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LINDENBERG, flying blind much of the way, hit Ireland “on the nose” as he winged inland from China. The ordinary altimeter shows only height above sea level. The radio echo altimeter, which gives pilots a navigational instrument of extraordinary accuracy, is one of the many fields of endeavor in which they play an important part. Meanwhile, two other General Electric contributions to aviation have been developed—the electric gasoline gauge and the radio echo altimeter. The ordinary altimeter shows only height above sea level. The radio echo altimeter warns the pilot of his actual distance above ground or water by flashing green, yellow, and red lights on the instrument board.

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That Vacation

SUMMER time is vacation time. Of course, some of us will be too busy to take that vacation; but most of us will put aside our work for a while, during the warm months of July and August, to do a little fishing, motoring or what-may-please-you.

There is a vacation program to suit every taste. Some prefer a week’s quiet at home in the cool shade of the lawn with plenty of iced tea, lemonade—or what have you. Naturally, such a program includes the warm months of July and August, to do a little of what most of us will put aside our work for a while, during the summer.

A program is also available to those who would prefer to be more active, and for these there is a vacation program to suit every taste.

Meeting A Need

JOURNALISM meets the first tribal need after warmth, food, and water;” so reads one of Kipling’s epigrams. Man hungered after many things, but the most insatiable hunger of all is for curiosity, and curiosity demands it.

No one has ever introduced an idea into this world which was entirely his own. An individual may organize facts in such a way as to bring about a new movement in industry; in the organization of political philosophies—But the step forward is due to a confrontation of theories, facts and previous work of many individuals who have gone over the same ground before. No man is entitled to demand too much credit for putting into workable form the knowledge that many have had a hand in feasting on the vague unknown.

To Whom the Credit?

IT may be stated that no school of mines lays claim to the ability to graduate a thorough going skilled engineer. The men who have been trained at such institutions have been trained intensely and are equipped with the special tools needed in the solution of particular problems. They have been familiarized with the procedure used in the solution of these problems. They have, to be sure, been required to work upon these problems in the laboratory and in the field, but not until they have become skilled engineers.

The Colorado School of Mines, in order to maintain the reputation of its graduates, has not only strengthened its curriculum, but has been particularly careful in selecting prospective students so that the highest possible per cent of its students may pass its test of experience.

Not only is it incondous to train men to solve particular problems, but it is necessary to formulate general working principles which offer a basis for the solution of these problems. Experiments, tests, analysis of data, and organized research, together with the publication of the results, are means of formulating such general working principles. And so it seems that the mining schools have a considerable part to play in addition to the training of men for the mineral industries.

Research at the Colorado School of Mines

The Experimental Ore Dressing and Metallurgical Plant was dedicated at the Colorado School of Mines in 1912. Many metallurgical problems confronting operators in Colorado and the West have been simplified and solved by experimentation carried on at this plant. Extensive and successful research on the flotation process has brought to the present director, A. J. Wimber, a great deal of praise from all over the world.

MINING SCHOOLS HAVE A PART

The part which the mining schools are taking in projecting what is to come into the future is twofold.

Two Fold Purpose of A Mining School

THE tremendous importance of the mining industry is seldom realized by the average citizen. He sits comfortably at home by a modern furnace made of iron and burning coal or oil. His light is brought to him over copper wires; his water is piped into the house through iron lines by an electrically driven pump; his telephone, automobile, cooking utensils, and a thousand other necessities and luxuries are all made possible by those men who discover, extract, and refine the minerals of the earth.

A Basic Industry

Mining and agriculture are related practically all of the raw materials used in the United States. These two industries, therefore, are basic, and upon their advancement depends the general prosperity of the country. They are different essentially in the fact that the raw products of the mines are not replaceable, whereas the facility of farms may be kept constant, or even increased. The natural resources upon which the mining industry is dependent can be, theoretically, exhausted; and in the same way that man hungers after many things, so research and scientific study are being carried on for the elimination of waste in the mining industry.

Two things seem necessary to make the mining industry go far into the future. One is the necessity of discovering new ore deposits, and the other is the perfection of processes leading to the highest possible recoveries of the low-grade ores already located. The various problems involved here are problems for trained minds. They are problems which will be exposed to the feasibility and the nature of the ore treated. General rules, therefore, are not always applicable; and the results of research, more often than not, have to be modified when applied to a specific project. Such a task requires the intelligence and specialized training of skilled engineers.

MINING SCHOOLS HAVE A PART

The part which the mining schools are taking in projecting what is to come into the future is twofold. These institutions are offering to selected groups of young men the fundamental training necessary to produce skilled engineers. Second, the mining schools are encouraging research and the gathering of data upon problems that confront the mining industry in their particular localities.

It may be stated that no school of mines lays claim to the ability to graduate a thoroughly skilled engineer. The men who have been trained at such institutions have been trained intensely and are equipped with the special tools needed in the solution of particular problems. They have been familiarized with the procedure used in the solution of these problems. They have, to be sure, been required to work upon these problems in the laboratory and in the field, but only experience will determine whether or not they will become skilled engineers.

The Colorado School of Mines, in order to maintain the reputation of its graduates, has not only strengthened its curriculum, but has been particularly careful in selecting prospective students so that the highest possible per cent of its students may pass this test of experience.

Not only is it indispensable to train men to solve particular problems, but it is necessary to formulate general working principles which offer a basis for the solution of these problems. Experiments, tests, analysis of data, and organized research, together with the publication of the results, are means of formulating such general working principles. And so it seems that the mining schools have a considerable part to play in addition to the training of men for the mineral industries.
Principles of the Hydro-metallurgy and Electrodeposition of the Metals

V. chapter on leaching—continued

By Thomas P. Casebile*

THEORY OF LEACHING

Suppose that we have a system in which a moles of some molecular species, A, react with b moles of another species, B, to produce c moles of M and d moles of N, according to the equation

A + bB = cM + dN.

As soon as the reactants are brought together and, in fact, as long as there is any trace of the reactants present in the system, the velocity of reaction from left to right at any instant is

V = \frac{k_c}{k_a} \cdot \frac{[A]^b}{[B]^d}.

where \( k_a \) is a constant, characteristic of the reactants, and does not depend on temperature and the parentheses indicate molar concentrations. Similarly, as soon as any quantity of M and N are formed, a back-reaction must set in, tending to reform A and B. Hence, again, the instantaneous velocity of reaction from right to left is

V = \frac{k_a}{k_c} \cdot \frac{[M]^c}{[N]^d}.

where \( k_c \) is the velocity proportionality constant for the reactants.

As the instant in the course of the proceeding, a point must be reached at which \( V = 0 \); that is, at which the velocity of formation of the products just equal the velocity of formation of the reactants; and, conversely, of course, that nothing escapes from the system. Then

\[ k_c \cdot \frac{[A]^b}{[B]^d} = k_a \cdot \frac{[M]^c}{[N]^d} \]

or

\[ k_c \cdot \frac{[A]^b}{[M]^c} = k_a \cdot \frac{[B]^d}{[N]^d} \]

This will be recognized as the familiar Law of Mass Action. The "equilibrium constant", K, is again dependent only on the temperature; in fact, it can be shown that, at fixed temperature, \( K = \frac{\text{products}}{\text{reactants}} \).

From the above considerations we find that the total concentration can change, depending on the reaction vessel. This can be appreciated by the engineering world.

As viewed from the outside, no net change takes place in the system.

These considerations were developed originally for, and still apply almost entirely to, homogeneous systems. The quantities represented by \( A \), \( B \), \( C \), etc., are assumed to be present in the same phase; for example, we might have \( \text{ZnSO}_4 \) and \( \text{BaCl}_2 \), each in separate solutions. Then in the first case we have

\[ \text{ZnSO}_4 + \text{BaCl}_2 \rightarrow \text{ZnCl}_2 + \text{BaSO}_4 \]

and in the second case

\[ \text{BaSO}_4 \text{BaCl}_2 \rightarrow \text{BaCl}_2 + \text{BaSO}_4 \]

and if this latter equilibrium produced enough \( \text{BaSO}_4 \), to saturate the solution, then not only does the concentration of the salt reach a fixed value, but at the same time the concentration of the unionized portion, \( \text{BaSO}_4 \) reaches a limiting value. Letting this value be represented by \( k' \), we write

\[ \text{BaSO}_4 = k' \cdot \text{BaCl}_2 \text{BaSO}_4 \]

and this factor \( k' \) may be called the "ionization constant". However, on mixing the two solutions, we should also find

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SOME sixty miles northeast of Mexico City, in the State of Hidalgo, lies the world-famous silver mining camp of Pachuca. The town itself is typical of mining camps in general, consisting of the heads of a gulch from which the hills rise abruptly on three sides. From the barracks, rugged and ostracism desolate appearance of these hills, which are directly adjacent to the town, it is hard for one to imagine that they contained the fabulous wealth that has been extracted from them during the past four centuries. The town of Pachuca is connected with Real del Monte and El Chico, which lie to the east, by an excellent automobile road that ascends more than a thousand feet in a few miles. The rapidity with which the vegetation changes from b surgery, cut-covered hills to beautiful pine forests presents an agreeable and pleasing contrast.

The known mineralized area of the Pachuca district comprises some 100 square miles, and it is stated upon fair good authority that the mines were worked on a small scale by the Astor Indians long before the arrival of the Spaniards. Cortez came to Mexico in 1519 and the Spanish occupation of Pachuca dates from the year 1522. There is no question that the mineral richness of the region led to its early exploitation by these people. The art of the gold and silver mining, the knowledge of the ore bodies, and especially the art of extracting the mineral values from it had been developed. These people were hard taskmasters and exceptionally skilled miners. They even imported workmen and overseers from Spain, and the native worker received only a mere pittance.

In 1557 Bartolome de Medina, a Spaniard and a merchant, opened the "patio process" ancient method used in Mexico for recovering values from silver ore. The trampling of the horses mixes the slime.

In 1557 Bartolome de Medina, a Spaniard and a merchant, opened the "patio process" ancient method used in Mexico for recovering values from silver ore. The trampling of the horses mixes the slime. The process was done as follows: The largest pieces of ore were broken by hand with sledge hammers. The next step in crushing was effected in a corriente called the "molino de grana," which consisted of a large stone tank about twenty-five feet in diameter and four feet deep. In the center was an iron cone, the sides of which were perforated and sloped down toward the outside of the tank. Two large, thick stone wheels, diametrically placed, were caused to roll around the inside periphery of the circular tank. These heavy wheels rotated upon a common axle fixed to the base of the conical core. The axle extended out beyond the sides of the tank and wheels were attached to this axle furnished the motive power.

"The ore was induced by letting it fall upon the apex of the cone, fine pieces fell through the perforations in the sides of the cone and the coarse ore rolled down to the periphery of the tank where it was crushed by the wheels rolling over it. Men inside the tank constantly shoveled, from the path of the wheels and threw it back upon the cone where the small pieces would fall through the openings in the tank. This crushing was done dry.

"The next step was wet grinding in the "arrastre," a corriente similar to the "molino de grana." Large rocks were dragged around over the ore on the floor of the tank, grinding the ore to about eighty mesh. As the slime was raised up, it was thrown out on the banks and stored in large tanks until three or four hundred tons of slime were added to the periphery of the tank where it was crushed by the wheels rolling over it. Men inside the tank constantly shoveled, from the path of the wheels and threw it back upon the cone where the small pieces would fall through the openings in the tank. This crushing was done dry.

"The mass was then loaded on sleds and hauled to the "lavadero," a stone tank about twenty feet square, having several inches of mercury in the bottom. As the product from the "arrastre" was thrown into the tank, several men inside, by means of their bare feet and shovels, mixed it with the mercury in the bottom of the tank. At the same time water was kept running over the mixture, thus washing the rock into long riled hoppers. Catches filled with mercury were also located at intervals along the hoppers. The amalgam that was not caught in the "lavadero" was recovered in the rilles and catch pits. After the clean-up the amalgam was put into a large canvas bag and as much pure mercury as possible was squeezed out through the canvas, leaving the amalgam to be amalgamized as before. The clean-up was begun.

"A batch of ore thus spread out was called a "torta." It was allowed to dry for two or three days until it attained the consistency of bottom dressing. About ten percent by weight of salt, three percent of copper sulphate and one pound of silver content of the ore, were distributed and mixed through the mass.

"The maximum extraction of silver obtained by the "pato process" was around ninety-nine per cent but the gold extraction was lower. This process was still in use at Pachuca until about 1905. The ancient walls that surrounded the "patios," where the Barrancero de Medina process used to be carried on, are still in a ruined state and the old silver coins once contained considerable gold. In more recent times the bullion was parted and the ponderous old silver coins and copper sulphate and one pound of silver content of the ore, were distributed and mixed through the mass.

"In the early days the treatment of ores by the "pato process" was done as follows: The largest pieces of ore were first broken by hand with sledge hammers. The next step in crushing was effected in a corriente called the "molino de grana," which consisted of a large stone tank about twenty-five feet in diameter and four feet deep. In the center was an iron cone, the sides of which were perforated and sloped down toward the outside of the tank. Two large, thick stone wheels, diametrically placed, were caused to roll around the inside periphery of the circular tank. These heavy wheels rotated upon a common axle fixed to the base of the conical core. The axle extended out beyond the sides of the tank and wheels were attached to this axle furnished the motive power.

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The reaction, is the "dissolution of the solution" and the mass is the amount of the solvent reactant used in the reaction. Therefore, by integration and conversion to base 10, we have:
\[
\log_{10} (a) - \log_{10} (b) = \log_{10} \left( \frac{a}{b} \right)
\]

This rate is required for half of the potential dissolved power of the solution to be used up: i.e., for \( x = \frac{1}{2} \).

Then the solution will be necessary included. But does not account for the diffusion rate.

If there were no agitation of any sort, the reaction rate as observed would be determined almost wholly by the natural diffusion of the ions of the solution. The rate of this diffusion, in turn, would be largely the pressure of the various ions involved. But in practice it is the invariable custom to account for relative motion of solids and liquids, so that we need not concern ourselves with the problem of osmosis from the quantitative standpoint at this time.

Referring again to the equation for the rate for reaction, it will be seen that our leaching system as such a way that the solids and liquids diffuse counter-current to each other, we should be able to shorten the time required for leaching. In such a system, the rate of leaching is accordingly, such that the process of leaching would occur in the weak, or until nearly viscous, and vice versa. It will be refine also in the following section on "swelling and mass.

Again, as noted under roasting, increase in temperature increases the rate of all chemical reactions. In the case of roasting, the upper limit of temperature was defined in the chapter on roasting. In the case of leaching reactions, the upper limit of temperature is the boiling point of the solvent, in most cases, in accordance with the practice of the process not the reaction of solvent. Another point worth remembering is that if temperature increases the speed of all chemical processes, and rapid plant deterioration brought about by the reaction.

As in the case of roasting, the reaction is said to be exothermic, the rate factor being, as a rule, the major consideration.

Finally, as to the choice of solvent: The ideal solvent would be one that is highly selective in action, safe and stable, and one or two examples, some of the more..
DATA ON PROPERTIES AND STRUCTURE OF THE ELEMENTS
(From International Critical Tables)

<table>
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<tr>
<th>Elements</th>
<th>Atomic No.</th>
<th>Atomic Weight</th>
<th>Melting Point °C</th>
<th>Boiling Point °C</th>
<th>Density g/cm³</th>
<th>No. of Valence Electrons</th>
<th>Class of Derivatives</th>
<th>Class of Derivatives</th>
<th>Class of Derivatives</th>
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</table>

The Colorado School of Mines Magazine
July 1950

The complete cycle is thirteen days, as one tank is exchanged for a filter-bottom and the next tank is immediately ready for operation. The solution over each tank is collected, and the solid residue is filtered off. The resulting solution is then concentrated to a definite volume, and the solid residue is refluxed back to the tank for further extraction.

The solvent is allowed to cool to room temperature, and the solid residue is filtered off. The resulting solution is then concentrated to a definite volume, and the solid residue is refluxed back to the tank for further extraction. The cycle is then repeated for the next tank. The resulting solutions from each tank are then blended to form a final solution, which is then concentrated to the desired volume for further processing. The cycle is then repeated for the next tank. The resulting solutions from each tank are then blended to form a final solution, which is then concentrated to the desired volume for further processing. The cycle is then repeated for the next tank. The resulting solutions from each tank are then blended to form a final solution, which is then concentrated to the desired volume for further processing.

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Continuous agitation implies an equal and uniform rate of feed and discharge of material. This, in turn, means that we know the amount of material to be treated in any given period of time, the time of contact required to bring about desired reaction, and the solid/liquid ratio of the pulp. In practice it is impossible to provide for an absolutely uniform time of contact of all particles with the solvent; some particles will be "short-circuited," and discharged almost immediately; others will remain in the agitator a very long time; but we can compute, from the test data mentioned above, the average length of time required for a given size of paddle agitator, and the "short-circuiting effect" is almost completely eliminated. The Pachuca tank (Fig. 3) is another form of air-lift agitator in which there are no moving parts; the bottom of the tank is coned, so that the settled particles may slide down toward the bottom of the central air-lift column. The main advantage claimed for this type of agitator is the building up of solids along the side walls near the bottom; this leads to channeling, and lack of uniform leaching; sudden stops of this caked material may cause clogging of the air-lift. Steam may be substituted for air in either the Dorr or Pachuca types when heating action is also required; in some cases a steam-air injector, such as is used on gas producers, may be used. When the oxidizing effect of air is harmful, however, it is usually best to resort to purely mechanical agitation.

To a certain extent, the solids moving to strong solution again, is a good practice to use a number of relatively small tanks, set in cascade, or series feed, rather than a few large tanks. The pulp then flows from the head to the foot of each series, having a definite average time of retention in each tank; but for the cascade as a whole the motion of solids and liquids is concurrent. In order, then, to obtain the counter-current effect, and thus increase the reaction velocity for the extraction as a whole, it is customary to make the leach stages in such a way that at the end of each stage the solids in the pulp are separated.

For example, in the extraction of zinc from roasted concentrates by dilute H₂SO₄, the leach is split into two parts, the "acid leach" and the "neutral leach." Each of these parts may consist of several agitators, set in cascade, feeding into one or more "neutral leach" agitators together with solution which has the capacity of a large amount of undissolved, reactive material in the solid phase does exert a definite influence, not only on the rate of the reaction, but on its course as well. For instance, in the zinc leach illustrated above, the addition of fresh solution to nearly neutralized solvent serves a double purpose: first, to bring about complete neutralization as quickly as possible; and, second, to build up the alkalinity of the solution (by saturation with Zn(OH)₂) to such a point that ferric iron may precipitate as Fe(OH)₃. Thus, at 18°C, the solubility product of Zn(OH)₂ is given as 1.8x10⁻¹⁵, while that for Fe(OH)₃ is much smaller, 1.1x10⁻⁵; and the value for Fe(OH)₃ is slightly higher than that for Zn(OH)₂, 1.6x10⁻¹⁴. In other words, zinc hydroxide can precipitate ferric hydroxide, but not ferrous hydroxide. And incidently this illustrates the value of knowing about the realm of elementary inorganic chemistry when developing a process.

Mercury, Mineral of Many Uses

Approximately one thousand uses are claimed for mercury. In many lines the substitutes for the metal are employed; but in others there is a constant ebb and flow as consumers experiment with first one substitute and then another, only to return to mercury. New lights and new uses are the making of sels to be employed in the manufacture of artificial silk, certain processes connected with petroleum refining, the manufacture of automatic switches for interior refrigerators and other electrical devices, radio tubes, storage batteries, and a fertilizer compound for grass on golf courses. The Enamet mercury boiler is another potential factor in future demands. Mercury heated in one boiler is used first time like steam to drive a turbine and in thence exhausted into a second boiler which acts as a condenser for the mercury and as a source of steam to drive another turbine.

Although there is no destructive consumption of mercury in a mercury power plant each new installation will absorb a considerable quantity of the metal, as between 6 and 8 pounds are required per boiler horse-power installed. It is proposed to use mercury as a heat carrier in a somewhat similar way for cracking gasoline.

Pharmaceuticals, chemical manufacturing processes, soon and mercury light and electrical , and the electrical industry are steady consumers. Mercury-containing disinfectants for seed treatment are gradually being replaced by cheaper substitutes.

Many attempts have been made to find substitutes for the mercury fulminate used in blasting caps and ammunition. Manufacturers have, however, found that at times of high mercury prices, it is not a substitute and cannot be used. Bridge, dam, subway, mine and all other work requiring explosives will be continued and will probably increase.

One surprising factor disclosed by the survey is the relatively large proportion of the mercury output used for scientific and technical instruments. Modern industry has turned more and more to scientific and quasi-automatic-control methods in its processes. As mercury is a liquid metal at ordinary temperatures, it has a unique field of usefulness. To have faith in the future of modern industry is to have confidence in the future of mercury.

Two English cockney broom vendors met on a London street and started discussing mercury. One asked the other how he could get rid of his old, rusty, crowded, and less valuable ones.

"Any it all," said one. "I don't see 'ow you can sell those 'ere bloomers at all. I rent the brush, and I steals the wire, and I steals the 'andles an' I can't sell 'em for a pittance and make any money on 'em."

And the other replied: "Why, I steals 'em ready made.

JULY 1930
Chemistry in Relation to Industry and Its Development

By SUSANA PFEIFFER

MR. MULVILHALL has stated that more than one thousand items can be made from the by-products of coal, and that the value of all marketable products of bituminous coal would run over $2,000 per ton on Florida.

In 1926, two counties in southern Illinois, Franklin and Williamson, gathered mined 23,890,878 tons of coal. This coal will be used at the mine. A large percent of the possible profit on these millions of tons of coal was lost because the coal operators did not make full use of the knowledge of expert chemists.

Notwithstanding the fact that the coal fields of the United States are extensive, the coal supply is not inexhaustible. So much coal could be used in a few hundred years if man's knowledge of chemistry should be properly applied. This can be done by a chemical modification of the volatile matter either in form or amount, so that a smokeless fuel will result and possibly also a fuel of a higher rate of efficiency in combustion.

The desire to obtain from this material that fulfills these conditions is coke. Bituminous coal, as mined in Southern Illinois, is a rather hard, black, dense hydro-carbon, in which the volatile matter is 42.5%, and which gives, when run through an average analysis of coal of Williamson and Franklin Counties is almost identical. The average analysis of Franklin County coal, measured in pounds, is as follows: volatile matter, 36.75 per cent; fixed carbon, 53.77 per cent; ash, 2.92 per cent; sulphur, 1.43 per cent; carbon dioxide, 0.04 per cent; δ CO2, 0.13, and specific gravity of about 1.3.

In the making of coke from bituminous coal many other by-products are produced. Among these are used in the manufacture of coke, which is used in the manufacture of coke pipes which supports the rough surfaces of the buildings and streets in the city. The pitch residue of coal tar is used in roofing, paving, and railroad building.

Coke tar is used in the making of coke pipes. To show some of the uses of coal tar it can be said that if a person goes to a confectioner for a soda in all probability his or her soda will be flavored with some coal tar derivative, as follows: volatile matter, 36.75 per cent; fixed carbon, 53.77 per cent; ash, 9.61 per cent; sulphur, 1.43 per cent; carbon dioxide, 0.04 per cent; δ CO2, 0.13, and specific gravity of about 1.3.

The chief importance of low temperature distillation to the coal industry is to be expected in the broadening of the field of uses for coal. The expansion of low-temperature distillation will encourage the production of a high grade, smokeless fuel suitable for the manufacture of coke. In 1924, more than sixty-five billion cubic feet of coke oven gas were distributed through the city main. When carbonized, coke oven gas is easily used, alone, or with an admixture of low-temperature distillation to improved coke quality.

More ammonia is obtained from Illinois coal than from eastern coal. By using phosphoric acid and sodium carbonate, the following average results per ton: 11,030 cubic feet gas, 8.6 gallons tar, 22.2 pounds ammonium sulphate, and 29.7 gallons crude oil.

The coke used in the manufacture of coke pipes is suitable for the manufacture of coke in a high grade, smokeless fuel. Gas ovens may be used for the manufacture of coke suitable for the manufacture of coke. In 1924, more than sixty-five billion cubic feet of coke oven gas were distributed through the city main. When carbonized, coke oven gas is easily used, alone, or with an admixture of low-temperature distillation to improved coke quality.

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Looking at the Campus from
A Different Angle

The Dean's Residence

Entrance to Gymnasium

Guggenheim Hall and South Lane

Stratton Hall and the Quadrangle

Phi Alpha Alpha Entrance

Phi Delta Tau Entrance
A Trip to A Deep Mine in China

By MARSHALL D. DRAFER, '97

SOME years ago, in 1920 to be exact, Dr. H. Foster of Colorado School of Mines Magazine, the Colorado School of Mines Magazine

By MARSHALL D. DRAFER, '97

After 1.5 hours at noon camp again took the road. Sev­
carrier coolies are also met carrying coal. No matter how JULY

from Tung Chuan is about 50 miles. I quote from my OME years ago, in 1920 to be exact, Dr. H. Foster

centers and returning some weeks later, then set out for there, proceeded on our way to various copper mining

to Gunnanfu, the capital of the Province. After a considerable wait at the capital, while several nearby

ments controlled mines of the province and to that end we proceeded to Tung Chuan, the capital of the Province. After a considerable wait at the capital, while several nearby mountain fastnesses from which it is difficult for the government troops to reach, a small open cut from which much ore was broken and the place was dangerous as active opera­
tions here had been abandoned. Zinc carbonate was in inner side of each crucible was a groove to carry the zinc

were broken and the place was dangerous as active opera­
tions here had been abandoned. Zinc carbonate was in inner side of each crucible was a groove to carry the zinc

The crucibles were charged nearly full of carbonate

The crucibles were charged nearly full of carbonate

With a splendid future before him.

with a splendid future before him.

The deceased is survived by his parents, his widow and Miss Davis was now living in his own first home after

Alumnius Called Beyond

Alumnius Called Beyond

Word has just reached the Alumni Office of the death of J. S. Davis, Jr. on August 9, 1929. Mr. Davis was graduated from the School of Mines in 1920. He was a mining engineer with a splendid future ahead of him.

His untimely death is a loss to the engineering profession.

After leaving the Colorado School of Mines, young Davis went to Chille where he was appointed by the Braden Copper Company. He was engaged in mining work in the United States he went with the Federal Zinc Company. He was in the copper mines of Missouri for a while, and then was
tocommunicate with Mr. Davis’s father in Washington, D. C. He was in those days learning the mining business in the United States.

J. S. Davis, Jr., 29

Tampa for two years, leaving this position to go to Buffalo, New York. At the time of his death, Mr. Davis was clay ferules or condensing chambers about 6” diam. and 6” high.

An unusual and distinctive custom at this mining camp was the rule of placing an elaborate fun around shelter over the fire hearth sets of timber at the linewall mouth. These sets were invariably of about 8 inch round timber and copper dimensions of the entrance would then be some 7 feet in the clear by 4 or 5 feet wide. However, unfortunately and invasively these surface would funnel down so that in 10 or 15 minutes the air would approach a tine timber spaced about 6 or 8 inches apart and making an

side dimension of 1 meter wide by 1.2 meters high. Most of these drained openings either on hands and knees or else in a crouching position so that after an hour or two the face of the miners was covered by the continual position, the leg muscles in particular be­

change from the bad trails, high rivers, mud waves and this trail has been over good cartroad a most welcome

This zone, from which considerable pro­

feet below the shaft collar. All workings from this main

mine on his operations at considerable depths.

The crucibles were charged nearly full of carbonate

The crucibles were charged nearly full of carbonate

with a splendid future before him.

It is probable that the European methods of zinc ore

In the afternoon we west to the South of this zone where the lead mine has recently been opened. The incline was started, running N. 30°E. At some 200 feet down the direction change to S 60°E. At this point, some

Some of our smallest interpreters is •

although much zinc is produced here the Chinese officials

understand that the business is not at present of great importance.

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Fatal Accident Takes Alumnus

Diane C. Kelso

Mr. Kelso was an active member of the Alumni Association, and an enthusiastic booster for Mines. He was one of the dependable leaders for the Mines Christian Association, and gave her organization both moral and financial support at all times.

Mr. Kelso was buried with the Masonic ceremony at the Crown Hill Cemetery, Denver. He is survived by his wife and two daughters, Jane and Esther.

Students on Job Until July 5

Commencement exercises do not mean the end of the school year at the Colorado School of Mines. Only the seniors are through when the diplomas are given out. All others must continue her six more weeks.

The freshmen are busy with surveying courses in and around Golden. Over seventy men are still in town doing work that follows the commencement program.junior problems are solved at work at Wild Horse Park near Pueblo, and the mining men are busy doing mine surveying at the school's experimental mine at Idaho Springs. The sophomores are in camp at Fort Logan. The school year begins in a few weeks.

The School of Mines begins its regular term the first of September and ends it, for all except seniors, July 5. Independence day is given as the first day of the regular session. This summer field work is a part of the regular session, and is not a summer school term. The summer school term begins itself June 30, overlapping by five days the regular session.

Eighty future officers of the U. S. Army engineering corps, all members of the School of Mines of R. O. T. C., are taking intensive military training at Fort Logan. The camp started May 24. The embryo officers will remain at Fort Logan until June 24, after which, with their training complete, they will report to Rifle. Captain Heron Cole is in command of the R. O. T. C. camp, with Lieut. H. V. Cameron and Sergeant Pat Meagher as his assistants.

The Hills and Pleasant Dells

Oh Lord of Hosts whose claim I boast
To be all right with all my might,
To be all right with all my might,

Oh Lord of Hosts whose claim I boast
To be all right with all my might,

Bring forth thy wines from all the mines
Where glories aye have brought us fame.

Where glories aye have brought us fame.

Bring on the drop, for I'll not flop
For I'll not flop

Beneath the moon afloat in the sky
For I'll not flop

I'll work the drift with all the thrift
I'll work the drift with all the thrift

When mines cave in and rock with din
When mines cave in and rock with din

What matters now for all I care
What matters now for all I care

Of solid ores to drip through pores
Of solid ores to drip through pores

That glorious dells have brought me fame
That glorious dells have brought me fame

By making eyes and telling lies
By making eyes and telling lies

I will not shrink to death's fair drink
I will not shrink to death's fair drink

For I'll not flop
For I'll not flop

To toll the way of parting day
To toll the way of parting day

Bring forth thy wines from all the mines
Bring forth thy wines from all the mines

Shall be the hills and pleasant dells!
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Of solid ores to drip through pores

To toll the way of parting day
To toll the way of parting day

Where nature's drink seeps through the brink
Where nature's drink seeps through the brink

What matters now for all I care
What matters now for all I care

Of solid ores to drip through pores
Of solid ores to drip through pores

That glorious dells have brought me fame
That glorious dells have brought me fame

By making eyes and telling lies
By making eyes and telling lies

I will not shrink to death's fair drink
I will not shrink to death's fair drink

For I'll not flop
For I'll not flop

To toll the way of parting day
To toll the way of parting day

Bring forth thy wines from all the mines
Bring forth thy wines from all the mines

Shall be the hills and pleasant dells!
Shall be the hills and pleasant dells!

Oh Lord of Hosts whose claim I boast
Oh Lord of Hosts whose claim I boast

To be all right with all my might,
To be all right with all my might,

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Figuring the Slope in the Corner of a Bin

By Fred C. Bond, ’22

The slope in the corner of a bin or chute is of considerable importance. It should exceed the angle of repose of the material to be handled by a safe margin; otherwise there is danger that the material may hang up in the corners instead of running freely.

This slope is usually found either by graphical methods or by a somewhat laborious calculation. The following formula will apply to most conditions and will simplify this calculation.

\[ \tan \theta = \frac{\tan \alpha \times \tan \beta}{\tan \alpha + \tan \beta} \]

where \( \theta \) is the angle of slope in the corner, and \( \alpha \) and \( \beta \) are the angles of the two intersecting sides. All of the angles are measured in vertical planes in degrees from the horizontal.

The formula will apply to all bin corners the traces of whose intersecting surfaces on a horizontal plane make an angle of 90°. The two intersecting surfaces may have the same or different slopes from the horizontal.

The derivation of the formula follows:

In Fig. 1 angle AOD = angle of side of bin = angle ABO

and angle EOB = angle of adjacent side = angle ABO.

Angle DAO = angle BAO = angle of adjacent side = angle ABO.

The following lines are horizontal: AD, AB, AC, OF, OF, OB, Line OA is vertical.

Now AD = BC = tan FOD

and AB = CD = \( \frac{AO}{\tan EOB} \)

Therefore \( AC = \sqrt{(AO)^2 + (CD)^2} = \frac{AO}{\tan EOB} \)

But angle OCA = angle COG = angle of slope in the bin corner, Therefore

\[ \tan OCA = \frac{AO}{AC} = \frac{AO}{\sqrt{(AO)^2 + (CD)^2}} \]

The following table has been computed with the aid of the formulas:

<table>
<thead>
<tr>
<th>Slopes</th>
<th>Fine Side</th>
<th>Adjacent Side</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Included Corner</td>
<td></td>
</tr>
<tr>
<td>40°</td>
<td>20°-41'</td>
<td></td>
</tr>
<tr>
<td>45°</td>
<td>35°-16'</td>
<td></td>
</tr>
<tr>
<td>50°</td>
<td>50°</td>
<td></td>
</tr>
<tr>
<td>60°</td>
<td>50°-46'</td>
<td></td>
</tr>
<tr>
<td>40°</td>
<td>34°-27'</td>
<td></td>
</tr>
<tr>
<td>50°</td>
<td>60°</td>
<td></td>
</tr>
</tbody>
</table>

Heads Federal M. & S. Co.

H. G. Washburn, graduate of the Colorado School of Mines in 1904, was appointed in April general manager of the Federal Mining and Smelting company. Washburn had been assistant general manager of the company for five years.

The career of H. G. Washburn since leaving the School of Mines has been notable for its success and for his continuous connection with one organization. He was from the very start the man after the type of the American Smelting and Refining company as a mining engineer and business manager. In 1894 he joined the engineering staff of the Federal mining company, a subsidiary of the A. S. & R., with headquarters at Farmington. He continued until 1913 as engineer for the company, which was rapidly expanding its operations, finally becoming the far-flung activities of an organization which includes many mines in the Tri-State district and large operations in the Coeur d’Alene district.

Provided That tuition in said school of Mines shall be free to all the ablest executives to sit in the governor's chair. And the Board of Trustees—Hon. W. A. H. Loveland, Golden, Jefferson County; Hon. Alpheus Wright, Golden, Colorado; Rev. Thos. M. Heil, Boulder, Boulder County.

The appropriation bill for 1876-1877 called for only $3,500, but several other points are noted in the act. One not noted near Golden, Jefferson County, Colorado Territory, for the years 1876 and 1877 the sum of $3,500 is hereby appropriated out of any funds in the Territory treasury not otherwise appropriated.
The Two-Fold Purpose of A Mining School

(Continued from page 3)

the world, producing about 90 per cent of the world's supply.

Another field in which the Colorado School of Mines has been conducting research is in the application of geophysics to practical prospecting. In this activity Colorado Mines is a pioneer in the United States to teach applied geophysics and the only institution offering a complete course in geophysical methods of prospecting with the special object of determining which geophysical method or methods would be the most economic and efficient in a particular district. The Colorado School of Mines was called on to furnish equipment and two experts, members of the school faculty, for the task.

The results of this work have been published in a United States bureau of mines technical paper (No. 439), entitled, "Geo-

physical Investigation at Caribou, Colorado," and may be referred to by those who may be interested in the results of this research project.

The Edgar Mine at Idaho Springs, Colorado, is maintained by the Colorado School of Mines as an experimental mine. This mine is not only used for undergraduate work in mining which cannot be taught in the classroom or in the regular college laboratories. It provides a place for the carrying out of mine research and experimental work covering all phases of mining which permit of further development and increased efficiency. The school welcomes the use of this experimental mine by those companies having problems to solve or tests to make. A complete description of these problems and results is in progress. This information, however, has been published elsewhere by the school and is available to those who may require it.

In addition to the activities conducted by the departments mentioned above and by all other departments, the school is co-operating, in the same manner as other western mining schools are doing, with its state geological survey in mapping the geology of Colorado with a view to the development of mineralized areas.

RESULTS OF RESEARCH ARE PUBLISHED

Through its department of publications, the School of Mines has been printing and publishing the results of its research for over forty years. The school is charging for the cost of production. The following are some of the publications now available:

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Dear Colleague—

Long Beach, California

June 4, 1930.

Mr. Colburn—

This wire from "Red" Wallis, 28, who is in the stations business, says that he will be with me on Saturday night and that we are going to the opera on the nineteenth for a session with old friends. I am sure we shall enjoy it and it will be a treat. Incidentally, I am including a copy of the information card we received from the Republic Iron and Steel Corporation in Youngstown, Ohio, as it is probable that you have been to the Midland Steel Company and it may be of interest to you.

Several weeks ago I was amusing an airplane enthusiast and a Municipal Air Port in Long Beach and when did 2 run across but kidney Rose, class of '26, is not in the world of aviation, but holds the position of pilot and instructor for the O. H. S. Air School. I am not sure if there is any metallurgical work going on in Long Beach, but you are the expert on all such matters. You are from Angle-Gram, and I have been to the Los Angeles World's Fair. It was there that I was first introduced to the metallurgical work in the zinc industry. I am still at it, and it is interesting work. In the meantime, I have met trains early in the morning at the railroad stations. "Red" wired me that he is interested in political graft now, and we have four men from Chicago arrive at the same time he would arrive at 7:20 A.M., blissfully ignorant of the fact that these four men are in the same business here at different stations. I am soon to be leaving there, and I find it difficult to keep my mind on the job, especially when the trains are running by the Risley home, were the German police dog pal of campus days, and also be interesting to former classmates of Sidney to know that "Duke", his German police dog pal of campus days, is still with him.

I wish to take this opportunity to notify you of the recent change of address. It is now 317 Beech St., Long Beach, California.

Sincerely yours,

L. A. Haak, 25.

Johnstown, Thursday last.

Mr. Colburn—

Yours of March 20 only arrived by the last mail and when I was so late for my reply to reach you before the fifteenth of May.

Many thanks for your kind invitation to attend the annual banquet which is much regret being unable to accept, especially owing to the fact that I am away from my home and my friends for a time. It is one of my regular vacations and I expect many of my old classmates, to make a point of being here for a few moments. He will be stationed in the fleetwood district—director of mining activities of the Utah Association. I have kind personal regards and best wishes.

Sincerely yours,

L. M. Banks, '22.

U. S. FOUNDRIES, Inc.

Station Verhnija, Alaska

Mr. Colburn—

June 1. I have been intending to send you a wire from the address was delivered by Professor Scott Turner, Director of the United States Bureau of Mines, presented on the following: "The Economies of Coal Mining," at the National Power Conference held in Berlin, Germany, in April, 1927. Mr. Turner's special qualifications for discussion of this subject are to be the fifth consecutive year the insurance company has managed to keep in the lead with an accident rate so low that it is the envy of some of their single brokers. In only one year the business has made a profit, they averaged 74.10 to the uninsured student. In 1929, the competition showed. The Indiana regents for the year reported that out of a student body of 428, 23 have been married to widows and 113 in the pursuit of their studies.

Clipped from a California Newspaper

Los Angeles, May 7.—The California Auditors Association is holding its annual meeting from all over the world. One of the most interesting groups to pay a recent visit was a party composed of ten members of the senior petroleum engineering class of the Colorado School of Mines. This famous Golden institution draws students from all over the country and has a unique capability to make men capable of working in oil industry in offering an outstanding course in petroleum engineering.

At the Colorado School of Mines the students are trained at an engineering for this theory. This trip, in which about twenty men were taken to a few of the oil fields of California's field and refinery methods, was arranged by the group of oil companies.

The registrar's book for the year released at the registrar's office. The fact that they do is borne out by the figures released at the registrar's office. There were two men in the business of mining, and they were the men who had the highest average for the married group. The average for the single men was 57.79, and for the married one 78.69. The fact that their grades are better is consistently than the unmarried ones.

The Colorado Transcript is the oldest newspaper of the School's graduates and is on file. The Colorado Transcript is the oldest newspaper of the School's graduates and is on file. The Colorado Transcript is the oldest newspaper of the School's graduates and is on file.

Married Men Lead in Grades

Another problem for the psycho­

chologist is—why do married men lead in grades at the Colorado School of Mines make better grades consistently than the single men?

The fact that they do is borne out by figures released at the registrar's office. For the fifth consecutive year the insurance company has managed to keep in the lead with an accident rate so low that it is the envy of some of their single brokers. In only one year the business has made a profit, they averaged 74.10 to the uninsured student. In 1929, the competition showed. The Indiana regents for the year reported that out of a student body of 428, 23 have been married to widows and 113 in the pursuit of their studies.

JULY

The Colorado School of Mines Magazine

PHOTO BY A. C. HOVEY.
Telling the News of Golden and the School of Mines
Since 1856
COLORADO TRANSCRIPT
Give Yourself A Weekly Treat from the Old Compan
$2.50 Per Year.

Keep Posted on Golden through
The Jefferson County Republican

United Verde Copper Co.
Miners at Jerome, Arizona
Smaller and Concentrator
Clarkdale, Arizona

Climax Molybdenum Co.
Climax, Colo.

Inspiration Consolidated Copper Company
New York Office, 25 Broadway
Philadelphia and Pittsburgh
Inspiration, Gila Co., Arizona

TORSMON BALANCE
and Magnetometer Surveys

GEORGE STEINER
PETROLEUM BLEDS—HOUSTON, TEXAS
and
PETROLEUM SECURITIES BLDG.—LOS ANGELES, CALIFORNIA

Report by
Donald C. Buxton
Consulting Geophysicist and Geographer


Clayton Kerv, '30, is now in Billings, Montana. He has employed the Texas Production Co.

E. C. Gill, a graduate student at Mines, is doing some experimental work concerning possible effects of gases on coal beds. He is checking results against certain formulas published in connection with this problem.

Ray E. Futcher, '29, is Industrial Engineer for the Kansas City Gas Co.

Young Members in the author of an article in the June 1930 issue of the Industrial Gas Journal. He describes the process of converting a heating plant to gas fuel.

This young graduate engineer is making remarkable progress in the engineering profession. In a few years he will be in one of the most important positions in the industry. A young man of 26, and a member of Sigma Phi Fraternity.

Harkemaier-Soorcock

Miners will be interested in the news of the wedding of L. W. Harkemaier, associate professor of chemistry and Mining School Dean Dorothy Soorcock, June 28, 1930. The wedding took place at Mines, Miners, Colorado. The newlyweds will be in Golden by the middle of July.

BIRTHS

Getting his professional and his personal degree within a month is the record for H. T. Van Gelder, Class of June 9, 1930. He was married to Miss Janet Davidson, who attended Mines. They will remain in Golden until winter when she will join her husband in Steamboat Springs where he is following his profession of petroleum engineer. He is a graduate of Mines, and a member of Sigma Phi Fraternity.

The Ruby National Bank of Golden
The Miners’ Bank
Thoroughly Reliable and Competent

More Power to Mines and Golden
Colorado Central Power Co.
Golden, Colorado

Golden Fire Brick Co.
One of Golden’s Mineral Industries

Golden — Colorado

Page Thirty-three