The COLORADO SCHOOL OF MINES MAGAZINE

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Outdoor Number

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....

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Colorado School of Mines Alumni Association

C. Lorimer Colburn, Secretary, 509-17th St., Denver, Colo.

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Editorial Comment

The Engineering Course

A YOUNG man, graduated from the Colorado School of Mines in 1928, recently ranked *third* in a general survey examination at the Tucker School of Business Administration, Dartmouth. This young man was granted the degree of master of business administration this spring.

If this has any special significance, it seems to be that the four years' engineering course at the Colorado School has a more general application than is commonly believed.

It is usually held that a specialized training, such as given in engineering schools, has no significance other than the imparting of practical knowledge, the application of which is definitely limited to a given field of activity. This belief has been contradicted many times. In pointing to this specific case—the case of one of our very recent graduates—we are not giving all the evidence. There is no hasty generalization here. A long list of prominent names could be compiled—men whose engineering training has proved valuable in other fields. An engineering course is intended primarily to train men for the engineering profession, but there are some general cultural values, after all, in such a course.

A Strong Department

STUDENTS from Georgia Tech, West Virginia University, Penn State, Louisiana University and other colleges are registered in the Colorado School of Mines summer courses for graduate work in geology. The Mines department of geology is recognized throughout the country as giving one of the most thorough and practical courses in mining and petroleum geology.

On the faculty in this department, the School of Mines has men whose actual experience in the field is notable.

Strengthened by the department of geophysics, which supplements the geology department, the geological training offered at Mines is not equalled anywhere else in this country. A geophysicist, you know, has been defined as a "real good geologist."

Chronical Knocking

IF your motor car commences to knock, you know that something is radically wrong with the engine, and if you are wise, you have it overhauled as soon as possible, either doing the job yourself, or hiring it done by a competent mechanic. But if you commence chronical knocking yourself, (by which I mean habitual, carping criticism), who is there to overhaul you? You must do the job yourself, or take chances of becoming a general nuisance, and perhaps ruining your own career and success in life.

I do not know whether it was a Rotarian or a Kiwanian who first coined the expression: "Throw away your hammer and use a saw. Quit knocking and saw wood. Be a Booster." Although I agree with the sentiment he was trying to express, it seems to me that there are two sides to this question. For example, if you hire a carpenter to build a frame house, and he reports on the job with a saw but no hammer in his tool kit, he will not be able to do much of a job until he gets a hammer or uses something else in place of one. Although it is a well known fact that "you cannot saw wood with a hammer", it is equally true that "you cannot drive nails with a saw". Both a hammer and a saw are necessary tools in a builder's kit, if used for their own proper purposes. A little of the right kind of knocking is sometimes helpful, but it must be constructive knocking.

—*R. P. FitzGerald, '10.*

Market Worth Cultivating

RECENTLY The American Mining Congress, through its Bureau of Mining Economics, made an investigation concerning the purchasing power of the mines. The result was most informative and amazing. For instance, taking the industry in the units into which it is geologically divided, a large coal company, representative in production of at least 50 of the great producers, spent more than a million and a half for supplies and replacement equipment. Multiply this sum by 50 and the result is quite a sizable market, isn't it? It is common knowledge that approximately 90 percent of our more than 500,000,000 tons of coal is produced by less than 2,000 companies. So this is a somewhat conservative estimate.

One large copper company, representative of the group of great producers, spent almost three millions for its necessary supplies and equipment. This expenditure may be multiplied by at least 10 to secure a fair estimate of the purchasing power of that industry. A large lead and zinc property spent approximately one million, and an iron ore producer nearly three millions. In addition, as is shown by another statement in this issue, our export trade in 1929 amounted to better than seventeen millions of dollars for the manufacturer of mining machinery. Certainly the mining industry offers a great market—one worth cultivating.

—*From the Mining Congress Journal.*

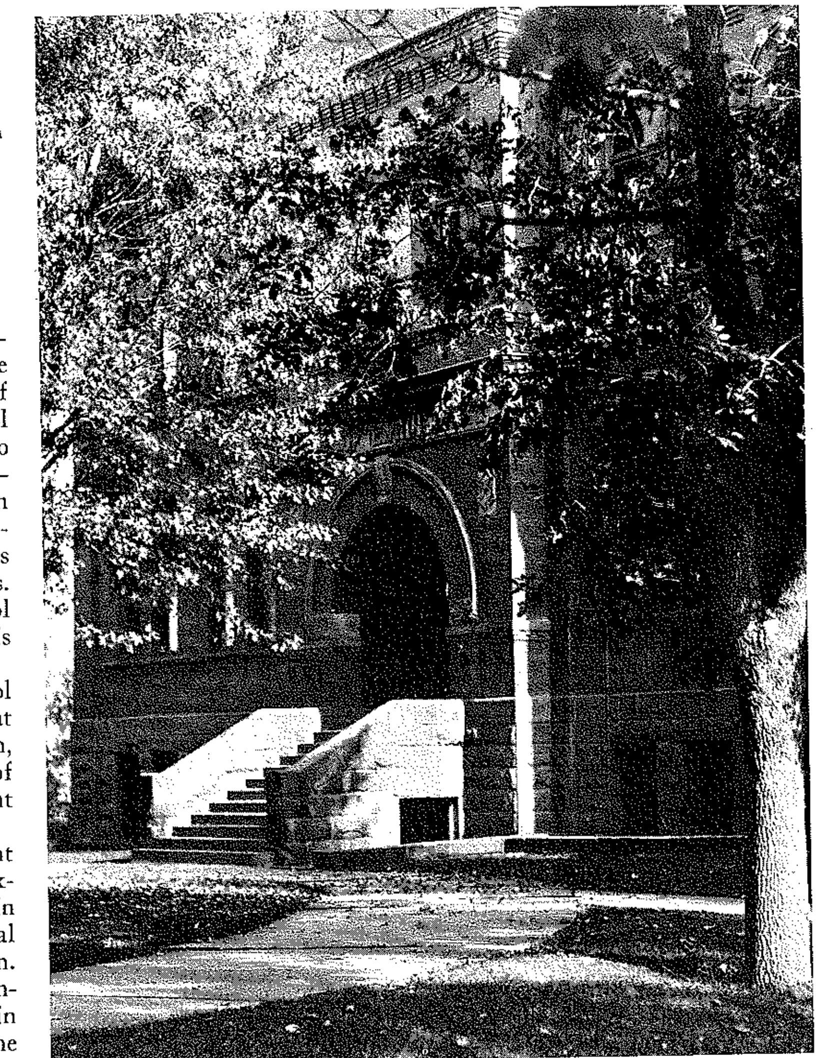
A Small School Puts It Over

Why not Mines?

AS an example of how other alumni associations are putting over the thing that the Mines Alumni are striving for, the case of Rollins College may be cited. Like the School of Mines, Rollins is comparatively small in so far as its student body is taken into account—the enrollment is about 400. Like Mines, in another respect, this southern school is an institution with less than a century of tradition, and its alumni do not number far into the thousands. The principal difference is that, while the School of Mines is an engineering institution, Rollins is a college of arts and sciences.

The alumni of this relatively small school announced in the June issue of their *Record* that more than $1,000,000 had been raised, in cash, since last March. This is almost one half of the amount set as their goal for their endowment campaign.

This is how it is being done: The president of the college and the alumni secretary are working together, and both are devoting their time in carrying out a well organized drive. Several formal dinners and luncheons have been given. These affairs were attended by a number of influential and wealthy men who are interested in promoting education. The endowment plan, the college aims and the purposes for which the money is to be employed are all carefully explained on these occasions.



Entrance to Hall of Engineering

Following is an outline of the general policy which the Rollins alumni adopted before the campaign.

"(a) To utilize all appropriate opportunities of describing the Rollins conference plan and its strongly developed spirit of mutual fellowship between faculty and students to men and women who might become interested in helping the endowment fund.

"(b) To report to the Alumni Chairman, Rex Beach, at the Endowment Office, 17 East 42nd Street, New York City, the names and addresses of potential donors, together with such details regarding them as may be helpful in making effective approaches. It is understood that the source of such suggestions will be held confidential.

"(c) To place themselves at the disposal of the President and this committee or its staff representatives whenever they may be engaged in work on behalf of the fund in cities where alumni are resident.

Why Not Mines?

If Rollins college, with an enrollment no larger than the School of Mines, and with an alumni list no longer than our own, can ask and receive from its friends such a sum of money in so short a time, why not Mines? No college has an alumni group that has shown more enthusiasm than our own bunch of Miners! The Mines Alumni Association *can* put its Foundation Plan across as easily and with as much success as the Rollins alumni are doing when the time comes.

At present the work on the School of Mines Foundation is still in its first stage—that of popularization. The best procedure, it has been held, is to give the Foundation plan as much publicity as possible before undertaking an organized drive for funds. A great deal of time has been given by various Alumni in committee meetings, working out the details of the Plan, and the machinery for the handling of gifts, bequests and the like has all been provided. The publicity campaign is now being carried into its third year, but there is one feature of this effort to popularize—the Plan which should be emphasized more.

The Magazine has carried, in practically every issue since the Plan's conception in 1928, a page editorial relating to the Foundation. Printed matter, broadcasting the School of Mines Foundation, has appeared often in various publications, but what is needed most at this time is a by-the-word-of-mouth campaign on the part of Alumni. It must not be inferred that information has not been given out in this manner. It has, but there should be more talking than ever before. We may take a hint from resolution (a) adopted by the Rollins alumni referred to above: "To utilize all appropriate opportunities of describing the plan . . . to men and women who might become interested in helping the endowment fund."

High pressure salesmanship is not necessary—it is not desirable. What is pertinent to the final success of the Foundation, however, is an understanding of what the Colorado School of Mines Alumni are trying to do in the way of raising much needed money for their Alma Mater. Influential men, men who hold high positions in the mineral industries in particular, should be informed. It is up to Mines men to give out this information, and when the time arrives for conducting an organized campaign, many friends of the Colorado School of Mines can be approached easily because of this preliminary talking which the Alumni will have done.

What Some Associations Are Doing

Various alumni groups have established what is called the "Alumni Fund". This is different from an "Endowment Fund" in that it is administered by the alumni association and not by the college or some other non-alumni board. These alumni funds are built up by donations from graduates, and in most cases by voluntary donations. The money accumulated in this manner is employed, as the association sees fit, in aiding alma mater. As an example of the functioning of such a fund the case of New York University is cited:

New York University alumni, through the Alumni Fund, have just given to the University $35,300.

In making the announcement, the chairman of the Alumni Fund Committee, reported that, after it had conducted a survey of the needs of the University and its several schools and colleges, decision was reached to assist through the Alumni Fund those agencies which seemed most worthy of help at this time. Accordingly, ten schools, colleges, and funds in the University received various amounts of the total sum, of which the largest contribution, $15,000, went to the fund for faculty pensions. Started in 1928, the Alumni Fund has received from alumni approximately $80,000. This money has been obtained solely on a voluntary basis. No stated amount has been requested, and alumni have felt free to give entirely as their personal circumstances dictated. For example, the 1930 Alumni Fund received contributions ranging all the way from $1 to $1,000.

Something Definite to Consider

Many of us are unable to grasp the full significance of a project when stated in the abstract. And so here is a concrete example of what the Foundation could do for the School in the way of providing new buildings. The Colorado School of Mines has not had a new building for over twenty years. Even so the outside appearance of the campus is something to be proud of. However, crowded conditions prevail on the inside. *One new building* would relieve this overcrowded condition to a great extent.

Strange to say, the one new building proposed is a gymnasium. Yet, it is not so strange when explained, for the interior of the present gym would be remodeled into laboratories and class rooms. It is centrally located, near to Guggenheim Hall, and therefore an ideal building for instructional purposes. As a gym, this building is not only out of place, but is sadly out of date. The basketball court is too small for indoor games, but it could be converted into a splendid museum to house all the valuable specimens now scattered among the various buildings about the campus. The lower floors of the present gym are unsuited to the needs of a physical education department which, through the encouragement of intramural sports, has expanded ten fold since the day this building was erected. With a few partitions, this floor space could be made to accommodate a large number of students.

The new gym would be built on a lot just one and a half blocks from Brooks Field. It would be better located here than would a building for instructional purposes. Perhaps the most evident advantage of having a new gymnasium is the stimulus to athletics which would follow the installation of better equipment.

A new gymnasium—Here is a definite project for consideration with all generalities removed.

The New York University Alumni are sponsoring a "Gymnasium Fund". During its first year this fund has grown to $124,812. About 360 alumni have made individual subscriptions, averaging $53.60 for each contributor. Of the total amount subscribed for the new gymnasium so far, the engineering graduates have donated $53,000. Other amounts have been subscribed by various groups, classes, and so forth.

The individual donations of the 360, who were not counted in the various groups, is significant. There are always a number of loyal members in any organization who give help, both financial and otherwise, without having to be stimulated to action by a group rally.

Here is a thought, left at the very end of this essay, to be pondered over in the Alumni minds: What individual in the Colorado School of Mines Alumni Association is interested enough and able financially to donate enough money to start a new gymnasium this year? What two individuals, or possibly what three, are willing to get together on such a project and donate $100,000 for a building at Mines?

Alumnus Takes up Old Duties

L. J. Hartzell, '95

Lester J. Hartzell will return to the Montana State School of Mines in September after a year's leave of absence which was spent in study at Oberlin college, Ohio. Since his graduation from the Colorado School of Mines in 1895, Professor Hartzell has been connected with the Montana institution. He is now the head of the chemistry department.

While at Oberlin, Professor Hartzell was associated with Dr. H. N. Holms, the noted authority on colloidal chemistry. In addition to his study under Doctor Holms, he taught several classes in Chemistry at Oberlin.

Professor Hartzell took advantage of the holiday recesses while at Oberlin to do a great deal of traveling. He visited a number of industrial plants and more than a dozen educational institutions, including such schools as Case, Western Reserve, Columbia, New York University, Pittsburg and the Mellon Institute.

While travelling in the East, Professor Hartzell met many School of Mines Alumni, and he reports that all of them expressed enthusiasm for Mines. He and Dan Harrington of the safety division of the U. S. Bureau of Mines, had a long chat in Washington.

The Hartzells returned to Butte by way of Golden and Denver. Professor Hartzell expressed himself as well pleased with the growth of the Colorado School of Mines. He visited the Alumni office in Denver and talked over old times.

Anomalies of Vertical Intensity

By George B. Somers, '29

Correlation of the Anomalies of vertical intensity of the earth's magnetic field with the regional geology of North America

This thesis was presented to the President, Board of Trustees and faculty of the Colorado School of Mines by George B. Somers as a partial fulfillment of the requirements for the degree of Doctor of Science.

The entire thesis will be published in this Magazine in five consecutive installments.

Introduction

As originally planned this work was to cover thoroughly the whole of North America. In working up the magnetic data, however, it was found that although there were numerous stations for Alaska, Mexico and Central America, these stations were so widely scattered that no connection could be shown between the isonomalics for these countries and the geology. Furthermore, Northern Canada was found to be practically devoid of magnetic stations with the exception of a few along the Alaskan boundary. Consequently, the major portion of the work was concentrated on the United States and Southern Canada.

It was found from the first few states examined that little could be inferred about the geology from the isonomalic lines unless something was already known regarding the regional geology. For example, in places the magnetic "highs" coincided with the geologic structural highs, while at other points the reverse was found to be the case. Under the circumstances it become necessary to try and correlate known geologic structures with magnetic anomalies as found, and to try and explain the causes for position and negative magnetic effects from similar geologic structures. It was also decided to make plain isonomalic maps which might prove useful to persons wishing to make more thorough magnetic and geologic investigations.

In order to obtain the most recent geological data, copies of the isonomalic map were sent to the various State Geological Surveys with requests that the geologic structures be plotted on the maps. The response was excellent, and showed, on the whole, considerable interest in this line of work. The information thus obtained was of great aid in the preparation of this thesis. Unfortunately, a few states did not reply, others reported such data as "not known" or "unobtainable", and a few that the geology was too complicated to show on such a small map. In addition some states appeared so small on the maps and the magnetic data for them was so scanty that very poor interpretative results were obtained.

In a similar manner the isonomalic map of Canada was sent to the Bureau of Mines at Ottawa.

As a result of the variations in the amount of geologic and magnetic data obtainable, equal attention could not be given to the different states. Probably the state of Colorado brought out the possibilities and difficulties of correlation better than most of the others inasmuch as this state offered many types of structures, and considerable data, both geologic and magnetic, was available. Other states which offer more than the usual amount of interest are California, Texas and Florida.

It should be stated here that while there were approximately 4300 magnetic stations in the United States, and 900 in Canada, that these stations were so widely scattered that it was usually possible to show regional structure only.

In order to remove as far as possible local magnetic effects which did not reveal local structure but simply clouded the regional anomalies, a 250 gamma isonomalic interval was used. A 100 gamma interval was found to show too many meaningless local anomalies, while a 500 gamma interval left out too much regional information.

Acknowledgments

The writer acknowledges with pleasure his indebtedness to the United States Coast and Geodetic Survey, the Topographical Survey of Canada, the Carnegie Institution of Washington, and the Observatorio Astronomico Nacional de Tacubaya, Mexico, for the magnetic data used in this thesis. To the United States Geological Survey, the Canadian Bureau of Mines, the Instituto Geologico de Mexico and the various State surveys and Universities for geological data obtained either directly from them, or from their publications. To Dr. C. A. Heiland and Dr. F. M. Van Tuyl of the Colorado School of Mines faculty for their helpful suggestions and criticisms. To Dr. Jaroslav Malkovsky for information and personal assistance with a magnetometer which aided in clearing up many problems in Colorado. To Professor J. Harlan Johnson of the School of Mines faculty and Dr. T. S. Lovering of the United States Geological Survey for their assistance with the geology of Colorado. To Mr. Dart Wantland, also of the School of Mines faculty for his preliminary criticisms of this thesis, and to any others not specifically mentioned, who rendered aid in the preparation of this work.

Definitions

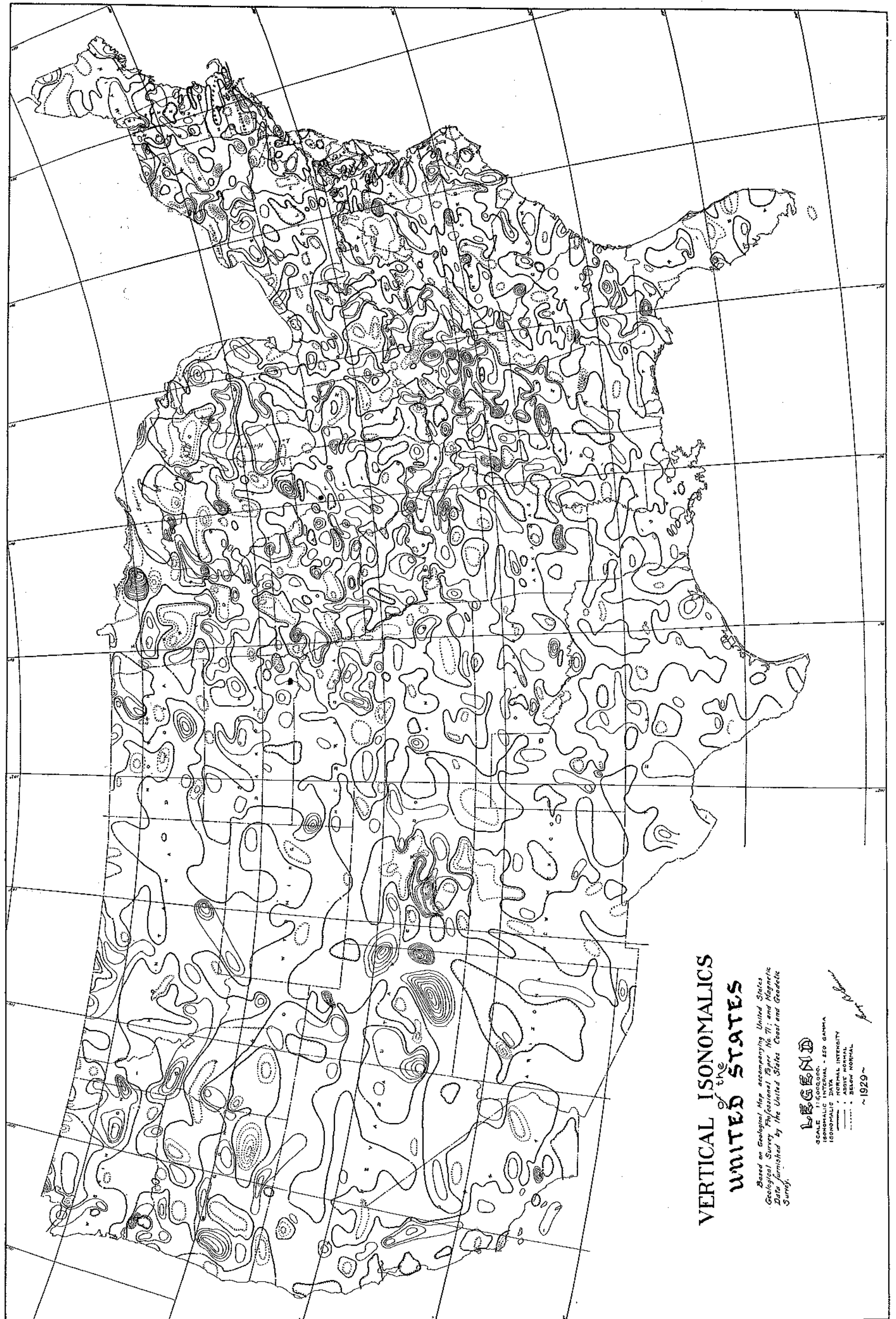
Isonomalic line—A line which connects points of equal intensity of magnetic anomalies after the intensities have been corrected for planetary effects.

Isomagnetic line—A line which connects points of equal intensity with no correction for planetary effects. On the United States Coast and Geodetic Survey map of vertical intensity for 1925 for the United States, the isomagnetic lines have been smoothed out.

Anomaly—A variation from the normal planetary, regional or local effects.

Positive Anomaly—One in which the intensity is greater than normal.

Negative Anomaly—One in which the intensity is less than normal.



Gamma—1/100,000 of a gauss.
"High"—A magnetic high.
High—A structural high.

In several places in this thesis the expression "the isonomalics coincide positively (or negatively) with the structure" is issued—By "positive coincidence" is meant those conditions where a magnetic "high" coincides with a structural high. Conversely "negative coincidence" has meant that a structural high coincides with a magnetic "low" or vice versa.

Chapter I—method of procedure

Selection of a Base Map

In order to show the relationship between the anomalies of vertical intensity and the regional geology to advantage, the best method seemed to be to superimpose the isonomalics onto a geologic map of North America. The best geologic map available for this purpose was the one accompanying Professional Paper No. 71 of the United States Geological Survey, but after due consideration it was decided that a tinted tracing of this map on tracing cloth would be more suitable for the following reasons: (1) The map was out of print and copies were hard to obtain. (2) Tracing cloth would be more durable, and corrections or alterations could be more readily made. (3) The colors on the map were too deep to show the isonomalics to the best advantage. (4) Unnecessary material could be eliminated in tracing.

After this tracing was made it was found that the isonomalics still did not show to best advantage on account of the colors. Furthermore, prints could not be made from it. Consequently plain outline maps showing only the countries, states and isonomalics were made on tracing paper. From these white prints were made so that each copy of the thesis could be provided with maps. The original colored tracing was then presented to the Geophysics Department of the Colorado School of Mines for reference work.

Preparation of Magnetic Data

General—In order to locate magnetic stations accurately without putting too many lines on the tracing, a supplementary sheet was made on which the meridians and parallels of latitude were drawn for each degree. By means of this supplementary sheet the stations could be easily and accurately transferred to the tracing from data sheets and maps.

On account of the fact that the magnetic intensity at any point changes from year to year, it was necessary to choose some year as a base and then obtain the vertical intensity of each station for that year in order to make the results conformable. 1925 was chosen as being the most recent year for which the greatest amount of data was readily available. The balance, given chiefly for 1915, 1920, 1924 and 1926 was recalculated for 1925.

The United States—The magnetic data for the United States for the year 1925 was obtained from a photostat copy of a vertical intensity map prepared by the United States Coast and Geodetic Survey for that year. This map gave both the vertical intensity at each station and the calculated or approximate location of the isomagnetic lines for each one thousand gamma or hundredths of a gauss.

Each station was given a number for convenience in making calculations and plotting results. Several different systems were used as new ideas occurred and were tried out during the numbering process, but on the whole the numbers will be found to occur in groups. In a narrow strip which ran across Kentucky, Southern Ohio, West Virginia, Pennsylvania and New Jersey, the stations were so close together that a four figured number could not be given conveniently to each one. In order to overcome this difficulty the area was divided into five sections which were labelled A, B, C, D, and E. As each section contained less than one hundred stations, each station could be given a two figured number.

In several instances stations were overlooked during the numbering process and these were later given the number of a nearby station together with a letter as 367A or 367B for example. They were thus easier to locate when the calculations were made and plotted than they would have been had they been given a consecutive number which differed by several hundred from those of surrounding stations.

Inasmuch as the vertical intensity increases from zero at the magnetic equator to a maximum at the north magnetic pole it was necessary to make a correction for this planetary variation in order to bring all stations to a common or normal basis before anomalies could be determined. In a previous article[1] of a similar nature the writer used a base station and compared all other stations to this base. The average change in gamma per mile in north-south and east-west directions was computed. This result was multiplied by the distance north or south and east or west of the station to be corrected, from the base station. The algebraic sum of these two corrections added algebraically to the value of the station gave the corrected value for that station. The method worked in a fairly satisfactory manner for one state, but it had several drawbacks for a larger area. First, it gave only the average change per mile while the actual change may have varied considerably from the average. Second, the error introduced by using the average change would have been too great over an area as large as the United States, especially as the average changes at every point from east to west and north to south. Third, it was both cumbersome and liable to error. Fourth, the corrections at the extreme points of the country would have been so large that the anomalies by comparison would have been too small to be effective. Other methods of eliminating the plaintary or regional effect have been used by Nippoldt and others but the one used here was decided upon as being more suitable for this work.

In order to overcome the difficulty, an entirely different scheme was used. First, the normal value vertical intensity was determined for each station by interpolating between the isomagnetic lines on the United States Coast and Geodetic Survey map: These lines on the map have been smoothed out to such an extent as to leave an appearance of continental anomalies but to eliminate regional and local ones. The value thus obtained was considered to be the true value of the station. The difference between this calculated value and the value given on the map (column 2 in data sheets) was taken as the anomaly at that station. This anomaly was considered as positive when the given value was greater than the true or calculated value, and negative when the given value was smaller.

After all the stations had been calculated and plotted, the isonomalic lines, or contour lines connecting points of equal anomalies, were drawn at 250 gamma intervals. This interval was chosen to remove any errors due to possible local anomalies at stations and thus to give more truly the regional effect. It was considered that an isonomalic interval of 100 gamma was entirely too small, but the

1—Somers, George B. Anomalies of Vertical Intensity compared with Regional Geology for the State of California. Colorado School of Mines Magazine. Sept. 1929. pp. 23-29.

possibility is also admitted that a 500 gamma interval might have been better than the one used.

On the main base map or tracing the zero isonomalic was colored green, positive ones blue, and negative ones red. These colors would not print, so—for the maps accompanying this thesis the zero isonomalic is shown by a heavy solid line, the positive isonomalics are shown by light solid lines and the negative ones by light dash lines. Areas whose magnetic low point is lower than the last isonomalic line, have a series of short lines drawn inside of, touching, and perpendicular to the inner isonomalic line like depression contour marks.

Canada—The magnetic data for this country was obtained from two separate sources, the Topographic Survey of Canada and the United States Coast and Geodetic Survey[2]. The former furnished approximately 400 stations with the vertical intensity given for 1925, while the latter had 500 additional stations with the horizontal intensity "H" and the inclination "I" given for 1915. The Topographical Survey of Canada also provided a table giving the changes in vertical intensity from 1915 to 1925 for all parts of Canada included in the United States Coast and Geodetic Survey's data sheets.

The next step was to obtain the vertical intensity "Z" for 1915 for the 500 stations furnished by the Coast and Geodetic Survey. This was calculated from the formula $Z=H \tan I$. These values of Z for 1915 were then changed to 1925 values with the aid of the Canadian tables, the exact correction being obtained by interpolation. On the whole the values obtained from these two separate sources checked very closely where they represented the same stations, the maximum difference with one or two exceptions being well under 100 gamma. Where the two stations differed in value the average was taken to be the correct amount.

The isomagnetic lines were obtained by extending into Canada the isomagnetic lines found on the photostat map of the United States described under b. In doing this the effort was made to balance the values as well as possible. Inasmuch as the extension of the known isonomalic lines was for a comparatively short distance, the location of the extensions should be reasonably accurate.

An attempt was made to get the isomagnetic lines of vertical intensity from magnetic maps for 1925 published by the Hydrographic Office in Washington. Due probably to the generalized character of these maps and the northern latitude which tended to accentuate errors in Z derived from H and I, the values of Z were so irregular, and the results so unsatisfactory, that the method had to be abandoned. It was, however, applied to Mexico and Central America with somewhat better results which will be discussed under the heading of these countries.

The determination of the position and negative anomalies and the drawing of the isonomalic lines was then carried out as described for the United States under (b). As stated previously these isonomalic lines cover only the southern part of Canada and a narrow strip along the Alaskan border.

Alaska—The data for the Territory of Alaska was obtained from Serial No. 125 of the United States Coast and Geodetic Survey entitled "Alaska Magnetic Tables and Magnetic Charts for 1920."

On page 14 of this publication was a table which gave the changes in H and I per five year periods from 1870 to 1915 for a number of stations in different parts of Alaska. From these, and the 1920 values, the writer made charts which showed the corrections on curves, with variation plotted against time, and from these, the changes in H and I values from 1920 to 1925 was derived by extrapolation. While this method was not exact it at least served as a basis on which to work, and inasmuch as the location and number of stations in Alaska was not favorable for making an isonomalic map, any errors in extrapolation would be unimportant.

The areas about each of the above base stations was then considered to have the same amount of change. Hence the necessary correction for H and I was applied to each station in the area according to the variation noted for the base station; thus giving H and I for each for 1925. Z, the vertical intensity, was then calculated directly by the formula used before, namely, $Z=H \tan I$.

On account of the distances between stations another scheme had to be worked out to obtain the isomagnetic lines. From maps accompanying the bulletin, which showed H and I lines for Alaska, the values of H and I were obtained for a number of points all over the territory. Z was then calculated for these points for 1915. The correction for Z for the Alaskan base stations from 1920 to 1925 was then derived and applied to the Z values for the above points. From these values the isomagnetic Z lines for 1925 were drawn at 1000 gamma intervals by interpolation.

The position and negative anomalies were then obtained in the same manner as those of the United States already described.

When the stations in Alaska were plotted they were found to fall naturally into six groups.

1. Southeastern Alaska
2. The South Coast
3. The Aleutian Islands
4. The West Coast
5. The Yukon river from the coast to the Canadian boundary
6. Canada along the Alaskan boundary

The areas covered by these stations were so narrow, and the country in between so vast, that only an exceedingly rough isonomalic map could be drawn. The writer considered any correlation between the geology and the vertical intensity anomalies to be out of the question.

Mexico and Central America—For a number of reasons which will be discussed later, the isonomalic map drawn for Mexico and the Central American countries was unsatisfactory.

The magnetic data was obtained from three sources, namely, the United States Coast and Geodetic Survey[3], the Carnegie Institution[4] of Washington, and the Observatorio Atronomico Nacional de Tacubaya[5]. The total number of stations available from these three sources was less than two hundred and fifty for the entire area. These were scattered, fortunately, so that an isonomalic map could be made, but the distance between stations was so great that the isonomalic map probably bears little or no relation to the regional geology.

While the data from the first two sources checked very closely with data for corresponding stations given in the Anuario de Tacubaya, a large percentage of the stations given in the Anuario which were not given by either of

[2]—Topographic Survey of Canada—Data sheets showing vertical intensity of 400 stations for 1925. United States Coast and Geodetic Survey—Tables and charts for 1915. pp. 192-207.

[3]—United States Coast and Geodetic Survey. Tables and charts for 1915. pp. 208-223.

[4]—Carnegie Institution of Washington. Land and Magnetic Observations 1918-1926. Dept. of Terr. Mag. Vol. VI.

[5]—Observatorio Astronomico Nacional de Tacubaya. Anuario para el ano 1928.

(Continued on page 25)

A New and Quick Method of Surveying

Kodak challenges Transit

By G. O. Marrs, '01*

AMONG the many really useful by-products of the World War of 1914, is the making of surveys by photography. It is true that the camera had been used before that time for certain reconnaissance work over large areas, however, the use never became general among surveyors.

On the battle front, a technique of measurement had to be evolved which would give an approximate idea of the terrain, the distances to hilltops, rivers and forests—a general topography of rather wide stretches of land—and much other detail information. Two methods of doing this proved worthy of development. One was the focus of telescope survey and the other was photography.

The various forms of telescopes, or optical instruments, obtained the result by measuring the angle of inclination from aeroplane or elevated observation post by clinometer and reading the distance by means of focus. Thus was obtained almost instantaneously a direction and elevation for guns, or for other purposes,—but of course this method was limited to a single-point observation each time. This necessitated a great number of individual readings and correlation therefrom,—under great difficulties and stress.

Pictures Preferred

Because of the above limitations, the picture method of topography getting was far superior to the one-point telescope reading, for the kodak took in with wide range of vision a whole section, a great number of vital points, at one stroke. A very elaborate system of survey was thus evolved, in some instances, whereby whole sections of the country, miles wide and hundreds of miles long could be 'surveyed' in an incredibly short space of time, and with fair degree of accuracy.

But today, the simpler aspects of photo-surveying can revolutionize and aid the work of the engineer. The author has used it constantly in his engineering work the last four years and has found it eminently satisfactory. Who has not felt the need of a rapid, easy, and inexpensive way of obtaining reconnaissance and preliminary information,—without the necessity of carrying about a great impedimenta of paraphernalia, and minus the assistance of an horde of technical and non-technical helpers.

This urgent need has been met by photo-surveying. The two methods by which it can be done are both simple and inexpensive, and especially adapted to the needs of the mining and civil engineer. One is the 'stadia' method, getting the distance, and angles, by measurement of length of image, or length on photo of the distance between images. The other,—the 'triangulation' method, works from a base line,—obtaining the angles from the base line by measurements on the photo print or film. The latter is the more accurate but the former, or stadia method, is the easier and more practical for engineering preliminary data.

The Stadia Method

The stadia method is based on the principle that the length of an object, and the length of the image or picture of that object are in direct proportion to the distances of each from the focus lens. The curvature of the lens has little effect on this mathematical relation because the only part of the lens through which the rays of light pass in forming the image is near the center, and the impingement is practically at right angles to the curve of the lens.

The 'stadia' method is generally carried out by directing the kodak toward a person, automobile, horse, house, or any object, the height of which we know. The measurement of the height of the image on the negative or print gives the distance from the kodak to the object. What is really measured on the film or print is the small angle subtended by the object. With the small angle the sine and tangent are, for all practical purposes, the same as the angle itself.

The image is measured by laying the print down flat, putting an ordinary engineer's scale beside it, and looking at the image and the scale with an ordinary handglass or pocket microscope. The 50 scale is usually handiest for this purpose as the readings can readily be reduced to thousandths of an inch. The readings can easily be made to 5/1000 of an inch, and with care can probably be depended upon to 2/1000 of an inch.

The author uses for his work an ordinary Eastman kodak 2¼"x3¼" with universal focus, and which cost about $1. For ordinary work the universal, non-adjusting focus is better than the focusing type of camera, as the pictures are all taken with the same fixed distance from focus to film, and so there is no danger of error coming in from an unwitting change in this distance.

Angular Scope

This 2¼x3¼ kodak embraces a range of about 30° horizontally and about 44° vertically. One degree of arc measured on the print .074 inches. That is .1000 inches on print or film equal 1.35°, that is 1° 21′ or 81′. A five foot stadia pole was used to 'calibrate' the kodak and the readings obtained for distances of 25 ft. to 110 ft. are given in the following table.

Distance	Image length	1°=
25 ft.	.840″ = 11.3°	.0743″
50 ft.	.420″ = 5.7°	.0737″
75 ft.	.280″ = 3.8°	.0738″
100 ft.	.210″ = 2.8°	.0750″
105 ft.	.200″ = 2.7°	.0742″
110 ft.	.190″ = 2.6°	.0730″
		Average = .074″

The table would indicate that the measurements of height of image were obtained to nearest 1/1000 of an inch,—but that degree of accuracy will not ordinarily be obtained. If only 10% accuracy is desired (usually case of rough preliminary surveys), a 5 ft. pole, or a man a little over 5 ft. in height would suffice to measure distances of not to exceed 500 ft., assuming that we can only measure the image to the nearest 5/1000 of an inch. With more accurate measurement of the image (to the nearest 2/1000 of an inch), the man would suffice for distances up to 1200 ft. For greater distances, with same degree of accuracy, a taller object should be employed,—such as a house, an automobile, etc.

*Professor of Civil Engineering, New Mexico School of Mines.

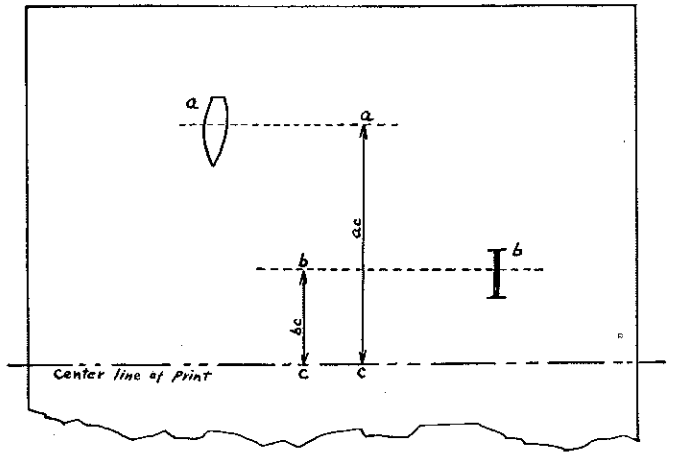


FIGURE 1—ac=.4"=*about* 5.5° bc=.74"=*about* 10° *about* 15.5°=*horizontal angle between a and b.*

Tangent Correction

In obtaining horizontal angles by measuring the distance between objects on the film no correction need be made for the difference between the tangent of the angle, and the angle itself for ordinary work. If, however, more accuracy is desired, the following corrections can be made to the measured lengths of image differences:
Up to 10°—No correction.

11° Deduct .5% from the tangent measurement to get angle.
12° Deduct .8% from the tangent measurement to get angle.
13° Deduct 1.0% from the tangent measurement to get angle.
14° Deduct 1.3% from the tangent measurement to get angle.
15° Deduct 1.5% from the tangent measurement to get angle.

The limit of the film, horizontally, is 30°, which is 15° on each side of the center, so that the correction for 15° in the table, supra, is really correction for 30°. For example suppose that the distance between vertical lines on the print showed an equivalent of 26°. We would apply the correction for 13° (1.%); so that the angle instead of being 26° was in reality only 25.74 degrees, that is, about 25¾ degrees. Figure 1 illustrates the method of 'measuring' an angle on the print.

Vertical Angles

Vertical angles are found by the fact, that if the kodak is held level, the center of the film is level with the elevation of the kodak. The center of the print is found by measuring with the scale; the vertical distance to the object giving the degree of elevation or angle of elevation. If more accurate levelling is desired, an object whose elevation is known can be included in the picture, and the vertical angles measured up and down from that. Figure 2 illustrates the method of obtaining vertical angles (and thus elevations) from the print.

Interpolation

By the stadia method of picture surveying we can only directly measure such objects in the view of which we know the height or other available dimension: but a very close approximate can be made to elevations and distances of all points between these known points and the kodak. This is done by observing the slope of the ground, as shown on the picture, and by approximations from other objects, whose height, while not measured by us can be closely estimated. For example, in some localities trees of a certain appearance are of fairly uniform height,—heights of one-story frame buildings are rather uniform in any given locality, etc. A little experience will enable anyone to 'interpolate' between known points to a fair degree of accuracy.

Heights of objects are better to measure from, than other dimensions because it is not always easy to tell at what angle the other dimensions are presented to us, but upright objects are so nearly vertical as to introduce little error,—on the whole.

Central and Peripheral Surveying

Two advantageous ways of picture surveying are:

(1) To measure some centrally located object, as a house, for example, and go around it at such distances as are advantageous, using handcompass or angle from sun with time of day, for angles from meridian.

(2) Stand with kodak at some central spot and have someone walk in a big circle around the kodak, at such distance as is desired, stopping for his 'picture' at about every 20° angle, so as to get a continuous overlapping series of pictures around the whole circle.

Measure from the Prints

In measuring from the 'picture' it is better to use prints, rather than the negative, for several reasons:

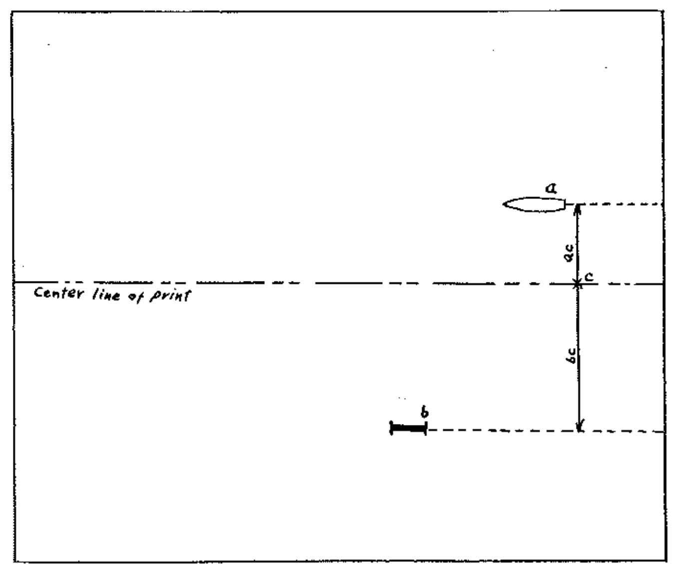


FIGURE 2—ac=1.26"=*about* 17° bc= .50"=*about* 6.6° *about* 10.4°=*vertical angle between a and b.*

(1) The negative has the image upside down, while on the print the image is rightsideup, and more easily seen in relation to other objects.

(2) On account of the texture of the two, it is easier to make an accurate measurement on the print than on the negative for the same amount of pains.

(3) Auxiliary pencil lines are easier to make and easier to read from on the print than on the negative.

(4) If by any accident the print is spoiled or injured while measuring, another print can easily be secured; not so with negative.

Triangulation method of picture surveying is to measure a base triangle, as shown in Figure 3, and obtain the location of points by the intersection of lines from A and B, found by taking pictures from A and B, including C in each picture. On the whole this is not as convenient as the stadia method.

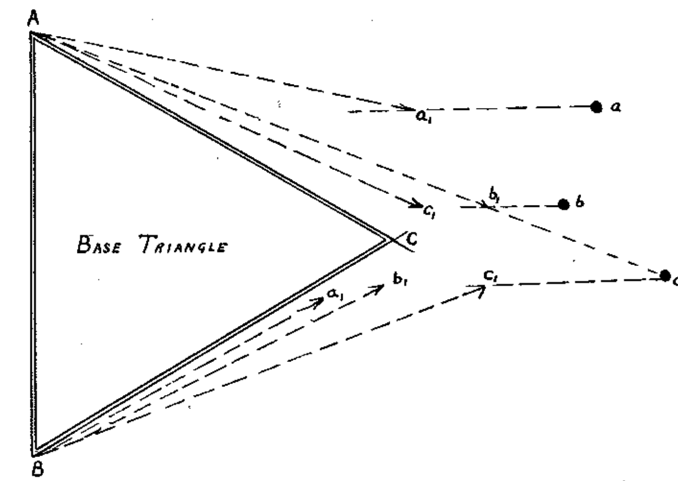


FIGURE 3—*Sights a, b, c, are aimed half way between objects a, b, c and C.*
AB, AC and BC are measured.
Intersection Aa, with Ba, gives a.
Intersection Ab, with Bb, gives b.
Intersection Ac, with Bc, gives c.

Of General Value

Picture surveying is of very great advantage in connection with mine examinations, water power preliminaries, railroad reconnaissance, geological advance explorations, etc. The work of the engineer, and of the executive, and consultant in engineering lines is concerned at least ten times as much with approximate and preliminary surveys and estimates, as with final and more exact later surveys.

With a small $1. kodak he can frequently do more than could be accomplished by using a large $300. surveying outfit, and with less time consumed, less money expended, and almost complete elimination of the personal-error factor.

Foreign Engineers Visit Mines

Mines is constantly receiving visits from engineers of international reputation.

Valdimir M. Kreiter, Chief Geologist of the U. S. S. R. and B. P. Nebrasoff of the State Institute of Non-Ferrous Metals, Moscow, were guests at Mines, June 28. Mr. Kreiter has charge of a vast geological area in eastern Siberia and is investigating geological methods for locating hidden ore bodies in that section. Mr. Kreiter, who is head of the Geological survey for U. S. S. R., hopes to use electrical prospecting in regions where there are no perceptible geological clues.

Andre Uzel, of Paris, France, is in the United States studying mining conditions and mines. He visited the Experimental plant and the geophysical laboratories. Mr. Uzel expects to spend two years in his study and will devote part of his time to prospecting in Texas.

Doctor Jaroslav Malkovsky acted as guide to these visiting engineers.

Presents Dr. Chauvenet's Book

Two hundred and fifty copies of a Chemical Arithmetic, written by the late Dr. Regis Chauvenet, beloved former president of the Colorado School of Mines, are being presented to the educator's old friends and associates. The books, which were published in 1912, were given the school by Mrs. Chauvenet, who now lives in Denver, with instructions to present them to leading educators.

Sons and Brothers of Mines Men to Attend C. S. M.

Mines men are demonstrating their faith in the Old School by encouraging their sons and brothers to attend the Colorado School of Mines. Lee Hoyt Larison, son of E. L. Larison, '05, will enter Mines this fall. Young Larison is one of several "Miner sons" in attendance. Philo Grommon, Jr., will be a sophomore next term, and so will Charles N. Bell, Jr. Both Grommon and Bell are sons of Mines men who have achieved success.

Word has just reached the Dean's office that Walt Lofgren, '28, is sending along his "kid brother" to take up freshman work at the opening of the fall term. Lofgren was captain of football in his senior year, and his brother is expected to follow in his footsteps as a great athlete. "Bobbie" Bond, who played end on the same team with Walt, already has a brother at Mines. Young Bond, known about the campus as "Ernie", has proved himself an athlete of no mean ability. He was captain of basketball this past season, being the first sophomore ever to captain a sport at Mines. Ernie has also shown ability on the football field.

Report has it that the brother of Calvin W. Townsend, '29, will attend Mines in 1930-31. Townsend's brother has been one of the outstanding players on the Wheatridge, Colorado, basketball team during the past season. The Wheatridge team was one of the outstanding teams in the State.

According to announcement from the State superintendent of public instruction, Robert H. Sayre, Jr., has been awarded the All-Colorado scholarship to the School of Mines. Young Sayre was selected from a number of applicants by the State superintendent because of his excellent high school record. He is a graduate of South High, Denver.

Sayre Junior is the son of Robert H. Sayre, prominent Denver mining engineer and a member of the School of Mines Board of Trustees. His grandfather, Hal Sayre, was a pioneer miner of Colorado; and young Robert's decision to follow mining engineering will carry on the family tradition for the third generation. In selecting the Colorado School of Mines as his place of training he designates it as the best institution of its kind in the country, for it may be said that he had all the colleges of the United States to choose from.

* * *

A Chemical Study of Oklahoma Coals. J. E. Moose and V. C. Searle. *Oklahoma Geological Survey Bulletin* 51. 112 pp., maps, and illus. 1929.

The writers purpose in preparing the report was to supplement previous work done on Oklahoma Coals and to make available proximate analysis data on composite face samples taken from all mines in the State which were operating during the summer of 1928; to interpret the data obtained in such a manner that it will be of assistance to producers and consumers in making coal contracts; in checking samples submitted as to their agreement with gross shipments, in calculating approximate calorific values in the absence of a calorimeter; and in making a comparative evaluation of one coal with another.

Chapter headings include: geography and geology, production of coal in Oklahoma, method of taking and preparing samples, laboratory procedure, analysis of composite face samples, description of mines and samples, the utilization of "unit coal" B. T. U. values, comparative evaluation of Oklahoma coals, list of mine operators.

—J. H. J.

Air Repressuring Greatly Increases Production of Oil

in Williams pool, Texas

THE details of how production of oil in the Williams pool, in Callahan County, Texas, has been greatly increased by the application of air repressuring methods are outlined in an engineering report just made public by the United States Bureau of Mines, Department of Commerce. The Williams pool, with 61 producing wells and 9 input pressure wells, showed an estimated gain in production over what have been expected from normal production of 33 per cent under repressuring methods during 1927, 78 per cent in 1928, and 76 per cent in 1929. The initial production of wells in this pool ranged from less than 4 to 35 barrels, with a daily average of 12 barrels. The estimated net increase for the field over the 3½-year period is 57,500 barrels, or 44 per cent.

The Williams pool is one of a number of shallow pools in the lenticular sands of the Cisco series in the Putnam-Moran district. The outstanding features of the pool are the abrupt variation in sand conditions, the absence of pronounced edge-water encroachment, the irregular oil-water contact, and the "low-head" and "small-volume" water that occurs apparently in the base of the sands in the "lows" of areas of depression.

The following conclusions of the author of the report, H. B. Hill, are based upon a detailed study of repressuring operations in the Williams pool. Other shallow pools in the Putnam-Moran District have many similar features and characteristics. Correlative data on these pools were gathered during the study made by the Bureau of Mines and are recorded briefly in an appendix to this report.

Old development records are sometimes inadequate or unreliable, and it is often advisable to drill 5-spot wells and core the sand to ascertain subsurface conditions and to obtain other data regarding drainage, porosity, saturation, fluid levels, reservoir pressure, and water conditions. Five-spot wells were drilled for this purpose in the Williams pool and cased to make them input pressure wells. This procedure gave satisfactory results.

The practice of coring with cable-tool equipment has been adopted by several of the companies.

Coring has supplied data that can be used to interpret more accurately the character of the producing sands and has facilitated the application of proper development methods and production practices, including restoration measures.

The gravity of the oil in the Williams pool was lower from the beginning of production than that of oil from wells in the surrounding pools. The use of air in this pool has lowered the gravity from 33.3 to 31.8° A.P.I. during approximately 18 months.

The average gasoline content of the air-gas mixture taken at the casing head of four wells in the Williams pool during November, 1927, was 1.1 gallons per 1,000 cubic feet. Fifteen samples collected later from representative wells in the different pools in the district that were also under repressuring operations showed an average gasoline content of 0.796 gallon per 1,000 cubic feet. Before application of air very little, if any, gas was produced at the casing heads.

The gas-oil ratios during the flush periods in the shallow pools of the district are usually small, and when repressuring commenced these ratios were probably below 500 cubic feet per barrel of oil.

Methods of repressuring that favor the maintenance of a low gas-oil ratio (approximately 1,000 cubic feet or less per barrel of oil) are desirable and aid in conserving the repressuring medium by preventing by-passing.

The use of air for repressuring or the circulation of an air-gas mixture of high air content aggravates corrosive action. Brass and bronze working parts are now generally used in the pumping equipment in the pools of this district wherever possible.

Gas, when available, is probably a better repressuring medium, because it is more soluble in oil and its corrosive action is less. The recycling of casing-head vapors with gas for make-up purposes has given satisfactory results on a number of properties in the district. The use of all vapors produced with the oil is a conservation measure and tends to prevent loss in the gravity of the oil.

During the early development of the shallow pools some wells were completed to produce from one or more sand lenses, and a considerable depth of open formation was left in the bottom of the hole. In other wells pockets were drilled below the pay. Although these methods of completing wells may not appear detrimental to production when a well is completed, later they may constitute a hazard, especially under repressuring operations. The best practice requires close isolation of the pay sand. If there is a barren formation or water zone below the producing sand the hole should be plugged back to the bottom of the pay, or if a barren formation or gas sand occurs above the pay the wells should be properly cased before repressuring is begun.

The sand conditions in several of the shallow pools under observation were as follows: Free gas occurred in the upper part of the zone, and below this zone in sand probably 6 to 10 feet thick the best pay was found. A low-head small-volume water was encountered in the base of the sand over parts of the pools. At relatively low pressures the repressuring medium passed more freely through the depleted gas sand than through the oil sand or the less-saturated parts of the water sand. This condition may be helped or partly overcome by shutting in the wells or maintaining a high fluid level.

Restoration of pressure in the producing zone tends to retard encroachment of water, especially in the lenticular sand areas of low-head small-volume waters.

The presence of small volumes of gas in the shallow pools of this district suggests that low initial production is caused by lack of enough expelling force in the reservoir sand to move appreciable amounts of oil into the hole. Repressuring methods offer a logical means of supplying the additional energy necessary for a higher recovery. The gravity and viscosity of the oil, the amount of gas in solution, the permeability and porosity of the sand, and the character of the sand reservoir influence the results and largely determine the most suitable operating plan.

Uniform distribution and spread of the repressuring medium are advisable but are generally difficult to obtain,

(Continued on page 25)

Principles of the Hydro-metallurgy and Electrodeposition of the Metals

VI. Chapter on Separating and Washing

By Thomas P. Campbell*

Nearly all ores and concentrates are more or less porous; and, as the solids lose part of their mass in leaching, this condition of porosity becomes increasingly evident and important as the leach proceeds. Again, even if there were no pores in the solid, it would still possess a surface field of force, or "adsorption field". Hence, with the very large amount of surface created by the pores, as well as by the capillary action of the pores proper, all solids absorb more or less liquids.

Following the leach proper, it is necessary to separate the enriched solution from the spent solids. But this problem is always complicated by the fact that some of the rich solution will cling to, and be absorbed by, the particles of the solid. Hence, in addition to separation, as such, we must also provide means for recovering, in large part at least, these absorbed solution values.

The most common method of attack on this problem is, first, to thicken, or concentrate the spent solids, together with their absorbed liquids, and then to displace the rich liquids with water.

In general we may distinguish two divisions or types of materials to be separated and washed: First, coarse, low-grade ores which have been batch-leached. In this case, there is no question as to thickening; the whole job is merely one of washing. Secondly, we have to deal with relatively fine-grained materials which have been leached by agitation and which are more or less in suspension in the solution. Evidently, these pulps must first be settled, or thickened, to obtain as high a ratio of solids to liquids as may be economically possible; then this thickened pulp must be washed to recover the entrained solution values. The treatment of this problem entails the theory and practice of settling and filtering, together with what little we know about adsorption phenomena.

General Principles

Taking up first the relatively simple case of ores which have been batch-leached by percolation, it is seen that, since the solids remain stationary, the question of recovery of entrained solution values is largely one of displacing rich solution by water. For purposes of analogy, this process may be conceived of as a simple piston displacement. That is, if there were no diffusion effects to be considered, we might picture the action of washing as a pure mechanical displacement: barren water pushing the rich solution away from the ore particles, and driving it out of the solid mass.

Actually, of course, this action cannot take place; the rich solution and the barren water diffuse into each other, and the best that can be hoped for is an eventual dilution of the absorbed values. From the kinetic standpoint the mechanism of this process may again be fairly accurately represented as a logarithmic function of time or of the number of batch washes applied. Thus, let a represent the value (of metal or metallic compound) absorbed in the drained, leached solids. Then x equals the absorbed value at any time, t, after washing begins; when $t = 0$, $x = 0$; and as before, we have

$$t = C(\log a - \log(a-x)),$$

where C is again a constant for constant temperature. From this it also follows that the "displacement efficiency" at any time, or for a given number of successive washes, is

$$D = \frac{(a-x)}{a} 100\%.$$

Example: 100 pounds of clean sand were saturated with 25 grains of gold, as $KAu(CN)_2$, in weak solution. Six batch washes were applied, each wash being allowed to drain completely before the next was added. Each batch weighed 16.7 lbs., making a total of 100 lbs. of wash water added. Results:[39]

No. of Wash.	Au in Sump Soln., gr.	Displacement Efficiency	
	(a—x)	Unit	Cumulative
1	16.6	66.4	66.4
2	4.11	49.0	82.8
3	1.3	30.3	88.0
4	0.5	16.7	90.0
5	0.22	8.8	90.8
6	0.07	3.1	91.1

Thus the total weight of gold recovered was 22.80 grains. In the formula given above, then, we may substitute $a = 25$, $(a-x) = (25 - 22.8) = 2.2$, when $t = 6$

hence, $6 = C(\text{Log } 25 - \log 2.2)$,

and $C = 5.69$.

Then when $t = 1$,

$$1 = 5.69(\log 25 - \log(25-x))$$
$$25 - x = 16.6,$$
$$x = 8.4.$$

When $t = 2$,

$$2 = 5.69(\log 8.4 - \log(8.4 - x))$$
$$8.4 - x = 3.83,$$
$$x = 4.57.$$

Similarly we may calculate successive values of x for the remaining values of t. The following table shows the calculated values of (a—x) in comparison with those found experimentally, as listed above:

Wash No.	Au in Sump Soln., Gr., Calculated	Observed
1	16.6	16.6
2	3.83	4.11
3	1.38	1.3
4	0.64	0.5
5	0.34	0.22
6	0.20	0.07
Total	22.99	22.80

*Associate Professor of Metallurgy, Colorado School of Mines.

[39]—Julian & Smart, Cyanidation of Gold and Silver Ores.

By contrast, when the entire 100 lbs. of wash water were added in one batch, the sump solution contained 19.8 grains of Au, or 79% of the absorbed value in the sand. This brings out the advantage of stage washing with relatively small amounts of water. For, needless to state, there is a definite limit to the quantity of wash water that can be applied in any given system: in general the total amount of wash water allowable cannot exceed the amount of water carried out of the system in the washed residues, plus the water lost by leakage and evaporation; otherwise the solution volume would soon exceed the tank capacity of the plant. In some cases, where impurities tend to build up in solution, a certain amount of the main solution must be "bled off" at regular intervals to control the concentration of impurities. In this event, part of the make-up may be added as wash-water.

In practice, the counter-current principle is applied to the batch washing of ores after leaching. The first two stages of such a wash are shown in Figure 5, above. In such an arrangement, each lot of ore receives first the wash water that has passed through all the other tanks under wash; this water will be relatively rich in metal values. In the next stage, the same ore is washed by a weaker solution; and so on, until, in the final stage, the ore is treated with fresh, barren water. (See also ref. no. 38).

We turn now to the somewhat more complicated problem of the recovery of absorbed values from materials which have been subjected to an agitation or slime leach. The most obvious way of accomplishing this end would be simply to run the pulp into a large tank, settle, decant, and then filter the thickened pulp. The filter cake could then be pugged with fresh water and refiltered, this process being carried out a sufficient number of times to obtain a commercial recovery.

However, most agitation leaching is carried out on a continuous basis; hence an intermittent separation and washing scheme, such as proposed, would require over-size tanks, and would introduce other complicating factors. Hence, the tendency has been to make separation washing systems continuous in action also.

It can be shown[40] that a body of irregular shape, falling freely through any fluid medium, will attain the velocity

$$V = k\sqrt{\frac{D(S-s)}{s}}$$

where D is the average diameter, S the specific gravity of the solid, s the specific gravity of the fluid, k is a constant for constant temperature, equal to about 9, and V is the velocity of the solid *relative to the fluid*. By "free fall" or "free settling" is meant a condition wherein there is no interference between particles of the solid, each particle acting as though it were entirely alone in the fluid. However, it is seen at once that such a condition cannot obtain in settling tanks, where many particles of solid must be present in any given portion of liquid.

But most leaching pulps are fairly dilute (say five parts of liquid to one of solid), so that when the pulp first enters the settling tank, "free settling" conditions may be assumed. Experimental evidence tends to support this conclusion: it is found that, during the first period of sedimentation, the rate of subsidence is nearly constant; but particle interference soon becomes evident, as shown by a change in the rate of fall, and this gives rise to a sort of "transition period" between free settling, on the one hand, and "impeded settling", on the other hand. The transition period begins when h/h_o attains a characteristic value, determined by the nature of the pulp, where h is the height of the sludge at the time the rate is measured, and h_o is the final height to which the sludge will settle in a very long time. Finally, then, during the period of impeded settling, the rate of subsidence is

$$V = \frac{-dh}{dt} = k\frac{h-h_o}{h_o};$$

and from this it follows that, during all three periods, the time necessary to drop between two *fixed* values of h/h_o is proportional to h_o.

So far, we have assumed no motion of the fluid medium. But in continuous settlers the pulp must be introduced and the products (overflow and underflow) withdrawn continuously. Hence there must be a horizontal component of motion of the liquid in the tank. The simplest form of settling tank is simply a flat-bottomed cylinder, the feed coming in at the top center, and the overflow taking place uniformly around the top periphery. Assuming free settling conditions, the path of a solid particle entering the center of the tank will be[41]

$$y = \frac{mx^2}{2RV},$$

where m is the downward rate of fall, R is the radius of the tank, and V the velocity at the overflow. This velocity is given by the cubic contents of the entering stream, in cubic feet per second, divided by the depth of water in the tank times $2\pi R$. The *actual* depth in an operating tank is of course the depth of the tank at the overflow plus the overflow head, as calculated from the relation for weir discharge,

$$h_a = \sqrt[3]{\frac{9Q^2}{32\pi R^2 g}}$$

This formula for particle path postulates the existence of conditions which are very seldom, if ever, met with in practice. However, most of these conditions may be assumed to exist at least in the upper part of the tank, where the actual overflow is taking place.

In most cases the pulp contains particles of all sizes from the upper limit of grain required for "unlocking" down to true suspensoids. In practice, then, settling pulps will be found to arrange themselves in zones, the particles acting as masses, rather than as individuals,—very much like voters at an election. As these various size-zones settle, clear liquid will appear above the top-most layer, "and the rate at which the surface of the top-most zone subsides is the practical rate of settlement for the material being tested."

From the theoretical standpoint, it should make little, if any, difference whether we use a circular tank, or a rectangular tank into which pulp is being fed at one end, and from which clear overflow is being taken at the opposite end, so long as the two tanks have equal cubical capacity. However, in practice the overflow conditions are more uniform in circular tanks, and there is less tendency to turbulance, and consequent lack of unhindered settling, than in the case of rectangular tanks.

Where true suspensoids are present it is impossible to obtain an absolutely clear overflow without the use of some flocculating agent. As mentioned before, colloidal particles are kept in suspension in virtue of their like surface fields. These fields, in turn, tend to attract ions of unlike sign from the fluid; hence for every colloid there is some critical condition of ionic sign and concentration which will bring about neutralization of the surface fields and cause coagulation and precipitation of the colloid. In fact, metal and mineral colloids,—if not all colloids,—may be said to have a definite isoelectric point; that is, a condition of potential hydrogen concentration* on one side or the other of which the colloid becomes unstable. Thus, a suspensoid which is stable above pH = 8, would flocculate below that value,—and vice versa. In general, it has been shown that the "flocculating power" of ionizable salts, acids, and bases is approximately proportional to the valence of the ion which neutralizes the colloid charge.

In flotation, and in cyaniding, the solution usually contains electrolytes which can serve as flocculating agents,—notably lime. But in acid work colloids may be produced which cannot be flocculated without spoiling the composition of the solution. Hence it is not uncommon to find thickener overflows quite murky in acid circuits. However, these solutions are usually filtered before passing to electrolysis or other form of metal recovery, and in that operation all but the finest, most reactionary suspensoids can be removed. Another difficulty sometimes encountered is the "protective" or "peptizing" affect due to the presence of certain proteins and other substances in solution. These peptizers tend to prevent coagulation of suspended particles; apparently the peptizer forms a film of some sort around each particle, thus tending to prevent the adsorption of the neutralizing ion,—but just what happens is not very well understood. We shall have occasion to deal with this question of "protective colloids" again when we come to consider the electrolytic precipitation of metals; but for the present, sufficient unto the day is the ignorance thereof.

[40]—Walker, Lewis & McAdams, Principles of Chemical Engineering, pp. 308-311, pp. 330-335; N. Y., 1923.

[41]—Liddell, Handbook of Chem. Eng., pp. 282-285.

*Potential hydrogen = pH = —log(H^+). Thus, if (H^+) = 10^{-4}, pH = —(—4) log 10 = +4.

Mines Gets Students from Far

Registration June 30, for the eight-weeks courses given during the summer at the Colorado School of Mines, revealed the following interesting data:

Students from Texas, Ohio, Wyoming, Illinois, New York and Colorado registered for preparatory subjects required as entrance units by the School of Mines and other technical institutions.

Other states represented by students registered in the regular college courses are California, Oklahoma, Iowa, New Jersey, Florida, Utah, District of Columbia, Illinois, Michigan, Pennsylvania and Indiana.

Several eastern colleges as well as a number of schools in the Rocky mountain region are represented by students seeking advanced credit in engineering courses. These students come from Cornell university, Rennselaer Polytechnic institute, Occidental college, Indiana university, the Missouri School of Mines, Iowa State college and South Dakota State School of Mines. Several students from the University of Colorado and Regis college are registered.

The summer work at the School of Mines is divided into eight weeks and six weeks courses, the more difficult and longer subjects being given over a period of eight weeks.

Registration for the six weeks' courses was held July 14.

Some Say Yes, Some Say No

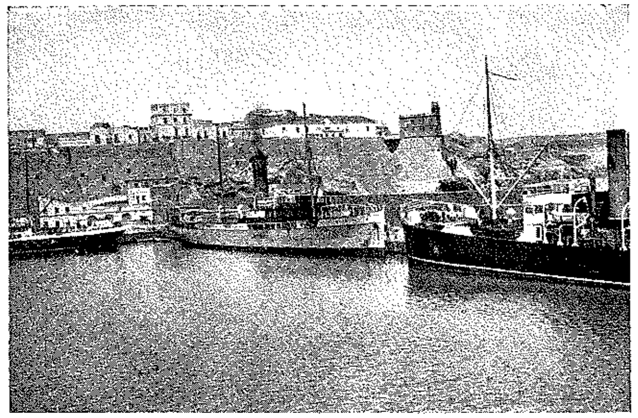
An engineer is a poorly paid man
Who works to beat hell to get what he can
He makes up reports on oil fields and mines
Or anything else—depending on times.
His problems are varied and difficult too
For he's called to do jobs that the others can't do.
He begins in the morning, works far into night
And stays with the job till the end is in sight.
With the facts he has found from the difficult grind
He draws his conclusions with unbiased mind
He writes his report in a clear concise way
In hope that its contents will bring him some pay.
He checks all the pages, the maps, and the graphs
So that other trained men can hand him no laughs.
To the finished report he then signs his name
Expecting some pay and a great deal of fame.
With his work then completed he figures his fee
In hope that his client will readily see
That time and expense and experience too
Have solved all the problems to carry him through.
After hours of thought he heaves a great sigh
For what he has figured seems terribly high,
He thinks of the fees of professional men
Including the doctors and most legal men.
How a doctor will look and say you are ill
Then ask for ten dollars and give you a pill
No report on his work, just one single glance
Yet you can't beat his bill—you haven't a chance.
The legal man, too, says one hundred a day
And meekly concedes that isn't much pay
From the lowest court up to the highest court known
They drag out your case till your money's all blown.
Thus the doctors and lawyers and a few other men
Will take all your money if it's only a yen
Without a report to back their conclusions—
Just as likely as not their thoughts are delusions.
So the fee is refigured, the price finally set,
With the same old conclusion "That's all I can get!"
Then he mails his report, his bill and a letter—
Receives in reply "None could have done better."
He gets his small check and hides all his pride
Yet millions were saved by the engineer guide.
His work will continue, his fees remain small—
For he'd rather get little than nothing at all.
With a dollar or two and a little more fame
The engineer works, upholding his name.
But the saving of millions, or making of them
Should give bigger fees for the engineer men.
Yet the fact still remains all over the earth
That the engineer rates just a "tourist car berth"
But he'll work to beat hell to do what he can
Though he always will be a poorly paid man.

—*W. A. Waldschmidt*

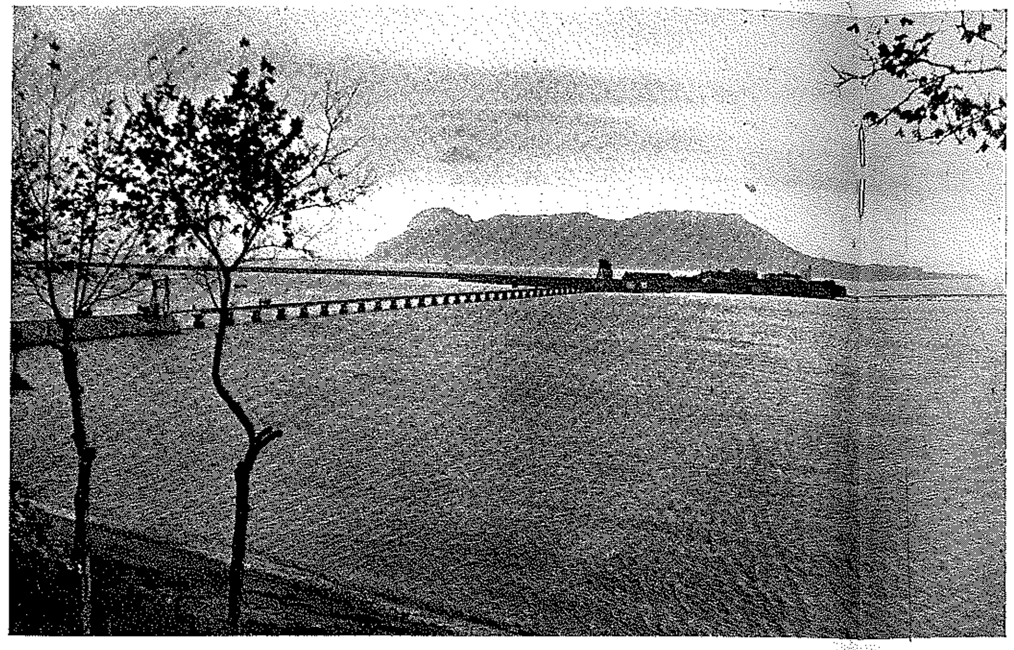
Mines Grad at Swedish Meeting

Dr. Jeroslav Malkovsky, who received his doctor's degree at the Colorado School of Mines in May, has a place on the program of the annual meeting of the American Geophysical Union in Stockholm, Sweden, in August. Malkovsky will read two papers by Prof. C. A. Heiland of Mines as well as one of his own.

While on his European trip, Doctor Malkovsky expects to observe geophysical methods in northern Sweden, Leningrad, Moscow and Kauasus, before visiting to his home in Checkoslavika.



The Arrival at Melilla. Right: The Majestic Head of Gibraltar Beyond the Harbor.



Through Spain to North Africa and Spanish Morocco

By J. A. Riley, '23

SPANISH Morocco is usually entered from Spain, crossing the Mediterranean Sea from Algeciras (Gibraltar) to Ceuta or Tetuan, or from Malaga to Melilla. Lack of intercommunication within Morocco by means of good railroads makes it necessary to plan one's trip so as to arrive as near to the ultimate destination as possible. Southern Spain is, however, very accessible from the United States. Three very fine Italian steamship lines call at Gibraltar en route to Italy, and it is also possible to go direct to Ceuta or Melilla by means of the American Export Line, a line principally concerned with freight but having accommodations for a limited number of passengers. This latter method eliminates a very unpleasant Mediterranean crossing on very small Spanish mail boats.

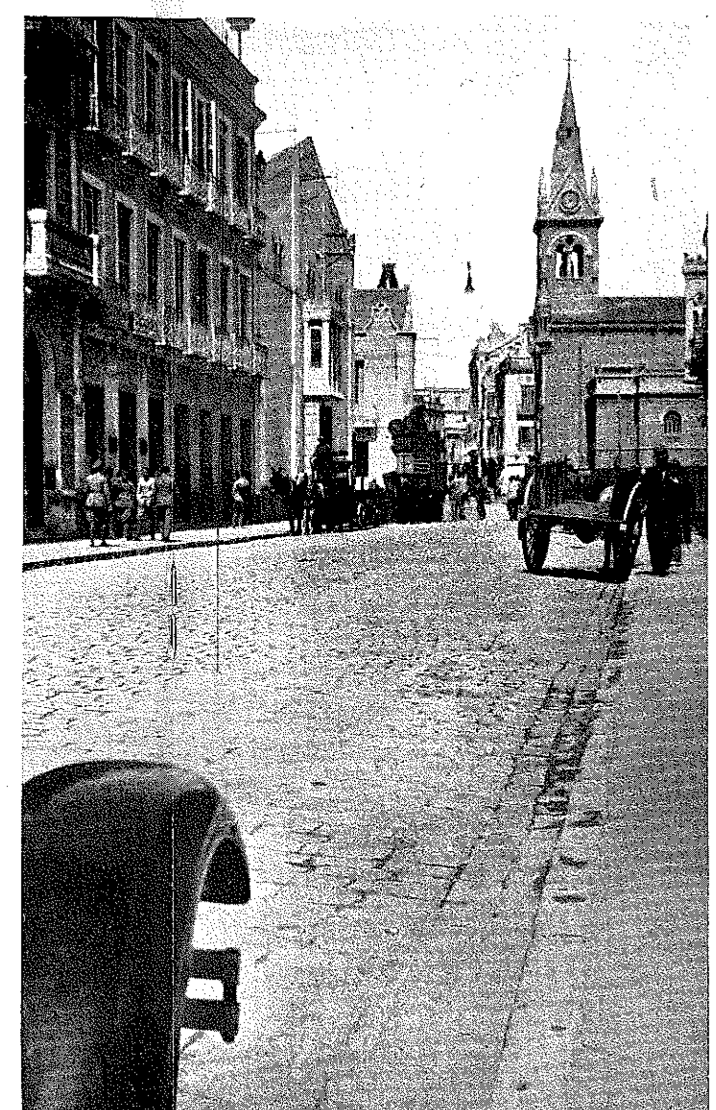
Our crossing on the "Roma" of the best known of the Italian lines was a very rough one during the "off" season of American Mediterranean travel, and laid us down in Gibraltar just seven days after our departure from New York. During these seven days we enjoyed 168 hours of quiet boredom. The passenger list was small and no-one seemed interested in the activities that usually make life at sea so highly enjoyable. (This is a condition seldom met with on an American ship, and one of the best arguments for using them.) The trip was very uneventful. They told us we saw the Azores on the fifth night. What I saw was a light house beacon for about a half hour. However, all the other calculations of the Captain and crew seemed to be correct—we eventually arrived at the port for which we set sail—and I suppose we were in that neighborhood. I also suppose some of the best known and least liked of that breed called the American Tourist will report a 'visit to the Azores' on their return.

My first view of Southern Spain with its semi-barren hilly coast line very nearly persuaded me that it was South America's west coast again. But there is a little more green in evidence—then the majestic head of Gibraltar, and soon its shoulder, appeared and the similarity ended. But Gibraltar disappointed me. Since I last studied geography they have moved this noble rock. Not far, its true, but moved never-the-less. Gibraltar, to my mind's eye, had been the southernmost point of Spain and at the narrowest point between Africa and Europe. A glance at a map will show that this is not quite true. There is another point of land at the narrowest point, a little to the west which, with Gibraltar forms the harbor, and on which are located Tarifa and Algeciras. Tarifa is the town from which we very appropriately get our word 'tariff'. But my disappointment ended there for Gibraltar is all the Prudential Life has advertised it to be and after viewing it first hand I am convinced they gained rather than lost in strategical position in its moving. Johnny Bull is extremely efficient.

And in the harbor one of his sea dogs in bright new grey paint and boasting four stacks, with a manner of being ready for "what have you", swung at anchor. Sailors lolled on deck, the guns were plugged, and only one stack gave forth a thin, lazy curl of smoke. Still it seemed to personify action and indicate law and order to all who might see it. Otherwise the harbor was full of all manner of ships. Freighters from the world at large in the modern manner, mixed with tramps, tankers, antiques of all sorts that included even old side wheelers, and fishing rigs with their forward leaning mast and single sail. These last look for all the world as if they had been transported from the world of biblical pictures. Built like a skiff in general shape, they are slightly broader of beam and usually carry a small carved wooden figure-head fore and aft. Under sail they are extremely picturesque in the bright blue of Mediterranean sky and water, and for their size acknowledge no superior in nasty weather. And as we go ashore in the lighter, to the east is stolid old Gibraltar and to the west Algeciras sits on the lap of the gently rolling hills, a glistening white spot of a town twenty minutes by ferry (when once the ferry decides to proceed) and forty-five by auto around the head of the circular bay or harbor.

Gibraltar itself, from the moment one steps ashore from

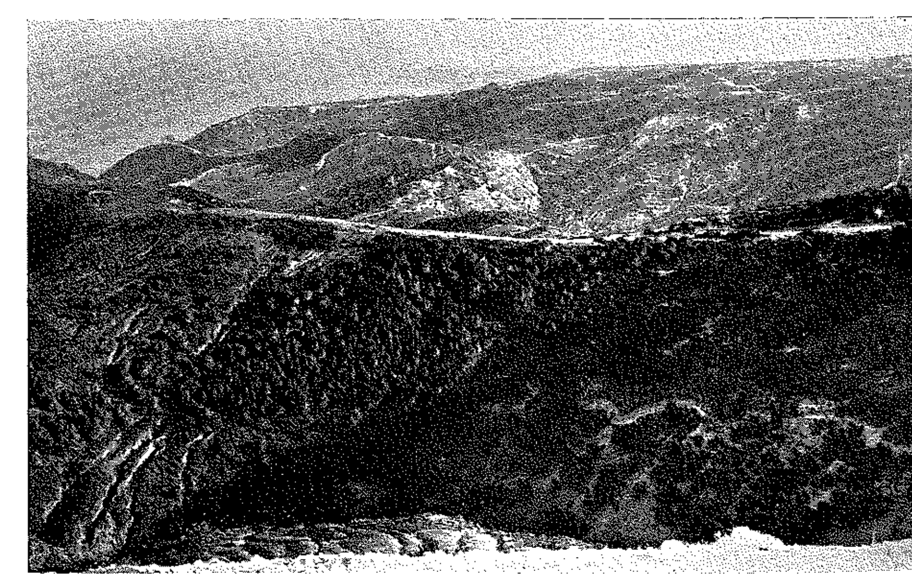
the lighter, reveals to the traveller a superb mixture of modern and ancient. A blaze of color and commercialism. On the warf ancient horse drawn carriages and American automobiles of the latest vintage compete for your patronage. And above the gate to the city, where your passport is inspected, narrow streets, on the hip of the rock which is Gibraltar, are teeming with shouting burro drivers, autos with constantly screeching horns, these picturesque horse-drawn vehicles of Victorian age—all demanding right-of-way from pedestrians of all nations who, for lack of adequate or any sidewalks, must also use these narrow traffic lanes. A type of English Bobby controls this heterogeneous moving mass and one cannot help but feel the respect all classes pay to him. Lining these streets are stores too of all nations; Spanish, British, African, Indian, and Hebrew merchants in their native garbs give to this city a colorfulness, along with its military aspect, to be found in certainly few if any other cities. Even the noise of the voices, as they rise like a small roar, give the idea of the polyglot nature of the throats that give it life. Separated from Spain only by an imaginary line; two hours from Africa; existing under English rule; and at one of the most important trade cross-roads of the world; it is no wonder that this city seems to present itself as a composite picture of the world in general and Europe and Africa in particular.



We drove to Algeciras, but as we left Gibraltar we stopped a moment to pick up a friend's bags. We were promptly assailed by a vendor of laces from whom we derived a considerable amount of satisfaction in our purchases—because we bought at half per asking price. Later in retrospection we felt perhaps half her asking price was enough to pay. We crossed the barren half mile of neutral territory and had our first introduction to the Spanish Customs Officials. Bad as is their reputation (at least as bad as the worst in Europe) they treated us very kindly, opening only one bag and this picked at random. Phonograph records I was carrying in a separate package they had decided must pay a duty. Inside the custom's house they discovered the name of a Marques of Spain, an officer of the company for which I was to work, inscribed on the box. So after a brief consultation, and relieving themselves of all culpability, at least to their notion, by saying they understood they were in transit to Africa, they very courteously waved us along our way. The question, "What's in a name?" had been answered, at least to my present satisfaction. And so we drove on out of this little 'village of entrance', over streets of rough cobble-stone and out on to the road around the head of the bay. Once out of town the road became good. Laboriously made by hand and a wheezing steam roller, it was thoroughly inadequate to cope with high speed auto travel as we know it in the States, but good enough for our Spanish driver to negotiate at 90 kilometers an hour. Thoroughly weary from breath holding on the curves and when passing other vehicles, we arrived at Algeciras still intact and thankful for it.

What a mirage had been our first view of this town from the harbor! Instead of the glistening whiteness we found filth and extreme poverty—the dazzle was all lost in a close-up. Distance and a semi-tropical sun can work wonders. Added to this was the typical smell of Spain; composed of many ill smelling flavors, chief among which is burning olive oil. This, like taxes, follows one everywhere and, while I have found some few who claim it no longer bothers them, I have yet to find a single person not born to it who has learned to like it or the cooking accomplished as a result.

But to get back to Algeciras. The town, about as large as Golden in area, and housing perhaps twice as many people and dogs, to say nothing of goats (the milk supply of Spain), is composed of two or three buildings that really deserve the name and numerous adobe shacks and a dock, at which were two or three small steamers. These were very good looking ships of about a thousand tons and pure



Left: A Street Scene in Malaga. Above: A Scene Along the Shores of the Mediterranean.

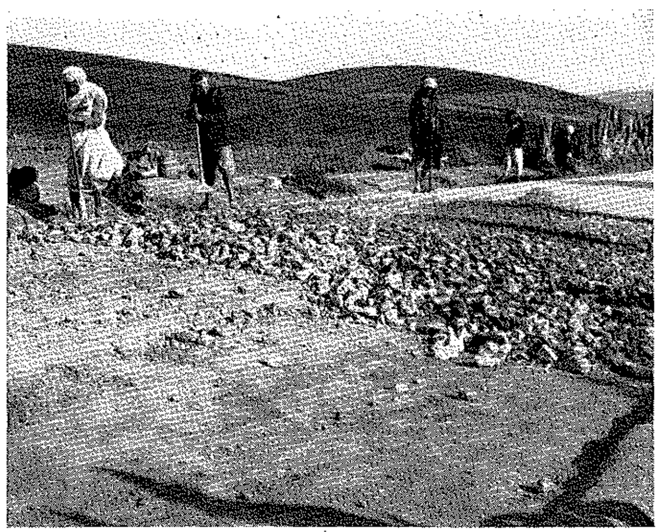
white that sail each day for Tangiers. The city is also a terminal for the railroad on which one may procure a ticket for Seville, Madrid, and other northern points and eventually arrive at ones destination.

Here it may be mentioned that all travel in Spain by railroad, with very few exceptions, is through Madrid and the time tables so arranged that your arrival is just ten to forty minutes less than twenty-four hours before your connecting train leaves. Said to have been done to assist the cafes and hotels of the capital.

Most of the populace of Algeciras was draping itself in and about the doorways as we slowly drove through the twisting street. Not yet two o'clock, their siesta was still in progress. Dress of the Spanish is not striking. Except that shoes, as we understand them, are a rarity among the poorer classes. They substitute 'alpargatas', a sort of fibre sandal and both men and women use them. The children were in evidence everywhere in all stages of undress—the younger the more undress. What they wear usually starts at the shoulder and woefully lacks the length necessary to procure much if any degree of what we like to call modesty. But I'm not at all inclined to ridicule their customs or dress—the way we were stared at made us feel that, different as they looked to us, we must have been absolute monstrosities to them. And then around a few more turns and we drove through a wonderful tropical garden to our hotel for the night—Algeciras' one beautiful redeeming feature.

The Hotel Riena Cristina is about a quarter of a mile from the town of Algeciras, situated in the midst of a semi-tropical garden about 75 feet above the harbor. The garden itself, except that it is slightly smaller, compares favorably with the famous "Jardin Tropical" outside of Havana. From the midst of its palms and rows of orange trees the yellow tile roof of the hotel hardly succeeds in making itself seen, so slightly higher is the rambling building. And from this beautiful spot one looks nearly due east across the crystal clear blue water of the harbor from the Hotel's front porch. Beyond the harbor Gibraltar raises itself in all its glory and splendor, and still further on the Mediterranean stretches its unbroken blueness to the horizon. And off to the south the mountains of Africa rise purple-brown from the sea in a haze of enchanting distance. Truly this setting and view is an instantaneous exposition in one picture of what countless tourists' bureaus try to tell travellers life in the Mediterranean countries is. Yet no word picture, however eloquent it may attempt to be, can create the atmosphere of spots like this one. But Spain's beauty exists this way. So close to poverty and unpleasant surroundings one finds the things that make life worth while. But they must be looked for and fully remembered and appreciated to bring away a picture that is not full of the shadows of unpleasantness. For the balance between the two extremes must be accomplished by the observer—adding whenever possible to the pan of worth while things, and closing one's mind to the addition of so many of the other kind which so very easily creep in.

The next morning, after we had been formally robbed at the desk of the hotel clerk, we set out for Malaga. The trip was made in an American car over another good but narrow and treacherous road along the shores of the sea. Three hours were consumed in its making and it is one that will long be remembered for the brilliant semi-tropical scenery. Through orange, lemon, and olive groves, and districts producing cork, occasionally broken by barren stretches and small fishing villages we drove—always in sight of the sea. We made a stop at the village of Marbella for gas. And here on the corner of the public square was a Spanish edition of the hand organ and monkey playing Spanish airs. Around it were dancing most of the children of the town and the large group of idlers always to be found in towns of Spain. Throughout the entire distance the coast is dotted with Moorish and Spanish forts of varying sizes and in various states of preservation. Some of them no doubt date to 700 A. D. and among them is one in a very delapidated condition now called the 'Moors Chair' from the fact that it once was a Moorish fort and in its present state resembles a large arm chair. Usually these forts along the sea are square in shape with either one good sized tower or a small tower on each corner. In both the towers and square sides are the small slits left open for rifles of the protecting forces. Some few are merely towers and round in shape. We passed through the town of Estepona a fishing village where both methods and equipment seemed as old as the forts themselves, and actually were perhaps older. The village itself consisted of one street, on one side of which were houses of wood—a very unusual sight in Spain—and on the other the beach. Along the beach were all manner of fishing boats of all sizes with their nets draped for drying either on the sand or over the mast and boat itself. At the waters edge groups of men were tugging at huge nets laden with the catch, and on the street tables were piled high with sardines, shrimp, and all kinds of hideous looking denizens of the deep including shark which the natives eat. A little further on the road became a trifle wider and we dropped down into a plain and beyond lay Malaga, her stacks of industry dulling the brilliance we had driven through all morning. For Malaga is ambitious, hoping some day also it will augment its industry by becoming a Spanish Nice. It has absorbed more of the outside world than most Spanish cities through its contact in shipping wine, grapes, other fruits, and olive oil to the ports of the world.



Road Construction Work in Spain. Laboriously Made by Hand. Note the Moorish Labor.

Malaga is a little off the main line of travel, and when reached by train from the other centers of Spain, it is usually approached from Bobadilla, forty-three miles to the north. Reports of this short journey picture it as one of the most picturesque in all Spain. The railroad passes through numerous gorges, tunnels and ledges above the river that it follows through the mountains which circle this port on the Mediterranean. Emerging from this mountain country one crosses mile after mile of level orchard land where oranges, lemons, olives, almonds, figs, pomegranates, and grapes, grown in nearly perpetual sunshine, thrive magnificently in this, one of Spain's most productive valleys. And this valley is one of the chief reasons for Malaga. A very large proportion of the fruits exported are shipped from Malaga.

Malaga is a very old, and one of the most famous of all Mediterranean seaports. Its history is the history of the Phoenicians, the Romans, the Visigoths, the Arabs, and the Spaniards. The date 711 A. D. once more appears in the history of Spain—the conquering of Malaga by the Arabs coming along with the fall of the rest of the country to them in that year. Under the Moors the city reached its peak about 1350 A. D., being at that time the chief port of the entire Moorish Kingdom of Granada. To the Phoenicians goes the credit of having bestowed the name that stuck best—though it has several times since been renamed by various conquerors—"Malaca". This is supposed to have come from the word "malac", meaning 'to salt', as at that time the city was a great fishing center and the abundance of the catch made it possible to salt away fish for future use.

Historical remnants of past ages remain in the Alcazaba, or Moorish temple, on a hill above the city. Supposedly this is the point where the first settlement of the site by the Phoenicians was made.

The district called the Limonar is perhaps the most beautiful in the present city of Malaga. Here live the many English people who find its climate ideal for the winter months, and in it have built many very beautiful homes of all architectures, but chiefly Spanish. Just above this district—very like Vina del Mar in Chile—there is a very high eminence from which one may view this city, its harbor, and the sea beyond. Just below on a rim of city-surrounding rocks are the fortifications of the city, standing since the thirteenth century. Toward the east end of the view, and at the outskirts of the city is the bathing beach. Just east of the harbor the bull ring, seating 10,000 people, and nearly in the center of the city, east and west, the huge Cathedral. The towers of this building have never been completed but still the edifice is an imposing one, and should they ever be finished, the building will be the predominant note in the view of the city from any point. Starting at this Cathedral and running due east for a couple of blocks is the 'Alemada'. Here the populace takes its daily dozen in the form of a short walk at stipulated hours. A very Spanish type mathematical symmetrical garden lines either side of the broad street, above which join giant palms to form a shady canopy from the intense heat of the summer months. Farther west and north are the large well kept stores on two or three streets, and the cheaper traders dens surrounding this small area. Then south of the alemada is the harbor, and beyond the ever beautiful, azure Mediterranean, and, if the day be clear, one may look southwest to the mountains of Africa near Tetuan in Morocco. Still farther to the west along the beach the railroad shops appear to be the only activity producing visible evidence enough to mar the otherwise indolent tranquility of this city.

The harbor to me was most interesting. Lining the docks are ships of all flags loading and unloading cargoes of wine, coal, broomstraw, fruit of every kind (which in the summer months are multiplied a hundred times in quantity and variety) wheat, olive oil, automobiles, and a thousand and one less important items. In the harbor was a beautiful black yacht—once the king of Spain's, it now serves as a naval officers training ship. And beside it an American, several English and Spanish, two German and numerous other small craft.

Malaga boasts street cars, paved streets, two or three very good hotels, an over abundance of noisy taxis with never-ceasing horns, and, in comparison with others of the south of Spain, is a city of industry. As stated above, this industry is nearly forced on the city by the proximity of this wonderfully fertile valley to the north. For here is Spain, the second largest producer of oranges in the world, without a market to sell them in. Just these last few months the country seems to be awakening. They are realizing that their oranges are rotting on the ground, and that those that they do sell bring on the average less than a peseta (12½c) per dozen. They are beginning to realize too that olive oil can be marketed better than it is, and at this time they have an envoy in the States investigating means to increase the sale of this best product they have. Spain has in the last four years increased her exports greatly, at the same time decreasing her imports, but there is still a long way to go. They have recently deposed their Primo Rivera, but he has told them one thing that I think they may have learned, "If Spain is to take its place in the world as a power of any kind its people must work harder and more hours, sleep more, eat less and take a lot less time to do it." But when nature serves so bountifully, and habits are so fixed by time and inclination, it's hard to see the need for hard work and progress. Particularly when one considers that the average Spaniard needs much less for contentment than the average of most other countries, to say nothing of the United States. When he shall have been educated up to the point where he is not content with what nature presents him with, and what a very little work will give him, then, and only then, will the purchasing desire of the country increase to the point where corresponding effort to produce these new found needs will result.

Malaga has not much to recommend it to the traveller. Chiefly one misses good food, and warmth to be comfortable indoors. And so we were glad after two days to be moving on to our destination—Africa. We spent nearly a day trying to find out if we were to be able to get a cabin on the boat Saturday night. No one seemed to know. We wanted one of the two best cabins the ship boasted, and were assured we could have one. But later we found that they had been engaged over a week before. But the weather was fine, and from advise we had beforehand we preferred a quiet crossing to a fine cabin, and we took what we could get. Perhaps had we known just what it was we might have waited to our advantage. Our bags were taken to the boat and we were ready at nine in the evening to set sail. But before we leave Spain let me tell a story that, while it loses much in translation, expresses much, to my mind, of the mental attitude of Spain.

The parts of Spain in which tourists are frequent and longingly looked for as an easy means to a few pesetas, are over run with men and boys who have found "guiding" an easy, profitable existence. The story is told of one of them, who, in showing some tourists around seemed to be extremely well versed in his art. The tourist had also under his arm a Baedecker. Arriving at the chief point of interest in the town being viewed, he said, "Here it was that Columbus stopped on his triumphant march across Spain to Barcelona on his return from the discovery of America". "But," said the tourist, "the book says nothing about any such visit by Columbus here at all". "Well", returned the guide, "if he did not stop here he surely intended to". Ask anyone how to get anywhere in any town in Spain and just such a flexible answer is obtained. Evidently they feel a good story should never be spoiled by sticking too close to the truth. And accuracy is far beyond their understanding.

So we boarded the "Atlante", a 1000 ton ship in the mail service to Melilla, Spanish Morocco. Dirty of itself, 300 army recruits bound for Africa as deck cargo helped not a bit. The deck was black with coal and to this had been added orange skins, grapes, pieces of bread and other once-edible tid bits. And rising above all this the smell of 300 recently eaten meals, the greater part of each of which must have been garlic! How thankful I was later below in my stuffy cabin that the water was calm! What a description this must have been had these men of brave hearts, and probable sensitive stomachs, been tested by the Mediterranean in the angry mood it can assume! My berth was four inches shorter and three narrower than I, and once more I was glad for a calm sea. The cabin smelled musty and the boat creaked at full speed of eight miles. Early in the morning I was glad to get up to rest and, out in the air once more, I watched Africa draw near over the starboard bow. And shortly the old Moorish part of Melilla became visible, perched above the new breakwater that is trying to make a harbor for Melilla. We were slowly docked to the music of a military band, in which the leader played no part but to give them a running start and then proceeded to talk to friends and to smoke, returning only to see who won in the headlong race to finish first. Sadly I discovered this band was not for us but for our friends the recruits, and down the gangplank we went onto the dock and our first view of the Moors in their picturesque robes—a part of every day life in Morocco.

Magnesium in 1929

The domestic output of new magnesium ingot increased from 521,075 pounds in 1928 to 1,329,669 in 1929, or 155 per cent, according to the United States Bureau of Mines, Department of Commerce. Magnesium has become a commercial material of substantial importance. Price reductions of 5 to 20 cents a pound, which became effective in January, 1930, now place this metal on a competitive price basis with other light metals.

During the last two years the domestic output of primary magnesium has been all obtained from magnesium chloride recovered as one of the many co-products of the extensive industry based on the brine wells at Midland, Mich. The manufacture of ingot magnesium by the oxide process has been suspended.

Much progress has been made in the development of extrusion, forging, and other fabrication methods and as a result magnesium can now be obtained in practically all standard sizes of rods, angles, tubing, etc. Magnesium wire and ribbon are used largely in the radio lamp trade for the degassification of radio tubes. Magnesium ribbon (extruded) goes into various heating appliances as an insulator. Sheet is employed largely in radio rectifiers. For sand castings a heat treated alloy containing 7 per cent aluminum and 0.4 per cent manganese is increasingly used in connection with airplane construction, especially for engine castings. The marketed production of manufactured magnesium other than ingot as reported by the leading companies for recent years amounted to 196,321 pounds in 1929 compared with 137,232 in 1928 and 85,895 in 1926.

Magnesium imported for consumption in 1929, according to the records of the Bureau of Foreign and Domestic Commerce, amounted to 3,490 pounds, valued at $6,539, and included alloys, powder, sheets and tubing.

What Others Are Doing

On June fourth, 1930, to become the first contributor to The Bucknell Alumni Fund, the Senior Class of 1930 voted unanimously to establish their Class Memorial in the form of this initial bequest to the University's newest and greatest project.

The Bucknell Alumni Fund came officially into existence on June first, 1930, by authority of The Alumni Council and The Board of Trustees. The handsome gift of 1930 three days later brought The Fund into being.

Miami Scholarships

On the basis of permission granted by the Board of Trustees a year ago and through funds available from the Alumni Loyalty Fund and other sources, Miami University has been able to award during the current year a total of twenty-three tuition scholarships. Fourteen of these were county or city scholarships; five were awarded to outstanding competitors in the open scholarship competition; and four were recognitions of distinctive achievements in the state-wide scholarship contests. Awards for next year have not yet been made.

Procedure at Bates

According to the new constitution of the Association the Alumni Council is the working body for the larger and more scattered General Association. The Executive Committee of the Council in turn is the group which functions between annual meetings of the Council and of the Association. Beginning in September, 1929, regular quarterly meetings have been held, the first in Portland and the last two in Boston. By vote of the Executive Committee a summary of its proceedings now appears in the *Alumnus*. There has been a one hundred per cent attendance at all the meetings except the last, when one member was unavoidably kept away by pressure of business.

Prize Scholarships at Rochester

The Rochester prize scholarships are children of the Alumni Council, and participation in the scholarship movement by the regional associations has long been a concern of the alumni office. There are now sixteen such scholarships in existence, including eleven in the Chicago territory, three in the home office, one in Buffalo and one in New York. Of these, fourteen have been in effect during the past year, accommodating one senior, two juniors, five sophomores and six freshmen. Six others, attracted by the competition, have come on regular scholarships, and all but two of the twenty undergraduates thus accounted for are from outside the state.

From present indications this number will be increased to twenty-five, or more, next fall, as at least five more boys are scheduled to come from Chicago—three on prize scholarships and two on regular scholarships. The New York association may also send a boy. It established its first prize scholarship last November but among several applicants considered has not yet found one who meets all of the exacting requirements. The Buffalo association contributed two boys to the present freshman class, one on a prize scholarship and another on a so-called second prize scholarship of $300. The regional associations keep in reasonably close contact with their undergraduate representatives after admission to college. The Chicago association entertains its scholarship holders once or twice during the year, while the two boys from the Buffalo territory were guests at the recent Buffalo dinner.

Air Repressuring Increases

(Continued from page 16)

especially where there are several operating units. Leases in some of the pools have therefore been consolidated, a condition that permits greater freedom in choosing a plan of operation. Cooperative development, involving uniform practices, has given satisfactory results.

By-passing is controlled by regulating the input volume, holding back pressure at the casing head of the producing wells, adjusting the rate and stroke in pumping equipment, raising tubing, and properly timing the intermittent pumping and rest periods.

The selection of input wells in the Williams and adjacent pools to give greatest recovery probably depends more upon the number of producing wells that may be affected by air injection than upon the following factors: The position of the wells on the structure, the distance of the input well from lease boundary lines, the mechanical conditions of the wells, and the past production history of the wells. In these shallow pools the average ratio is 1 input well to 6 producing wells.

The pressures necessary to deliver a given volume of air or gas to the sand in the pressure wells of a pool and in various pools vary considerably. In this district approximately 20,000 to 30,000 cubic feet of gas is delivered to the sand through each key well daily at whatever pressure is needed to inject this amount into the producing formation. Forcing the daily production by high-power injection methods increases by-passing and is detrimental to uniform distribution and spread of the repressuring medium. A gradual increase in production over a long period of time under repressuring practices is believed to be desirable and will result in a higher ultimate recovery.

Attention is called to the importance of accurate observations and records of production data, including input and output air-gas volumes and pressures, and to the necessity of installing proper equipment and recording devices for obtaining these data.

Experimental tests at the individual wells with portable compressors offer a practical method of obtaining pressure-volume data for planning permanent installations.

Sands in the Cisco series in several shallow pools in this district have been successfully repressured. Three of the larger pools for which figures are available and on which air was applied during 1926 showed gains in production of 300,286, and 118 per cent for the year 1927. The average daily production per well for the month prior to repressuring in the three pools was 1.2, 1.3, and 2.9 barrels, respectively.

Anomalies of Vertical Intensity

(Continued from page 12)

the other sources, showed excessively high anomalies running into thousands of gamma. After considerable discussion with Dr. Heiland it was decided not to use these stations in making the isonomalic map. This is not to be considered as any reflection on the work of the Mexican magnetic survey parties, but was done to eliminate extreme anomalies which might be due to local rather than to regional causes. Inasmuch as a considerable area of Mexico is covered by basaltic beds, it is quite probable that these large anomalies were due to the presence of local magnetic poles in the basalt.

The data furnished by the Coast and Geodetic Survey was for the year 1915, while that furnished by the Carnegie Institution was for a number of years, chiefly 1923-1926. By choosing a number of stations throughout the area at which several observations had been made over a period of years, it was possible to determine the average change in vertical intensity per year. This method of getting the average change was none too satisfactory, but by checking the changes for several years it was found to work fairly well. As the maximum period to be corrected was only ten years it was felt that the results would not be sufficiently in error to vitiate the results.

A map of Mexico and Central America was then made upon which these stations with their annual Z change were plotted. Contour lines were then drawn connecting points of equal annual change, and with this map as a base, all the station intensities were changed to 1925 values. To do this the station was first located on the map and the annual change in Z noted for that area. This value multiplied by the number of years for which the correction was to be applied, gave the total correction.

Z was then calculated for 1915 according to the formula $Z = H \tan I$ and the correction applied to this value in order to get Z for 1925.

So very few[1] stations were available, even including those in the United States along the Mexican border, that it was found difficult to draw the normal isomagnetic lines. It was decided therefore to use the horizontal intensity and inclination maps of the United States Hydrographic Office, as a basis for drawing these lines. To do this, H and I were obtained for a number of points and Z calculated from these data. Using these values, the drawing of the isomagnetic lines by interpolation was a simple matter. These lines checked very closely with those found on the photostat map of the United States and seemed to give satisfactory results in northern Mexico, and along the west coast of Mexico and Central America. In Yucatan and eastern Central America, however, the isomagnetic lines seemed to be a little too far to the north, and to run approximately a thousand gamma too high.

On account of the close check with the isomagnetic lines near the United States boundary it was decided to use these lines in Yucatan and Western Central America just as they were. It would undoubtedly have been better had the values in the western part been allowed to remain as they were, while those in the east were decreased at least a thousand gamma. The final decision was to the effect that as little or no correlation with the regional geology could be attempted due to shortage of stations, it was hardly worth while to change the isomagnetic lines, recompute the anomalies and make a new map. The map therefore remains as originally made.

The difficulties encountered with the United States Hydrographic Office maps both in Mexico and Canada were undoubtedly due in part to the generalized character of these maps and in part to the lack of stations available for furnishing map data in these areas.

It can be readily seen from the above discussion regarding, first, the reduction in the number of stations to some two hundred and fifteen by dropping those of Mexican origin, second, the size of the area covered compared with the number of stations, and third, the possibility of poor location of the isomagnetic lines along the eastern coast, why the isonomalic map of these countries is considered unsatisfactory. The above information also explains why no further work was done to try and change this condition.

Sources of Geologic Data

Geological information was obtained from every possible available source. These include:

(Continued on page 26)

(a) Personal communications from the various State and National Geological Surveys, certain Universities and Colleges, members of the Geological Department of the Colorado School of Mines, and visiting geologists.
(b) Maps and publications of the State and National Surveys, and various Universities.
(c) Articles in Technical Publications such as oil magazines, bulletins of technical societies, etc.
(d) Technical Books on Geology.

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Kansas Magnetometer Highs and Lows, Oct. 18, '28.
Kansas Has Several Promising Areas, Oct. 25, '28.
Use of the Magnetometer in Oklahoma, Nov. 1, '28.
Magnetometer Survey of Oklahoma, Nov. 8, '28.
Oklahoma's Promising Magnetic Areas, Nov. 15, '28.
Magnetometer Study of State of Texas, Dec. 20, '28.
Magnetometer Possibilities of Texas, Jan. 3, '29.
Magnetometer Survey of Arkansas, Jan. 24, '29.
Arkansas Magnetometer Study Results, Feb. 14, '29.
Magnetometer Survey of Louisiana, Apr. 4, '29.
Magnetometer Survey of Louisiana, Apr. 18, '29.
Magnetometer Study of Mississippi, May 16, '29.
Magnetometer Results in Mississippi, June 27, '29.
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New Professors on Faculty

Prof. Jarvis Fulmer

Constantinople will lose one of its leading American educators when Jarvis Fulmer, present head of the department of chemistry at Robert College, joins the faculty of the Colorado School of Mines. Mr. and Mrs. Fulmer and their small son are expected in Golden the later part of August.

Doctor Fulmer, who was graduated from Washington State College at Pullman and received his master's degree at the University of Minneosota, did further graduate work at the University of Colorado from which he received his doctor's degree five years ago.

Since that time he has been associated with Robert College in Constantinople.

Announcement had also been made of the appointment of M. G. Pawley of Ithaca, N. Y., as instructor in mathematics. A graduate of Cornell, Class of '26, Mr. Pawley taught at Rensselaer Polytechnic Institute at Troy, N. Y., and did graduate work at Massachusetts Institute of Technology and Cornell. He received his master's degree from that institution and at present is working toward his doctor's degree.

The personnel of the faculty at C. S. M. for the coming school year is almost completed. Other new members are, W. B. Jacobson, University of Utah graduate, appointed to fill the vacancy in the metallurgy department, and S. A. McCosh, the new instructor in civil engineering. Both these men will be in Golden the latter part of August.

Miner's Mother Visits School

A Mines mother, Mrs. L. S. Austin, whose son, Arthur Austin, '05, died in 1914, paid a visit to her boy's alma mater, July 3. Mrs. Austin is the widow of former Professor Austin who died in California last year.

While her son attended school, Mrs. Austin made her home in Golden when houses were still rather scattered, and before the streets were paved. Guggenheim Hall had not then been built and the assay lab was just a row of shacks. She stated that her son was one of the delegates sent by President Alderson to receive the $50,000 check from the Guggenheims that meant the building of Guggenheim Hall. Other stories of both peaceful and turbulent times were recounted during her visit. The class pictures hung in Guggenheim were of special interest, Mrs. Austin finding a number of Mines men whom she had known during her Golden residence.

Mrs. Austin is deeply interested in mining and metallurgy. She told of times when she assisted her husband in assaying, doing much of the preliminary work for him.

Returning to her Los Angeles home from an Oklahoma trip, Mrs. Austin could not resist a side trip to Golden to review the town and school she had known years ago. Mrs. Austin, who is in her latter seventies, travels alone.

Veteran Goes Beyond

Another veteran mining engineer passed away early in July. Victor G. Hills, father-in-law of James L. Bruce, '01, died at his home on the Island of Cyprus after a brief illness.

Mr. Hill's long and successful career was begun in Colorado. He was city engineer at Pueblo and Cripple Creek, and consulting engineer for Portland and Ajax and other mines at Cripple Creek. Besides his activities at these Colorado mining properties, Mr. Hills was manager of the Scheelite Mines, Nova Scotia, and the Colorado Tungsten Corporation.

For four years he was engineer for the Cyprus Mines Corporation, copper mines on the Island of Cyprus. He was also a contributor to leading mining societies and journals.

Mr. Hills was a member of the American Institute of Mining Engineers, Canadian Mining Institute, Institution of Mining and Metallurgy, and a director of the Colorado Scientific Society.

He belonged to the Sons of the Revolution and the Colorado Consistory of the A. F. & A. M., and El Jebel Shrine.

Mines Grad Heads Department

Wm. A. Manuel, '29

Dr. William A. Manuel, professor of chemistry at Ohio Wesleyan university, and a Mines graduate, has been named by university authorities as new head of the department of chemistry.

Doctor Manuel was graduated from DePauw university in 1912 with the degree of bachelor of arts. He later received an M.S. from the University of Illinois, and in 1928 was awarded the doctor of science degree from the Colorado School of Mines.

From 1921 to 1929 Professor Manuel was connected with the department of chemistry at Western State college, Colorado. He is a member of Phi Beta Kappa and has distinguished himself in other ways as a scholar.

Professor Manuel is the author of "Colorado Coals," a School of Mines Quarterly. He has written various other articles dealing with the application of chemistry to industry.

General Hale Passes On

General Irving Hale, pioneer, scholar, and hero of the battlefield, died at his home in Denver, July 25. General Hale was awarded an honorary degree by the School of Mines in 1905. With his death, comes to a close his twin careers of scholarship and military achievement which in many phases are unparalleled in American history.

General Hale was a member of the first graduating class of East High School, Denver, and was the honor graduate of that class.

Following his graduation from high school he operated an express service between Central City and Grand Lake, Colorado.

Alumni Letters

Newark, N. J.,
July 9, 1930.

My dear Colburn:—

I am on the verge of changing my address again, this time to Tampico, Mexico, where I will be working with Eddie C. Borrego, Ex-'27, as Assistant Production Superintendent for the Huateca Petroleum Co. Please forward any forthcoming mail to me there.

As you know, I have been connected with the U. S. Metals Refining Co., a subsidiary of the American Metals Co. and one of the largest American copper refineries.

Ralph Maxwell, '23, has been with us until recently. He left two weeks ago for our new Copper Cliff Refinery in Canada. I believe he is to have charge of the silver refinery there. George Strables, Ex-'28, who has been around Michigan on his vacation is now back with us. He is in the research department.

Last year, during my trip to Colombia, S. A., I was very pleasantly surprised to learn that one of the best known and liked residents of Barranquilla, a large seacoast town, was none other than an old Mines product, Mr. Karl Parrish, '01. He was instrumental in building a large, modern and beautiful residential section that rivals anything I have seen in Havana or Long Island. He is also putting up, probably up by now, a large modern hotel which is rightly the boast of the town. Mr. Parrish has not forsaken mining altogether, however. He has associated himself with a Mr. Whittaker and Mr. Probst in developing one of the largest hydraulic ventures in Colombia. While there I also familiarized myself with the name of another Miner, Mr. W. Thorne, Ex-'03. I never had the pleasure of actually meeting Mr. Thorne, but I was told he is considered by the British as one of the best authorities on placer mining and is very highly regarded down there.

Archilla and Jaime Botero, both P. G. '27, are also in Colombia. I saw quite a bit of Jaime while in Medellin. He was at one time regulator of petroleum for the Colombian government at Barranca-Bermeja, headquarters for the Tropical Oil Co., a subsidiary of the S. O. of N. J.

By the way, Professor Shannon came down there while I was in Medellin to take charge of the outfit in some way or other. My good friend Ben Zwick, '29, who must have followed the "Prof" down there, wrote me a letter from Barranca-Bermeja announcing his advent into the country and I nearly went nuts. I tried to arrange a reunion, but couldn't.

By the way, I saw a Mines car on Broad Street in Newark the other day, but couldn't catch it. I have Mines' stickers on my sister's and brother's cars which I put on in such a way that they couldn't take them off, but it wasn't either of theirs.

Warmest regards,
SALVADOR DEL RIO, '28.

West Newton, Penna.,
June 26, 1930.

Dear Mr. Colburn:—

How soon will another directory of Alumni be published? The Mines alumni seem to move around so much that it is somewhat of a job to keep up to date on addresses. I believe that the last directory was the one of September 1928.

There seems to be a considerable crew of Golden men around this district.

C. E. Lesher, '08, Executive Vice-President of the Pittsburgh Coal Company, drops out to the plant quite frequently.

S. H. Sherman, '04, Superintendent of the Champion No. 5 Preparation Plant, is quite busy keeping me busy.

Sayres, '29, and Gardner, Ex-'30, are over at the Champion No. 1 Plant and evidently are having an enjoyable time of it all. Sayres informed me the other day that Phil Ray, '29, who is with the Hercules Powder Co., had been over there.

Percy Echols, '27, is to the best of my knowledge with some Steel company at Steubenville, Ohio. Have been intending to go over and see him for the past year, but somehow never seem able to make it.

Johns, '30, was here for a week a short time ago, but decided not to stay and has departed for somewhere in Utah. We were all sorry to see him go.

Have heard a rumor lately to the effect that one of this year's crop is due at No. 5 Plant, but do not know anything definite as yet.

Am leaving July 5 for two weeks active duty with the 324th Engineers at Fort Humphreys, Va. As it is located only 15 miles from Washington, D. C., I expect to have a rather enjoyable time of it.

Very truly yours,
JACK CRAWFORD, '27.

Dear Colburn:—

I am returning the address slip which came in the mail today. It is correct with the exception of my business address. I have none at present.

My chief occupation since last November 8 has been attending the classes at the Chicago business college. The only thing I knew about the art of accounting was a short course in mine accounts which was given by Prof. Harry Wolf.

This stuff I am taking now is real up-to-date. The trouble comes when you reach the end of a fiscal period and try to make the trial balance *balance*. The next problem is making the work sheet *work* to the satisfaction of the teacher who checks it. That is followed by a balance sheet and the final hurdle is the profit and loss statement.

The unique thing about the course is that there are no lectures. They sell you a text book and a book called The Work Book of Reports. We read the text and do our best to fill them in properly.

After we have done about twenty of these reports they sell us another outfit called The First Practice Set. This form of torture contains a full set of accounting books. Later they give you another and more difficult one with a lot of extra things like depreciation, notes payable and receivable, interest expense and income, postage and postage used, freight and drayage in and out, etc.

The last two, and far more hazardous, are the third and fourth sets which deal with partnership and corporations. If a student can possibly finish those, he is given a diploma. Then just try and find a job. That is the hardest part of the whole business.

Yours very truly,
H. L. BICKNELL, '16.

Manila, P. I.
June 13, 1930.

My dear Mr. Colburn:—

I have just received your communication.

It may interest our friends to know that Quirico A. Abadilla, '20, has gone to Peru under contract to do oil geology.

Another bit of news of which I am very happy is the recent award of my Ph.D. from the University of Chicago, and my election to Sigma Xi.

I hope you will send the Magazine regularly as it is the only means I have of getting information about the Old School and my friends.

I am now engaged in consulting work in Manila. I am also opening a gold prospect which I discovered a few months ago. It looks pretty good.

This is 1930, ten years after my graduation. How I wish I could have been there for the celebration, but the distance is too far. So I must be present in spirit only.

Yours truly,
A. D. ALVIR, '20.

Riley Writes

Another interesting letter has been received from *J. A. Riley*, '22, from Melilla, Spanish Morocco, where he is Assistant Directing Engineer of Mine Operations for Compania Espanola de Minas del Rif. The problems incident to the working of this property were quite complicated, but have been solved successfully, quoting directly from Riley's letter:

"The ore occurs as oxides and sulphides and cannot be shovel-dug without mixing, not alone with themselves, but also with some rock. The task was to separate these three materials in the treatment of the shovel product. As this is iron ore, it really was only to be crushed and shipped. To make a long story short a system of picking belts has been installed following both crushing stages—the first taking out the rock, and the second separating the two ores. Of course there are other items in the flow sheet, including the collection of fines from several places, their jigging and then at last a little sintering."

Donald I. Gahagan, '27, is with the Midwest Refining Company in the New Hobbs Field, New Mexico, doing geological and engineering work.

Wayne H. Denning, '26, is working out of Tucumcari, New Mexico, doing field geology for the Midwest Refining Company.

G. N. Pfeiffer, '05, and his family stopped at Mines on their way to their home in Herin, Illinois, after a month's tour of the Mesa Verde, Teton, and Yellowstone National Parks.

Ward Graham, Ex-'26, who left school in February, 1926, and has been superintendent of the Rawley Mine at Bonanza since that time, came back to Golden the middle of July on what he termed a "loafing" trip. The Rawley is temporarily closed.

K. E. Hickok, '26, has registered for courses in the summer school at Mines. He has been in South America with the Cerro de Pasco Copper Corp.

BIRTHS

California claims another native son! Harold Duane Weaver, arrived in San Jose, California, June 26, 1930. He is the son of Mr. and Mrs. Harold Weaver and will come to Golden the first part of August to help his Miner dad study. Mrs. Weaver's mother will accompany her and make a visit of several weeks.

Mr. and Mrs. Kenneth S. Ferguson announce the arrival of their little daughter, Jean, on May 24th. Ferguson of the class of 1917 is Geologist for the Midwest Refining Company, having his headquarters at present at Rapid City, South Dakota.

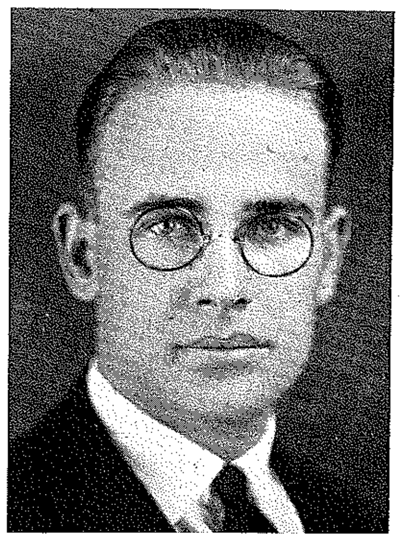
Mr. and Mrs. H. L. Minister announce the birth of a 7½ pound baby boy in July. Minister is a graduate, class of 1916.

A son was born to Mr. and Mrs. Dudley Rankin, '23, at Casper, last month. Mother and son are doing nicely.

Personal Notes

Clarence A. Farlow, '22, formerly development engineer with Miami Copper Company, left Miami, Arizona, June 14, for the U. S. S. R., where he will accept a position as mine superintendent. He leaves Miami Copper after six years of service.

Thomas L. Chapman, '06, is vitally interested in the record of the Estelle unit of the A. S. R. & M. Company. He has been mine manager of the Estelle mine at Keeler, California.



GEORGE SHUE, '26

George Shue, '26, who has been an instructor in the department of physics at C. S. M., has accepted an offer from the Montana State School of Mines. He will leave the first of September to take over his duties as assistant professor in the physics department at Butte.

Barney Bench, '30, who flew down to Oklahoma and his new job the morning after commencement, is living at the Logan apartments, Norman, Oklahoma.

H. E. Nyburg, '05, general manager for Cia. Minera Las Dos Estrallas, S. A., which is operating gold and silver properties in Michoacan, Mexico, reports that his company is running on practically regular schedule notwithstanding adverse conditions.

Robert H. Waterman, '28, received the degree of Master of business administration from the Tucker school of business, Dartmouth, this past June. He stood third in the general survey exam, which should convince one of the value of Mines' courses as a liberal training.

Jack Paddleford, who left Mines in January 1929, was back again for a short visit the first week in July. He has been working for the Signal Hill Petroleum Securities Company and making his headquarters at Los Angeles. He was on his way to Paris, France. Jack is making plans to return to Mines in the near future.

Dell E. Litz, '27, has accepted a position as Junior Mining Engineer for the Alan-Wood Mining Company of New Jersey. His address is Box No. 64, R. F. D. No. 2, Dover, N. J.

Neil H. Wills, '26 and *Milward Miller*, '26, spent the first half of July in Denver on vacations. Both are living in Roswell at present. Wills is employed by Midwest Refining Company; Miller by Humble Oil & Refining Company; both doing geological work.

Bailey Price, '23, who has been with the Bethlehem Mines Corporation, subsidiary of the Bethlehem Steel Corporation, has been made Master Mechanic for all the coal mines in the Johnstown Division. He is located at Johnstown, Penna.

Thomas L. Wells, '29, has recently been made Superintendent of the Guijas Tungsten Mine of the Tungsten Alloys Corp., a subsidiary of North American Mines, Inc., of Boston. The property is located in the Arivaca district of Arizona, 60 miles south of Tucson. They are about to install a 50 ton mill and equip the mine with a hoist and compressor plant preparatory to commencing operations. Until the camp is established Wells is making his headquarters at the Roskruge Hotel in Tucson.

Richard H. Ross, '29, who has been with the Consolidated Mining & Smelting Co. of Canada, Ltd., since graduation, has just been promoted to chief chemist of the zinc plant. His address is Trail, B. C., Canada.

G. Harold Cronin, '26, petroleum engineer for the U. S. Geological Survey at Tulsa, Oklahoma, spent six weeks in his home in Maryland during June and July.

James H. Cairns, '23, has recently moved to Colfax, Washington where he is Deputy County Engineer for Whitman County. His address is 603 Lake Street.

Frank C. Cross, who was in the English department at Mines in '23-'25, and who is now Grand Governor of the Junior Order of Moose, with headquarters at Mooseheart, Illinois, dropped into C. S. M. to renew old friendships, July 22.

Harry Showman, '10, and former instructor in math at C. S. M., stopped at the school to say "hello" while on his vacation from his work in the math department of the southern branch of the U. of California at Los Angeles.

Alex Speer, Ex-'03, is Executive Vice-President of the Florida Power Corporation, Saint Petersburg, Florida.

Daniel ("Brick") S. Harroun, '22, was married to Miss Eleanor Flowers at Carlsbad, New Mexico, June 6, 1930. It was a beautiful wedding with all the "fixin's". Don Gahagan '26 attended. The Harrouns went on a honeymoon to California, and are now living in Carlsbad. "Brick" manages and does the engineering on an extensive irrigated tenant farm near Malaga, New Mexico, 20 miles south of Carlsbad, on the East side of the Pecos River.

Ed Bitzer, '29, with the Youngstown Steel Company, in Ohio, spent a part of his summer's vacation visiting Mines and Miners.

Norman Whitmore, '26, accompanied by Mrs. Whitmore, drove from Los Angeles to Colorado for their vacation trip. They were visitors at Mines, July 18. Mr. Whitmore's Los Angeles headquarters are at 1031 South Broadway.

Burton F. Amsden, '25, presented the School with a collection of tin ores from the tin mines of the Pahang Consolidated Mining Company, Pahang State, British Malaya., July 8, when he visited Mines while on a vacation from his work in Singapore. He is with Ingersoll-Rand.

Paul Lewis, '29, and Mrs. Lewis, a former Golden girl, were visitors in Golden, for several days last month. Lewis was captain of the 1928 football team.

George Wagoner, '28, is now in Houston with the Humble Oil company.

A. Y. Barney, '30, left Golden the first of August for Amarillo, Texas. After a few weeks here, he will proceed to San Antonio. "Art" is doing geological work for the Piney Oil and Gas company.

Clarence Guth, '22, spent a two weeks vacation with his parents in Golden during the month of July. Guth is one of the engineers of the Westinghouse organization.

John B. Brown, '06, was in Houston recently on professional business. Brown is president of the Rainbow Mines, Inc., Terlingua, Texas. This company is producing quicksilver at the rate of about seventy-five flasks per month at the present time. Plans are under way, however, for greatly increasing the capacity of the retort plant in the near future. Brown's business headquarters are at 638 Milam Bldg., San Antonio, Texas.

Edward W. Cowperthwaite, '13, and Mrs. Cowperthwaite lost their little daughter, Carol, June 15. The Association extends its sympathy to the bereaved family.

Vernon M. Peck, '23, resigned his position in Houston, Texas, with Ingersoll-Rand, Inc., the latter part of July. Mr. and Mrs. Peck will make a two months auto trip to the eastern part of the United States with Bridgeport, Conn., Peck's old home, as their destination. Peck was secretary of the Houston section of the Alumni Association and his loss will be keenly felt by that group.

Thomas S. Harrison, '08, moved from Denver to California the middle of July, his address now being Box 324, Encinitas.

Amado Chapa, '27, who is associated with the Cia. Minera Kildun y Anexas, S. A., at Matehuala, S. L. P., Mexico, is in San Antonio, Texas with his family recuperating from injuries received recently.

Benjamin Arkin, '27, was in Houston, Texas, May 17 on a combined business and pleasure trip. Arkin has been with The Texas Company for about a year as lubricating engineer, his territory being Oklahoma and Arkansas. He has just received an appointment as lubricating engineer in charge of the entire republic of Mexico. His headquarters will be in the City of Mexico and he will have to do considerable traveling by air-plane.

Student President Elected

Kenneth Dickey, star pitcher of the School of Mines baseball team, football fullback and basketball player, today was elected president of the student body of the school for the ensuing year. Dickey received 143 votes to 70 for Jack Coolbaugh, son of Dr. M. F. Coolbaugh, president of the school.

Ivan Burrell defeated Claude Wilkerson for a place on the school athletic council. Burrell received 134 votes to 81 for Wilkerson.

The election followed a week of electioneering on the campus, first for the primary election and then for the final ballot.

John Doughtery, librarian of the School of Mines of the University of Missouri, Rolla, Mo., visited the library at Colorado School of Mines in July on his return from the Los Angeles meeting of the American Library association.

How Many in the Pile?

The other day I was visiting my good friend T. R. Hunt, Mill Supt. of the Shenandoah-Dives Syndicate, at Silverton, Colo., remarked Fred C. Carstarphen, Aerial Tramway Expert, and I found him worrying about the proper size of balls for his Mills, all of which reminds me of one of Professor Adams' students who was found covering an old envelope with figures. On being asked what he was doing he said:—At the alpha mill we had a pile of five inch balls, and on five different days I went to the pile and after throwing away a cracked ball took one fifth of pile as is, and on the sixth day without throwing away any broken balls was able to divide the remainder into five equal parts. This isn't anything new in the experience of a mill hand but the boss now wants to know how many balls there were to begin with, because he wishes to make a complaint against the company, and he has lost his notes, so it is up to me to figure it out or lose my job. Will some of the mathematical readers of the School of Mines Magazine Help me?

Santa Barbara, Chih.,

Capability Exchange Committee:

It is indeed a pleasure to know that the Mines Capability Exchange is again active. What the Engineering Profession most needs is cooperation among its members to better their economical position and I see the activity of the Capability Exchange as a step in the right direction.

Your work will be much appreciated by many men as it is lots of comfort to know where one is likely to find a job when one is needed.

Yours very truly,
E. R. RICHARDS, '05.

R. P. Clark, Ex-'26, is Geophysicist with the Sloane Prospecting Company, Second National Bank Bldg., Houston, Texas.

ENGAGEMENTS and WEDDINGS

Locke-Spindler

From Los Angeles comes news of the wedding of Edgar Locke, Sigma Nu member of the Class of '28, and Miss Josephine Spindler, July 2, 1930. The couple will make their home in the southern California city.

Sullivan-Torbet

Dennis Sullivan, senior this coming year, and his bride, nee Torbet, have taken an apartment at 1823 Ford Street, Golden. They were married in Texas the twenty-sixth day of May. Sullivan, a Beta, will be business manager of next year's Prospector.

Bitzer-Hartl

A romance that started when Edmund Bitzer, '29, attended Mines and Margaret Hartl attended Golden High, culminated in their marriage, Sunday, July 20. After the ceremony, the couple left on a honeymoon trip to points in Colorado, Wisconsin, and Illinois. They will be at home after August 1, at Youngstown, Ohio, where he is chief metallurgical inspector for the Youngstown Steel and Tube Company. Bitzer is an affiliate of Sigma Nu.

Nelson-Strop

Fred M. Nelson, '25, and Miss Mamie Strop were married at St. Joseph, Mo. on May 17, 1930. Both were from St. Joseph, and Mrs. Nelson was practicing law there prior to her marriage. Nelson is Assistant Production Superintendent for the Texas Gulf Sulphur Company at Newgulf, Texas, where he and his bride are now residing.

Dotson-Greever

Mr. and Mrs. Joseph N. Dotson arrived in Golden late in July on a honeymoon journey from their home in Virginia. Mr. Dotson is a sophomore at the Colorado School of Mines and is attending summer school.

Mrs. Dotson was formerly Miss Virginia Greever, beautiful belle of Norton, Va. Mr. Dotson's home is in West Virginia. They were married at a church wedding in Norton, June 28.

Mr. Dotson is a member of the Sigma Alpha Epsilon fraternity. The young couple will make their home in Golden until the bridegroom finishes his course at Mines.

Hancock-Moffett

Word has been received in Golden of the marriage of Miss Louise Moffett and Robert Hancock, president of the Philippine Railway company, in the church of St. Mary the Virgin New York City in March.

The bridal couple sailed March 23 and are touring Europe. They will return to Manila to make their home. Miss Moffett attended the School of Mines for one year and while here made her home with Mr. and Mrs. J. C. Roberts.

Monterrey, N. L., Mexico
July 17th, 1930.

My dear Colburn:—

Out of plain justice I must say that I have enjoyed every issue of the Magazine and have noticed how it has been gradually growing to the A-1 class it is in now.

Every one of the members of the MONTERREY SECTION OF THE ALUMNI ASSOCIATION is a subscriber and has always a good word of appreciation for the splendid work being done through it.

Yours very truly,
PABLO M. SADA.

Basketball Rules Changes

Proposals to eliminate the center-jump in basketball were rejected by the joint rules committee which adopted a number of less drastic rule changes.

Despite this decision the committee recommended that experiments with the elimination of the jump at center be continued.

Rule changes, voted by the committee, included:

1: A player fouled in the act of shooting, will be awarded only one free throw if he makes the basket. In the event the foul prevents a score, two free throws will be awarded as in the past.

2: Failing to remain in the jump circle until the ball is tapped will constitute a technical foul, except when the ball is tapped into the basket, in which case a free throw will be voided.

3: On a jump ball the ball may be tapped not more than twice by either player.

4: In case of missed free throws the ball will remain in play instead of being returned to center.

5: When time is taken out for free throws, the watch shall be started when the ball leaves the throwers hands, instead of when he takes his position on the free-throw line.

6: A player removed for a substitute may not return to the game until after play has restarted.

7: Not more than three overtime periods shall be played in high school games and a rest period of five minutes shall be allowed after the first overtime period. Local committees are given the authority to make the final overtime period a "sudden death" test, with the first team to score winning the game.

8: The circumference of the ball shall not be more than 31 inches and not less than 30 inches. The weight maximum shall be 23 ounces and the minimum 20 ounces.

The committee went on record as favoring the three official plan when feasible.

Coaches will be asked to vote next year on a plan to provide a 16-foot circle for the center jump from which other players will be barred and on a plan to name zones in which players must remain until after the jump.

The committee also suggested that experiment be made with rules limiting the dribble to a single bounce in the defensive half of the court, as a means to prevent stalling.

No anti-stalling rules were passed, but it was voted to print an article in the rule book calling attention to the fact that the team behind in scoring is responsible for all stalling in basketball.

News from the Chapters

Colorado Section

The July Meeting of the Colorado Section of the School of Mines Alumni Association was held at the Auditorium Hotel on July 18. C. O. Parker presiding.

R. V. Koupal, Al S. Wyner of Ajo, Arizona, and Geo. A. Wigton, Eureka, Utah were visitors from outside of Colorado.

Geo. H. Wigton described the milling methods employed by the Consolidated Chief Mining Co. at Eureka in a very instructive and pleasing extemporaneous talk.

Dean Morgan spoke on the summer school activities. William Hazard endeavored to offer an alibi for leaving the School of Mines and affiliating himself with the Colorado University at Boulder. He tried very hard to convince the chapter that the fact Boulder is a Co-educational institution had nothing to do with his choice.

The following members attended the luncheon: C. O. Parker, G. R. Miller, W. H. Paul, F. C. Bowman, W. P. Simpson, J. L. White, Al. S. Wyner, Donald Dyrenforth, Dewey Dutton, W. M. Traver, Jr., R. V. Koupal, Geo. H. Wigton, William J. Hazard, A. H. Buck, Howard A. Storm, Jesse R. Morgan, Dave Johnston, J. E. Norman.

Student Editors Named

Heads of the School of Mines publications for the coming year were named at a recent meeting of the school publication board: Oredigger editor, Ralph Keeler; manager, Carl Deismant; Prospector editor, Emil Holmberg; Dennis J. Sullivan, manager. Both Keeler and Sullivan are members of Beta Theta Phi, while Deismant and Holmberg are Sigma Phi Epsilons. The members of the publication board are George Playter, Page Morris, William Wallis and Frank Hayward, who represent the student body, and Prof. Ralph N. Morrison, George Allen and C. H. C. Braden, faculty representatives.

Penn State's Plan

Resulting indirectly from discussion at the National Student Federation of America convention at Stanford in January, the student council at Penn State has unanimously agreed to place elections of La Vie, the senior class annual, on a competitive basis. Formerly the editor was elected by undergraduate political parties, and other members of the staff were appointed as a reward for political support.

Under the new plan all sophomores who wish may try out for the staff. During the first semester of their junior year twelve of this group will be elected to the junior board. In May the new editor, his assistants, and a new junior board will be named by the outgoing staff.

Montana Section

The last meeting of the Montana Alumni was held at the Silver Bow Club, in Butte, for the purpose of meeting Mr. Allan E. Craig and also to hold election of officers.

Minutes of meeting of December 3, 1929. Meeting called to meet Mr. Craig and to elect officers. Election of officers: E. S. McGlone unanimously elected President; M. N. Taylor unanimously elected Vice-President; H. M. Strock unanimously elected Secy.-Treas.

Retiring officers: A. S. Richardson, President; L. J. Hartzell, Vice-President; and C. E. Calvert, Secy.-Treas.

Moved, seconded and passed that Secretary-Treasurer act as corresponding member of committee on publication of the Alumni Magazine.

Mr. Allan E. Craig gave an interesting talk relative to present conditions in Golden.

Moved, seconded and passed that a vote of thanks be extended to Mr. Craig for his talk to those present.

Moved, seconded and passed that meeting be adjourned.

Leaves for Panama Canal

Thomas E. Northrop, Colorado School of Mines student, left for Balboa Heights, Canal Zone July 2 to visit the home of his father and mother for the first time in two years. He will travel via New York and Haiti, possibly stopping on the way to visit some friends now residing in the States.

Before leaving his home two years ago he was considered one of the foremost model boat builders, having built them both of paper and wood. He is well known in maritime circles there as a winner of races in which he entered both in the motor and sailing classics.

It is expected, however, that he will visit many of the scenes of interest and especially some of the new mining districts which have just been opened up, but which have been known since the time of Columbus in the Darien and Veraguas regions of Panama. His father with friends have a thirty-seven mile concession of gold bearing placer in the Darien region, and is quite prominent in diplomatic circles.

Ralph Jensen is another student from the Canal Zone. He returned to C. S. M. recently after a year's stay at his home in Balboa Heights. Ralph is attending summer school and will register with the junior class at the beginning of the fall term.

Offices and class rooms at Guggenheim hall are being remodeled in order to take care of an expected increase in enrollment in geological courses at the School of Mines next fall. The offices of Professor C. A. Heiland and W. A. Waldschmidt are being remodeled and an additional classroom is being provided.

INDEX TO ADVERTISERS

About Advertising Interest

Interest follows attraction as night follows day. In *advertising* it marks the germination of the seed skillfully sown. Curiosity demands satisfaction and Interest is thus created. The desire for greater knowledge has been stimulated and the test period is at hand. Interest is not easily aroused and protects itself against invasion by the creation of mental barriers that are able to withstand repeated assaults. Interest stands at the outer gate of the fortress and may be passed only by that which satisfies the guardian. He who displays interest stands half committed and is *impregnable* no longer.—*Chas. A. Clark.*

General Electric Switchboard

The General Electric Company has announced an enclosed miniature switchboard to control an electrical system from a central point. This switchboard, of unique construction, involves a great saving in space. It is made up of one or more self-contained units arranged in circular formation. When these units are mounted side by side, with moulding at front and back, a switchboard of uniform and neat appearance is obtained.

Each individual unit is factory built complete, and is made of welded fabricated parts. It occupies an angular space of 30 degrees so that a total of six units can be mounted in the half-circle, leaving the operator a space of 4½ feet in diameter.

DuPont's New Line of Fabrics

The Rubber Products Section of the du Pont Company has recently introduced to the mining trade du Pont Brattice Cloth, comprising a complete line of coated and uncoated fabrics, scientifically developed to resist underground conditions.

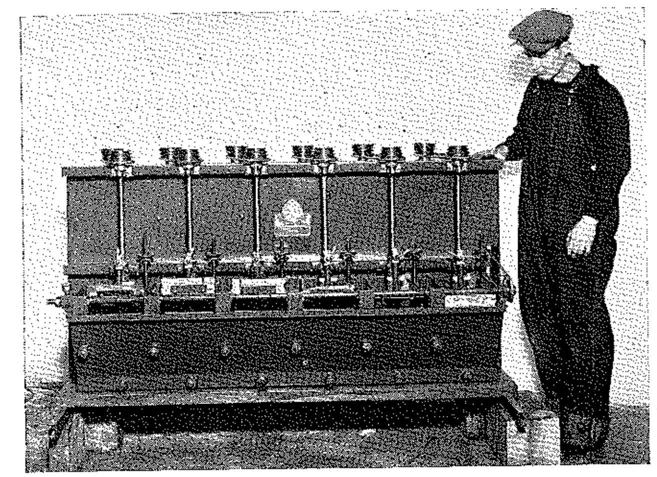
For the past nine years this department has been manufacturing du Pont Ventube, the flexible tubing that has proved so successful for auxiliary mine ventilation. Naturally, during these years much information has been accumulated regarding the treatment and manufacture of fabrics that will successfully withstand the rigors of underground use. This knowledge has been of great value in developing the new line of brattice cloth.

Denver Equipment Designs New Type Machine

To meet the requirements of continuous flotation testing, the Denver Equipment Company has recently designed a radically different type of machine.

This flotation unit duplicates to the most minute detail the large size Denver "Sub-A" (Fahrenwald) Flotation Machine. The all steel welded construction insures rugged design and occupies less floor space.

The machine shown here is a No. 5, being the smallest type of continuous flotation machine manufactured. Such a flotation unit makes it possible to perform small scale tests which are duplicated in field practice.



Denver Equipment's New Type Flotation Machine

Traylor Vibrator Solves Conveyor Problems

Some particularly difficult and interesting conveyor problems have recently been solved by the Traylor Vibrator Company, Denver, Colorado. One of these required the installation of two conveyors feeding a 12-foot gyratory crusher, each conveyor handling approximately 100 tons an hour. The conveyors must operate slightly downhill and be mounted upon the floor at the feed end of the conveyors. These have been so arranged that a twist of the rheostat varies the speed of travel of the conveyors, giving the operator positive control over the tonnage fed to the crusher.

Another unique installation was that of a tubular conveyor delivering hot sinter up 18 degrees under a set of rolls. This has eliminated the costly maintenance of belts, pulleys and bearings, as well as saving the poisonous, valuable dust. Smelter fume and other poisonous materials are handled without dust, danger and loss.

A third installation consisted of a Traylor Vibrator conveyor for conveying zinc calcines in a leaching plant. The three essential requirements for this installation called for: climb 11 degrees—convey 20 feet—screen the entire discharge from the conveyor. The average feed is 2 tons each hour and peak loads run up as high as 50 tons each hour. Less than two horsepower are required to operate this screening conveyor.

Professional Cards

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DENVER, COLORADO

JOHN WELLINGTON FINCH
Consulting Geologist and Engineer
668 Gilpin St. Denver, Colo.

EDWARD P. ARTHUR, '95
Mining Engineer
Cripple Creek, Colo.

LIONEL BROOKE, '14
Mining Engineer
824 Royal Bank Bldg.
Montreal, Canada

JOHN HAYS HAMMOND, Hon. '09
Mining Engineer
120 Broadway New York, N. Y.

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Exchange National Bank Bldg., Tulsa

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Consulting Engineer
721 Marion St. Denver, Colo.

THOMAS S. HARRISON, '08
Consulting Oil Geologist
Post Office Box No. 324
Encinitas, California

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C. LORIMER COLBURN, '07
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A. E. MOYNAHAN, '00
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T. D. BENJOVSKY, '09
Mining Engineer
Salida, Colorado

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1267 Race Street Denver, Colo.

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Metallurgical Engineer
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ALFRED E. PERKINS, '10
District Manager
Crucible Steel Co. of America
2635 Walnut Street Denver, Colo.

JACK P. BONARDI, '21
Sales Manager
The Mine & Smelter Supply Co.
225 Broadway, New York City

MARSHALL D. DRAPER, E.M., '97
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Consulting Geologist and Geophysicist
Box 187 Golden, Colo.

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Mining Engineer
715 First National Bank Bldg.
Denver, Colo.

WM. D. WALTMAN, '99
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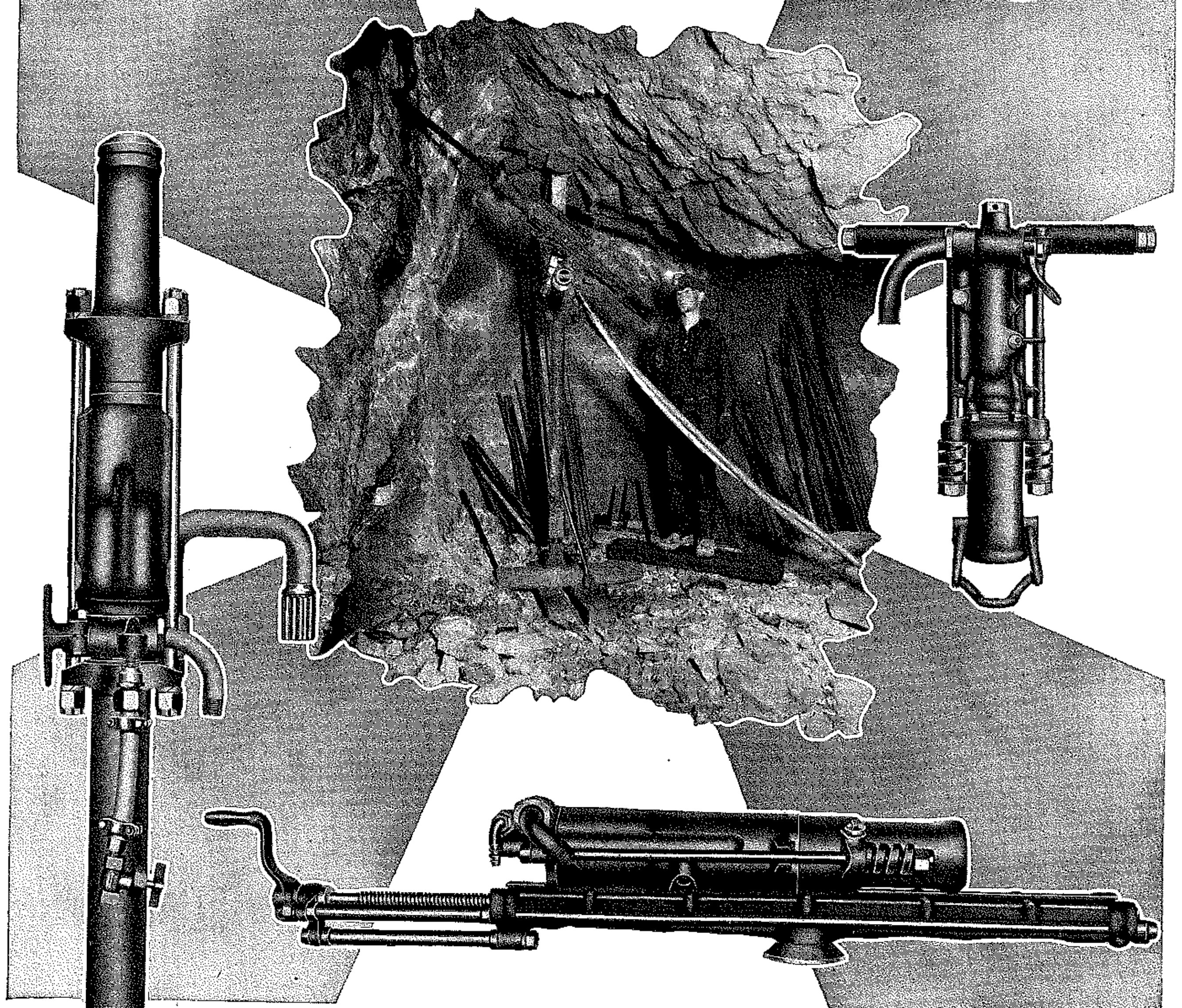
Teacher: "Johnny, how many days are there in each month?"

"Thirty days hath September,
All the rest I can't remember;
The calendar hangs on the wall,
Why bother me with this at all?"

George F. Cooper ?

If anyone knows George F. Cooper who was in Tampico, Mexico in 1917, would he please communicate with C. Lorimer Colburn, 511 C. A. Johnson Bldg., Denver.

FROM SET-UP



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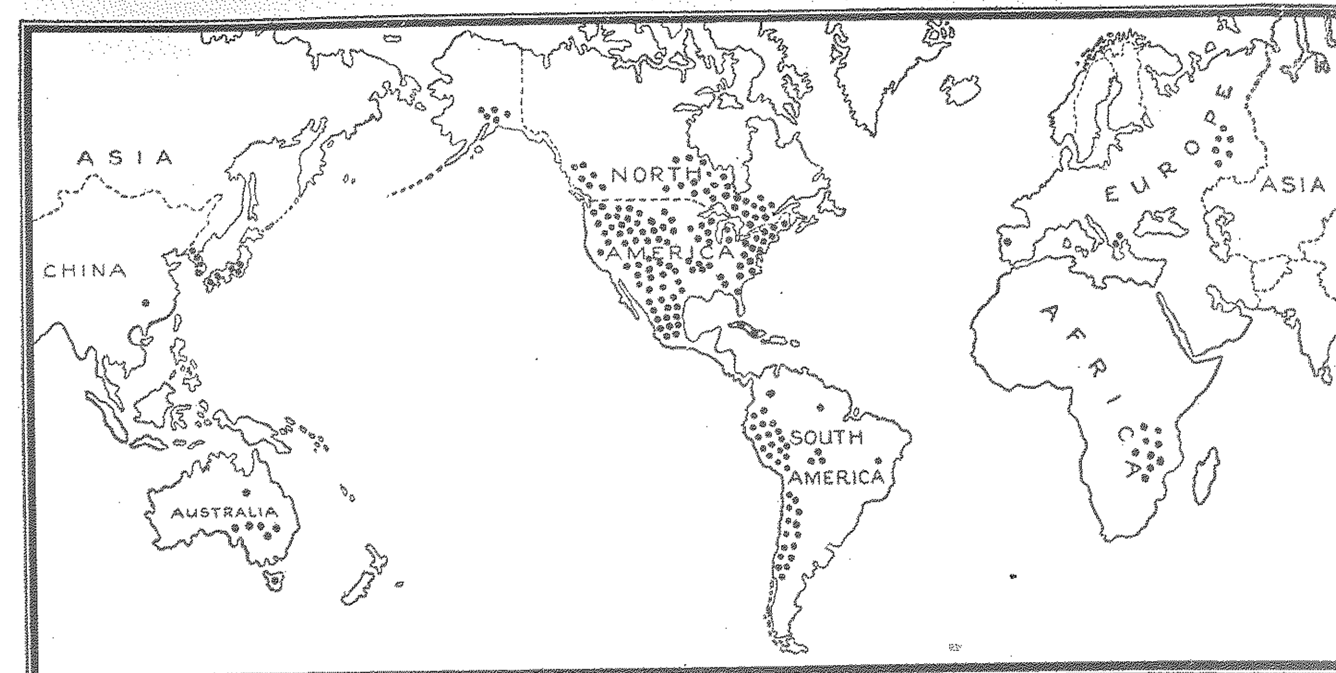

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