. He is an associate member of Mines Alumni Association.

Pike-Hinds

Charles S. Pike was married on October 28, 1939 to Miss Marjorie Louise Hinds of Stamford, Conn. The bride is the daughter of Mr. and Mrs. Raymond Hinds and a graduate of Mount Ida college in Newton, Mass.

Mr. Pike was reared and educated in Golden. After completing two years at *Mines* he accepted a position with the American Smelting & Refining Company in Old Mexico and was connected with this company for ten years. He returned to *Mines* in 1937 and received his degree of Metallurgical Engineer last year. He is now metallurgist for the American Cyanamid Company at Stamford, Conn., where the couple are residing at 1937 Main Street.

Blair-Townsend

The home of Dr. and Mrs. A. B. Townsend of Birmingham, Alabama, was the scene of the marriage of their daughter, Hazel Ruth, to Mr. John Robert Blair the evening of December 29, 1939.

Mr. Blair who received his mining engineer degree from *Mines* last year is engineer for the Tennessee Coal, Iron & R. R. Company. The couple are now at home at 323 Tenth Avenue, West, Birmingham.

● Births

Mr. and Mrs. Robert S. Burton announce the arrival of a baby daughter at their home on January 5, 1940 whom they have named Virginia. The family are now residing in Leadville, Colorado, 835 West 8th Street, since returning from South America, where Mr. Burton, of the class of '29, was shift boss for the Cerro de Pasco Copper Corporation.

Notice Sent to Bureau of Census

Dear Sirs:

Wish to call your attention to an *error* in the last census.

The last *total* is *one* short.

P. S.—Please include baby—
Name—Timothy Earl
Date—January 9, 1940
Weight—6 lb. 6 oz.
Witnesses—Mr. and Mrs. M. E. Volin

Mr. and Mrs. M. Edward Chapman announce the arrival of Russell Martin the morning of January 22, 1940 at Tulsa, Okla. Weight: 9 lb. 4½ oz. Mother, *Dad* and son are doing fine!

PRIZE WINNER—
December, 1939

C. B. Neiswender, '12, enjoyed so much his free subscription of last year to *Mines Magazine* that he got busy and found 40 errors in the December 1939 issue in order to have another free subscription in 1940. There was no one who scored higher so to him goes the prize.

LOCAL SECTIONS

Scheduled Meetings

Birmingham Steel Empire
Tenney C. DeSollar, '04, President; W. C. Chase, Ex-'05, Vice-President; Hubert E. Risser, '37, Secretary, Flat Creek, Alabama.

Bay Cities, California
Four meetings per year, 2nd Monday, March, June, September and December. Frank Hayward, '32, President. William J. Rupnik, '29, Secretary-Treasurer, 714 Hillgirt Circle, Oakland, Calif.

Southern California
Four meetings during the year, 2nd Monday of month, January, April, July and October. R. S. Brummett, '26, President; William Dugan, Ex-'12, Secretary, 315 West 9th St., Los Angeles, Calif.

Cleveland
Four meetings during year, 4th Friday, March, June, September and December. K. D. True, '35, President; R. J. Maloit, '37, Secretary-Treasurer, 9701 Lamont Ave., Cleveland, Ohio.

Colorado
Luncheon meeting, third Friday each month. Dent L. Lay, '35, President; R. J. McGlone, '27, Vice-President; A. L. Mueller, '35, Secretary, 430 E. 11th Ave., Denver, Colo.

Great Lakes
Meetings announced later. A. L. Lynne, '06, President; M. E. Frank, '06, Secretary, 4537 Drexel Blvd., Chicago.

Houston
Dinner meeting, second Friday of month. 6:00 P. M., Lamar Hotel, Houston, Texas. Clark W. Moore, '32, President; R. J. Schilthuis, '30, Secretary, 1410 Gustav, Houston, Texas.

Kansas
Meetings announced later. Thomas H. Allan, '18, President; John T. Paddleford, '33, Secretary-Treasurer, 429 First National Bank Building, Wichita, Kansas.

Montana
Meetings announced later. E. S. McGlone, President. H. M. Strock, '22, Secretary, 1309 Platinum St., Butte, Mont.

New York
Meetings announced later. C. L. French, '13, President; Ben W. Geddes, '37, Secretary, 1112 University Terrace, Linden, N. J.

Oklahoma
Meetings announced later. John R. Evans, '23, President; D. H. Peaker, '32, Secy.-Treas., c/o The Carter Oil Co., Tulsa, Okla.

Pennsylvania-Ohio
Meetings announced later. S. L. Goodale, '04, President; A. M. Keenan, '35, Secretary, Box 146, Pittsburgh, Pa.

Utah
Meetings announced later. Otto Herres, '11, President. Kuno Doerr, Jr., '27, Secretary, 700 McCormick Bldg., Salt Lake City, Utah.

Baguio, P. I.
Dinner meeting, first Wednesday each month, Pines Hotel, Baguio. W. T. Graham, Ex-'26, President; C. W. Berry, '36, Secretary, Box 249, Baguio, P. I.

Manila, P. I.
Dinner meeting, first Friday each month. A. F. Duggleby, '15, President; Ralph Keeler, '31, Secretary, Box 297, Manila.

Bartlesville, Oklahoma

A group of Mines Men in Bartlesville and their wives had a get-together the evening of January 20, 1940 at the home of Mr. and Mrs. A. J. Hintze. Assistant hostesses were Mrs. A. E. Buell and Mrs. A. F. Beck.

The main entertainment of the evening was the showing of movie films of *Mines* football games of the 1939 season which were much enjoyed.

Those present were:

Messrs. and Mesdames W. H. Courtier, '28; J. S. Montgomery, '31; J. W. Baldwin, '21; A. F. Beck, '25; A. E. Buell, '26; Vincent Miller, '35; R. P. Clark, Ex-'26; A. J. Hintze, '31; and Messrs. Norman Maxwell, '17 and George B. Spencer, '32.

The Mines Men decided to continue meetings and elected A. F. Beck as general secretary.

Bay Cities

The City Club Hotel, Oakland, California, was the meeting place on January 19, 1940, for the largest attendance the Bay Cities Section has thus far enjoyed. Thanks to our president and secretary for making this splendid meeting possible.

The meeting started off in excellent shape with a lively bull session and get-together at the bar. Greetings were exchanged in a hale and hearty manner among many of the boys who have not seen one another for several years. Among the early-comers were the fellows from Incline, Jackson, Fresno and Weimar, who travelled at least 200 miles (one direction) to attend this meeting! They were:

Geo. G. Goodwin, '20, Fresno; A. S. Wyner, '25, Incline; Geo. W. Plantz, '31, Incline; J. F. Emerson, '38, Incline; Ben T. Wells, '04, Jackson; Steve Dettman, '31, Weimar.

These out-of-towners have proven to be among our most enthusiastic members.

A fine dinner was enjoyed by all and many compliments were received upon the selection of the meeting place. The hotel management allowed our group to use the facilities of a larger room for the showing of the football films when the dining-room proved to be inadequate for our record attendance. The City Club Hotel appears to be the answer to our needs.

Following the dinner the gang loosened up their vocal chords to render a noble "Mining Engineer" with the piano accompaniment by Mr. William Wells, a guest and brother of Ben T. Wells, '04. It might be interesting to add that Mr. Wells divulged the fact that he had graduated from Colorado University in 1907.

President Hayward gave a brief outline of a scholarship loan fund to be created by the Bay Cities Section to sponsor worthy students who this section recommends. The fund, although insignificantly small at present, will grow as time passes on. It is hoped that from time to time this fund may be increased by donations of any amount by our members. Surpluses from our section treasury will also supplement the fund. Let's remember, fellows, that this is a real opportunity to help *Mines*.

The films of the Mines-C. C. and Mines-Aggies games were enjoyed by all present. Coach Mason deserves plenty of credit for producing such an outstanding team and the Bay Cities Section sends him hearty congratulations and also best wishes for 1940. Steve Dettman was a great help in lending his operating technique in the showing of the films. Steve promises us another treat in offering to show his "World's Fair" films at our next meeting.

George Goodwin has been actively engaged in scheduling the Mines-Fresno State football game to be played in November 1940 in Fresno. George reports that the game is definitely on and suggests that the Bay Cities members schedule a special car and go down in a body for the game, thus avoiding traffic and the strain of a long drive. This is an excellent idea as it makes possible the opportunity

for a joint meeting with the Southern California Section at which time we would be hosts to the *Mines'* team, Coach Mason and the accompanying members. Here's a chance we have been waiting for, fellows, a meeting arranged by our out-of-town members! Let's give this plan our full support.

Noteworthy among the members present was W. G. Swart, Hon. '17, Vice-President and General Manager of the Mesabi Iron Company. Mr. Swart is a great booster for *Mines* and we are honored in having him included in our Bay Cities roster.

Conspicuous among our absent members was Major F. M. S. Johnson, D.Engr. '38, who sent his letter of regret at not being able to attend this meeting because of having been transferred to a new post in Boston, Mass. (See letter this page.) We members of the Bay Cities Section will miss Major Johnson, for a more enthusiastic supporter for *Colorado Mines* and its Alumni does not exist. Major's unselfish efforts in reorganizing Bay Cities Section will not be forgotten by us. He travelled East by Army transport via the Panama Canal and took up his duties in Boston the first of this month. Best wishes to you, Major, in your new assignment.

R. S. Coulter, '19, announced that he has another good prospect in mind for an athletic scholarship and will bring him to our next meeting for introduction. Good work, Coulter, we certainly appreciate this.

The Selby Plant of A. S. & R. Co., was present in full force with the exception of one member who was indisposed. Someone raised the question as to whether the smelter had to shut down because of the absence of so many members of the Selby "brain trust!" Thanks for the fine support, fellows.

Following is the roster of those present at the record meeting:

C. M. Stephens, '98, Berkeley; Ben T. Wells, '04, Jackson, and brother, W. M. Wells, C. U. '07, Oakland, guest; G. W. Schellenberg, '12, Berkeley; Verne Frazee, '12, Oakland; W. E. Heinrichs, '13, San Francisco; P. J. McGuire, '15, San Francisco; W. G. Swart, Hon. '17, Alameda; Ron S. Coulter, '19, Burlingame; G. G. Goodwin, '20, Fresno; A. C. Kinsley, '20, Alameda; Ben L. Raiff, '21, Selby; A. S. Wyner, '25, Incline; H. C. Renken, '25, Richmond; E. J. Nylund, '25, Oakland; Dale Nix, '26, San Francisco; C. K. Viland, '29, Martinez; W. J. Rupnik, '29, Oakland; Geo. Playter, '30, Selby; S. J. Artese, '30, Martinez; D. J. Lyons, '30, Martinez; Geo. W. Plantz, '31, Incline; S. S. Dettman, '31, Weimar; P. C. Gribben, '31, Rodeo; Frank Hayward, '32, San Francisco; R. E. Shinkoskey, Ex-'35, Crockett; F. A. Smith, '34, Berkeley; R. P. Obrecht, '34, Antioch; G. H. Ripley, '36, Hercules; E. L. Chambers, '36, Rodeo; J. F. Emerson, '38, Incline.

Mr. W. J. Rupnik,
714 Hillgirt Circle,
Oakland, Calif. January 15, 1940.

Dear Bill:

I am sorry to report that I will not be able to be present on January 19, as I have been ordered to Boston, Massachusetts, and will sail on the transport for Panama and New York, leaving San Francisco in about a week.

I enclose herewith local dues and Alumni dues, together with donation for the Alumni Loan Fund. I understood we were supposed to send these through the Bay City Section. If not, I am sorry to have troubled you with it.

Please give my best wishes to all present at the meeting on the 19th and tell them how sorry I am not to be with them, but am very busy closing up office and getting furniture packed, etc., preparatory to leaving for the New England States.

I want you to know how much I have enjoyed my association with the C. S. M. men in the Bay Cities Section. They are a grand bunch and a credit to their Alma Mater. Especially, remember me to Frank Hayward, your local president.

Fraternally yours,
F. M. S. Johnson,
Major, Corps of Engineers.

Southern California

Southern California Mines Men turned out en masse on January 15th to the Clark Hotel to enjoy a fine dinner, see the great 1939 Mines eleven flash championship form on the silver screen, and to honor the new President of the Alumni Association.

After the members had disposed of famous Clark steaks with all the trimmings the usual introduction of guests was staged. Guest Bob McNeish, backfield coach at the University of Southern California, after paying tribute to Coach Mason's 1939 Miners, answered numerous queries concerning the more technical aspects of modern football. He made a decided "hit" with our group.

Presents Gavel

Frank Brown, representing the Section, then presented our retiring three-time President Ed Brook with a beautiful gavel as a token of esteem for his past services. Mr. Brown in making the presentation summed up the sentiments of the group when he said "You have been addressed this evening by the new President of the Colorado School of Mines Alumni Association—if he does half as much for the National Association as he has done for our Section, the members will never regret their choice." The members responded with a ringing ovation and individual congratulations and felicitations.

New Officers

New officers were then elected to carry on for 1940. A strong slate of Robert S. Brummett, '26, President; W. J. Boyle, '12, Vice-President; J. Murray Maxwell, '30, Vice-President; F. A. Brown, '21, Treasurer, and our perennial Secretary Bill Dugan, Ex-'12, were unanimously elected and inducted into office. Our chapter hopes to continue on top with this leadership.

Following a brief intermission Clem Peoples, Los Angeles County Jailer, gave one of the most interesting talks we have ever had on "Psychology of Crime". Clem graphically gave us the intimate details of life in the "Big House" which we never hear about, and told numerous specific cases of the strange viewpoints and mental quirks of famous local criminals. The interest in his address was evidenced when members asked for "more" after his allotted time had been consumed.

Heads Up Now

The final feature was the showing of the Mines-Colorado College football game pictures. As Bill Boyle so aptly put it "For years we used to go through the Sunday paper not to see whether Mines won a game but to see how badly we lost. Now we have a team and a coach we can hold up our heads about and be proud of—let's keep it that way."

Those who signed the roster were:

C. Terry Du Rell, '95; Marshall Draper, '97; Geo. B. Clark, '01; J. L. Bruce, '01; John V. Richards, '02; A. C. Watts, '02; Wm. C. Wattles, '03; Henry E. King, '03; H. J. Wallace, '04; Fred T. Hiltz, Ex-'04; C. A. Spicer, Ex-'05; John B. Neville, Jr., '05; C. C. Stillman, '05; Howard Spangler, '05; R. L. Dimmick, Ex-'06; H. C. Armington, '07; H. L. Jacques, '08; Gower Waters, '09; H. C. Eddy, '09; Chas. L. Hansen, '09; J. C. Ballagh, '10; J. P. Pinger, Ex-'10; E. Clarke Austin, Ex-'10; Sid Blum, '11; C. B. Morrison, Ex-'11; C. B. Neiswender, '12; W. J. Boyle, Jr., '12; Bill Dugan, Ex-'12; C. W. Westervelt, '13; Merle W. Wilkinson, '13; Walter J. Eaton, '13; C. F. Oram, '13; Chas. N. Whitaker, '14; John N. Teets, '15; W. J. Jenni, Ex-'15; Wayne A. Harrod, '16; Oscar E. Hanno, Ex-'17; L. R. Van Burgh, '17; Chas. W. Teets, Ex-'17; R. F. White, '18; L. D. Mulford, '19; Geo. T. Johnson, Ex-'19; A. M. Turner, '20; N. F. Gallucci, '20; F. A. Brown, '21; Harry M. Fiske, '21; L. P. Rooney, Ex-'21; H. H. Pratley, '22; Rex J. Allan, '22; N. J. Mueller, '22; E. J. Brook, '23; Chas. T. Baroch, '23; H. W. McGowan, '23; E. C. Curzon, '23; N. H. McKay, Ex-'23; H. P. Fidel, '23; A. E. Hambly, '23; E. D. Miller, '24; Norman Whitmore, '26; R. S. Brummett, '26; W. G. Lofgren, '28; V. P. Pentegoff, '28; J. L. Soske, '29; E. F. Bladholm, '29; C. F. Bonnet, '31; J. J. Rupnik, '33; Morgan Leonard, '36; Bill V. Beggs, '37; A. H. Scudamore, '37; F. E. Holland, '37; E. E. Dawson, '38; O. B. Stewart, Ex-'39; John H. Dismant, '39; R. H. Harris, '39. Guests: Bob McNeish, Clem Peoples, Don Eden, Gene Volpi, E. J. Jeuck, R. C. Austin, Lincoln Clark, Paul Veenlingzen.

Colorado

The January meeting of Colorado section was held at the Oxford Hotel, Denver, at Noon on January 19th.

The meeting was opened by President Prosser who introduced W. P. Cary, '10, of the Bay Cities section and asked him for a few words. Mr. Cary stated that the Bay Cities section had many enthusiastic members who always enjoyed getting together to discuss Colorado School of Mines activities. V. C. Robbins, Ex-'12, of McAlester, Oklahoma, was also called upon who expressed the desire to attend more meetings of Colorado section because of their interesting nature. A third visitor was Robert H. Sayre, Jr., '34, who is now at Ward, Colorado.

This being the annual business meeting of the section, the president asked for the treasurer's report for the year 1939 which was read and approved. It was noted that Colorado Section is now in good financial condition.

Frank Bowman, chairman of the Nominating committee, was then called upon to give recommendations for officers for the coming year, which he did as follows:

President, D. L. Lay, '35; Vice-President, R. J. McGlone, '27; Secretary-Treasurer, A. L. Mueller, '35.

A motion was made, seconded and carried that these men be the officers for 1940.

The high-light of the meeting was F. C. Carstarphen's talk on "The Future of the Mining Engineer". Dr. Carstarphen gave many statistics on a young man's chances of becoming a successful mining engineer, compared with one of some years ago. He made one definite conclusion that the young man of today has a much better chance of succeeding if he has an education, although he may not follow the field in which he thought at first he would specialize. Dr. Carstarphen closed his talk with his viewpoint on conditions today in relation to business. (His address will appear in an early issue of Mines Magazine.)

The following members were present:

Frank C. Bowman, '01; Robert H. Sayre, Jr., '34; V. C. Robbins, Ex-'12; Dean J. R. Morgan; W. H. Paul, '96; G. A. Kennedy, '95; W. P. Cary, '10; A. E. Perkins, '10; B. B. LaFollette, '22; R. S. Spalding, '33; A. L. Mueller, '35; D. L. Lay, '35; Warren Prosser, Ex-'07; F. C. Carstarphen, '05.

New York

Many thanks are due Fred Sealey, '17, for the entertaining program which he provided for the January meeting of the New York Section. The meeting was held at the Western Universities Club in New York City, the evening of January 9th.

The entertainment consisted of a number of slides and movies of the construction work of the Barco pipe line which was recently completed across Colombia from the Barco oil concession to the coast. Mr. Phillip Humphrey of the Texas Co. was present as a narrator for some slides and movies which he had taken and he also showed the group some movies which were taken by a Fortune magazine photographer. This pipe line was constructed over very rugged and wild terrain which not only offered many construction difficulties, but also presented a complicated problem of supplying equipment and food. This problem of transportation of supplies was solved by operating a fleet of airplanes which hauled in most of the food and equipment even up to "bulldozer" tractors and road scrapers.

Those present were:

Harry J. Wolf, '03; Warren Currens, '12; C. L. French, '13; Fred Sealey, '17; George Roll, '19; J. G. Bevan, '21; Jack Bonardi, '21; Frank McKinless, '23; Wm. Berry, '24; B. W. Geddes, '37; Jack Leary, '38; Jim Hollywood, Ex-'37; and guests Messrs. Roll, Butte, and Humphreys.

Oklahoma

Twenty miners attended the first meeting in 1940 of the Oklahoma Section of the C. S. M. A. A. Following dinner in the dining room at 7 o'clock, a brief business meeting was held in the Oriental Room of the Tulsa Hotel, to elect officers for the new year. Those elected were as follows:

President, John R. Evans, '23; Vice-President, A. F. Beck, '25; Secretary-Treasurer, D. H. Peaker, '32.

Having disposed of the regular business, the meeting adjourned to view movies of some of the *Mines* games played last year. Eddie Chapman arranged to obtain the films and E. A. Renfro ran them off using his projector. Films of the Aggies, C. C., Greeley and Chadron games were shown without stopping. We outdid "Gone With the Wind" as it took slightly more than four hours!

Everyone was delighted—not only with the films which were very excellent, but with the team. It was a very enjoyable sight to see a *Mines* team that consistently blocked well, tackled hard, executed plays perfectly and won games. The team and coaches are to be highly complimented and we are justly proud of them.

We wish to extend our thanks to those who sponsored the making of these films. They gave us a very enjoyable evening.

In addition to members from this area, we had two visitors present—M. P. Huntington, '26, from Casper, Wyoming, and B. M. Bench, '30, from Dallas, Texas.

Members present were:

G. F. Bauer, Jr., Ex-'38; A. S. Bunte, '26; Raymond Carr, Ex-'19; M. E. Chapman, '27; R. D. Curtis, '26; G. V. Dunn, '20; E. J. Dickinson, Ex-'18; L. E. Elkins, '34; J. R. Evans, '23; W. M. Gebo, '23; P. A. Gill, '36; R. N. Hastings, '30; M. C. Kiess, '25; F. Lindeman, Jr., '33; E. A. Renfro, '30; A. A. Townsend, '35; W. A. Van Hook, '35; R. E. Westling, '37.

ALUMNI ASSOCIATION

Business Reports

Report of Special Meeting Executive Committee
January 23rd, 1940

A special meeting of the Executive Committee was held in the Alumni office on Tuesday, January 23, 1940 and continued to January 25th, 1940, at 8:00 P.M. for the purpose of appointment of committees and adopting an operating budget for the year 1940.

Members present were Frank C. Bowman, Vice President, George W. Thomas, Treasurer, A. George Setter, Acting Secretary, Charles O. Parker and retiring members, Russell H. Volk, Past President, T. Court Doolittle, Treasurer. Absent were Edward J. Brook, newly elected President and Fred C. Carstarphen, newly elected member of the Executive Committee.

Mr. Bowman read an address from the President to the Executive Committee and other important points brought out.

Mr. Brook stated, "Our Executive Committee consists of the elective officers and chairman of the standing committees, each of whom has one vote. So that each committee may be represented at every meeting, if the chairman cannot attend, he shall make arrangements for his vice-chairman or one other committee member (if the vice-chairman is unable to attend) to attend meetings and vote his proxy. This will give us a full expression of opinion at each meeting. To the standing committees provided for in the constitution, Nomination, Athletics, Instruction, and Publication, we will add the following this year, Capability Exchange, Membership, Budget and Finance, Alumni Foundation, Legislative, and Public Relations. The last four are new to our set-up.

"I suggest that the policy be adopted by the Executive Committee to have each Committee Chairman submit a written report covering the activities of his committee between business meetings. This (1) greatly lessens the work of the secretary and (2) gives us a correct, concise progress report of each committee."

Chairmen of the various committees will welcome suggestions from all Mines Men regarding ways of increasing the scope of Alumni Activities for the benefit of all. The continued and combined interest and efforts of all will help your committees accomplish the most. Send in your suggestions.

The resignation of Edward J. Brook as member of the Executive Committee was read, which was necessitated by his election to the office of President of the Association. The resignation was duly accepted by the committee and at the suggestion of the President, M. Edward Chapman of Tulsa, Okla. was appointed as a member of the Executive Committee to fill the unexpired term of Edward J. Brook.

At the suggestion of Edward J. Brook, President, the following men were considered and approved by the Executive Committee to serve on the various committees for the year 1940:

Budget and Finance
T. Court Doolittle, Chairman
Russell H. Volk, Vice-Chairman
Frank C. Bowman
A. George Setter
George W. Thomas
Frank A. Brown

Publication
Bruce B. LaFollette, Chairman
J. Harlan Johnson, Vice-Chairman
Charles W. Henderson
Fred C. Carstarphen
John H. Winchell
Claude L. Barker
Russell H. Volk
Arthur W. Buell
W. A. Waldschmidt

Capability Exchange
Allan E. Craig, Chairman
Max W. Bowen, Vice-Chairman
Jack Paddleford
George V. Dunn
Russell B. Paul

Public Relations
Donald Dyrenforth, Chairman
A. E. Perkins, Vice-Chairman
Dent Lay

Nominations
Kenneth E. Hickok, Chairman
Vice-President of each Local Section

Membership
Russell H. Volk, Chairman
W. A. Waldschmidt, Vice-Chairman
C. K. Viland
Lamont E. Smith
Clare L. French

Alumni Foundation
C. Lorimer Colburn, Chairman
James Boyd, Vice-Chairman
Willis J. Boyle, Jr.
Alan Kissock
Donald M. Davis

Athletic
James W. Dudgeon, Chairman
Joseph M. Maxwell, Vice-Chairman
Frank E. Briber
Ronald S. Coulter
George G. Goodwin
J. Kell Houssels

Instruction
Keppel Brierly, Chairman
William P. Huleatt, Vice-Chairman
Arthur S. Adams
William J. Rupnik

Legislation
A. George Setter, Chairman
Malcolm E. Collier, Vice-Chairman
L. R. Van Burgh

The report of the Budget and Finance Committee was presented and each item was discussed. After due consideration the Budget as presented by the committee was approved and adopted for the year 1940 by the Executive Committee and is as follows:

BUDGET FOR THE YEAR 1940

	Budget 1939	Allowed for 1940
RECEIPTS		
From Accounts Receivable	$ 1,000.00	$ 2,423.32
Alumni Council		200.00
Capability Exchange	180.00	50.00
Dues	2,100.00	2,892.16
Entertainment Committee		300.00
Interest	80.00	80.00
Miscellaneous	100.00	100.00
Publications	12,500.00	14,100.00
	$16,360.00	$20,145.48
DISBURSEMENTS		
For Accounts Payable	$ 2,500.00	$ 4,055.93
Alumni Council		200.00
Bank Service Charge	25.00	50.00
Capability Exchange	180.00	150.00
Entertainment Committee		400.00
Insurance		9.55
Membership Committee	300.00	400.00
Miscellaneous	75.00	100.00
Postage	700.00	550.00
Printing and Multigraphing	100.00	100.00
Publications	9,100.00	10,694.00
Rent	480.00	480.00
Salaries	2,500.00	2,500.00
Stationery and Supplies	200.00	150.00
Telephone and Telegraph	100.00	150.00
Traveling	100.00	150.00
	$16,360.00	$20,139.48

RECAPITULATION

Cash on hand, January 1, 1940	$ 423.27
Estimated receipts	20,145.48
	$20,568.75
Estimated disbursements	20,139.48
Estimated cash on hand, January 1, 1941	$ 429.27

Working In Foreign Countries—

(Continued from page 74)

holiday. But I think the above remarks may be of interest to the majority of Mines students.

Now, as to the possibilities of obtaining employment upon arrival, after having successfully passed the Pthisis Board examination:

I came to South Africa two years ago. Since I have been here two classes have been graduated, the Class of '38 and '39. Out of those classes, the Rand could have absorbed from twenty to fifty mining graduates easily and not felt the strain.

It is a recognized fact that the Witwatersrand University, located at Johannesburg, although a good university, does not furnish sufficient technical men to meet requirements. This must not be considered as derogatory to the university nor to the graduates. It is a compliment to the size of the Witwatersrand mining area.

The people here are kindly disposed to Americans. With reasonable tact, the average engineer should be able to live peacefully and happily in South Africa. Beginning salaries of the young engineer are not large, but sufficient to insure a decent standard of living. Cost of living is rather higher than in the States but the mines generally have accommodation for both married and single men at a scale employees are able to pay.

To obtain preliminary contacts the prospective emigrant should select mining companies from the Mining Year Book. By making an intelligent application to say fifty or one hundred companies, I am confident those interested in obtaining a position here will receive either a definite offer or sufficient encouragement to warrant a visit to the gold mines of the Witwatersrand.

To those young men desiring to come to the Union of South Africa, I hope these words may be of some help in realizing their aim.

A. S. Walter Heads New Mexico M. & P. Association

A. S. Walter, '15, was elected president of the New Mexico Miners and Prospectors Association at their annual convention held in Albuquerque, New Mexico, on January 19 and 20, 1940. He succeeds T. D. Benjovsky, '09, who has been operating in New Mexico since 1935.

Walter, who is dean of Mining and Metallurgy at the New Mexico School of Mines, has had over thirty-two years experience in mining, milling and metallurgical fields and is junior member of the firm of R. J. Walter and A. S. Walter Consulting Mining and Metallurgical Engineers, established in Colorado in 1879.

In 1929 and 1930 he appraised all the coal and metal mines in New Mexico for the State Tax Commission and has made a large number of private mine examinations and mill tests. He formerly operated the Rosedale and Nogal mines.

1939 Applications of Electric Equipment—

(Continued from page 75)

locomotives deliver the cars from the storage yard to the mule pit.

A special feature of the mule drive is an interlocking circuit which prevents the car from overrunning the mule on a power failure or emergency stop, thus preventing breakage of the hoisting cable. Another feature of this dumper is a barney cycle that assures loaded cars at the dumper when required. The barney will move a 120-ton loaded car up the slope at 10 to 12 mph and return at 15 mph to pick up another car. The speed of the barney is automatically controlled as it picks up the car.

Special thrustor brakes are used on the main drives, each of these brakes having a sufficient capacity to hold the cradle in position, so that reroping can be carried on without anchoring the cradle. The dumping rate is also aided by equipment for spotting cars on the dumper which includes a car retarder on the platen to stop loaded cars having a speed of five to six mph within five seconds and 22 feet of travel. Cradle operating speeds permit hoisting, dumping, and lowering the car within the alotted time and automatic control regulates the speeds at critical points in the cycle.

Another feature that speeds up the dumping rate and avoids degradation of the coal is a coal flow retarder with a 54-foot baffle and a travel of 15 feet in the pan from the top position at the lip of the overturning car. The coal flow re-

(Continued on page 89)

Annual Business Meeting — Reports of Committees

(Continued from page 56)

James W. Dudgeon, Chairman of the Athletic Committee gave a very inspiring report for his committee as follows:

It is with real pleasure that I make the annual report of the Athletic Committee. It is not necessary for me to again reiterate all the details of the greatest football team in Mines history, as these are all known to you. However, the part that the Association played in making it possible to produce a football team in an engineering school of the standing of Mines, undefeated and untied with the national high scorer, two All-Americans, the winner of the Williamson award for the most valuable college football player in the country, placing eight out of its eleven men on the All Rocky Mountain Conference team, I believe is of interest to all of you.

Three years ago, when Athletics at Mines had reached such a low ebb that there was a question whether we should continue inter-collegiate competition, a few men, loyal to the School, worked out a well planned program for the betterment of Mines Athletics. This program, as you all know, has been carried out and has produced results far beyond our wildest expectations. This was merely the result of carrying out an intelligent program for the betterment of our athletic standing at the school and although we cannot hope to produce a team each year comparable to that of the past season, nevertheless, I can assure you that if we continue to carry out the program that has been so carefully planned we will, year after year, turn out teams at the school that we can all be proud of.

In making this report tonight the thing that gives me the greatest pleasure is to tell you that this has all been accomplished by means that have in no way lowered the academic standards at Mines. There has not been any subsidizing, commercializing or professionalizing of athletics at Mines. Every player was a bona fide student of the school and had to withstand its rigid requirements in their entirety. The facts are that the football players were well above the average of the school in their scholastic standing. I want to assure every Alumnus that never will there be any deviation from the high academic standards of Mines for the benefit of Athletics. We have proven, and definitely so, that we can have good athletic teams without the necessity of sacrificing our standards.

TREASURER'S REPORT
COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION
BUDGET FOR THE YEAR 1939

Dec. 31, 1939 — No. 12

DISBURSEMENTS

	Budget Approp. 1939	Disbursements	Percent Expended	Credit Balance	Debit Balance
For Accts. Payable	$ 2,500.00	$ 2,936.72	117.47		$ 436.72
Bank Service Chg.	25.00	44.78	179.12		19.78
Capability Exchange	180.00	135.40	75.22	$ 44.60	
Membership Com.	300.00	374.66	124.88		74.66
Miscellaneous	75.00	1,453.89	1,938.52		1,378.89
Postage	700.00	523.27	74.75	176.73	
Printing and Multg.	100.00	62.28	62.28	37.72	
Publications	9,100.00	6,465.67	71.05	2,634.33	
Rent	480.00	480.00	100.00		
Salaries	2,500.00	2,336.25	93.45	163.75	
Stationery and Supplies	200.00	133.30	66.65	66.70	
Telephone and Telegraph	100.00	113.48	113.48		13.48
Traveling	100.00	40.00	40.00	60.00	
	$16,360.00	$15,099.70	92.29	$3,183.83	$1,923.53

	Budget Estimate	Coll. No. Dec.	Coll. To date	Percent Collected	Amount Expected
From Accounts Receivable	$ 1,000.00	$ 9.61	$ 1,853.14	185.31	$ 853.14*
Capability Exchange	180.00		16.43	9.12	163.57
Dues	2,100.00	250.00	2,239.45	106.64	139.45*
Exchanges	400.00		400.00	100.00	
Interest	80.00	11.65	79.40	99.25	.60
Miscellaneous	100.00	77.07	887.88	887.88	787.88*
Publications	12,500.00	615.40	9,937.23	79.49	2,562.77
	$16,360.00	$963.73	$15,413.53	94.21	$ 946.47

* = Debit.

RECEIPTS

Balance at beginning of budget period	$ 109.44	
Income to date, budget period	15,413.53	$15,522.97

DISBURSEMENTS

Expenditures to date, budget period	15,099.70
Cash on hand	$ 423.27

RECAPITULATION

Accounts Payable on December 31, 1939		$4,055.93
Less Accounts Receivable December 31, 1939	$2,423.32	
Cash on hand	423.27	2,846.59
Net deficit January 1, 1940		$1,209.34
The net deficit Jan. 1, 1939, was		$1,680.16
The net deficit Jan. 1, 1940, was		1,209.34
Reduction during the year 1939		$ 470.82

Respectfully submitted,
T. C. DOOLITTLE,
Treasurer.

1939 Applications of Electric Equipment —

(Continued from page 87)

tarder is for two purposes—to permit rapid loading and to avoid degradation. The retarder prevents a drop and free run of coal in the pan and also permits the continuous loading of coal in the vessel during the intermittent dumping of coal.

Power for the main drives is supplied by two four-unit, five-bearing synchronous motor-generator sets, each consisting of two 450-kw adjustable voltage generators and one 375-kw constant voltage generator driven by a 2300-volt synchronous motor.

The mule and cradle are each driven by two similar 500-hp d-c motors whose armatures are duplicates of those for the 450-kw generators. This arrangement makes it possible to carry only one spare armature for the four generators and four motors used for the main drives for the dumper.

A novel attraction of the dumper is the fact that one generator on each of the main sets is connected to the mule and the same hook-up is used on the cradle, which is counterweighted to reduce power demands. By means of this arrangement, it is possible to obtain a diversity of loading on the motor-generator sets. When the mule is handling a loaded car, the cradle is coming down light. Likewise, when the load on the mule is light, the cradle is being hoisted under load. Another important advantage of this system of connection is that the dumper can still handle coal even though a major piece of apparatus should fail.

In erecting the plant, special care was taken to combine attractiveness with utility. The engine room is ventilated by a blower and filter arrangement so that fresh, clean air is supplied at all times. The dumper is equipped with floodlights for night operation.

New Dredge for U. S. S. R.

To start a 3,000,000-kva power project on the Volga, the U. S. S. R. is obtaining a 30-inch hydraulic dredge and 30-inch booster from Bucyrus-Erie Co. This dredging apparatus will be used in the erection of an earthwork and concrete dam across the Volga River.

Because of the distance between the dam and the spoil areas, and the height of the earth fill, the booster pump is required in addition to the main pump on the dredge. Power for the dredge and booster will be supplied from the shore by 750,000-cm shore cables. The electric equipment includes two 4000-hp, 333-rpm, heavy-duty wound-rotor dredge pump motors with liquid rheostats; the auxiliary dredge equipment includes the usual cutter-head drive, winch motor, transformers and switchgear.

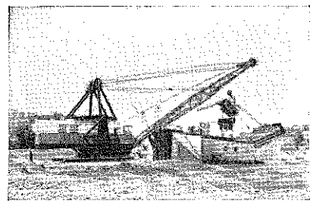
The dredging operations are the start of the Kuibyshev Power project which will supply electricity over a distance of 500 miles to industrial plants and load centers.

New Walking Dragline for California Gold Fields

Modern gold mining equipment was built by the Marion Steam Shovel Company for use in California fields. The

● Mountain Copper Company, Ltd., surface operations of gold mine 17 miles northwest of Redding, Calif. Showing "Caterpillar" tractor and truck-type wagons loading ore to haul to mill.

equipment, a walking dragline, is built with two shoes which, with the central "tub," walk it over marshy ground where ordinary track-type shovels could not enter.



The dragline is a 182-ton apparatus with a 100-foot boom enabling it to reach out in a radius of over 100 feet. The dragline scoops up the gravel and deposits it in a barge in which the recovery machinery is located. Here the gold is reclaimed from the gravel and the "tailings" gravel is dumped back in the hole from which it was scooped.

The walking operation of this dragline is accomplished by lifting the entire machine on, the shoes moving the suspended machine forward and then lowering it until it rests firmly on the ground. The base is a large "tub" between the shoes on which the machine rests—the large areas of the "tub" and of the pontoon shoes permit the machine to walk on swampy ground. The drive for this walking operation is taken from the main hoist machinery.

The electric equipment for the walking dragline consists of a motor-generator set, composed of a 250-hp a-c motor driving a 230-volt, shunt-wound generator for supplying power to hoisting motors, a 187½-hp hoisting motor with a blower for forced ventilation, a 40-hp rotating motor and various control and auxiliary items. The hoisting generator is rated 165 kw and the rotating generator 36 kw. Large floodlights are installed to illuminate the pit in front and rear of the dragline, thus facilitating night work.

New Books

Practical Oil Geology (5th Edition). By Dorsey Hager. Consulting Geologist and Petroleum Engineer. $4.00.

This is a guidebook of all-around interest, not only for the oil geologist, but also for the oil producer and engineer who wish to know exactly how geology may serve them. Descriptive and reference materials are combined to cover every phase of prospecting for oil and exploiting oil fields in which geologic science may be applied. The geologist will get from this book all the facts on the composition and properties of oil, the geologic structures in which oil occurs, problems of producing oil, and other specialized facts to enable him to apply his knowledge in this field. At the same time the petroleum engineer will get the fundamentals of geology that will be of aid to him in the problems of investigating and appraising oil fields, choosing methods of drilling and operating, etc., with constant application of geology to important commercial considerations.

Here is a clear, concise, and practical work on the occurrence of oil, and its geology. Covers facts about petroleum, fundamentals of geology, methods of geological exploration, factors in oil production, and other information needed to give the reader a well-rounded picture of the value of geology to the oil business and how geology can be used in the exploration for, and the exploitation of, gas and oil fields.

For 23 years, through four editions, this book has been a standard and widely-used guide to the application of geology to oil-field development and engineering. Now again it has been revised in all respects necessary to bring it completely up to date and to give readers practical information on newest developments in the field.

Public Speaking for Technical Men. By S. Marion Tucker. The Polytechnic Institute of Brooklyn. 397 pages, 5½x8, $3.00.

A readable and practical book on public speaking, written especially from the viewpoint of scientists and technologists, and showing how their characteristic faults in speaking may be removed.

Virtues and defects in speaking are interestingly and graphically brought to the reader through narrative treatment in a large part of the book.

The book is thorough, covering not only diction, organization of material, and platform technique, but also especially important helps for the technical speaker on how to use the blackboard, charts, and exhibits; how to use material meant for distribution among the audience; how to give a lecture with lantern slides; how to meet interruptions and answer questions; etc. A chapter on radio talking is included.

The Flow of Homogeneous Fluids through Porous Media. By M. Muskat. Chief of Physics Division, Gulf Research and Development Company. (International Series in Physics). 760 pages, 6x9, illustrated, $8.00.

This book has been made as complete as possible. However, no attempt has been made to discuss every conceivable problem of fluid flow. Rather the purpose has been to treat all typical problems that are of some practical interest.

Many of the problems will be of interest to engineers in the oil and gas industries. A considerable number are also applicable to the study of hydrological questions, irrigation, dam-construction problems, and those involving fluid flow through refractories and ceramic materials.

The first part of the book develops foundation and background for the detailed analytical treatments of the latter three parts. It presents the experimental basis for the fundamental laws, describes the technique for determining permeability, and formulates the empirical laws generally into the three partial differential equations which form the starting points for Parts II, III, and IV.

ERRATUM

In article, "Mitchell's Marble Mountain," January 1940 issue, page 10, captions on two illustrations were reversed. Captions should read: Fig. 2. Tomb of the Unknown Soldier. Fig. 3. Lincoln Memorial, Washington, D. C.

Professional Cards

PRIZE OFFER

Check the errors found in Mines Magazine as you read it. The reader reporting the most errors receives FREE one year's subscription to the magazine. The winner will be announced in the magazine the second month after publication. Send list of errors to Mines Magazine, 734 Cooper Building, Denver, Colorado.

PATENT SERVICE

Recent Patents Relating to the Mineral Industries, edited by James Atkins, registered patent attorney, Munsey Building, Washington, D. C.

Inquiries with reference to this subject or to any patents appearing in this department should be addressed to Mr. Atkins.

CASING PERFORATOR. Patent No. 2,186,323, issued Jan. 9, 1940, to Cicero C. Brown, Houston, Tex.

PACKER AND SETTING TOOL COMBINATION. Patent No. 2,186,324, issued Jan. 9, 1940, to Cicero C. Brown, Houston, Texas.

METHOD FOR ACIDIZING WELLS. Patent No. 2,186,349, issued Jan. 9, 1940, to John T. Simmons, Duncan, Okla., assignor to Halliburton Oil Well Cementing Co., Duncan, Okla.

HYDRAULIC PUMPING APPARATUS. Patent No. 2,186,411, issued Jan. 9, 1940, to James M. Gurley and Arnold M. Gurley, Fort Worth, Texas.

SAFETY DEVICE FOR MINE CARS. Patent No. 2,186,390, issued Jan. 9, 1940, to John Pugh, Pennington Gap, Va., assignor to Earl P. Smyth, St. Charles, Va.

FEEDING MECHANISM FOR SHAKER OR JIGGING CONVEYORS. Patent No. 2,186,472, issued Jan. 9, 1940, to Ernst R. Bergmann, Chicago, Ill., assignor to Goodman Mfg. Co., Chicago, Ill., a corporation of Illinois.

ROCK DRILL. Patent No. 2,186,503, issued Jan. 9, 1940, to Frank E. Sinclair, Claremont, N. H., assignor to Sullivan Machinery Co., a corporation of Mass.

APPARATUS FOR HIGH-VACUUM DISTILLATION. Patent No. 2,186,669, issued Jan. 9, 1940, to Eric William Fawcett and Godfrey Burrows, Northwich, England, assignors to Imperial Chemical Industries Limited, a corporation of Great Britain.

GONIOMETRIC DEVICE FOR DETERMINING THE DIP AND STRIKE OF STRATA FROM BORE-CORE. Patent No. 2,186,677, issued Jan. 9, 1940, to Frank Humphreys, Klerksdorp, Union of South Africa.

STRAIGHT HOLE BIT. Patent No. 2,186,725, issued Jan. 9, 1940, to James D. Hughes, Houston, Tex., assignor to Oil Well Engineering Co., Houston, Tex., a corporation of Tex.

METHOD OF RECOVERING GOLD FROM SAPROLITE GOLD ORES AND OTHER REFRACTORY SLOW SETTLING GOLD ORES. Patent No. 2,186,779, issued Jan. 9, 1940, to Bruce D. Crawford, Grass Valley, Calif., assignor to American Cyanamid Co., New York, N. Y., a corporation of Maine.

WELL BORE TREATMENT. Patent No. 2,186,875, issued Jan. 9, 1940, to Duke C. Matthews, Taylor, Tex.

PROCESS FOR THE PRODUCTION OF MERCURY FROM ORES. Patent No. 2,186,876, issued Jan. 9, 1940, to Harold B. Menardi, Los Angeles, Calif.

FLUID LIFT. Patent No. 2,186,886, issued Jan. 9, 1940, to Paul M. Sieck and Robert M. Holloway, Mission, Tex.

APPARATUS FOR REMOVING CONDENSATE FROM PIPELINES. Patent No. 2,186,923, issued Jan. 9, 1940, to Louis G. Hooper, Sarepta, La., and Virgil I. Hooper, Gordon, Tex., assignors to The Bastian-Blessing Co., Chicago, Ill., a corporation of Ill.

OIL FIELD POWER PLANT. Patent No. 2,186,999, issued Jan. 16, 1940, to Albert L. Sone and Allen E. Rice, Palos Verdes Estates, and Joseph H. Appleton, Los Angeles, Calif., assignors to Hydril Co., Los Angeles, Calif., a corporation of Calif.

RELEASABLE CABLE HEAD. Patent No. 2,187,007, issued Jan. 16, 1940, to Charles H. Barnes, Glendale, Calif., assignor to Lane-Wells Co., Los Angeles, Calif., a corporation of Del.

WELL SURVEY INSTRUMENT CASE. Patent No. 2,187,028, issued Jan. 16, 1940, to Ralph E. Hendrickson, Los Angeles, Calif., assignor to Lane-Wells Co., Los Angeles, Calif., a corporation of Del.

WELL TOOL OR THE LIKE. Patent No. 2,187,037, issued Jan. 16, 1940, to Lafayette H. Kirkpatrick, Pasadena, Calif.

BAILER OR SAND PUMP. Patent No. 2,187,042, issued Jan. 16, 1940, to William A. Larson, Centralia, Ill., and Harry T. Swortwood, Oklahoma City, Okla.

MEANS AND METHOD OF SAMPLING WELL FLUID. Patent No. 2,187,047, issued Jan. 16, 1940, to Keith H. Miner, Huntington Park, Calif., assignor to Lane-Wells Co., Los Angeles, Calif., a corporation of Del.

APPARATUS FOR DRILLING WELLS. Patent No. 2,187,092, issued Jan. 16, 1940, to William J. Newman, Chicago, Ill.

AUTOMATIC CONTROL FOR SWITCHING CARS ON AND OFF MINE CAGES. Patent No. 2,187,100, issued Jan. 16, 1940, to Karl Ruhl, Unna-Konigsborn, Germany.

MEANS FOR LOCATING AND CEMENTING OFF LEAKS IN WELL CASINGS. Patent No. 2,187,275, issued Jan. 16, 1940, to Amos N. McLennan, Maywood, Calif.

METHOD AND APPARATUS FOR ORIENTING DRILL SYSTEMS. Patent No. 2,187,367, issued Jan. 16, 1940, to George A. Smith, Philadelphia, Pa., assignor to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Del.

DERRICK. Patent No. 2,187,392, issued Jan. 16, 1940, to James F. Chappell, Mineola, Tex., assignor of one-half to Alvin H. Lane, Dallas, Tex.

DEVICE FOR MAKING DRILL PIPE CONNECTIONS. Patent No. 2,187,399, issued Jan. 16, 1940, to Louis J. Hopkins, Wasco, Calif., assignor to Continental Oil Co., Ponca City, Okla., a corporation of Del.

DRILL STEM DRIVE. Patent No. 2,187,405, issued Jan. 16, 1940, to James A. Smethers, Odessa, Tex.

PROCESS OF TREATING MOLYBDENUM. Patent No. 2,187,468, issued Jan. 16, 1940, to John D. Sullivan and Dimitry Niconoff, Columbus, Ohio, assignors to Battelle Memorial Institute, Columbus, Ohio, a corporation of Ohio.

DIAMOND DRILL BIT. Patent No. 2,187,384, issued Jan. 16, 1940, to George J. Maier, New York, N. Y., assignor to J. K. Smit & Sons, Inc., New York, N. Y., a corporation of New York.

MINER'S LANTERN. Patent No. 2,187,539, issued Jan. 16, 1940, to Pasquale Carbonara, Uniontown, Pa.

MINING APPARATUS (For the mining of coal). Patent No. 2,187,700, issued Jan. 16, 1940, to Edgar M. Cadwallader, Cleveland, Ohio, assignor to Mineral Cutting Machine Co., Inc., Cleveland, Ohio, a corporation of Delaware.

WELL CEMENTING APPARATUS. Patent No. 2,187,480, issued Jan. 16, 1940, to Reuben C. Baker, Coalinga, Calif., assignor to Baker Oil Tools, Inc., Huntington Park, Calif., a corporation of California.

WELL PACKER. Patent No. 2,187,481, issued Jan. 16, 1940, to Reuben C. Baker, Coalinga, and Clarence E. Burt, Los Angeles, Calif., assignors to Baker Oil Tools, Inc., Huntington Park, Calif., a corporation of Calif.

CEMENT RETAINER. Patent No. 2,187,482, issued Jan. 16, 1940, to Reuben C. Baker, Coalinga, and Thomas M. Ragan, Los Angeles, Calif., assignors to Baker Oil Tools, Inc., Huntington Park, Calif., a corporation of Calif.

FORMATION TESTING METHOD AND APPARATUS. Patent No. 2,187,486, issued Jan. 16, 1940, to Clarence E. Burt, Los Angeles, Calif., assignor to Baker Oil Tools, Inc., Huntington Park, Calif., a corporation of Calif.

BRIDGE PLUG. Patent No. 2,187,487, issued Jan. 16, 1940, to Clarence E. Burt, Los Angeles, Calif., assignor to Baker Oil Tools, Inc., Huntington Park, Calif., a corporation of Calif.

METHOD OF EXFOLIATING VERMICULITE AND SIMILAR MINERALS. Patent No. 2,187,538, issued Jan. 16, 1940, to Clarence H. Butler, Minneapolis, Minn., assignor to Amalgamated Minerals Corporation, Minneapolis, Minn., a corporation of Minn.

WELL CEMENTING APPARATUS. Patent No. 2,187,483, issued Jan. 16, 1940, to Reuben C. Baker, Coalinga, Calif., assignor to Baker Oil Tools, Inc., Huntington Park, Calif., a corporation of California.

MACHINE FOR CLEARING OUT PIPE. Patent No. 2,183,518, issued Dec. 19, 1939, to John O. Magruder, Los Angeles, Calif.

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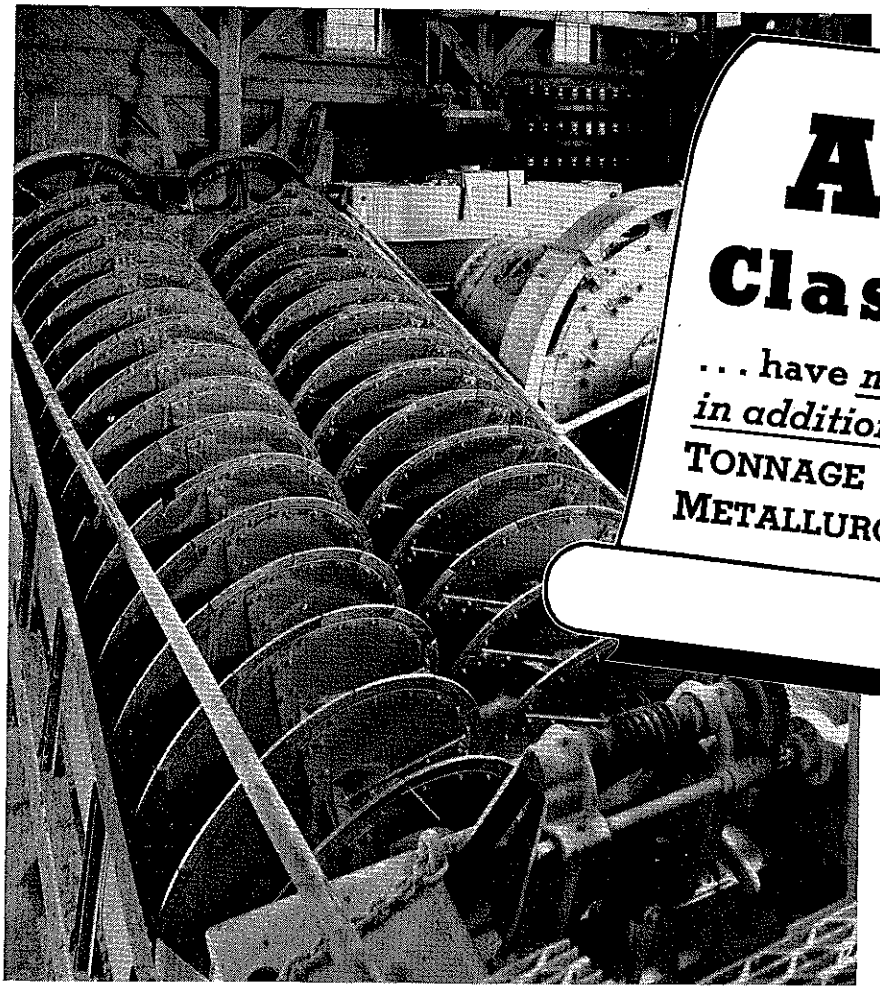

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