

MAY 15 1922

157

# ENGINEERING & MINING JOURNAL PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

MCGRAW-HILL CO., INC.

PRICE 15 CENTS

Engineering and Mining Journal-Press does not sell its front covers to advertisers. In uniting Engineering and Mining Journal with Mining and Scientific Press, however, the combined journal has respected existing advertising contracts. Some of these made with the Mining and Scientific Press were for its front covers. Through the courtesy of these advertisers such obligations have been released. The front cover this week has been released by the kindness of Broderick & Bascom Rope Co., whose advertisement will be found on page eighteen.

## The American Zinc Institute

By Felix Edgar Wormser

## Non-Ferrous Metallurgy in Russia

By M. G. Korsunsky

## Dredge and Power Plant Construction in the Far East

By P. R. Parker

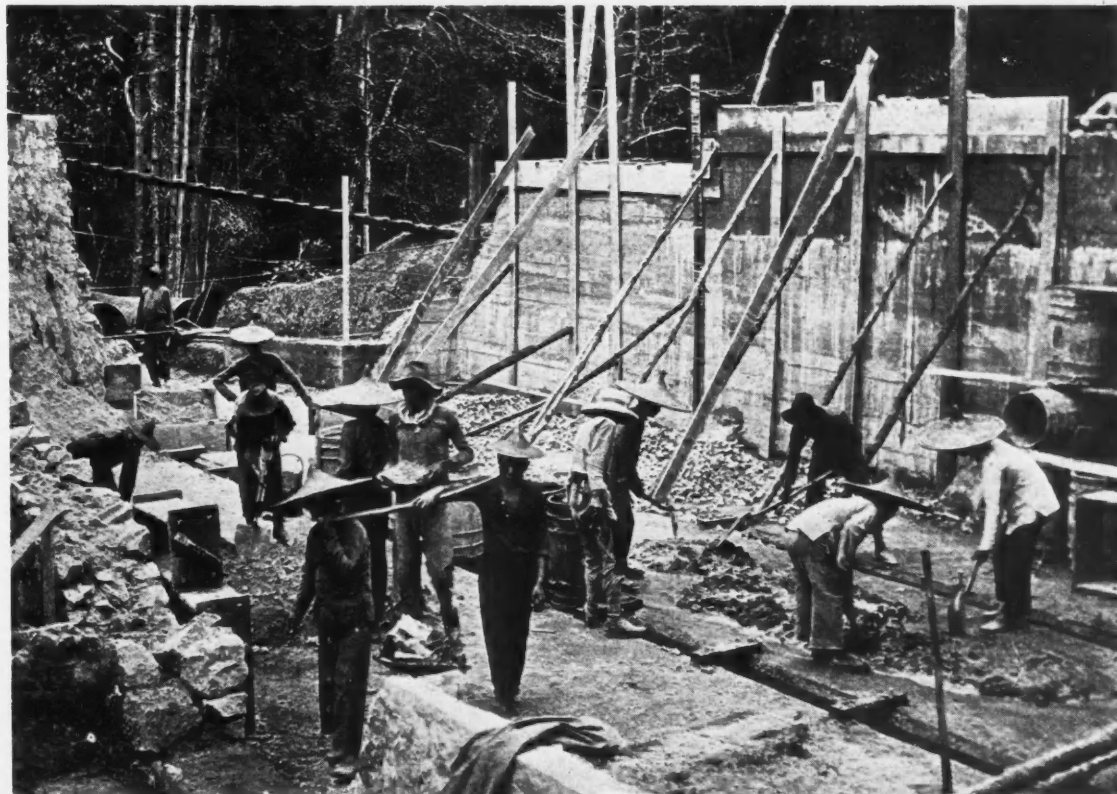
## Oil in the Quadrant Formation in Montana

By O. W. Freeman

## Selection of Fans for Pipe Ventilation

By Walter S. Weeks

## Biography of B. Britton Gottsberger



Constructing a Settling Basin in the State of Pahang, Federated Malay States.

A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

May 13, 1922



## All-Steel Ball Bearing Carriers

**ALL-STEEL**—No other construction offers the great strength with the comparative light weight of the all-steel design. The S-A Steel Unit is practically indestructible. The steel tubing rolls have a smooth surface for contact with the belt.

**BALL BEARING**—To reduce friction the ball bearing gives the best results. Each unit has two ball bearings, each one having far greater load carrying capacity than is ever required in conveyor service. The smooth, easy-turning rolls mean long belt life.

---

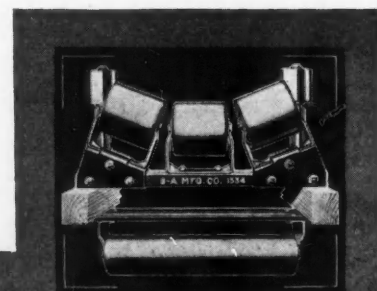
The "S-A Belt Conveyors" Catalog No. 26 is a handbook of valuable information concerning the latest machinery equipment for belt conveyors. Illustrations, descriptions and tabular matter are available for quick reference.

*Send for Your Copy.*

---

**Stephens-Adamson Mfg. Co.**  
Aurora, Illinois

S-A Unit Carrier—Patented



# ENGINEERING & MINING JOURNAL-PRESS

T. A. RICKARD  
Contributing Editor

G. J. YOUNG, Western Editor  
D. E. A. CHARLTON, Managing Editor  
A. H. HUBBELL, News Editor  
E. H. ROBIE, Metallurgical Editor

J. E. SPURR, Editor

F. E. WORMSER  
W. N. P. REED  
A. W. ALLEN  
A. B. PARSONS  
Assistant Editors  
BENJAMIN MILLER  
ROBERT M. HAIG  
Special Consulting Editors

Volume 113

New York, May 13, 1922

Number 19

## The Minerals Separation Settlement

**A**FTER ELEVEN YEARS of litigation, Minerals Separation and its chief opponents have made peace. The Jackling properties—Butte & Superior, Utah Copper, Nevada Consolidated, Chino, and Ray Consolidated—along with the Miami Copper Co., have made an agreement with the flotation-patent exploiting company which will go far to clear the air and pave the way for the adjustment of other cases. The details of settlement have not yet been announced, but there is little doubt that both sides to the controversy will, in a large way, profit to a greater extent than either would have done by continuing the legal tangle. Vast sums had already been expended in the prosecution of the various cases, and the end still seemed far away.

We wonder if the settlement was hastened by the death of John Ballot, until recently the president of Minerals Separation. Mr. Ballot was known to be unrelenting in his demand for the punishment of alleged infringers of his patent rights, and certainly was not disposed to allow any favors to achieve a settlement with the powerful companies with which agreement has now been made. Mr. Ballot fought for what he thought was right, and did not care to be diplomatic. It may be that his death made it easier for a settlement wherein each of the contending parties made large concessions, as was almost certainly the fact. It would not be surprising if the so-called porphyries may now enjoy a royalty arrangement no more onerous than that concluded some years ago with the Anaconda and Phelps Dodge interests.

The flotation litigation should be a lesson to technical men. It seems to show clearly that lawyers are not capable of satisfactorily deciding upon a highly technical question for which engineering judgment rather than legal judgment is required. The various trials have been singularly disappointing, confusing, and conflicting. As a result of the years of time and the large sums of money which have been spent, practically all that has been decided is that patent No. 835,120 is valid and that when "oil" is mixed with an ore pulp in the proportion of less than 20 lb. of the oil to one ton of the dry ore, the mixture violently agitated, and the resulting pulp subjected to "flotation," the process so performed is comprehended by the patent. If more than 1 per cent of oil is used, the patent is apparently not infringed, but whether oil in circulation in a closed circuit shall be included is open to question.

Users of pneumatic machines, such as the Callow cell, are infringers if they violently agitate the oil and pulp before flotation, but just what violent agitation is, has only partly been defined. The interpretation of patent No. 962,678, which relates to the use of soluble frothing agents, has hardly been touched. What does "soluble" mean anyway? All things are soluble more or less, not least so the "insoluble" often seen on laboratory reports issued by chemists. Does the addition of one of the newer flotation reagents, such as ortho-toluidine, to the

launder immediately preceding a Callow cell infringe Minerals Separation patents? We sincerely hope that it will not take another ten years of litigation and attendant uncertainty to find out.

Mr. Callow and Minerals Separation now have the opportunity of doing a great thing for the mining industry if they can arrive at some middle ground of agreement on this question. Flotation operators should not object to a reasonable royalty for the benefit of those who have done most toward developing this highly ingenious process, and it is to be hoped that the royalty can be so adjusted and so apportioned among the contending patentees that all will be satisfied, both in peace of mind and pocket-book.

Several smaller suits are still outstanding, we believe. They are between Minerals Separation and companies of less importance, though the principles involved are of prime interest. For example, the suit brought against the Magma Copper Co., if it is intelligently argued and carried to its conclusion, should establish pretty thoroughly the rights of users of simple porous-bottom cells. Experience, however, makes us think that a long and expensive legal battle would be necessary before any definite results would be achieved, if at all; and we cannot help but think how much more satisfactory it would be if a settlement could be made out of court, as suggested above. Such a settlement would show a particularly conciliatory attitude by Minerals Separation, for that company is now even more powerful and affluent than before, and by retaining legal experts of the highest ability could drag a case along through the courts for years, even though the earlier decisions went against it—which is by no means certain. And it does make a difference how good a lawyer one can afford!

We hope that the gradual elimination of the M. S. opponents will make the members of that organization less secretive in their attitude to the mining engineering profession. Unwilling to release information concerning their processes, they have been keenly alive to learning what they could about others. They have been among our most constant subscribers. Sometimes we wish that we could delete from our subscription list those organizations and individuals that are unwilling to give as well as to receive information. The attitude of Minerals Separation has, of course, been guided by legal advice. We question, however, whether the advice has been good, for a vast antagonism against the patent-exploiting company has been generated in the minds of usually fair-minded persons. Underhanded work has been charged against both sides to the controversies, and the behavior generally has been that of which no engineer can be proud.

Possibly the dawn of a new day has now come, when all flotation plants will be operated in accord with the best metallurgical rather than the best legal practice. The world is gradually straightening itself out, and perhaps that small section of it devoted to making minerals float is no exception.

### A Silver and Gold Association

**W**E NOTE with great interest that the silver and gold industries of the country are to be specially represented by a Silver and Gold Association, of the type technically called trade associations; and we greatly approve of the step. The personality of the management and the extent of participation in the association by gold and silver producers have not yet been disclosed; but it appears that Mr. H. N. Lowry will be one of the guiding spirits; and the record of his work in behalf of the gold industry, conducted under the auspices of the American Mining Congress, is such as to inspire considerable confidence in the soundness and yet boldness of the policies which will guide the new association. Upon the quality of such policies, of course, depend progress and success; but we believe that producers of the precious metals are fully warranted in joining in this association with enthusiasm.

### Gottsberger to Yale

**Y**ALE UNIVERSITY is to be congratulated on the appointment of Mr. B. Britton Gottsberger as professor of mining. Mr. Gottsberger has a record of successful mine operation and mine management, combining a close knowledge of the technique of mining with an unusual degree of interest in the human element of mining problems. His highly successful record as general manager of the Tennessee Copper Co. and the Miami Copper Co. is what might be expected from this mental attitude. Mr. Gottsberger is secretary of the Mining and Metallurgical Society of America, and has recently devoted his chief energies to this society, and also to work in the American Institute of Mining and Metallurgical Engineers.

Undoubtedly, the great American mining school, comparable in eminence to the old-time glories of Freiberg, in Saxony, has not yet been developed. Yale is strategically so situated that she has as good a chance at attaining this goal as any other. With neither too much city nor too much isolation (and either extreme probably militates against the maximum development of the ideal mining school), with the stimulating and leavening influences of a great cultural center at hand to assist in fostering intellectual and social growth, the stage is favorably set for the entrance of the personalities who might build up a mining school of national eminence.

### The Ethics of Ordering Supplies

**A**FIRM manufacturing chemicals and chemical apparatus sends a circular letter to engineers as follows:

"You no doubt have a great many people on the list for whom you are constructing a plant and perhaps adding thereto, so that they perhaps might ask you to order what equipment is necessary for the chemical or physical laboratory.

"Any orders that you may be in a position to divert in our way, we will be very glad to accept and *will allow you a commission of 5 per cent.* If you will take it up with the parties and have them send us a list, we will be very glad to make them our very best prices, instead of our going after it, we will allow you for the information 5 per cent commission in lieu of our going after the business."

The ethics of the mining engineering profession have

not been thoroughly formulated; but one thing is established and clear, and generally agreed upon: that it is unethical for an engineer to accept a commission upon supplies which he orders for his client. The firm in question should be aware of this, and that it is no recommendation for it to address communications to engineers, offering them a cash inducement to turn the money of their principal in its direction. An engineer is not a broker, a middleman, a scalper, or a commission merchant; he is a professional man, whose job is to protect his client and see that his money is spent with the merchant who will give him the most for it, in quantity, quality, and valuable service. For any of that money to stick to his fingers would be for him an underhanded and dishonorable thing. Whatever he earns is a matter of open and fair agreement between him and his client, as between gentlemen. Therefore, it does not nurse kindly feelings in the breast of a mining engineer to receive a letter of this sort, for his first reaction is that of being personally affronted. When he studies the letter, however, and detects the disguised marks of a circular letter, he realizes with relief that he has not been singled out for such an unethical proposition. Nevertheless, so far as he is concerned, the standing of the firm suffers, and it is quite unlikely that it will be favored either with protestations or with orders.

### The Genoa Conference

**T**HE GENOA CONFERENCE is of a different type from that held in Washington. The latter put a stop to the race for war preparation, for the common good of the world; that at Genoa subordinates the common good of Europe to the sharp bargaining of nations for their own commercial preferment. To understand the Genoa conference, it is only necessary to observe four factors—France, England, Russia, and Germany. England and Germany, great manufacturing nations, with the need of raw materials and markets, are in so far comparable; they have been engaged in a race as to which shall first exploit Russia. France, a relatively self-contained agricultural country, is in another class. She is interested first and foremost in the German indemnity, which to England is decidedly secondary. The Russian government, unscrupulous and sharp, plays Germany against England, with the ultimate object, openly avowed, of undermining all governments.

The Lenine government is violent and fanatic. "It is a case of communism against capitalism," state the Bolshevik envoys, and as an example of their anti-capitalistic views, they demand capital to the extent of some billions in gold, as a loan! Germany scores with a separate agreement with Russia; but next a great British petroleum company undertakes to make a commercial treaty with the Soviet government, to go in partnership with it in the exploitation of the immense petroleum wealth of Russia.

Principles? They are forgotten in the commercial urge—the rush for wealth. The utter lack of any record for truth, decency, morality, or honesty, or any pretense to it, on the part of the Soviet government, is overlooked by those thinking to enrich themselves by trafficking with it. There is no world-statesmanship at Genoa. There was in Washington.

The United States was wise in abstaining from this conference. She is not ready to treat the Lenine gov-

ernment, foe to every principle of liberty and democracy for which she herself stands, as a crony; she is not ready to forget the standards upon which her institutions were founded, for the opportunity to traffic with a treacherous highwayman. Samuel Gompers, has well expressed it: "I can think of nothing that would constitute a more needless and base betrayal of civilization than American recognition of Bolshevik tyranny."

### The Front View and the Back

**T**HE Logan (Kan.) *Republican* is a versatile sheet. In a recent issue, we find, in the middle of the first page front, flanked on either side by an advertisement of church revival services, much wisdom as to the ravages of the fraudulent stock-selling sharks.

"Modern highwaymen," it says, "operating as salesmen of fraudulent stocks, appear to have had a rich harvest in this depressed country, and promoters of get-rich-quick schemes have had no occasion to complain of hard times. Scarcely a city of any size has escaped, while many sequestered villages inhabited by retired farmers have been victimized; and the largest harvest of all have been reaped from the prosperous farming districts of the Middle West.

"The conventional reaction is to feel righteous indignation against the stock sharks. Certainly they are a despicable tribe, wholly outside even that criminal class whose boldness and adventure sometimes compel admiration. The old highwayman took a risk; the real robber stakes his life and liberty; these thieves of old men's savings and widows' insurance moneys are not in that class at all." And so on, for two columns—good strong language. This is copied from an article by Henry Ford in the *Dearborn Independent*.

But if we reverse the paper (the *Logan Republican*), we find in the middle of the back page, a full-length advertisement of the Colorado-Utah Mines Holding Co., of which Chas. E. Havener is president. This advertisement contains the following gem:

"Government statistics show the following returns on capital invested: railroads, 3 per cent; national banks, 6½ per cent; insurance, 11 per cent; lumbering, 14 per cent; manufacturing, 14; and mining, 182 per cent."

The farmer readers of the *Logan Republican* are further informed that "only 36 per cent of all legitimate mining fails, against 54 per cent in all other commercial lines of business."

We gather from the advertisement that the company owns a mine of hematite in Utah (Willard Iron Mountain); and a very advantageous contract to furnish this ore is published, made with the Mineral, Metal & By-Products Co., of Denver, "whose President is Dr. Charles H. Gage, one of the leading Metallurgical Experts of this country." Dr. Gage quotes the Utah company \$61 to \$65 per ton, f.o.b. mines, for its hematite. "We find that this is a very desirable ore for the manufacture of soil pipe and machine-tool steel which we will produce in our electric furnaces." Dr. Gage further finds that "your iron ore will have a value of \$100 a ton, f.o.b. the mines, for the special purpose of manufacturing ferrosilicon." "These prices do not include the values of rare and precious metals such as gold, silver, titanium, nickel, platinum, or copper values which are contained in your Utah property, all of which will be settled for at the prevailing prices at the reduction works."

As an afterthought Mr. Havener sticks in the news paragraphs this advertisement: "The Arizona Co., with over 16,000,000 tons of surveyed 2 per cent copper ore, is now part of our Holding Co."

The *Logan Republican* is thus a Dr. Jekyll and Mr. Hyde. The doings at the churches and the wise warnings of Mr. Ford against buying worthless stock occupy the front page, while it sells its back page for questionable stock-selling purposes.

Yet in some of our mining communities there is an element which opposes all and every form of "blue-sky" legislation, which is designed to prevent just this form of fraudulent stock promotion. Their plea is that such restriction interferes with business. What kind of business have they in mind? Do they want to be confused with the business-getter who preys on the unwise investor?

### The Nickel Affair

**S**TRANGE the ramifications of the nickel industry! In Norway they have been having a time in the press and in the Storting over events connected with the participation of Norwegian capital in the financing of the war-baby British America Nickel Corporation, whose property is in the Sudbury district, Ontario. A Norwegian bank has liquidated as an outcome, it is said, of the Kristianssand Nickel Refining Co.'s association with the Canadian project. Left-handed compliments have flown and charges of official corruption have been made. The government at Kristiania has made an inquiry, and the wolves may yet get the guilty ones, if there be such, it is said. The presence of twenty-nine Communist and eight Socialist members may well render difficult any possible whitewashing.

### Do Your Ordering Early

**F**OR SOME WEEKS preceding the Christmas shopping season the Post Office, the local merchants, and others who anticipate a special rush of business at that time admonish us to do our shopping early.

On each Monday previous to the publication of the following Saturday's issue of the *Engineering and Mining Journal-Press*, it is necessary for us to specify the number of copies that will be required to take care of the circulation for that week.

The number of copies needed for subscribers is furnished us by the Circulation Department, copies for the advertisers by the Advertising Department, and we of the Editorial Department add the number which has been asked for by our contributors or others interested in that particular issue. A certain allowance above that total is made for possible contingencies, but this is kept at a minimum, for obvious reasons.

A notice is sent to our contributors immediately upon the acceptance of an article, and included with this is a request to the effect that those desiring extra copies should notify us at once, so that they may be arranged for. The reason is obvious.

The story is told of a man who continued to smoke in a public building, although a sign in a conspicuous place stated that such was prohibited. When he was taken to task by an official he replied that the sign did not state "no smoking—positively," so therefore, he thought that it was all right to smoke.

Will it be necessary for us to make a similar addition to our notice?

## An Industrial Experiment

BY T. A. RICKARD

ON ANOTHER PAGE of this issue I review a book on the labor problem by Mr. John Graham Brooks. Among the interesting matters discussed by him is the proposal that was made by Haywood, Moyer, and other anarchists, posing as socialists, to buy a mine and run it in the interest of the I. W. W. The idea was to raise capital for the purchase by assessments, and to use the profit for union purposes. It is a great pity that the scheme was not carried out, for it might have been a useful object lesson to all concerned, including the public. It would have been proved, I feel confident, that the so-called practical knowledge of mining possessed by these misleaders of labor was entirely insufficient to bring a mine to economic fruition, and it may be that their deluded followers might have discovered that brawn and brains have something in common, and that they fare best when working together amicably. In our country, if in no other, the attempt to develop class consciousness and even to establish castes in the community is not only highly regrettable but, let us hope, futile, because any such attitude of mind is repugnant to the democratic ideal.

Mr. Brooks, in his book, does not discuss an interesting experiment that is now being made in Kansas: I refer to the Industrial Court. The State of Kansas is a prairie region dependent for its power and heat upon three coal-producing counties in which 705 strikes were recorded in four years. These repeated interruptions to the prosperity and comfort of the community prompted the Governor, Mr. Henry J. Allen, and a Judge, Mr. W. L. Huggins, to recognize the basic fact that industry is "affected with a public interest", and therefore that strikes and lock-outs should be subordinated to that interest for the sake of the commonweal. This idea, that the community has the right to insist upon the settlement of such controversies in accordance with principles of justice, is as old as the common law of the English-speaking peoples; it is an idea that has been pushed into the background too long, and it is well that it should be re-asserted in the face of the vendetta waged so recklessly by the irreconcilable and irresponsible leaders on the two sides of Capital and Labor. For the purpose of establishing the public right to inquire and determine, the State has constituted a court of three persons to whom has been given the power to issue summons to compel attendance of the parties in conflict, to demand the production of accounts and correspondence, to employ investigators, and to hold public hearings. The Industrial Court may act upon its own initiative, on complaint of either party, upon petition of any ten citizens of the district affected; it may act upon complaint of the Attorney General or upon agreement of the parties to refer their quarrel, but only when it is apparent that employers and employees are unable to agree, and when the controversy appears likely to endanger the continuity or efficiency of public service or public health, or cause such industrial strife as will affect the production or

transportation of necessities. There is no overt interference with the right of collective bargaining, which right is specifically recognized, and any judgment rendered by the Court stands only until the parties reach an agreement, when, upon approval of the Court, such agreement supersedes its decision. The danger of becoming autocratic in its dealings with disputants in an industrial quarrel has been avoided, so far, by the Court. It aims to be administrative rather than judicial: to promote industrial peace by facilitating conferences between employers and employees.

The Kansas law prohibits strikes and lock-outs, boycotts and intimidation, but it is supposed to guarantee to every worker the right to stop work when he pleases, to choose his employment, and to make reasonable contracts, to bargain collectively and to organize with his fellows for the purpose of such bargaining. There has been, and there will be, difficulty in reconciling the right to stop work with the ban on strikes. Under the Kansas Industrial Act it is unlawful for any two or more persons to conspire or federate together, or to injure any other persons by means of a strike or boycott, with the purpose of hindering, delaying, or interfering with operations covered by the provisions of the Act. The Supreme Court of the State has modified the rigidity of this enactment so far as to hold that workmen may consult together in order to determine among themselves whether or not it be to their common interest that all of them shall exercise the individual right to quit work at any time, but the line is drawn at such action being taken on the order of the officers of an organization. The Act requires a hearing and an investigation of every controversy without the interposing of a strike or lock-out. It may prove difficult to distinguish voluntary abstention from quitting under order of an organization, but the idea of regarding strikes and lock-outs as contrary to public welfare is one that must be affirmed; such methods are justified only in the last resort, after every other method has failed. The right to strike on the part of the employees or the right to dismiss his workers on the part of an employer has been regarded as inalienable, but the right of the community as a whole to prevent the abuse of the rights of its component elements is even less assailable. Civilization exists only by grace of the concessions made by the individual for the sake of the community. The strike and lock-out are inheritances from the jungle, as is a fist-fight on the street or a duel in the park.

Appeal can be made from the Industrial Court to the Supreme Court of the State, and, strange to say, the latter has been liberal in its interpretation of the Act under which the Industrial Court functions. The main feature of the Industrial Court is that it represents the third party in interest—the community as a whole—and provides means for saving that party from being the helpless victim of quarrels between the two parties that represent capital and labor in the complex processes of modern industry. It gives means for ensuring delay, investigation, and discussion, all of which are needed before public opinion can become intelligent, and therefore effective.

## DISCUSSION

### Financial Economies Needed in Latin America

Governmental Expenses in the Countries of the Region Require Reduction Unless Higher Taxes or Increased Export Duties Are Forthcoming

THE EDITOR:

Sir—Probably there is no reader of the *Engineering and Mining Journal-Press* in 1922 who is not in some way affected by the problem of foreign exchange and finance. This matter is a daily reality in the Latin-American republics, which are sources of raw materials, and it may be said that the depression in business existing there is connected with that of the European consuming countries, although the present ratio between paper currencies in South America and their par value is higher than that for European paper.

The combined volume of South American export and import commerce has lately touched markedly low figures, though there is hope that at least no worse conditions will be reached hereafter. This slender quantity of business permits dangerous fluctuations in exchange on New York and Europe by the negotiations of relatively small sums, whereas when South American exports were flourishing the sale of small drafts on New York produced no noticeable effect on rates. Now exchange is exceedingly sensitive, with exportation almost stagnant.

Such conditions opened the way in 1921 to the floating of American gold loans for the Latin-American republics and now induce reflections as to their final effect on mining enterprise and on the mutual relations between the United States and the borrowing countries.

It is commonly known that twelve loans, totaling almost \$200,000,000 in United States currency, were floated last year in New York for various Latin-American countries and cities. Naturally, these bonds bear coupons payable in United States gold, at the rates ruling in 1921—usually 8 per cent for such obligations—though the bonds doubtless netted the governments interested considerably less than par, as most were offered to the investing public to net more than the nominal coupon rate. (See any bond-house circular at time of issue.)

Under the circumstances it is fair to assume that the net proceeds of such loans ranged from 95 per cent of the face value downward, and the coupons therefore represent to the borrowing governments from 8 to 10 per cent interest.

The final destination of such loan funds cannot be ascertained exactly, but it is safe to say that, in general, these funds represent the inability or the unwillingness of the South American governments to live within their present incomes, after having passed through the era of extravagance and high-living while they were supplying raw materials to the world during the Great War.

It will be claimed that these loans are for rehabilitation of railways and other similar projects, but apologists for the borrowing governments are mute upon the subject of large military and naval establishments, government owned and operated railway systems, heavily staffed civil services, and so on, all of which form the basis of large potential economies if only there existed the will to carry them into effect.

The situation produced by these large loans to the Latin-American states from the financial resources of the United States is of great significance henceforth to mining and commercial interests operating in South America.

Primarily, it is to be hoped that South America will use these loans to put her house in order, while reducing budgets, so that, when the cash proceeds of the loans have been spent, internal resources will meet future needs.

If this elementary step is not taken, the semi-annual interest payable abroad in gold will be found to be a dead weight upon the recovery of the paper currencies in South America. The effects of low exchange rates are always harmful to the population of the country so affected, although the exporter of mine or farm products is favored by the resulting reduction in his labor cost.

It is hardly conceivable that former sources of taxation will balance the South American budgets in an era of depression, and as adequate voluntary economies in government appear to be unlikely in such event, it is almost certain that new taxes are to be provided, probably consisting of a tax on real-estate holdings, a tax on income, and further export duties laid upon commodities and products heretofore exempt.

Taxation on land will be fought bitterly by the wealthy land owners who form the bulk of the governing element in South America, but it is a step that cannot be long delayed; nor the income tax, either, as the "peon" laboring element is already heavily taxed indirectly by the progressive depreciation of the paper currencies, and should be relieved rather than burdened still further.

Adverting to the mineral industry, it seems likely that exporters of metals and minerals of economic importance will find new, or increased, export duties laid on their production in the not distant future. Certainly export duties cannot be opposed as unjust unless they become too burdensome, or, as with sodium nitrate, there is an exaction of 25 to 30 per cent of the value of the world's fertilizer.

Nevertheless, assuming insufficient public economies and only a slow revival of commerce, the paper currencies south of Panama will recover only slowly, and interest on foreign gold loans will compel new taxes.

For example, since nitrate export duties in Chile have shrunk so alarmingly in 1921, the introduction of export duties on copper, to relieve the deficit in part, becomes generally anticipated.

It is a matter for reflection to consider what would

have happened in South America in 1921 had no loans been obtainable, and, furthermore, just what fundamental change has been produced by these loans in the relations of the United States with the Latin-American republics which so desperately needed them.

Evidently, our position has been altered from that of the friendly "elder brother"—an interceder in family disputes, and protector against assaults on republican forms of government—to that of the business counsel with a recognized interest in the proper administration of the public affairs of South America.

Giving us at once a plainly legal and honorable stake in the Southern continent should bring about closer relations, and our footing will approximate the financial significance attaching to previous loans by European countries.

As it is well known that export duties on nitrate have provided the bulk of the state revenue in Chile in the past, it is interesting to observe the actual sums obtained thereby or obtainable hereafter.

The duty on nitrate has been set at 2s. 4d. per quintal of 101.4 lb. and this represents from 51c. in United States currency to 57c., depending upon the fluctuation of the pound sterling. During the war a maximum production of about 60,000,000 quintals per year was obtained, due to high prices and an unlimited market, but it was admittedly an abnormal production and not considered possible of repetition at this time. An assured exportation of 40,000,000 quintals per year at this time would be viewed gladly by the nitrate maker.

If we may assume exportation of 40,000,000 quintals per year as a basis, without evoking discussion of the future in store for Chilean nitrate, we may estimate a gross revenue from nitrate of \$20,000,000 to \$22,500,000 United States money, depending upon sterling exchange rates. For every million quintals less than 40,000,000 per year, deduct about \$550,000 from the above-noted revenue sums.

When there is subtracted from this hypothetical future revenue, derivable from nitrate duties, the sum of \$22,000,000 in United States money—due annually on the heavy borrowings made by Chile abroad—it is a legitimate cause for wonder as to where an equal additional revenue can be raised in Chile to carry on the existing governmental services, which in the past have consumed all the revenue obtainable from nitrate as well as from other sources.

Two courses are open—either retrenchment or imposition of further taxation to fill the voids in the budget.

Additional loans under the circumstances are as little to be advised as would be the issue of inconvertible paper money which is ruining some European currencies.

Any economically possible export tax on copper could not, for some time to come, go far toward providing for the service of the Chilean debt.

During a stagnant or weak nitrate market there is a corresponding diminishing return from the associated branches of industry dependent on nitrate—one of which is dividends, and hence taxable incomes—so that a probable result will be that every promising source of revenue must be levied upon to meet heavy foreign obligations, including land tax, income tax, and a further extension of export taxes on copper.

Substantial disarmament would be of the greatest help to Chile and to other South American countries. Guayaquil, Ecuador. DONALD F. IRVIN.

## Neglected Opportunities

### THE EDITOR:

Sir—If the wails of disgruntled mining engineers, as evidenced in the technical press of the United States during the last year, are as true as they appear at first glance, we of less prominence in the profession are going to have a tough time "making her pay." It is my opinion, however, that there are "neglected opportunities" which concern us as a body.

Mining rightly conducted is an ancient art, a basic industry, by which new wealth is won from the earth and turned into the channels of trade. If we all quit and "let George do it," can we be dispensed with?

Our business is suffering from two diseases: one, the reaction of the World War, from which we are receiving no greater setback than other businesses and concerning which we can only be patient; and the other, our joint shame, the "parasites of our industry." These glib individuals, called mining promoters and mining men, each year in increasing numbers turn vast sums of the public wealth available for the industry into their own pockets and into illegitimate operations (principally precious metals and oil), where the money through bad judgment is generally dissipated in impossible endeavors. By lies and chicanery, exaggeration and misrepresentation, and with the aid of the press of the country, this process has grown to such an extent that the industry is looked upon with suspicion by the layman, and the term "mining" has nothing but regrets for the majority of people.

Are not most of us too bashful, too unbusinesslike, not aggressive enough, or jealous enough of our calling, to allow such parasites to take away from us work which we are able to do efficiently? Does a sick man go to a lawyer, or a man in the meshes of the law to a doctor? No. They know better. Yet Mr. Public generally listens to the promoter and forgets that mining engineers exist to advise him, which is the fault of the mining engineers themselves.

There is a lot of work to be done all around us if we can jointly impress upon the mining investor that we are in this business, at his service, can advise him of his hazards and his chances, and tell him truthfully and fearlessly each set of conditions as they exist. A lot of this work may be negative at first and turn money back into the pockets of the prospective investors. However, if hazards are explained and Mr. Investor is guided in his endeavors he will come back again where the risk justifies the investment, and his money in the end will help produce new wealth and be a benefit to all dependents on the mining industry.

I know of three laymen who have aggregate losses this year of \$40,000 because they wanted to interest themselves in mining and did not think it necessary to employ a mining engineer to advise them. They were about as successful as you or I would be if we accepted the other fellow's terms of a contract drawn by his attorney without consulting an attorney ourselves. These parties are disgusted with mining, and the money is lost for legitimate development work.

If each and every mining engineer will make it his business to seek out three such individuals—an easy thing to do anywhere in the world—and sagely advise them that mining engineers should be consulted on mining investments, all would eventually benefit, the industry, the public and ourselves.

San Francisco, Cal.

ROBERT J. BURGESS.



## Dredge and Power-Plant Construction in the Far East

Equipment Purchased in United States, Modeled on California Gold Practice, a Success in Dredging for Stream Tin in Malay States—Difficulties of Transportation and Installation Solved

BY P. R. PARKER

**D**REDGING FOR TIN has been successfully carried on in the Malay States for many years. This work has in most instances followed the primitive though extensive mining by Chinese of the tin placers of that country. Most of these tin-dredging companies are of Australian origin, and without exception all of the dredges are of light construction and are driven by steam engines.

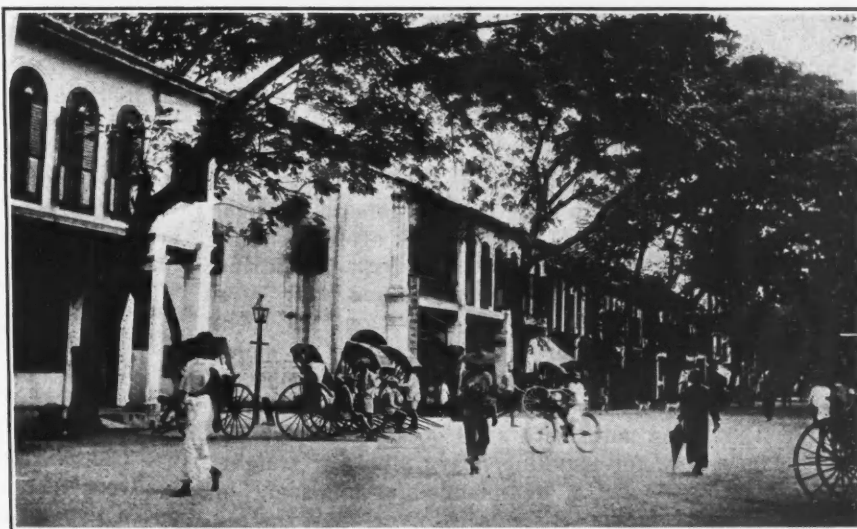
In 1913, a new Australian tin-dredging company was incorporated as the "Tin Bentong No Liability." This company had acquired some tin-placer ground near Bentong, in the State of Pahang, Federated Malay States, and intended to work this ground with a new Australian dredge. The directors of this company were unusually progressive, and as two of them, Mr. Peacock and Mr. Palferyman, had to make a trip to California in 1914 on other matters, they decided to investigate the gold dredging there to see if some of the developments in that industry might not be applied to advantage in tin dredging in the Malay States. They found that the most radical improvement in the California dredges was the electric drive. The California dredges were also heavier and made of special alloy steels where parts were subjected to severe stresses and wear. These points of advantage so impressed these men that they decided to buy a California, electrically operated dredge, modified to provide for sluices or tables that had been especially designed for saving tin instead of gold. It was also necessary to determine the type of power plant best suited to the conditions to be met. An investigation of the streams about Bentong developed the fact that about 1,500 hp. could be generated on the Perting River, near by. This power site made it possible to obtain a drop of 450 ft. with a pipe line about 4,000 ft. long.

In July, 1915, a contract was placed with the Bucyrus Co., of Wisconsin, for an electrically driven dredge with 7-cu.ft. buckets and a steel hull. A few months later contracts were placed with the General Electric Co. for a 1,000 kva. generator and electrical equipment for the power house; with the Pelton Water Wheel Co., of San Francisco, for a 1,200-hp. duplex-nozzle tangential water wheel, complete with shaft for mounting the generator armature; and with the Western Pipe & Steel Co. for the steel, cut to size and punched ready for rolling, for the power-plant pipe line.

It was foreseen that one of the principal difficulties in the final erection of this dredge and power plant would be its transportation from the sea at Port Swettenham to the site of erection. There is a meter-gauge railroad from this port twenty-six miles to Kuala

Lumpur, the capital of the Federated Malay States. From Kuala Lumpur to Bentong is fifty miles by wagon road. This narrow road winds up over a mountain pass about 2,000 ft. high, from the State of Selangor into the State of Pahang, and then down the northeastern side of the range to Bentong. The grade is not more than 5 or 6 per cent, but most of the way the road is cut into the rough mountain side and is exceedingly crooked, the turns being so sharp that a motor car has to round them slowly. The center of the road is well paved with broken stone, but this pavement is so narrow that two vehicles cannot pass each other on the paved ground.

To meet these conditions, special trucks were required to transport the machinery over this road. For this



Main Street, Bentong

purpose two electrically driven trucks were purchased from the Couple Gear Co., of Grand Rapids, Mich. Each of these trucks carried a direct-current generator driven by a four-cylinder gas engine. The current from the generator was used to drive motors in each of the four separate wheels. The four wheels were also used to steer the trucks, and the rear wheels, when turning sharp curves, followed the tracks of the front wheels.

To carry the larger pieces, two trailers were purchased. One trailer consisted of a long truck body with a pair of large steel wheels at the rear end, with the forward end arranged to be mounted on a turntable at the center of either one of the electric trucks. The other trailer had four steel wheels and a swivel bolster mounted in the center.

Unsuccessful attempts were then made to secure space on various steamers which were to sail about the time this equipment would be ready. It happened at that time that the small freight steamer "Manila" (captured by Admiral Dewey in the Spanish war) was for sale in San Francisco and that this vessel was just large enough to carry the entire shipment. It was finally decided to



Transporting spud casing for dredge

purchase it after arrangements had been made for the resale of the vessel later in Shanghai.

The United States shipping laws made it expensive to operate this vessel under the American flag, and as most of the European nations were at war, the "Manila" was finally registered under the Chilean flag.

All of the machinery and equipment for the dredge and power plant were assembled in San Francisco during the latter part of February, 1916, and the S.S. "Manila" was loaded and sailed on March 6, 1916.

I had been employed in July, 1915, as general manager of the Tin Bentong No Liability, and after spending several months at the works of the Bucyrus Co. during the final designing of the dredge, sailed with Mrs. Parker on Dec. 31, 1915, for Singapore, arriving there the end of January, 1916. From Singapore we sailed to Port Swettenham, a night's trip up the west coast of the Malay Peninsula, and were surprised to find a well-equipped shipping port, with steel docks, steel lighters and steam cranes for handling heavy pieces of freight, steel warehouses, and a well-planned arrangement of steam railroad tracks. All worries over the expected difficulties of unloading the "Manila's" cargo were therefore dispelled.

#### THE JOURNEY TO KUALA LUMPUR

We took the train at Port Swettenham and traveled through rubber plantations and stretches of jungle, which seemed fast giving way to the planting of more rubber, now and then passing a small town with its Indian, Malay, and Chinese inhabitants and its brick shop houses and thatched huts, until we had covered the twenty-six miles to Kuala Lumpur.

Kuala Lumpur is a beautiful city, with a picturesque arrangement of government buildings of Moorish architecture and built of brick, good stores of both native and European wares and supplies, well-kept parks, club houses, and athletic fields. The city is situated at the confluence of two rivers, and its name means "Muddy Mouth," for one of these rivers is extremely turbid. At the fork of the two rivers is a splendid Mohammedan mosque, and across the river not far from the mosque is a Christian church. In fact, Christians, Mohammedans, Buddhists, Brahmans, and followers of Confucius are here intermingled on the streets, in banks, in stores, in government buildings, and in almost every place except in private homes.

The principal products of the land are rubber, tin, and coconuts, but the trade in Kuala Lumpur includes all things needed in the lives of the various people and by their different methods of cultivation and mining.

There are a number of iron foundries, machine shops, and structural shops in Kuala Lumpur, some operated by Orientals and others by Europeans. We later found these shops well able to do many classes of work, and they served us well in making repairs for our machinery and even in making new parts for the head works of our hydro-electric plant. Bentong is a smaller city, but it is the seat of government for an extensive and important section. A good government hospital is maintained there. The power site which we were to develop

was situated on the Perting River about five miles from Bentong, and the dam and intake were one mile further upstream. A good wagon road ran from Bentong two and one-quarter miles in the general direction of the power site, but the rest of the way was over jungle trails on steep and, in places, rocky hillsides. We investigated the feasibility of transporting our pipe line and power-house material through the jungle on elephants, but were convinced that this was impracticable and that the road ought to be built even if we had to do the work. We finally contracted with the government to build two and one-half miles of this road for not to exceed \$12,000, work to be done at the following rates:

Cutting and clearing jungle, 1 chain wide, per chain.....	\$1.12
Earth excavation, per cubic yard.....	.112
Earth fill or banking, per cubic yard.....	.123
Rock excavation, per cubic yard.....	.669
Side drains, per chain.....	.56
Dry rubble wall, per cubic yard.....	2.24
Concrete culverts and similar work, per cubic yard.....	11.20

The average pay for first-class Chinese general labor was 56c. per day. Only Chinese labor was used on this road contract. All of the above figures have been reduced to gold dollars, as are all the cost figures given herein. One hundred dollars Straits was at that time equal to 55.75 dollars gold.

The road crossed many small mountain streams requiring stone or concrete culverts. Large granite boulders and ledges were often encountered, for the road was laid out on grades not exceeding 4 per cent, and the hills were steep and rugged. Heavy, dry rubble retaining walls were sometimes necessary to hold the road in place. In fact, the road resembled the roadbed of a heavy single-track narrow-gage railroad, but it illustrated the substantial way in which the Public Works Department of the Federated Malay States carried out its work.

The road work was divided among six Chinese contractors, and the company supplied them with power and fuse for blasting and even helped them to finance their contracts. This plan worked well, and most of the contractors did all that was expected of them. However, some of them gave trouble and had to be replaced by better men.

A private road was built from our power house, following about a 15 per cent grade most of the way up to the new government road, a distance of nearly half a mile.

The section of the Perting River used for the power

development has a drop of a little over 450 ft. in about a mile, but by a survey it was found that a pipe line only 4,000 ft. long would connect the intake with the power house. The river usually carried about 100 or 150 sec.-ft. of water, but in flood the flow increased to about 4,000 or 5,000 sec.-ft. Owing to the steep hills and heavy rainfall, these floods would occur suddenly and would almost as suddenly subside. It was found impracticable when constructing the diverting dam to build the protecting wing dams and bulkheads strong enough to withstand these floods, and these temporary works had to be rebuilt several times. The average annual rainfall for the previous ten years in Bentong was 93 in., and in the surrounding hills considerably more.

Above the power site, many small hydraulic tin mines dumped their tailings into the river, until the stream was forced to carry great quantities of sand and gravel. The settling of this material and its removal from the water before it reached the power house proved to be the greatest problem. To overcome this trouble it was decided to build a settling basin about 1,000 ft. from the dam, 12 ft. deep and of irregular shape to suit the ground but equivalent to about 50 ft. square. The basin was divided into two parts by a skimming-wall 60 ft. long, rising to within 6 in. of the surface of the water. Thus most of the heavy sand was caught in the first compartment, and the finer and lighter sediment was deposited in the second one.

The power plant required not more than 30 cu.ft. of water, and as there was always much more than this in the river, and as there was a 36-in. pipe from the dam to the settling basin, with a 9 ft. minimum difference in elevation of water surfaces, water could be wasted either at the settling basin or from the 36-in. pipe leading to it. Owing to the low velocity in this pipe, a lot of coarse sand and gravel settled to the bottom. To take advantage of this settling, and of the fact that water could be wasted from this pipe, holes 24 in. square were cut in the bottom of the pipe at two points along its length, and over these openings were bolted hopper-shaped iron castings which tapered from the 24-in. square openings at the top to 6 in. diameter, flanged openings about 18 in. below the pipe. To these 6-in. openings, 4-in. flanged nozzles were bolted, which were allowed to run continuously. A great deal of sand and gravel was in this way removed from the water, which added somewhat to the efficiency of the settling basin.

For the diverting dam, 300 bbl. of cement was purchased in Kuala Lumpur at \$3.25 per bbl. and hauled fifty-two miles by bullock carts through Bentong to the end of the wagon road, for \$1.87 per bbl. It was carried the last three and one-half miles to the dam over jungle trails by Chinese coolies for \$2.36 per bbl., making the cost per barrel of this cement, delivered at the dam, \$7.48.

After the wagon road had been extended to the power-house site, so that the cement was carried by coolies only three-quarters of a mile to the dam, the total cost of transportation from Kuala Lumpur was reduced from \$4.23 to \$2.60 per bbl.

The dam was a rubble masonry arch, 60 ft. long, 2½ ft. wide on top and about 10 ft. high, with a 5 x 6-ft.

scour gate at one end, set 5 ft. deep in a channel blasted out of the granite ledge on which the dam was built. At the other end an intake chamber 10 ft. wide served to let the water into the pipe line.

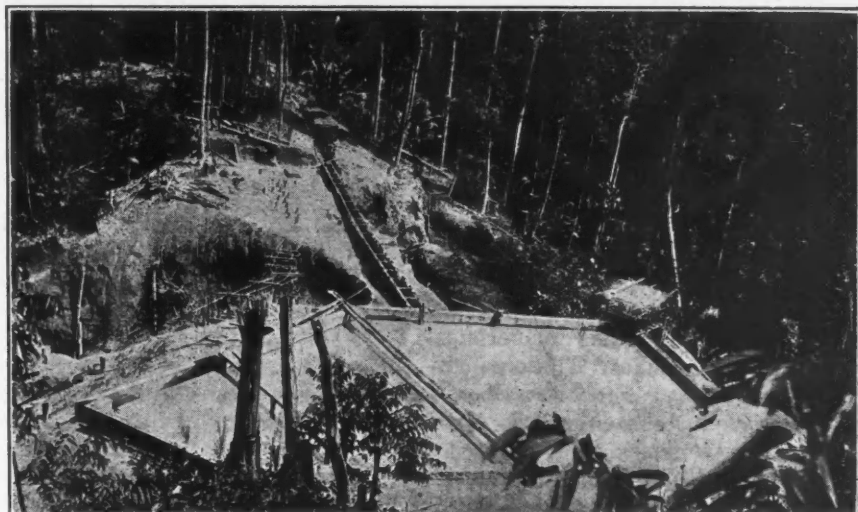
On April 14, 1916, the dredge superintendent, Mr. Lepetit, and two American winchmen arrived from California. One of the winchmen brought with him his wife and little daughter, and they proved to be a great boon to the camp.

A site for building the dredge was selected at the extreme lower end of the dredging property, where a long pit had been excavated near the road by early Chinese miners. The bottom of this pit was leveled, and levees were thrown up across it about 200 ft. apart, so that when the dredge was floated by filling the pit with water it would have a suitable pond in which to start digging. Stocks on which to build the dredge were made by placing on end short sections of round logs obtained from clearing this part of the dredging ground.

On May 24, 1916, the "Manila" arrived at Port Swettenham, and her cargo was transferred without difficulty to the narrow-gage railroad, which carried it to the freight yards at Pudu on the outskirts of Kuala Lumpur. The hauling to Bentong by the two electric motor trucks was promptly begun. The trucks were run day and night, with three Malay drivers for each truck. It was found that much of the material could be transported more economically on bullock carts, and as there seemed to be no limit to the number available, no time was lost in making use of them. Each cart was capable of carrying 2,000 lb., and by selecting carts drawn by strong bullocks, this average weight was maintained. The cost was \$8.40 per bullock cartload, and each cart made the fifty-mile trip to Bentong in from three to four days.

The total weight of equipment and cement was about 1,100 tons, of which 450 tons were hauled by the trucks at \$31 per ton and 650 tons by bullock carts at \$10 per ton, making the total cost of the hauling from Kuala Lumpur to Bentong \$20,450. These costs include direct supervision and the expenses pertaining to the headquarters maintained at Pudu, but they do not include the cost of the trucks.

The trucks had to haul all the large and heavy parts that the bullock carts could not carry, including the eleven-ton dredge spuds, which were 40 ft. long and for



Settling basin completed and filled with water

which a hand-steering gear had to be rigged on the four-wheeled trailer, to negotiate the sharp turns on the mountain road, much as a long piece of city fire apparatus is handled around street corners.

If the trucks had transported all our equipment, the cost per ton would probably not have exceeded \$25, but the total hauling would have cost more and taken twice as long, and the construction of our dredge and power plant therefore would have been delayed accordingly.



*Power house and Perting River*

The dredge was constructed under Mr. Lepetit's direct supervision, but we arranged with a Chinese contractor to supply coolies for 50c. per day and to do all the riveting.

To house these Chinese coolies and mechanics, necessary for the construction of the dredge, we built two large camp buildings called "kongsies," made of split bamboo and thatched with palms. These, with their accompanying cook-houses, cost \$445.

In determining each day the amount due for dredge construction labor, the number of coolies was counted and the figure was agreed upon with the Chinese contractor. The Chinese mechanics were paid individually. The contractor was compelled by law to post in each kongsi a record of the amount earned each day by every coolie. Thus, disputes regarding the amount of time worked by any coolie were not delayed until pay day, but were settled promptly.

It was impossible for the California winchmen, who assisted Mr. Lepetit, to learn and remember the names of even the coolies who were doing more or less special work. They, therefore, gave them names that happened to suit their fancy, or perhaps to describe the coolies. These names were more or less as follows: Shorty, Slim, Smilie, Bill, Jim, Pop, Jack Johnson, and so forth. The coolies soon learned these names, and referred to one another by them when speaking to the Americans. The common language used by all Europeans in talking to the Chinese or Indians, and of course to the Malays, is that of the Malays. The language consists merely of a vocabulary,

and as the words do not change in form no matter how they are used, the language is easy to pick up.

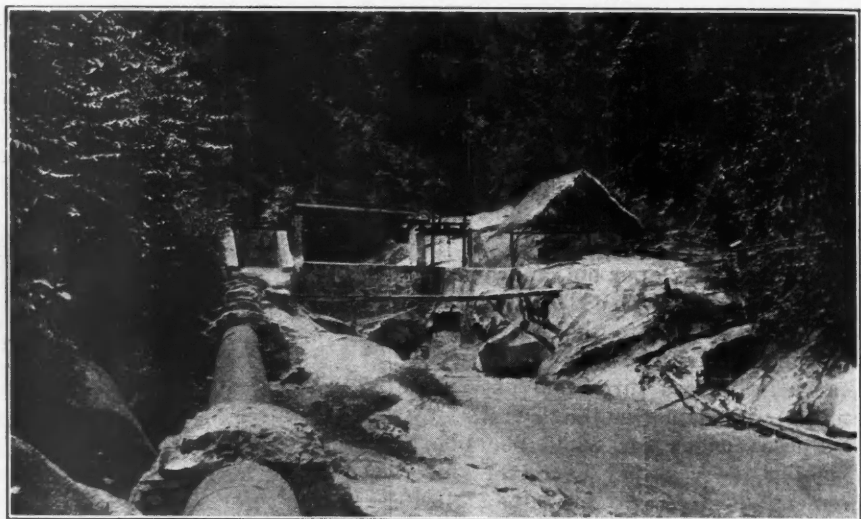
The work of the Chinese mechanics, both in amount done per hour and in quality, compares favorably with the work of American and European mechanics. The Chinese riveters were inclined to slight their work, as do many piece workers, until they learned that we would not accept any loose or imperfect rivets and that we made them cut out all such rivets and redrive them.

When this was thoroughly understood, we had no more trouble with these men. In fact, the entire work of the erection of the dredge went along smoothly until completion. This was attributable in a large measure to the efficient superintendents, but partly to the good work and sense of fair play of the Chinese coolies and mechanics.

The steel plates for the power-plant pipe line were cut to size and punched in San Francisco, but were shipped flat so as to save space. To roll these pipes a set of power rolls was made in a Chinese foundry and machine shop in Kuala Lumpur and set up near our dredge. The rolls were driven by a gas engine. These rolls were not strong enough to shape the  $\frac{1}{4}$ - and  $\frac{3}{8}$ -in. plates used for the 30-in. pipe forming the penstock. These

plates, therefore, had to be rolled by a European machine shop in Kuala Lumpur.

The entire pipe line was riveted together, and the expansion and contraction when the pipe was empty, caused by the great change in the heat between day and night, was taken care of by allowing the pipe to move at each bend. The pipe line was firmly anchored between these bends by large concrete blocks, to which



*Dam and intake for power line*

the pipe was firmly fastened by steel straps and anchor bolts.

The distance from the power house to the dredge along the most practical route for a power line was about four and one-half miles, most of this line being through heavy jungle and part of the way over steep hills. This line was originally surveyed by Europeans,

but careful study of the ground made it advisable to change the line somewhat. This work was slow and difficult, because of the thick growth of large trees and vines through which it was necessary to brush out each line that was surveyed. This work was done by Malays under the direct supervision of an intelligent Malay foreman, who was capable of running lines by compass and making maps of this work. We were fortunate in being able to secure native men to handle technical work of this kind.

The contract for clearing the jungle for a width of one chain along the power line was given to a Chinaman for \$8.35 per acre. This included cutting any large trees which stood near enough to fall across the power line. After this clearing was done, a contract was given to another Chinaman for building a foot-path 5 ft. wide along this line, for \$2 per chain. When this work was completed, the actual construction of the line was begun, and the contract was given for the digging of holes for the power poles at 85c. per hole. These holes were 6 ft. deep and 2 ft. in diameter. The poles were of hard wood, cut in the jungle as near as possible to the power line, and were 7 in. in diameter at the top and about 36 ft. long.

The power was transmitted at 11,000 v. over No. 4 copper wire to a substation near the dredge, where the voltage was reduced to 2,200. The large motors on the dredge were for 2,200 v., but the smaller motors were for 220 and were supplied with current from the transformers on the dredge. The dredge motors were of the following horsepower:

Digging and ladder hoist machinery.....	150
Winch for swinging dredge and hoisting spuds.....	25
Revolving screen.....	35
Stacker.....	25
14-in. high-pressure pump.....	200
16-in. low-pressure pump.....	150
8-in. gravel pump.....	50
Total.....	635

The motor driving the 12-in. pump which supplied the dredge pond with water was of 75 hp. There was also a 5-hp. motor driving a 3½-in. pump supplying the tin shed with water. The total motor horsepower which was necessary to operate the dredge was, therefore, 715.

The company was fortunate in securing the services of Mr. Mudispacher, a Swiss engineer with several years' experience in the Malay States, to build the power house and power line and to operate the whole power plant. He was able to collect a number of Malays with some experience in this work, so that after the construction was completed, a cheap operating crew was at hand that was familiar with every detail of the plant.

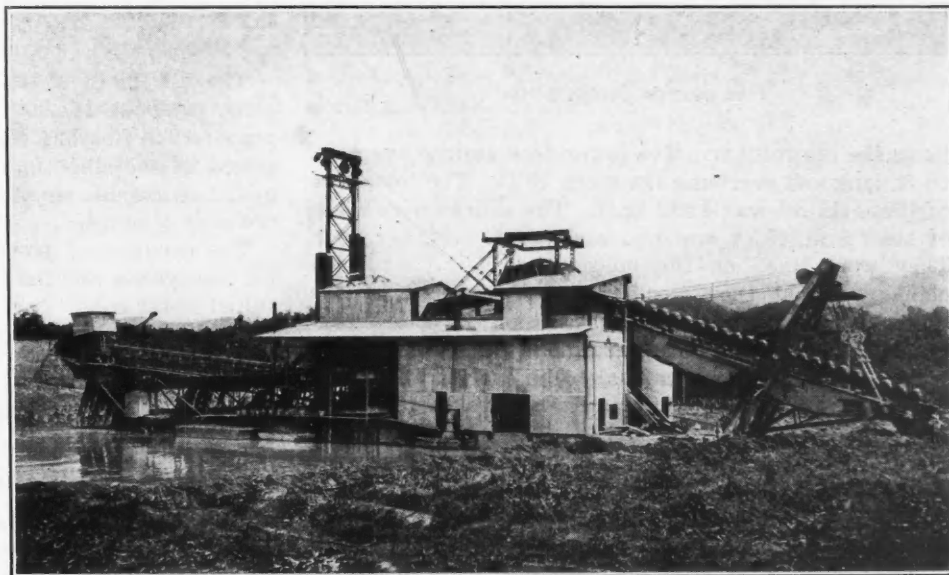
When the power plant had been tested and inspected by the government engineer, the 12-in. motor-driven pump at the river was started and the dredge pit filled through the half mile of ditch which had been dug for this purpose. The dredge was floated into position to receive its bow gantry, then turned around, and the

stacker and spuds were hoisted into place and their tackles completed. It was then turned around again, and the digging ladder and buckets were installed. All of this work was done by the use of the electrically driven winches on the dredge. This completed the whole equipment, and the dredge started digging in May, 1917.

DREDGE AND POWER-PLANT CONSTRUCTION COSTS

The cost of transportation and construction of the dredge and power plant, including the material purchased in the Malay States, but not including the cost of the equipment brought from America or the expense of the trip of the S.S. "Manila" is given in the table in this column, below the illustration.

The ground contained a large percentage of clay, which made it sticky. When the dredge buckets were



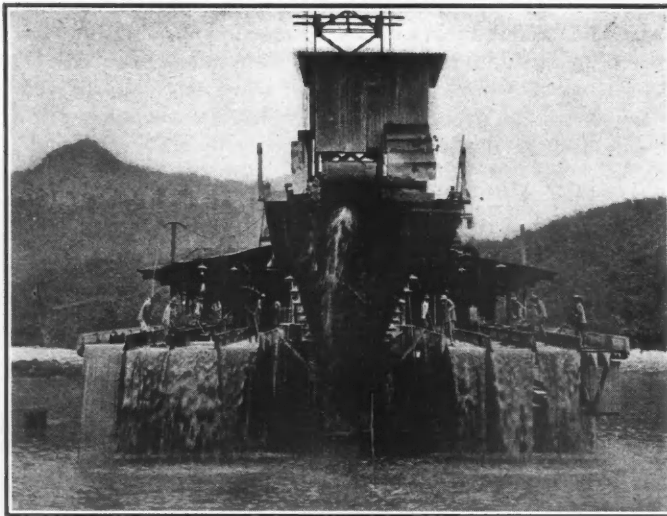
Electrically driven dredge as erected

filled to capacity they would not always dump, and after a few revolutions of the bucket line the buckets became so choked that they had to be dug out by hand. Consequently, it was found best to fill the buckets only a little more than half full, taking a light cut so that the material would not become packed in the buckets. The output of the dredge was thus kept down to not more than 70,000 cu.yd. per month, whereas its output would have been about 120,000 cu.yd. if the ground had been free from clay.

The operation of the dredge was the same as that of the gold dredges in California, except that the tin-saving

Power plant, including transportation from Bentong...	\$48,600
Dredge construction.....	27,400
Transportation, Kuala Lumpur to Bentong.....	20,450
Machine and blacksmith shops.....	270
Tin shed.....	940
Government road construction.....	13,300
Government road upkeep.....	640
Private road to power house.....	1,440
Water supply for dredge.....	1,360
General expenses.....	29,300
Total.....	\$143,700

equipment differed considerably from that required for saving gold. The fine material and tin, after passing through the holes in the revolving screen, was fed by a distributor to two decks of sluices, one about 6½ ft. above the other. There were eight longitudinal sluices in each deck, arranged symmetrically about the center line of the dredge. All of the sluices were 4 ft. wide. Those in the upper deck averaged 85 ft. long and over-



The dredge in operation

hung the stern 22 ft. The lower-deck sluices averaged 66 ft. long and overhung the stern 10 ft. The total area of these sluices was 4,832 sq.ft. The sluices were made of steel  $\frac{1}{4}$  in. thick and had a slope of  $\frac{1}{2}$  in. per foot. They were lined on the bottom by  $1\frac{1}{2}$ -in. hardwood planks, so that they would not be worn out by the chunkles, long hoe-like tools, with which the coolies continually stirred up the concentrate to permit the tin to settle and the lighter material to be carried off by the water. Every eight feet along the sluices 2-in. vertical angle irons were riveted to the sides to hold in place 2 x 3-in. wooden cross-stops used to retard the flow of material down the sluices. When the concentrate filled a section of a sluice, making it level with the top of a stop, another stop was placed on top of the first one until these barriers were built up three or four stops high, which usually took twenty-four hours.

#### METHOD OF OPERATING THE DREDGE

The dredge was shut down about two hours each day to clean the tables, and advantage was taken of this period to make minor repairs and adjustments. To clean the sluices, the stops were all taken up and a small stream of water was turned on. The concentrate was then worked back and forth with chunkles until this operation had reduced the concentrate to about 30 per cent tin ore, much in the way that a flume is steamed down to save gold, except that in the latter operation the riffles are taken up but a number of stops left in. The 30 per cent concentrate was put into buckets and carried to the tin shed, where it was further treated in short sluices and by hand sieves until it was reduced to about 98 per cent tin ore. It was then dried in special driers, sacked, and weighed.

#### METHOD OF MARKETING THE PRODUCT

The tin was sold, f.o.b. our shed, to the Tong Shoon Kongs, in Bentong. This was a Chinese company owning a tin smelter in town and a number of mining properties in surrounding country, including most of the property leased by Tin Bentong No Liability.

The tin mineral, which is an oxide ( $\text{SnO}_2$ ), free from black sand and other such material, was assumed to contain 75 per cent of metallic tin, for many assays gave an average of this value. Concentrate containing 98 per cent oxide therefore contained 73.5 per cent tin.

If the price of tin at Singapore was \$45.16 per 100 lb., as on July 20, 1917, and the concentrate contained 98 per cent tin oxide, the price at which the concentrate was sold to Tong Shoon Kongs was determined thus:

Price of concentrate at Singapore.....	45.16 x 73.5	\$33.19
Government duty of 10 per cent.....		\$3.32
Government war tax.....		.42
Smelting and transportation.....	1.58	
		<u>5.32</u>
		\$27.87
Lease tribute to Tong Shoon Kongs, 5 per cent ...		1.39
		<u>\$26.48</u>

The results of the first few months of operation of the dredge in 1917 were as follows:

Month	Cubic Yards	Pounds of Tin Concentrate	Gross Return
June.....	45,000	33,100	\$8,760
July.....	73,600	70,150	18,650
August.....	61,000	26,900	7,280
September.....	68,600	45,300	12,430
October.....	71,000	52,650	14,400
Total for five months.....	319,200	228,100	\$61,520

The 228,100 lb. of tin concentrate was probably equivalent to about 168,000 lb. of metallic tin, the average price to Tin Bentong No Liability being about 36.6c. per pound of metallic tin. The average market price per pound of metallic tin at Singapore, during this time, was probably about 45c.

The dredge and power plant have been in operation for four years, and the entire equipment has proved well suited to the conditions. Other dredging companies will no doubt install more electrically driven dredges in the Malay States, because fuel for steam dredges is inconvenient to use and expensive when delivered aboard a dredge and the electric drive is generally more efficient.

#### Smelter and Refinery Statistics for 1919

A special report to the Senate Finance Committee by the Bureau of the Census shows that in 1919 thirty-four establishments were engaged in smelting and refining of copper. The invested capital was \$308,680,268. Salary and wage payments totaled \$31,619,716. Officers, superintendents, managers, and other salaried employees numbered 2,309. The average number of wage earners was 17,345. An aggregate of 321,610 hp. was employed. The value of products in 1919 was \$651,101,591.

Twenty-five establishments were engaged in the smelting and refining of lead. Their capitalization was \$115,676,768. Salary and wage payments totaled \$11,281,401. Officers, superintendents, managers, and other salaried employees numbered 915. The average number of wage earners is given as 6,438. The aggregate horsepower employed was 52,565. The value of products in 1919 was \$196,794,519.

In the smelting and refining of zinc, the number of establishments is given as thirty-nine. The capital employed is \$98,757,355. Salary and wage payments totaled \$20,244,747. Officers, superintendents, managers, and other salaried employees numbered 1,107. The average number of wage earners was 13,796. The aggregate horsepower employed was 73,604. The value of products in 1919 was \$104,122,938.

Thirteen plants, with a capital of \$20,227,544, were engaged in smelting and refining other metals. Officers, superintendents, managers and other salaried employees numbered 318. The average number of wage earners was 2,041. The aggregate horsepower employed was 11,700. The value of products in 1919 was \$20,074,504.

## Non-Ferrous Metallurgy in Russia

Several Smelters Treated Copper Ores Until Disorganized Conditions Resulted in Virtually Complete Suspension—Some Plants Have Up-to-Date Equipment—Electrolytic Refineries in Moscow and Petrograd—Lead and Zinc Plants Less Numerous

BY M. G. KORSUNSKY

**A**LTHOUGH copper and lead were mined and smelted in Russia three and a half centuries ago, only crude methods were used up to about 1908, and the production was small. European smelting practice was not sufficiently impressive either as to technique or magnitude to cause the Russians to adopt it. Growing knowledge of American ways and business methods finally impressed the Russian smelters and caused them to undertake progressive innovations, but as the Russian spirit is generally slow-acting, and the period of pre-war improvements did not last longer than about six years, not much headway was made.

At the beginning of the Great War, the Russian copper market was supplied from three sources: The Ural Mountain area; the Caucasus district; and the Siberian region.

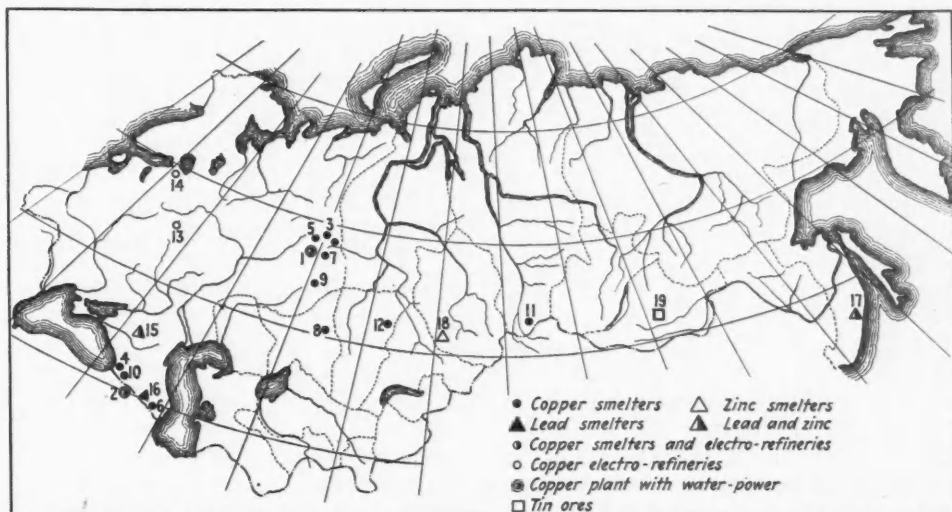
The principal plant in the Urals was the copper smelter of Karabash, belonging to the Kyshtim Corporation, headed by English interests (Leslie Urkhart). The ores were poor in copper but high in silver and gold. They were treated by carefully planned processes, an intelligent duplication of those in use at the Washoe smelter, in the United States. Agglomerated ores were smelted pyritically in a blast furnace to a low-grade matte, and the matte was treated in large basic-lined converters. The resulting high-grade blister copper was refined electrolytically, and the recovered precious metals represented a neat margin of about 20 per cent of the value of the copper. Much thought was given to the recovery of all metals found in the fumes and different tailings; they were concentrated in an immense regenerative Martin furnace, producing a matte of about 10 to 15 per cent of copper. The Kyshtim smelter had an output of 17,000,000 lb. per year.

The Bogoslovsky smelter was much smaller, and produced only 8,000,000 to 9,000,000 lb. of copper per year. The practice here was more varied than at the Karabash smelter, but far more conservative and conducted less efficiently. The metal was sold partly to the rolling mills and foundries and partly to the electrolytic refineries of Moscow and Petrograd.

The Vyisky smelter was the third in the Ural district, having a capacity of about 5,000,000 lb. The technical equipment and methods of work were highly conservative and not especially promising. The existence of this plant depended largely upon high custom duties on imported copper.

A few other smelters existed in the Ural region, but all were either in their infancy (as the Tanalyk smelter), or manipulated with little capital and even less knowledge. Their total output did not exceed about 2,500,000 lb. per year.

The southern slopes of the Caucasus Mountains are rich in copper deposits, but these are distributed in



Map showing location of copper, lead, zinc, and tin smelters of Russia, arranged according to metals smelted, and size

1. Karabash smelter (Kyshtim district). Dressed ores. Water power. Own cheap coal. High-priced custom coke. Efficient labor.
2. Alla-Verdi smelter. (Sangezur district). Dressed ores. Water power. Expensive coke. Oil fuel cheap. Persian labor of low efficiency.
3. Bogoslovsky smelter. (Bogoslovsky district). Undressed ores. High-priced coke. Cheap coal. Good labor.
4. Dzansoulsky smelter. (Batum district). Dressed ores. Expensive coke. Oil fuel. Labor not efficient.
5. Vyisky smelter. (Vyisky district). Undressed ores. Expensive coke. Peat and wood fuel. Efficient labor.
6. Kedabeg smelter. (Elisavetpolsky district). Undressed ores. Oil fuel. Expensive coke. Inefficient labor.
7. Kalatinsky smelter. (Verkh-Isetsy district). Being enlarged.
8. Spassky smelter. (Spassky district). Flotation plant. Being enlarged.
9. Tanalyksky smelter. Small production. Capital lacking. Copper ores contain high gold content.
10. Kvarzhkhana smelter. (Batum district). Under construction.
11. Eniseysky smelter. (Minusinsky district). Undressed malachite ores. Cheap wood fuel and charcoal.
12. Pavlodarsky smelter. (Pavlodarsky district). Shut down.
13. Electrolytic refinery of Moscow (formerly Vogau). Custom high-grade copper. Oil and peat fuel.
14. Electrolytic refinery of Rosenkranz (Petrograd). Custom high-grade copper. Imported coal. Oil fuel.
15. Alagir smelter. (Zinc and lead).
16. Alikent smelter. (Lead only). Inactive.
17. Ore dressing plant only. Lead and zinc ores of the Primorsky district.
18. Ekibastus zinc and smelter. (Riddersky district). Under construction.
19. Tin ores of Onon.

such a way that extensive mining and shipping of the ores to the smelters cannot be successfully undertaken for a long time to come. Therefore, the Caucasus production figures give but a vague presentation of the real possibilities.

The Kedabeg smelter is the oldest large smelter in the Caucasus. It was conducted for about fifty years by the Siemens interests. The process included roasting highly pyritic ores, smelting them to a 35 per cent

matte in round reverberatory furnaces of Siemens patent (fired with two steam-pressure oil burners), and resmelting the matte, after preliminary roasting in heaps, to low-grade blister copper (96 per cent and lower). This blister copper was refined in reverberatory furnaces with air-pressure oil burners, and sent to the electrolytic refinery of Vogau, in Moscow. All operations were conducted with heavy losses of metal in slags and fumes. Instead of blister copper, often a mixture of it with a 75 per cent matte was obtained, and the process was never standardized.

Some decades ago, the Kedabeg smelter was connected with the Kelakent electro-refinery, where the Siemens process of extracting copper from matte by electricity was long but unsuccessfully used. It is reasonable to conclude that no scientific process could be a success in this place, where the operators were content to run a slag containing up to 7 per cent of copper out of the old brick-walled furnaces. The accumulated mountains of this slag were, in later years, removed over a steam railroad to Kedabeg, and resmelted to recover the copper.

An important side line of the business consisted in roasting any ore containing less than 3 per cent of copper, in big heaps covering hundreds of acres; leaching the product with rain water; precipitating the copper on scrap iron in big wooden vats; and melting the cement copper thus produced.

The production of Kedabeg was subject to heavy fluctuations as a result of the shortage of sufficiently rich ore, which occurred only in the form of limited lenses.

Far larger were the undertakings of a French concern, working under the name of the Caucasus Industrial & Metallurgical Co. This company bought up the rights of various small landowners and producers in the southern region of Georgia, and began an extensive mining of copper ores in the Sangezour district, shipping them to the Alla-Verdi copper smelter. Here the customary practice consisted in dressing ores by hand and hydraulic methods; agglomerating them in roasting pots; pyritic smelting to a 30 per cent matte; converting the matte to blister copper in acid-lined converters; refining the blister copper in large reverberatories; and shipping a part of the product to dealers, another part being refined electrolytically at the works. Although the Alla-Verdi smelter was not well planned, consisting of a mass of disconnected units, it was capable of doing a good business, and had fine prospects of growth. It produced about 12,000,000 lb. of copper per year.

The third large enterprise in the Caucasus was the Dzansoul copper-smelting works, controlled by English and American interests. Their copper-ore reserves were large, but the ore was exceedingly refractory. So, although highly pyritic, it could not be profitably smelted in the water-jacketed blast furnaces, and a complete plant built for such treatment had to be dismantled after heavy losses. The smelter began profitable work only after the introduction of reverberatories, preceded by ore dressing. Its output was about 8,000,000 lb., but plans had been made for a markedly increased production.

A well-designed pyritic smelter for the treatment of copper-bearing pyrites included in a basic (dolomitic) rock was built by Siemens at Kvarzhana, near Batum, in the neighborhood of Dzansoul. It was planned for the production of about 8,000,000 lb. of copper per year,

but had barely begun operating when the war occurred.

The Spassky smelter, in the Kyrgis prairies, was operated at modest capacity for a decade on low-grade ores till it was decided that no headway could be made without installing a flotation plant and suitable smelting equipment. The old plant was therefore dismantled, and plans were made for an equipment capable of producing about 11,000,000 lb. per year, but this plant did not begin operations before the war.

Other extensive deposits of copper ores distributed through Siberia were sufficiently developed to permit of the planning of smelters and their auxiliaries. Nevertheless, the conditions of transport, fuel, and even water supply were so difficult that only a concern with large capital and with a heavy demand for copper guaranteed could afford to start operations. To illustrate: In the Transkaspien district, in a region devoid of fuel, inadequately supplied with water, and subject to many difficulties with regard to the installation of necessary transportation systems, are deposits of sands bearing finely divided native copper in abundance.

#### WAR'S INFLUENCE ON PRODUCTION

Despite the fact that copper was one of the foremost necessities for successful warfare, the Russian copper smelters experienced heavy setbacks during the war. Even the smelters of the Ural, so remote from the fields of the struggle, gradually declined. In the first place, when no definite mobilization policy was followed, they were robbed of their most skillful workmen, who never returned to the district. Then, when the war became strenuous, these smelters could not get the most necessary commodities, from pure sulphuric acid, needed in the laboratory, to structural and sheet iron.

The smelters of the Caucasus were even more afflicted. They came into real contact with the battlefields, and, as the inadequate railroads were too busy transporting human and other war material, the smelters were cut off from essential supplies of coke and building materials.

#### RUSSIAN COPPER PLANTS DURING THE REVOLUTION

The tremendous tottering of the Russian currency, which began about three months before the revolution, could not remain unobserved or unfelt by any industry, and the copper smelters were no exception. If one considers that the whole internal output of copper was controlled and mostly paid for by the government on a fixed-price basis, while the costs of production soared divergent and uncontrolled, it can be imagined that this particular industry was highly depressed. The copper-smelting industry could not survive without a broad constructive intervention by the government and the people. Unfortunately, the first provisional government was too weak and too busy to try to cope with the situation, and no strong and constructive forces existed outside of its ranks. Afterward, when the Bolsheviks came into power, they tried to solve every problem of economic life by issuing decrees, planned and introduced into industrial life by young people with no technical knowledge and not a trace of industrial experience. Therefore, all their efforts were doomed to remain either fruitless or destructive.

The marked shortage of domestic copper and the heavy demand for this metal in various war-supply industries were met chiefly by enlarging the quantity of imports. Only a little copper was imported from Japan, most of the total coming from the United States.



RUSSIAN COPPER IMPORTS  
In Millions of Pounds

	1913	1915	1916	1917
Total imports.....	18	45	65	85
Imports from United States.....	8	37	57	75

Still, the needs for copper were not sufficiently covered, and the amount of this metal used for private and community purposes dropped to approximately 25 per cent of normal.

OUTLOOK FOR THE RUSSIAN COPPER INDUSTRY

There can be no doubt that for a period of not less than five years no hope can be entertained for the resumption of copper production in Russia to its former level. Meanwhile, the country will be in sore need for this metal for reconstruction and progress. The potential Russian demand amounts to not less than 100,000,000 lb. of copper per year.

OTHER NON-FERROUS METALS IN RUSSIA

Metals other than copper were never produced to any material extent in Russia. Lead and zinc ores are found in good deposits, both in the Caucasus and Siberia. A few smelters in the Urals and one in the northern Caucasus turned out about 10,000,000 lb. of lead annually. A quarter of this quantity was produced by copper smelters as a complex copper-lead matte, for the treatment of which ingenious methods were devised by the Russian metallurgists. The rest was produced by the Alagir Chemical Works (northern Caucasus). This plant had an elaborate equipment for coking semi-lignitic coals, recovering byproducts, smelting lead, and distilling zinc.

Zinc was produced in Russia in small amounts, and

gether with large ore reserves. Although calling for a heavy primary outlay of money, it could supply Russia with approximately 80,000,000 lb. of zinc annually at a profit.

Some extensive deposits of zinc and lead ores are found in the Far East near the shores of the Sea of Japan. The rich ores of this district, even before the war, attracted the attention of the Krupps, and there is no doubt that either these interests, or Japanese companies, will cover this field with the establishment of more stabilized political conditions.

As for the presence of ores of nickel, aluminum, tin, and antimony, little can be said at present. A nickel ore was found at unusually deep levels in the Revdinsky district, in the Ural Mountains. This ore, containing not more than 0.5 per cent of nickel, could not become a source of the pure metal for the domestic market, at least under the technical and economic conditions existing in 1913, but it was regularly mixed with iron ores, and an alloy containing about 2 per cent of nickel was produced as a marketable ferronickel.

Aluminum ores were not found in Russia, despite prospecting work undertaken by governmental and scientific institutions during 1915 and 1916.

Large deposits of antimony ore were known in the southern Caucasus, but they were not mined.

Seemingly important deposits of tin ore were said to exist to the east of Lake Baikal, in Siberia, and both the transport and fuel conditions were favorable enough to warrant starting development work. Nothing was really done, however, and Russia had to depend, right from the beginning of the war, on the tin imported

DATA ON RUSSIAN COPPER SMELTERS, 1913-1918

District	Smelter	Type of Work	Transport Conditions		—Fuel Conditions—		—Power Conditions—		Annual Output (Pounds)		
			Refining	Pre-War	Second Revolution	Pre-War	Second Revolution	Pre-War	Second Revolution	Pre-War	Second Revolution
Ural.....	Kyshtim (Karabash)	Pyritic; bas.-convtg.	Electr. on the spot	Fine	Bad	Good	Bad	Good	Fair (water)	17,000,000	-90%
	Bogoslovsky	Combined	Fire; ship. to ref. and trade	Fine	Bad	Good	Fair	Good	Bad	9,000,000	-90%
	Vyisky Tanalyk	Pyritic Combined	Fire	Fair	Fair	Good	Bad	Fair	Bad	5,000,000	-97%
Caucasus..	Kedabeg	Roast. and reverb. smelting	Fire; ship to refin'y	Bad	Bad	.....	.....	.....	.....	1,500,000	-100%
	Alla-Verdi....	Pyritic and acid-converting	Fire; ship. to refin'y	Difficult	Bad	Good	Very bad	Good	Bad	4,000,000	-95%
	Dzansoul....	Roast. and reverb. smelting	Electr. on the spot	Fine	Very bad	Good	Very bad	Good	Fair (water)	12,000,000	-95%
Siberia....	Kvashana....	Pyritic and bas.-converting	Fire; ship to refin'y	Fine	Bad	Good	Very bad	Fair	Very bad	9,000,000	-90%
	Spassky.....	Flot.; pyrit.; bas.-converting	Fire	Fine	Bad	Good	Very bad	Fair	Very bad	.....	.....
	Tenincy.....	Roast.; smelt.; bas.-converting	None	Difficult	Fair	Bad	Very bad	Fair	Bad	5,000,000	-80%
			Fire	Difficult	Difficult	Fair	Fair	Fair	Fair	2,000,000	-70%
										65,000,000	5,000,000

most of it came from the smelters situated in Poland. These fell into German hands soon after the beginning of the war, and from the former output of 22,000,000 lb., only the Caucasian (Alagir) production of 6,000,000 lb. remained. The latter rapidly declined, owing to the general disorganization of industry and the slight attention given to the question of improving or preserving normal conditions in the zinc trade. It was not difficult for the government to purchase enough foreign zinc to cover the needs of war, and private interests did not continue to require zinc at pre-war rates.

Nevertheless, extensive plans were laid by the corporation owning the Kyshtim property, to establish an up-to-date zinc plant in the Altai Mountains. This district, commonly known by the names "Ridder and Ekibastus," presents exceedingly difficult problems from the viewpoint of transport and labor conditions, but it has enormous sources of fuel and water power, to-

from English producers. The before-mentioned tin ore (and tungsten ore) deposits in Transbaikalia are worthy of serious attention from American prospectors, as they may easily prove far richer than they are popularly supposed to be.

Tin Exports from Bolivia

Vice-Consul Nelson R. Park, at La Paz, Bolivia, cables, according to *Commerce Reports*, that exports of tin concentrate from Bolivia in March, 1922, were 2,702 tons to Great Britain, 1,317 tons to the United States, 103 tons to France, 45 tons to Belgium, 8 tons to Germany, and 4 tons to Chile. In February Bolivia shipped 2,998 tons to Great Britain, 677 tons to the United States, and 211 tons to France, as against 2,593 tons, 1,633 tons, and 50 tons to these countries, respectively, in January.

## Selection of Fans for Pipe Ventilation

Theory of Operation and Calculations To Be Made in Choosing Equipment for Assuring Proper Supply of Pure Air and for Fire Fighting—Computation of Characteristic Curves at Different Speeds—Discussion Limited to Small Fans

BY WALTER S. WEEKS

**K**NOWLEDGE of the method of making the calculations that are preliminary to the selection of the proper mine fan for ventilation and fire-fighting purposes is often of practical use. In this discussion I shall consider only small fans and assume that they are of the pressure type. Although the calculations given here may be applied to the large fans, the selection of such fans entails a consideration of many factors that are beyond the scope of this paper. I shall assume that the reader desires only a working knowledge of the fan, and shall tell only such part of the story as will make it possible to obtain the desired results.

The centrifugal fan produces pressure by whirling the air around in the casing. This pressure in the casing is produced in two ways—first, by the generation of centrifugal pressure by the whirling, and, second, by giving the air a high velocity and then converting this velocity into pressure in the gradually expanding scroll of the fan. Think of a fan as a machine that produces pressure, not as a paddle wheel that pushes the air. If a pipe is connected to the fan the air will flow from the fan through the pipe, not because the fan blades push it, but because the pressure in the fan is higher than that of the surrounding air.

When air flows through a pipe it is impeded by friction between the walls of the pipe and the moving column of air. This resistance to the flow of the air is expressed by the formula  $R = KSV^2$ , in which  $R$  is measured in pounds;  $S$  is the rubbing surface of the pipe in square feet (perimeter times length);  $V$  is the velocity of the air in feet per minute; and  $K$  is the friction coefficient, the value of which depends upon the condition of the surface of the pipe and the density of the air.

When a pressure gage is connected to the air pipe it measures unit pressure in pounds per square foot or per square inch.

The symbol  $R$  in the formula represents the total pressure on the end of the pipe toward the fan, necessary to force the air through.  $R$  may be replaced by  $P \times A$ , where  $P$  is the unit pressure in pounds per square foot, and  $A$  is the area of the pipe in square feet. The formula now becomes

$$PA = KSV^2$$

If we divide through by  $A$  we obtain the unit pressure  $P$  necessary to force the air through the pipe.

$$P = \frac{KSV^2}{A}$$

The instrument used to measure the unit pressure is a vertical U-tube with water in it. One end is connected by a rubber tube to the pipe at the fan and the other end is open to the atmosphere. The difference in level in inches of water in the two legs of the U-tube, or manometer, multiplied by 5.2, gives the unit pressure in pounds per square foot.

Now, if we assume having 100 ft. of a given size of pipe, and know the coefficient  $K$ , we may calculate the pressure  $P$  necessary to force given amounts of air through the pipe. If these pressures are divided by 5.2, the corresponding water gages are obtained. These data may be plotted on a chart, such as that in Fig. 1, which is reprinted by permission of the American Blower Co.

As an example of the use of this chart let it be assumed that we desire to force 5,000 cu.ft. of air per minute through 1,000 ft. of 16-in. pipe. What must be the water gage at the fan? Running along the bottom line of the chart we find 5,000. Passing up the 5,000 line we find where it intersects the "16-in. pipe" line. The pressure is read at the left and is seen to be 1.5 in. per 100 ft. As we have 1,000 ft. of pipe it will take ten times this pressure, or 15 in. Unless the fan is able to maintain this pressure at the end of the pipe, this amount of air will not pass through.

### SELECTION OF FAN FOLLOWS CALCULATION OF PRESSURE

The calculation of the necessary pressure is thus simple. The next problem is to select a fan that will do the work. Before we can do this intelligently we must study the action of the fan and become familiar with all operating conditions.

Assume that a short length of pipe is to be connected to a fan with a gate on the end of the pipe and a water gage connected to the pipe at the fan. The fan is run at constant speed. The highest pressure that can be obtained will be given when the gate is entirely or nearly shut, depending on the type of fan used. As we open the gate, more air flows and the pressure drops, until, when the gate is wide open, the pressure is slight. If at each gate opening the air is measured and the pressure is recorded, the necessary data are obtained for plotting the pressure-volume characteristic of that fan at that speed. This characteristic forms the basis of all the fan calculations we shall attempt. Such a characteristic is shown in Fig. 2.

A study of the curve shows that when a given amount of air is delivered, the fan is able to maintain a certain pressure. If the volume of air is increased, the fan is able to hold a smaller pressure, and, correspondingly, if the volume is decreased, the fan can maintain a higher pressure. How may we explain this action of the fan?

Consider for a moment a shunt-wound direct-current generator. Assume that a voltmeter is connected to its terminals and no current is allowed to flow. The armature revolving in the field produces a certain voltage or electrical pressure. If a conductor is placed between the terminals, a current flows and the voltmeter shows a lower pressure across the terminals. This is because some of the pressure produced by the generator is

used to force the current through the wires of the armature itself. Only such voltage is available for the service of the outside conductor as is not used in the armature.

FAN A GENERATOR OF PRESSURE

Think of the fan as a generator of pressure. Its two terminals are the inlet and discharge openings. The manometer measures the pressure across the terminals. The wheel in revolving produces nearly a constant pressure. As air is drawn from the fan, friction in the fan blades consumes a part of this pressure, so only such portion remains to drive the air through the pipe as is not used in forcing the air through the fan blades. The manometer shows the pressure that is left after the fan itself has taken its toll.

If, to use the example worked out, it is desired to force 5,000 cu.ft. of air per minute through the 16-in. pipe, a pressure of 15 in. of water must be maintained at the end of the pipe. If there is no point on the fan characteristic that shows as much as 15 in. water gage at 5,000 cu.ft., the fan will not do the work at the speed at which the characteristic is made. The speed must be increased or a different fan chosen.

The characteristic curves of all the fans to be used should be known. The characteristic at one speed is enough for a start, because characteristics at other speeds may be calculated as will be shown. If possible, a characteristic curve for each fan should be obtained

from the maker. If this is impossible, it may be determined with sufficient accuracy as follows:

Connect 100 ft. of 12-in. pipe to the fan with a gate 20 ft. from the fan. Connect the water gage close to the fan. Run the fan at constant speed and measure the velocity with a high-speed anemometer held in the center of the pipe at the outlet. The reading of the anemometer in feet per minute should be corrected by the friction correction given by the maker. This corrected velocity multiplied by 0.85 will give a close approximation of the average velocity in the pipe.<sup>1</sup>

The average velocity in feet per minute multiplied by the area of the pipe in square feet gives the cubic feet flowing per minute. Seven or eight readings should be taken, starting with the gate closed and ending with it wide open. For each gate opening the water gage and the cubic feet of air should be recorded. These results when plotted will give a curve similar to that in Fig. 2. The fan speed should, of course, be ascertained. A fan may be run at any speed up to its breaking point. The maximum allowable speed should be ascertained from the fan maker.

As has been stated, if we have one characteristic, we may compute others. Let us assume that the characteristic in Fig. 1 was made at 1,000 r.p.m., and that from this we desire to construct characteristics at other speeds. The fan law which applies is this: With

<sup>1</sup>"A Method for Rapid Removal of Powder Smoke in Tunnels," by Walter S. Weeks and George L. Wolfin, *Engineering and Mining Journal*, Oct. 29, 1921, page 699.

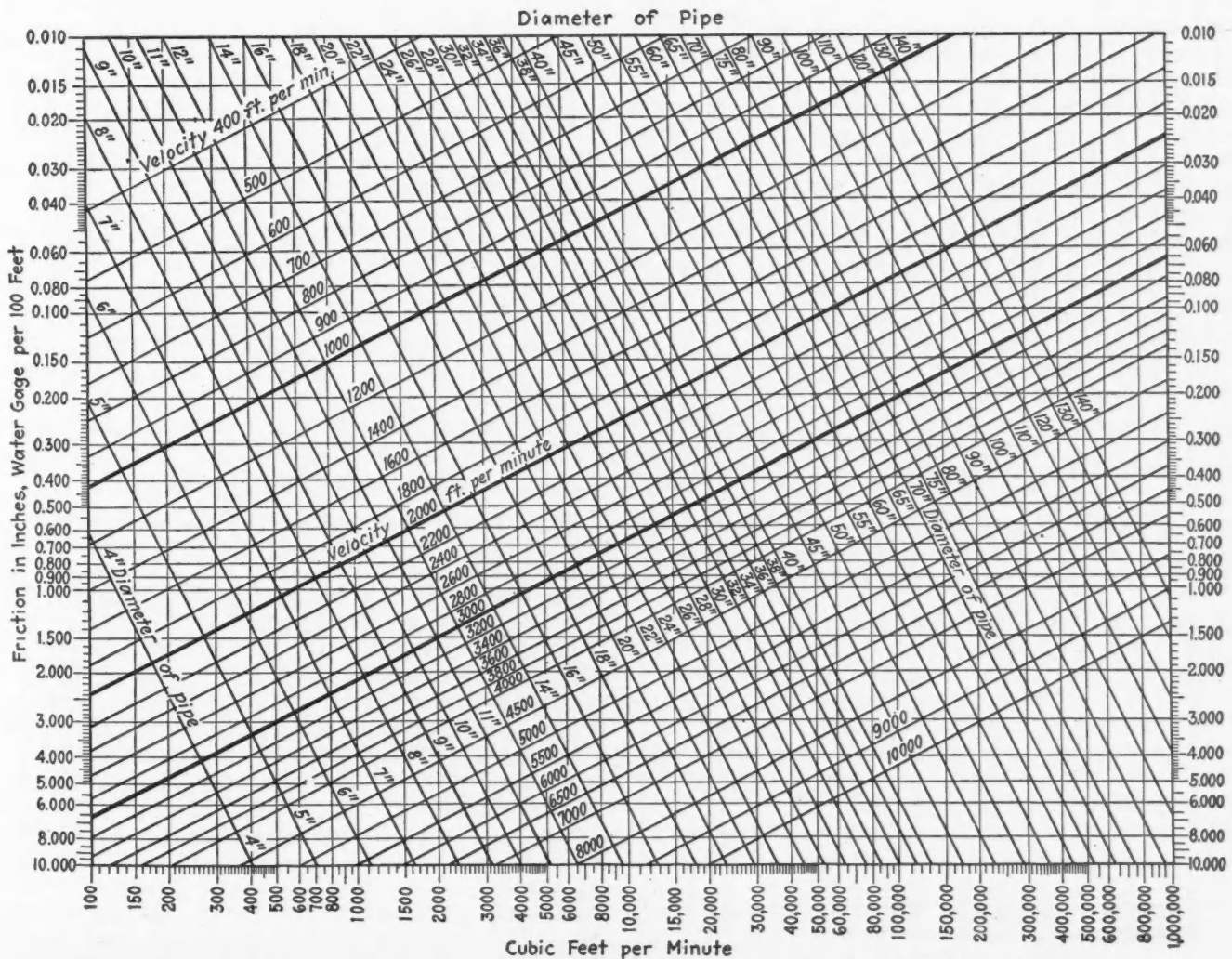


Fig. 1. Chart showing pressure necessary to force given amounts of air through pipe

a given gate opening, the volume of air delivered varies directly with the speed and the pressure varies as the square of the speed. For example: If a fan delivered 4,000 cu.ft. at 6-in. water gage at 1,000 r.p.m., it would deliver at 2,000 r.p.m. a volume of 8,000 cu.ft. at 24-in. water gage, if the gate opening is not changed.

To construct the new characteristic, therefore, select any point on the known characteristic and multiply the volume of air by the ratio of speeds, and the corresponding water gage by the square of the speeds. This computation will give the values for a point on the new curve. The full lines in Fig. 3 are a series of curves at different speeds constructed from the curve in Fig. 2.

From the pipe-resistance chart it is evident that for a given length of pipe, different volumes of air require different pressures to make the air pass through. So we may plot a pipe characteristic for a given length showing the pressure necessary to force different volumes of air through the pipe. Characteristics may be plotted for different lengths. The dotted lines in Fig. 3 are characteristics for different lengths of 12-in. pipe.

When a fan running at constant speed is placed on a pipe of given size and length, we have these conditions: The fan can produce only such combinations of pressure and volume as appear on its characteristic and the pipe can have only such combinations of pressure and volume as appear on its characteristic. So the two jockey a bit, and come to an agreement where the two characteristics cross. At this point, with the volume shown on the chart, the fan will produce exactly the pressure that is necessary to force this volume through the pipe.

My suggestion for the rapid selection of a fan to do a given piece of work is this: Plot a series of characteristic curves at different speeds as in Fig. 3, for each size and type of fan. To the same scale plot on tracing cloth a series of pipe characteristics for the lengths of pipe that will be used.

All that is necessary to determine the speed at which a fan must be run to force a given amount of air through a given length of pipe is to place the tracing cloth on a fan characteristic chart and select a crossing at the desired amount of air. Fig. 3 shows how the characteristics will appear when this is done. If, for example, we desire to force 2,500 cu.ft. through 200 ft. of pipe, we see that at that volume the 200-ft. pipe characteristic crosses the 1,400-r.p.m. curve of the fan.

If the motor is direct-connected and its speed cannot be changed, we shall be limited to one characteristic for that fan. Several of such single characteristics may be

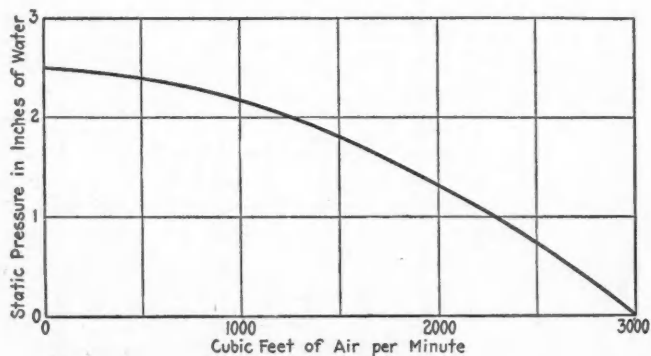


Fig. 2. Fan characteristic

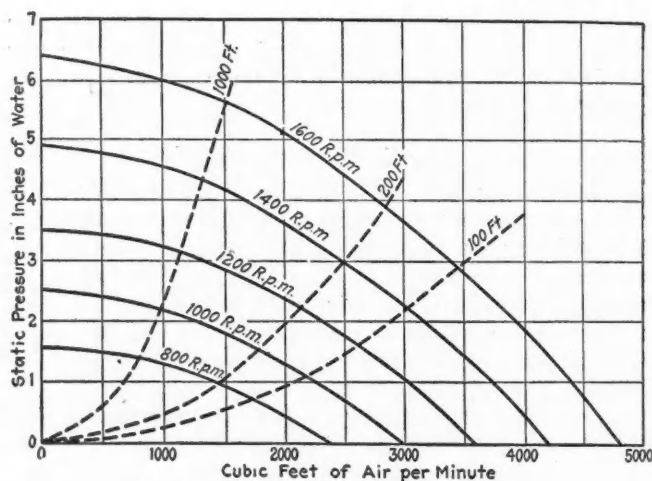


Fig. 3. Fan and pipe characteristics

drawn on one chart. The intersection of a pipe characteristic and any one of these fan characteristics indicates the maximum volume that can be obtained. Anything less than the maximum may be obtained by means of a gate. The fan should be selected that most nearly meets the condition.

So far we have considered only pressure fans. If the fan is to be used as an exhauster, increase the amount of air that is actually desired by 10 per cent and use the chart as if dealing with a pressure fan.

It remains now to consider the power necessary. It is safe to assume a 30 per cent efficiency for fan and motor, so the power to run the fan will be:

$$\text{Horsepower} = \frac{5.2 i Q}{33,000 \times 0.30}$$

$i$  = water gage and  $Q$  = cubic feet of air per minute.

If the fan is throttled by a gate, use the water gage from the fan characteristic that goes with the amount of air actually flowing, for computation with the above formula.

The fan efficiency, of course, will change with every change in the piping. Sometimes it will be high and sometimes low. I selected a low efficiency for use in the formula to allow for most conditions. While the fan characteristic is being determined, the motor should be watched for heating. As the flow of air increases, the load on the motor increases, and the motor is most heavily loaded when there is no pipe or gate on the fan.

### California Gold Dredging

In a paper presented to the local section of the A. I. M. E. in San Francisco, Newton Cleveland gave some interesting facts about the California gold-dredging industry. Mr. Cleveland's wide experience in gold dredging and his long-continued study of this industry make his contribution authoritative. He said that 132 gold dredges have been constructed in California up to 1922. At present thirty-one are in operation. Of a total gold production of \$124,726,430 by dredging operations, earnings have been returned amounting to \$31,000,000 on an investment of approximately \$32,000,000 during a period in excess of twenty years. The approximate average return on invested capital is more than 10 per cent. According to Mr. Cleveland, 75 per cent of the dredging companies have paid better than 15 per cent on the capital invested. This is a remarkable result, and indicates the stability of the mining industry when efficiently controlled.

## The American Zinc Institute

Association Has Effected Pronounced Changes—Zinc Industry Efficiently Organized and Interested in All Matters Affecting Its Prosperity

By FELIX EDGAR WORMSER

Assistant Editor, *Engineering and Mining Journal-Press*

ON TURNING the knob on the door of its modest New York office and entering, a person unfamiliar with the work of the American Zinc Institute would probably inquiringly view the grand assortment of zinc manufactures, shingles, gutters, leaders, and nails, that meet his gaze, and might incorrectly conclude that someone is contemplating building an addition to the office. Zinc producers are so intensely interested in widening the market for their product that they have used their association to gather an interesting and comprehensive collection of zinc articles—a minor phase of the institute's work, but one that is immediately noticeable. Other phases quickly become apparent as one delves into the causes which led to the formation of the organization and learns that in the four short years of its existence it has become the best-organized trade association in the non-ferrous metal-mining industries, with about 95 per cent of the American zinc industry represented in its membership.

Agitation for an association of zinc producers became active during the war and was translated into an accomplished fact on July 29, 1918, when, in St. Louis, an earnest group of zinc miners, smelters, and manufacturers laid the foundation for the present body. Looking back upon that period, one wonders how an industry which has been continually accused of secrecy and backward business methods could have organized so readily, but the credit is placed upon the war, which doubtless caused producers to realize how small their differences were when it came to the great task of winning the conflict. At any rate, opportunity knocked, and the zinc producers bade it enter. Directly responsible for the convocation in St. Louis was the recommendation of Pope Yeatman, then chairman of the non-ferrous metals section of the War Industries Board, that zinc miners and smelters reconcile their quarrels by getting together in a common organization that could co-operate in an effective manner with the Government.

### MANY SMALL PLANTS ENGAGED IN ZINC PRODUCTION

Zinc mining, it must be remembered, has a peculiar industrial status. A few large producers, such as the New Jersey Zinc Co., the American Metal Co., the United States Steel Corporation, the American Zinc, Lead & Smelting Co., and the Anaconda Copper Mining Co., with an output from their own ores, are most influential in supplying the galvanizing and brass industries of the country, but there are also a host of small producers who mine zinc ore and dispose of it to the large smelters in the Middle West. They are a highly important factor in the industry. The equipment of these small mines is intended for a quick exploitation of the deposits, and, as such, is not often of the most efficient type. The mines being comparatively shallow, production is quickly attained, and if the mining occurs on leased ground, the question of operating before the expiration of the lease is an added incentive of production.

A dollar invested in a Middle Western zinc mine will return an income more quickly than one invested in

copper, owing to the simpler quality of the plant required and the generally greater ease in mining. Zinc smelters have in turn become dependent upon the miners for an adequate supply of zinc concentrates, and the fact that they are mutually dependent, that one must buy and the other sell, has frequently introduced a hostile spirit between the two—the miner often feeling that he is being paid poorly for his concentrates and the smelter that too high a price is being paid considering the risk assumed. This feeling was intensified during the war, when prices fluctuated violently and when the industry was overbuilt and overstimulated.

Just before the armistice a Zinc Producers' Committee was to have been formed by the Government, a forerunner of the present American Zinc Institute—to conciliate the various conflicting interests; but the end of the war put a sudden stop to the aid of the Government in ironing out industrial difficulties. Thereafter ills had to be cured by the patients. Thanks to the remarkable change in spirit that had been brought about by the effort to fight a determined enemy, and a realization that internal wrangling was worse than desertion in an army, the various groups in the zinc industry of the United States were prepared to cast off the veil of mutual distrust and secrecy which had done so much to discredit them in the eyes of the public.

### DISSENSION MARKED A FEW YEARS AGO

Antagonism not only between miners and smelters but among the smelters themselves was prevalent prior to the war, a spirit not conducive to the development of an industry to its highest point of efficiency and usefulness to society. Looking back upon those days it is no doubt difficult for the operators to realize that they were so stupid in their old attitude, when everyone shifted for himself and when matters common to the whole industry were subordinated to the position of each individual industrial unit.

On July 29, 1918, Victor Rakowsky presided over the first meeting of the new association, which was called by a group of Arkansas, Kansas, Missouri, and Oklahoma zinc producers who had previously conferred with Mr. Yeatman as to the advantages and necessity of organizing the various factions in the industry. Mr. Yeatman gave it his hearty support. At this meeting the urgent need of both miners and smelters co-operating with one another and working whole-heartedly together was emphasized. The field of an American Zinc Institute was debated, and the advantages of promoting the wider use of zinc, establishing uniform systems of accounting, the collection of better statistics of production, consumption, and stocks (prices were not discussed so far as I have been able to ascertain), and the improvement of technical processes in zinc mining and smelting, were too strong to resist. It did not take long to start the wheels of the actual organization machinery moving. In fact, the method pursued is not a bad guide for other industries having under consideration the formation of a similar association.

First, it was resolved to form a nominating committee of twenty-one persons which was to select an organization committee of seven representative persons chosen from the zinc mining and smelting industries. The organization committee was given power to form a plan of organization for the institute, to select a board of twenty-one directors, to nominate officers for the ensuing year, to prepare a report of their transactions, together with a plan of a ballot by mail, and lastly to mail within ninety days to all persons attending the meeting, and to all other persons whom the organization committee desired to invite to become members of the institute, a report of the committee's transactions and papers for casting a postal ballot.

Rakowsky, Ingalls, Siebenthal, H. I. Young, and O. F. Brinton took a prominent part in the organization proceedings. The organization committee as finally selected included W. R. Ingalls, F. C. Heywood, D. D. Dunkin, Fred A. Hale, Jr., G. L. Coleman, J. H. Billingsley, W. B. Shackelford, P. B. Butler, and J. L. Bruce, representing the mining interests, and A. P. Cobb, A. S. McMillan, William A. Ogg, Julius W. Hegeler, George E. Nicholson, Edward Mosehauer, W. H. Eardly, O. S. Picher, E. H. Wolff, J. L. Hauser, and Charles T. Orr, representing the smelting interests. This committee of twenty-one members finally selected a committee of seven including Victor Rakowsky and J. L. Bruce as mining representatives, E. H. Wolff and A. S. McMillan as smelter representatives, and Charles T. Orr, A. P. Cobb, and W. F. Rossman as mining and smelting representatives.

On Sept. 20, 1918, the committee of seven met in Chicago and attended to the formation of the constitution and bylaws of the society, and on Oct. 22, 1919, as a culmination of the efforts to effect an organization, a certificate of incorporation was issued to the American Zinc Institute. The following representatives of the American zinc industry signed the articles of incorporation: James L. Bruce, A. S. McMillan, Victor Rakowsky, William F. Rossman, E. H. Wolff, Joseph Brenneman, C. M. Loeb, Edward M. McIlvan, George E. Nicholson, F. C. Wallower, J. H. Billingsley, P. B. Butler, J. W. Hegeler, C. F. Kelley, W. A. Ogg, Edgar Palmer, G. S. Picher, A. P. Cobb, Charles T. Orr, G. O. Argall, and Arthur Thacher. Charles T. Orr was elected the first president.

The objects of the American Zinc Institute, according to its articles of incorporation, are broadly stated: "The particular object for which this corporation is to be formed is to promote the welfare of the industry by affording a means of communication between members upon matters bearing on their business interests."

Thus was the American Zinc Institute launched. It has been sailing for four years, and although its voyage has not always been under the most perfect conditions it has easily exceeded the expectation of its builders.

The institute has chosen an equitable method of raising funds for carrying on its work. The plan is based upon the production of the various members. The smelters pay 5c. per ton upon their individual zinc production, and the ore producers 2½c. per ton upon their individual production of concentrates running over 50 per cent in zinc, and 1½c. per ton upon production of concentrates running under 50 per cent zinc. Provision has been made for contribution to the support of the institute when the production of a member drops excessively and for contributions from manufacturers of zinc products on a similar basis to that of the smelters.

Representation on the board of directors is also equitably arranged, and now includes five directors from the smelting industry, five from mining, and eleven from the combined mining and smelting groups.

#### PRODUCERS TO IMPROVE THEIR STATUS

The outstanding accomplishment of the American Zinc Institute, and the one which it has driven hard and promises to drive harder before it is through, is the attempt to obtain for the zinc industry its proper place in the business world. To this end, company and individual animosity has been dispelled, the splendid facilities for getting together to discuss the industry's acute problems at the meetings of the institute have been utilized to the full, and the benefit of hearing the collective opinion of miners, smelters, engineers, manufacturers, and others has been thoroughly appreciated. No longer was zinc to be called "spelter"; no longer was zinc to give way to other metals, and no longer was the zinc industry to suffer from erratic price fluctuations carrying it from prosperity to poverty. That was the new temper of the industry.

The members of the newly formed institute early realized the advantages of acquiring a better knowledge of the business conditions of the industry, and took intelligent steps to procure it. Prior to the organization of the American Zinc Institute the larger producers, with their comprehensive organizations, were able to conduct a well-equipped information service to supply themselves with trade information acquired from various points of contact with the activities of the zinc industry. The smaller producers were less fortunate, and were forced to rely either upon Government statistics or such unconfirmed reports as reached their offices. Government reports, except during the war, were issued once or twice a year, and excellently served their purpose, but for only a short time.

#### FULL PUBLICITY GIVEN STATISTICS

The need of a better statistical service was evident. To remedy this defect the American Zinc Institute soon began to collect statistics of zinc production, consumption and stocks, retort capacity, and activity. At first these reports were kept confidential and the summaries distributed among the members, but through the efforts of the broad-minded and progressive element of the American Zinc Institute, and not without some internal difficulties, it was decided to give the fullest publicity to the composite statistical summaries, and since January, 1922, the association has issued a monthly statement of production, consumption, stocks, retort capacity, and retort activity for the United States that is exceedingly valuable not only to the zinc producers but also to any observer of business conditions. That the zinc industry, which has been so often accused of secrecy and backwardness, should be the first great metal industry to stand for publicity in its current statistical compilations illustrates how completely a new spirit has been introduced in it by the formation and work of the American Zinc Institute.

#### PRICE TABULATIONS AVOIDED

It must be emphasized that in all the institute's compilation no attempt has been made to gather price statistics. In this way, and by its advocacy of publicity, the institute has cleared its skirts of any suspicion that its statistical compilations have any illegal function. Only one person gathers and issues the completed statistics

for the whole industry, and that is the secretary. No competitor knows what his neighbor is doing from any direct report through the American Zinc Institute's offices.

There is so much to be done by the association that it rightly feels it is the height of folly to tamper with any activity that might entangle it with the law. Of course, in the great raw-material industries, whether agricultural or mineral, a broad market usually exists that is exceedingly sensitive to changes in business conditions, and producers may quickly learn what the market level is without statistics. There can be no secrecy in that. Such sources as the grain exchanges, cotton exchanges, the metal quotations of *Engineering and Mining Journal-Press*, and the telephone contact between producer and consumer enable the interested raw-material producer to ascertain what his competitors are doing in the market. This sensitive condition does not obtain in industries dealing with finished or retail products. Hence, the trade association in the raw-material industries has less incentive to deal with price matters. Nevertheless, when it decides not to do so its action is commendable.

#### AMERICAN ZINC INSTITUTE ADVOCATES TARIFF

A problem that has bothered the whole zinc industry greatly has been, and is, the tariff. The American Zinc Institute is splendidly suited to take up this question, and judging from the protection accorded zinc in the tariff bill as presented to the Senate it has been highly successful in its work. Without going into the merits or demerits of the tariff, it is not difficult to see that the full influence of the American zinc industry through its organization could easily be brought to bear upon Washington. Its secretary maintains close contact with activities in the Senate and the House, and has frequently hurried to the Capital from New York to urge upon Congressmen the wish of the zinc industry to be adequately protected from importations. From the standpoint of Congress and the industry it has been more efficient to deal with a spokesman or a few spokesmen of an industry than with a scattered, unorganized group.

The contact which the American Zinc Institute maintains with Washington is exceedingly valuable from many angles. Recently, it was discovered that the Post Office Department had under consideration renewing old street letter-boxes in the eastern part of the United States. Sensing a possible outlet for zinc in these wholesale renewals, the American Zinc Institute proposed that the new boxes be constructed of zinc instead of iron, which corrodes much easier. The matter is now in the hands of the department, and may open an additional use for zinc.

The fact that prospective production is larger than prospective consumption has made the principal object of the American Zinc Institute the stimulation of wider uses of zinc. This is a tremendously important and difficult problem. Prior to the war zinc had practically only two outlets in this country—the galvanizing trade and brass manufactures, galvanizing consumption being the most important. Hence the prosperity of the zinc business was rather firmly interwoven with that of the steel trade.

#### SHEET ZINC HAS MANY USES

At first blush it may be difficult to think of any important independent industrial applications of zinc that give much promise of affecting production. However,

the home wash-board, fruit-jar tops, tips for shoe laces, buckets, pails, alarm clocks, dry-cell batteries, hot-water bottle caps, window glazier-points, refrigerator linings, table tops, sinks, nails, toilet-preparation boxes, picture frames, cameras, humidors, and many other common examples of the interior use of zinc may be mentioned. But the greatest effort to widen the consuming channel at the present time, and one that gives much promise, is the exterior application of zinc to shingles and other building materials where the ability of zinc to withstand corrosion can be utilized to good advantage. Unfortunately for zinc, however, the competition for the roofing business is intense; in fact, the prospective home or factory builder may become quite perplexed nowadays over the choice of a proper material with which to build a roof. Should he use zinc or copper, asbestos, rubberoid, slate, terra cotta, iron, tin or nickel plate, lead or aluminum—or go back to wood? Many of these substances are being vigorously pushed as excellent roofing. Naturally and oddly enough, they all possess merits that can be enlarged upon to furnish ammunition to the advertiser and confusion to the buyer. Cheapness, cold- and heat-resisting qualities, and durability have all been stressed. Zinc compares well with other materials, and has a record of successful use in building construction that speaks better than any theoretical considerations. European builders have used zinc for a longer time than those of the United States. Many roofs said to have been built in Belgium between 1820 and 1850 are still giving service. The application of zinc for this purpose in the United States is only now beginning to look promising and successful. Early attempts to use zinc as a roofing were sometimes failures, due to an inferior quality of metal or to improper application. Then again, quality of permanence is not as important a factor in building in the United States as it is abroad. But zinc has proved so well adapted to roofing in Europe, and has been so little used in the United States, that an excellent field is open to its more extensive application for this purpose. Through the efforts of the American Zinc Institute and the individual shingle manufacturers the public is being educated to the benefits of using zinc for roofs.

The meetings of the American Zinc Institute have been exceedingly valuable in opening discussion as to methods of stimulating zinc consumption, and have brought about a unity of effort that could not have existed without some common meeting ground for a collective consideration of zinc's problems. The institute is now working upon a "Zinc Workers' Handbook," which will describe the proper application of the metal to roofing and supply data to architects and builders that will enlighten them as to the advantages and proper application of zinc roofs. It is an adaptation of a volume published by the Vieille Montagne Co., in Belgium. Communications are constantly coming to the secretary requesting information about the advisability of constructing a zinc roof under certain conditions and requesting sources of additional information, which seems to indicate the great public interest in the work.

The zinc industry is not content with merely pushing into the roofing channel, and has its ear trained to catch any other sounds that would help consumption. Its research work has not reached a stage that can be called perfect, but the industry is not asleep, and the spirit shown in its work since the organization of the institute argues well for an intensive investigation of the market for zinc. The slogan "Make It of Zinc" needs

substantial support to make it effective. No one will make it of zinc unless shown that it is to his particular advantage—that it means dollars and cents to him. The awakening of the zinc trade of the United States, with its compact association, is an assurance that this support will be forthcoming. In fact, the collective advertising of zinc products has been under consideration for many months.

#### STANDARDIZATION WORK AIDED

It is important in dealing with any commodity to know exactly what each trade term signifies. This is no less true of zinc ore and its products than of any other material, so that the American Zinc Institute is now engaged in the standardization of trade terms and has a committee to assist in the international standardization of zinc ore, slab zinc, and sheet zinc specifications. This work was initiated by the Belgian Standardization Association and is being aided by the American Society for Testing Materials and the American Engineering Standards Committee.

Although the American Zinc Institute is a business organization, and must stand or fall as such, many discussions that have been quite technical have occurred at its meetings and been recorded in its reports. It is entirely natural that this should be so; in fact, I look to an expansion of this activity of the institute, for when practically all the units of an industry are gathered in one organization its meetings are ideal occasions at which to discuss technical matters of concern to that particular industry.

There has not been the freedom and interchange of technical information among zinc smelters that has been the practice and custom among other metal producers, and it is highly questionable whether this secretive attitude has benefited anyone. Now that the entire industry is gradually dropping its cloak of mystery, it would be most impressive and encouraging to see it introduce a wider exchange of technical information. A beginning could be made in a small manner, and from the record of the society during the last few years I believe that the movement would gather momentum and become an important function of the institute.

#### AMERICAN PRACTICE SHOULD BE IMPROVED

George C. Stone, probably the best-informed zinc metallurgist in the country, made a careful investigation of European smelting conditions in 1920 for the American Zinc Institute, and at a meeting pointed out the differences in American and European zinc-smelting practices. He started an interesting discussion, and his talk was replete with stimulating ideas for research work in zinc metallurgy. He left the impression that there was much work that could be done to improve American processes, European methods being more efficient than American. If the zinc industry can combine to improve its position in business matters affecting the entire industry, it should also be able to perform similar work in its technical problems, for in the last analysis perfection of technical processes and lowering of costs are just as vital to the prosperity of the industry, if not more so, than the need for, say—a tariff.

It may be something of an innovation for a trade associate to discuss strictly technical matters, but the institute has already done so, and business and zinc technology are so closely allied that certain measures of each can be advantageously treated together.

In any industrial organization success depends upon

the guidance by its officers. The American Zinc Institute was fortunate in having for its presidents two men, Charles T. Orr and E. H. Wolff, whose ability and whole-hearted wish to further the interests of the American zinc industry have helped greatly in the formative years of the institute.

The secretary of any trade association is without doubt the most important officer in the direction of its current affairs. A good secretary can make, and a poor one easily break, the organization. A good secretary must have the ability of a diplomat and the capacity of a horse for work. There are naturally many duties of a conciliatory nature to be performed among the several groups in any trade association. Mr. Tuthill has devoted himself unstintingly to serving the American Zinc Institute, and has turned his office into a clearing house of information about the industry. His vigilance keeps the organization informed of activities in Washington and elsewhere that affect its prosperity, and the monthly bulletin which is issued under his direction keeps members abreast of the institute's work.

The outstanding feature of the American Zinc Institute's activities is the fact that it has been able to accomplish so many useful and valuable changes in the industry. It has set a hot pace for itself, and if that pace is kept up no one should be amazed to see further marked changes. Much remains to be done—which no one knows better than the American Zinc Institute—but with the progressive attitude of its officers, and the support that has been given them, other fields will doubtless be conquered.

#### MORE COST DATA DESIRABLE

Charles M. Schwab, speaking before the institute's annual meeting at St. Louis in 1920, expressed surprise that the zinc producers were so reticent about an exchange of cost information among themselves. His speech is well worth reading again by the producers. The soundness of the friendly after-dinner advice which he gave two years ago is just as apparent today. His theory in accounting for the failure of the zinc business to receive a proper return upon its invested capital was that the zinc producers were not close enough together. His reference to cost information was an illustration of that condition.

G. C. Stone, in a friendly criticism of Professor Hofmann's new book, "The Metallurgy of Zinc and Cadmium," remarks: "If in places it is not as full as we could have wished, the zinc smelters have only themselves to blame. If all of them had given information as freely as a few of the larger ones did, Professor Hofmann would have had the information that would have enabled him to write an even better book."

As soon as the zinc industry follows the copper industry in learning that an interchange of technical information is mutually beneficial, a distinct step forward in producing cheaper zinc will be made.

However, the zinc producers should not be too severely criticised. Highly important changes have been wrought in the industry by the American Zinc Institute since the war, and it is too much to expect a complete eradication of all its defects in four years. Improvements must necessarily be slow, and credit is due the miners, smelters, and rollers of zinc for the admirable spirit they have exhibited at so early a period in their organization. If its record in the past is any indication of what is ahead, a great future may confidently be predicted for the American Zinc Institute.



## USEFUL OPERATING IDEAS

### Preparing Two Stamp Battery Foundations

Novel Method Used To Make Unreliable Shale Formation Safe—Molten Sulphur Employed To Cement Fractured Concrete

BY BERNARD MACDONALD

THE article entitled "Applying the Cementation Process to a Stamp Battery Foundation," which appeared in the *Engineering and Mining Journal* of March 25, interested me, inasmuch as I had a somewhat similar experience in two instances. Perhaps the facts and the remedies employed may be found of interest by others.

In 1910, I was engaged by the Alvarado Mining & Milling Co., of Parral, Chihuahua, to plan and supervise the building of that company's sixty-stamp cyanide mill at Parral. The rock underlying the mill site was a thin blocky shale, the bedding planes of which had a strike diagonal to the center line of the mill, with a dip of 30 deg. Between the bedding planes of the shale there were knife-blade seams of greasy clay, so that the shale strata could be easily lifted one from the other by pick or bar. Evidently, this was an unreliable foundation for heavy machinery, especially so for the concrete block that was to carry the stamp batteries.

The remedy applied was as follows: On the bench graded for the battery foundation a trench 2 ft. deep by 6 ft. wide by 102 ft. long was excavated in the shale. In the bottom of this trench, holes 3 in. in diameter spaced 3 ft. apart were drilled into the shale to the depth of 5 ft. Into these holes pieces of old 16-lb. rails, 9 ft. long, were dropped. Where these rails rose above the collars of the drill holes they were bent from 15 to 30 deg. and leaned irregularly in all directions. A 2 to 1 mixture of sand and cement was poured into the holes around the rails and allowed to set. The lumber form for the concrete block to carry the batteries was then built, the pipe casings for the holding-down bolts were suspended from the battery template, and the concrete was poured. The concrete block measured 10 ft. in height above the bench floor (12 ft. from the bottom) by an over-all length of 102 ft., with a cross section measuring 7 ft. at the bench level by 3½ ft. at the top or mortar base.

The concrete block was a solid monolith, except that a tunnel 2½ ft. by 2½ ft. ran longitudinally through it on the bench level to give access for the removal and replacement of the holding-down bolts in case of breakage. No movement or cracks developed in this foundation block.

The second instance, which I wish to cite more closely, resembled the one referred to in the *Journal* of March 25.

In 1907, the Veta Colorada eighty-stamp cyanide mill, also near Parral, was being constructed, but work was suspended on account of the panic that occurred that year. Four years later, in 1911, the company arranged

to complete the construction, and I was engaged to supervise the work. I found then that the concrete foundation blocks for the batteries which had been poured in 1907 had developed a series of horizontal cracks from 4 to 6 in. apart and extending continuously around the blocks to the depth of 2 ft.; that is, from four to six cracks extended horizontally around the foundation block. The cracks varied from a sixteenth to a quarter of an inch in width. A blow from a hammer on top of the concrete block gave out a cracked sound and would perceptibly jar the block 10 ft. away. These cracks, too, were doubtless due to "badly prepared and badly stamped concrete," and perhaps one layer of the concrete was allowed to set before another was poured on it. After some deliberation the following remedy was decided upon:

A series of 1-in. holes spaced 2 ft. apart was drilled vertically from the top of the mortar blocks to a depth of 30 in., which carried them down through and 6 in. below the cracked zone into the solid portion of the block. Into these holes, pieces of ¾-in. octagon drill steel 30 in. long were dropped, so that their top ends came flush with the top of the concrete blocks. The holes were allowed to dry out for a few days, and then molten sulphur was poured into the holes around the pieces of drill steel. The molten sulphur flowed into all the horizontal cracks and perfectly cemented the parted layers of concrete together, as well as cementing the pieces of drill steel to the sides of the holes. After being set for a few days, the blow of the hammer on the blocks brought out a solid sound and caused no vibration on the top layer.

The battery mortars were mounted on the blocks, and during subsequent operations of the stamp batteries no trouble developed, and the old cracks cemented by the sulphur never reopened.

### Checking Assay Samples by Screening Analysis

BY A. W. ALLEN

In the wet-chemical, bulk treatment of ores, the extraction is based usually on the difference between the amount of metal in the charge and in the residue samples. The theoretical estimate often tallies closely with actual recovery, depending largely on the avoidance of mechanical losses and on the accuracy of sampling and assaying. A discrepancy or an excess in yield may be due to a number of circumstances. In some instances a loss may be apparent rather than real, arising not from the disappearance of metal but because the estimate of the amount in head sample or in residue is in error. A simple method of checking the result, to encourage accuracy in one particular at least—in the sampling—is to see that the screening analyses of both are in close agreement, for the metal is seldom distributed evenly among the various sizings.

It sometimes happens, on drying a residue sample of crushed ore after wet-metallurgical treatment, that a

cohesion of the finer particles occurs; this affects the screening analysis, particularly when mechanical sizing of samples is being practiced in the laboratory; for under normal circumstances it is difficult to insure the breaking up of small agglomerations of fine material that are mechanically associated with particles of rock of approximately the same diameter. In such cases it is sometimes found desirable to wet the head sample retained for screen analysis, afterward subjecting it to a drying and screening treatment identical to that given to the residue sample. It is possible, if this precaution be taken, to compare closely the screening analyses of heading and residue, and without the need for an allowance in consequence of the cementing of the finer particles in the residue.

It is seldom practicable, in routine work, to make screening analyses by a method or combination of methods that insures absolute accuracy. Dry screening, by means of a mechanical separator, is customary; but it is recognized that the coarser particles in the separated sizings may be coated with a minute proportion of fine dust, and that small agglomerations of slime cannot always be broken up completely by customary methods. Routine screen analysis is essentially for comparative purposes—to demonstrate that, as determined by empirical results, desirable conditions are being maintained. The essential precaution under such circumstances is to see that the physical characteristics of the material and the conditions of the test are maintained constant in every respect.

### Surface Arrangements for Hoisting

For cage hoisting, the landing deck arrangements are comparatively simple. The landing deck in almost all cases is placed on one side only and may be covered with steel plate or served by tracks leading to the collar. In the latter case, cross-overs are necessary. The tracks which connect with the plate floor or collar are extended to the ore bins and waste pile. Ore bins, stockpiles, and waste dump are placed as close to the shaft as can conveniently be done.

In skip hoisting, two landing levels are required, one for the skip and one for men and supplies and for changing skips and cages. The skip landing point is of necessity placed above the other landing, to give sufficient height for the bin and chutes. By the use of deflecting aprons, ore and waste can be sent in separate directions.

Two methods for skip and cage changing are in use. In the first the guides are hinged above the collar for a length equal to the maximum length of the cage or skip. The hinged portion is free from the upper and lower sections of the guides. In removing a cage, the hinged portion of both guides in the compartment is turned to one side, the cage hoisted opposite the break and a block and tackle attached to the lower edge of the cage, the upper end of the block being attached to a point above and a moderate distance in front of the shaft collar. The cage is then swung out from the shaft, and, by lowering on the hoisting rope and tackle, it is lowered upon a small flat car. The method requires several men. In the second method, the section of guide timber is pivoted on one end and the lower end swings on an arc. The cage or skip is lowered into a pocket on one side of the shaft collar and below the landing platform. By this method one man can change from skip to cage in about two minutes.

For vertical shafts, bucket dumping arrangements of many different types are in use. Probably the simplest device is a heavy door on which is a short length of track. The door is counterweighted and in position covers the shaft compartment. The bucket is hoisted, the door lowered, and a mine car run over the compartment.

The relative positions of the headframe and hoist depend upon the type of hoist used and indirectly upon the dimensions of the drum. The angle which the hoisting rope makes with the head-sheave plane is called the fleet angle, and is limited to a maximum of 2 deg. The hoist must therefore be placed far enough away from the shaft collar to avoid a larger angle.

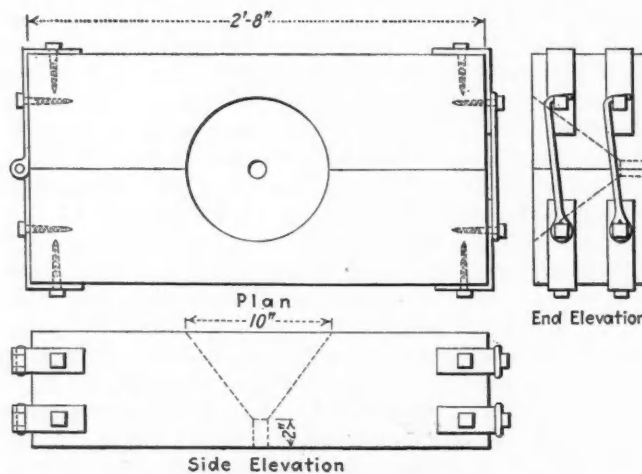
### Device for Oiling Hoisting Rope

BY HAROLD A. LINKE

A useful device for oiling a hoisting rope may be made as follows: Two pieces of 8 x 8-in. timber 2 ft. 8 in. long are laid side by side, hinged together at one end and hooked at the other end, as shown in the sketch. The timbers are surfaced where they join, so as to make a tight, neat joint. Strap hinges made of  $\frac{1}{2}$  x  $1\frac{1}{2}$ -in. iron are attached at one end with  $\frac{3}{4}$  x 4-in. lag screws. The hook angles shown are made of  $\frac{1}{2}$  x  $1\frac{1}{2}$ -in. iron, fastened with  $\frac{3}{4}$  x 4-in. lag screws. Hooks are made of  $\frac{1}{2}$ -in. round mild steel.

Where a lathe is available, a funnel-shaped depression is cut in the timbers as shown, ending in a cylindrical hole 2 to 3 in. long at the bottom. This hole is bored to the same diameter as the rope which is to be oiled.

To use this oiling device, two timbers are laid parallel across the shaft collar and about 10 in. apart, one on either side of the rope. The oiling device is



Device of timber for oiling hoisting rope

then swung open on its hinges, placed crosswise on the two timbers so that the rope passes through the funnel-shaped hole. The timbers are then fastened together with the two hooks.

As the cage or bucket is lowered, oil is poured into the funnel in such quantity as may be required. If the rope is to be lubricated with grease, the grease must first be warmed.

Credit for this device is due John Hosking, assistant superintendent of the Arevalo mine of the Cia. de Real del Monte y Pachuca.

## THE PETROLEUM INDUSTRY

### Oil in the Quadrant Formation in Montana

BY O. W. FREEMAN

**O**IL was first discovered in Montana in the Quadrant formation of the Devil's Basin about fifteen miles north of Roundup, in November, 1919. A few months later the important Cat Creek field, sixty miles east of Lewistown, was discovered, and in March, 1920, oil was struck forty miles south of Hardin, in the Soap Creek field. The oil of Cat Creek comes from the Kootenai, and though the production is chiefly from the top sand of this formation, some has come from another sand about 200 ft. below the first. This lower sand has been called the Lupton sand. The oil of Soap Creek comes from near the base of the Quadrant and from what probably corresponds to the Tensleep formation of Wyoming. At present there are over seventy producing wells at Cat Creek, five at Soap Creek, and two in the Devil's Basin. Only Cat Creek, however, is served with a pipe line. No oil has been marketed from the Devil's Basin and Soap Creek except for drilling purposes.

#### CAT CREEK OIL UNUSUAL

The oil of both Soap Creek and the Devil's Basin is a heavy black oil. It is low in gasoline but high in lubricating oil. The oil of Cat Creek analyses over half gasoline and is not a normal oil, as it has neither a paraffin nor asphaltic base and contains almost no lubricating oil. It appears to have been fractionated and filtered before collecting in the Kootenai sands, probably by passing through other sedimentary rocks after migrating from its source, which is believed to be a considerable distance stratigraphically below the Kootenai.

In addition to these fields, oil has been found in the Quadrant near the eastern end of the Little Belt Mountains, and oil and gas from the top of the Ellis beds near Kevin, Mont. These cannot be classed as proved fields, however. The oil is a normal, paraffin-base product, dark brown in color, of about 30.1 Bé. gravity. It contains some sulphur and resembles Ohio crude in some respects. The gasoline content is average.

There is a nearly complete Paleozoic series of rocks in Montana. The Cambrian is about 1,000 ft. thick, and next above are found beds of black shale and bituminous limestone usually referred to the Devonian. The Devonian is a source of oil in northern Canada, but in Montana it is an improbable source of oil, as the limestones are exceedingly dense and sand appears to be lacking. Overlying the Devonian is about 1,000 ft. of blue-gray limestone, called the Madison, that is of Mississippian or Lower Carboniferous age. Next above comes the Quadrant, followed by the Ellis and Morrison beds, of Jurassic age, and then the Kootenai, of Lower Cretaceous age. The Colorado shale overlies the Koo-

tenai, and Reeves, of the U. S. Geological Survey, believes it to be the source of the oil in the Cat Creek field. He classifies the chief producing sand of Cat Creek, which occurs just below the shales of the Colorado, as being part of the Colorado itself.

#### EVIDENCE TENDS TO DISPROVE OLD THEORIES

I cannot agree with this interpretation. If the oil came from the Colorado shale or from the Kootenai itself, other suitable closed structures should also be found to contain oil in the Kootenai. In the last two years more than a score of such structures in Montana have been tested to the base of the Kootenai without finding oil, so that it seems improbable that the source of the oil was from the Cretaceous strata. The Kootenai formation itself contains beds of coal and shaly matter derived from plants, but as the formation is terrestrial in origin it contains no animal fossils. Few geologists believe that petroleum is formed chiefly from plant matter, and it is improbable that the oil originated within the Kootenai itself. Regarding the age of the top sand at Cat Creek, which Reeves called Colorado and others have called Dakota, on insufficient grounds: I consider it to be Kootenai, as the Colorado is a marine and the Kootenai is a terrestrial formation. About twelve miles west of Cat Creek this sand outcrops at the surface, where it is cross-bedded and conglomerate in character, thereby indicating an origin either from streams or as the last shore deposit made before the advance of the sea in which the Colorado shales were laid down.

In northern Montana there are sandstone beds within the Colorado; in favorable structures it seems probable that oil could accumulate whose source was the shale of the Colorado, but at Cat Creek it is most likely that the petroleum came from sources below the Kootenai. The Ellis formation, of Jurassic age, contains thick beds of black shale that might have furnished some oil, but the most probable source is the Quadrant formation, which is still deeper.

#### CAT CREEK FIELD IN A REGION OF FAULTING

Many structurally perfect areas in Montana have been tested by the drill through the Kootenai in the last three years, and if only one field has produced oil, one naturally wonders what features are lacking in the others. Most of the structures tested have an adequate drainage area and are perfectly closed. The chief difference is that Cat Creek has been tremendously faulted. There are not any faults of great displacement in the field, but there are scores of faults of from 20- to 100-ft. throw. These faults have an effect upon the location of producing wells, and therefore do not appear to dis-

appear at shallow depth. It appears highly probable that the oil from the Quadrant and possibly from other formations migrated upward through these faults until the sands of the Kootenai were reached. Further migration would then be prevented by the impervious Colorado shale that overlies the top sand of the Kootenai. During the migration the petroleum would be altered and fractionated by filtering through strata of different character. Oil has therefore not accumulated in the other structures that have been drilled to the Kootenai, because there were either no faults to permit the migration of the oil upward from deeper formations, or in some instances the deeper formations may not have been petroliferous in that locality.

If we assume that the Cat Creek oil has migrated from the Quadrant, as seems probable from the evidence available, then the location and character of the Quadrant is of paramount importance to the prospector for oil in Montana.

Paleontologists who have studied collections of fossils from the Quadrant in Montana are not agreed as to its exact age. It is usually classified as Pennsylvanian or Upper Carboniferous. But fossils from the lower part of the formation closely resemble some of the Mississippian fossils, and those from the upper part are similar to fossils that occur in the Red Beds of Texas and Oklahoma. Accordingly, it is possible that part of the formation may be considered of Permo-Carboniferous age.

#### WIDE VARIATION IN THE CHARACTER OF FORMATION

The Quadrant formation is extremely variable, both in thickness and in the character of the rocks composing it. It may vary hundreds of feet in thickness within a few miles, and stratigraphic section may vary in short distances. Since drilling for oil has extended down into the Quadrant many operators claim that the logs of their wells are identical with Soap Creek or the Devil's Basin wells, which is taken as a sure sign they will find oil. The facts are that the Quadrant is so variable that probably no two wells drilled through it will have the same log. For example, the logs of two wells near Judith Gap, drilled within a few hundred feet of each other, were entirely different. Again, the discovery well in the Devil's Basin found oil in a conglomerate, called the Van Dusen sand, a few feet thick, but in an offset well a short distance away this oil sand did not exist, and the test resulted in a dry hole. Thick beds of oil shale outcrop in the Quadrant around the Big Snowy Mountains in central Montana, but twenty miles south in the Shawmut dome—a favorable structure superficially—no black shale was found in a hole drilled through the Quadrant and well into the Madison limestone. The Quadrant was much thinner at Shawmut than it was a few miles north, and petroliferous material appeared to be entirely lacking, so a splendid structure was non-producing because of the lack of a source of oil.

The Front Range of the Rockies in Montana runs from the northwest to the southeast, and, in the center of the state, anticlinal mountains extend for many miles almost due east from the Front Range. These are the Little Belt and Big Snowy Mountains, which are separated by a syncline a few miles wide called Judith Gap.

In an investigation of oil-shale deposits carried on by the U. S. Geological Survey the richest shale from Montana was secured from the Quadrant near the Little

Belt Mountains. The formation is also exceedingly thick here, aggregating 1,400 ft. near Utica and Tyler and averaging at least 1,000 ft., although south of the Belts in the Castle Mountains the Quadrant is only 400 ft. thick and consists of shallow water deposits, with little black marine shale. As one goes west it is found that the Quadrant thins out and finally disappears. Near Stockett and Sand Coulee the Jurassic rests directly upon the Madison limestone and the Quadrant is also absent in the north half of the Front Range of the Rockies in Montana.

#### THEORY OF OCCURRENCE

It is therefore believed that there was an extensive land mass extending through Montana during Quadrant time in the approximate locality of the Rocky Mountains, and that this land probably extended east as far as the Missouri River in the latitude of Great Falls. As the Quadrant is thickest eastward along the Little Belt and Big Snowy Mountains, and contains much coarse material there, it seems probable that a great river or ocean current was the cause of the greater amount of sedimentation there.

The Quadrant again outcrops around the Judith and Moccasin Mountains about twenty miles north of the Big Snowies. On the south side of the Moccasins there is an abundance of coarse sediments in the Quadrant, but on the north side the beds are mostly shale. Going north, no further exposures of Paleozoic rocks are found until the Little Rocky Mountains north of the Missouri River are reached. Here the Quadrant has been reported to be entirely absent by the Geological Survey, but it may possibly be represented by a few feet of shale. At any rate, the Quadrant as a mapable formation disappears at about the latitude of the Missouri River.

It is also probable that the Quadrant thins out in eastern Montana. In no place have I noticed any angular unconformity between the Madison and Quadrant. Sedimentation seems to have been continuous, although the deposits were made in shallow water in the Quadrant. It is not known if there was land in Quadrant time in northern Montana, but, if so, its elevation must have been slight, as the sediments seem to have come entirely from the west and not from the north.

A mistake has been made by oil drillers in central Montana in trying to apply the names of the subdivisions of the Upper Carboniferous of the Big Horn Mountains in Wyoming to the Quadrant beds of mid-Montana, when, as a matter of fact, there is present no exact counterpart of the Tensleep, Embar, and Chugwater. The Soap Creek field is comparable, but it would be much better to use local names for the subdivision of the Quadrant further north.

#### NAMES SUGGESTED FOR NEWLY IDENTIFIED SERIES

Around the Little Belt Mountains, W. H. Weed, in U. S. Geological Survey Folios 55 and 56, divides the Quadrant into the Kibbey sandstones and Otter shales. The Kibbey was intended to include the lowest beds of reddish and yellow clayey sandstones and included some reddish shale and gypsum beds. These were overlain by the Otter shales, which vary from black and purple to a vivid coppery green and contain interbedded layers of limestone. To these names I would add two more. Around the Big Snowy Mountains are a series of hogbacks and sloping benches formed by an excessively

hard gray fossiliferous limestone that weathers red. This is well exposed on top of Alaska Bench east of the Snowies. A broad valley has been carved in the soft shales and sands that occur below this hard lime. The name of Alaska Bench limestone might well be applied to this bed, which, on Alaska Bench, is 100-150 ft. thick. Just below it are white to red sandstones 300 ft. thick interbedded with varicolored shale. This is beautifully exposed at the east end of Middle Bench a mile west of the post office of Tyler, and might well be called the Tyler sand. Next below are the green shales and limestone of the Otter; at the base are the Kibbey beds.

Above the Alaska Bench cap rock of limestone are beds of black shale usually classified with the Quadrant, but these beds are non-fossiliferous and in part may belong to the Ellis. They are overlain by sandstones and limestones containing Jurassic fossils.

A generalized section of the Quadrant in central Montana would be as follows:

Description of Rock	Thickness, Feet	Name of Formation
Black shale	100	Alaska Bench limestone
Limestone	50-150	
Gray shale	100	Tyler sandstone
Red and white sandstone and sandy shale	300	
Gray to black shale and bituminous limestone	400	Otter shales
Green and gray shales	200	
Brown, red and yellow sandstone, with shale and gypsum beds	200	Kibbey sandstone

In any specific locality the beds would not coincide exactly with this section, as the formation is variable, but the general sequence will be found to be approximately correct.

If my contention is correct, and the Cat Creek oil in the Kootenai sandstone has been derived from the underlying Quadrant formation by migration through faults, then, so far, all the commercial oil production in Montana has come from rocks of Carboniferous age. In prospecting in new fields it would be wise to select areas known to contain the Quadrant and not to stop drilling until the Madison limestone had been reached.

**QUADRANT IN CAT CREEK FIELD SHOULD BE TESTED**

It is highly desirable that the Quadrant in Cat Creek be thoroughly tested, which could be done with a well about 3,000 ft. deep, and it is probable that the discovery of a large deposit of black low-grade oil would result. Unless wells in northern Montana, and for fifty miles east of the Front Range of the Rockies, find oil in the Blackleaf sands which make up the lower part of the Colorado formation in that region, or in the Kootenai and Jurassic, deeper drilling probably would be useless, as the Quadrant does not exist there. However, if the new well at Kelvin, which is believed to have entered oil in the top of the Ellis, with an estimated production of ten to fifty barrels per day, proves to be a success, it will pay to test the Jurassic in all the structures of northern and central Montana where it can be reached at reasonable depth. Because the best oil shales have been found in the Quadrant of central Montana, and since good reservoir rocks are closely associated with them, it would seem wise thoroughly to prospect all favorable structures in this vicinity down to the Madison limestone; and it is probable that good discoveries of heavy black oil would be made in the Quadrant.

The Tyler sand, Kibbey sand, and sandy and limy zones in the Otter shale would apparently be satisfactory reservoir rocks. But it must be remembered that any particular bed may become thin or change its char-

acter laterally, so that the uncertainty of drilling even in a proved field may be somewhat increased.

In the eastern third of Montana are several large excellent structures in which the Kootenai lies 3,000 to 3,500 ft. below the surface. To test the Quadrant would therefore require a well about 5,000 ft. deep, which would not be practicable at present; and, in eastern Montana, if oil is not found in the Colorado or Kootenai, drilling should cease.

Oil-bearing marine shales have been found in the Soap Creek field north of the Big Horn Mountains and in the Devil's Basin southeast of the Big Snowy Mountains. What the character of the Quadrant is between these two localities is not definitely known. If the absence of black shale and bituminous limestone at Shawmut is a criterion, however, it is possible that the Quadrant is only a few hundred feet thick and probably contains fewer marine deposits in the Musselshell and Yellowstone valleys than south and north of there; accordingly, it would not be as likely a source of oil.

The most favorable sites to test the Quadrant should be between the Yellowstone River and the Big Horn Mountains, and around the mountain uplifts in central Montana. If one were prospecting for oil in the Colorado formation, the most favorable localities to test would be east of the Rockies from fifty to seventy-five miles, and north of the Missouri River, where better sands in the shale beds exist. If a test is desired of the Cretaceous formations above the Colorado—called the Montana group—the best localities would be in east-central and northern Montana. But I believe that the Quadrant affords a better probability for finding oil in Montana than either the Kootenai or the Montana formation.

**American Oil Magnates in Mexico Conclude Agreement with De la Huerta**

"The Mexican government has shown us every courtesy, and Minister De la Huerta has been most generous in giving us fully of his time in order to cover the various matters under discussion. Much consideration has been devoted to tax problems, and results satisfactory to both parties have been reached.

"As to production taxes, a basis of valuation of petroleum products has been agreed upon, using actual selling prices as a criterion, and providing, moreover, for an increase in the rate of taxation as selling prices advance.

"As to export taxes, the arrangement made by the Mexican government with the committee on Sept. 3 last remains effective, and it is expected that during a conference which the secretary (De la Huerta) will have in New York with bankers, a final disposition of this matter will be reached.

"Views on the future development of the petroleum resources of the republic have been exchanged, and at a later conference it is hoped that a satisfactory understanding may be reached."

The above statement was made at the conclusion of a conference in Mexico City by Walter C. Teagle, speaking for the other members of a committee made up of J. W. Van Dyke, president of the Atlantic Refining Co.; E. L. Doheny, president of the Mexican Petroleum Co.; E. C. Lufkin, president of the Texas Co., and Harry F. Sinclair, chairman of the Sinclair Consolidated Oil Corporation.

## Mining Engineers of Note

### B. BRITTON GOTTSBERGER

**I**N OUR undergraduate days we were wont to look askance at professors, believing them to be more or less unapproachable beings. Since then we have discovered that professors are human, very human, and that the aloofness with which we credited them was merely a fabrication of our own weaving. This characteristic perhaps is more desirable in those having to do with the education of mining engineers than with many of the other professions, for certainly the mining engineer requires an understanding of human relations if he is to be a success as an executive. We have heard and read many arguments concerning the ratio of the theoretical and the practical in their relation to the mining engineer's curriculum, but not infrequently that important consideration, the choice of a guiding personnel, is overlooked. In an editorial in this issue we have already pointed out the fact that Yale University is to be congratulated on its selection of B. Britton Gottsberger as professor of mining, and we also feel that Mr. Gottsberger should be felicitated on his choice.

His career has been marked by continuous achievement, and that he will make a similar success of his new calling there is no doubt. Mr. Gottsberger was born in Brooklyn, N. Y., in 1874, the son of Francis Gottsberger, who was a native of New York. His mother was Eliza Peck, of Colonial ancestry with New Haven connections. Young Gottsberger attended the Brooklyn Polytechnic Institute, and upon completion of his studies there entered the Columbia School of Mines, where he received the degree of Engineer of Mines in 1895. His early experiences carried him far afield, his first job being that of assayer for the Montserrat Consolidated Mining Co. at Yuscaran, Honduras. In 1897 he was appointed engineer for the El Oro Mining & Railway Co. at El Oro, Mexico. In 1900 he returned to the States and became mining engineer for the Tennessee Copper Co. at Copper Hill, Tenn., ultimately rising to the position of general manager for that company. His excellent work at Copper Hill led to the selection of Mr. Gottsberger as general

manager for the Miami Copper Co. at Miami, Ariz., in 1909. This company was just beginning operations at that time, and it was due to his efficient management that the properties have become among the great copper producers of the Southwest. In 1920 he

resigned active management of the Miami and moved to New York City, where he has since engaged in consulting practice. Upon the resignation of F. F. Sharpless as secretary of the Mining and Metallurgical Society of America, Mr. Gottsberger was selected for that position, which he has filled admirably. His participation in the various activities of the society, as well as in the American Institute of Mining and Metallurgical Engineers, has evoked most favorable comment, and his example is one which can well be followed by other mining engineers who have the welfare of their profession at heart. Particularly notable has been his work in connection with the recent investigations of mining engineering education which has been carried on by the Mining and Metallurgical Society and the

activities of the Mining Methods Committee of the Institute. Essentially an outdoor man, Mr. Gottsberger has always interspersed his professional activities with plenty of exercise, which is one of the rules of successful management. He has been keenly alive to the necessity for recreational enjoyment among the men with whom he has been associated, and his record shows that his success has not been attained merely by technical ability.

Few men have to their credit as brilliant a record of management as the new Yale appointee has established during his twenty years of experience. He is considered by those who have been intimately associated with him as one of the best qualified American mining engineers who could be chosen for the task of developing a department in Yale University which is of large importance to the expansion of engineering instruction. Beyond question, Mr. Gottsberger—or Professor Gottsberger, as we will now call him—will meet with the same degree of success in his new field that he attained while *major domo* in the Southwest.



B. BRITTON GOTTSBERGER

## SOCIETIES, ADDRESSES, AND REPORTS

### American Zinc Institute Meets at St. Louis

E. H. Wolff Re-elected President—Need of Fund for Advertising Zinc Emphasized—Thacher Asks More Accuracy in Reports of Output and Stocks—Philip N. Moore Optimistic

BY P. R. COLDREN

By telegraph to the "Journal-Press"

**E. H. WOLFF**, vice-president and general manager of the Illinois Zinc Co., was unanimously re-elected president of the American Zinc Institute at the close of the annual convention at the Statler Hotel at St. Louis on May 9. He has previously served two terms in the office.

The vice-presidents chosen were: A. P. Cobb, of New York, vice-president of the New Jersey Zinc Co.; Cornelius F. Kelly, of New York, of the Anaconda Copper Mining Co.; and F. C. Wallower, of Joplin, vice-president and general manager of the Goldenrod Mining & Smelting Co.

More than 100 men engaged directly or indirectly in the zinc industry were present at the convention. A report from the board of directors showed that the institute has weathered the period of depression well, and a spirit of optimism, due to the improvement in conditions in recent weeks, prevailed.

The convention was opened at noon May 8, when there was a short talk by the president, E. H. Wolff, followed by an address of welcome by Edwin R. Kinzy, of St. Louis, and a response by C. T. Orr.

#### IMPORTANT ADDRESSES FEATURE MEETING

Two unusually interesting addresses, each illustrated by lantern slides, featured the afternoon program. One was by R. G. Hall, formerly resident manager for the Burma Mines, of India, who told of the difficulties of mining zinc in that country. He declared that on account of the high cost of labor, caused not by high wages per man, but by inefficiency, and by reason of the remoteness from transportation and the difficulty of securing fuel, the Burma Mines could never compete with producers in the United States.

The other address was by Dr. Charles H. Fulton, director of the Missouri School of Mines, who discussed the practicability of the new process of electro-thermic smelting of zinc. His conclusion, after much experimentation, is that the process may be expected to produce slab zinc from 60 per cent ores at a cost around \$13 a ton, exclusive of office expense and roasting of the ores.

Arthur Thacher, chairman of the advisory committee of the Mississippi Valley experiment station, argued for a

more accurate report on zinc-ore production and stocks in the Tri-State field. It was the sentiment of the convention that this, if it can be accomplished, will be generally helpful to the entire zinc industry.

The principal social session of the convention was the annual dinner, on Monday evening, A. P. Cobb acting as toastmaster.

#### BAD ACCIDENT RECORD SCORED

Both praise and friendly criticism of the mine operators of the Tri-State field was offered by Francis P. Sinn, of the New Jersey Zinc Co., in discussing "What Safety Means to the Zinc Industry." In part, he said: "I know of no other operation in the mining, smelting or manufacturing game, where, with so little equipment, so much work is done, so much per man, and so cheaply as in your mines and mills.

"But what of your accident record? For every 1,000 underground workers working 300 days, 4.91 are killed. That means that five men are killed out of every 1,000. In 1917, 1918, and 1919 one-third of the underground workers were injured seriously enough to lose one day or more of time. This record is not a good one." Mr. Sinn urged the zinc producers to pay increased attention to safety work, declaring it would be effort well expended.

C. H. Stewart, of the American Zinc Products Co., read a paper, in which he urged people of the zinc industry to prove their faith in the metal by using more of it.

#### MORE MINES RUNNING THAN LAST YEAR

In review of the Tri-State field, Otto Ruhl, of Joplin, stated that production recently has increased from around 7,000 tons per week to about 9,000 tons, and said that approximately 100 mines are operating, against an average of sixty last year. He expressed much optimism as to the outlook. Brief reviews of other districts also were given by A. M. Plumb, Howard I. Young, and Charles Bocking.

#### MUST ADVERTISE ZINC

An appeal for the raising of a fund for advertising zinc, not to exceed \$200,000, was made by the publicity committee of the institute. Its chairman, Edwards Gallatly, pointed out that

intensive advertising campaigns are being carried out by other makers of roofing material, notably the copper people, and urged that something be done by the institute in making a start at least toward similar advertising of zinc.

"The general subject has been discussed at the annual meetings for several years," he said. "While it has always been one of the important issues at our convention, it has been impossible in the past to treat the subject more than academically, since there has been no real competition and the entire industry is now facing a situation wherein conditions are entirely changed and where real constructive selling and publicity promotion work must be immediately inaugurated if the industry is to progress."

The report was approved by the convention, and the directors were requested to carry out the suggestions made to the fullest extent possible.

#### PHILIP N. MOORE OPTIMISTIC

One of the most important addresses was made by Philip N. Moore, past president of the A. I. M. E. He showed by the use of graphic charts that the demand and production of zinc, lead, and copper and several other mineral products has been steadily upward since the middle of the nineteenth century, advancing at a great rate when considered in units of decades rather than comparatively brief periods. The natural deduction, he inferred, is that these increases are to continue and the zinc industry must profit accordingly. In part he said: "These cheerful facts teach inevitably that if the producer will hold himself well in hand, will finance himself to produce from an intelligently chosen ore deposit or in a wisely designed plant, guarded against sudden financial surprise, he may go on his way safely, assured that the demands of this land and the outer world will take the product, and if his enterprise be wisely founded, it will, in the period, compensate him satisfactorily for his effort."

It was decided to take a postal vote of the membership to determine whether the 1923 convention be held in St. Louis or in Atlantic City.

#### Mathewson and Van Law Address New York Section of the Institute

Two hundred members of the New York Section of the A. I. M. E. listened to illustrated talks by E. P. Mathewson and C. W. Van Law at the regular monthly meeting at the Machinery Club on the evening of May 3. The meeting was preceded by a dinner.

Robert Linton, who presided, explained that Mr. Mathewson had been commissioned by the New York Section to go around the world and to report what he saw. Having an incidental engagement to solve a small smelter problem in India, Mr. Mathewson had undertaken the task. His route had been through London, Paris, Port Said, Palestine, Colombo, Rangoon, Penang, Singapore, Hongkong, various cities in Japan, and thence to the Golden Gate. His impressions of these places were related in Mr. Mathewson's own, not-to-be-imitated style. He described coaling vessels at Port Said; he explained ancient methods of mining and smelting by the Chinese; he slandered Burma cheroots; described tiger hunting by others—not by himself; and he declared his belief that the Japanese were "the most wonderful people on the face of the earth." He told of their remarkable achievements of half a century.

Mr. Van Law's most recent travels had taken him through Peru. Among others he showed pictures of the remarkable Central Railway of Peru that runs inland from Callao, crossing the Andes at an elevation of 15,665 ft.; the Cerro de Pasco mines and plants; the unique port of Mollendo; and, most interesting of all, the amazing masonry of the ancient Incas at Cuzco. As to the future of Peru, Mr. Van Law explained that the high cost of trans-Andean transportation was a serious obstacle.

### MEN YOU SHOULD KNOW ABOUT

Alfred James is in Mexico City.

H. C. Dudley is at Chihuahua, Mexico.

J. MacDonald Mitchell has returned to New York from Bolivia.

D. M. Riordan left San Francisco recently for an extended stay at San Diego.

D. W. Brunton passed through San Francisco on his return from Tahiti to Denver.

J. A. Burgess is making a geological examination of the Comstock Silver property on the Comstock.

C. D. Kaeding, of San Francisco, has been inspecting operations at Rochester and Candelaria, in Nevada.

J. J. Mac Donald is now at Crown King, Ariz., in the interests of the Crown King Consolidated Mines, Inc.

Harold Stotesbury, consulting engineer of San Francisco, has been in Reno and Tonopah, Nev., on professional business.

J. T. Shimmin, superintendent of mills for the Chino Copper Co., at Hurley, N. M., is now in New York on business.

J. D. Sears, James Gilluly, and W. H. Bradley will do geological work in Moffat County, Col., during the coming field season.

A. E. Fath and W. W. Rubey are to make a study of oil prospects in the part of eastern Wyoming which borders on the Black Hills.

Kuno B. Heberlein, president of the International Process and Engineering Corporation, is now in Europe on an extended business trip.

Charles Butte is investigating the stratigraphy and the paleontology of the lower paleozoic formations in Georgia, Alabama, and Tennessee.

Henri A. Cardozo, manager for the Société d'Electrometallurgie de Dives, operating near Grenoble, France, is visiting our Western copper mines.

A. M. McDermott, general manager of the El Fuerte Mining & Smelting Co., of Los Angeles, Cal., is in Mexico City on business for the company.

John H. MacKenzie moved to new offices on May 1. His address is now Room 1312, California-Commercial Union Building, San Francisco, Cal.

A. J. Collier has been sent by the U. S. Geological Survey to study the geology of the region near Avon, Mont., as a result of the discovery of oil there.

C. E. Dobbin, A. H. Redfield, and J. E. Hoffmeister have been assigned to work on the coal fields of Garfield County, Mont., for the U. S. Geological Survey.

A. J. McQuatters has retired from the presidency of the Alvarado Mining & Milling Co. He has been president of the company since its incorporation in 1910.

Shigeichi Sugihara, a Japanese mining engineer, is studying copper mining and milling processes in the Southwest, at Nacozari, at the Chino mines, Miami, and Ray.

W. W. Wishon, recently elected director of the White Hills Mining Co., of Mohave County, Ariz., has just completed an inspection of the properties of that company.

W. S. Greene is leaving for Mexico, having been engaged as designing engineer for the construction of the 250-ton cyanide plant of the Cia Minera Mexicana, Las Tejones, Yaga, Nayarit, Mexico.

Charles F. Jackson, for the last four years connected with the mining engineering department of M. A. Hanna & Co., Cleveland, is now associated with Crowell & Murray, Cleveland, as mining engineer.

Ivan J. A. Diamond will leave the Kambove mine, in the Belgian Congo, some time in June. His address after July 15 will be in care of the Institute of Mining and Metallurgy, Cleveland House, City Road, London, E. C.

W. H. Webster, who has been connected with the Copper Queen Branch of the Phelps Dodge Corporation, and latterly as assistant manager, was recently tendered a reception and banquet by his friends in Douglas. Mr. Webster is leaving for New York.

Rowland King, of the C. M. Fassett Co., Inc., at Spokane, has been chosen first president of the International Association for Mining Development, an organization formed this spring for the purpose of bringing owners and capital together for the development of Northwest mining properties of merit.

Mining and metallurgical engineers visiting New York City in the week ended May 6, included: Elmer Bird, of Little Rock, Ark.; D. R. Semmes, of Tampico, Mexico; W. A. Reiter, of Dallas, Tex.; H. A. Barker, of London; E. W. Engelmann, of Salt Lake City, Utah; R. H. Townsend, of Mexico, D. F.; Guillermo Machado M., of Caracas Venezuela; H. Hardison, of Santa Paula, Cal.; and John Daniel, of Calumet, Mich.

### OBITUARY

C. H. Ellsworth, of Goldfield, Nev., died on April 25, 1922. Mr. Ellsworth was born in 1871 at Chico, Cal. He entered the employ of Abbot Hanks in the early 90's and remained with him for seven years. When he left for Goldfield he was in charge of the Hanks's assay laboratory. At Goldfield he was solution man in the Combination mill. In 1905 he started an assay office in Goldfield for himself.

Stephen Rickard, assayer and chemist of Denver, Co., died on April 8, at the age of sixty-seven. He was born in London, England, the son of William T. Rickard, and became an American citizen in 1896. In his early life Mr. Rickard was associated with his father in the operation of mines successively in Sardinia, Newfoundland, Arizona, and Nevada. He was assayer and chemist at Anaconda from 1884 to 1887, and later occupied a similar position at the Argo smelter, at Denver, until 1898, when he opened an assay office of his own at Denver, conducting this business successfully up to his death.

William J. West, for the last five years manager of the eastern district on the Mesabi Range, for the Oliver Iron Mining Co., with headquarters at Virginia, Minn., died on April 25 at the Presbyterian Hospital at Chicago, Ill. Mr. West's first experience in iron mining was at Tower, Minn., where he superintended the development of some properties in the late 80's. In 1900 he was in charge of the Sparta mine, at Sparta, and later at the Sharon properties at Buhl, Minn. In 1905 he was made general superintendent of the Oliver properties at Hibbing, remaining there until he moved to Virginia as district manager. Mr. West was a prominent figure on the Mesabi Range, and his loss will be mourned by many friends. He was an able executive, a keen sportsman, and a thoroughly lovable character.



## New Books

### A Study of Conditions Affecting The Manual Worker

REVIEWED BY T. A. RICKARD

**Labor's Challenge to the Social Order.**  
By John Graham Brooks. The Macmillan Company. \$2.50.

This is a book that should be read by engineers, and others responsible for the employment of labor in industry. The author, John Graham Brooks, is well known as an earnest student of sociology. I have heard him lecture and I have read his 'Social Unrest'; he gives the impression of sincerity of purpose—and that, with intelligence, is what we ask of any writer on such a serious topic as the labor problem. In this book he gives the reader the result of his "study of power rapidly and in part accidentally acquired by labor". It is a study of the effects of the War on the laboring class, an examination of the advantages and disadvantages that have accrued to labor in consequence of that great upheaval in the structure of human society. "The same applied science which tightens us into world unities has in a thousand ways put dangerous tools within easy reach of many. The wider education has scattered explosive ideas, while popularized chemistry with other sciences has given to the masses the readiest access to material weapons which the more reckless will never leave unused. Here again, war has been a terrible instructor." He insists that the dominating power of organized labor must be recognized and that the obvious thing to do is to obtain the "assent and co-operation" of the best men in the ranks of labor. "The class which Burke called 'swinish' and Hamilton 'the beast' is now so far in control that it cannot be dislodged. It will retain its power and add to it. Very wastefully and with many rank abuses labor is now to try its hand in managing politics and industry. It has come to believe and upon the whole rightly believe, that the upper classes alone are at the end of their rope; that they are incompetent any longer to direct social forces without disaster to us all."

The author is of the opinion that it is wise to let labor try its experiments, but his mental pose evidently is too detached to be convincing to those who actually employ large forces of men industrially; his cheerful acquiescence in the dominance of the less educated members of the community will irritate many of us in the professions. "So far as it is the aim of these attempts to keep labor from trying out its own revolutionary program, they will as certainly fail as the futile 'Antis' will fail to stop the woman's vote, or as Mr. Gompers will fail to keep the unions long out of politics. We in the United States drift steadily toward the European situation. Labor there at the present moment holds a balance of power which alters every factor in the

problem. Before we are prepared for it, it will be true in our own country." To which I demur in part: the separation of the classes in Europe is more definite and more fixed than in our country; moreover, the distribution of property—of homes, bank savings, and bonds—among our working people is such as to bridge the gap between capital and labor in the United States, as in Canada; Mr. Brooks is laying too much stress on the class-consciousness of the American laborer; the laborer of today is the manager of tomorrow; we as a people have the ability of social self-extrication in such measure as is rare in Europe. However, I agree with him heartily when he says that "for capital, the day of the lone hand has closed"; also for others, because the playing of the lone hand is a poor kind of a game; systematic co-operation is the keynote of progress in human affairs, for individuals and for nations. Class feeling, like nationalism, has been perverted to anti-social uses. The hope of mankind lies in the recognition of the fact that these inter-class and international feuds are mutually destructive. As our author himself says, in another chapter: "For any real approach to humanized relations among the nations there is one test: the acquired habit of working openly and generously together as if the prosperity of one was the prosperity of all".

In another chapter Mr. Brooks discusses the spread of unionization to classes other than labor and the consequent new alliances that are available to labor in its effort to secure political power. It is only too sadly true that unorganized employees are at a great disadvantage in protecting themselves against unfair treatment from their employers. The school-teacher and the college professor are examples of unorganized groups that fail to protect themselves. Many of them refuse the protection that might come by means of unionization, largely because such organization savors of the 'unprofessional'; it is tainted with social vulgarities and misdemeanors; it is repugnant. Nevertheless, it seems certain that the time will come when all forms of labor—by brain as well as by brawn—will find self-organization the most practicable method for redressing social injustices. The employer class is thoroughly organized: every corporation is a union of stockholders; corporations make unwritten agreements among themselves in regard to ways and materials; the Government itself represents the unionization of a political party for the obtaining of power and the distribution of patronage. In co-operation there is strength. Again, the lone hand is a poor game.

An interesting chapter is devoted to "syndicalism". This, as most of my readers are aware, is a term and a method that originated in France; it stands for the sympathetic strike, for the federation of all classes of labor in the effort to assist any one class in obtaining its demands. It has been called "a protest against a State corrupted by capitalism." In the United States we associate syndicalism with the Industrial Workers of the World, a movement

that has aroused widespread irritation, contempt, and opposition among the employers of labor. Mr. Brooks says that the I. W. W. movement has defects that are "common and vicious", but he insists that it can not be dismissed with disdain; that it must be studied carefully and opposed intelligently. Indeed that is the consistent undertone of his writings; he pleads for a scientific, and also a sympathetic, examination of these manifestations of labor unrest, insisting rightly that only by a correct understanding of the motives and purposes of such manifestations is it possible to use what is good in them and to fight what is bad in them. "These social maladies, as causes, can no more be disconnected from phenomena like the I. W. W. than tuberculosis and high infant mortality from rickety and sunless tenements." What is needed is insight and sympathy. The annual labor turnover among the I. W. W. is over 500%. Much of this vagrancy is due to the fact that they belong largely to the hobo or tramp type of human derelicts. Fully 90% of them are unmarried; they are "womanless, voteless, and jobless". They are the product of the lumber camp and of other temporary communities of the less civilized kind. Many of them are the result of the injustice to which they have been subjected. "The shacks in which they were housed", says Mayor Ole Hanson of Seattle, "were unsanitary, and the men were marooned in a wilderness without any amusement whatsoever, even a chance to read. When they were paid off and visited Seattle, nobody greeted them but the I. W. W. agents, and the only places where they got any welcome were the saloons, where they dumped their dunnage and even deposited their pay-checks." So the Mayor used nails in default of the law and closed the 'wobbly' halls. He suggested "more cemeteries" as the only cure for the evil. That is the kind of social philosopher he was, and yet he was acclaimed at public meetings all the way from San Francisco to Boston. His idea of a method for suppressing the I. W. W. and others like them is the one that meets the approval of the unthinking because it is the 'direct' method; and yet when the labor-unions start to use a 'direct method', we find a wholly different public reaction. Lawlessness is lawlessness whether invoked by a mayor or a hobo. The cure is education, the intelligent discussion of economic problems, and a fixed purpose to be just to all members of the community.

Only "a little less than one hundred years ago, men trying to get collective bargaining were hung. There was a popular fury against them closely akin to the New England man'a over witches. All dangers to society could be put upon these new conspirators just as our I. W. W. are now made a scape-goat for every sin, real or imagined". There is some truth in this, but it is exaggerated. We do not impute "all dangers to society" to the I. W. W. and their likes; most of us are willing to lay some of them to the unreasonable and unintelligent opposition of the unprogressive representatives of entrenched capital, to

men like Judge Gary, who choose to regard the labor problem purely as a class vendetta, which is exactly what Mr. Brooks reprobates. As he suggests, what is needed is co-operation between the thoughtful and well meaning—that is, the eminently social (in its economic sense)—men on both sides. They can work together to transform the existing system “by slowly putting something better in its place”. Among the labor leaders there are many whose methods “are not those of delirious persons who cannot wait for things to happen”. For example, it is well to give the theorists among the radical laborites a chance to learn by experiment. Concerning the proposal to run a mine, Mr. Brooks says: “the supposition that the least skilled of the labor mass, if once given a chance, can take over the management of industry is among the most fantastic of utopian freaks”.

The proposal was made by Moyer, Haywood, and St. John that the I. W. W. should buy a mine with union money and run it, just “to show the world what could be done in the way of business”. They were to levy assessments to get the money needed to buy the mine and they would set aside the profits for union purposes. The mining enterprise would serve as a test of industrial democracy as they understood it. The leaders had said that “capital got three-fourths of the product” of mining enterprise; their own experiment would have shown them better. It was a pity the idea was not put into action. They would have discovered that in the running of a mine, as in running their own organization, they were lacking in business experience; they might arrange for the world’s financing, but they could not conduct a relatively simple undertaking. “The mine would have failed, but one of those elementary lessons which go-it-alone-labor has got to learn would have gone on record.” Perhaps if “a few hundreds of them had put their money into it with that ‘practical knowledge of mining’ which they said they possessed far more than directors and owners, some sense of proprietorship would have developed among the I. W. W. investors”. They might have been shown the falsity of their ‘philosophy’ and the untruth of the first plank in their platform: “The working class and the employing class have nothing in common”. On the contrary, as Mr. Brooks says, “there is a vast network of up-and-down ties between employers and workers in which economic interests of the most vital sort are strictly in common. This common interest moreover will hold until labor learns its own independent superiorities in producing and distributing wealth. It may some time accomplish this, but its success at every step will depend on a long co-operation with industry in the hands of employers. Labor is not through with this schooling.” Of course, not; labor is at the beginning of education in such matters. The community as a whole is only beginning to study its own economic problems, and the education in them, like education generally, must filter down, from the few to the many.

The I. W. W. movement in its unreason and criminality represents a

social disease; as an expression of anarchy it plays the part of a social drain-pipe. Our author quotes the Webbs approvingly: “If the anarchist creed did not exist, it would almost be necessary for the socialists to invent it, as the drain-pipe to carry out of their organizations those nuisance-elements of revolt, envy, mortified vanity, and the impulse to bear false witness against one’s neighbor”. To which Mr. Brooks adds: “Each society has its swampy miasma to be made wholesome by social engineers who know their business too well to revive again the ways of the medicine man. A traveler, quoted by Fraser, tells of a tribe stricken by miasma. The mists they said were full of devils only to be driven off by howlings and throwing of spears. It was not a question of drainage or destroying mosquitoes, but of drums, shouting and hurling of darts. This was the local patriotism of the time. We are not yet rid of the medicine men. Some sit in Congress and other high places. They still put faith in noisy activities having as little relation to the causes of our trouble, as the contortions of their ancient brothers. In method they are strictly on a par with the I. W. W.” Again he says: “When shall we get statesmen with sagacity and forehandedness enough to recognize that heavy-handed ways as crude as this [the suggestion of ‘plenty of rope’] merely close the factional strife and apathy within radical labor ranks, thus arming them with the very weapons they most need? There is at this hour, no danger so great as this playing into the hands of the least responsible in the labor class.” This is the main thesis of the book, together with insistence upon investigation of the causes of trouble and the need for co-operating with the intelligent leaders of labor in a sincere effort to promote both social peace and industrial welfare. For example, I suggest, when the ‘wobblies’ came to Seattle it would have been better for the city, as represented by its Mayor, to provide clean lodgings and a little wholesome soup, together with some elementary information on social economics, by printed word or spoken utterance, than to treat these vagrants as if they were already—what they were likely to become—the bubonic rats of the social *ménage*.

I have quoted enough from Mr. Brooks to indicate the style of his writing, which is colloquial. He, like many writers ranking above him, such as Bryce and Wells, shows no evidence of having studied the technique of the art of writing; a few simple lessons would help him greatly. In this respect he resembles many who live by publishing books; and that is why so many books are hard to read. His own, the book under review, is so full of information and suggestion, it is so suffused by keen intelligence and sincerity of purpose, that its infelicities of diction can be forgiven. It is a book that the mining engineer ought to read because it will give him not only a valuable insight into a pressing problem, but suggestions to be used by himself in his management of employees at mines and smelters.

### An Economic Geology for the Student

**General Economic Geology.** A Text-book by William Harvey Emmons, Ph.D., McGraw-Hill Book Co., New York. 1922. \$4.

One would have said that there was no further room for textbooks on economic geology; yet there is room for this new one by Professor Emmons, who is in a fair way to establish himself as the foremost writer of textbooks on his specialty.

The present volume is, as explicitly stated, a textbook. It is not so much for the geologist as for the student, whether in college or outside. Its great merit is that it presents in a relatively small compass the essential features of the geology, not only of the metals, but of the so-called non-metallic ores, and of the fuel minerals—coal, oil, oil shale, and asphalt. The subject of coal is first presented; then that of petroleum and gas; then the question of metallic ores is taken up from the genetic standpoint—possibly a shade too much so in consideration of the general simple purpose of the volume, though to be sure it is always easier to criticize than to improve. At any rate, the explanations are clear and brief. Then come building materials; then the “non-metallics,” like mica, graphite, magnesite, phosphates, and sulphur, which get short shrift in the normal economic geology textbook. Then comes special consideration of iron; and then successively appear gold and silver, zinc, and lead; and finally the less important metals.

Of course, the book is a compilation, and one can see the process of compression and assimilation from Professor Emmons’ other textbooks, and from the books of other authors. But it is an intelligent, carefully weighed and mixed menu, into which the author has put his own very considerable experience and judgment. J. E. S.

### Human Relations

**Pulling Together.** By John T. Broderick. Robson & Adey, Schenectady, N. Y. \$1.

This valuable little book is an interesting presentation of the problem of co-operation between employer and employee, through shop committees and other devices. The argument is presented as a conversation between a manufacturer, a salesman, and the author, in a smoking compartment of a railway train.

### Metal Prices and Production

**Metal Statistics, 1922.** The American Metal Market, New York. \$1.

The production of all the more important metals over a long period of years is given, as well as consumption, stocks, grades, imports and exports, and prices as published in the daily editions of *The American Metal Market*. This little red book is well and favorably known to the metal trade.

## THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

### Leading Events

**T**HE 10 per cent tariff on potassium cyanide provided for in the McCumber-Fordney bill has been the subject of a debate in the Senate, there being a difference of opinion among the Western Senators. The minority report on the tariff bill has been made.

On the Rand, recovery from the effects of the recent strike will require six months, according to advices received in Washington. Reuter's Agency states that an indemnity bill has been debated rather bitterly.

Cessation of smelting operations at its Cockle Creek works has been found necessary by the Sulphide Corporation, New South Wales.

Mount Morgan's future is still in doubt, despite its Government subsidy—this being on account of the metal market situation.

The outlook continues improving in the Lake Superior iron country. In particular, the Oliver Iron Mining Co. has just issued orders to increase the scale of its operations at four mines on the Gogebic Range.

Reorganization of the Sydvaranger company, in Norway, has been effected, and operations will soon be resumed at its iron mines, the most northerly in Europe.

#### Work on Middle Mines Group on Comstock Dropped

*By Telegraph to "Engineering and Mining Journal-Press."*

Virginia City, Nev., May 8—All work was stopped on the Middle Mines group at Virginia City on May 3 by orders from New York. No reason was given, and future plans were not announced. Local opinion in general is that development to date has been satisfactory, with the most promising ground ahead. A payment is due June 1.

The operations just discontinued were being conducted by the Paramount Comstock Mines Co., an organization recently effected by Dr. R. M. Ward, of Philadelphia and New York, and associates, who took the group under option after the previous option held by the Boericke interests was dropped.

#### Replogle Steel to Resume

The Replogle Steel Co. will start one of its two blast furnaces at Wharton, N. J., about May 15 on stock ore. Work will probably be resumed at the mine and mills also not long thereafter.

#### Recovery from Strike on Rand Will Take Six Months

In a memorandum issued by the executive committee of the association of Chambers of Commerce of the Union of South Africa, it has been estimated that the various labor disturbances, strikes, and rebellion during January, February and March cost the public at least £9,000,000, according to the Department of Commerce.

The loss of this huge sum has affected every section of the South African community, the farmer, the

wholesale and retail merchant, the industrialist, the forwarding and shipping agent, and the body of workers. Business has been badly shaken, and although the lessons to be derived from the manner of settlement inject a hopeful confidence for the future, allowance must be made for the time necessary for full recuperation, which, according to a report of the Standard Bank of South Africa, Ltd., will take at least six months.

*By Reuters Agency*

Capetown, April 22—In the House of Assembly today the Indemnity bill arising from the Rand revolution was read for the second time. The opposition speeches were marked by the same bitter attacks on the Premier and Chamber of Mines as characterized the debate on the first reading. The Minister of the Interior, P. Duncan, announced the appointment of a committee to investigate claims and to make recommendations regarding compensation for damages. General Smuts, replying during the debate in a vigorous fighting speech, said that the commission appointed to investigate the recent strikes was more necessary than ever, because, owing to the mine owners' victory, there were dangers that employers would refuse to take into account the voice of organized labor. The government (he said) could not countenance tyranny by either side.

#### Butte & Superior's Settlement

It is reported that Minerals Separation will settle its flotation litigation with the Jackling companies for something under \$5,000,000, of which Butte & Superior's share will be about \$800,000.

#### Oliver Iron Orders Full Time at Four Gogebic Mines

*By Telegraph to "Engineering and Mining Journal-Press"*

Iron Mountain, Mich., May 8—Orders have been issued by D. E. Sutherland for the Oliver Iron Mining Co., that 2,000 men at the Norrie, Aurora, Pabst and Puritan mines are to increase their work from half time to full time on May 8. It is also reported that similar action has been taken at all other mines of the company in Michigan.

#### La Rose Mines Appeal Dismissed

The appeal of La Rose Mines, Ltd., of Cobalt, Ont., in connection with the O'Brien-Violet case, has been dismissed with costs, the O'Brien cross appeal being allowed, with costs. It is thought by the O'Brien officials that the decision puts the 600 ft. shaft 20 or 30 ft. on the O'Brien side of the boundary line. D. Lorne McGibbon, president of the La Rose company, states that no decision has yet been reached as to whether or not the case will be taken to the Privy Council.

#### Against Raw Asbestos Embargo

President W. G. Ross of the Asbestos Corporation of Canada, Ltd., addressing the annual meeting of the company at Montreal on April 26, said that the placing of an embargo on the export of raw asbestos, as had been advocated, would kill the asbestos-mining industry. If this policy were adopted, he said, the world's supply of raw asbestos would be drawn from Rhodesia, Russia, and the United States, and Canada could mine only sufficient to supply her own needs.

## News from Washington

By PAUL WOOTON  
Special Correspondent

### Duty on Cyanide Causes Debate in Senate

McCumber's Allegation That Protection Is Needed Denied by Pittman—Smoot Against Tariff

The Western Senators, without regard to party, are divided in their opinion as to whether or not cyanide should be on the free list. The Republican members of the Ways and Means Committee of the House put it on the list. Republican members of the Finance Committee of the Senate amended the bill so as to take it off and make it dutiable at 10 per cent ad valorem.

Senator Oddie, Republican, and Senator Pittman, Democrat, both of Nevada, are leading a determined fight in the Senate against the action of the Finance Committee. Senator McCumber, the chairman of the Finance Committee, made the following contribution to the debate:

"We have a monopoly in Germany, a monopoly in Canada, and a monopoly in the United States. There is no question that if every one of those three was left entirely alone to fix the prices, we would undoubtedly pay rather heavily for our cyanide. There is competition between the Canadian monopoly and the American monopoly, and also some competition between the German cartel or monopoly and the American monopoly.

"The Senator will remember that when we got into trouble and needed this cyanide or sodium cyanide very badly, the price went up from about 10c., I think, to practically \$2 per lb. That shows the situation we would be in whenever we were not producing it in the United States. Is there not some danger that if we do not protect the home industry, even though we have but one manufacturer, as against another manufacturer in Canada and another manufacturer in Germany, and if we put the American entirely out of business, that the other two may easily combine and fix our prices? Is it not best, if we can do it, to maintain an industry in the United States even though it costs on the basis of what may perhaps in the near future be the equivalent of an ad valorem duty of 1½c. per lb. and if it comes down to 10c. per lb., the old price, it would be simply 1 cent per lb?"

In reply, Senator Pittman said:

"I will answer the Senator directly and say that this duty is not essential at all—and I do not believe he thinks it is—in order to keep the Roessler & Hasslacher Chemical Co. going in this country. I think that the profits of that institution, as shown by the report of the Alien Property Custodian, and as shown in the hearings of the committee, and never denied by the Roessler & Hasslacher Co., prove that they could sell the material for about half what they are now selling it for."

Senator Smoot, among other things, said:

"Just as surely as we live, this is

what is going to happen if we put cyanide upon the free list: So far as the manufacture of cyanide in this country by the Roessler & Hasslacher Co. is concerned, it is going to cease, for they can make greater profits by buying cyanide in Germany and selling it in this country than they can if it is put on the free list, and selling it in competition with Canada.

"I am as sure as that I live that that will be what they will do; they will import it into this country, and they tell me that is what they will do under the 10 per cent duty."

### Coal Strike Situation Unchanged

The beginning of the second month of the coal strike found each contender well dug in, and prepared to settle down for an indefinite period of trench warfare. Despite the fact that a score of coal specialists in Washington are constantly on the watch for any sign which may have significance, they could point to no important change in the situation at the end of the first week in May. The worst feature is that no one sees a prospect of anything more than a makeshift peace. Secretary Hoover admits that something more fundamental must be done than try to patch up the present quarrel, but that is as far as he is willing to go at this time.

### Shasta County Taxation Case Not To Be Reviewed

The U. S. Supreme Court has refused to review the lower court's decision in the case of the County of Shasta, Cal., vs. The Mountain Copper Co. and The Balakala Consolidated Copper Co. In this case Shasta County failed in its effort to increase the valuation of the copper companies for taxing purposes.

### Government's Silver Purchases

Purchases of silver by the Bureau of the Mint during the week ended May 6 amounted to 1,610,000 fine ounces. This brings the total purchases under the Pittman Act to 109,471,356 fine ounces.

### Potash in New Area of Texas

The discovery of potash in a new area in Texas is announced by the U. S. Geological Survey. The find is brought to light through the analysis by the survey of drill cuttings collected from the Santa Rita No. 1 well, drilled by the Texon Oil & Land Co., in the southwest corner of Reagan County, Tex. The sample, which, according to the driller's log, was taken from bailings after drilling from 1,150 to 1,165 ft., contained the equivalent of 2.46 per cent of K<sub>2</sub>O; that from 1,175 to 1,182 ft., 5.63 per cent; 1,155 to 1,265 ft., 5.65 per cent; 1,265 to 1,275 ft., 2.50 per cent; 1,275 to 1,283 ft., 6.38 per cent; 1,283 to 1,293 ft., 7.88 per cent; 1,293 to 1,300 ft.

### Minority Report on Tariff Bill Before Senate

Alleges Lack of Rule for Measuring Protection — Beneficiaries Seek High Profits, It Charges

The Senate received the minority report on the tariff bill on May 6. Among other things the report declares:

That there is no definitely fixed rule to measure the amount of protection accorded.

That the aggregate burdens imposed on the people by the tariff bill will be greater than the burdens imposed by direct taxes levied by the revenue bill—between three and four billions of dollars.

That the standard of wages in foreign competing countries is today more nearly equal to the American standard than ever before.

That the cost of products bears a much slighter relation to daily wage paid to labor than in former times.

That selling prices neither in this country nor in foreign countries are measured by the cost of production and that profits constitute a far larger element in these selling prices than all other elements.

That the tariff beneficiaries believe that embargoes and prohibitions upon foreign imports will enable them to reap the exorbitant profits of war times.

That the bill ignores the principle of imposing rates to measure the difference in labor costs or in production costs here and abroad.

That the so-called invasion of our markets by foreign countries amounts only to 4 per cent of our annual production, whereas our invasion of foreign markets amounts to 7 per cent of our production.

That if American goods can compete with foreign goods in the markets of the world they can compete with the same goods in our own markets without entailing any disaster.

That the rates of the bill are from 40 to 50 per cent higher than the Payne-Aldrich bill, considering the present higher prices of imported merchandise. In many instances they are absolutely prohibitive.

That the Senate has not improved the Fordney bill.

That in substance the present bill if properly entitled would be "an act to mortgage the country and its resources to the protected and monopolized industries."

### No Review of Quicksilver Case

The U. S. Supreme Court has declined to review the decision of the lower court in the case of the American & British Manufacturing Co. vs. McNear. McNear recovered on contracts for the sale of quicksilver by the American & British Manufacturing Co.

## News by Mining Districts

### London Letter

**City Deep Shows Total Profit of £711,516—Development Tonnage Drops; Cost Increases**

BY W. A. DOMAN

London, April 26—The City Deep report for 1921 has now come to hand. This mine is one of the most interesting properties on the Rand. For years after the amalgamation took place, it was the sport of rumor; a dead set was made against it, but the predicted failures never materialized. The company has continued to pay dividends, and though the amounts have varied, it is worth noting that to the end of last year it had distributed £3,760,250 from the milling of 7,095,943 tons and the recovery of 3,140,963 fine oz. of gold. This is not a bad record. Like other companies on the same field, it has benefited greatly by the so-called premium on gold, for last year this additional price accounted for 62 per cent of the total profit earned. With gold at 84s. per oz. the profit was £270,140; the additional revenue from premium brought in £441,376, and the total working profit was £711,516. With miscellaneous revenue, the amount was raised to £718,585. From this amount must be deducted capital expenditure, £96,203, and taxes, £114,439, or, altogether, £210,642, leaving available for distribution from the year's operations, £507,943.

Gold account was.....	£2,198,825
Available on the year.....	£507,943
Dividends paid .....	£485,625
Dividends, per cent.....	37½
Per cent of gold recovered distributed.....	22

The company has a substantial carry-forward, but percentages can be calculated only on actual distributions.

Working costs were a shade below those of 1920—that is, 29s. 11d. per ton—against 30s. 2d. per ton. A better comparison perhaps is to be got by taking the cost per oz. In 1920 it was £3.70 and last year £3.554. A heavy item in expenses apparently was development, for each ton milled was debited with just over 3s. per ton, as against a little more than 2s. 6d. per ton the previous year. To appreciate the actual position, however, it is necessary to look at the fresh tonnage opened up. The figures are:

	1920	1921
Pay tons developed..	598,500	342,200
Average value dwt. .	8.9	9.4
Cost of development. £108,890	£149,265	
Cost per ton .....	3/8	8/9

This is a substantial increase in costs, and a heavy fall in tonnage developed. The explanation, of course, is that an abnormal amount of dead work, nearly 8,000 ft., was necessary, and opened up no ore. It will be noticed that the average value of the new ore is ½ dwt. higher. This increase, however, does not mean that any general improve-

ment in value has taken place, but that in view of the decreased selling price of gold, and the fact that working costs are not likely to decrease as rapidly, the pay limit taken for estimating the payable ore reserves has been raised. The stoping width has also been increased. The ore reserves have declined in the following manner:

	1919	1920	1921
Tons.....	3,418,050	3,099,200	2,428,300
Average value dwt.	9.4	9.0	8.8

The Main Reef Leader is the chief gold carrier, and last year, of 1,130,917 tons mined, no less than 1,056,148 tons was stoped from this body. Extraction has reached a high pitch, for the actual of 96.3 per cent in 1920 was raised last year to 96.7 per cent. The average of the 12.1 per cent of waste rock discarded was .2 dwt. gold per ton. At the end of the year, the No. 2 incline shaft was 5,312 ft. vertically below the surface. It has another 200 ft. to go for its destined depth of 5,512 ft. The south shaft has reached a vertical depth of 4,470 ft. The quantity of sand lowered into the mine during the year was 137,711 tons.

An attempt is being made to reopen the Great Laxey Mines, in the Isle of Man, partly to give employment and partly to get the lead.

### CZECHOSLOVAKIA

**Four Out of Twenty-four Iron Furnaces in Blast—Seek to Merge Companies**

Prague, April 25—Recently the iron industry of Czechoslovakia has made the most strenuous efforts to form a concern including all the leading works of the country. The three largest iron works of the republic, the Prague Iron Industrial Co., the Witkowitz Iron Works, and the Mining and Metallurgical Co., which combined, represent about three-fourths of the total Czechoslovakian iron production, have already installed a common sales office and are now about to associate with all the smaller companies.

At the end of April, the situation of the Czechoslovakia iron industries leaves much to be desired. Of twenty-four blast furnaces only four are running, and even these are working only half the time. The industry is hampered by three circumstances—namely, a 30-per cent tax on all furnace coke, which constitutes a charge of at least 15 crowns on each double quintal of iron; the extremely high wages as compared with those in Austria, Germany, and France, and by the fact that the individual plants are still too little organized and specialized. The iron prices are almost prohibitive for export trade. It is, however, hoped that with the large influx of foreign capital (Stinnes, Schneider-Creusot and others) and the intended specialization of the largest works the situation will improve.

### Melbourne Letter

**Sulphide Corporation Ceases Smelting—Waihi Grand Junction Stops Crushing Pending Development**

BY PETER G. TAIT

Melbourne, April. 3—The Sulphide Corporation, Ltd., has advised producers of silver-lead concentrates that no ore will be received at Cockle Creek, near Newcastle, N. S. W., after April 13. The following notice was posted at the works:

"In consequence of the decrease in the tonnage of ore received at the works, it is found impossible to keep even the small smelter running. The output of lead concentrates of the mine at Broken Hill has fallen off by more than one-third. Supplies from other sources have fallen off to an even greater extent. As the corporation cannot keep one smelter going economically, it has made arrangements to smelt its ores at Port Pirie, and as soon as the ore in stock is used up its smelting and refinery works at Cockle Creek must close."

In future the company will act as a buying agent for the Broken Hill Associated Smelters, Port Pirie. The fertilizer (superphosphate) department will be continued.

Operations are now confined to the Mount Lyell's North Lyell mine, the output being approximately 7,000 tons monthly. At the reduction works the new smelting program as outlined in a previous letter is in full swing. There are now 350 fewer men employed at the mines and works as a result of the retrenchment policy.

The Waihi Grand Junction Gold Mining Co., Waihi, New Zealand, has temporarily ceased crushing pending the carrying out of an underground development policy as laid down by the company's consulting engineer, H. Stansfield, formerly general manager of the Talisman Consolidated at Karangahake. The mill comprises sixty heads of stamps, but latterly it has been crushing up to only two-thirds capacity.

Muir's Gold Reefs, Te Puke, New Zealand, which has been engaged on development work for some time, has installed a twenty-head battery and will crush 125 tons per day. The ore in sight averages 71s. per ton. The general manager of the company is J. R. Noble.

W. H. Woodhead, chairman of the London directors of the British Broken Hill company is at present visiting Australia. It was the British mine that first announced the intention to resume operations to demonstrate the impossibility of making ends meet under the present wages award at the low market prices. The British company in common with other Barrier mines ships its concentrates to the Broken Hill Associated Smelters, Port Pirie. In the early days of the war the Prime Minister announced that all lead concentrates must be treated in Australia and it was only by coercion on

the part of the company that the British company was induced to enter into the contract with the Associated Smelters. The company now claims that as it can sell its concentrate for shipment abroad more advantageously, the privilege of a free market should be allowed, and there is good reason to believe that unless the local smelters are able to offer terms comparable with those obtainable from buyers for export, present arrangements will be cancelled.

#### Queensland

#### Future Doubtful for Mount Morgan, Despite Resumption—Drop in Premium Shocks Producers

*From Our Special Correspondent*

**Brisbane, April 9.**—The Mount Morgan mine and works resumed operations on March 20, just twelve months after closing down. In the final settlement the government increased its promised subsidy by £100 per week.

When this big mine closed down at Easter of last year, and when the experts engaged to investigate the position of the company reported that, even with the proposed reduction, work could not be carried on at a profit, the market price of standard copper was about £70 per ton and gold was worth £5 6s. per oz. Unfortunately, just before the resumption and since, both metals have continued to drop further in price, so much so that copper is now below £58 and the price of gold is £4 13s. per oz. Under the agreement now consummated there is a provision for increases in wages on a sliding scale as the price of copper improves, but further reductions in market values were not provided for, and how long the company will be prepared to keep going under existing circumstances is a question that all concerned are anxiously considering. It is estimated that at least £300,000 has been lost in wages during the twelve months' strike.

Naturally, the closing down of Mount Morgan had a disastrous effect on the total gold output of the state for 1921, the official statistics connected with which have just been completed. Of the yield for 1920 (about £490,000) this mine contributed a little over £385,000, or nearly 78 per cent; last year the total output was but £171,500, and of this Mount Morgan returned only 42 per cent.

Queensland benefited last year to the extent of £111,578 from the contributions of the Gold Producers' Association, whose total payments to its members throughout Australia from premiums on the sales of gold for that period aggregated over £840,000. But for these contributions it is doubtful whether some of the gold mines that made profits would not have been forced to close down. The recent heavy fall in the premium on gold has given a decided shock to the industry, which is accentuated by the fact that as yet there has been no corresponding reduction in the cost of production. Only one gold mining company has paid a dividend this year.

#### Johannesburg Letter

#### Wolhüter Gold To Pass Dividend—Rhodesia's Mineral Output Increases—Heidelberg-Roodepoort Under Option

BY JOHN WATSON

**Johannesburg, March 28.**—A message from Brussels says that the Colonial Council has ratified draft decrees approving of the order of the Vice-Governor of Katanga Province, Belgian Congo, dated Dec. 19, last, suspending prospecting along the Lulua River, and approving the concessions and cessions of territory sanctioned by the local authorities; also the agreement made on Feb. 10, between the government of the colony and the Belgian Congo company.

The annual meeting of the Wolhüter Gold Mines, Ltd., was held in Johannesburg on March 23. The chairman, A. F. Mullins, stated that in consequence of the strike, the mine would experience a loss of about £16,000 for the first three months of 1922 and that no dividend could be paid for the six months ending April 30 next.

It is reported from Cairo that an extensive mineralized area has been discovered by prospectors employed by the Nile and Congo Syndicate, which belongs to the Tanganyika Concessions group. The discovery is described as alluvial gold, which has been traced in several rivers. What is believed to be the source of this gold has also been discovered in the form of an auriferous belt extending for several miles.

The Rhodesian Chamber of Mines has re-elected Sir Bonchier Wrey as president. Last week, in his presidential address at Bulawayo, he stated that the total mineral yield of Rhodesia for 1921 was of a value equal to £4,720,375, an increase of nearly £270,000 over that of the previous year. This was due largely to the gold premium, now dwindling. The dividends paid by Rhodesian mining companies had dropped from over a million in 1920 to £663,000 last year.

J. G. McDonald criticized recent statements by the secretary of the Rhodesian branch of the South African Mine Workers' Union, following the break-up of the conference on the wages question. This secretary was urged to give up a policy of bluff to both workers and owners, or it was said that he would not be received by the latter.

The annual meeting of the Transvaal Chamber of Mines was held in Johannesburg on March 27, when the President H. O. Buckle, reviewed the industrial situation. He set forth the conditions which would govern their future policy with the unions.

The total gold output from the Transvaal for 1921 was 8,114,586 fine ounces, a decrease of 39,586 oz. compared with 1920. For the last five years the amount of gold annually produced had been diminishing, as mine after mine has been compelled to close; nor does it look as if this tendency was likely to be reversed soon.

General Frank Joubert is now in the Heidelberg district. He has been many years in Europe and now represents a Belgian firm and is said to have taken an option on the old Heidelberg-Roodepoort mines, with a view to working them for their iridium content as well as gold.

#### BRITISH GUIANA

#### W. J. La Varre Seeks Concession for Diamond-Bearing Ground

**Georgetown, April 9.**—Following investigations carried out during several years of exploration in British Guiana, William J. La Varre has applied for location papers for a large concession of Crown land bordering the Merume River, a principal stream of the Mazaruni diamondiferous area, extending for a distance of ten miles along the Merume and containing an estimated area of 6,000 acres. No information is available as to the nature of this concession, but it is understood that it contains the richest discovery yet made in Guiana.

According to Mr. La Varre, native prospectors in March produced 16,000 carats valued at \$400,000.

#### NORWAY

#### Sydvaranger Company, Reorganized, to Resume Work at Iron Mine—Clash Threatened With Danish Interests in Greenland

**Kristiania.**—The Sydvaranger company's iron mines, the largest in Norway, and at latitude 70 deg., probably farther north than any other of the kind in the world, show signs of resuming operation after two years' shutdown. The large central steam power plant at Kirkenaes has started. The company has for some time been undergoing drastic reconstruction on the following proposed lines: The share capital is to be written down by 19,550,000 kroner to 3,450,000 kroner, and new shares will be issued to bring the capital up to 25,000,000 kroner. Liabilities would thereby be reduced to 16,250,000 kroner, including a loan of 3,176,000 kroner from the Bank of Norway. In addition, the state is to grant to the company an effective loan of 4,000,000 kroner. Finally, a further amount of 5,000,000 kroner is to be obtained from the Central Bank of Norway toward an operating account. The share issue is stated to have been subscribed, and the new share capital is given at 25,000,000 kroner.

The tenor of the Sydvaranger ores is 36 per cent iron, similar to that of Dunderland; but, unlike the latter, the ore is a magnetite, free from iron glance, and lower in phosphorus. The output in 1913 was about 450,000 tons of concentrate running 67 per cent iron, nearly half of which was briquetted. The improved lay-out now warrants an output of 650,000 tons. Professor Vogt places the ore available by open cut at 100,000,000 tons.

O. A. Bachke, a mining engineer of Trondhjem, Norway, has petitioned the

government for 50,000 kroner, toward the cost of his research expedition to Scoresby Sound, East Greenland. He reminds the government that, in anticipation of Denmark annexing Greenland, it is advisable to secure, beforehand, a permanent footing in East Greenland. Private interests have assured a contribution of 20,000 kroner.

The proposed expedition has evoked much criticism in the Danish press, in which it is claimed that the Danes have long exploited the region around Scoresby Sound. The chairman of the East Greenland Co. has said that he could not imagine that the Norwegian government would agree to a proposition clashing with Danish work in Greenland.

#### SPAIN

##### Bilbao Mine Owners Ask Bounty on Iron Ores

Madrid, April 15—The Bilbao mine owners still complain of the lack of sales and point out that there is over 2,000,000 tons of ore at the mines and that it is no longer possible to remain with folded arms in face of the competition of other ores such as those from the African coast. The owners demand a bounty on Spanish ores similar to that which exists on Spanish coal.

The labor situation in the Bilbao mining region is unsatisfactory, owing to the lack of discipline among the communist workers, who are agitating for a general strike in order to avoid a reduction in wages. The workers belonging to the Socialist party appear to be less intransigent.

#### KOREA

##### Oriental Consolidated's April Output Drops Slightly

Unsankinko—The Oriental Consolidated's April clean-up was \$89,500, compared with \$91,303 in March. In March 17,450 tons was milled. The new shaft was deepened 191 ft. in that month.

#### CANADA

##### British Columbia

##### Granby Consolidated Planning Hydro-electric Plant

Anyox—it is stated that the Granby Consolidated Mining, Smelting & Power Co. is planning to install a new hydro-electric plant at Anyox this summer. The company prefers to use hydro-electric power altogether, it is said. As a preliminary step, a water-storage dam is under construction. The contract for this work has been given a Vancouver firm, known as Dredging & Contracting, Ltd.

Stewart—The Big Missouri property, in the Salmon River Valley is to be developed this summer. Trites, Woods and Wilson are reported to have taken a working bond on this property.

Trail—Ore received by the Consolidated smelter from April 22 to 30 inclusive totaled 9,173 tons. Shippers were: Black Rock (zinc), North-

port, Wash., 37; W. E. Brown, Eldon, Alta., 3; Ottawa, Slocan City, B. C., 11; Renner & Drace, Ewings Landing, B. C., 31; Republic, Republic, Wash., 45; Silversmith, Sandon, B. C., 31; Wind Pass, Chu Chua, B. C., 23, and company mines, 8,992.

#### Ontario

##### Teck-Hughes Cuts New Ore on Seventh Level—Dome Mines Continues Operation on High-Grade Ore

Kirkland Lake—At the seventh level of the Teck-Hughes, while a station was being cut at the winze, ore was found, which, it is understood, is equal to the average of the mine. It is of good width, but will probably not be energetically developed until the work of continuing the winze to 980 ft. is completed. It is unofficially stated that South African interests will take over the control of Teck-Hughes by purchasing stock from large shareholders. The report says that the new company would have a capital of \$6,000,000.

Porcupine—Recently the Triplex gold mine, operating in Shaw Township, Porcupine, purchased a fourteen-drill compressor, which is now being delivered. The shaft is now down over 100 ft., and as soon as a station is cut it is intended to crosscut the banded iron formation, in which the Triplex veins occur. This has a width of from 50 to 100 ft.

The work of dewatering the Porcupine Vipond mine is now well under way, and the surface plant is in condition for the starting of underground operations, which will probably be in three or four weeks. The management expects to continue the main shaft to a depth of 750 ft., where a station will be cut and some lateral work done, then to sink to 900 ft.

Diamond drilling on the Dome Mines continues to indicate big bodies of ore lying beyond the present points of development, and these tend to hold out good prospects of ore, reserves being materially increased in due course. It is stated that these new bodies show gold contents ranging from \$8 to \$1,000 per ton. It is also stated that the mill treats an average of approximately 1,000 tons of ore daily and is recording an output of around \$10,000 a day. This continued operation on high-grade ore is one of the more favorable features in connection with gold mining in northern Ontario. In the meantime, the huge tonnage of medium-grade ore being placed in sight as a future asset is increasing in an important extent from week to week and is pointing the way to an exceptionally long life.

On April 27 McIntyre cut a north section of No. 7 vein at the 1,875 level, and on May 2 cut into the south section of the same vein, after passing through about 20 ft. of low grade. The north section shows 8 ft. of excellent ore, and judging from diamond-drilling indications, the south section at this point should have a width of about 20 ft. There are now 100,000 tons of broken ore ahead of the mill.

#### CALIFORNIA

##### Bureau of Mines Expects More Support From State Than It Gets—Carson Hill Producing \$125,000 Per Month

San Francisco Correspondence

San Francisco—According to local reports, the U. S. Bureau of Mines is not altogether satisfied with the failure of California to co-operate in supplying funds for research work. At present the Bureau enjoys quarters, light, heat, and janitor service at the University of California, but little other support is given. Director Bain is reported to have said "that the amount of co-operation offered the Bureau from other states is large, and it becomes a difficult problem for an administrator to justify any increased expenditure in a state which does not itself take part in or assist in the work."

In view of the fact that other states are anxious to co-operate, it would appear that California is in danger of forcing a termination of its arrangement with the Bureau.

In northern California, reports are given out that the Estabrook dredge is to resume operation. The Adrian and Leavitt ranches, not far from Lewiston, have been bonded to a dredging company. Prospecting and drilling are to be undertaken by the company.

Derrer and Caughlin have resumed work at the Eastman mine, south of Goodyear Bar, Sierra County.

The Bullion Exploration Co., of Grass Valley, is preparing to unwater and reopen its property.

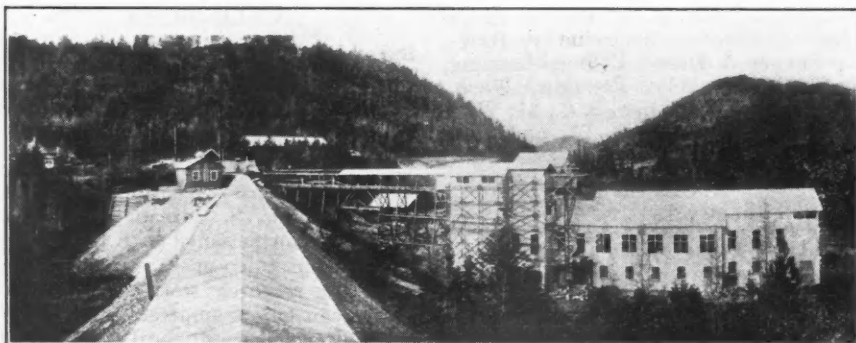
The present production of the Carson Hill mine, controlled by W. J. Loring, is stated to be \$125,000 per month. The aggregate production since the property was taken over is stated to have been \$3,000,000.

The Pacific Gas & Electric Co. reports that within the last few months power contracts in excess of 1,000 hp. have been signed in Tuolumne County for mining use. In Stanislaus County, a new dredge on the Tuolumne River, taking 600 hp., has been recently placed in operation. Revival of mining is attributed to the lower cost of labor and materials and the abundance of hydro-electric power at moderate sales.

A new strike is reported from the Randsburg district between Mohave and Randsburg. The prospect is known as the Mispah, the vein being discovered at a depth of 110 ft.

##### Arizona Corporation Commission May Not Prosecute

The Arizona Legislature has refused the Arizona Corporation Commission permission to proceed summarily or generally against about 30,000 Arizona corporations that are delinquent in annual filing fees to the gross amount of \$4,000,000. Many have failed to report since 1912. It is apparent that the commission is endeavoring to find a way to annul charters without filing separate suits in the Arizona courts.



*New Mill at Talache, Idaho, erected by Armstead Mines, Inc., and recently sold to A. H. Burroughs and associates*

## NEVADA

### United Comstock Strike Still On— Orleans Hornsilver Mine Closed Pending Outcome of Suit

*From Our Special Correspondent*

**Virginia City**—There is no material change to report in strike conditions in the United Comstock underground operations. Conditions are slowly improving and the men are returning to work. As previously reported, surface construction work has not been delayed, and the mill will be completed by October.

On April 25, fire broke out in an old stope on the 1,650 level of the Con Virginia. The burning area was sealed off by concrete bulkheads without trouble or accidents. This stope has given trouble of this sort since the bonanza days of the Comstock, and it is considered doubtful whether the danger can ever be entirely removed without flooding.

**Mina**—The Simon Silver-Lead Mines Co. is producing about 180 tons daily. This tonnage is said to approximate hoisting capacity at present. The company is planning to sink a new three compartment shaft to a depth of 600 ft. This will permit an increase in tonnage to at least 500 daily. Repairs to the roasting plant in Goldfield are practically completed, and shipments of zinc concentrates will be started during May. A favorable railroad freight rate has been obtained from Mina to Goldfield and from Goldfield to Harbor City, effective May 11, the through rate being about \$5.60 per ton.

**Tonopah**—All mines in this district are operating at capacity, with no new discoveries of importance reported. As soon as the new pumps of the Tonopah Extension Co. are placed, important work will be started to the west. This is important to this part of the district, as developments have always been stopped because of excess water as depth was attained. The Halifax Co. reports continuation of favorable developments on the 900 level. Shipments of about 30 tons of ore per day are being made by this company.

**Hornsilver**—The Orleans Hornsilver mine has been temporarily closed until the suit filed by C. A. Terwilligar, of Goldfield, against J. W. Dunfee has been settled. Dunfee, who, with Terwilligar,

was the original bond holder, disposed of the mine to the present company. He claims that Terwilligar relinquished his claim in the bond four years ago, but the latter denies this.

**Pioche**—The Combined Metals mine has started to ship about forty tons of ore daily to the Garfield smelter. The ore runs .04 gold, 8.2 oz. silver, 8 per cent lead, and 18 per cent zinc.

Development work has been started on the Virginia Louise mine, adjoining the Prince Consolidated. The work is being done on the 500 level to prove the further extension of the big fluxing beds.

Shipments for the week ended April 27 were: Bristol Silver, 310 tons; Black Metals, 225; Mendha, 45; Hamburg, 50; total, 630 tons.

**Goodsprings**—Several lots of cobalt ore, averaging from 6 to 28 per cent cobalt, were recently shipped to the Shepherd Chemical Co. at Cincinnati, Ohio, from the Goodsprings district, the ore coming from the Copper Chief; High Line, and Columbia mines. A considerable tonnage of cobalt ore assaying 10 per cent is available in this district. The mineral occurs in the form of oxides and is known as heterogenite. Vanadium ore also has been mined from the Hoodoo, Spelter, and Whale, all of which are near Goodsprings.

Eggers and Fredickson, leasing on the Anchor mine, about four miles south of Goodsprings, have about 100 tons of high-grade lead ore ready for shipment, also some marketable lead-zinc ore.

**Ely**—All departments of the Nevada Consolidated are now active. Six ball mills, with a daily capacity of 2,500 tons, are running. Two steam shovels are employed in the Ruth pit. About 250 men are working underground and in the shovel pit at Ruth. The new reverberatory at McGill, 27 x 134 ft. inside measurement, has been completed, and another of similar size is ready for operation. But one will be fired at this time. About 35,000 tons of high-grade ore from the Ruth orebody are on hand at the smelter, and this tonnage will be smelted direct with the concentrates derived from the milling of the disseminated porphyry ores. Five hundred men are working at McGill.

## IDAHO

### Talache Mines' Production Rapidly Nearing Mill Capacity

**Talache**—The mine, mill and other holdings of the Armstead Mines, Inc., which were recently sold to A. H. Burroughs, Jr., and associates are now operated by a new company known as Talache Mines, of which the officers are: A. H. Burroughs, president; A. H. Burroughs, Jr., vice-president; H. S. Brown, secretary-treasurer and C. C. Dula, J. Peterson, Karl Jungbleeth, and H. D. Kingsbury, directors.

The name of Armstead Mines, Inc., will be retained by H. H. Armstead for other operations which he may conduct.

The mine is now developed with about 20,000 ft. of drifts, crosscuts, and raises on twelve levels, thus giving 1,700 ft. of backs on the Little Joe vein. Stopping is being done on the 400, 600, 700, and 800 levels yielding 100 to 125 tons of ore per day. With the opening of new stopes it is expected to reach the maximum mill capacity of 150 tons daily soon.

The new mill, which was designed by the General Engineering Co., of Salt Lake City, is recovering 96 per cent of the silver, which is the principal value in the ore, and is producing a concentrate running .71 oz. gold, 160.7 oz. silver, 53 per cent lead, 6.2 per cent copper, 8 per cent insoluble, 30 per cent iron, 1 per cent manganese, and 3.7 per cent zinc. Mill operation is continuous; and concentrates are being hauled daily by motor trucks to the Northern Pacific at Sagel, Idaho, six miles away, from which point shipments are being made to the East Helena smelter.

The plant recently completed includes a 150-ton flotation mill using Callow cells, a 1,600-cu.ft. Ingersoll-Rand compressor, and eleven-mile transmission line, a central heating plant, and hoisting and haulage facilities.

**Warren**—The Unity Gold Mining Co.'s property is in the Warren district about forty miles from the railroad. Considerable development has been done on the mill level, and several parallel veins of gold-bearing ore have been opened. One orebody has been opened for a horizontal distance of over 900 ft. and the other for more than 300 ft. The veins are 14 in. to 20 in. wide and the ore averages about \$40 a ton, mostly gold. The ore is higher in grade in places. Prior to the present development on the mill level, it was generally believed that the ore deposits of the district were more or less superficial. Development has reached a depth of 600 ft. below the outcrop. The ore appears to be primary, and the outlook for favorable development at greater depths is encouraging. The present amalgamating and concentrating mill will be remodeled and flotation equipment added. The power plant will be moved about five miles to the Salmon River, where there is an abundance of water the year round. The power will be ample for all needs when the new plant and transmission line are installed.



The company will raise about \$100,000 by issue of treasury stock, to finance the above mentioned improvements and leave satisfactory working capital. With the new mill and power plant installed, the company can treat over fifty tons of \$40 ore per day, at a cost of less than \$15 a ton. The present ore reserve is ample to justify the improvements now under consideration, and the new financing may be regarded as a modest capitalization of the promising orebodies opened in the last few years.

#### UTAH

##### Bingham Busier—International Smelter Receiving Ore—Chief Consolidated Interested in Apex Standard—New Lease on Gemini

*From Our Special Correspondent*

**Bingham**—Additional miners are being put on by the Utah Apex, and at present between 125 and 150 men are employed. During the latter part of the month up to three cars of ore per day were shipped.

At the Utah Consolidated sixteen men were added during the last part of April in cleaning up and repair work, and it is probable that operations will be resumed before long.

The International Smelting Co., at Tooele, is receiving ores from the Ophir Hill mine, at Ophir, and a considerable tonnage from the Tintic Standard; also other ores. The Walker Mining Co.'s mill, in Plumas County, Cal., is expected to start up some time this month, and the concentrates will be shipped to the International. About 100 men are now employed at Tooele. It is thought that smelting operations will be started some time in June.

**Eureka**—Ore shipments from the Tintic district for the week ended April 28 amount to 174 cars, compared with 180 cars the week preceding. Shippers were: Chief Consolidated, 48 cars; Tintic Standard, 48; Colorado, 16; Grand Central, 15; Iron Blossom, 14; Eagle & Blue Bell, 10; Victoria, 9; Swansea, 5; Centennial-Eureka, 4; Eureka Hill, 2; Gemini, 2; Mammoth, 1; Dragon, 1; Sunbeam, 1.

The lower levels of the Gemini are to be unwatered and reopened under lease to S. M. Soupcoff, Edgar Newhouse, and other Salt Lake mining men. The mine has been operated to the 1,900 level through the 72 winze, where excellent ore was opened. The water level was formerly about 40 ft. below the 1,600 level, but recently has receded to near the 1,700 level, on account of pumping in the neighboring Chief Consolidated. Pumps are being installed and the 72 winze will be unwatered and pumped into an open fissure or cave on the northeast 1,600 level, which is expected to take care of the flow. Pumps capable of handling 500 gal. per minute are to be used. Additional pumping units will be added as development progresses. Lead ore running well in silver is exposed on all of the levels, 1,700, 1,800 and 1,900, in this section.

At the Grand Central mine, at Mammoth, many changes and improvements are being made. It is controlled by the Chief Consolidated and is responding favorably to the campaign of development now under way. The surveys are practically completed and geologic mapping is in progress. Correlating and locating the favorable limestone beds which have been productive in neighboring properties, many of which have been but little developed in the Grand Central, is being done. The hoisting plant is to be electrified soon and a new electric signal system and telephones are to be added to the equipment. A new electrically-driven Sullivan angle-compound has been installed, and another unit may be added. At present 117 lessees are working.

The extensive development campaign mapped out by the company will be done largely on the night shift. Drifting is to be started on the 1,300 and 1,600 levels. Improvements to the tramway and loading station make it possible to handle three cars of ore in eight hours. Fifteen cars of ore were shipped the week ended April 29, but despite this much ore remains broken and ready for shipment, and many lessees are still crowded with ore. Paul Hillsdale is in charge.

The Copper Leaf and Central Standard have been consolidated into one company to be known as the Central Standard Mines Co. This will have a capitalization of \$250,000, divided into shares of 10c. each.

The Chief Consolidated on May 1 paid a dividend of 5c. a share, bringing the total to \$2,136,726. Operations are carried on here almost entirely by lessees. The same leasing system is being used at the Grand Central, and other Tintic mines are beginning to copy it and are going from an operating deficit on to a dividend-paying basis. The Iron Blossom and the Colorado have recently adopted leasing, and have done much better by it than by working on company account. The Eagle & Blue Bell, including the Victoria, is to undertake leasing, especially in the ground adjoining the Grand Central. A few blocks of ground, including some of the old stopes, are being leased at the Tintic Standard, and it is probable that the leasing system will be adopted on a larger scale here.

At the Apex Standard, in East Tintic, it is reported that the Chief Consolidated people have become interested by subscribing money to be used entirely in development, in exchange for stock. Four headings are being driven from the Water Lily shaft of the Chief Consolidated, in East Tintic.

**Park City**—Shipments for the week ended Feb. 28 amounted to 2,222 tons of ore and concentrates, compared with 2,333 tons the week preceding. Shippers were: Judge companies, 973 tons; Ontario, 719; Silver King Coalition, 530.

**Alta**—At the Emma 5 ft. of good ore has been opened on the Montezuma

fault in a raise 80 ft. above the Bay City tunnel. This ore assays well in lead and silver, and is thought to be making out from the fissure on the limestone bedding. The strike is the favorable part of the mine and is considered important. M. M. Johnson is consulting engineer.

The Wasatch Mines is continuing development from its 5,000-ft. drain and operating tunnel. New ore has been opened at the Columbus-Rexall in several places.

The Michigan-Utah is rebuilding its tramway, which was taken out by snowslides in February. This tram will be shorter than the other—the length being about 12,000 ft. Hauling will be done from the lower terminal to Wasatch.

At present no ore is being shipped from Alta, on account of the melting snows and the poor condition of the roads.

#### COLORADO

##### Freeland Mine to Be Reopened—New Strike at War Dance

**Telluride**—The boiler house at the Tomboy mine was destroyed by fire recently, with a loss of about \$15,000, covered by insurance. A new boiler plant is under construction. As the plant supplied heat for the mill, the later was shut down temporarily as a result of the accident.

**Freeland**—After a shut down of several years on account of litigation, the Freeland mine will be reopened in the near future, and development work will be resumed. The power plant is being overhauled, and repairs are being made at the dam, preparatory to resumption of operations under the management of W. L. Shaffer, of Idaho Springs.

**Russell Gulch**—Another rich strike has been made in the famous little War Dance mine, this time in the form of a 2-ft. vein of \$40 gold ore. A test shipment was made recently to the smelter at Leadville.

**Georgetown**—The St. George mine, operating on Douglas Mountain, in Clear Creek County, will erect a fifty-ton mill. Construction work will begin by May 15. Theodore R. Heinrichs, manager, expects to have the plant completed by Aug. 1.

**Alma**—The Lincoln Consolidation company made the first shipment of lead-silver ore from its recent strike on April 1.

The Yuba Construction Co., which is erecting the dredge for the Platte River Dredging Co. on the Platte River near Fairplay, has the boat under cover and floated. The remainder of the machinery, ten carloads in all, is expected early in April. When this is installed, the boat will be placed in commission.

#### Western Australia's Gold Output

*By Cable from Reuters to "Engineering and Mining Journal-Press"*

**London, May 6**—The gold output in April in Western Australia totaled 46,384 ounces.

## SOUTH DAKOTA

**Homestake's South Mill Building Nearly Completed—Mica Producers Busy***From Our Special Correspondent*

**Custer**—Work will be resumed on May 1 at the Great Northern mica mine west of Custer. A compressor and crude oil engine have been ordered. A site for a grinding plant has been selected at Custer, where the mica will be ground. Motor trucks will be employed for hauling between mine and plant, a distance of nine miles.

**Keystone**—The American Producers Mica Co. is shipping a car a week from properties near Keystone. Most of the material is scrap, although some plate mica is recovered.

Work at the Maywood Chemical Co.'s property is continuing, and amblygonite has been shipped recently to the plant in New Jersey. Production will be increased when the weather improves.

**Lead**—The new South mill building of the Homestake company is nearly completed, and installation of equipment has begun. Part of the new plant will be in operation by Sept. 1. A crusher has been installed underground at the Ellison shaft, and skip loaders are being placed. Most of the machinery is in place, and the skips will be running within a few months.

## ARIZONA

**Humboldt Smelter to Start About June 1—Iron Cap Following North-South Vein—Grading for Stargo Mill Begun**

**Jerome**—United Verde shovel operations are above the hot stopes. Some small deposits of good ore are being found, but little of importance is expected until the headings are advanced to the same point on the next lower shovel level.

The northwest drift from the 650 station of the Verde Central is in solid ore that assays 22 per cent copper and 5 oz. silver, in disseminated glance and carbonate. The drift is now advanced about 230 ft. and is about 1,500 ft. from the United Verde side line along the fault. New electrical equipment is being installed, and the wires of the Arizona Power Co. are being extended to the mine.

Announcement has been made that the Southwest Metals Co. expects to start operation of the Humboldt smelter about June 1, and that it is in the market for custom gold, silver, and copper ore. G. M. Colvocoresses, the manager, is reopening the Swansea mine, in northern Yuma County, and has sent Chester A. Knight to Swansea to take charge of the concentrator there.

**Globe**—On the 900 level of the Iron Cap, east of the Iron Cap shaft, a new vein, called the Spur, is being followed. Its trend is due north and south, at right angles to the course of the main veins of the district. F. A. Woodward says that for 150 ft. the vein assays, for 25-in. width, 11 per cent copper and 20 oz. silver.

**Morenci**—Grading has been started for the new seventy-five ton cyanide mill of the Stargo Mines. Construction is expected to take four months and to cost \$75,000. The ore to be treated carries silver and gold and is expected to average nearly \$15 a ton at the mill. In the past about 300 cars have been shipped to smelters at Clifton and Douglas. The company has been reorganized. Ben Getzoff, of Bernardsville, N. J., is president. Mike Han-non remains manager. The offices will continue in Phoenix.

## MICHIGAN

**The Copper Country****Lake Rate on Export Copper Lower—Ahmeek Increases Tonnage.**

BY M. W. YOUNGS

**Houghton**—No definite advices have been received as to when other of the Calumet & Hecla mines and independent properties, such as Franklin, Mass, and Michigan, will reopen. Resumption by some, if not by all, of these mines, however, is expected before the close of the year.

It is expected that May will witness a considerable increase in the amount of copper shipped out of the district. The Lake rate on export copper to the coast is 40c. per 100 lb., as compared with the all-rail rate of 48c.; the rate to Detroit and Buffalo is 25c., compared with 38c., all rail. This is a decrease of 4c. per lb. from last season's rate. The New England lake-rail rate is 44c. compared with 50c., all rail.

The first copper boat out May 3 took 800,000 lb. of metal for export to France as well as a large cargo of copper for domestic customers.

Six stamps are in operation at the Calumet mill of the Calumet & Hecla, and it is probable that two more will be started soon. Nos. 9 and 10 shafts are now being reopened.

**Mayflower-Old Colony** is investigating a mineralized formation met in the south drift on the 1,450 level, a cross-cut proceeding west toward the foot wall to ascertain the width. The showing is described as encouraging.

Seneca should be in a position to resume sinking in Gratiot No. 2 shaft within ninety days. The stripping and straightening of the shaft is now proceeding below the tenth level, and only about 300 ft. remain to be given attention. The seventh level south has practically reached the Ahmeek boundary and a drift south from the sixth level will now be driven. All openings north, toward Gratiot, continue in good milling ground.

Ahmeek has increased its tonnage somewhat, the daily average now being about 1,800.

## OREGON

**Grants Pass**—Dr. A. M. Knapp and William G. Tait, of Medford, have acquired the Jewett gold mine five miles from Grants Pass, and are reopening it.

## MINNESOTA

**Outlook Much Improved for Mesabi and Vermillion Ranges**

**Hibbing**—Prospects for a good shipping season on the Mesabi and Vermillion iron ranges are bright. Practically every operating company has started some phase of operations which indicates that a revival of the iron business is near.

On the Mesabi, after an almost complete shut down for all properties, there was a slight improvement in January, 1922, when some of the underground properties resumed work on a one-shift basis. Since then, and more especially in April, some companies have started ore operations both underground and in open pits, while others have started stripping only. The Oliver Iron Mining Co., the largest shipper on the range, has not yet received orders to forward ore, but is preparing to do so at some of its properties; and at others stripping is being done.

The Vermillion range companies withstood the depression in better manner than those on any other range in the Lake Superior district. Nearly all work was carried at full time and there were few shutdowns. Active work at nearly all mines is now in progress.

Comparing the situation with normal, it is estimated that some form of work is being done at 60 per cent of the properties giving employment to about 7,000 men, compared with 16,000 in normal times. Only about one-quarter of these properties, or 15 per cent of the total, are on ore operations, as it is still a little early in the season. Several instances have been noted where mines entered the shipping list for a short period and then ceased.

Several factors tend to retard a general resumption of activities. At present a definite price on iron ore has not been announced, and the controversies relative to the rail rate from the mines to the upper Lake docks and the Lake freight from the upper to the lower docks has not been definitely settled. A suit to compel the railroads to reduce their rate from the mines to the upper docks is in progress, with little possibility of an early decision. Indications, however, on the whole, point to a good movement of ore which is estimated at about 25,000,000 tons for the Mesabi and Vermillion ranges and about 45,000,000 tons for the Lake Superior district.

**Duluth**—Some drilling for iron ore has been done on the Namekon Range, northwest of Tower and west of Vermillion Lake. It is understood that two or three groups, one of them the International Iron & Steel Co., (Minneapolis interests), have been doing this work. Some seams of magnetic ore are said to have been cut. The company named is reported to have spent \$180,000 and to be ready to spend more. Two engineers examined the properties concerned some time ago. The opinion is expressed that the operators stand a good chance of finding commercial ore.

# THE MARKET REPORT

## Daily Prices of Metals

May	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
4	12.75	30.00	30.875	5.25	5.125@5.15	5.00
5	12.75	30.125	30.875	5.25	5.125@5.15	5.025
6	12.75	30.125	30.875	5.25	5.125@5.15	5.025@5.05
8	12.75	30.00	30.75	5.25	5.125@5.15	5.025@5.05
9	12.75	29.875	30.625	5.25	5.125@5.15	5.025@5.05
10	12.75	29.875	30.625	5.25	5.125@5.15	5.025@5.05

\*These prices correspond to the following quotations for copper delivered: May 4 to 10 inc., 13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

## London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
4	60	60 $\frac{1}{2}$	65	148 $\frac{1}{2}$	150 $\frac{1}{2}$	24	23	27	26 $\frac{1}{2}$
5	59 $\frac{1}{2}$	60 $\frac{1}{2}$	65	149 $\frac{1}{2}$	151 $\frac{1}{2}$	24	23 $\frac{1}{2}$	27	26 $\frac{1}{2}$
6	...	...	...	...	...	...	...	...	...
8	60 $\frac{1}{2}$	60 $\frac{1}{2}$	65	149 $\frac{1}{2}$	150 $\frac{3}{4}$	24 $\frac{1}{2}$	23 $\frac{1}{2}$	27 $\frac{1}{2}$	27
9	60 $\frac{1}{2}$	60 $\frac{1}{2}$	65	148 $\frac{1}{2}$	150 $\frac{1}{2}$	24 $\frac{1}{2}$	23 $\frac{1}{2}$	27 $\frac{1}{2}$	27 $\frac{1}{2}$
10	60	60 $\frac{1}{2}$	65	148 $\frac{1}{2}$	150 $\frac{1}{2}$	24 $\frac{1}{2}$	23	27 $\frac{1}{2}$	27

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

## Silver and Sterling Exchange

May	Sterling Exchange "Checks"	Silver			May	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
4	443 $\frac{1}{2}$	99 $\frac{1}{2}$	69 $\frac{1}{2}$	35 $\frac{1}{2}$	8	444	99 $\frac{1}{2}$	69 $\frac{1}{2}$	35 $\frac{1}{2}$
5	444	99 $\frac{1}{2}$	70 $\frac{1}{2}$	35 $\frac{1}{2}$	9	443 $\frac{1}{2}$	99 $\frac{1}{2}$	69 $\frac{1}{2}$	35 $\frac{1}{2}$
6	444	99 $\frac{1}{2}$	69	35	10	444 $\frac{1}{2}$	99 $\frac{1}{2}$	70 $\frac{1}{2}$	35 $\frac{1}{2}$

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

## Metal Markets

New York, May 10, 1922

The metal market has been generally quiet during the last week, tin and zinc being particularly stagnant. Lead is much less active than three or four weeks ago. Copper business improved somewhat, but sales did not indicate any general buying wave.

### Copper

Copper has been in better demand than any of the other non-ferrous metals during the last week. This has been partly owing to the fact that copper producers generally feel that higher prices are in prospect and have been reluctant to sell. When some of

them began to raise their price above the 13c. level which has ruled for the last ten days, there was a small-sized rush to contract for requirements at the even figure. Producers who have been willing to sell for 13c., delivered, during the last three days have done an excellent business; those who have gone to 13 $\frac{1}{2}$ c. have sold only an occasional carload or none at all. In some instances, where delivery charges have been low, consumers have been able to get copper for 12 $\frac{1}{2}$ c., but in no transaction have sales netted producers less than 12.75c. f.o.b. refinery, so far as we have learned. Most of the copper has been sold for June and July delivery. It would not be surprising to see the 13 $\frac{1}{2}$ c. level established within

the next two or three days. Demand has been generally distributed.

Export demand has been in fair volume to the usual consuming countries, including England. The price was advanced from 13.25c. to 13 $\frac{1}{2}$ c.

The announcement has been made that the Granby output will hereafter be sold by the Nichols Copper Co. instead of by the American Metal Co.

### Lead

The official contract price of the American Smelting & Refining Co. remains at 5.25c., New York.

Since the phenomenal demand of a few weeks ago, the market has settled down, and consumers now realize that the advance has been definitely terminated, so that they need not hurry to provide for future requirements. Lead is freely offered now at 5.25c., New York, though 5.35c. has been realized on some lots of metal for delivery within a week or two. Most of the lead sold at the 5.25c. price has been for June delivery. Demand has not been large, though well distributed. Large orders continue to be accepted at our average prices rather than at a fixed price to a greater extent than usual.

The St. Louis lead market is also quiet. Several carload orders have been placed at 5.15 to 5.175c., but consumers desiring larger quantities have been able to obtain their requirements at 5 $\frac{1}{2}$ c. Two or three fair-sized tonnage have sold at that level.

Lead continues to go well into consumption, and the building industry should absorb large quantities this summer. Corroders have not taken quite so much metal as usual, but this is for the reason that they are planning on carrying smaller stocks rather than because of a slackened demand for their product.

### Zinc

Zinc has been exceedingly quiet during the last week. The large buying on the rise a few weeks ago seems to have left producers with their current requirements well supplied. It is encouraging to note that the price has not weakened, remaining slightly above the 5c. level. Without doubt, foreign demand has had an effect on keeping up the price; several thousand tons have likely been taken off the market by European demands. High-grade business continues good at the unchanged price of 6c. per lb., delivered.

### Tin

Though prices have declined somewhat, consumers have been off the market to a large extent. Some small business by both consumers and dealers is reported, but the demand has cer-

tainly not been insistent. Electrolytic has been sold in small lots at the prices realized for Straits. Tin continues to be freely offered in the Far East, where large stocks are still held, but no violent decline is anticipated, and it is likely that a 30c. price would bring out considerable business and act as a stop on the market.

Arrivals of tin, in long tons: May 3, Liverpool, 25; May 4, Liverpool, 25; May 5, Liverpool, 25; May 9, London, 100; Liverpool, 50.

#### Gold

Gold in London: May 4th, 93s. 2d.; 5th, 93s. 3d.; 8th, 93s. 3d.; 9th, 93s. 4d.; 10th, 93s. 5d.

#### Foreign Exchange

No marked changes have taken place in the exchange market during the week. International bankers are still looking to Genoa for guidance. On Tuesday, May 9, francs were 9.115c.; lire, 5.305c.; marks, 0.3425c.; and Canadian dollars, 98.34c.

#### Silver

Good buying by China and India advanced the market, New York making a new high price for the year at 70½c. The internal dissensions in China, rather than any improved trade conditions there, are considered responsible for the rise, and although the future tendency is uncertain, the market appears steady at the present time.

Mexican Dollars—May 4th, 52½; 5th, 53½; 6th, 52½; 8th, 53½; 9th, 53½; 10th, 53½.

#### Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17.50@18.50c. for 98@99 per cent virgin grades.

Antimony -- Chinese and Japanese brands, 5.50c. W.C.C. brand, 6@6½c. Cookson's "C" grade, spot, 8.75@9c. Chinese needle antimony, lump, nominal, 3.5@4c. per lb. Standard powdered needle antimony (200 mesh) nominal at 5½c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb<sub>2</sub>O<sub>3</sub>, 6.75@7c.

Arsenic—7c. per lb.

Bismuth—\$2@2.10 per lb.

Cadmium—Demand for cadmium has improved recently and inquiries have been received from London. The price quoted for large quantities is now \$1.15 @ \$1.20 per lb. The metal is principally used by electro-platers.

Iridium—Nominal, \$150@170 per oz.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Small tonnages, spot, nominal at 30@33c.

Palladium—\$50@55 per oz.

Platinum—Market slightly weaker at \$85 per oz., but stocks are low and dealers not inclined to sell much at that level.

Quicksilver—\$55 per 75-lb. flask. San Francisco wires \$54.30. Steady.

The prices of Cobalt, Molybdenum, Monel Metal, Osmium, Rhodium, Selenium, Thallium and Tungsten are unchanged from the prices in the issue of May 6.

#### Metallic Ores

Molybdenum Ore—Increased demand for ferromolybdenum, coupled with the fact that the Colorado properties are closed down, has resulted in an active demand for molybdenum ore, and the price has advanced to 50c. per lb. of MoS<sub>2</sub>, for 85 per cent MoS<sub>2</sub> concentrates.

Tungsten Ore—Chinese quoted nominally at slightly advanced price, \$2.75 per unit.

The prices of Bauxite, Chrome, Manganese, Tantalum, Uranium, Vanadium, Titanium and Iron Ore, Zircon and Zirkite are unchanged from the prices in the issue of May 6.

#### Zinc and Lead Ore Markets

Joplin, Mo., May 6—Zinc blende, per ton, high, \$32.70; basis 60 per cent zinc, premium, \$31; Prime Western, \$29; fines and slimes, \$28@27; average settling price, all grades of blende, \$30.04. Calamine, 40 per cent zinc, average, \$15.

Lead, high, \$73.95; basis 80 per cent lead, \$70@72; average settling price, all lead ores, \$70.02 per ton.

Shipments for the week: Blende, 11,515; calamine, 125; lead, 1,808 tons. Value, all ores the week, \$475,700.

Purchases this week were 3,340 tons under last week, buyers feeling that present prices were no longer warranted, since the foreign market had dropped below an export level. With export hopes blasted and a resurvey of the domestic situation made, a thought has assumed shape that in all probability consumers were pretty well stocked against the existing coal supply and that a falling off in demand might occur. Sellers of zinc ore refused to accept a pessimistic view and declined to accept lower offerings, and as a consequence only 7,690 tons was sold, as against 11,030 the previous week.

Platteville, Wis., May 6 — Blende, basis 60 per cent zinc, \$30 per ton. Lead ore, basis 80 per cent lead, \$70.50 per ton. Shipments for the week: Blende 363; lead ore, 70 tons. Shipments for the year: Blende 5,318; lead ore, 830 tons. Shipped during the week to separating plants, 1,066 tons blende.

#### Non-Metallic Minerals

Feldspar—One producer reports No. 1 pottery grade has recently been in good demand at a slight recession in price, \$6.40 per ton, f.o.b. Eastern mines.

Talc—20 to 200 mesh, \$7@12 per ton, f.o.b. Vermont; \$8@10, f.o.b. Georgia; 200 mesh, \$18, f.o.b. California; through No. 25 Swiss silk, \$25, f.o.b. California. Market fair, but producers complain of Italian and Canadian competition and high freight rates to Eastern points of consumption.

Prices are unchanged from those in the issue of May 6, on Asbestos,

Barytes, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica and Sulphur.

#### Mineral Products

Copper Sulphate—Active demand and advancing copper prices have resulted in an advance to 5.75c. per lb. for large crystals.

The prices of Potassium Sulphate, Sodium Nitrate, and Sodium Sulphate are unchanged from the issue of May 6.

#### Ferro-Alloys

Ferromanganese—Domestic, 78 to 82 per cent, \$67@69, f.o.b. furnace; English, \$65, c.i.f. Atlantic seaports. Spiegeleisen, 19 to 21 per cent, scarce at \$35 per gross ton, f.o.b. furnace; 16 to 19 per cent, \$34.

Ferrotitanium, Ferrocromium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-uranium, and Ferrovandium are unchanged from the prices published May 6.

#### Metal Products

Copper Sheets—New York base, 19.25c. per lb.; wire, 14.75c.

Lead Sheets, Nickel Silver, Yellow Metal, and Zinc Sheets are unchanged from the prices published May 6.

#### Refractories

Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, Magnesite Brick, and Silica Brick are unchanged from the prices quoted May 6.

#### The Iron Trade

Pittsburgh, May 9, 1922

The steel market has made gains in the last week, buyers being insistent on early deliveries. Specifications against contracts are heavy. The industry seems to have settled down to a relatively steady rate, at 36,000,000 to 38,000,000 tons of ingots a year. There is no material change in the strike situation in the Connellsville region, where production is at about one-third the rate in March. After long idleness the agricultural-implement factories are moderately active. Railroad buying is of fair proportions, and the automobile industry is operating at close to capacity.

Steel prices are firm and some independent mills have been advancing quotations. In occasional instances delivery premiums would be paid. Sheet bars have sold at \$35.

Pig Iron—The merchant furnaces remain out of the market as regular sellers. There is hardly any inquiry. On a forced purchase about \$24, Valley basis, would probably have to be paid for bessemer, basic or foundry.

#### Coke

Connellsville Coke—With limited demand and offerings the market is up 25c., at \$6.25 for furnace and \$6.75 for foundry. Connellsville steam coal is higher, at \$3.

# COMPANY REPORTS

## Chile Copper Co.

The sixth annual report of the Chile Copper Co. for 1921 shows that although operations were carried on at less than half the scale maintained in 1920, the actual cost of producing copper increased only 0.1c., the cost being 10.7c. per lb. during 1920 and 10.8c. during 1921. This figure does not include depreciation and depletion. During March, 1922, the figure had been reduced to 7.8c. per lb. Development of a new anode, which will be installed throughout the tanks by the end of 1922, will in itself reduce the cost 3c. per lb. A combined statement of income and surplus accounts for the Chile Copper Co. and the Chile Exploration Co. for the year ended Dec. 31, 1921, follows:

Operating revenue		
Copper sold and delivered, 67,823,964 lb. @ 13.7993c...	\$9,359,266	
Operating cost		
Cost f. o. b. plant yards	\$6,595,449	
Freight, insurance, and delivery expense	738,513	
Selling expense	90,554	
	7,424,517	
Operating profit		\$1,934,749
Other income		
Dividends—Chile Steamship Co.	\$100,000	
Interest and discount received	678,211	
Miscellaneous	68,491	
	846,702	
Total income		\$2,781,451
Charges against income		
Taxes and miscellaneous charges	\$615,284	
Interest on bonds of Chile Copper Co.	3,150,000	
	3,765,284	
Net loss carried to surplus account		\$983,832
Balance of surplus account as stated Dec. 31, 1920, deficit		\$349,718
Add		
Adjustment of Chilean import duties and miscellaneous adjustments		878,076
Net deficit, Dec. 31, 1920, as adjusted		\$1,227,794
Net loss for year as above		983,832
		\$2,211,626
Charges against surplus		
Depreciation of plant and equipment	\$2,984,115	
Obsolete plant, equipment, and supplies	232,473	
Depletion of ore reserves	1,338,520	
Amortization of discount on bonds	140,000	
	4,695,108	
Deficit, Dec. 31, 1921		\$6,906,735
Depletion reserve		8,436,054
		\$1,529,320
Less unamortized bond discount		1,435,000
Net combined surplus and depletion reserve, Dec. 31, 1921		\$94,320

Ore reserves as of Dec. 31, 1921, were as follows:

Oxidized ore	327,630,000 tons, averaging 1.91 per cent copper	
Mixed ore	151,000,000 tons, averaging 2.98 per cent copper	
Sulphide ore	210,000,000 tons, averaging 1.84 per cent copper	

During the year, 54,008,065 lb. of marketable copper was produced. Production in December, 1921, and for several months preceding, was about 2,000 tons; in January, 2,697; in February, 3,441; and in March, 4,161 tons. From the time the ore is mined to the production of finished wire bars is only twelve days, compared with ninety to one hundred days with most producers. During 1922 the dechloridizing plant will be enlarged, additional mine tracks provided, fifty additional ore cars secured, water conservation will be extended, and other improvements will bring the capacity of the plant to about 200,000,000 lb. of copper per year. Further minor additions would bring the capacity to 225,000,000 lb.

Capitalization: Outstanding, 3,800,000 shares at \$25 par. Funded debt, \$15,000,000 in collateral trust 7 per cent ten-year convertible gold bonds; and \$35,000,000 in collateral trust 6 per cent fifteen-year convertible gold bonds.

## Silver King Consolidated Mining Co. of Utah

A report of the operations of the Silver King Consolidated Mining Co. of Utah for 1921 shows assessments of \$258,835.96. Production amounted to twenty-nine tons of ore, of a net value of \$1,179.50. Financial statement follows:

<b>RECEIPTS</b>		
Cash on hand, Jan. 1, 1921	\$17,563.12	
Inventory	5,404.61	
	\$22,967.73	
Sale of capital stock	\$19,244.50	
Assessments Nos. 10, 11, and 12	258,835.96	
Ore sales	1,179.50	
Notes payable	19,900.00	
Sale of second-hand equipment	4,017.41	
Accounts receivable	6,326.34	
Miscellaneous	36.35	
	309,540.05	
<b>DISBURSEMENTS</b>		
Mine account	\$3,352.66	
Tunnel account	92,709.14	
Mill maintenance	1,893.65	
Expense accounts		
General, office and legal	34,032.43	
Interest	15,789.00	
Miscellaneous	787.98	
Accounts and notes paid	175,769.26	
	\$324,335.12	
Total disbursements		
Less accounts payable taken into account and charged out Dec. 31, 1921	10,392.86	
Total cash disbursements		\$313,942.26
Balance on hand, Jan. 1, 1922		
Cash	\$15,455.00	
Inventory	3,110.52	
	18,565.52	
		\$332,507.78
The number of issued and outstanding shares of capital stock on Dec. 31, 1921		868,870
The number of shares remaining in Treasury on Dec. 31, 1921		381,130
Total number of shares authorized		1,250,000

The Spiro tunnel was driven 904 ft. during the year, making its total length 15,014 ft. on Jan. 1, 1922. The president states that "the position of the company is far better than it was at the beginning of the year and is improving daily."

## Hedley Gold Mining Co.

A report of the operations of the Hedley Gold Mining Co. for 1921 shows no production, as the property was closed in November, 1920. The financial condition of the company on Dec. 31, 1921, is shown by the following balance sheet:

<b>ASSETS</b>		
Fixed		
Mines and mining claims	\$1,359,715.78	
Buildings, machinery, and plant	656,831.85	
Stock: the Similkameen Water Works Co., Ltd.	6,000.00	
Copper Flat property	200,000.00	
	\$2,222,547.63	
Deferred		
Supplies	\$74,965.55	
Mine development	57,948.67	
Items in suspense	10,205.34	
	143,119.56	
Current		
Cash in banks	\$67,145.13	
Accounts receivable	893.39	
	68,038.52	
		\$2,433,705.71
<b>LIABILITIES</b>		
Capital stock		
Authorized and issued (240,000 shares, par value \$10 each.)		\$2,400,000.00
Current		
Accounts payable, sundry creditors		2,714.20
Reserve		
For taxes	\$29,387.99	
Unearned insurance	399.74	
	29,787.73	
Surplus at Dec. 31, 1921		1,263.78
		\$2,433,705.71

Development work during 1921 did not increase the tonnage of reserve ore, which is estimated at 70,000 tons of \$9 grade, without taking into account considerable lower-grade ore that could not be milled at a profit under present conditions.

### Belmont Surf Inlet Mines, Ltd.

A report of the operations of the Belmont Surf Inlet Mines, Ltd., for 1921, show an operating profit of \$62,758.94 according to the following account:

CREDITS		
Values realized.....		\$632,731.12
DEBITS		
Mining.....	\$454,604.15	
Milling.....	145,296.49	
Loading.....	22,321.45	
		622,222.09
Difference in exchange and miscellaneous income.....		\$10,509.03
		70,059.22
		\$80,568.25
Loss on maintenance of hospital.....	\$15,242.29	
Less rents and discounts.....	6,024.60	
		\$9,217.69
Administration expenses.....	\$8,591.62	
		17,809.31
Operating profit for the year 1921.....		\$62,758.94
Depreciation.....		
Mill, buildings and machinery tug.....		57,639.81
Net income for the year 1921.....		\$5,119.13

#### Balance sheet as of Dec. 31, 1921, follows:

ASSETS		
Property.....		
Mines and mining claims at cost.....		\$1,923,465.22
Mill, buildings and machinery after writing off \$255,626.34 depreciation.....		307,226.57
Launches and tug after writing off \$8,550.21 depreciation.....		30,635.65
		\$2,261,327.44
Investment.....		
Surf Inlet Power Co., Ltd.....		200,000.00
Deferred accounts.....		9,912.19
Available assets.....	\$124,180.69	
Concentrates on hand.....	14,734.32	
Ore stocks on hand.....	4,948.18	
Accounts receivable.....	75,027.48	
Cash in bank and on hand.....	74,915.21	
		293,805.88
		\$2,765,045.51
LIABILITIES		
Capital stock.....		
2,500,000 shares of \$1 each, fully paid.....		\$2,500,000.00
Current liabilities.....		59,251.86
Reserve for income taxes up to date.....		48,758.90
Surplus.....		
Balance as at Dec. 31, 1920.....	\$252,336.62	
Net income 1921.....	5,119.13	
		\$257,455.75
Less adjustments of prior year.....	100,421.00	
		157,034.75
		\$2,765,045.51

The metal content of 134,570 tons produced was 39,825.19 oz. of gold, 24,549.5 oz. silver and 709,971 lb. of copper.

### Noted Indian Gold Mine Pays Dividends for Thirty-six Years

The net revenue of the Mysore Gold Mining Co. for 1921 was £648,762 4s. 6d., the receipts from the sale of gold and silver amounting to £688,640 17s. 11d. The total profits aggregated £213,030 5s. 3d., of which £61,000 (25 per cent of value of fully paid shares) was distributed in dividends. The liquid assets as at Dec. 31, 1921, amounted to £508,003 5s. 1d. This is the thirty-sixth consecutive year in which the company has paid a dividend, the total amount thus distributed to date amounting to £9,146,519 13s. 11d.

On the termination, in May last, of the arrangement for the sale of gold to the government of India, the company was able to sell all its product in the open market. Sales have been effected in London, involving shipment to New York; and it has been possible to dispose of parcels of the metal in India on advantageous terms. The average price in British paper money has been favorable, although toward the end of the year under review there was a considerable decline in the premium.

### Movements of Ores and Metals for March

Imports and exports of the more important metals and ores in March, 1922, and the revised figures for March, 1921, as compiled by the Bureau of Foreign and Domestic Commerce, are as follows:

	IMPORTS	
	In Pounds, Unless Otherwise Stated	
	March, 1921	March, 1922
Antimony matte, regulus or metal.....	1,776,484	2,441,872
Copper.....		
Ore, contents.....	4,029,414	1,005,357
Concentrates, contents.....	4,816,400	2,799,997
Matte and regulus, contents.....	1,020,103	169,070
Imported from.....		
Spain.....	123,648	223,280
Canada.....	423,480	261,892
Cuba.....	2,852,773	2,224,641
Chile.....	2,762,246	252,909
Peru.....	330,952	3,226
Unrefined black and blister.....	12,448,823	17,205,149
Refined, in bars and plates.....	324,060	13,737,242
Old, for remanufacture.....	35,062	4,097,807
Composition metal, copper chief value.....	450	108,129
Lead.....		
Ore, contents.....	341,211	642,376
Bullion, contents.....	1,867	13,034,908
Imported from.....		
Canada.....	163,269	340,267
Mexico.....	9,867	13,034,908
Chile.....		221,008
Other countries.....	169,942	81,101
Pigs, bars and old.....	1,993,264	
Manganese ore, long tons.....	69,710	15,124
Imported from.....		
Brazil.....	30,750	76,088
British India.....	38,460	
Other countries.....	500	828
Tungsten ore, long tons.....	64	
Pyrites, long tons.....	18,773	7,533
Imported from.....		
Spain.....	11,223	7,533
Tin.....		
Ore and oxide, long tons.....	1,852	566
Bars, blocks and pigs.....	3,028,356	15,783,259
Imported from.....		
United Kingdom.....	907,289	3,327,204
British Straits Settlements.....	1,689,489	10,892,979
Dutch East Indies.....		279,922
Hongkong.....	319,201	281,845
Australia.....	56,000	270,172
Other countries.....	56,377	731,137
Zinc.....		
Ore, contents.....	981,494	153,408
Imported from.....		
Canada.....	470,927	153,408
Blocks, pigs and old.....	6,162,061	
Zinc dust.....		42,916

#### EXPORTS OF COPPER, LEAD AND ZINC

	In Pounds	
	March, 1921	March, 1922
Copper.....		
Ore concentrates, matte and regulus, copper content.....	60,970	
Unrefined black and blister.....	33,613	
Refined, in ingots and bars.....	36,574,236	72,393,485
Exported to.....		
Belgium.....	2,106,438	3,353,514
France.....	2,925,938	10,227,165
Germany.....	19,020,962	26,357,542
Italy.....		3,642,817
Netherlands.....	1,164,846	2,746,519
Spain.....	554,656	1,526,812
Sweden.....	509,009	1,143,374
United Kingdom.....	7,406,780	4,713,226
Canada.....	1,224,040	99,213
Japan.....		8,848,079
Other countries.....	1,661,567	9,735,341
Composition metal, copper chief value.....	3,216	273,525
Old and scrap.....		144,001
Pipes and tubes.....	293,826	127,537
Plates and sheets.....	830,544	1,438,667
Rods.....		5,130,679
Wire.....	984,878	1,344,995
Lead.....		
Pigs and bars.....		
From domestic ore.....	77,458	168,115
From foreign ore.....	3,138,794	11,170,618
Exported to.....		
France.....		2,464,953
United Kingdom.....	2,017,347	1,904,670
Canada.....	21,649	10,529
Argentina.....	112,000	448,000
Brazil.....		526,879
China.....	1,200	
Other countries.....	1,064,056	5,983,702
Zinc.....		
Dross.....	7,340	635,195
Spelter.....		
From domestic ore.....	174,106	6,668,357
From foreign ore.....		784,000
Total zinc slabs and blocks.....	174,106	7,452,357
Exported to.....		
France.....		4,483,828
Italy.....		
United Kingdom.....		1,654,325
Canada.....	3,750	167,534
Mexico.....	136,833	5,547
Japan.....		1,030,523
Other countries.....	33,523	110,598
In sheets and strips.....	171,865	391,568
Zinc dust.....		269,825
Other zinc manufactures.....		53,615

# MINING STOCKS

Week Ended May 6, 1922

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.	
<b>COPPER</b>						<b>GOLD</b>						
Ahmeek.....	Boston	62	61	61	Sept. '20, Q	\$0.50	Alaska Gold.....	New York	1	1		
Alaska-Br. Col. new.	N. Y. Curb	4	3	4			Alaska Juneau.....	New York	1	1		
Allouez.....	Boston	27	25	25	Mar. '19	1.00	Carson Hill.....	New York	15	14	15	
Anaconda.....	New York	54	52	52	Nov. '20, Q	1.00	Cresson Consol. G.....	N. Y. Curb	2	2	2	
Arcadian Consol.....	Boston	3	3	3			Dome Extension.....	Toronto	28	27	27	
Aria, Com'l.....	Boston	9	9	9	Oct. '18, Q	0.50	Dome Mines.....	New York	23	22	23	
Big Ledge.....	N. Y. Curb	*24	*21	*24			Florence Goldfield.....	N. Y. Curb	*23	*22	*23	
Bingham Mines.....	Boston	15	15	15	Sept. '19, Q	0.25	Golden Cycle.....	Colo. Springs	*76	*72	*76	
Calumet & Arizona.....	Boston	60	58	59	Mar. '22, Q	0.50	Goldfield Consol.....	N. Y. Curb	*7	*7	*7	
Calumet & Hecla.....	Boston	275	270	270	June '20, Q	5.00	Hollinger Consol.....	Toronto	9.80	9.65	9.75	
Canada Copper.....	N. Y. Curb	*55	*47	*50			Homestake Mining.....	New York	73	71	72	
Centennial.....	Boston	11	10	10	Dec. '18, SA	1.00	Kirkland Lake.....	Toronto	46	42	44	
Cerro de Pasco.....	New York	37	36	37	Mar. '21, Q	0.50	Lake Shore.....	Toronto	2.44	2.35	2.38	
Chile Copper.....	New York	20	18	20			McIntyre-Porcupine.....	Toronto	19.25	18.50	19.00	
Chino.....	New York	29	28	28	Sept. '20, Q	0.37	Porcupine Crown.....	Toronto	*29	*26	*28	
Columbus Rexall.....	Salt Lake	†*31	*29	*31			Porcupine V. N. T.....	Toronto	*39	*34	*37	
Con. Arizona.....	N. Y. Curb	*8	*2	*8	Dec. '18, Q	0.05	Portland.....	Colo. Springs	*30	*30	*30	
Con. Copper Mines.....	N. Y. Curb	1	1	1			Schumacher.....	Toronto	*59	*57	*58	
Copper Range.....	Boston	43	41	41	Mar. '22, Q	1.00	Silver Pick.....	N. Y. Curb	*20	*18	*19	
Crystal Copper.....	Boston Curb	1	1	1			Teck Hughes.....	Toronto	*60	*58	*59	
Davis-Daly.....	Boston	8	8	8	Mar. '20, Q	0.25	Tom Reed.....	Los Angeles	*60	*60	*60	
East Butte.....	Boston	11	11	11	Dec. '19, A	0.50	United Eastern.....	N. Y. Curb	1	1	1	
First National.....	Boston Curb	*85	*78	*85	Feb. '19, SA	0.15	Vindicator Consol.....	Colo. Springs	*10	*8	*8	
Franklin.....	Boston	2	2	2			White Caps Mining.....	N. Y. Curb	*9	*8	*8	
Gadsden Copper.....	Boston Curb	2	1	1			Wright-Hargreaves.....	Toronto	3.00	2.85	2.90	
Granby Consol.....	New York	27	25	27	May '19, Q	1.25	Yukon Gold.....	N. Y. Curb	1	1	1	
Greene-Canaan.....	New York	32	31	31	Nov. '20, Q	0.50	<b>SILVER</b>					
Hancock.....	Boston	3	3	3			Batopilas Mining.....	New York	1	1	1	
Howe Sound.....	N. Y. Curb	3	3	3	Jan. '21, Q	0.05	Beaver Consol.....	Toronto	*36	*34	*35	
Inspiration Consol.....	New York	42	40	40	Oct. '20, Q	1.00	Coniagas.....	Toronto	1.30	1.27	1.27	
Iron Cap.....	Boston Curb	9	7	9	Sept. '20, K	0.25	Crown Reserve.....	Toronto	*18	*16	*17	
Isla Royale.....	Boston	24	23	23	Sept. '19, SA	0.50	Kerr Lake.....	N. Y. Curb	4	4	4	
Kenecott.....	New York	34	33	33	Dec. '20, Q	0.50	La Rose.....	Toronto	*35	*27	*28	
Keweenaw.....	Boston	3	3	3			McKinley-Dar-Sav.....	Toronto	1.15	*28	*30	
Lake Copper.....	Boston	4	3	4			Mining Corp. Can.....	Toronto	1.15	*80	1.05	
La Salle.....	Boston	2	1	2			Nipissing.....	N. Y. Curb	6	5	6	
Magma Copper.....	N. Y. Curb	30	29	29	Jan. '19, Q	0.50	Ontario Silver.....	New York	9	8	9	
Majestic.....	Boston Curb	†*12	†*9	†*10			Ophir Silver.....	N. Y. Curb	*3	*3	*3	
Mason Valley.....	Boston	2	2	2			Temiskaming.....	Toronto	*36	*30	*32	
Mass. Consolidated.....	Boston	4	3	3	Nov. '17, Q	1.00	Trethewey.....	Toronto	*6	*4	*4	
Miami Copper.....	New York	29	29	29	Feb. '22, Q	0.50	<b>GOLD AND SILVER</b>					
Michigan.....	Boston	5	2	3			Boston & Montana.....	N. Y. Curb	*22	*19	*20	
Mohawk.....	Boston	59	56	57	Feb. '22, Q	1.00	Cash Boy.....	N. Y. Curb			*4	
Mother Lode Coa.....	N. Y. Curb	10	8	9			Dolores Esperanza.....	N. Y. Curb	2	1	1	
Nevada Consol.....	New York	17	16	17	Sept. '20, Q	0.25	El Salvador.....	N. Y. Curb	*7	*5	*7	
New Cornelia.....	Boston	18	18	18	Feb. '22, K	0.25	Jim Butler.....	N. Y. Curb	*8	*8	*8	
North Butte.....	Boston	13	12	12	Oct. '18, Q	0.25	Jumbo Extension.....	N. Y. Curb	*5	*5	*5	
North Lake.....	Boston			*40			MacNamara M.&M.....	N. Y. Curb	*10	*9	*9	
Ohio Copper.....	N. Y. Curb	*10	*8	*10			Tonopah Belmont.....	N. Y. Curb	1	1	1	
Old Dominion.....	Boston	25	23	24	Dec. '18, Q	1.00	Tonopah Divide.....	N. Y. Curb	*80	*75	*76	
Oseola.....	Boston	35	35	35	June '20, Q	0.50	Tonopah Extension.....	N. Y. Curb	1	1	1	
Phelps Dodge.....	Open Mar.		†165		Apr. '22, Q	1.00	Tonopah Mining.....	N. Y. Curb	10	1	1	
Quincy.....	Boston	44	43	43	Mar. '20, Q	1.00	West End Consol.....	N. Y. Curb	1	1	1	
Ray Consolidated.....	New York	16	16	16	Dec. '20, Q	0.25	<b>SILVER-LEAD</b>					
Ray Hercules.....	N. Y. Curb	1	1	1			Caledonia.....	N. Y. Curb	*7	*7	*7	
St. Mary's Min. Ld.....	Boston	46	45	45	Apr. '22, K	2.00	Cardiff M. & M.....	Salt Lake	*95	*95	*95	
Seneca Copper.....	Boston	13	13	13			Chief Consol.....	Boston Curb	4	4	4	
Shannon.....	Boston	*95	*80	*80	Nov. '17, Q	0.25	Consol. M. & S.....	Montreal	23	22	23	
Shattuck Arizona.....	New York	9	8	8	Jan. '20, Q	0.25	Daly Mining.....	Salt Lake	†2.00	†1.00		
South Lake.....	Boston	*90	*90	*90			Daly-West.....	Boston	2	2	2	
Superior & Boston.....	Boston	1	1	1			Eagle & Blue Bell.....	Boston Curb	†3	†2	†2	
Tenn. C. & C. cfs.....	New York	12	11	11	May '18, I	1.00	Electric Point.....	Spokane	*8	*7	*8	
Tuolumne.....	Boston	*69	*65	*69	May '13,	0.10	Federal M. & S.....	New York	13	13	13	
United Verde Ex.....	Boston Curb	28	28	28	May '22, Q	0.25	Federal M. & S. pfd.....	New York	45	44	44	
Utah Consol.....	Boston	2	2	2	Sept. '18,	0.25	Florence Silver.....	Spokane	*23	*20	*22	
Utah Copper.....	New York	67	65	65	Mar. '22, Q	0.50	Grand Central.....	Salt Lake	†*80	†*60	*75	
Utah Metal & T.....	Boston	1	1	1	Dec. '17,	0.30	Hecla Mining.....	N. Y. Curb	6	6	6	
Victoria.....	Boston	1	1	1			Iron Blossom Con.....	N. Y. Curb	*20	*20	*20	
Winona.....	Boston	1	1	1			Judge M. & S.....	Salt Lake	†2.60	†2.20	2.60	
Wolverine.....	Boston	13	12	13			Marsh Mines.....	N. Y. Curb	*22	*9	*9	
<b>NICKEL-COPPER</b>						<b>VANADIUM</b>						
Internat. Nickel.....	New York	18	17	18	Mar. '19,	0.50	Vanadium Corp.....	New York	47	41	47	
Internat. Nickel, pfd	New York	82	80	82	Feb. '22, Q	1.50	<b>ASBESTOS</b>					
<b>LEAD</b>						<b>SULPHUR</b>						
National Lead.....	New York	94	92	93	Mar. '22, Q	1.50	Freeport, Texas.....	New York	19	17	18	
National Lead, pfd.....	New York	110	110	110	Mar. '22, Q	1.75	Texas Gulf.....	New York	44	43	43	
St. Joseph Lead.....	New York	15	14	15	Mar. '22, Q	0.25	<b>MINING, SMELTING AND REFINING</b>					
<b>QUICKSILVER</b>						<b>AMER. SM. &amp; REF.</b>						
New Idria.....	Boston	1	1	1			Amer. Sm. & Ref.....	New York	59	57	57	
<b>ZINC</b>						<b>AM. SM. SEC. PF. A.</b>						
Am. Z. L. & S.....	New York	19	18	18	May '20,	1.00	Am. Sm. Sec. pf. A.....	New York	92	92	92	
Am. Z. L. & S. pfd.....	New York	44	43	44	Nov. '20, Q	1.50	U. S. Sm. R. & M.....	New York	41	40	40	
Butte C. & Z.....	New York	7	6	6	June '18,	0.50	U. S. Sm. R. & M. pf.....	New York	46	45	45	
Butte & Superior.....	New York	31	29	30	Sept. '20,	1.25	<b>ASBESTOS</b>					
Callahan Zn-Ld.....	New York	7	7	7	Dec. '20, Q	0.50	Asbestos Corp.....	Montreal	60	57	57	
New Jersey Zn.....	N. Y. Curb	146	146	146	Feb. '22, Q	2.00	Asbestos Corp. pfd.....	Montreal	75	75	75	
Yellow Pine.....	Los Angeles	*45	*40	*40	Sept. '20, Q	0.03	<b>SULPHUR</b>					

\*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

# Current Prices of Mine Materials and Supplies

## Rise and Fall of the Market

**Advances**—Dynamite steadies with slight advances along the Western coast. Flotation oils continue brisk and linseed rises 5c. in the New York market. Drill rods are steady. Wire rope shows added strength over the previous two weeks. Cement is quoted 20c. higher.

**Declines**—Yellow pine down \$1 in Chicago, douglas fir and hemlock fall \$3 in Los Angeles. Lime is 15c. to 20c. lower in St. Louis and Seattle.

**SHEETS**—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed No. 10	\$2.45	\$3.47½	\$3.38	\$3.95	\$3.38
Black No. 28	3.15	4.30	4.30	5.45	4.25
Galvanized No. 28	4.15	5.30	5.30	6.30	5.25

**STEEL RAILS**—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh One	Year Ago	Birmingham	Chicago
Standard bessemer rails	\$40.00	\$45.00		\$40.00
Standard openhearth rails	40.00	47.00	\$40.00	40.00

**TRACK SUPPLIES**—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ½-in. and larger	\$2.15@2.25	\$3.30	\$2.55	\$3.00	\$4.25
Track bolts	3.00@3.50	4.35	3.65	4.25	5.25
Standard section angle bars	2.40	2.50	2.40	3.00	4.00

**STRUCTURAL MATERIAL**—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Birmingham	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	1.60	\$1.65	\$2.58	\$4.00	\$2.57½	\$2.48
Channel, 3 to 15 in.	1.60	1.65	2.58	4.00	2.57½	2.48
Angles, 3 to 6 in., ½ in. thick	1.60	1.65	2.58	4.00	2.57½	2.48
Tees, 3 in. and larger	1.60	1.65	2.58	4.00	2.57½	2.48
Plates	1.60	1.65	2.58	4.00	2.57½	2.48

**WIRE ROPE**—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Hercules red strand, all constructions	30%
Cast steel round strand rope	32½%

	New York	Cleveland	Chicago
Drill Rod (from list)	55@60%	55%	50%

**WROUGHT PIPE**—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD—1 to 3	71	58½	½ to 1½	44½	29½
LAP WELD—2	64	51½	2	39½	25½

**STEEL**—From warehouses at the places named the following discounts hold for steel pipe:

	New York	Black Chicago	St. Louis
1 to 3 in. butt welded	66%	62½%	59%

**CAST-IRON**—The following are prices per net ton for carload lots:

	New York	One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
4 in.	\$50.80	\$73.30	\$38.50	\$48.10	\$43.70	\$54.00

	New York	Cleveland	Chicago
Nuts, hot pressed, sq., per 100 lb. Off list	\$2.50	\$3.50	\$4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.50	3.50	4.00

**MACHINE BOLTS**  
1½ and 1½x3 in. up to 12 in.  
Button head bolts, with hex. nuts.

	New York	Cleveland	Chicago
1½ and 1½x3 in. up to 12 in.	40%	60-10-10%	60-10%
Button head bolts, with hex. nuts.	30%	\$3.90 net	

**HOLLOW TILE**—Price per block in carload lots to contractor for hollow building tile.

	New York	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy
4x12x12	\$0.11120	\$0.1895	\$0.0821	\$0.095	\$0.063	\$0.108
6x12x12	.16670	.2526	.0950	.08	.156	
8x12x12	.20840		.1295	.175	.12	\$0.17890

**LUMBER San Francisco**—Prices of rough Douglas fir No. 1 common, in more than carload lots. To contractors, \$2 per M ft. additional.

	6-8 and 10-16-18 and 22 and 24 Ft.	20 Ft.	24 Ft.	25 to 32 Ft.
3x3 and 4	\$24.00	\$24.00	\$25.00	\$30.00
3x6 and 8	25.00	25.00	26.00	31.00
4x4-6 and 8	25.00	26.90	27.00	32.00

## LUMBER (continued)

Wholesale prices to dealers of long leaf yellow pine.

	New York	Chicago
3x4 to 8x8	20 Ft. and Under \$38.00	22-24 Ft. and Under \$36.00
3x10 to 10x10	41.00	42.00
3x12 to 12x12	43.00	44.00

## Other Cities

	8 x 8-In. x 20 Ft. and Under	12 x 12-In. 20 Ft. and Under
Boston	\$50.00	\$54.00
Cincinnati	39.00	40.00
Montreal	47.00	82.00
Denver	35.75	35.75
Minneapolis	40.00	38.00
Kansas City	33.00	34.00
Birmingham	21.00	26.00

**NAILS**—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	\$2.40	\$3.15	\$3.90	\$5.00	\$3.25	\$4.95
Cut	2.25	5.80	5.90	7.75		5.00

**PORTLAND CEMENT**—Prices to contractors per bbl. in carload lots f.o.b. points listed without bags. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York	\$2.60	\$2.30	\$3.20
Chicago	1.97	1.94	2.17
Cleveland	2.26	2.26	2.43

**LIME**—Warehouse prices:

	Hydrated, per Ton Finishing	Common	Lump, per Barrel Finishing	Common
New York	\$15.80@16.80	\$12.50	\$3.68	\$2.75@3.18
San Francisco	22.00	18.00		1.75

**LINSEED OIL**—These prices are per gallon:

	New York	Chicago
Raw in barrel (5 bbl. lots)	Current \$0.95	One Year Ago \$0.67

**WHITE AND RED LEAD**—Base price in cents per pound:

	Current	Red 1 Year Ago	White Current	White Yr. Ago
100-lb. keg	Dry 12.25	In Oil 13.75	Dry 13.00	In Oil 14.50
25 and 50-lb. kegs	12.50	14.00	13.25	14.75

## HOSE

	Fire	50-Ft. Lengths
Underwriters' 2½-in.		49½¢ per ft.
¾-in. per ft.	Air First Grade \$0.24	Second Grade \$0.19½
First grade	40-10%	Second grade 50-5%
Third grade		5-10-5%

**RUBBER BELTING**—The following discounts from list apply to transmission rubber and duck belting:

Competition	60-10-5%	Best grade	60-5%
-------------	----------	------------	-------

**LEATHER BELTING**—Present discounts from list in fair quantities:

Light Grade	Medium Grade	Heavy Grade
50%	40-5%	35%

## RAWHIDE LACING

For cut, best grade, 50-10%, 2nd grade, 60%. For laces in sides, best, 41c. per sq.ft.; 2nd, 39c. Semi-tanned: cut, 50%; sides, 43c. per sq.ft.

**PACKING**—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	\$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

## MANILA ROPE

Boston	\$0.20	New Orleans	\$0.17½
New York	.17	Los Angeles	.16½
Chicago	.19	Seattle	.16½

**COTTON WASTE**—The following prices are in cents per pound:

	New York	Cleveland	Chicago
White	7.50@10.00	12.00	12.00
Colored mixed	5.50@9.00	9.00	9.00

**EXPLOSIVES**—Prices per pound of dynamite in small lots:

	Gelatin
New York	40% \$0.2950
Kansas City	60% \$0.3250
Denver	.2550
Baltimore	.2550
Cincinnati	.2550
New Orleans	.2725
San Francisco	.195

**FLOTATION REAGENTS**—All prices are f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Pine oil, steam dist., sp.gr. 0.930-0.940	gal.	\$1.90
Pine oil, pure, dest. dist.	gal.	1.50
Pine tar oil, ref., sp.gr. 1.025-1.035	gal.	.46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla.	gal.	.35



## NEW MACHINERY AND INVENTIONS

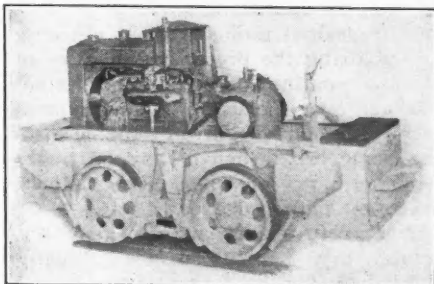
### A New Gasoline Mine Locomotive

The accompanying illustration shows a type of mine locomotive which was developed to meet the demand for a compact, dependable gasoline locomotive for light haulage service. It is a substantial machine complete in every detail, and is built to stand severe service.

The motor is of the rugged tractor type with all parts thoroughly inclosed and protected, but still easily accessible. The in-take air is washed by passing through a water clarifier, which removes the dust. A simple and effective splash system of lubrication is used. The lubricating oil is introduced at one point in a central reservoir which lubricates all parts of the motor and transmission.

The clutch is placed just behind the flywheel in the usual manner, and the propeller shaft mounts at its extremity a bevel pinion which is in constant mesh with two bevel gears, causing the bevel gears to rotate in opposite directions. Forward or reverse motion is obtained by engaging either one of these bevel gears by means of a sliding gear clutch. A neutral position is also provided. The drive from the bevel gear shaft is by a spur gear reduction to the jack shaft, on the extremities of which are mounted sprockets which drive the axles through high-grade roller chains.

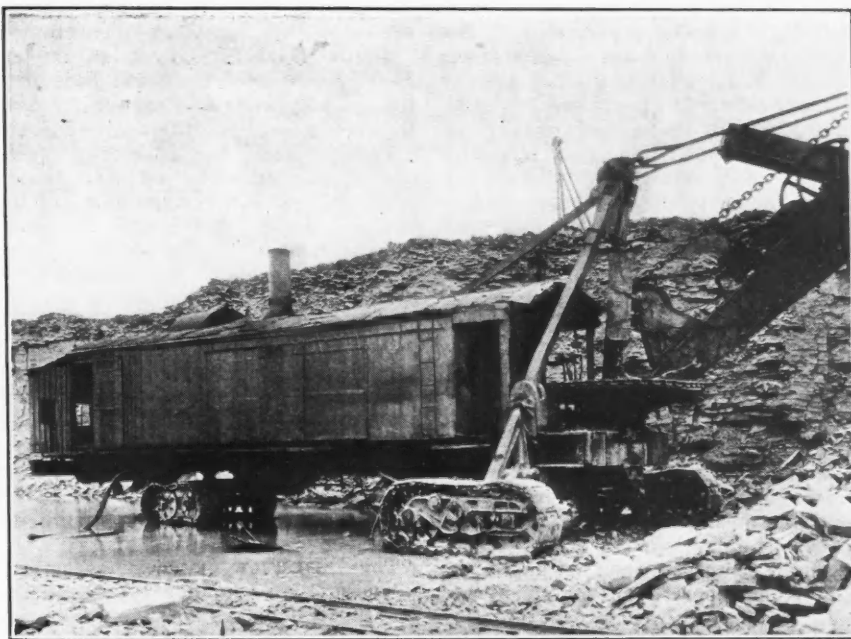
The power plant is mounted in a standard locomotive frame similar to that which has been used for some time



Gasoline locomotive for light hauls

on electric locomotives in mining and industrial service. Complete locomotive equipment, such as hand-operated brakes with renewable brake shoes, hand-operated sanders of rugged design, structural steel frame and locomotive type bumpers, is used. Speed changes are obtained by throttle control similar in operation to that of a steam locomotive. All control levers are conveniently grouped in the operator's compartment. Cast-iron wheels are standard equipment, but steel wheels or steel-tired wheels, as well as a cab for inclosing the operator and mechanism, can be provided if desired.

The locomotive is known as Type "G" and is manufactured by the Atlas Car & Manufacturing Co., Cleveland, Ohio.



Steam shovel, equipped with caterpillar traction, in operation in Ohio lime quarry

### Caterpillars Applied to Shovels

Of interest to operators of railroad-type shovels is the announcement that all sizes can now be equipped with caterpillar traction. Among the advantages of mounting a shovel in this way are the following: No time lost in moving up; an ordinary move requires about ten seconds only; no rails to lay; no jacks to release and set; no stops during operation to reset jacks; the shovel is always ready to dig; the shovel does not have to face blasting; may be moved back out of the way quickly and easily; can be turned around quickly; no track trouble when in water; in emergencies, such as slides, can be moved back quickly out of danger; shovel can always dig at most effective distance from bank—short moves easy and quick to make; no delay on account of boulders rolling in close to shovel; lighter work for pitmen; saves from two to four pitmen and sometimes more; can travel and work on approximately same character of ground as shovel on railroad trucks, and where shovel on railroad trucks requires blocking under jacks and both rails, when working on soft ground, the shovel on caterpillars requires blocking only under the caterpillars.

The mounting consists in general of two forward caterpillars, replacing the jack arm, and two rear caterpillars mounted under the rear end of the shovel.

The front caterpillars are so designed that they can swivel and adjust themselves to unevenness of the ground. Both front caterpillars are drivers.

The rear caterpillars consist of two caterpillar units mounted on the same frame. They are designed with sufficient strength to permit the crossing of holes and ditches without the delay incidental to filling in.

Steering is accomplished through the rear caterpillars. The massive steering

arm is integral with the pintle of the rear caterpillar trucks. It carries a heavy gear segment which engages a pinion on a vertical shaft. It is driven by an independent center-valve, reverse-type engine, suspended underneath the car frame. This engine may be operated either from the operator's stand or from ground alongside the rear caterpillars. Steering in curves of large diameter can be accomplished by the swinging of the boom without the steering mechanism.

Propelling is accomplished through the front caterpillars. Both caterpillars may be driven together or each one independently, forward or backward. The propelling speed is about half a mile per hour. The tractive power is sufficient to enable the shovel to climb with ease 15 per cent to 20 per cent grades.

The Bucyrus Co., Milwaukee, Wis., was the first manufacturer to equip dragline excavators with caterpillars, over eleven years ago; it was the first to apply this mounting to revolving shovels; the first to mount tower excavators weighing over 200 tons on caterpillars; and it is now the first to design and build a caterpillar mounting for railroad-type shovels of all sizes.

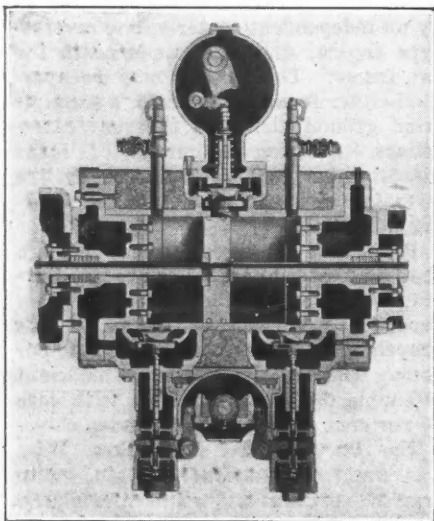
### High-Carbon Iron Advantageous in Grinding Balls and Mill Liners

A grinding ball cast from an alloyed steel-base white iron containing a high percentage of combined carbon is said to possess a degree of hardness that makes it almost impossible to scratch the surface with a steel tool. Such a grinding ball should furnish excellent service in reducing ore to any degree of fineness. It is stated that these "Duroloid" grinding balls are cast in such a way that the iron crystals radiate from the cores of the balls; thus, only the ends of the crystals are ex-

posed, wear is reduced to a minimum, and chipping becomes impossible. The balls are made in sizes ranging from  $\frac{1}{8}$  to 3 in. in diameter by the Los Angeles Foundry Co., of Los Angeles, Cal. "Duroloid" mill liners, made of the same metal as the grinding balls, are produced with a smooth hard face by a special facing process which eliminates blow holes and rough spots so common to the ordinary white iron liner. This gives added value in cutting down horsepower required and a maximum of ore crushed per pound of grinding medium.

### Steam Economy Is Keynote of New Compressor

Builders of steam-driven air compressors have made little effort to improve the steam economy of their machines. The development of the steam-driven air compressor has not kept pace with the development of the steam engine, for today the steam consumption per unit of work of the former is much higher than that of the modern steam engine built for general service. There has been an urgent need for improvement in compressor design, and this need has been greatly increased by



*Steam cylinder in which initial condensation is almost eliminated*

the widespread and ever-growing use of superheated, high-pressure steam.

A new type, which is known as the "Dual Flow" steam-driven air compressor, is being produced by the Chicago Pneumatic Tool Co., and is said to obtain better steam economy than has heretofore been found possible.

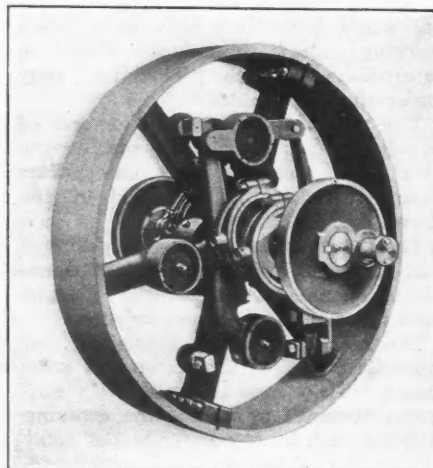
The foremost feature of the Dual Flow compressor is the steam cylinder, which is so designed and constructed that initial condensation is almost entirely eliminated, resulting in a great saving in steam power. Initial condensation is one of the greatest preventable losses in steam engines of the old counterflow or compound type; it is caused by the cooling of the cylinder walls and head by the comparatively cool exhaust steam as it washes over

them in leaving the cylinder through the same port by which it entered.

In the Dual Flow cylinder, the exhaust steam does not wash back over the cylinder walls and head, but leaves through a port in the center of the cylinder. Thus the interior surfaces of the cylinder walls and head remain at nearly the same temperature as the entering steam, and initial condensation is reduced to the absolute minimum. The exhaust port is uncovered by the piston when the latter has traveled about half its stroke. The exhaust is controlled, however, by a patented steam-tight poppet valve, which opens when the piston is near the end of its stroke and closes again (if the machine is running non-condensing) when the piston covers the port on the return stroke. When running condensing, the valve of course closes early in the return stroke.

The Dual Flow cylinder has several advantages over unaflow types. In the first place, it makes possible a material saving in steam consumption when running non-condensing. As the piston of a unaflow engine covers the exhaust port at the start of the return stroke, some provision must be made for preventing excessive compression. This usually takes the form of large clearing spaces. If there is any back pressure, there must be still greater clearance. Compression in the Dual Flow cylinder, on the other hand, does not begin until the piston has traveled half the return stroke.

Valve leakage probably causes a greater steam loss than any other single factor. Especially is this true of installations where superheated, high-pressure steam is used; in fact the faults common in most of the valves now used, such as leakage, excessive clearance and the necessity of valve lubrication, have served to defeat the advantage to be derived from the use of superheated steam. The valve problem has been solved in the construction of the Dual Flow compressor by the adoption of the Skinner steam-tight, double-seat poppet valve, which is patented, for both admission and exhaust. It is claimed that this valve will remain



*Governor of Dual Flow compressor*

steam-tight indefinitely and will seat perfectly, regardless of the pressure or temperature under which the cylinder is operated. It has been known to keep steam-tight, with one grinding, with 159 lb. pressure and 150 deg. F. superheat and also with saturated steam at 100 lb. pressure. No lubrication is required.

The governor is mounted in the flywheel and operates by centrifugal force and inertia. The governor arm is connected to the steam valve eccentric, and by changing the throw of the latter, it changes the point of the cut-off of the steam entering the cylinder. This method is far superior to the old scheme of merely throttling the steam. Variations in speed may be made by adding or removing weights.

### A Non-Corrosive, Non-Flaking Coating

Realizing the inherent chemical and mechanical deficiencies of zinc galvanizing as a protective coating, Richard Staack, after many years in research work and experiments, has invented and perfected the "Nonpareil" method of hot-dipped lead coating, which is said to provide a flexible non-corroding coating of pure metallic lead. This coating is not merely a surface covering, but it forms an alloy with the outer surface of the metallic object to which it is applied, thus making the coating an integral part of the article itself and removing all tendency of the coating to break away from the metallic object to which it has been applied.

Metallic lead, being a highly ductile metal, makes it possible for articles or metal parts which have been lead-coated by the "Nonpareil" method to be bent to any desired radius without cracking or impairing the protective qualities of the lead coating. This is a distinct advantage over the use of zinc galvanizing, on account of galvanized zinc-coating being brittle and flaking off under hammer blows or when metal is bent even to a limited degree.

Zinc galvanizing, unless kept absolutely dry, sheds its surface gradually through surface oxidation when exposed to moisture of the air, thus making its protective life temporary and inefficient. It is rapidly eaten away when exposed to acid fumes or spray. As zinc itself corrodes when exposed to acid fumes, it cannot be considered as a protection against corrosion. Pure metallic lead, on the contrary, is not brittle and is unaffected by moisture or acid fumes or spray, and is a permanent protector against corrosion and rust. Though its surface may become tarnished or even covered with deposits of iron oxide from the moisture in the air, it can be wiped off, and the coating will be found not to have been impaired, and the article itself has been efficiently protected.

The process is controlled by the Richard Staack Lead Coating Works, Inc., of North Bergen, N. J.