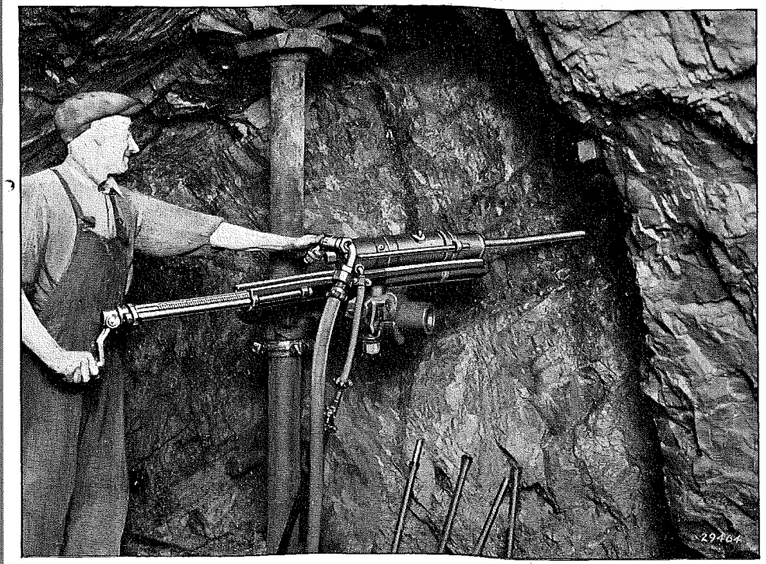

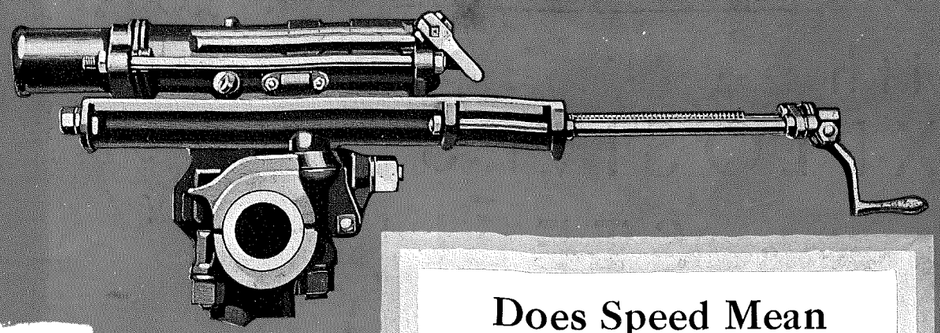

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These new drills are made in three sizes. Descriptive bulletins will be sent on request.

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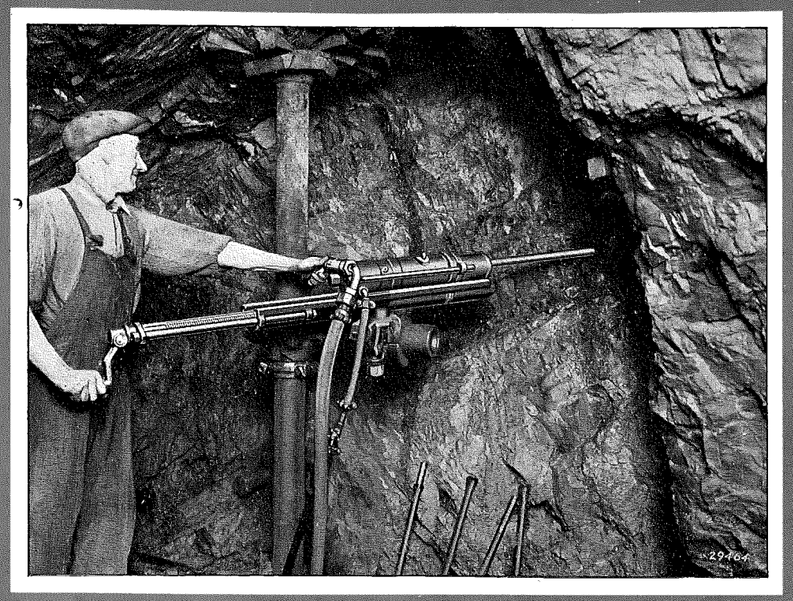
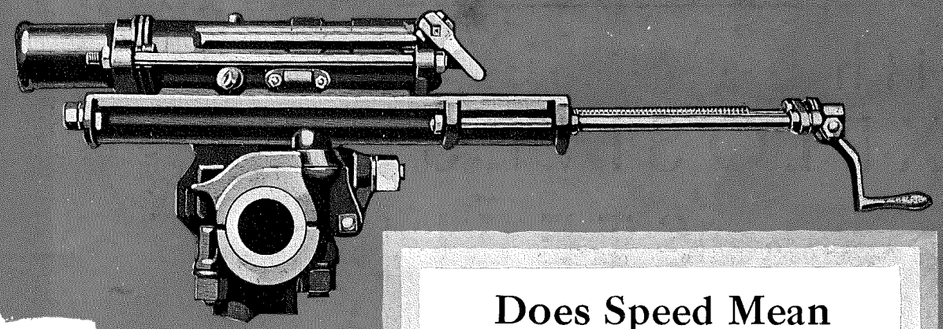
The COLORADO SCHOOL OF MINES MAGAZINE

Volume 20 No. 12 *December 1930*

Christmas Number





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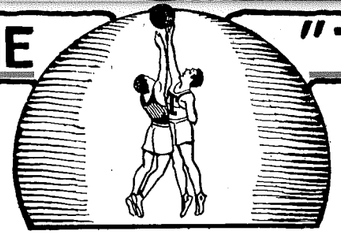
GETTING THE "TIP OFF"



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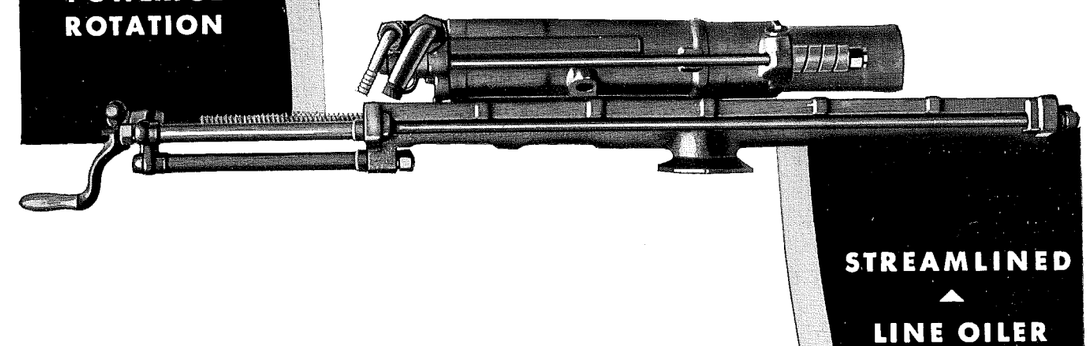

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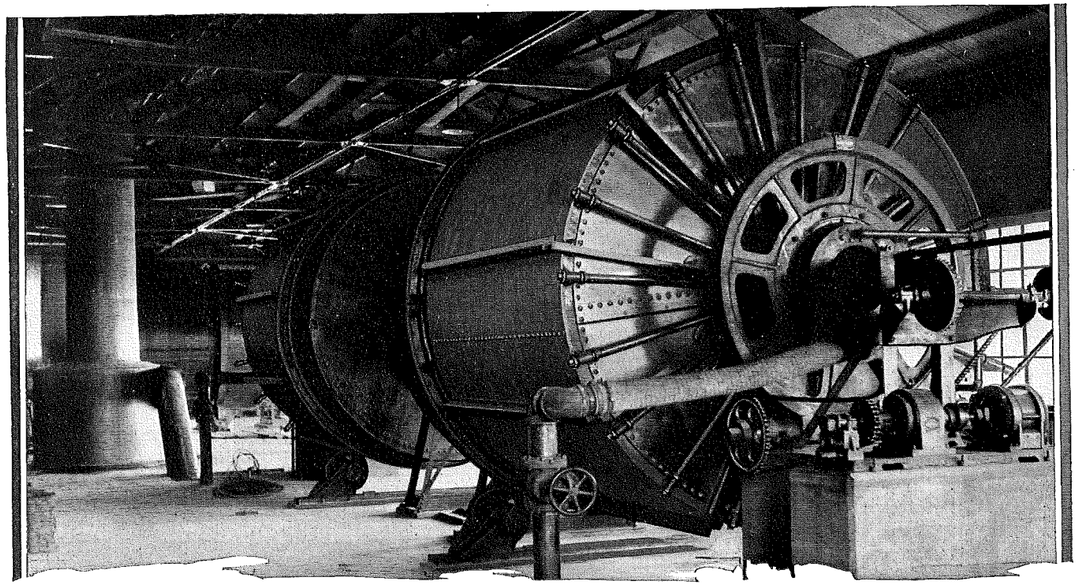

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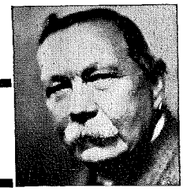

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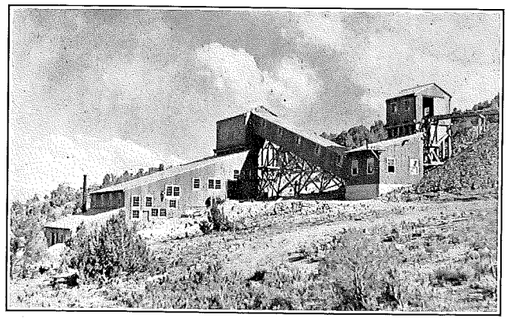

50-Ton Silver Flotation Mill in Nevada
Designed and equipped by Stearns-Roger in 1929

For 45 Years we have been designing, erecting and equipping Mills for the Middle West, Canada, and Mexico. Many carloads of Mining Machinery leave our shops each year, including Hoists, Timber Framers, Flotation Machines, Rod and Ball Mills, Jigs, Roasting Furnaces, etc.

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Low-cost ore reduction!

Colorado Iron Works products are the result of wide experience accumulated during many years' solving of metallurgical and mechanical problems. They have long been the choice of mill and smelter men throughout the world. Some specialties of outstanding merit are mentioned below. May we send you pamphlets fully describing them?

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Many mill screens come and go, but the Impact Screen continues to show superiority on every point of comparison. Though already the best, it has recently been further improved. Large capacity—sharp separation—low upkeep.

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An air-cooled, multiple-hearth roaster of acknowledged superiority both mechanically and metallurgically. Great freedom from interruptions even when run at high speed and very high temperature. For metallurgical roasting, acid making and special calcining operations.

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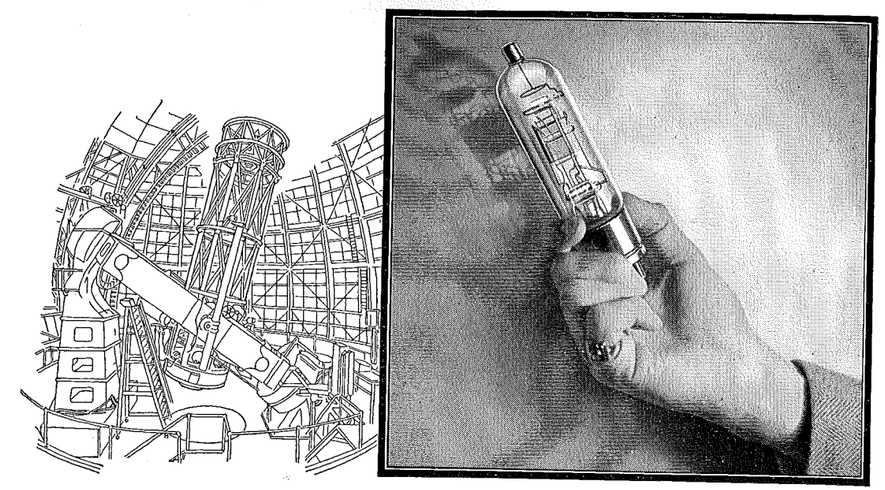

The new G-E low-grid-current Pliotron tube capable of measuring a current as small as 10^{-17} ampere

This Little Tube Measures Stars Centuries of Light Years Distant

BY MEANS of a new vacuum tube called a low-grid-current Pliotron tube, astronomers can gather the facts of stellar news with greater speed and accuracy. In conjunction with a photoelectric tube, it will help render information on the amount of light radiation and position of stars centuries of light years away. It is further applicable to such laboratory uses as demand the most delicate measurement of electric current.

So sensitive is this tube, that it can measure 0.000,000,000,000,000,01 of an ampere, or, one-hundredth of a millionth of a billionth of an ampere. This amount of current, compared with that of a 50-watt incandescent lamp, is as two drops of water compared with the entire volume of water spilled over Niagara Falls in a year.

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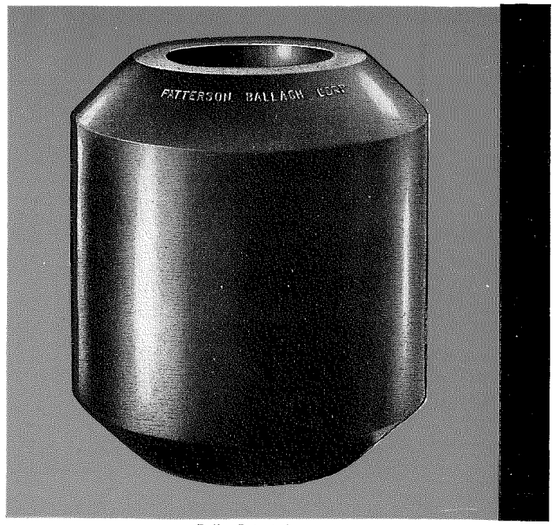

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APPLICATION of Bettis Drill Stabilizers above the drill bit is fast becoming universal practice in rotary drilling fields.

These Stabilizers, like their worthy companions, Bettis Protectors, are made entirely of specially compounded rubber—so tough in texture, so durable, that they are actually outlasting the drill pipe.

Bettis Stabilizers cushion the drill pipe in open formation, eliminating to a large extent those factors of destruction that prematurely fatigue drill pipe.

Excessive strain is removed from the vital point immediately above the drill because these large protecting cushions keep the drill pipe and drill stem in centre, preventing whipping.

Bettis Drill Stabilizers may be slipped over the tool joints or couplings to the desired location on the drill stem or pipe. They hold the pipe in centre when fishing. No wall hook is needed. The overshot will always go over the fish and push the Stabilizer ahead without interference.

Extra reamers can be eliminated.

There is no need for more than one drill collar. Twist-offs at the drill collar are practically eliminated. The collar will not corkscrew under heavy drilling.

The tool joints will not wear out, because friction is not imposed upon them.

The drill pipe will last much longer, due to reduction in vibration and fatigue.

By keeping the pipe centred and in vertical position, straighter hole is drilled.

Bettis Stabilizers do not interfere with mud circulation because the open area on the outside for the return circulation is several times greater than the area within the drill pipe.

In case of a cave-in the drill pipe and bit can be pulled through the Stabilizers. Being lighter than the mud, the Stabilizers will float to the surface and if by any chance they become lodged in the hole will cause no trouble because no metal is used.

If used in stovepipe casing the Stabilizer will practically eliminate trouble from collapsing or a broken seat.

Under ordinary conditions dropped drill pipe, equipped with Stabilizers, will float to the bottom—avoiding serious trouble.

Bettis Stabilizers on the drill pipe in open formation and Bettis Protectors on the pipe within the casing guarantee 100 per cent. protection against excessive friction. They are a necessity in every rotary drilling well. Ask for Catalogue.

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CONTENTS

PAGE

Editorial and Comment 10
Frontispiece 12
Humanizing Trend in Mathematics 13
Alumnus Describes Interesting Features—Russia 14
A Relic of Other Days, This Arrastre on the Mines' Campus 15
More Room for Petrology 16
Gas Installations 17
The Millman's Lament—*A Poem* 18
Principles of the Hdyrometallurgy and Electrodeposition of the Metals—*X Chapter on Metal Recovery* 19
Moorish Life and Customs in Morocco 24
Anomalies of Vertical Intensity 27
Clipped From— 31
Athletics 33
Campus Topics 34
News from the Chapters 36
Alumni Letters 37
Personal Notes 38
Engagements and Weddings 39
Index to Advertisers 40

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Editorial Comment

Silver

THE price of silver has a direct influence on the production of gold, copper, lead and zinc. About 80 per cent of the silver produced in the United States is derived from copper, lead or zinc ores or from complex ores, principally valuable for its gold, copper, lead and zinc. Low prices for silver, therefore, not only curtails production in silver mines, but also reflects upon the prosperity of other metal mines. The metal mining industry is concerned with what happens to silver.

On November 25, Senator Key Pittman of Nevada, speaking over the national broadcast, gave a splendid picture of the relations of silver on the present world-wide depression. Senator Pittman said: "The world is not suffering from overproduction but from underconsumption. The problem confronting the world today is not one looking to the reduction of production but to the restoration of the power for consumption. Business genius and government statesmanship should be earnestly and intensely directed to the encouragement of a return to normal consumption by the removal of all obstacles which have brought about depressed consumption in the United States and throughout the world.

"The Senator goes on further to show that there was never an overproduction of silver, but that the present oversupply was due principally to the action of the British Government in deciding to place India upon a gold standard and dumping on the world India's stored supply of silver. He said that silver is the only money that the people of India know and that there are billions of ounces hoarded by its 350,000,000 people. This silver is the measure of their wealth and is substantially their only instrumentality of trade and commerce. And yet the British Government for India determined to destroy this silver as money and to substitute for it a paper money supply based on a miserably inadequate reserve of gold. This announcement was looked upon in amazement not only by every silver-producing and every silver-using country in the world, but even by the economists of gold standard countries, who realized that the gold of the world has a greater burden of credit based upon it than is actually safe.

"The British Government for India, by its policy, has struck down the wealth of India and destroyed the purchasing power of its subjects. It has not only injured its own subjects, but it has equally and in the same manner destroyed the purchasing power of China, South America, Mexico and every silver-using country in the world.

"The producers of silver, although a small group by comparison with all of the other groups affected, have suffered even more deeply than the producers of other commodities. Mines throughout the world have been compelled to close, adding hundreds of thousands of idle men to the horde of unemployed."

The Senator blames the present world-wide stagnation of business primarily upon the depressed value of silver and, therefore, the inability of more than one-half of the people in the world to buy. As a remedy for this condition he proposes:

First, That the British Government should immediately announce its intention to abandon the policy of dumping Indian silver on the market; Second, There should be an agreement that governments would abandon the policy and practice of selling government silver; and Third, That there should be an agreement between the governments of the world as to the stabilization and use of silver for monetarial purposes.

When the dumping of silver is ceased, the Senator believes that the United States, Great Britain, France, Japan and other countries enjoying great commercial benefits in China should lend to the national government of China financial and expert aid for the pacification of China and the revivification of that country.

Taxation

WHAT do you know about taxation? Right now the economic side of the mineral industry is in the forefront, as it is bound to be in a period of depression. Not only in Colorado, but in other Western states, the mining industry must keep a keen eye on the forthcoming legislative sessions. Taxation is the big problem which each legislature will endeavor to solve during the next few months.

The tax burden on real property has become virtually unbearable. Legislators are looking for new sources of revenue. The income tax, the sales tax, the severence tax are all suggested as substituted for the general property tax. The mining industry, too often immersed in technical problems, must see that its interests in taxation are safeguarded.

The Geology Quarterly

THE second and revised edition of "The Geology of the Golden Area", from the pen of Prof. J. Harlan Johnson, '23, is just off the press—Colorado School of Mines Quarterly, Volume XXV, No. 3. The bulletin is used as a classroom text in geology at the school.

The excellent geographical location of the School of Mines is brought home most forcibly by this little publication. The Golden area is indeed a "golden area" for the geologist. Here nature has told and pictured her story so clearly that the veriest tyro in science can see and understand. Location is one of the factors which has aided greatly in making the Colorado School of Mines "the world's greatest mining school."

The U. S. Geological Survey

THE Director of the United States Geological Survey, in his one hundredth annual report, brings out the fact that the work of this Government Bureau is steadily enlarging and that the Survey has large tasks ahead.

Scientific investigation is a continuing work. Its field always expands, never contracts. The fiscal year 1930 shows a great expansion in the work accomplished by the Survey. The personnel, of which more than eighty per cent is professional, was larger than ever before. The appropriations for the year exceeded by 50 per cent those of 1910. Including cooperation funds, the expenditures were double those of 1910.

In spite of all this enlargement and progress, the Geological Survey is woefully deficient in its ability to publish promptly the result of its field work and investigations. The reason for this is partly due to the inadequacy of the printing appropriation. In 1910, the appropriation for printing and binding was $140,000, with an additional appropriation of $35,000 for engraving. For the fiscal year 1930, the printing appropriation was $150,000 of which not to exceed $35,000 could be spent for engraving. This shows a decrease in the appropriation for printing.

New demands are constantly being made on the Survey for more investigations with no additional allowances for the publication of results. The dollar does not buy as much today as it did in 1910, and coupled with the vast amount of increased investigations the Survey has a good excuse for its inability to publish the results of its work promptly.

There is no doubt about the great value to the country of the publications issued by the Geological Survey. The work of this scientific bureau should be made available to the public immediately after it is prepared. Scientific work loses much of its value if held up for several years in cold storage. Congress should increase the appropriations to the Geological Survey for editorial, mechanical, and printing purposes.

But the trouble does not lie wholly in the inadequate printing appropriation. There is much room for improvement in the Geological Survey itself. Too much time elapses between the time that the manuscript is written until it reaches the editor. Too many good geologists are being killed with administrative duties. Get busy, Geological Survey, clean house! Increase your efficiency and we will go down the line for larger printing appropriations.

- - -

George Bernard Shaw, who isn't given to praising very many people, did a right-about-face recently and honored a scientist, Einstein.

But first he "Shawed" Napoleon saying that it would have been much better for the world had he never lived; and although the Little Colonel had built empires, Einstein had created a universe, and had made a real contribution to mankind.

Talkies in School

"SOUND MOVIES", since their introduction into technical schools, have gone a long way in bringing theory and practice closer together. The gulf between the two has been lamented by professional men for years.

Research has proved that most of our knowledge is obtained through sight. (The Missourian says, "seeing is believing.") Second in importance in learning is hearing. A lesson combining the use of these major senses and in such a vivid and acceptable way as "talking pictures" are presented, should be invaluable in making even the most complicated lessons less difficult.

The printed page teaches well but by indirect means, while "the talkies" offer the direct services of the world's finest scientists and teachers.

Mines' Spirit

RACCOON coats and pink teas have never been in style at Mines. Working clothes are the costume of the School. It may be that this disregard for the social side of life and concentration on the business at hand is one of the reasons for the famous "Mines' spirit." Anyway, here is what the Silver and Gold, Colorado University's newspaper, has to say about it:

". . . . Mines, with almost always a losing team, is certainly a school of loyalty, of indomitable spirit. Why? Because there is no tendency to substitute social life, no set of lounge lizards. How great Colorado could be with the loyalty and support Colorado Mines afford its losing team, if such spirit could be placed behind the winning State eleven."

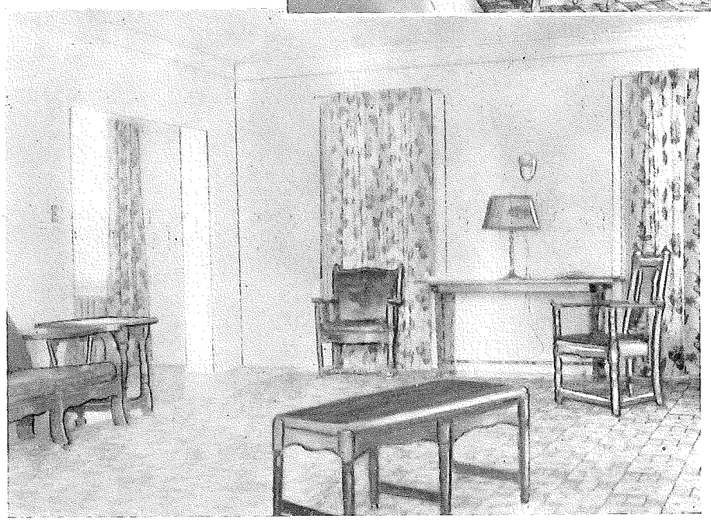
On Giving

REPORTS from workers in a nearby community chest drive, reveal that those who are in a position to give at all, are digging a little deeper this year than ever before. Not very many of us have been entirely untouched by the depression period, and so, having felt the pinch ourselves and knowing how uncomfortable it is, are more generous in acting to alleviate the conditions of those less fortunate than we. Christmas time is giving time, and we shall all be the happier because of our gifts.

The Red Cross Drive

THE campaign of the Red Cross for funds to carry on its relief work closed Thanksgiving Day.

Mining men were prominent among those contributing to the fund. Many times in the past, when catastrophes have overtaken workings where they have been in charge, they have been relieved to know that an organization such as the Red Cross could be depended upon to bring relief and to assuage the effects of unavoidable tragedies.



THE Fraternities have done their share to make the Campus beautiful.

This is the new A.T.O. house, looking across the stretch of lawn in front of Guggenheim Hall. The interior of this club house is no less beautiful.

Humanizing Trend in Mathematics

More practical courses Traditions ignored For engineers

By J. C. FITTERER*

NOT so many years ago—at least in the late Pleistocene—a movement to humanize or industrialize mathematics had a vague inception in scientific circles engaged in research and teaching. The accepted and time-honored development of the subject was logical and concise; a beautiful structure of thought and argument, worthy of the labors of the ancients who fashioned and shaped their concepts into objects of grace and intellectual appeal. All due praise to them for their efforts and contributions, without stint or cavil.

However, the modern world needs and demands something more. The machine-age incessantly calls for the annihilation of space, that is, for transportation in minimum time, the instantaneous transmission of information and news, and the prompt generation, conveyance and utilization of power anywhere and everywhere. Not only these, but in the building of vast centers of population structures undreamt of require erection each to house an industrial army engaged in daily vocations and professions. The old order is ever on the wane while the new waxes into a fuller orb. And yet the Wise Man once said "methinks between public balls and court banquets that there is nothing new under the sun." Maybe not in essence, but surely in the application of old principles to new and changing conditions.

The question naturally arises; is mathematics amenable to a closer adaption and better application; may the gulf between theory and practice be spanned by a suitable bridge, or must this yawning chasm ever present its cavernous depths as an insurmountable barrier? This leads us to a short review of the main steps in a movement, or trend, to make formal analysis better understood and more useful and usable. America, still young and unjaded by centuries of conservatism, deserves at least some slight credit.

In 1824, the first distinctive college of engineering in the world was founded in Troy, N. Y. by Stephen Van Rensselaer—Rensselaer Polytechnic Institute—from which time engineering education, as such, under the influence of industrial growth has advanced by leaps and bounds, not only in the United States, but in Europe and the world over. In 1924 the centenary of this pioneer institution was duly celebrated and many of its early aims and vicissitudes consigned to the printed page for posterity.

Another landmark arises in the Morrill Land Grant Act, 1861, by which 10,000,000 acres of public land were set aside for the express purpose of scientific education in its broadest sense. With this step the modern movement was in full swing and the increasing growth of the annual student body presages a most magnificent future.

Soon thereafter a different and better type of textbook made its appearance, and especially so in the field of mathematics, which constitutes our special theme. Not so much that there was less of Euclid, but more of DesCartes and Newton and Leibnitz, and the latter in working dress.

One of the first writers of books to respond to the modern call of the scientific workers was John Perry, who to contribute his part to the new era was inspired—inspired seems proper—to issue a "Calculus for Engineers", 1897; in a way an epoch-making book. This volume received many favorable comments from scientists and, on the other hand, some criticisms from the old-line mathematicians as being more or less a desecration of the sacred fame of ancient mathematics. But Perry sent as good as he received in the argument, and to say the least, started a new train of thought in the education of engineers. With him, hand and heart and mind went together in the training of youth, and his inspiration as a teacher was spontaneous and infectious, which seems invariably the way of the real instructor wherever his lot may fall.

Soon others followed, and to meet special needs special texts were written.

For the benefit of chemists and physicists Professor Mellor, 1902, wrote a rather monumental work which he named "Higher Mathematics for Students of Chemistry and Physics." The applications, of course, are largely drawn from these two fields of science. The easy-going chemist of an older and pioneer order might be tempted to turn in his grave with a sepulchral groan could he but see the introduction of so many equations into chemistry and its vigorous off-shoot, chemical engineering. Nevertheless, as the need arises it becomes imperative for research and adequate teaching to make use of any and every phase of helpful analysis. And this emphasizes an important point, namely, the idea of helpfulness in modern science. A cold, godlike attitude of abstraction may bespeak wisdom, dignity and purple robes, but in our busy day such an attitude seems out of place when there is work to be done requiring neutral colored denims.

Again, one of the outstanding men to bring mathematics into more intimate everyday use was Steinmetz—a German youth aflame with the zest of learning and, like most youngsters, not in boisterous sympathy with the artificial restraints of a conservative social order. As a student, and associated with fellow students, his impetuosity soon manifested itself in political activity, the ultimate end of which was to be a German Republic. However, when expression became too pronounced, repression became violent, and young Steinmetz discreetly stepped across the border on a stormy night and wended his way to America—the land of his youthful dreams. The story of his life and labors as a teacher and engineer is quite well known to one and all. The salient fact for us is that he insisted upon teaching and using the complex variable in his courses amid somewhat of an academic ruction, at first. His reasons were eminently sound. To develop the theory of electrokinetics he sorely needed this incisive analysis. He finally wrote a book, "Engineering Mathematics," first edition 1910, which, together with his other works, all fall within the field of electric engineering. The Wizard of Schenectady and his humanizing of mathematics will always be remembered in the length and breadth of his adopted country, and many regret that all too soon he crossed another bourne into the land of the eternal beyond.

*Professor of Mathematics, Colorado School of Mines.

Silvanus P. Thompson wrote a small book, and named it "Calculus made Easy."[1] One of his chief objects was evidently to remove the usual inferiority complex with which the student very often approaches this subject, and furthermore to point out and simplify the uses and fundamental concepts of this most powerful method of analysis. Written in more or less of an inimitable spirit of joviality, it is vastly worth while the pleasant time spent in its perusal by anyone sufficiently interested. When we remember that he was one of the leading physicists of his generation—a giant among giants—his exquisite shafts of satire aimed at himself and others in his prologue to this little volume surely give us a better and more intimate insight into the true character of the man. We cannot forbear quoting it here:

THOMPSON'S PROLOGUE

"Considering how many fools can calculate, it is surprising that it should be thought either a difficult or a tedious task for any other fool to learn how to master the same tricks.

Some calculus-tricks are quite easy. Some are enormously difficult. The fools who write the textbooks of advanced mathematics—and they are mostly clever fools—seldom take the trouble to show you how easy the easy calculations are. On the contrary, they seem to desire to impress you with their tremendous cleverness by going about it in the most difficult way.

Being myself a remarkably stupid fellow, I have had to unteach myself the difficulties and now beg to present to my fellow fools the parts that are not hard. Master these thoroughly, and the rest will follow. What one fool can do, another can." The last sentence he mentions elsewhere as an ancient simian proverb.

Another small volume animated by and dedicated to Silvanus P. Thompson traverses much the same path, or off-shoot of the same path, "Exponentials made Easy, or, The Story of Epsilon,"—by DeBray, first edition 1911. A few of the chapter headings are illustrative of the style used, such as:—A little Chat about the Radian; Epsilon's Home, the Logarithmic Spiral; Epsilon on the Slack Rope, What there is in a Hanging Chain; etc. By Epsilon he means what is usually designated in America by "e", the base of the Naperian system of logarithms.

As another index of this trend to industrialize mathematics, we mention, "Hyperbolic Functions Applied to Electrical Engineering," by Prof. Kennelly, 1911. Our forebears may very likely have heard of, and used trignometric or circular functions in many instances, but perhaps little suspected that a peculiar and special set of functions lurked within the ample folds of the rectangular hyperbola, and still less that they had any connection with electricity. Well, to make a long story short, Kennelly and others in their numerous contributions to this field of science show their all-pervading presence and subtle influence. Usually when the average reader encounters a function involving e^x or the hyper-function family, uncles, aunts, cousins, positive and negative, to the nth degree, he experiences the gentle pleasure of an initial attack of ague and his spine undulates to the rhythmic wave impulses of a repellent nervous system. Why does the word "function" in mathematics (never its social counterpart) invoke such somber cloud effects in many minds? Perhaps more often than not because it is and remains a strange term for an unknown concept. *Hyperbolic* functions are no exceptions.

To call attention in a concrete way to the importance of this particular class of functions, only, the following list of recent contributions by F. C. Carstarphen, a Colorado School of Mines graduate, forcibly illustrates their use in certain types of engineering structures:—

(1) An Aerial Tramway for the Saline Valley Salt Co., Ingo County, California. Trans. Am. Soc. C.E., Vol. 81, p. 709, 1917.

(2) A simple Method of Computing Deflections of a Cable Span carrying Multiple Loads evenly spaced. Same, Vol. 83, p. 1383, 1920.

(3) The Eye-Bar Suspension Bridge at Florianopolis, Brazil, by Steinman & Grove. Discussion by F. C. Carstarphen and others. Same, Vol. 92, p. 266, 1928.

(4) Aerial Tramways. Same, Vol. 92, p. 875, 1928.

In reading these articles the student will find "e" and his fraternity, variously disguised, of course, dancing in glee from one end of the cable to the other, but never once does one of these nimble equilibrists suffer the fate of the awkward but more venerable Humpty Dumpty.

But what bearing has all this in connection with mining engineering? To say the least, the mining engineer is a more or less of a cosmopolite among his professional colleagues, and by that we mean that every field of engineering contributes to his training and discipline and his clients and employers look to him for service in many and varied ways. And at the root of his training is found the basal subject of mathematics.

A course in mathematics at the Colorado School of Mines, numbered 307, has primarily as an object the review of the first two years, furthermore in addition to gain a better working knowledge of the subjects involved, and also to dissipate as far as possible any misconceptions incurred along the way. In short, the purpose of this 307 course is to take mathematics out of the realm of the deified and convey it to the homes of fellow mortals.

[1]—The Macmillan Co., New York.

Alumnus Describes Interesting Features Encountered While On Foreign Duty in Russia

EDITOR'S NOTE: Here are two interesting letters about the Union of Socialistic Soviet Republics, written to Mines' faculty members by Ben F. Angus, '29. Angus is one of the many American engineers now located in the U. S. S. R.

LETTER TO PROF. J. H. JOHNSON

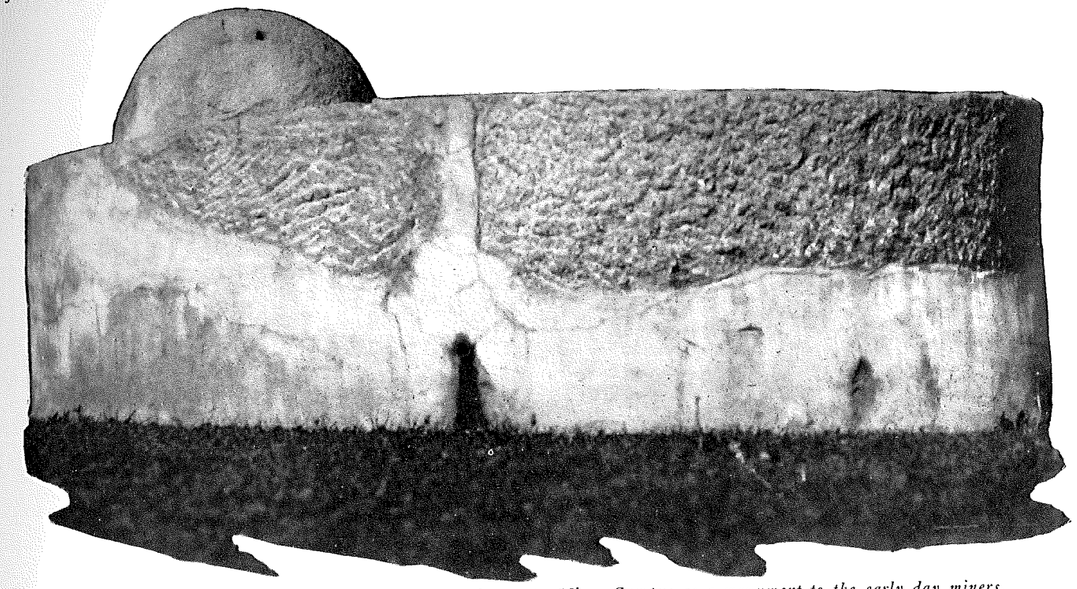
I suppose by this time you are busily engaged in getting the new "Frosh" straightened out. When this time of the year rolls round it makes me wish I were back in school once more.

So far, I have had a great trip and have seen many interesting things over here in the U. S. S. R. I stayed in Leningrad about four days and was in Moscow about a week. Coming south, we came along the Caspian Sea for miles until we reached Baku. From Baku we came west again until we reached Tiflis, in the State of Georgia, about half way between the Caspian and the Black seas. Thence we came on south again to Armenia near the Persian border where I've been located.

In Lenigrad, we visited many art galleries and museums including the former Czar's palace, which is now also a museum. Leningrad is the headquarters for both the geological and geophysical institutes.

The geological institute has one of the finest mineralogical collections I have ever seen. Fine specimens of all known minerals may be found there which are gathered

(Continued on page 32)



The Arrastre, crude drag-stone mill, which stands on the Mines Campus as a monument to the early day miners.

A Relic of Other Days, This Arrastre on The Mines Campus

By INEZ G. HINTZE

MORE fanciful tales and queer ideas have been associated with the arrastre on the Mines campus than with any other relic possessed by the School. Even the name is subject to contortion, being spelled both arrastre, (which is given preference in the dictionary) and arrastra.

Variously described as an Indian corn mill and a bird bath by know-it-alls and occasionally used as an ash tray by unthinking Miners, this crude drag-stone mill lays claim to a most interesting identity and an ancestry with a Spanish-Mexican flavor.

Dr. James Underhill, Director of the Experimental Mine, presented the arrastre to the School of Mines when it was retired from active duty at Dumont, Colorado, just west of Idaho Springs. A place was made for the old mining machine on the front lawn of Guggenheim, near the steps. There it has stayed, misunderstood and misrepresented, no longer a chalice for the shining metal—but for rain and snow.

Colorado has been a meeting place for Spanish and French terms, northern Colorado giving us the Cache la Poudre and the southern section bearing names of Spanish origin, Las Animas, Trinidad, and so forth. The arrastre at Dumont had found its way far north.

Arrastres have earned a good name for themselves among miners, especially among those whose capital for investing in mining equipment is limited. Usually native material, basalt or granite, is employed in constructing an arrastre. Large blocks of stone are fitted carefully to make the circular depressed bed and this is surrounded by a curb of stone or wood. In the center an elevation of stone, even with the outer rim, is used as a base for an upright revolving post to which are attached two pieces of wood making four strong arms. One of these is made longer than the other three so as to extend several feet beyond the machine, and to this is hitched the motive power—usually mule.

Drag-stones are appended by chains to the other arms. Stones used as draggers are big fellows, sometimes weighing from three to four hundred pounds.

Quartz, broken into egg-like pieces, is dumped into the arrastre, a little water is added to the recipe, and the fun is on. This first mixing bowl operation takes from four to five hours. By this time the quartz is so greatly reduced that with the addition of more water, the mixture resembles a rather thick cream, somewhat Ethiopian in color.

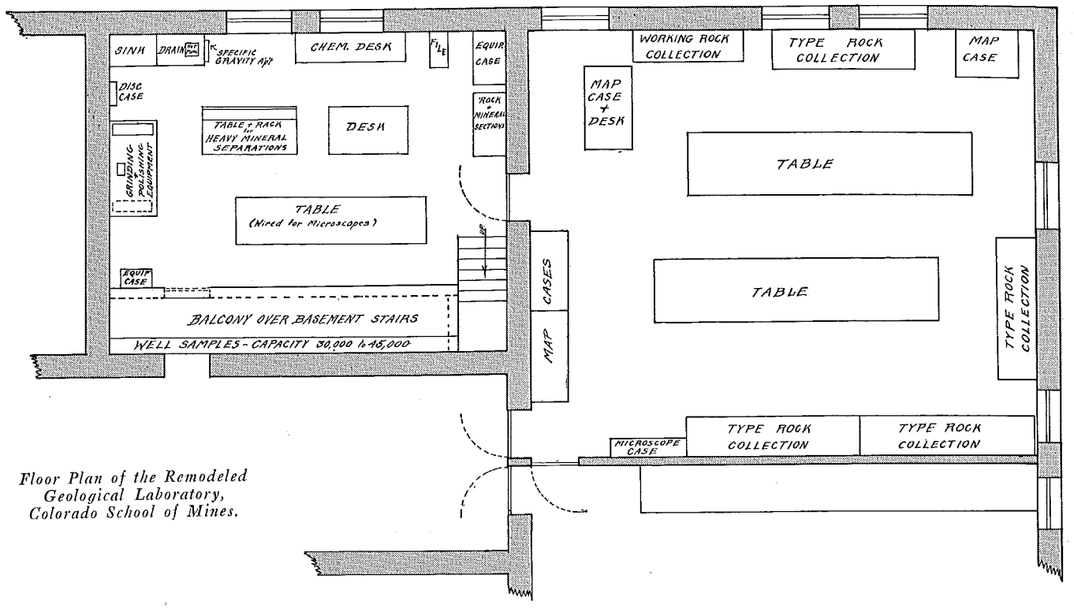
Mercury, which works magic with gold, is sprinkled over the batter and the grinding goes merrily on for a couple of hours. Water is now let into the arrastre for the purpose of settling the amalgam for recovery of the gold. The mules are allowed to follow their own inclination as to speed and they move slowly around for half an hour.

The thin mud is then run off leaving a small fortune, more or less, imprisoned by the mercury in the basin of the arrastre.

During the process, various potions are added to enliven the action. For ores containing a large percentage of gold, an extra dose of potassium cyanide is given, and for those rich in silver, copper sulphate and salt are prescribed.

Good arrastre housekeepers among miners clean their machines every ten days. If the precious mud has settled too deeply into the cracks between the blocks, these must be taken up and carefully washed to recover the elusive metal. Stones with a rough surface make the best floors as smooth surfaced stones allow the ore to slip around and keep it from amalgamating with the mercury. Coarse stone rubs the metal particles bright and this assists in attracting the mercury.

(Continued on page 45)



Floor Plan of the Remodeled Geological Laboratory, Colorado School of Mines.

More Room for Petrology

By W. A. Waldschmidt*

During the past summer numerous changes have been made in the petrographic laboratories of the Colorado School of Mines because additional laboratory space, new sample cases and new equipment were necessary to meet the rapid growth of classes in petrology, optical mineralogy, petrography, sedimentary petrography and mineralography.

The old museum room at the north end of the first floor of Guggenheim Hall has been divided by a permanent partition thus providing two well lighted laboratories of equal size. The east laboratory has been rearranged to accommodate classes in freshman map work and senior paleontology. The west laboratory has been arranged primarily for the courses named above in which the use of microscopes is essential. This laboratory is also used for advanced courses in map interpretation.

The accompanying sketch shows the arrangement of cases and tables in the new laboratory and also the arrangement of the adjoining smaller laboratory which is used primarily for research work in sedimentation, petrography and mineralography.

All cases containing specimens of the type and working collections of rocks have been placed in the new laboratory, and a new index is being prepared of these collections, permitting immediate access to any type of rock to be studied. Enough space is now available in the cases for the filing of approximately 3,000 specimens.

The new tables have been wired for any type of illumination necessary in microscopic work. Artificial illumination is used because more uniform color and intensity of light can be obtained than by use of day light. With this new arrangement it is possible for twenty-four students to work without crowding or interfering with one another.

*Assistant Professor of Geology, Colorado School of Mines.

The room adjacent to the large laboratory is used both as an office and a research laboratory. All microscope accessories, thin sections of rocks and polished ore, and mineral sections are kept here. This room is equipped with a grinding and polishing machine, hot plate, balance, specific gravity apparatus, racks for heavy mineral separations; running water and a complete set of chemicals. The tables are wired for lights in about the same way as those in the big laboratory.

Probably the most important change made in the small laboratory has been the building of a low wall and balcony which completely incloses the space over the basement stairs. Cases, of the pigeon-hole type, have been built on the balcony for filing oil well samples. It is possible to file from 30,000 to 45,000 samples, depending upon the type of sample container used in these cases.

About 4,000 well samples, given to the School of Mines by the Texas Production company last year, are now ready to be filed in the new cases. Additional samples will be received at various times from other companies, and it is hoped that eventually the School of Mines will become a depository for all well samples of wells drilled in the Rocky Mountain States.

Problems now being investigated by advanced students and the faculty of the geological department are: The Relation of Ralston Dike to North and South Table Mountains; A Study of the Embar, Tensleep and Amsden Formations of Western Wyoming; Salt Dome Minerals; Hauerite and Its Associated Minerals; Stratigraphy of North Park, Colorado; Stratigraphic Studies of the Greenhorn Formation of the Pueblo Quadrangle; Bentonite Beds as Horizon Markers; Measurement of Rock Flowage Pressures; and A New Peneplain in the High Plains.

The results of these investigations will be published in this and other magazines.

Gas Installations

Proper heating equipment ▪▪ Economical operation ▪▪ Estimating gas consumption ▪▪ Furnaces ▪▪▪

By Roy B. Munroe, '29*

Introduction

THE satisfactory and efficient heating of homes with gas is becoming more of a reality each year and thousands of homes are now using this new automatic heat. It is to the advantage of the gas companies to make every effort to keep these homes satisfied with their gas equipment as well as with the gas service. This may easily be accomplished by installing the proper equipment in every home.

To install the proper house heating equipment a complete survey is made of the house by the house heating engineer to determine the size, type and construction, adequacy of the present heating plant, temperature desired and many other important factors. After the proper equipment has been installed its principle should be thoroughly explained to the user and he should be given definite instructions as to the operation as well as being told what to do in case of an emergency, such as the pilot going out or the failure of the thermostat to turn on the gas, and soforth.

Factors Affecting the Operation of a House Heating Plant

Of the numerous factors entering into the operation of any house heating plant, a few of the more important will be mentioned:

(1) The chimney flue should be of the proper size and in the proper place. Chimneys, defective in construction or badly located cause many failures of heating systems. All flues should be lined, although the first cost may be greater, the fuel savings and better furnace operation soon over shadow this first cost. The most efficient chimney flue, as far as draft is concerned, is one built perfectly straight from the bottom up with a round or nearly round smooth interior surface. A square flue is much better than one of rectangular design and the latter should be avoided.

(2) All houses should be weather-tight for the most economical operation of the heating plant. In residences, one complete change of air every hour is usually considered adequate. Under conditions of moderate temperature and wind velocity, the air change through window and door cracks, in houses of ordinary construction, is not objectionable, nor does it materially affect the operation of the heating plant. But where a wind of 25 to 60 miles an hour often causes as many as five air changes per hour, the atmosphere in the rooms especially on the windward side, may be several degrees below that usually maintained. Then it is that the heating plant is often taxed beyond its capacity. This can easily be remedied if the house is made weather-tight by using one or more of the following: storm sash, wood and felt weather stripping, strip felting, metal weather stripping, caulking compounds, or insulation materials used in construction of the house.

The first five refer principally to windows and doors while the sixth refers to such insulating materials as celotex, insultite, and others used to insulate walls and ceilings of buildings.

(3) The air in all residences should be kept humidified to as near the correct relative humidity as possible, as air that is too dry is unhealthful as well as uncomfortable. If properly humidified, the atmosphere in any residence will be much more comfortable at a lower temperature than if the moisture content was too low. Too much moisture with heat is equally as unpleasant as too low a percentage for this produces a muggy feeling quite noticeable in some parts of the country where high humidity and high temperatures prevail for long periods. As far as we know now, the best conditions of temperature and moisture content for our dwellings are: a temperature of 70 degrees fahrenheit with a humidity between 40 and 50 percent, whereas it is very probable that were the relative humidity in our houses tested, it would probably be found to be about 20 percent or lower. There are several methods by which moisture may be added to the air supply of a warm-air heating system and every home should have some kind of humidifying equipment, whether it be attached to the furnace or operated separately. A satisfactory method of moistening air in houses heated by hot water systems has not yet been devised. Water pans which hang on the back of the radiator are obtainable but do not have a large enough surface to properly humidify the air. These pans are slightly more effective with steam heat than with hot water but are not sufficient in either case.

(5) Fresh air should be admitted continually or from time to time, in sufficient quantities to obtain satisfactory ventilation. Air confined within an occupied room or building becomes foul and unfit for breathing. Ventilation consists of the natural or mechanical displacement of the vitiated air by fresh air. The use of an electric fan, installed in the cold air duct (with hot air heating systems) will increase the air circulation which, beside giving better heating efficiency will aid ventilation.

Method of Estimating

In Kansas City a detailed survey was made of each house to determine the size of equipment and also to give a rough estimate as to the annual gas consumption. The total hourly B.t.u. loss of the house for a 70 degree temperature difference (0° outside and 70° inside) was determined by measuring the building for square feet of exposed wall, square feet of windows and doors, square feet of cold ceiling, and cubic feet of cubical content, and then applying the factors of the Standard Heating Code for heat transfer through different materials. From this information it was an easy matter to determine the theoretical number of square feet of radiation to heat the building, in the case of hot water or steam (in still air at 70°, 1 sq. ft. hot water radiation will give off 150 B.t.u. per hour and 1 sq. ft. steam radiation will give off 240 B.t.u. per hour) or the proper size of warm air ducts in the case of warm air heat. (If we let H equal the B.t.u. to be supplied per hour and A the area of the warm air leaders, then assuming an air velocity of 4.5, 6.5 and 8.0 feet per sec. for 1st, 2nd and 3rd floor leaders respectively:

$A_1 = H/20088$ for 1st floor leaders
$A_2 = H/29016$ for 2nd floor leaders
$A_3 = H/35712$ for 3rd floor leaders

Knowing the total hourly B.t.u. loss of the building and the calculated amount of radiation or size of warm air ducts to supply this loss, it was possible to predict, with some degree of accuracy, the amount of gas required to supply the heat.

*Engineer, Kansas City Gas Company.

Because the climatic conditions vary in different parts of the country it was necessary to provide a means of estimating the fuel consumption for any specific part of the country. The "degree day" was devised for this purpose and represents the product of the number of days for any given interval, and the difference between the average temperature for this interval and 65°F. For example, if the average temperature for 10 days is 55°F. there would be 10 by 10 or 100 degree days for the 10 day period. The A. G. A. determined that for temperatures below 65° gas was consumed for heating, thus this temperature is used as a basis to calculate degree days.

The Conversion Burner

The conversion burner is used if one does not wish to install a new gas designed furnace in his home. The burner is very easily installed but certain principles must be strictly adhered to if correct and efficient operation is to be obtained. The burner should be of a diameter near that of the fire bowl as possible. Obviously a small burner in a large fire bowl would not operate efficiently if at all, because of the large space between the source of heat supply and the walls of the fire bowl. In order to take care of the average size bowls, namely: 14 in., 16 in., 16 in. split and 20 in. The burner should be set level with the grate line and if set too low, the radiant heat has a tendency to overheat the ash pit which in turn overheats the incoming cold air and tends to retard, or may completely reverse, the air circulation. On the other hand, if the burner is set too high, there will be a loss of efficiency due to the shorter fire travel. It is therefore, very important that the burner be properly located in the fire bowl to obtain the best results.

When a "leaning radiant" burner, (which is probably the most efficient conversion burner designed to date) is installed, it is necessary to draw the secondary air around the outside ring of the burner as combustion takes place between the leaning radiants and the walls of the fire bowl.

Gas Designed Hot Air Furnace

The gas designed hot air furnace has proven very satisfactory as far as efficiency, cost and length of life are concerned. The fire chamber of one particular furnace is of sheet metal allowing the heat to radiate through its walls much faster than it could through the heavy cast iron walls of the fire bowl in a coal furnace. The steel radiating drum surrounds the fire chamber and is supported by it. The products of combustion leave the fire chamber entering the base of the drum and passing up and around the fire chamber four and one half times, by means of a spiral flue travel. There are 24 vertical tubes passing through the drum, through which the fresh air to be heated passes upward absorbing heat from the flue products and delivering it to the warm air ducts. The total distance of the fire travel in the smallest size furnace is over 30 ft. as compared with 8 to 12 ft. in the ordinary coal furnace. The gas designed furnace contains 140 sq. ft. of radiating surface or about 4 times that of the coal furnace. The burners in this furnace are straight flat top cast burners with raised parts, Venturi injecting tubes, adjustable air mixers and adjustable gas orifices.

Gas Designed Boiler

These boilers combine beauty and efficiency with the convenience and cleanliness of gas and are equipped with numerous accessories not used on the ordinary coal boiler. These controls are simple and neat in design and are absolutely positive in action and practically wear-proof and include; low water fuel cut off, gas pressure governor, steam regulator, water regulator, and automatic pilot.

(Continued on page 45)

The Millman's Lament (A Poem)

Ken Hickok, '26

The Superintendent of Mining used to rave at the young "Mill gang" and he'd often say (at least, once a day,) "they're not worth rope to hang."

One day I was called to his office, and this is what he said: "Your whole damn mill is upside down and recovery's on its head, and furthermore I don't believe you quite know zinc from lead." He then went on at greater length, to show just what he knew, "How can you keep your recovery up when the dryer blows a flu. I read in the Mining Journal, where you will have great need, to find the pH of the "overflow," when the ball-mill's choked with feed. Experience is a teacher, and I believe it's true, for you lack the years of experience to know just what to do when the classifier bends a rake or the roll mill casts a shoe."

So I said to the Mining Super, "That's easy as 1-2-3, a Marcy Mill or a broken flue are simple as A-B-C, but there are some things that make a mess of the mill recovery. When the fine ore hangs in the feeder chutes and you sweat like a nigger slave while you poke and punch with a long iron bar, till you feel like a broken stave, the ball-mill man howls loud for feed, and you mutter a heart-felt curse, while you hope and pray that the mill chokes up, or something even worse.

A "kick-out" in the power line is the worst of any ill, for it cannot be controlled by us and comes just when it will. The classifier rakes bed down when the cut-off hits the line, so, you rush like mad to lift them up, but you never are in time. Then you tug and you pull on the driving chain but all without avail, so you drain the muck to the tailing race and then its sampled tails. At last the power is on again and you crawl out in the light to find that the froth of the "cleaner cells" is clean down out of sight. So you make a sprint for the "cleaner-floor," and hope that it isn't bad, but you find six inches of settled muck on every canvas pad. With a groan you grab the air hose to clean the damn things out, and just as you finish up the job, you hear a lusty shout; What? The Forrester tail gates stuck tight shut! You arrive to find it's true, and messy mess the whole darn floor is covered a foot with goo.

You feel like sitting down to cry and your hair starts turning grey, when you start to rig the blocks you feel much more that way. The job is fully finished and with pleasure your gods you thank that the nearest place to get fresh air is the top of the big Dorr Tank. You stumble out on lagging feet and perhaps get half way there when the "overload-bell" begins to ring and you wildly tear your hair. So you madly dash to the filter room and arrive like a wind-broke horse to find that the filter man has gone, to hell, you hope, of course. So you madly dash to the tank again to turn that valve and this, you throw the switch to start the pump and the fuses all go fss—. By the time you return with fuses the pump line's clogged plumb tight, and then you're stuck on the blankety blank pump the rest of the whole damn night. Just as the "seven whistle" blows you finally stop the bell, but I'm here to state, that early or late, your recovery is shot to hell. This is not a song of alibis, but I'd like for you to know that when the recovery is way down there's a reason why it's so; and here's a closing thought for you to think about when you will, if you want recovery of lead or zinc, keep your hands off of the mill.

Principles of the Hydro-metallurgy and Electrodeposition of the Metals

X. Chapter on Metal Recovery

By Thomas P. Campbell*

The electrodeposition of a metal from an aqueous solution requires an electrical system which, like *omnia Gallia,* may be considered as consisting of three parts,—all of which are inhabited by electrons. First, there is the external, metallic circuit, containing a source of electromotive force, and comprising the metallic conductors leading to and from the electrodes, and the electrodes themselves. Second, there is the electrolyte, or the liquid conductor. And finally there are the junctions between the electrodes and the liquid.

The facts and fancies of electrochemistry are concerned with what happens in the solution proper, and with what happens at the electrodes when a current is forced thru an electrolyte by an external electromotive force. But for the moment it will be well to side-step a bit and review some of the elementary facts of metallic conduction and the more general aspects of electrical theory.

Let us suppose that we have a circuit containing a battery and a coil of wire. When this circuit is closed, two effects may be noted at once: first, the wire becomes hot; and second, a magnetic field is set up around the coil. Closer scrutiny would also reveal that chemical changes take place in the battery. To account for these phenomena we say that the battery causes a flow of electricity thru the circuit; it is usual to speak of the battery as a "source" of electrical energy.

The heating (Joule Effect), we say, is due to the resistance offered by the wire to the current; and the magnetic field is a condition or state of the space surrounding the wire caused by the flow of electricity.

Without going into details, it is sufficient for us to recall that, according to the prevalent view, all matter is composed of positive and negative charges of electricity in a constant state of relative motion; that the positive and some of the negative charges are supposed to be concentrated within a "nucleus" inside the atom; and that the rest of the negative charges revolve around this nucleus in one or more elliptical orbits. This picture may not be satisfactory to the mathematical physicist, but it suffices for the chemist in at least a descriptive way. It is evident, then, that in all parts of our circuit there are particles of electricity in confined motion. The function of the battery is thus one of bringing about a concerted flow, or drift, of these particles within the circuit. The battery is not, then, a "source of current" or of energy, but simply a means of causing motion of charged particles.

In metallic conductors we must assume that there are some electrons that can detach themselves from their atomic orbits and move from one atom, or molecule, to the next thru the body of the conductor, under the influence of the potential gradient imposed by the external e.m.f. The atoms, or molecules, of the metal do not move with the current; nor do their positive nuclei. Therefore, metallic conduction is due to a resultant movement of electrons within the body of the conductor.

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The practical measure of electrical charge, however, is not the electron, but the coulomb. And the current is defined in terms of amperes, one ampere being equal to one coulomb per second. The ampere, therefore, has the dimensions of velocity, or rate of flow.

According to Ohm's Law, the current must be proportional to the applied e.m.f., and inversely proportional to the resistance. The e.m.f., in turn, is defined as the work required to transport unit charge thru the circuit. Thus

$$E=W/q \text{ volts,}$$

and

$$I=q/t \text{ amperes.}$$

Therefore, $\text{Power}=P=EI=W/q\times q/t=W/t$.

And hence power also has the dimensions of velocity, or rate of expenditure of energy. The product of power and time thus gives a quantity of energy,—volt-amperes, or watts, are comparable to calories per second, or to B.t.u. per minute, while watt-hours are comparable to calories or to B.t.u.

The resistance of the circuit is defined as being directly proportional to the length, and inversely proportional to the area of cross section of the circuit,—

$$R=\rho\ L/A$$

where ρ is the proportionality factor, and is called the "specific resistance" of the substance in question. In metric units, ρ would be given in ohms per centimeter cube; the corresponding English unit would be ohms per inch cube.

Resistance appears to be connected with the mass effect of the conductor: resistance is a function of temperature, and therefore of the thermal agitation of the atoms or molecules of which the solid is composed. As the temperature falls, resistance also decreases, and vice versa. Theoretically, at absolute zero (—273°C) the resistance would also be zero; and an electrical current once started in a circuit would keep on flowing ad infinitum. At any other temperature, however, part of the electrical energy is dissipated as heat, the *rate* of loss being given by

$$P=RI^2 \text{ watts.}$$

The resistance of several conductors connected in series is

$$R_0=R_1+R_2+R_3+\ \cdots\cdots$$

and that of several conductors connected in parallel is

$$1/R_0=1/R_1+1/R_2+1/R_3+\ \cdots\cdots$$

Over a century ago it was observed that certain solutes would make good conductors in aqueous solution, while others would not. Later on, it was also observed that these *electrolytes,* or conductors, gave erratic results as to boiling-point raising, freezing-point lowering, and osmotic pressure in solutions. Ostwald applied the gas laws to the case of osmotic pressures of sugar solutions and, for dilute solutions, got a satisfactory agreement between observed and calculated results. His calculations were founded on the assumption that the particles of solute in solution behaved like gas molecules under the same conditions of pressure, volume and temperature. He ascribed no action whatsoever to the solvent. When applied to solutions of electrolytes, however, the calculations were all wrong: the pressures observed were always higher than those calculated.

Arrhenius[62] met this difficulty by assuming that part, or all, of the molecules of solute split up, or dissociated, in solution to form charged *ions,* or discrete particles displaying a net positive or negative charge. Thus, in aqueous solution,

$$NaCl = Na^{+} + Cl^{-};$$

and if the NaCl dissociated to the extent of x%, then the concentration of NaCl must be 100—x, that of Na^{+} must be x% and that of Cl^{-} also x%, so that the total number of particles, both charged and neutral, should be 100+x.

The ionization of a given electrolyte was found to be a function of temperature, of concentration, and of pressure. Since the conduction of electricity thru a solution was obviously due to the motion of the ions, under the potential gradient of the applied e.m.f. at the electrodes, it was thought that conductivity ratios should be a convenient and accurate measure of the degree of ionization. Instead of using specific conductances, the ratio of "equivalent conductivities" was employed. The equivalent conductivity was taken as the conductance of a volume of solution contained between two parallel plane electrodes one centimeter apart and having one gram-equivalent weight of solute in solution. Then, since it was assumed that all electrolytes were completely dissociated at infinite dilution, the ratio of the conductivity at any finite concentration to that at infinite dilution should give the degree of ionization at the given concentration. That is

$$x = \Lambda/\Lambda\infty.$$

Once again, this method gave results within the limits of experimental accuracy for dilute solutions, but not for concentrated solutions. Various modifications and substitutions have been proposed from time to time, and just now the general theory is itself pretty well dissociated. Two views are held: first, that of Lewis and coworkers, according to which all electrolytes are completely dissociated, but only a part of the ions are able to go to work[63]; second, and more recent, the new Fermi statistics have been applied to experimental data to show that there is not complete dissociation[64].

In any event, and regardless of theory, several facts may be noted: first, Ohm's Law holds for electrolytic conduction as well as for electronic conduction. Second, electrolytic conduction is a transport phenomenon; i.e., electrical charges are transported thru the solution by the motion of ions, or material particles. Third, the *quantity* of chemical change produced at the electrodes is proportional to the *quantity* of electricity passed thru the solution (Faraday's Law)[65],—for every 96,500 coulombs passed across the junction between a purely metallic conductor and a purely electrolytic conductor, one gram equivalent of chemical change will be effected, independent of temperature, pressure, concentration, or anything else.

Evidently, then, the conduction of electricity thru an electrolytic solution must be due to the motion of charged particles; and the specific conductance,

$$k = 1/\rho$$

of any dissolved substance is thus a function of (1) the concentration of the ions, (2) their velocity of migration, and (3) their charge.

Taking these factors in reverse order, it will be seen at once that a trivalent ion,—e.g., Al^{+++}, or Fe^{+++},—must carry three times as much electricity thru a solution, at the same velocity, as a monovalent ion,—e.g., Na^{+} or K^{+}. On the other hand, however, not all ions move with the same velocity under the same potential gradient, concentration, temperature, etc.

The common method of calculation of velocity of migration is as follows: Suppose that between two plane parallel electrodes one centimeter apart there is one gram equivalent of a uni-univalent salt (as, e.g., NaCl) at infinite dilution, and that one volt is impressed. Then the current which passes is $I = 1/R = \Lambda\infty$.

Suppose the positive ion (cation) moves at the rate of U_o^{+} cm. per sec., and the negative ion (anion) at the rate of U_o^{-} cm. per sec. Now these velocities are directly proportional to the potential gradient, since the velocity of a particle moving in a medium of great frictional resistance is proportional to the force acting upon the particle, and the force on a charged particle in an electric field is

$$f = qE/1,$$

where q is the charge, and E/1 is the potential gradient. The charge carried across every unit of cross section in a second by the cations is FU_o^{+}, and for the anions is FU_o^{-},—where F stands for the Faraday=96,500 coulombs. But by definition, the sum of the quantities of positive and negative electricity passing any cross section per second is the current, I. Hence,

$$I = F(U_o^{+} + U_o^{-}) = \Lambda\infty; \text{ and } U_o^{+} + U_o^{-} = \Lambda\infty/F.$$

To arrive at the velocities of the single ions, finally, we make use of a quantity called the *transference number,* or *transport ratio* of the ions. The transference number of the cation is defined as

$$n_c = \frac{U_c}{U_c + U_a}$$

and that of the anion as

$$n_a = \frac{U_a}{U_c + U_a}.$$

Practically, these ratios are measured by observing the equivalents of cation and of anion transferred to, or from, the electrodes of a cell thru which a known quantity of electricity has been passed[66]. Then

$$n_c = \frac{\text{Equivalents of cation transferred to cathode}}{\text{Total equivalents of ions transferred in both directions.}}$$

From this it follows that

$$n_c = FU_o^{+}/\Lambda\infty$$

and

$$n_a = FU_o^{-}/\Lambda\infty.$$

Therefore, $U_o^{-} = n_a\Lambda\infty/F$, and $U_o^{+} = n_c\Lambda\infty/F$.

For example, at 18°C, the values for KCl are

$$n_c = 0.496,$$
$$\Lambda\infty = 130.$$

Hence, $U_o^{+} = 0.496 \times 130/96500 = 0.000665$ cm. per sec., for a potential gradient of 1 volt per cm. And since $n_a = 1 - n_c$, $U_o^{-} = 0.000675$ cm. per sec.

Just a word here as to the meaning of the term "infinite dilution": obviously measurements at infinite dilution cannot be made directly. We could, however, measure the conductivity of a salt solution, for example, at increasingly greater dilution values; then, by plotting the results, we could extrapolate to a value of dilution which would approach that at infinite dilution as the concentration approached zero.

Returning now to the first factor mentioned as affecting the conductivity of an electrolyte, to wit, the number

[62]—Zeit. phys. Chem. I, 631 (1887).
[63]—Lewis and Randall, Thermodynamics.
[64]—Van Rysselberge, Trans. Am. Electrochem. Soc. 57, (1930).
[65]—Experimental Researches, vol. I, series III, p. 102; and series VII, p. 195.

[66]—For general discussion, and description of method and apparatus, see Thompson, Theoretical and Applied Electrochemistry, ch. I, II, and III; N. Y., 1925.

of ions present, the first question to arise is that of degree of ionization. For, obviously, if a given solute be 100% dissociated, then we may state at once that the equivalent concentration of any one of its ions must be equal to that of the salt. For instance, if a certain solution contained one gram-equivalent of NaCl, per liter, then the concentration of Na^{+} must be 1-normal, and that of Cl^{-} must also be 1-normal. Again, a solution containing 136.4 gm. per liter of $ZnCl_2$ would, at 100% ionization, contain 65.4 gm. per L. of Zn^{++} (2-normal), and 71 gm. per L. of Cl^{-} (2-normal). But certainly very few electrolytes behave as though they were completely dissociated except at very high dilutions; and even more certainly the assumption of complete ionization, and wholehearted participation of all the ions thus formed in the business of conduction, is invalid for the solutions met with in hydrometallurgical practice. As mentioned before, it was thought at one time that conductivity ratios could be used as a measure of degree of ionization. Values derived on this assumption give reasonably precise results up to concentrations of about 0.1-N. Viscosity corrections, and other factors were suggested to account for the lack of orthodoxy at higher concentrations, but none of them proved entirely satisfactory. Some characteristic values computed from conductivity ratios are given in the following table[67]:

Degrees of Dissociation for Different Types of Salts.*
(Noyes and Falk, J. Am. Chem. Soc. 34, 474 (1912))

Type	Salt	Normality			
		0.001	0.01	0.1	1.0
Uni-univalent	KCl	97.9	94.1	86.0	74.2
	$NaNO_3$	97.7	93.5	82.4	61.3
Uni-bivalent	$BaCl_2$	95.6	88.3	75.9	64.2
	K_2SO_4	95.4	87.2	72.2	59.2
Bi-bivalent	$CuSO_4$	86.2	62.9	39.6	30.9
	$ZnSO_4$	85.4	63.3	40.5	30.9

The conductance of all electrolytes tends to increase at first with rise of temperature; but as the temperature goes higher, this increase becomes less and less apparent, and at high temperatures, the conductance begins to decrease. Furthermore, it was found that the degree of dissociation decreased more or less steadily with increase in temperature. It was assumed, therefore, that the initial increase in conductance was due to the increase in fluidity of the water with rise of temperature; but that the ionization tended to decrease at the same time, and that this finally counter-balanced the fluidity factor. Just why ionization should decrease with increase in temperature is not clear except that most "heats of ionization" are exothermic; from this fact and the Principle of Le Chatelier* decrease in ionization might be expected with rise of temperature.

Unfortunately, however, the degrees of dissociation found by the conductance method did not agree too well with similar data derived from measurements on boiling-point raising, freezing-point-lowering, osmotic pressure, and single electrode potentials. Theoretically, all of these methods should give concordant results, since their effects are, presumably, all due to the same cause,—that is, to the presence of discrete particles dispersed in the solution.

For instance, if a given substance displays a boiling-point rise greater than that of a non-electrolyte, then it follows that some sort of dissociation has taken place, and the measure of this should be

$$\frac{\text{abnormal boiling-point raising}}{\text{normal boiling-point raising}} = i.$$

Then if x is the degree of dissociation, and n is the number of parts into which the electrolyte dissociates,

$$i = 1 - x + nx,$$

and

$$x = \frac{i-1}{n-1}.$$

Similar reasoning would apply to the other phenomena mentioned.

While there can be little doubt that strong electrolytes behave as though they were only partially dissociated, still the conflicting data make an exact definition of the term "dissociation" very difficult. In any event, it is evident that this phenomenon is quite different in strong and weak electrolytes.

For example: "If we have a uni-univalent electrolyte whose cation is M^{+} and whose anion is X^{-}, the molecule may be represented by the formula

$$M:\ddot{X}:$$

where the pairs of dots represent the valence electrons or the electrons of the outer shells. The pair lying between atomic kernels M and X constitutes the chemical bond. In weak electrolytes, like acetic acid or mercuric chloride, this approximates to the typical bond of organic chemistry, but as we pass to stronger electrolytes the kernel of the cation draws away from this bonding pair until, in the limit, this electron pair may be regarded as the property of the anion alone. Then the positive ion, which is the kernel M, is held to the symmetrical anion $:\ddot{X}:$ only by the fact that they are oppositely charged. When an electrolyte in a strongly polar or electrophilic medium approximates to this condition it may be classified as a strong electrolyte.

"If then we agree that a strong electrolyte is one which is completely polar, and that the ions are held together by a simple electric force which obeys Coulomb's law, it becomes merely a matter of terminology to decide whether we shall say that a certain fraction of such an electrolyte is dissociated, or with Ghosh, that a certain fraction of the ions are free, or outside the 'sphere of mutual attraction' "[67].

Fortunately, the answer to this question is of relatively little concern if we resort to purely thermodynamic reasoning. For if we can trace out and measure the energy quantities involved, the particular mechanism by which the process may be pictured as occurring is of no importance.

The first law of thermodynamics, commonly called the Law of Conservation of Energy, states that in *any* process the change in intrinsic energy is equal to the heat change diminished by the work done. That is,

$$dU = dQ - dW \quad . \; . \; . \; . \; . \quad (1)$$

Here dU signifies *an increase* in total energy, dQ means heat *absorbed by* the system, and dW means work *done by* the system upon its surroundings. This is a potential function: the change in U between any two states of the system is independent of the path followed; according to how the change is carried out, the values of Q and W may vary widely, but the values of ΔU depend solely upon the initial and final states of the system. Hence for a cyclical process,—one in which the system returns to its initial state,—dU must be equal to zero, and therefore dQ=dW.

*(See also Kohlrausch and Holborn, Das Leitvermogen der Elektrolyte; Landolt-Bornstein Tabellen; Foerster, Elektrochemie Wasseriger Losungen; etc.)

* "When a factor determining the equilibrium of a system is altered, the system tends to change in such a way as to oppose and partly annul the alteration in that factor."

[67]—Lewis and Randall, op. cit., pp. 324-325.

The second law of thermodynamics, also known as the Law of Degredation of Energy, is derived by putting a system through a particular type of cyclical process. This Law states that the *maximum* work that can be derived from any thermal process is equal to the heat energy involved multiplied by a temperature difference and divided by the maximum temperature. That is,

$$W_{max.}=Q\frac{T_1-T_2}{T_1},$$

where Q is the heat absorbed by the system at the temperature T_1, and T_2 is the lowest temperature to which the system is brought in the process.

Evidently equation (1) cannot be integrated as such. But we may integrate it by making certain assumptions as to conditions and constituents. For instance, we may assume that the process takes place at constant temperature, and that the substance involved is a perfect gas. Then if we allow the pressure on the system to decrease by very small amounts, so that at any instant the system could be returned to its previous state by a virtual increase in pressure, we have the effect at every instant of a cyclical process, and therefore $dU=0$, and $dQ=dW$.

But $$dW=pdv=-vdp,$$

and since, for one mole of a perfect gas $pv=RT$,

$$dW=\frac{-RT}{p}dp.$$

Integrating between limits p_2 and p_1, we have

$$W=RT\ \ln\left(\frac{p_1}{p_2}\right)$$

as the work which can be derived from an *isothermal, reversible process* carried out upon or by a perfect gas.

To apply this to solutions, we may use a function called by Lewis the "fugacity". From the name it is seen that fugacity has something to do with "escaping tendency"; and, in fact, the fugacity is taken as being equal to the vapor pressure when that vapor is a perfect gas. We may then partially define the fugacity, f, of a solution, by the equation

$$W=RT\ \ln f+B,$$

where B is a constant at constant temperature.

Between two isothermal states this equation becomes,

$$A=RT\ \ln\left(\frac{f_1}{f_2}\right),\ .\ .\ .\ .\ (2)$$

or $$dA=RT\ d\ln(f)\ .\ .\ .\ .\ .\ (3)$$

But this equation does not determine the numerical value of fugacity; so far we have merely shown the ratio of the fugacities of a substance in two isothermal states. The quantity A in equations (2) and (3) is called the "molal free energy" and is evidently the *maximum work* that can be derived from the process.

Finally, we may complete our definition of fugacity by recalling that, by assumption, the fugacity of a perfect gas is equal to the pressure. "Fugacity will be regarded as having the same dimensions as pressure, and the unit of fugacity will be the atmosphere."[68]

However, once again we are confronted by the fact that vapors are not perfect gases at ordinary pressures and temperatures. Hence, in evaluating fugacities, it has been found useful to deal with the ratio between the fugacity, f, of some substance in a given state, and its fugacity, f°, in some state which, for *temporary convenience,* is chosen as a standard state. This *relative* fugacity is called the *activity, a.*[69] Thus, in the standard state, the activity is $a^\circ=1$, while in any other state it is given by

$$a=f/f^\circ;\ A-A^\circ=RT\ \ln a.$$

To particularize still farther, we may distinguish between the activity of a solute in solution, and the activity of the solvent. Furthermore, we may denote the activity of the cation of the solute by a_+ and that of the anion by a_-. Then the activity of the solute is a_2 and that of the solvent is a_1. Hence we may write for the dissociation of a binary electrolyte, such as NaCl,

$$K=\frac{a_-a_+}{a_2}$$

for constant temperature. At infinite dilution we may then make the activity of each ion equal to its molality,* which, in turn, by assuming complete dissociation of the salt, becomes equal to the stoichiometrical molality of the solute.

Since, however, we do not know anything definite about degree of dissociation, we may choose as a standard state of the solute a condition such that $K=1$. Then for a binary electrolyte,

$$a_-a_+=a_2;$$

and since at infinite dilution the concentration of the anion and cation are the same (in terms of molality), we have

$$a^o_-=a^o_+=a_2^{o\,1/2}.$$

How far into the range of finite concentrations this relationship would hold is not known; but by taking the geometrical mean of the two ion activities, we may write for all concentrations

$$a_\pm=(a_-a_+)^{1/2}=a_2^{1/2}$$

"The mean activity of the ions, $a_\pm$, divided by the molality of the electrolyte, gives a quantity which has been called the thermodynamic degree of dissociation, since it may be used to replace the degree of dissociation as used in the older approximate formulas. This quantity has also been called the *activity coefficient,* and, in order to avoid any implication as to the molecular species which may be present, this is the term we shall ordinarily employ henceforth. It will be denoted by γ.

"So far we have been considering the case of a binary electrolyte, like KCl or $CuSO_4$. When we treat the more complicated types, such as K_2SO_4, $K_4Fe(CN)_6$, and $La_2(SO_4)_3$, our equations become a little more complicated. If an electrolyte dissociates into $\nu(=\nu_++\nu_-)$ ions according to the equation $X=\nu_+X^++\nu_-X^-$, we write for equilibrium

$$a_+^{\nu_+}a_-^{\nu_-}=a_2;\ a_\pm=(a_2)^{1/\nu}.$$

"If now we wish to define the activity coefficient γ, so that in dilute solutions it may be regarded as a thermodynamic degree of dissociation, and become equal to unity at infinite dilution, we must no longer write it equal to $a_\pm/m$. In a solution of barium chloride, in which the molality is very small, $a_\pm=m$, $a_-=2m$, and $a_\pm=[(m)(2m^2)]^{1/3}=2^{2/3}m$. By defining the activity coefficient by the equation $\gamma=a_\pm/(2^{2/3}m)$ it becomes equal to unity at infinite dilution. In the case of lanthanum sulfate, $La_2(SO_4)_3$, which gives 2 positive and three negative ions, the corresponding factor is $(2^2 3^3)^{1/5}$. In general, we shall define the activity coefficient by the equation"

$$\gamma=\frac{a_\pm}{m(\nu_+^{\nu_+}\nu_-^{\nu_-})^{1/\nu}}.$$[70]

68—Lewis and Randall, op. cit., Ch. XVII.

69—Ibid., Ch. XXII.

* Recall that Lewis uses this term, molality, to mean one gram molecular weight dissolved in 1000 gm. of water.

70—Lewis and Randall, op. cit., p. 328.

The activity may be determined by a number of different means, depending upon the nature of the substances involved. Among these methods may be mentioned: the vapor pressure of the solute; distribution ratios; vapor pressure of the solvent; and, finally, from electromotive force.[71] Some typical values are given in the following table:

SOME ACTIVITY COEFFICIENTS AT 25°C.[72]

Molality	0.01	0.02	0.05	0.1	0.2	0.5	1	3
HCl	0.924	0.894	0.860	0.814	0.783	0.762	0.823	1.35
LiCl	0.922	0.892	0.843	0.804	0.774	0.754	0.776	1.20
NaCl	0.922	0.892	0.842	0.798	0.752	0.689	0.650	0.704
KCl	0.922	0.892	0.840	0.794	0.749	0.682	0.634	
KOH	0.92	0.89	0.84	0.80	0.75	0.73	0.75	
KNO_3	0.916	0.878	0.806	0.732				
$AgNO_3$	0.902	0.857	0.783	0.723	0.655	0.526	0.396	
KIO_3, $NaNO_3$	0.882	0.840	0.765	0.692				
$BaCl_2$	0.716	0.655	0.568	0.501				
$CdCl_2$	0.532	0.44	0.30	0.219				
K_2SO_4	0.687	0.614	0.505	0.421				
H_2SO_4	0.617	0.519	0.397	0.313	0.244	0.178	0.150	0.170
$La(NO_3)_3$	0.571	0.491	0.391	0.326	0.271			
$MgSO_4$	0.404	0.321	0.225	0.166	0.199			
$CdSO_4$	0.404	0.324	0.220	0.160				
$CuSO_4$	0.404	0.320	0.216	0.158	0.110	0.067		

It will be noted that one peculiarity of these coefficients is that they all go thru minimum values, as contrasted to the values of ionization as calculated from conductivities. Since there is no apparent relation,—other than one of very informal analogy,—between activity coefficients and conductance ratios, the physical meaning of this behavior of the coefficients is somewhat obscure.

However, it is very seldom, if ever, that we have the opportunity of dealing with an absolutely pure electrolytic solution in hydrometallurgy. Hence, it is of importance to find out what affect impurities have on these activity coefficients. In dealing with solutions on the basis of conductance ratios, there is an empirical rule, namely, that the value of $x=\Lambda/\Lambda\infty$ for each electrolyte in a mixture having a common ion depends not upon the amount of that electrolyte, but only upon the total equivalent concentration. From electromotive force data, and from solubilities in mixed solutions, it has been found that "in dilute solutions, the activity coefficient of a given strong electrolyte is the same in all solutions of the same ionic strength."*[73] The following data on solutions of HCl containing various amounts of LiCl, NaCl, and KCl,—the strength of the HCl being kept always at 0.1M,—will serve to show the limits of application of this rule:

THE ACTIVITY COEFFICIENT OF HCl IN THE PRESENCE OF OTHER CHLORIDES[74]

Total m	γ Pure HCl	γ HCl in LiCl	γ HCl in NaCl	γ HCl in KCl
0.1	0.81	0.81	0.81	0.81
0.2	0.78	0.78	0.78	0.78
0.5	0.76	0.78	0.76	0.75
1.0	0.82	0.86	0.80	0.75
2.0	1.02	1.09	0.94	0.84
3.0	1.35	1.47	1.17	0.97
4.0	1.84	2.02	1.47	1.17

From these data it will be seen that even for these simple binary electrolytes, the affect of a foreign cation becomes appreciable at relatively low concentrations, and that the change in the activity coefficient at higher concentrations is not only a function of the concentration, but of the specific cation as well. It is fortunate, therefore, that most hydrometallurgical solutions, in the metal recovery stage, contain relatively small amounts of impurities.

With this brief survey of the nature of solutions of electrolytes as a lead, we may now turn to the contemplation of what happens at the electrodes of an electrolytic cell.

As noted before, electrical energy, like all other forms of energy, consists of two factors, to wit, quantity and intensity. In dealing with electrical *current,* and its conductance thru solutions of electrolytes, we have to do only with quantity, or rate of flow of quantity, of electricity. However, when we take up the consideration of the junctions between metallic and liquid conductors, we find that we have to do with the intensity factor, voltage, or potential. In a qualitative way, this might be predicted from the fact that, at such a junction, we pass from one kind of conduction to another, and from the fact that, in so doing, we are transferring electrical energy from one condition of concentration to another. Any such transfer must involve *work,* and, by definition, potential is equal to work per unit of charge.

We shall first take up the differences of potential produced by *voltaic* or *galvanic* cells, which may be defined as "any arrangement by which the energy of chemical reactions or of certain physical processes, such as diffusion, is changed to electric energy." Then we shall take up the problem of the voltage that must be applied to an electrolytic cell to force a current thru it. Obviously, if a certain combination of electrodes and electrolyte (or electrolytes) produce a certain e.m.f. under given conditions, a voltage somewhat greater than this e.m.f. must be applied at the electrodes to force a current thru the cell.

71—Ibid., Ch. XXVII.

72—Lewis and Randall, op. cit., p. 362.

* *Ionic strength* is defined as the sum of the stoichiometrical molality of each ion multiplied by the square of its valence and divided by two. It is designated by μ. Thus for 0.01M KCl, $\mu=0.01$; and for 0.01M $BaCl_2$, $\mu=0.03$.

73—Lewis and Randall, op. cit., p. 374.

74—Ibid., p. 367.

Miner to Stay in U. S. A.

Mines men will be interested in the case of Eugene Staritsky, '27, Russian student, who has been facing deportation. The latest information concerning the case is contained in the following dispatch from Washington:

"Confronted again with the perplexing problem of what to do with Eugene Staritsky, who is technically a resident of this country unlawfully, the bureau of immigration today once more suspended orders to issue a warrant of deportation against the former Denver youth.

"Assurance that the Staritsky case would be held in abeyance was given ex-Senator Charles S. Thomas of Colorado, who personally appealed to Commissioner General Hull, in response to an urgent telegram from Staritsky's mother in Denver, informing Thomas that on Nov. 15, her son was again subject to deportation.

"Mrs. Staritsky is a governess in the home of David R. C. Brown, 565 Logan street, Denver.

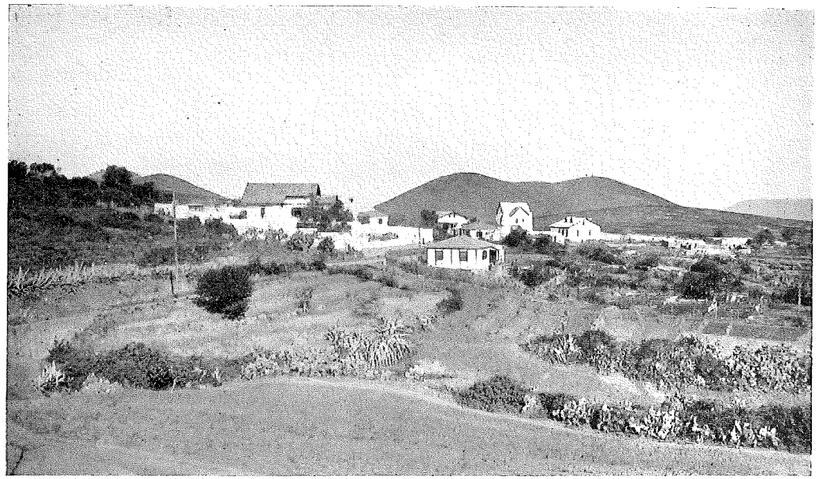
"A formal request for further extension of Staritsky's stay in the United States also had been made by Senator C. W. Waterman.

"The Staritsky case is unique because he is a Russian emigre who entered this country under a student's passport. Since his graduation from the School of Mines at the head of his class, he is no longer in student status. Therefore he is subject to be sent back to Russia.

"However, as he is a refugee from the Soviet government, he fears he may face prison if returned to Russia.

"Staritsky wants to be an American citizen, but cannot be naturalized owing to the illegality of his residence here."

While in Mines Staritsky was an honor student. He is a member of Beta Theta Pi.



The home of the author, Spanish Morocco.

Moorish Life and Customs in Morocco

By J. A. Riley, '23

A LITTLE south of Melilla are the two small Moorish towns of Nador ("Lookout" or "Watchtower") and Segangan. Dirty, squalid little places; unattractive in the extreme. Nador and Segangan are each now centers of activity and barracks for the Spanish-trained Moorish army. Nador is remembered by the Spanish as one of the last stands they made against the Moors during their war just before the blackest part of it for them when all that remained in Spanish hands was Melilla. Still standing are the ruins of a two story house in which some fifty Spanish took refuge and elected to fight it out to a finish rather than surrender. Surrender meant death of a kind too horrible. Rather death by Moorish bullets than Moorish torture. To surrender meant to both men and women a mutilation too terrible to describe; to be staked to the ground with face to the intense heat of the sun, and to be left, half dead, to thirst, and burn, and die. These fifty avoided most of the horrors but each met death.

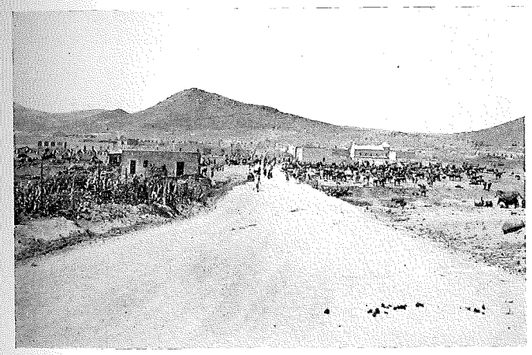
The war or, as the Spanish still call it, "The Disaster", might well have ended very differently. A little luck on the other side and it would have been too late for the events that turned the tide. Few who read in the American papers of the activities of Abdel Krim realize how close he came to having his own way. The fall of Melilla before the assistance of the French and the introduction of aeroplanes would have written, very possibly, a different story on that page of history. But Melilla held; the French came in at the right time; and the aeroplanes did the big part in setting fire to the crops and homes of the Moors—actually starving them into submission. Up to that time the Spanish were whipped and badly whipped and it is little wonder that the war is such a vivid memory to the Spanish; that they call it still "The Disaster"; and that now they take such pains that the Moors shall not come into possession of arms. And less does one wonder that the Moors were so hard to subdue once you have seen the country—their country—and their method of living. They are everywhere in this rugged inaccessible country. Their villages are everywhere. They live under conditions and with food that other peoples would find it impossible to endure. Lack of transportation facilities make it almost impossible to follow an invading army with food and necessities. To subdue the Moor is a gigantic task of which it is very doubtful that Spain alone is capable.

On the whole the Moors are a tall, strong, hardy race. The men are straight, well muscled, good looking fellows, capable of hard work and of great endurance. Living on little but barley bread, some meat, and poor water, one wonders how that the race endures, not to say thrives, as they seem to do. The women, quite beautiful to the age of twenty, age very early in life. At nine to twelve they work. After that they become pack-animals, transporting huge loads of brush; sacks of provisions; stone jars of water. Loads the muscles of the body will not support. Loads that must be placed on the bone frame with the assistance of others. Once there they manage to walk with them, but giving one the idea that the bare feet can hardly be forced off the ground as each painful step is taken. In the spring or fall when the barley is planted they may be

Down a trail to a Moorish village in the hills near Melilla.

seen hitched with a burro, a horse, or a cow to a primitive plow while the man guides the share. In the fall when harvesting is done dozens of them, under the watchful eye of a man seated at the edge of a field, may be seen cutting the golden heads. And one cannot help but feel that this man at the edge of the field is marking down demerits for poor work—certainly no credit is being given for herculean efforts. Their feet are hard and calloused, as are their hands. Their faces deep-lined at thirty with the toil of a lifetime already spent. And through it all the burden of a child on their back in Moorish fashion. Small wonder then that the men of these mothers are fine strong examples. A child of one of them must be of her best or worst. Those who are not of the fittest, of course, die very young. Many of the Moors speak Spanish very well—the women seldom. This is because the women are creatures of work in the house of her master. Her intercourse with the Spanish is as limited as it is possible for him to make it. Attempts to converse with the women have often disclosed that they speak no Spanish and, upon questioning the man of the house, he will usually say, "But they (the women) are not for social usage—their place is in the house and the field—they are for work." And this actually is their life—eternal work.

The boys are protected from all this suffering throughout their entire life. They are the chosen ones. They smile more easily—life has been much kinder to them. Even the future they think holds more for the man than the woman. When they die they are placed in the ground



Boco Day in Seguagan. This is the land of many fetes and special "days".

without any casket or protection—they will go to a Heaven. But the women are carefully placed in a protective casket for they are doomed to nothing good in a hereafter—just death.

Not long ago a Moorish family passed my home. First came the father riding a mule. Just behind him the mother with a sack of flour on her back—a load she could hardly carry. And then a very young boy who started to cry. We were delighted to see the father dismount to attend to the boy's trouble. He was tired and wanted to have a ride. But not, as we supposed, on the back of the mule with his father! He was carefully placed atop the sack of flour—added to the already too great load on the mother's back! The father remounted, and on they trudged.

Certainly this little scene explains a lot of Moorish custom. But had this little fellow been a little girl? What then? I'm very sure she would not have gotten the

Moorish boys grinning into the camera.

ride. But I'm also sure she would not have cried either. Even that young they carry the burden of being a woman.

The Moors greet each other in a very picturesque way. The hand is extended as for our handshake, but actually only a touching of the fingers seems to occur. The hand is then quickly raised to the mouth where the first finger is touched to the lips. Sometimes this is varied to the extent of adding the motion of the lips and head to each side of the other persons shoulder where the lapel of our coat would be while touching the fingers. The first finger is then raised to the lips as always. I have never seen any such greeting between a man and woman and do not think it is practiced. And very seldom do two women greet each other in this formal way.

One of the most eerie sounds I have ever heard is the Moorish call to prayer. Generally this is heard at sundown, but during the last few days of the yearly month-long fast of the Moors, during which twenty-eight days they eat nothing from sun-up to sun-down, and which is followed by three days of feasting, the priests call from the roof of their churches early in the morning hours. Each call is preceded by a peculiar high note which seems to be made without effort and which carries very clearly for great distances. Almost impossible to describe, its first hearing sends the cold chills chasing up and down one's spinal column. This ability to make the voice carry seems to be general among the Moors. Often you may see two of them standing a hundred to two hundred yards apart quiet-

A street scene in Nador, a Moorish village. Women and donkeys alike are pack animals in Morocco.

ly conversing. They seem not to raise the voice particularly, yet understanding seems to be complete. And as the language they speak is so difficult to the foreign ear, it seems all the more remarkable to a stranger that they are able to do this.

Near each church in particular and everywhere in general are seen Moorish graveyards or burial grounds. As each body is placed in the ground, a rough oval of small stones is made to surround the spot. These are stood on end and protrude about six or eight inches above the ground—apparently no effort is made to indicate the occupant of the cite except as memory serves. No effort is made to maintain these grounds—the Moorish paths, of which there is one from and to any spot you may seek, often cross the graves in their straight-line directness. Death seems to leave little impression on them.

The Moorish villages of the country are very picturesque, and inside present a paradox of filth and cleanliness. The villages spring up usually where there is water or good soil. And anywhere from fifty to five thousand people may live in them. Usually they are quite small. The houses, if they may be called such, are made of stone with flat roofs of whatever material they can beg, borrow, or steal. Usually arranged around a patio in which are numerous dogs, sheep, goats, and a cow and burro or mule, these patios are often ankle deep in filth. But the rooms leading off from this patio are kept quite spotless, particularly in the homes of those who are not absolutely penniless. But this cleanliness does not extend to the exclusion of lice, bedbugs, and fleas. The home has not developed chiefly because there is no great love of home, because of the attitude toward women, and because the Moor is primarily a wanderer. His "Chilaba", the robe the men wear, is his home. Wherever he may be he is content to curl up in this very useful garment, draw it over his head, and sleep. And somewhere within its folds is a piece of barley bread to serve as his next meal.

Moorish women carrying heavy loads.

The women practice tattooing and often henna the feet, particularly the heels. The hair is braided in two strands down each side of the back of the head and these braids are supplemented by the addition of braids of fine rope-like material. The boys shave the heads with the exception of a top knot. Quite often this decoration is on the side of the head toward the back. Upon reaching manhood even this top knot is removed. Women are usually tattooed on the forehead, the chin, throat, and the side of the foot just above the heel. And this tattooing is most often in the form of a repeating cross, the perpendicular bars of which are united.

Perhaps the best place to see the life of the Moors is at their market places. Each day the market is held at a different place—repeating themselves by the week. On the morning of market day the Moors may be seen assembling from all their villages to the place of the market or Zoco. The paths are full of them, some on mule or horse back, but most of them walking. With them they take old empty bottles to be filled with oil, both cooking and lighting, odds and ends to be traded, pieces of wood that someone may want to buy, pottery—mostly in the form of plates and water jars, camel loads of charcoal, and a million and one things of great or little value. The Zoco is a milling crowd of men and women and children. Meat, killed on the spot, is sold, and also vegetables, peanuts, and fruit. The smell of human and animal bodies permeates everything, but this is indeed the best picture of the Moors. To them a Zoco is a small holiday and they arrive in their best with the women displaying quantities of silver in the form of earrings and bracelets of huge proportions. Some of the latter are made of as many as twenty Spanish "Duros" (5 peseta pieces); are huge bands with cog-like projections around the outside; and at the present rate of exchange are worth about nine dollars or a little more. About noon the peak of the Zoco is over and the trek home begins, and once more the hills are a moving mass of Moors plodding their easy way home —to what? Just an existence. At least what seems to us to be just an existence. But the Moor is a contented, God-fearing man. He lives his religion continuously and openly in his daily life and association with others. Life gives him little of material things and, because he lacks these things which we consider so essential to happiness, we are inclined to pity him, to feel he is part of the earth's neglected millions, merely passing the three score and ten in the hope it won't be any longer than that. But somehow one cannot help but feel, after a closer view, that perhaps he pities us. Perhaps he feels that we are missing something worth while that life offers. Certainly, one cannot help but feel that he is getting something we are missing. Somehow he has a share of contentment and peace with the world that is not ours. One cannot help but marvel at the hold the Koran has had on him through all these centuries and how wise was the man who knew his people so well as to be able to give them a standard by which to live that seems to be as applicable today as then. Certainly their unenlightenment has had a lot to do with it, but here they are, against uncounted disadvantages and hardships, not only surviving but going forward each year in the measure of our Occidental eyes, meanwhile keeping all the faith and ritualism of a religion that has bound and held them so completely so long. The European is charged with a big task in their attempt to help them and still not take from them the wonderful qualities that are theirs.

Interesting Alumni Statistics

The new Alumni Directory which came out in September contains the names of many interesting people. It is surprising to notice the distribution of the Colorado School of Mines graduates over the United States. Colorado has most of the alumni with a total of 350; California has 200 graduates; Texas, 78; New York, 64; and Oklahoma is the last of the five leading states with 59 Alumni. There are at the present time 220 alumni in foreign countries. The Alumni Association has about 141 names of graduates whose address cannot be found.

It must be true that an engineering education fits one for almost any line of work. There are twenty-five men with degrees who are teaching, two tax agents, two in the title and trust, five working for the Soviet government on engineering projects, eight farmers, four are in the paint business, and three in airplane transportation. Among the lines of work represented by alumni are finance companies, druggists, florists, art galleries, laundries, foresters, tent and awning, stationers, publications, physicians, governors, packing, cemeteries and attorneys.

Anomalies of Vertical Intensity

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

By George B. Somers, '30

Chapter III—Interpretation, Continued.

Minnesota[39]

From available maps the surface of Minnesota appears to be covered with a considerable amount of glacial till which apparently gives rise to some local anomalies which detract from the regional effect. This effect of the glaciers was discussed under Illinois. There are, however, a few places in which regional effects seem to predominate. It is quite probable, however, that magnetometer work where stations were more closely spaced would give satisfactory results even though the regional effect is not so clear with widely separated stations. Closer stations and direct correlation with the geology would account for many anomalies which cannot be picked up by the method used here.

According to the map accompanying Professional Paper No. 71 of the United States Geological Survey, the state can be divided roughly into two sections by a north-south line passed through the center of the area. West of the line the exposed rocks are chiefly of Cretaceous age with some Pre-Cambrian. East of the line Pre-Cambrian are found in the northern half and Paleozoic (Cambrian through Pennsylvanian) in the southern part.

The magnetic anomalies noted are as follows:

The northern part is marked by extreme polarity. This is a Pre-Cambrian region with iron deposits, acidic and basic igneous rocks, sedimentaries, etc. so that the effects are undoubtedly due to local polarity.

The "high" marked by the I of Minnesota is shown on the topographic map to be a structural high. Additional connection between the two is not known to the writer.

The "low" marked by N N E, which with the exception of a narrow north-south "high" extends eastward to Lake Superior, roughly coincides with an area marked Upper Huronian on the map. The "high" is drawn from only two stations which may both be governed by local effects.

Just south of the western end of Lake Superior is a "high" which corresponds with rocks of Keeweenawan age. A similar area north of the lake shows no effect as there were no stations located here.

West of the S O T is a "high" which outlines the area marked as Laurentian. A similar area in the northwestern part of the state is also "high" with the exception of one "low" area. Only one "low" station was, however, found in the Laurentian.

The "low" marked by O is in Cambrian and Lower Ordovician rocks which corresponds to a similar area on the upper peninsula of Michigan. The "high" just south of this, marked by T A, is in upper Paleozoic rocks which also corresponds with observations in Michigan.

While the above areas seem to be marked by certain magnetic effects, there are some discrepancies which may or may not be due to glacial till. No attempt has been made to find local structures as the station arrangement did not seem to warrant it. The writer was also unable to find data regarding regional structures so that no effort was made to carry out this type of interpretation.

It is also to be noted that the magnetic anomalies appeared to coincide better with the geology, as they did in Michigan, than in the states to the south as Iowa, Illinois, Indiana and Ohio. This is quite probably due to the increased thickness of glacial material in the latter states over that in Minnesota and Michigan.

Mississippi[40]

A structure map of Mississippi based on the top of the Cretaceous formations, shows a terrace in the northeastern part, then a gradual dip to the southwest. There is also a terrace in the northwest part that leads to a ridge which extends from La Flore to Hinds county. Mr. Grimm reports the presence here of a buried ridge of volcanic nature which was buried by Tertiary sediments, though his more recent map shows the ridge extending from Washington to Hinds county. This he reports is the chief structure of regional significance.

Geologically the exposed rocks in this state are chiefly Cretaceous to Recent. The former are found in the northeast corner, next to the southwest come the various Tertiary formations, and lastly the Quaternary in the southern part.

The magnetic effects here are of the Florida type in which the anomalies roughly follow the regional structure, irregularities usually being due to local structures superimposed upon the regional ones. A close examination of the isonomalic map shows that the northeastern part of the state is predominately "high" while the southeastern part is "low". The volcanic ridge can be traced as a magnetic "high" from a point north of Flores county nearly to Hinds county. From the location of stations it could be just as possible to draw it the rest of the way to Hinds county, the isonomalics being drawn according to the rules for drawing contour lines.

A comparison of Mr. Bancroft's map which marks the location of a number of leases supposedly on structure, shows that these leases are practically all on magnetic "highs". This indicates as in Florida that local anticlinal structures appear here as magnetic "highs" superimposed on the region effects.

Missouri[41]

The Ozark uplift, consisting of lower Paleozoic and Pre-Cambrian rocks occupies the southern and southeastern part of Missouri. North and west of this uplift the Mississippian and Pennsylvanian formations lie northwest and west respectively. In these north and west areas struc-

39—Emmons, W. H. Director, Minnesota Geological Survey. Personal communication.
Final Report volumes of the Minnesota Geological Survey.

40—Grimm, Ralph E. Assistant State Geologist. Personal communication.
Grimm, Ralph E. Oil and Gas Property in Mississippi with a Brief Study of Subsurface Geology. Bul. No. 21, Mississippi Geological Survey, 1928.
Sparagen, L. Magnetometer Studies of Mississippi. Series in Oil and Gas Journal, May 16, June 27.
Bancroft, D. H.—Mississippi Now Attracting Attention, July 18, 1929.

41—Buehler, H. A. State Geologist. Personal communication.
Buehler, H. A. The Stratigraphy of the Pennsylvanian Series in Missouri. Missouri Bureau of Geology and Mines, Vol. III. 2nd Series.

ture contours have been drawn on the Bevier coal bed of the Pennsylvanian because of its persistency over a large area.

The isonomalic map shows that the Ozark Uplift is in general characterized by "lows" and that the trend of its axis from Oklahoma across Arkansas and into Missouri is well shown. Along the northern part of the uplift is a pronounced "high" for which no cause can be found on the geologic map.

North of the uplift the Mississippian area, enclosing the O of Missouri, appears as a "low" while west of the uplift the Mississippian is a magnetic high. The cause of this irregularity is not known but may be due to local structure. In the northeast and southwest the Pennsylvanian appears as a "high" and apparently shows local structures as indicated by the structure contour map. Mr. Buehler reports an anticline above the U of Missouri where the geologic map shows the Pennsylvanian to be surrounded by Mississippian formations. This area is shown on the isonomalic map as a magnetic "high".

An interesting feature is the "low" in the northwestern part which corresponds with the Douglas outcrop. Is this due to the fact that the formation is magnetically negative, or to local structure?

On account of the unexplained features mentioned in the Mississippian and Lower Paleozoic areas, the interpretation of this state is not as satisfactory as that of others. In general, though, it appears as if magnetometer work in the northern and western parts would be successful.

Glacial drift is reported as far south as the center of the state, and it is possible that some of the anomalies shown in the northern part can be ascribed to this cause. For a more complete account of magnetic effects in glacial areas the reader is referred to Illinois.

Montana[42]

The relatively few stations available in a state the size of Montana naturally permits only a generalized view of the regional structure and eliminates all relatively local structures. Even then it is remarkable how much of the subsurface geology is shown by a careful study of the isonomalic map.

In the western part of the state the Rocky Mountains appear in general as a "low" which corresponds with similar effects in states to the south. It is probably due to the location of stations in valleys. There is, however, at the northern end of the range a "high" due to three stations, whose cause cannot be found. It may be due to a change in the type of rock from that found in the surrounding region. At the southwestern corner is another "high" which corresponds to an area of Paleozoic rocks. It may represent structure or be caused by a concentration of magnetic properties in the rocks.

The Sweetgrass anticlinal structure shown in the Dakota is particularly well marked by a magnetic "high". It enters the state from Canada at roughly 111° 30′ west longitude and extends southeastward to a point between the N and T of Montana.

It may be noted here that the Bearpaw Mountains and Judith Mountains are in "lows" due probably as before stated to the location of stations in valleys. The Little Rockies are shown by a "high" but the isonomalics here are governed by two stations neither of which is in the mountains. In a similar way the Big Snowy and Big Horn Mountains are poorly represented by stations and do not show their true magnetic character.

[42]—Perry, Eugene S. Head, Dept. of Geol., Montana School of Mines. Personal communication.
Emmons, W. H. Geology of Petroleum. Map of Dakota Sandstone, after Huntley. p. 487.

The extreme "high" in the southern part is due to only two stations and has no structural significance.

One of the geological features that is well shown is the Sheridan Basin which is outlined as a "low". Except in the eastern part there are ample stations in the basin to really show its magnetic characteristics.

The Porcupine Dome and Baker Glendive anticline are both in "high" areas but although stations occur on or near them they are not well outlined. The Baker Glendive anticline is a ridge between the Moosejaw Synclinorium in the northeast corner of the state and the Sheridan Basin. Although the anticline is not well outlined, the "high", both magnetic and structural, between the two basins is distinctly shown.

The generalized map of the Dakota also shows a minor syncline extending southwestward from the northeast corner of the state. This structural low is clearly shown on the isonomalic map by a magnetic "low".

Nebraska[43]

The isonomalic map compares but roughly with the structure map[43] of the state based on the Dakota sandstone. The irregularities may be due to the effects of basement conditions which do not coincide with the Dakota, to local structures, in the eastern part to glacial drift, or even to many other causes.

The two chief geologic features shown are, first, a northwest-southeast anticline in the western part of the state, on which are two structural high points, one at the northern boundary, and one at the southern. Second, a syncline, which, starting near the center of the southern boundary goes northward about three fourths the width of the state, then turns northwestward and passes into South Dakota.

These two geologic features both appear on the isonomalic map. In the west it can be seen that the two structural highs on the anticline are both shown by magnetic "highs" with a "low" between them. There is also a magnetic "high" in the northwest corner of the state which coincides with a geologic high.

In the central part a magnetic "low" roughly follows the syncline as it goes northward, then there is a slight break or "high" where the syncline turns northwestward. The structure again appears as a magnetic "low" where it passes into South Dakota.

The eastern fifth of the state was covered by the terminus of the glacial ice sheet, and here a number of extreme "highs" and "lows" are found which may be due either to local structure or to the glacial drift (see Illinois). There is also an extreme "high" in the southeast quarter of the state which may be due to structure or the closer approach of the basement rocks to the surface.

Nevada[44]

Quoting from Mr. Jones' letter regarding the geology of Nevada we find that "The general structure of rocks in Nevada runs along north and south lines, ratio (?) defined by faulting. The structure underneath the valleys is unknown, and in the mountains, while the rocks are faulted, yet the areas involved are much smaller than the areas of anomalies".

Very little indeed can be told about the regional geology of Nevada from the isonomalic map and yet comparing this map with the geologic one of the United States Geological Survey[45] brings out several interesting possibilities. It must be remembered, however, that very few stations were

[43]—Darton, N. H. The Structure of Parts of the Central Great Plains. U. S.G.S. Bull. 691, 1918.
Emmons, H. E. Geology of Petroleum, p. 487, 1921.
[44]Jones, J. C. Geologist. Nevada State Bureau of Mines. Personal communication.
[45]—Professional Paper No. 71.

available in Nevada, and that as a result the directions of, and the areas involved by the isonomalic lines can be considered in only a general sense.

Considering first the magnetic "highs" we find that in the north this area closely coincides with one colored solidly as volcanic rocks. In the western part, and extending east as far as central Nevada, the "high" coincides with an area in which extrusive rocks predominate. In the eastern part the extreme "high" fits an extrusive area, shown as entirely extrusive on the geologic map, while the "high" as a whole coincides with a region in which there are a considerable number of scattered volcanic areas.

Volcanic rocks, particularly basaltic ones usually show polarity which normally is positive or "high" but which may be reversed due to folding, flowage, faulting or other causes. Whether the "high" areas actually show this positive effect of these extrusive rocks or whether the coincidence between magnetic "highs" and extrusive rocks is purely accidental the writer is unable to say.

At first glance the "high" in southern Nevada does not appear to fit the general theory so closely, but by examining a map on which the stations are shown, the situation is clarified. This southern "high" was drawn on the basis of five stations which actually occupy areas in which volcanic rocks predominate. It does not therefore show any possible intermediate low area except at one point. This one station is located in an area marked Pleiocene sediments, and may indicate almost anything.

The cause of the "low" areas is not so clear. They represent, however, very few stations, and may be due to negative or local polarity, to the station being in a valley below the volcanic rock, to structure or to many other causes. The geologic map is drawn on such a small scale that it is impossible to determine the local conditions at each station.

The few stations available in Nevada preclude any chance of a more extensive correlation. The chief point brought out being the apparent magnetically "high" effect of the volcanic rocks.

New Hampshire

The geology of this state is so complex that no correlation between it and the isonomalic lines appears possible. There is, however, particularly in the northern part, an indication that the isonomalics may reflect topography instead of geology as they appeared to do in the State of Maine.

New Jersey[46]

In the northern half of New Jersey are found in order, from northwest to southeast, folded and faulted Paleozoic limestones, sandstones and shales, Pre-Cambrian acidic and basic gneiss, diorite, magnetite etc. and the Newark formation of Triassic age in which occur basalt and diabase ridges having a northeast-southwest trend. The southern half is composed of Cretaceous and Tertiary sands, clays etc., which rest on Pre-Cambrian rocks, possibly more Paleozoics.

Magnetically, with the exception of two stations, the northern half is "high", while the southern half also with the exception of two stations, is "low". These four irregular stations are probably caused by local conditions.

The "high" in the northern part appears to give the general magnetic qualities of the basement rock while the "low" in the southern half indicates the dip of the basement structure to the east and south beneath the Cretaceous and Tertiary formations.

The first and fourth volumes of the Final Reports published by the Geological Survey of New Jersey in 1888 and 1895 respectively, contain a magnetic map in which the variations in declination are shown. No attempts were made to interpret the results of this survey but it is interesting to note how long ago magnetic anomalies were recorded and an effort made to correlate them with structure.

[46]—Kummel, Henry B. State Geologist and Director. Personal communication.

New Mexico[47]

The chief features of interest in the interpretation of this state are two magnetically "low" areas one of which covers the western half of the state, and the other which is found in the northeast corner. These outline areas in which the granitic rocks are either exposed or are relatively close to the surface[48]. Although several other positive and negative anomalies are shown they are largely due to either widely scattered stations or else to ones located under different geologic conditions so that their significance is negligible.

There are two oil areas in this state, one in the northwest corner and the other in the southeast one. The southeast corner is shown as a "high" but this anomalie is due to three stations near Artesia in Eddy county, and one in the Panhandle of Texas. The ones in Eddy county may represent local structure but there is no data for Lea county.

In the northwest corner the "high" is from a station at Shiprock. As it is due to one station only, it cannot be said to represent structure even though it may actually do so.

New York[49]

In the northeastern part of the state in the Adirondack Mountains is a large area of Pre-Cambrian rocks surrounding which are rocks of Silurian age. The Medina (Silurian) formation is found along the southern shore of Lake Ontario, and from here the formations appear to dip to the south with Devonian rocks covering the southern half of the area. The geologic outcrops indicate a synclinal structure (Ordovician-Silurian Plateau) extending from north to south and situated just east of Lake Ontario, and between it and the Adirondacks. Along the Hudson River the rocks are chiefly Silurian with some Triassic appearing near the New Jersey boundary. Long Island formations are chiefly of Cretaceous and Tertiary age.

The regional structure appears to be well shown by the isonomalics. The Pre-Cambrian region of the Adirondacks is predominately low, this effect being probably due to the stations being in the valleys. The area along the south shore of Lake Ontario is "low" but this changes to "high" as the sediments thicken to the south on the Appalachian plateau. In this it seems to resemble the Colorado type in which the magnetic effects appear to be due to sediments rather than to basement structure. The Ordovician-Silurian Plateau (apparently a syncline) is shown as a "high" which also agrees with the Colorado type.

A "low" area, in a general way, extends eastward from the south shore of Lake Ontario, and follows the formations as their outcrops turn southward along the Hudson River. This probably indicates that some rock of Silurian age is causing the "lows".

Long Island appears as a magnetic "high".

An interesting feature is the "low" in the south central part of the state in the vicinity of Seneca and Cayuga Lakes where the earlier formations again appear. This again seems to fit the sedimentary theory and also the "low" effects of the Silurian formations.

[47]—Wells, E. H. President of New Mexico School of Mines and Director New Mexico Bureau of Mines. Personal communication.
[48]—United States Geological Survey. Geological Map of New Mexico, by N H. Darton.
[49]—Newland, D. H. State Geologist, Personal communication.

North Carolina[50]

The western two thirds of North Carolina consists chiefly of igneous and highly metamorphosed rocks whose general strike is northeast southwest. The eastern third is made up of sediments which range in age from Cretaceous to Recent. They dip to the east or southeast.

It is interesting to note that although little can be told about the structure of the western part from the isonomalic map, that the general trend of the "highs" and "lows" in this region roughly follows the geology. This relationship is more clearly shown if one superimposes the isonomalic map on the geologic one of the United States Geological Survey in Professional Paper No. 71.

According to Mr. Bryson there are no structures in the eastern part which can be worked out from the surface. An examination of the isonomalic map shows a line of "highs" in this area adjacent to the igneous and metamorphic rocks, and a line of "lows" along the coast. This apparently indicates the regional dip of the strata according to the Florida type. There are three minor exceptions to the regional intensity as stated above. These are first, a "low" marked by the O of Carolina which extends into Cretaceous territory and is due to one station. Second, a "high" that reaches the coast in the southeast part caused by two stations. Third, a small "high" in the eastern part due to one station.

The three irregularities are based on so few stations that they can be neglected. They are undoubtedly due to local causes, possibly even to local structure but they do not materially affect the general regional indications of dip.

North Dakota[51]

The greater part of North Dakota is overlain by glacial drift. Underneath, the sedimentaries are found to be dipping in a general way toward the west. Tertiary formations are found in the western part with Cretaceous appearing in the eastern half. At the extreme east is an area of Pre-Cambrian ("Laurentian") rocks.

The only structural feature of significance as shown in the Dakota sandstone is a syncline which is a continuation of the one in South Dakota. It passes north and northwest into Canada at the northwest corner of the state. Four minor anticlines were also reported by the State Geologist but they were not of sufficient size to be shown by the relatively few magnetic stations available.

According to Huntley's map a syncline enters the state at a point almost due south of the O of North, extends northward to the O and thence northwestward to the northwest corner of the state. With the exception of a "high" just south of the A K of Dakota, this synclinal area is represented by a "low". The one "high" may be due to the method of drawing the isonomalics as there are no stations at that point over the syncline. The stations which caused the isonomalics to be drawn thus are both situated high up on the flanks of the depression.

At R and extending southeastward is another relatively minor syncline which is likewise shown as a "low". It swings southward near the T of Dakota and passes into South Dakota. The rest of the state is magnetically "high" and reflects the rising structure of the Dakota sandstone.

Although the state is covered with glacial drift, this does not apparently alter the correlation of geologic and magnetic structure. This agrees with the conclusions of European geophysicists and also with the hypotheses advanced in Chapter II, and under Illinois that the irregularities in intensity found in Iowa, Illinois, Indiana and northern Ohio were due to glacial drift from iron bearing formations.

The above data in regard to magnetic anomalies coinciding with geologic structure is corroborated by information furnished by Mr. John Wilson[52].

Ohio[53]

The northern part of Ohio was covered by the glacier in Pleistocene times and this fact appears to be reflected in the isonomalic map. The southern boundary of the ice sheet extended from a point near the Kentucky line in the southwest to a point a short distance north of the junction of Ohio, West Virginia and Pennsylvania in the east.

From a study of Iowa, Illinois, and Indiana (discussed fully under Illinois) together with Ohio, it appears that in these states along the southern border of the glacier, irregularities in the isonomalics seem to be caused by local effects in the glacial till rather than by regional structure. Since these irregularities do not seem to occur in other states east and west of the four mentioned even though they too are covered by the terminal moraine of the glacier, some cause other than glacial till must be given. The anomalies seem therefore to be due to the fact that the glacial material in those states in which the irregularities occur came from iron formations to the north, while in the other states it came from more normal or ordinary formations.

There are three main structural features in Ohio, namely, the Cincinnati Arch, the Parkersburg Syncline and the Cambridge anticline. Of these three the Cincinnati Arch which extends from the western end of Lake Erie southwestward through the first O of Ohio into Kentucky is the most important. In Kentucky in the area adjacent to the point where the axis of the arch enters Ohio from the south the results are negative, but in Ohio at this point there appears a positive anomalie. Just what causes this "high" does not appear from the geologic map, but inasmuch as practically all of the arch in Ohio was covered by the glacier, the irregularity seems possibly to be due to local rather than to regional causes.

In the eastern part the Parkersburg syncline and Cambridge anticline are better outlined, particularly in southeastern Ohio where they were not covered by ice. The former structure can be located by drawing a line from half way between the W E of West Virginia to a point halfway between the I and last O of Ohio. The latter structure is parallel with the former or Parkersburg syncline and passes through the last O of Ohio.

The isonomalics which outline these structures appear to be slightly offset, but from all indications the syncline is shown by a "high" and the anticline by a "low", an effect just the reverse of normal. It is noticeable that isonomalics become irregular as soon as the edge of the former ice sheet is reached, and that north of this point, local anomalies appear to prevail.

An oil pool in southeastern Ohio is shown with a magnetic "low" which corroborates the reversed effects of other structures. Whether the reversed effects are normal for this state or only appear to be so is not known. From all indications, however, magnetometer work in the southern part of the state would be more successful than it would in the northern part.

50—Bryson, H. J. State Geologist. Personal communication.
51—Leonard, A. G. State Geologist, University of North Dakota, Personal communication.
Emmons, W. H. Geology of Petroleum, p. 487. Generalized map of the Dakota sandstone after Huntley.

52—Wilson, John H. Consulting Geophysicist. Golden, Colo. Personal communication.
53—Stout, Wilber State Geologist. Personal communication.

CLIPPED FROM —

The Mining Congress Journal:

The most progressive nations of the world are those which have a gold reserve of sufficient size to assure stable money. Excepting Belgium, France suffered more by the World War than any other nation. Her buildings and manufacturing plants were destroyed, her farms ruined, her wealth wasted, and her man-power tremendously depleted. Today France is one of the most prosperous countries of the world. From a point of considerable less gold than some of her neighbors, she now possesses half as much gold as the United States, and nearly double that of Great Britain. Her economic policies are such as to insure industrial activity to absorb the greater part of her industrial power. This means increased earnings and increased wealth accumulation.

A Paris dispatch states that France with the second largest store of gold in the world may soon turn to the collection of a huge stock of silver to permit re-introduction of silver coinage. Notwithstanding the superior position which France occupies because of her large gold stock, her statesmen insist that that stock must be increased and that the purchase of silver will put France on a sound money basis as good as the best countries in the world and better than any of her direct competitors. No country can prosper permanently except in proportion to the stable money available for the transaction of its business. France will soon occupy a premier position among the nations of the world.

The Journal, Engineers of Australia:

Sir,

For the last eighteen months I have had the pleasure of acting as the Melbourne Division Correspondent of The Journal.

During that time I have had the opportunity of hearing a large number of papers, on a variety of subjects—civil, mechanical, electrical and municipal.

From a long experience of papers on similar subjects, read before British Institutions, I feel that papers in this country have two outstanding characteristics:—

1. Their matter is usually excellent;
2. Their method of presentation is far too long.

If I may mention two extreme cases, I recently heard part of one paper which took two and a half hours on its first presentation, and was then adjourned. I could not attend the adjourned meeting, but I am told that the author spoke for another hour, making altogether 210 minutes.

In the other case, I listened to a joint paper by two members, each of whom spoke for exactly thirty minutes, presenting his side of the case, and left the rest to his co-author. When each sat down one felt that he might have gone on longer, and when the joint effort was concluded, one felt that an hour had been usefully spent.

By the reader of a paper before the Institution, two things, I suggest, should be borne in mind.

1. He must do justice to his subject;
2. He must please his audience.

The second of these is of most importance, because if he pleases his audience, he will almost certainly have done justice to his subject.

The fault of many papers lies, not in the paper itself, but in its trimmings, its diagrams, maps, formulae, etc. These may look well in print. A formula is usually too simple to need explanation, or too complicated to make explanation efficacious, and should be in the printed appendix. Diagrams and slides should be self-explanatory. A pointer should be sparingly used at a lantern lecture. If a slide does not explain itself it does not deserve explaining, while the pointer is a temptation to the lecturer to be diffuse.

An Oxford tutor once advised his pupils, when they had written an essay, to read it over carefully, and, if they came across a passage that they thought particularly fine, to strike it out.

Sam Weller, when writing his first and only known love letter, rebuked his father, who had said that the letter was too short, by answering:—"Not a bit on it. She'll vish there wos more, and that's the great art o' letter writin'."

If members of the Institution would follow the advice of the Oxford Don and Sam Weller, the quality and quantity of the papers would be much improved, and the attendances at meetings largely increased.

Yours faithfully,
E. L. Hill, M.I.E.Aust.
Melbourne Division Correspondent.

The Saturday Review of Literature:

Scholarship has never enjoyed the esteem in America that it has held in Europe. As a matter of fact the masses in the United States have been rather inclined to look askance upon the man of learning, as though knowledge had atrophied his powers of good fellowship.

The legend of the scholar and the highbrow as a person so absorbed in things of the spirit as to be entirely oblivious to the multiple small interests of his day has, however, persisted beyond the facts which may once have justified it. Economic necessity alone, the inability to make from the pursuits of the study a livelihood sufficient to meet the demands imposed upon him and his family by the standards of taste and convention, has drawn the scholar from the retirement of his library into the maelstrom of the market place. He is today a lecturer, a contributor to the popular magazines, a syndicated feature writer for the newspapers, the conductor of trips to Europe, a consultant to a business or an engineering firm, a practicing lawyer, as well as a scholar or a teacher. The faculties of our universities are constantly being recruited from the fields of business and science just as our large scale industries, our law and engineering firms, our financial organizations are constantly drawing replenishment for practical direction from the staffs of the universities. The scholar who is ingrown into his scholarship hardly exists today in America.

And yet the prejudice against the scholar as a man capable of passing judgment upon the contemporary scene still persists. We encounter it every day in our own field where the callow youth, with the ink hardly dry on his sheepskin, frowns disapprovingly when informed that the important biography, the thoughtful novel, the new volume of verse which he wishes to review has been sent to the man who has taught him and his predecessors for twenty

years back all that they know of history and literature. His reaction to the statement is uniform—the professor is a less desirable critic than himself because the only gauge he will apply in analysis is that of a narrow and rigid academicism. That he need not be less the man because he is the scholar seems to escape these young objectors as completely as that it is not learning of itself that is narrow but some of those who follow it.

There is, to be sure, no substitute for the liveliness of interest, the eagerness of approach, with which youth fresh from the university turns to the literature of its day. But neither is there any evidence—rather is there every proof to the contrary—that scholarship in America today is as vitally concerned with living as with learning, and certainly there is every presumption that this being so, its reaction to the intellectual output of its time will be as pliant and far more informed than that of the tyro.

Interesting Features—Russia

(Continued from page 14)

from all parts of the U. S. S. R. Also, I saw a drill core of the first oil well drilled in the Ural Mountains. It was something over 1,200 feet long, drilled entirely by hand in limestone. Here, too, is a very fine fossil collection—fossils of all kinds. The ammanites in this collection were over five feet in diameter, and the sutures on many of them were developed to the highest degree. Dinosaurs, et cetera, were also represented by many skeletons which came from Siberia. In all, it was really worth while, but I had only one day to see it and couldn't do it justice.

I visited the geophysical institute and saw geophysical instruments in the making. They are making a new type of torsion balance, a modification of the "Z" type, which they claim is lighter and more portable. It is said that these new balances are being exported to Germany, France, et cetera, but I do not know how authentic this information is. The geophysical institute has many parties out, and will expand their work many times in the coming year.

In Moscow, I visited a museum in which all ages of man were shown. The stone, copper, bronze, and iron ages were complete with many pre-historic examples. I also went through the Kremlin and found it very interesting. All the historic things which have had to do with making Russian history are preserved. It was one of the best trips I had had, and I intend to go through it again when I reach Moscow, as one day is not enough.

We have just finished our work on an old copper property that was started under a French concession many years ago. Their methods here are rather primitive, but they are trying to modernize things now with the help of American engineers who are here. The mine produces about 100 to 125 tons of ore a day containing about four per cent copper. To get ore to the smelter, a rather antique affair, they use four inclines which were put in by the French. All their hauling is done by horses hitched to the cars or else carried by two men, a stretcher-like affair. They don't seem to grasp the idea of a wheel-barrow, but stick to a box on two poles, resembling a stretcher.

The ore is brought from the mine and unloaded in sorting sheds. Men, women and children then sort the ore where it is reloaded in other cars and sent to the smelter. Greeks, who have been here for 30 years or more supervise the sorting, and it is they who determine what shall be sent to the smelter. An American geologist who is here, is sampling the mine for the first time now. Quite a system, isn't it? The only means of transportation between here and the smelter town, Minez, is by ox-team. They are slow, but get there just the same.

On the whole, though, things are all right over here. We are treated with utmost courtesy everywhere, and they try to do everything possible for our comfort. Food is the chief problem. We get all there is, but at times that is rather scanty. Anyway, I haven't suffered as yet, and will rest content as long as they do the best they can for us.

There are many interesting things nearby. There's an old bridge at Minez, made of hewed basalt, that was built in 966. In another old Armenian village there is an old monastery built out of the same basalt that is over a thousand years old.

This region of the Caucasus is entirely volcanic and many good examples of hexagonal basaltic parting are evident. Moving to our next job in a few days, I will get a chance to see Mount Ararat, and see where Noah landed the "Ark."

Well, Prof., I'm about out of news, so better ring off. Would appreciate hearing from you, if you have the time, as it is a bit lonesome here at times.

With best regards to yourself and Mrs. Johnson, and also the other members of the department, I am,

Letter to Dean Morgan

I've traveled a lot since leaving Golden, and as we are finished with this job now, will start on the road once more. I was fortunate to get a trip to Leningrad and there visited the geological and the geophysical institutes and also one of their universities. These all proved very interesting as now I have a much better idea of the educational system in this country.

It is not an easy matter to gain admission to a university or "high school" as it is called over here, and not everyone is allowed the privilege of going to a school of higher education, as is the case in the States. However, children are compelled to go to school, but to a university it is different.

Their studies are very similar to ours in most respects. However, a student must go each summer to work at his or her profession whether mining, metallurgy, geology or geophysics. The place for this experience is designated by the government and its enforcement is rigidly adhered to. At the smelter here I have seen girls shoveling ore or coke along with the rest of the workers. It is a queer sight to one of us, but is common practice here.

At present we have a Russian geology student, who is also learning geophysics, at work with us. He is a first year student and can speak English fairly well, in fact more so than any of us can speak Russian.

One thing over here is very noticeable and that is the eagerness of the people to learn to speak English. The interpreters here in this camp are holding special English classes and they are filled to capacity. Another thing that is very noticeable is the amount of slang that we use. This was brought to my attention by a Russian professor and his wife who have been with us all summer and who speak good English. It surely amused me to learn that these people did not understand many phrases and expressions which we use every day and think nothing of it.

For the past two months I have been in the Caucasus Mountains in the Near East, Armenia. This country is much the same as we find in the desert in Arizona. The mountains are similar and vegetation about the same except there is no cactus.

In this region there is a medley of races with no less than six languages being spoken right here.

Athletics

C. C.—7, Mines—6

The Miners fell one point short of a tie with Colorado College in the traditional Thanksgiving game, which was played at Pueblo again this year. The score was 7 to 6, Bonnett's placement kick for the extra point failing to negotiate the uprights.

The Orediggers entered the game as under dogs but fought the Tigers to a standstill. The Miners' lone touchdown came in the final period, when Bond took a 15-yard pass from Eads and ran through the entire Tiger team, behind perfect interference, for 50 yards and a touchdown.

The Tigers made their touchdown in the first period on straight football, Deholczer smashing through tackle on the scoring play. E. Starbuck kicked goal.

Burrell, star player at center for Mines, and Preston, who has done an excellent job as right tackle the entire season, were the only two to stay the whole game through. Eads and Bond were the Mines' offensive stars, while Manhart was outstanding in the defense.

Fourteen Miners Play Last College Game

The Thanksgiving Day game was the last college contest fourteen members of the Class of '31 will play. Graduation this spring will eliminate them from the Oredigger football ranks.

Burrell, in three years of outstanding varsity football, will graduate with the class of '31. In three years Burley has not missed more than 15 minutes of play, a remarkable accomplishment.

A hard hitting, aggressive linesman, Preston, also leaves with the class of '31, as does Woodburn, another linesman who has a good record of three years behind him.

Robison and Manhart, who have been playing as regulars this year will also complete their football careers on Thanksgiving.

Ted Adams and Wilkerson have been two steady wingmen. The former came back to take graduate work and put on a football suit for another year.

Peaker, Bonnett and Eads, three men well known for their ball toting and consistent backfield playing, finished their football days on Turkey day.

Barker, Rice and Spiers, were unfortunate in having injuries that kept them out of scrimmage this year, their last year of eligibility.

Fishman has been out every year, but has never played in a game. Just the old Mines fighting spirit to be commemorated.

This large number out this year will leave a serious gap in next year's squad.

* * *

We need a sense of humor in the publications department. The other day we got a long distance call for the "complications" department.

Sprains and Bruises

By Charlie Whaurse

It may have no significance but it is nevertheless a fact that the annual Red Cross drive opened the same day Mines and Regis met on the girdiron. And the game furnished plenty of material for Red Cross nurses and ambulances.

* * *

Why not turn the next meeting of the members of the Rocky Mountain Athletic conference into a disarmament conference? Something will have to be done about that Utah team.

* * *

Let's see, didn't we hear something not long ago about Colorado Aggies having too much class for the rest of the Rocky Mountain football teams? And what has become of Harry Hughes' plan for a Big Six?

* * *

That Utah eleven is certainly a beautiful machine. Nothing spectacular but perfect co-ordination and timing and a knowledge of fundamental football which has not been in evidence in this section for many years. Charlie joins with the other sport scribes in hoping for a post-season game between the Utes and one of the nation's outstanding teams.

* * *

Lots of discussion as to whether Frank Christiansen, Ute halfback and triple-threater, is the greatest footballer the Rocky Mountain conference has ever turned out. We string along with Dutch Clark. Remember, Crashing Chris is playing on one of the strongest offensive and defensive elevens in the country, while the Dutchman piled up his amazing record with a mediocre aggregation. And Floyd Carr would have established some real records with the Ute line in front of him.

Intra-Mural Basketball

It seems that every basketball team playing in the intra-mural contests is out to win the championship. As they might say on the Bowery, "De competition is fierce!"

Intra-mural standings up to November 25 were as follows:

INTRA-MURAL BASKETBALL STANDING

	Won	Lost	Pct.
Betas	5	0	1.000
Kappa Sigs	4	1	.800
Sigma Nu	4	2	.666
S. P. E.	4	2	.666
Barbs	3	2	.600
A. T. O.	2	3	.400
S. A. E.	2	4	.333
Stray Greeks	1	3	.250
P. L. A.	0	6	.000

Mines-Regis Game

In a rough and tumble game which put three Miners in the hospital and sent a couple of Rangers in for repairs, Regis college defeated the Orediggers, 13 to 9, in an Armistice day contest on Regis field. Robison, Rump and Burrell were the Miners injured.

As compensation for the defeat the Miners showed an excellent attack and the best offensive football of the year. The Miners again played excellent defensive football, with Pressett and Fallis as the main cogs.

The Rangers started the game with a rush and in four plays had put over the first touchdown. It looked like a walk-away for the Catholics.

Then, however, the Miners settled down to real football. Cowboy Smith, the Regis star, was inserted in the game in an effort to add another score. But he was watched like a hawk by the Miners. He was able to get away on several long runs but never was he near scoring. On several occasions Fallis broke through and threw the baldheaded cowboy for a loss. Everytime he took the pigskin there were a half dozen Miners on him immediately. For the first time this season he was unable to break loose for one of his long runs.

Before the first period ended the Miners had evened up the score. Bonnett intercepted a wild heave from Finn and ran 25 yards to a touchdown. This was, by the way, the first touchdown the hard-hitting, hard-working Mines fullback has scored this year. Bonnett played cracking good football and his line smashes were always good for from 2 to 8 yards. Mines try for goal after the touchdown was blocked and the first period ended with the score six all.

The Orediggers opened up a pretty running attack in the second quarter. With Bonnett hammering at center and Eads and Peaker slicing off tackle the ball was carried to Regis 3-yard line. There the Mines were penalized 15 yards and Bond place kicked for 3 points.

The second half was a see-saw battle, with Regis uncorking everything it had in an effort to score and the Miners fighting tenaciously to hold its 3-point lead. Late in the final period Siems, a Regis substitute back, threw a beautiful pass to Vegher, who plowed through for 20 yards and the winning touchdown. Goal was kicked for the extra point.

In addition to Fallis, Bonnett and Presset, Mines men who were outstanding were Adams and McClure.

Frosh Game

The Oredigger Freshmen took a 32 to 0 licking from the Colorado College freshmen at Colorado Springs, Armistice day. The Golden yearlings showed a fairly good line but had no offensive punch.

R. O. T. C. to Have Lieutenant Colonel

A recent dispatch from military headquarters gives authority for the appointing of a Cadet Lieutenant Colonel to the R. O. T. C. unit at Mines. The Mines' group comprises nearly ninety per cent of the student body.

With this year's increase in the enlistment in the school unit, the Mines R. O. T. C. comprises more than one battalion and so is entitled to have a Lieutenant Colonel in command, in place of a Major being the ranking officer. In the future, the Cadet Major will be second in command.

Selections for these offices will be made the fore part of December according to Captain F. M. S. Johnson, professor of military science and tactics at Mines.

Sigma Gamma Epsilon Holds Ceremony

Initiation for the new members of Sig Gam was held at the Shirley-Savoy Hotel, Saturday, November 1. Following the initiation, a banquet was served.

"Scotty" Henderson, of the United States Bureau of Mines, addressed the meeting.

November Meeting of the Colorado Section of the Colorado School of Mines Alumni Association

The November luncheon of the Colorado Section of the Alumni was held at the Auditorium Hotel on Friday, November 21st at 12:15 P. M.

Mr. W. E. Thorne attended the meeting as the guest of C. O. Parker. Mr. Thorne has traveled extensively in connection with his professional work having spent much of his time in the tropics of Africa, India, and the South Sea Islands. He delivered a very fascinating and interesting, as well as instructive account of the gold fields of New Guinea.

He described the topography of the country, telling of the many difficulties encountered in the transportation of men and supplies and how these difficulties were overcome by the use of airplanes; how large machines were sectionalized, carried over the mountains by plane and reassembled by the use of oxacetylene welding methods.

Mr. Thorne's talk included a description of the geology of the mining fields, the customs and the habits of the native workmen, interspersed with many amusing and humorous anecdotes.

He also told of native customs and mining conditions in the copper fields of Africa.

This talk was so extraordinarily good and pleasing that it seems regrettable that the attendance was so small.

The meeting was attended by the following:

Mr. W. E. Thorne, C. O. Parker, Joseph Bradley, Shrive B. Collins, William H. Paul, Allan E. Craig, F. E. Briber, Frank Nagel, Donald Dyrenforth, C. L. Colburn, J. E. Norman.

Engineer's Day

Present plans of the committee in charge call for celebrating Engineer's day within the month.

Campus

Fraternities Entertain Pledges

A gay week-end for fraternity men and their ladies was that of November 7 and 8. Three Greek letter societies, Sigma Alpha Epsilon, Kappa Sigma, and Sigma Nu were hosts at parties for their pledges.

KAPPA SIGMA

One hundred and five Kappa Sigs and their guests were royally entertained at the Wellshire Country Club with a dinner dance Saturday evening. Between courses, Miss Helen Cullen, blues singer, and a quartet of Kappa Sigs composed of Paul Sharp, Jack Nollen, and Pledges Newson and Ryner, sang several numbers.

Hume Everett's orchestra played for the dancers. Mr. and Mrs. Gerald Schlessman, and Mesdames Phinney and Van Tuyl were patronesses.

SIGMA ALPHA EPSILON

Gold rush days were revived for the party the S. A. E.'s gave for their pledges Friday night. Ninety-nine were present at the dinner at the chapter house and at the dance at Lockwood Country club following.

Tony Ferraro and his orchestra furnished the music, and they, too, were dressed as old time miners.

SIGMA NU

Lakewood Country club was the scene of the Sigma Nu party. Here the Mines' Sigma Nus and a number of their brothers from Boulder and Fort Collins danced until midnight when the men and their guests returned to Golden for a buffet supper at the fraternity home.

Jack Watson and his players made music for the dancers.

Mines' Band Broadcasts

The microphone and the Mines band got together the evening of November 21, at K O A, and gave a program of college music over the radio. The musicians played five conference songs including the C. U., D. U., Aggie, C. C., and Mines numbers. Four of these were played without a score.

Professors Attend Einstein Celebration

Representing the School of Mines, Professors Fitterer, Hebel, Ward, Baxter, Fulmer and Howe attended the celebration of the twenty-fifth anniversary of the special theory of relativity of Einstein, known popularly as Einstein's Theory, at Boulder, November 10.

Among other facts of interest, the Mines' professors learned that the energy in one ounce of coal measured by the equation $E=M\ C^2$, is capable of boiling all the waters in Lake Nederland, Colorado.

The speakers at the celebration were Dean Lester and Professors Veazie, Germann and Lubovitch of the University.

Faculty Members Get Their Pictures In The Paper

A series of biographical sketches with accompanying cuts of Mines professors, have been appearing in the Transcript, one of Golden's two newspapers and the oldest weekly in the State.

Informal resumes of the faculty careers, education and affiliations, have given a new insight into professorial personalities.

Hobbies have been given special play and some interesting ones unearthed.

These sketches serve not only to acquaint Golden townspeople with the members of Mines' faculty, but a number of Alumni are subscribers to the paper and enjoy reading about their ex-teachers.

Tau Beta Pi Pledges

Ten Miners including two juniors, seven seniors, and one post graduate, were pledged to Tau Beta Pi, honorary scholastic engineering fraternity, November 7. To be pledged Tau Beta is one of the highest honors to be bestowed upon an upper classman.

The pledges are: Harrison Hays, A. J. Hintze, J. C. Wilkerson, C. L. Barker, James Boyd, James Needham, Clyde Spears, Art Bennett, C. D. Michaelson, and Luis Zubiria.

Tau Beta Pi was founded at Lehigh University in 1885 and Colorado Alpha chapter at Mines was installed in 1905. The University of Colorado obtained a chapter shortly afterwards. The fraternity demands outstanding scholarship, forceful personality, and integrity of its initiates.

Football Special

A special train for the Thanksgiving game at Pueblo was chartered for the Miners by Blue Key, honorary booster fraternity.

Two hundred and fifty fans, including the School band, were aboard the train when it pulled out of Golden early in the morning. Arriving in Pueblo shortly before noon, the rooters scattered over the town looking for large helpings of the Thanksgiving bird. Those who missed out on a feast in Pueblo were served on the diner on the return trip.

Several Alumni were noted in the Mines' cheering section at Centennial Field where the game was played under the auspices of the Minnequa University Club.

This is the second year the Mines-C. C. game has been held in Pueblo and the second football special that Blue Key has chartered to insure an adequate cheering section for the fighting Miners.

The entire squad of football men was taken on the Pueblo trip.

A large chunk of the Miners student body moved to Boulder, Saturday, November 15, to see Utah U. do things to C. U. They seem to have had a good time.

Topics

Colorado-Wyoming Academy Meeting Hears Mines' Speakers

Four Mines' professors were on the program of the fourth annual meeting of the Colorado-Wyoming Academy of Science which met at Boulder, November 28 and 29.

J. Harlan Johnson gave a paper on "A Pennsylvania Forest in Central Colorado." Dart Wantland spoke on "A Brief Discussion of the Relationship of Geophysics and Geology," and "Physical and Mineralogical Characteristics of Sediments Useful in Correlation of Oil Well Samples." The fourth speaker from Mines was R. Dickenson whose subject was "An Unusually Interesting Vacuum Tube of Special Design, and its Role in Engineering Measurements."

Several faculty members from the School including Professors Morgan, Ward, Roloff, and Baxter, attended the various sections of the convention. Prof. J. Harlan Johnson of the Geology depratment was re-elected secretary of the Academy for the coming year.

Engineers Have Talking Pictures

Students in the electrical engineering department of Mines recently had another opportunity to look and listen at a program of two talking pictures.

"The Conquest of the Cascades", one of the films, explained the interesting features of the Cascade tunnel and its contribution to better transportation between the East and the Pacific Northwest.

In the other picture, Dr. Irving Langmuir, world famous scientist and director of the General Electric Research laboratories, performed many interesting oil-film experiments.

Miners Plan Lighted "M"

Since the success of lighting the giant "M" on Mount Zion with flares, Miners have been anxious to have a permanent lighting system installed. However, this would prove far too expensive and a substitute plan, that of erecting a Neon "M" on Castle Rock or North Table Mountain, has been suggested.

Such a letter would be sixteen-feet high, blue Neon tubes on a white background, with an electrical contrivance to flash the "M" off and on. An "M" of this type would be visible from Denver, and to the east, as well as from the heights of Lookout Mountain.

The second meeting of the local Society for the Promotion of Engineering Education, was held November 12. A paper on "Engineering Education" was given by Prof. Irving A. Palmer.

John E. Field, well known Colorado engineer, will be the speaker at the dinner meeting of the Mines' group to be held at the Berrimore Hotel, Wednesday evening, December 10.

More About the Doings of the Dames

Eight new Dames were initiated into the Mines' chapter of the national association Monday evening, November 10. They were: Mesdames A. F. Conrad, Cleveland, Ohio; Phil Dixon, Golden; Joseph Dotson, Wise, Virginia; Harrison Hays, Savery, Wyoming; George Hilding, Denver; Clyde Osborne, Morrison; Ben Rosenthal, Denver; and M. A. Tibbetts, Boulder.

The ceremony over, a mock trial was staged with the aid of the sartorial equipment of several faculty members and of the old trunk in the attic. Each member had a chance to display her histrionic skill in the proceedings of the court. Refreshments were served in the jury room by the hostesses, Mrs. Q. L. Brewer, Mrs. M. F. Coolbaugh, Mrs. Howard Storm, and Mrs. W. C. Miller.

Stepping forth for the first time this season as hostesses to their husbands and sons, the Dames entertained at a dinner bridge for their men folk, Saturday evening, November 22. The affair was held at the Berrimore Hotel and places were set for forty-four guests.

Bridge followed the dinner with Mrs. Roscoe Morton and Mr. A. F. Conrad winning the prizes for high scores.

Plans for the party were under the direction of Mrs. J. C. Fitterer who was assisted by Mrs. Dan Dellinger, Mrs. Franklin Coolbaugh, and Mrs. Harrison Hays.

The December 8 meeting of the club will be devoted to arrangements for the Dames' good turn for the Christmas season. Each year the group takes care of the holiday needs of a family which otherwise would have to forego the pleasures of Christmas. Food, clothing and toys will be provided by the Mines' Dames. Mrs. H. F. McFarland, Mrs. John Marr, and Mrs. Harold Weaver will be hostesses.

Santa Claus is coming back to Mines! After an absence of fifteen years, the good old man is returning to entertain the children of Mines' men who will be looking for him several days ahead of schedule, December 22, when the Dames plan their first children's party.

Gifts from a real Christmas tree will be presented to each youngster who attends. Mrs. Paul Stroud, Mrs. John Terry and Mrs. A. J. Hintze are making the plans for Old Nick's visit.

Kappa Kappa Psi Dance Host

Kappa Kappa Psi, honorary band fraternity, made its debut as a dance host November 14, at Guggenheim Hall.

With Tony Ferrarro's music and novel decorations as features, the hop caused much favorable comment among one of the largest crowds seen at Mines.

The proceeds from the dance were turned over to the band to be used in purchasing new instruments.

Mines Men on All-Conference

Ivan Burrell, center for the Oredigger squad, was chosen for the Rocky Mountain Conference third team by C. L. (Poss) Parsons, sport's editor of the Denver Post in Parson's selections which will appear in Spalding's Football Guide.

Harold Eads, Mines' backfield man, was given honorable mention.

"Burley", had he been on a winning team, undoubtedly would have been given a berth on Parson's first team. He has been adept at getting in behind the line and wrecking the opposition play time and again, and has taken an active part in every play. Sixty minutes of heady football has gone into each game this star Mines' player has participated in.

IVAN BURRELL

Burrell was chosen captain for each game the Mines' squad played, added evidence of the impression his outstanding playing has made on his fellow Orediggers. He comes from Ohio and is a Kappa Sigma.

"Lefty" Eads, with his clever left-booted punting and his ability to make long runs, has been a bright spot on the Miners 1930 football season. Golden, his home town, is justly proud of "Lefty's" record as is his fraternity, Sigma Alpha Epsilon.

Both Burrell and Eads completed their college football careers with the C. C. game Thanksgiving day. They will graduate in the spring.

Eight Utah University men were given places on the Spalding first team with B. Y. U., Denver University and the University of Colorado each receiving a position.

Alumnus Praises Student Paper

Mr. Ralph Keeler, Editor,
The Oredigger,
Golden, Colorado. Denver, Colo.

Dear Mr. Keeler:

I have just read your first issue of "The Oredigger" and am moved to express my appreciation of two things: First, the standard and tone of the paper, with well-chosen material clearly presented, good English, and thorough proof-reading; and second, the delivery of the paper in Denver on the day after publication instead of five to seven days later. If the praise on this second score should go to Dismant or Farrell I trust you will see that it is duly delivered.

I hope that all your numbers are as good as this first one, and that you have a pleasant year of it.

Sincerely,
MAX W. BALL, '06.

News from the Chapters

Monterrey Section

My dear Colburn:—

I intended to write my monthly letter so that you could have time to publish any news you might think interesting in this month's issue of the Magazine but I am advised by Berthier (my worthy substitute) that one thing or another always kept the gang from getting together to discuss the different business propositions in hand. I am handling those in a separate letter.

The meeting finally was held at the exclusive Monterrey Casino the following men being present: Fidel Martinez, "Prexy", G. P. Robinson, "Robbie", Santiago Urteaga "Jimmy", T. J. Skeahan "Carta Blanca", L. C. Broun, and U. H. Berthier "Killer". G. F. "Buck" Kaufmann, H. W. "Pop" Haight and K. F. "Chino" Dallmus were unable to attend on account of the fact that their royal chariots were stuck in the mud sixty-three miles from Tamazunchale (That means nowhere in Spanish). L. B. (B stands for Beau Brummel) Gonzalez was unable to attend due to "most important business matters". Yea, I think he will be "going wrong" like other good men pretty soon. Fritz Feigel was out of time.

Plans were laid at the meeting for the coming seance to be held sometime next month at Cerralvo, Nuevo Leon, where a fine cinegetic get-together could take place, at which the ladies could be included. (These guys down here are sure going for this society stuff. Tommy Skeahan suggests "poileau-a la-Roi" instead of plain, common "chicken-a laking.")

Down here in San Luis Potosi it has been raining for about six months. I guess it just don't know how to quit now. Things are kind of dead as miners are "poco jodidos" on account of the low metal prices. Ben Arkin, representative for the Texas Co., in Mexico and Central America, dropped in about two weeks ago and remained here for a few days. He tells me he saw quite a number of Mines men in his recent trip through northern Mexico, including Tom Straney at Pilares, Sonora. He says Tommy is showing the boys how to put beer down. Huh! I always said Tom was a boy with a future. Good luck, Tommy, and drop us a line some time.

I ran up to Monterrey last Saturday night and returned Sunday night; in a few spare moments I had while on my doctor's visit hunted L. B. Gonzalez and Bill Wallace up and found them at the Plaza de Zaragoza. By the way, L. B., was held up a few nights ago and they stole his fraternity pin and his senior ring. No, I don't believe it either.

This letter will probably come out on the December number of the Magazine so I am taking the opportunity to extend our heartiest and best wishes for merry Christmas and a very happy new year to the officers of the Alumni Association, all the sister chapters and all those "rambling wrecks" that in any of the distant corners of this old world might read it.

Sincerely yours,

The Monterrey Section of the C. S. M. Alumni Association.
PABLO M. SADA,
Secretary-Treasurer.

Great Lakes Section

Great Lakes Section held its first meeting of the season. Those present were Lynee '06, Mercer '30, Holmes '26, Solomon '13, Pearce '14, Belleau '23, Frank '06, Swift '23, McCartney '23, Waterhouse '09, from Milwaukee came Crompton '14, Cadena '27, Bond '22, and Clark '14; we also had a visitor from New York, Lowe '23. Each man gave a short talk of his particular work, and many old friendships were again renewed.

Houston Section

The regular monthly luncheon of the Houston Section was held at the Rice Hotel on November 8.

The following were present: Albert G. Wolf, A. L. Ladner, Chas. E. Stewart, Geo. Lemaire, Tom Pulver, R. K. Tracy.

Geo. Lemaire gave a very interesting talk on petroleum refining which was followed by a general discussion. This is the second topic which has been taken up at the Houston Meetings and it is planned to continue with these talks since considerable interest is being shown by everyone.

New York Section

The 95th regular meeting of the New York Section of the Colorado School of Mines Alumni Association was held at the Fraternities Club, 22 East 38th St., New York City, on Friday November 14, 1930. Dinner was served at 6:30 P. M.

The following men were present:

Bonardi, J. P., '21, 225 Broadway, N. Y. C.; Briscoe, H. S., (Guest), 551 Fifth Ave., N. Y. C.; Burgess, C. W., '09, 247 Park Ave., N. Y. C.; Downes, F. A., '13, 247 Park Ave., N. Y. C.; Emler, C. R., '25, Koppers Co., Pittsburgh, Pa.; French, C. L., '13, 11 Bartlett St., Brooklyn, N. Y.; Mattson, V. L., '26, 15 West 38th St., N. Y. C.; McKinless, F. V., Jr., '23, 11 Broadway, N. Y. C.; McKinless, R., '25, 45 E. 55th St., N. Y. C.; Miller, A. L., '17, 247 Park Ave., N. Y. C.; O'Toole, A. L., '26, Crucible Steel Co. of Amer., 17 E. 42nd St., N. Y. C.; Paul, R. B., '02, 160 Front St., N. Y. C.; Pilger, T., Ex-'10, 55 Wall St., N. Y. C.; Schreiner, T. W., (Guest), 551 Fifth Ave., N. Y. C.; Staritzky, E., '27, 247 Park Ave., N. Y. C.; Waltman, W. D., '99, 551 Fifth Ave., N. Y. C.; Wolf, H. J., '03, 230 Park Ave., N. Y. C., Room 2615.

Following the dinner President Wolf called the meeting to order. The reading of the minutes of the previous meeting was dispensed with and the Treasurer's report was presented, accepted and ordered filed.

A greetings from the Monterrey Section was read and R. McKinless who had attended the Monterrey Meeting a year ago told us something about the activities of that section.

C. L. Colburn's letter pertaining to each section sending in suggestions to the Nominating Committee for officers for the coming year, was read and discussed in some detail.

Following the routine business President Wolf gave a very interesting talk on the securities market. The discussion included an explanation of a great many statistical charts and curves and the significance of same.

The meeting was adjourned at 10:30 P. M.

F. A. DOWNES,
Secretary.

IT will happen in Monterrey
MEXICO
Saturday after Commencement
MAYO—1931

Alumni Letters

Washington, D. C.,
Nov. 12, 1930.

Dear Colburn:—

Returning from my Western trip some little time ago, I found awaiting me a most wonderful present—Dr. Chauvenet's Chemical Arithmetic which covers the subject that he so excellently taught us in our school days and called Stoichiometry. The very name Stoichiometry is, in reality, a synonym for one whom we had a deep feeling of respect and gratitude, our Dear Professor. 'Tis true that many of us caused him much worry and tried his patience at times with our boyish pranks, but, nevertheless, when we sat in his chemistry or stoichiometry classes, we were awed and marveled at his profound knowledge, his intense interest in us and his insatiable desire to impart that knowledge to us. With infinite pains, he would elaborate an answer to a question to be sure that we understood and thus evidence his great interest in us.

Looking back over the gulf of more than 35 years, I realize more fully than ever his goodness and greatness in passing so lightly the many pranks perpetrated, many of which he must have known were mine or planned by me. Because of his wonderful sense of humor, he was easy of forgiveness. He never held resentment and how proud I felt during the close of the senior year when he called me to talk over the formation of the Alumni Association, and appointed me as one of the three to draft a constitution. His every thought was for the interests of the School, its students and graduates or for his Dear Wife. He wanted high standards for the School and that its graduates be worthy and proud of it.

After graduation I was gone to South Africa for a number of years and what a pleasure it was on returning to spend a number of delightful evenings at his home and in company with him and his Dear Wife, companion and helpmate. After various other trips I would look forward to my return and a renewal of those delightful evenings at his home. It was always good counsel and sound advice that he gave me.

All the old students are deeply indebted to Dr. Chauvenet for not only their training but for the principles and high honor inculcated into them. Not only the students but the State of Colorado is indebted to him for the very foundation of the School which he so well builded with such high scholastic standards. This high standard has been allowed to crumble at times, but the present President has repaired it like the stone foundation of the building that he also repaired so that it is again as good as ever.

How thoughtful and kind of Mrs. Chauvenet to send these books to "her boys". It is so characteristic of her. What a privilege it has been for her to have been the life companion of such a wonderful man.

Thanking you and hoping that you may express my thanks and appreciation to Mrs. Chauvenet, I am,

Sincerely,
C. TERRY DURELL, '95.

* * *

Maracaibo, Venezuela,
Nov. 5, 1930.

My dear Alumnus:—

Have threatened to write you for some time, but never seemed able to do so.

Although we receive most every type of literature, magazines and papers that are printed, I always look forward to the monthly edition of Mines Magazine. It sorta makes a fellow feel as tho' he knows what is going on at School as well as in the Alumni Association, even if it arrives three weeks late.

The C. S. M. Alumni Directory is sure a wonder! I notice by it that there are two or three old Alumni working here in the Maracaibo Basin; have not located them as yet, but hope to in the near future.

Wallis, Class of '28, gets around quite often and we have to shoot a little bull of course. Oh yes! Red has grown himself one of those cat whiskers on that upper shelf of his! Only thing lacking now are the fair maidens. Red doesn't think the native maidens here so fair; can hardly blame him as they *are* a bit dark.

Remember me to the bunch,

Yours truly,
(Signed) "Cal"
CALVIN W. TOWNSEND, '29.

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