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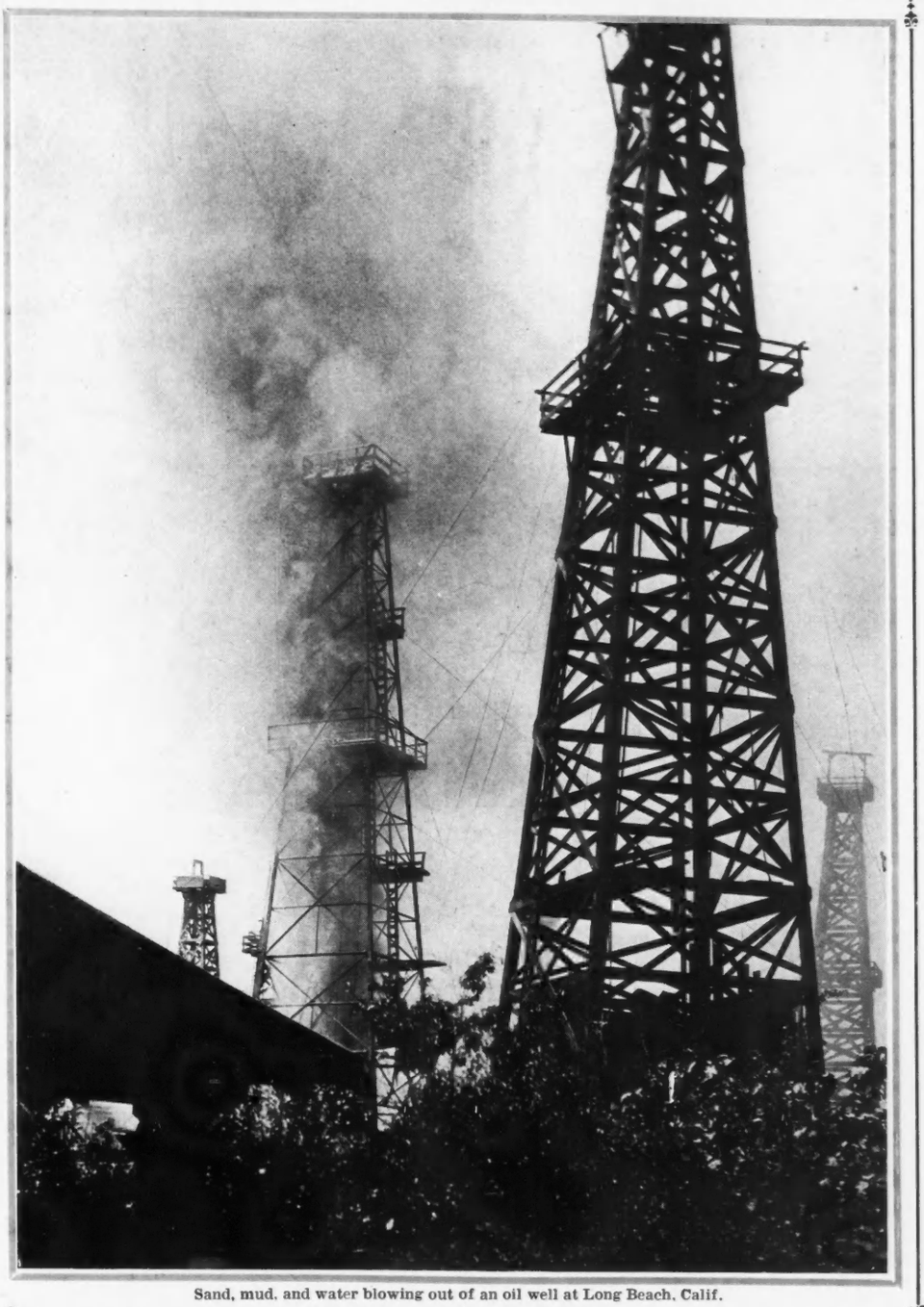
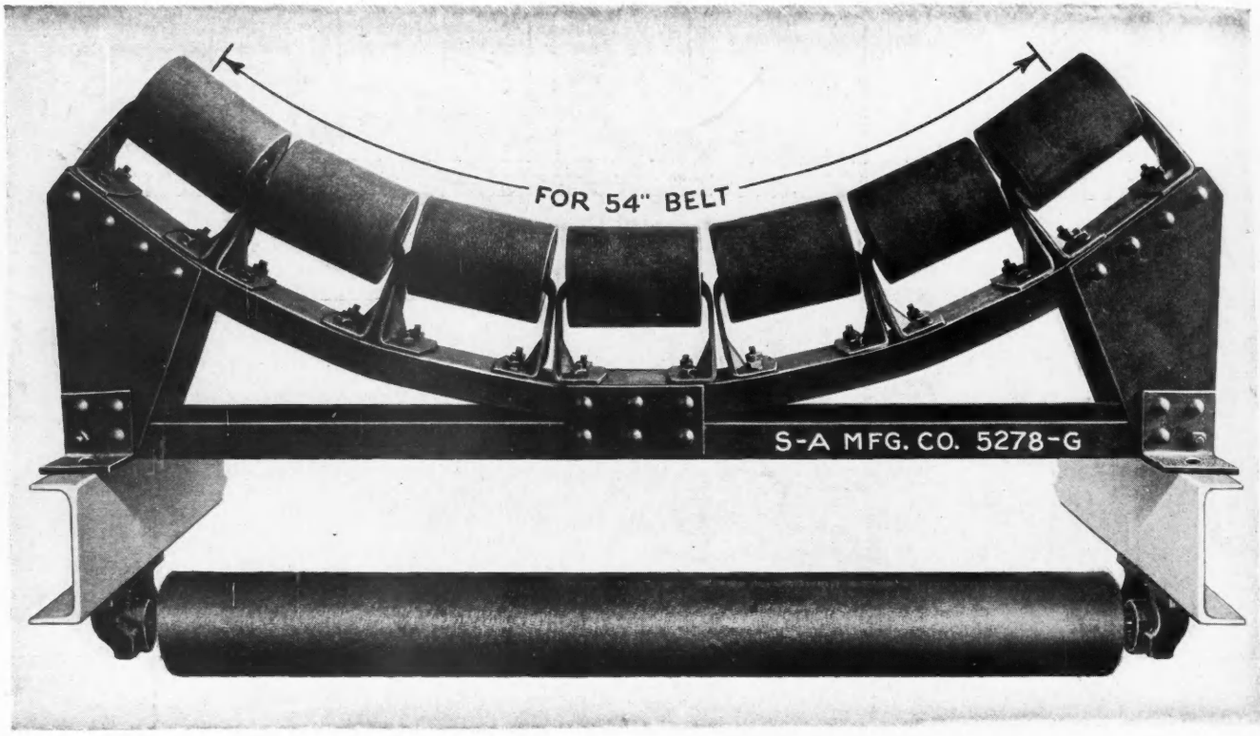


Sand, mud, and water blowing out of an oil well at Long Beach, Calif.

Mining and Washing Phosphate in Florida, by W. J. Dobbins

Prospecting with the Eötvös Balance, by Emanuel Wagner

The American Mining Congress Convention at Milwaukee



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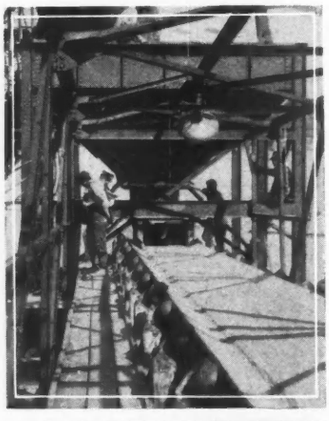

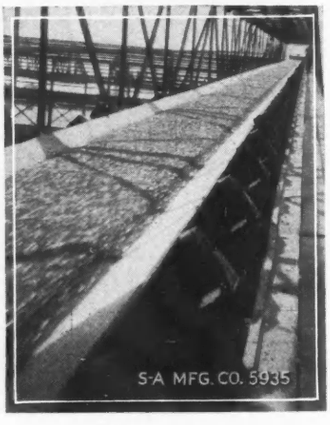

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ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

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Finding New Mines

TO DISCOVER NEW MINES is becoming increasingly difficult for the simple reason, that, as the world is becoming more and more settled—we refer to the land, of course—the unexplored areas are progressively decreasing. Opportunities for exploring virgin territory, striking a rich ore deposit and initiating a rush to the spot are indeed growing fewer in number. So far as the United States is concerned, they belong to the early mining history of the country, when prospectors could stumble upon spectacular showings at grass roots, and when a frontier existed beyond which only the most adventuresome dared to go. As a matter of fact, many countries are pretty well scratched and the easiest discoveries have been made. Note that we say easiest, for no one can doubt that many ore deposits remain to be unearthed. The cost of prospecting has also risen, not alone from the natural rise in prices and wages, but from the greater effort that is required to find new mines.

That is one reason why a definite modern trend is noticeable in the direction of lightening the work of prospecting. All the resources of science are being focused upon the problem—even radio, the latest popular wonder, has been harnessed in an experimental way. No positive system or machine which will say "Here is a deposit of gold, or there an oil field," has been devised. Some instruments have been advertised which claim to do just this thing, but they have proved worthless under trial. Scientifically inclined persons have attempted diligently to apply various physical principles to the problem that might lead to a solution. Not so long ago we recorded the theoretical and practical work done using electrical means for prospecting.

Believing that our readers should be familiar with all the work that is being done in this field we are publishing in this issue a description of the Eötvös torsional gravity-balance—a formidable name, but not nearly so bad as it looks—and the results that have been achieved by it. The Eötvös balance is a European development which, by measuring the varying forces of gravity, is used to locate the position of heavy or light bodies in the crust of the earth. The principle on which it operates is simple, but its actual operation in the field requires the presence and handling of an expert. Like most of such instruments, the Eötvös balance has distinct limitations and it seems to be best adapted for oil, salt, and coal fields. Although it may not have shown itself particularly applicable to non-ferrous metal mining, it will be well to watch the work that is to be done with the Eötvös balance in the United States in the future, as one recently has been imported.

Perhaps one of these days a machine will be invented that will peer into the ground and tell us what is there. Fanciful as this may seem, it is no more so than some of the achievements of the last twenty-five years. But how will it be done?

A Gesture From London

THE REFUSAL of the worthy British bullion brokers, who meet every week day to "fix" the world price of silver, to admit to their deliberations a correspondent of the *Journal-Press*, sojourning in London, is not a matter of great importance. The action should not be interpreted as an admission that there is anything "wrong" in the method used to arrive at the day's quotation for the metal, or that there is anything to hide. If there were ordinarily any sinister manipulation it easily could be omitted from the proceedings of one particular day. The visitor's request could have been granted and he would have gone forth and given the American producers an account of what happened. If, as it seems, the conference consists merely of a comparison of buying and selling orders and a decision on a price on that basis, there could have been no good reason for refusing to admit a lone spectator. The excuse that if one person were admitted, the conference would have to be made a public affair and a gallery provided seems to be childish. Our correspondent had a particular interest in the proceedings; he had credentials from high United States government officials, and he represented, in a way, the American silver producers. An exception easily could have been made in his case.

The chief significance of the episode seems to be the shedding of some additional light on the attitude of the majority of the silver brokers—we understand that one of the conferees advocated granting the desired privilege—toward the American mining industry. It is something between contempt and animosity. These gentlemen had an excellent chance to perform an act of simple courtesy to a visiting representative of the silver producers of this country. They knew that the American mining industry is vitally interested in the marketing of silver; that many view the star-chamber method of fixing the price with understandable suspicion. But they deliberately rejected the opportunity that was afforded them to do a friendly act that might easily have led to a better understanding.

Their attitude toward the American silver producer is probably not far from this: America sells silver and wants to get the best price it can; England handles it and wants to get it as cheaply as possible. Interests conflict, so why should there be any talk of co-operation or even of business courtesy? This statement of the case is not based particularly on the incident that we are discussing, but that action supports the impression of the prevailing feeling in London that we have obtained elsewhere. In their profound dignity the British brokers chose, as was, of course, their perfect right, to preserve the mystery of their little daily session. We suspect that the main reason was a desire to show the American silver folks—who will understand the slang if the Londoners do not—"just where to head in."

The Coal Problem

THE REPORT of the Coal Commission indicates the belief in the proprietary interest of the public at large in the coal industry, since coal is substantially one of the necessities of life, which cannot be dispensed with. As to how the public shall exert its rights of ownership in controlling the industry—there's the rub. It is no wonder that the commission pauses at recommending a definite solution, for if coal is a basic necessity and therefore in some sense a community, not a private matter, yet, indeed, so is wheat, and so indeed are railroads, and so again are shoes. And if the commission or ourselves think of representing the major public interest in coal by a major public (governmental) control, of coal, we realize that the same solution logically follows for wheat, and for shoes, and so on. "And thus," one says, startled, "is socialism." And we are suddenly face to face with Russia. That way, then, no further, evidently concludes the commission. If we start supplanting private initiative, or even that merged into great non-governmental combinations—combinations of coal operators, combinations of coal miners—by public, that is to say, governmental, control of coal, we shall start the progressive State Socialism for which our war-time experience with the railroads has left us little taste. So that the situation remains exactly where it was, for the present, at least.

The Coal Commission advises that the task of getting new statistics concerning the coal industry be delegated to the Interstate Commerce Commission. This is the principal recommendation of the report: and in effect it consists of passing the buck. Would any balanced commission have been able to arrive at a more tangible conclusion and constructive recommendation than this?

Safety in Government Work

CATASTROPHES, man-caused, sometimes will occur in spite of every reasonable precaution. It is not fair to condemn out of hand the officials of the Bureau of Standards responsible for the work in which, recently, four men lost their lives and six were seriously injured. It is possible that every known measure had been taken to prevent the fatal explosion in the Washington laboratories of the Bureau. Nevertheless, there is a touch of irony in the fact that the Federal Government, which, through the Bureau of Mines and other agencies, spends large sums of money each year in teaching "safety first" to others, should have no well-developed plan for safeguarding the thousands of employees in its own service.

The particular tests in hand dealt with aviation gasoline, a highly volatile grade that, mixed with air in certain proportion, makes an unusually powerful explosive. The report of a special investigating committee appointed by the director of the Bureau advances the opinion that a leak in a feed line or in the carburetor of the engine used in the tests allowed the gasoline vapor to escape, and that a backfire from the engine supplied the spark that produced the explosion. Neither leaks and backfires are mysterious or unusual phenomena. The work was being done in a small isolated chamber so that there was no opportunity for the vapors to be dissipated in the atmosphere and rendered innocuous. The experimenters were fully aware of the vital danger lurking in the tests they were conducting, and yet no effectual means seems to have been provided for detecting the presence of a dangerous explosive mixture—far more potent than the gases, for instance, that are to be found in mines.

Last spring the executive board of the American Engineering Council pointed out that the Federal Government "is paying heavily in the form of employees' compensation insurance, as well as in lost time and efficiency, for its failure to adopt a thoroughgoing safety program." Perhaps the present catastrophe will result in the formulation and adoption of plans for the adequate protection of government workers.

Foreign Languages

GLOBE-TROTTERS tell us that one of the differences between Americans and Europeans is that the first named speak only American, whereas the others, if they hold any claim to being educated, speak their native language plus English and French, or English and German. American mining engineers, we believe, are somewhat better linguists than other varieties of engineers, and an acquaintance with Spanish in addition to their native tongue is not unusual. In fact, it would seem that a knowledge of Spanish could well be made a requirement for an E. M. degree. Mining developments in Mexico will be of increasing importance and the South American countries will require increasing numbers of American mining engineers. A knowledge of Spanish, apart from what can be picked up in working with laborers, is advisable even if not essential, to those working in the countries to the south.

Two other languages are also interesting from the standpoint of the coming generations of mining engineers. We refer to the Russian and the Chinese. We would hardly advise one to master the Russian language, or the Chinese either, unless he had some idea of going to those countries, but in both Russia and China there is a vast wealth of undeveloped mineral land, and he who has prepared himself with the idea of helping to develop it should be better off than he who has not.

Too often students take up the study of a foreign language without any thought as to its adaptability to their possible needs. It is often a toss-up between French and German, or possibly Spanish. English and French are terse languages, the English having a large vocabulary and the French affording unusual precision of expression. Both are dominated by what is known as literary style and are accordingly easy to learn badly but difficult to learn well. The same is not true of German, which is somewhat forbidding at first, but when the vocabulary and grammar are mastered, one can do pretty well with it. The length of German words and methods of expression are well known, and it takes considerably more space for the average German to express a thought than it does the Frenchman or the Englishman.

H. L. Mencken has written a book about the American language. We have not read it, but it is our observation that English writers as a rule have a better style and are not so careless about their use of words as Americans, though many of them are inclined to lean over backward and obfuscate their thoughts with verbiage.

Electricity Gaining Ground in Metallurgy

MANY of those now living can remember when electricity played but a small part in industry—electric motors, lights, heating devices, and plating apparatus were only vaguely dreamed of in their present applications; the telegraph was new and the telephone a scientific toy. Until thirty or forty years ago, electricity was used hardly at all in metallurgy, though the art of winning metals from their ores is one of the most ancient. As the merits and applications of this force of nature became better known through the researches of Edison and others, it is small wonder that it has been applied to an increasing extent in the recovery of metals.

Copper was the first of the common metals in which the aid of electricity was enlisted, that metal having been successfully refined by electrolysis for the last fifty years, though it was 1883 before electrolytic refining was introduced in this country, at the Balbach plant. More recently, the development of the hydrometallurgy of copper at such plants as Chuquicamata and Ajo has made the electrolytic deposition of copper from leached ore solutions an important commercial process. Aluminum was the next important metal to be recovered by electrical methods on a large scale, the use of electric furnaces for the treatment of cryolite beginning around 1890. The recovery of zinc and cadmium from leach solutions by electrolysis was not seriously undertaken before ten years ago, but is now making rapid strides. Electrolytic refining of lead, by the Betts process, and of silver, gold, nickel, and tin, has also achieved commercial importance, though the production of the last-named metal by electrical methods is temporarily in eclipse owing to economic conditions having closed down the lone electrolytic producer.

It will be observed that there are three distinctive ways that electricity is used; first, for heat treatment of ores and ore products in electric furnaces, as in the reduction of aluminum, and to a slight extent, perhaps, for copper, and for many of the rarer metals and ferroalloys; second, for depositing the metals from solutions obtained by leaching the soluble constituents of an ore, as is done with certain copper and zinc ores; and third, for the refining or separation of metals already essentially free from undesirable elements—that is, of a purity of around 98 or 99 per cent. Some of these applications have not yet reached commercial importance so far as certain metals are concerned, but there is little doubt that development will be rapid and the metallurgist of the future is going to be left behind if he does not possess a full knowledge of the fundamental concepts of electricity and their application in electric furnaces and in electrolysis. Let college students bear this point in mind. The supply of metallurgists with an adequate knowledge of electrometallurgy is small and the demand is bound to increase.

At present we note particular activity, so far as new applications are concerned, in the production of electrolytic iron, in the production of formed copper articles by electrolysis, and in the electrolytic precipitation of lead from leach solutions. The first electrolytic iron plant in the United States, we believe, was started less than a year ago in Connecticut, and the subject has attracted considerable attention, inasmuch as a very pure iron can be produced in this way and the smaller the amount of undesirable impurities in an iron, the less it will rust.

We hear reports from time to time of experimental work that is being done on the precipitation of copper in a form that can be used without remelting. Particularly favorable seem to be the prospects of the Anaconda company in the production of copper-plated roofing shingles by this means. The lead-ore leaching plant which the Bunker Hill & Sullivan company has been erecting during the last year, in which the Tainton electrolytic lead process is used, has just begun operations. This is quite distinct from though often confused with the Tainton electrolytic zinc process, which is also to be given a trial at the Bunker Hill plant.

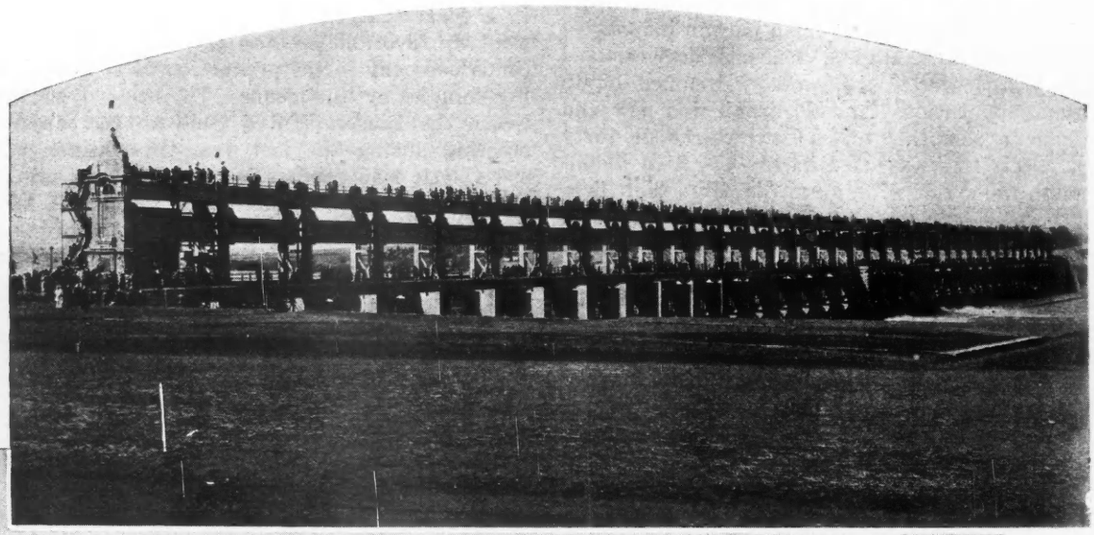
A Five-shift Week

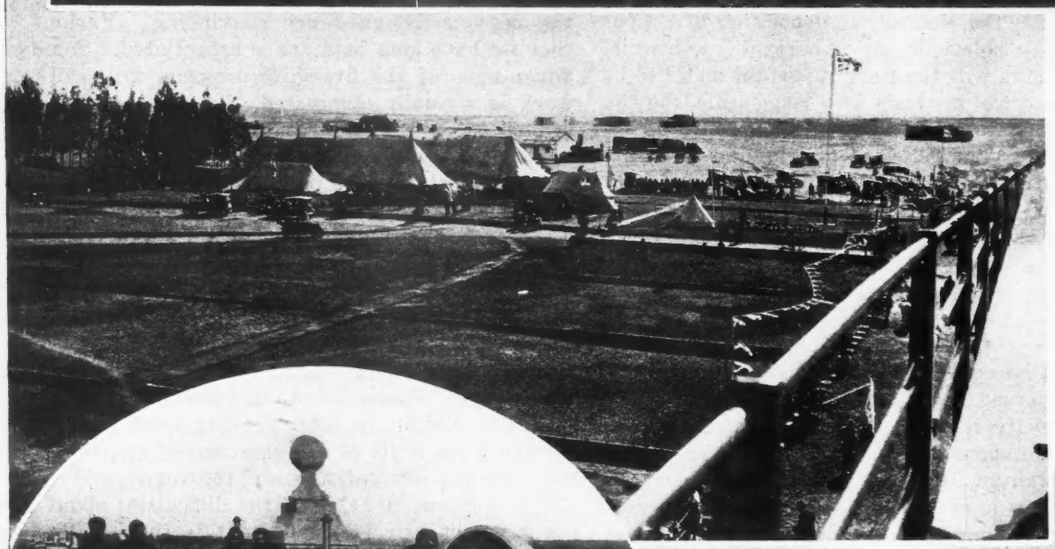
MORE THAN ONE OPERATOR in the zinc-lead district centering at Picher, Okla., says that he is milling three-fourths as much ore and getting a higher percentage recovery in five day-shifts per week than he did when running twelve shifts—six day and six night. The statement seems pretty hard to believe, but the reasons assigned are convincing. Various views that we have long held are substantiated. Some of the advantages of the five-shift program are: (1) Night work is virtually eliminated. There never was a crew of men who would do as much and as good work at night as when the sun is up. A few individuals may be as efficient from 10 p.m. to 4 a.m. as in the day time, but, by and large, day work is far the best. (2) Repair work around the mills is done on the sixth day. To get the best results from a concentrator the equipment should be given periodic inspection, and overhauling when found necessary. Under the present plan of operation in Oklahoma the machines are kept in first-class repair, and when they are running they do their maximum work. Under constant operation individual machines or units are always being shut down, thereby throwing the units of the plant out of step, so to speak, and causing less satisfactory recovery. (3) "Laying-off" is minimized. One of the difficulties about operating a comparatively small plant is the habit of many men to take a personal holiday every now and then without saying anything beforehand.

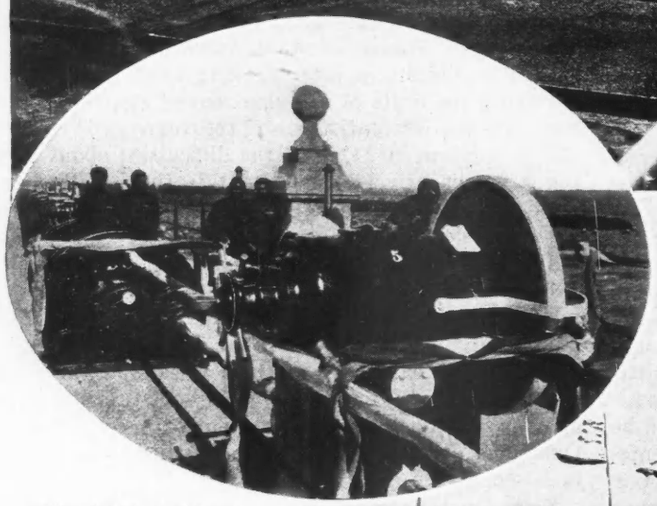
In Picher the workmen apparently are anxious to work five days a week and the result is a full crew of men trained for their jobs every day. It is a rather sad admission, but it seems true that some cannot stand the prosperity of earning more in a week that their living costs. That is one argument sometimes advanced against raising wages. Apparently the experience in Oklahoma supports the theory on which the argument is based.

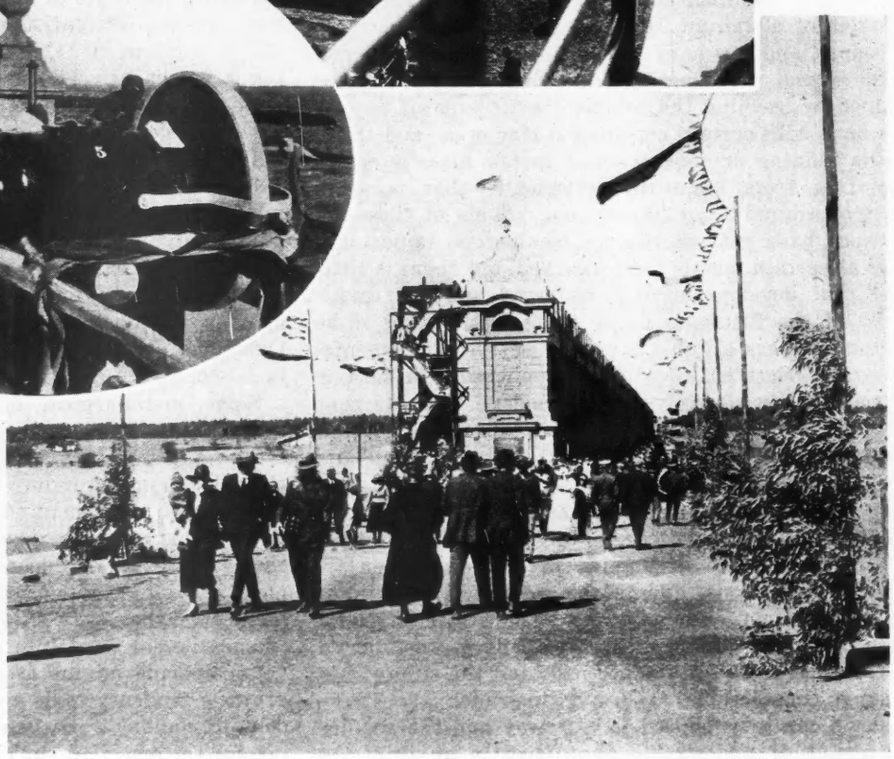
Some metallurgical operations must be conducted twenty-four hours each day, but much of the work of the mining industry can be accomplished on day shifts. Considerations of reduced overhead and of smaller investment in equipment to handle a given tonnage make it desirable to keep expensive plants in constant operation. However, producers in Picher say that they are making high-grade concentrate at a lower cost per ton today than they were a few months ago before the policy of curtailment went into effect.

Considering mining as a whole there is, we believe, a growing tendency to do away with night work, and incidentally Sunday work, in many departments of the industry, for the one good, sufficient, and unsentimental reason that it means more dollars of profit in the long run.



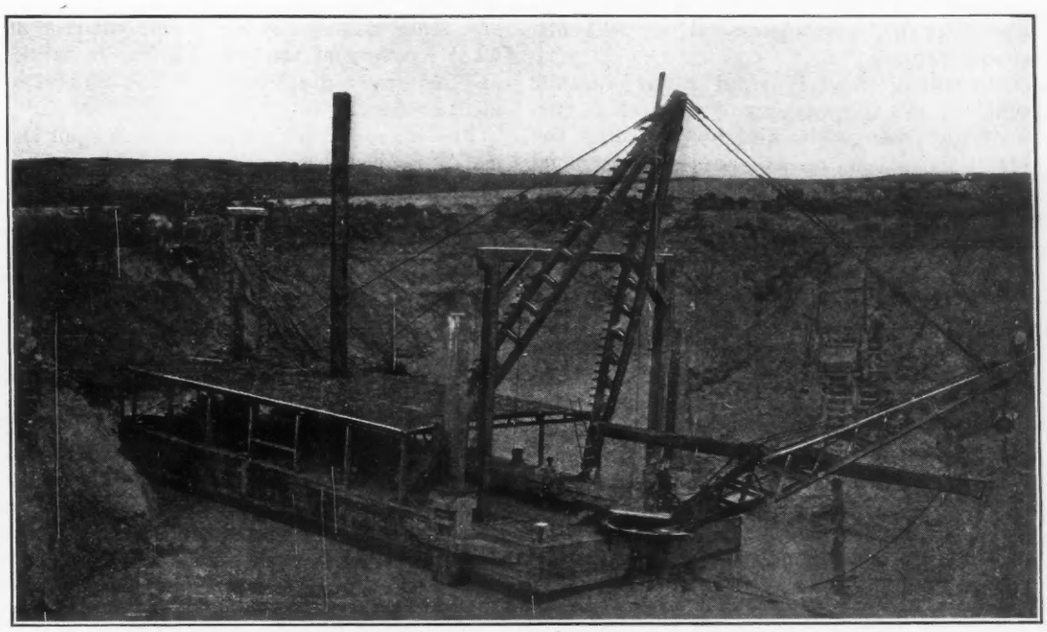






Vaal River Dam

The new Vaal River Dam at Vereeniging, Transvaal, was opened July 27, 1923, insuring a water supply for the gold mines and towns of the Witwatersrand. The reservoir thus constructed is 40 miles long and holds nearly 14 billion gallons. In the oval—Gate-opening machinery. Center—Looking from the top of the dam



A dredge mining phosphate in the Hard Rock district

Mining and Washing Phosphate in Florida

This State Produces More Than Half of the World's Phosphate Rock—Operations Are Described in Detail

By W. J. Dobbins
Mining Engineer, Washington, D. C.

PHOSPHATE ROCK is produced in three fields situated in the Southern States, and these have been the important producers not only of the United States but of the world.

Of these three, the standing in order of production is, the Florida Pebble district, the Florida Hard Rock district, and the Tennessee district. Though other districts, as Carolina and Kentucky, have produced much phosphate rock, they are not now active to an important extent. The present article will be confined to a discussion of the occurrence, mining, washing, and handling in the Florida districts. No attempt will be made to go into the geology of the deposits.

Pebble District Leads in Production

The Florida Pebble district, in the west central part of the peninsula, principally in the counties of Polk and Hillsboro, is by far the largest producer of phosphate rock in the world, and supplies more than all the other fields of the United States combined. It originally started with the dredging of river pebble on Peace River. This is low grade, and since the discovery and development of the Land Pebble deposits the district has been entirely abandoned. This field produces all grades of rock, from 66-68 per cent to 78-80 per cent bone phosphate of lime, either as a direct product from the various pits or by mixing in the driers or dry storage bins. The higher grades are principally for the export trade, which has until recently formed a large part of the market for this field, though of late, due both to the disruption of European countries and the production of phosphate rock in the colonial possessions of northern Africa, which have been successfully developed and are now attaining proportions of important competition, there has been a serious decline in export trade. This has decreased the rate of production.

The many original small producers have been consolidated, until today almost the entire output is produced by a few large companies, almost all of which are manufacturers of fertilizer as well, and use their own rock. By these consolidations many economies have been worked out and much duplication of producing facilities has been avoided.

The general plan of operation calls for washer plants at the various mining pits. These are connected by standard-gage railroads, either steam or electric operated, to a large central drying, storage, and shipping plant. As the mining of a pit under average conditions requires about a year, and as four pits are mined before a washer is either moved or discarded, it is obvious that the centralization of the drying and handling of the rock is logical. Also, with different grades of rock coming from the different pits, this arrangement allows of the proper mixing for the final shipment.

Electric Power Generated by Oil-Burning Boilers and Turbines

Electric power is used almost exclusively. Usually it is generated by steam turbine with oil as a fuel. The Tampico oil fields across the Gulf of Mexico from Tampa, which is only forty miles by rail from the center of the phosphate fields, allows the production of electric power at less than one cent per kilowatt-hour. Turbines from 500 to 6,000 kva. are in use at the various

plants. Some plants use internal-combustion engines of different types, but they have almost entirely been displaced by steam turbines.

The large amount of water required in the hydraulic mining operations and the washing of the rock is furnished from large, deep wells, and by returning the water used from the settling ponds. Large underground flows of water are available and wells from 600 ft. to 900 ft. deep and 18 in. diameter can furnish 5,000 gal. per minute with submerged centrifugal pumps placed at depths of from 40 to 60 ft.

The phosphate rock in this field occurs in beds, mixed with siliceous sand and clay, the sand being nearly all fine enough to pass a ¾-in. opening. The beds are from 3 to 20 ft. thick and rest on limestone; they are overlain with from 3 to 30 ft. of overburden, consisting mostly of sand with boulders of "iron rock" and sandstone, locally known as "sand rock." The phosphate rock ranges in size from the finest sand to pebbles 1 in. in diameter, there being but a negligible quantity of larger size except the phosphatic bones from extinct animals. The beds are continuous over large areas.

Prospecting Is Systematized

In determining the location of washing plants and mining pits, the ground under consideration is laid off in 40-acre tracts, and these in turn are divided into sixteen squares of 2½ acres each. In the center of each square a hole is bored, with a 4-in. hand auger, to bedrock. In each hole the depth of overburden and the depth of phosphate rock is recorded, and all material in the hole through the phosphate bed is retained. This is hand-washed and scrubbed in a screen-bottom box having ¾-in. openings, and the undersize is passed to another box with 1 mm. openings. The undersize from this passes to waste. After thorough hand scrubbing on both screens to remove all clay and undersize, the two samples are dried, weighed, and analyzed. The reason for using the two sizes of screen is to determine whether the grade of the fine material warrants the installation of the ¾-in. or 1-mm. screen on the washer.

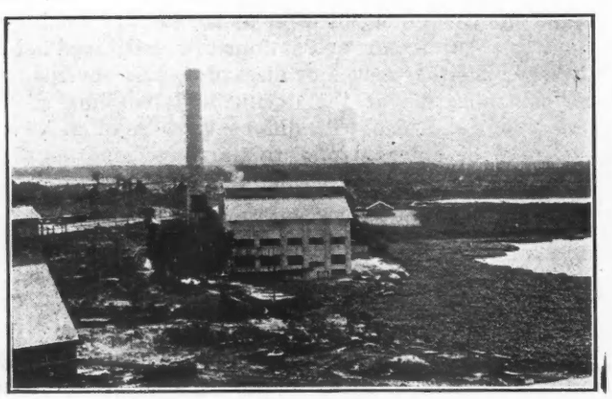
No Accurate Determinations of Recovery

From the weight and analysis, the tonnage and grade to be recovered from the 2½ acres which it represents is determined and likewise from the sixteen like samples the output from the proposed pit is calculated.

It will be seen that only the amount recoverable by the methods to be used is determined in the test; no account is taken of the loss in the undersize and soft phosphate which slimes off. This procedure is unlike any other mining; it leaves one entirely at sea as to what recovery of the total content is being made, and also removes a great incentive for improving the treatment process.

The regularity of the deposits is such that the estimated recoverable tonnage of a pit determined from these figures agrees closely with the actual recovery.

Also from these borings the yardage of overburden to be removed is calculated, so that before starting work on a pit accurate figures as to the cost of production may be worked out at small initial cost.



Power plant in the Pebble district. Oil fuel is used to generate steam

Stripping by Hydraulic Guns

In preparing for mining, the overburden is first removed with hydraulic guns. This is done by washing it down into a sump with the guns carrying a pressure of from 150 to 175 lb. per sq.in. and discharging through 1¾- to 2-in. gun tips. The sump is formed simply by cutting a hole, with the guns or by blasting, in the underlying phosphate bed. The "gunning off" of the material proceeds quite easily, except when patches of sand rock or iron rock are encountered, when considerable blasting is necessary to break it up. In some cases it is piled back by hand and rehandled when mining.

From the sump the overburden is pumped to a pit previously mined out or piled on ground proved barren by prospecting.

The pumps used in both overburden removal and mining are from 8- to 12-in. centrifugals, direct-connected to variable-speed motors. The whole unit is housed and mounted on steel frames, which makes it easily moved with caterpillar tractors.

With this equipment large yardages can be moved at small cost. The average cost per yard is from 6 to 8c., but under favorable conditions a cost of as low as 4c. has been attained. Some overburden has been removed with draglines and steam shovels, but, due to the particularly favorable supplies for water and power, they have not been able to compete with the hydraulic method in cost.

Heavy Pumping Equipment Used

Mining is carried on in much the same way as the removal of overburden, the bank of phosphate being broken down with hydraulic guns and pumped to the washer with centrifugal pumps. Where the pit is near the washer only one pump is used, but as the distance increases one or more pumps are added, the material being discharged to a sump and repumped at each station. The pumps handle, on an average, material containing 10 per cent solids, and with 12-in. equipment handle from 2,500 to 3,000 gal. of water per minute. The passage of this material through the pump and pipe lines is a large factor in the disintegrating and emulsifying of the clay contained in the beds, an important factor in the washing that follows.

The severe service to which these pumps are subjected has caused attempts to use manganese lining. This lining has not been adopted, because it is believed that the extra life does not warrant the cost.

In one case where the clay content of the bank was so high as to preclude hydraulic mining, a suction dredge fitted with a revolving cutter to break up the clay bank was tried, but was discontinued.

Although called washing, the process of preparing the phosphate rock for commercial use after it reaches

the plants is mainly not a washing but a screening process; for, after the disintegration of the clay in the pumping system, the principal object of the washer is to remove the sand, nearly all of which will pass through a ¾-in. opening. Though it is necessary that all material be scrubbed through the log washers to remove the last of the clay balls, tests on the feed and discharge show that little work is done by this machine.

The material as delivered to the washer contains from 35 to 50 per cent of material larger than ¾ in., which will grade as a commercial product, and 50 to 65 per cent finer than ¾ in., which will grade about 35 per cent B.P.L.[1] This latter material is about equally divided between plus and minus 100 mesh.

The material is discharged from the pumping lines to a long stationary screen, which removes not only the water and slime but a large part of the sand. This screen is especially effective, because it is kept clear by the constant beating of the large pieces of lime rock. Moreover, the sand and phosphate separate much more easily in water than otherwise, as, when this material is only moist, the sand and phosphate have a tendency to adhere and thus form particles too large to pass through the screen opening. Tests demonstrate that fully 70 per cent of the separation takes place on this first screen.

From the stationary screen the material passes to a coarse trommel, known locally as a separator, having 1-in. holes, which removes large clay balls, lime rock, and any debris, discharging the undersize to the log washer. From the log washer it is elevated and passed over a series of shaking screens, the oversize from which is again elevated to the wet storage bins, the undersize going to the debris sump. From the debris sump the waste material is pumped to the tailing pile.

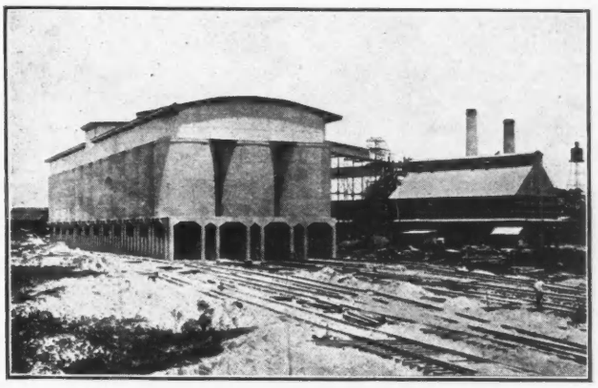
Vibrating Screens Successful

Recently at some plants the shaking screens, which were of the arm-eccentric driven type, have been replaced by electric vibrating screens, which have been able to do the same work with one-fifth the screen area. Also considerable experimental work has been done in attempting a further separation of the fine sands discharged as undersize from the various screens, and a system of hydraulic classification has been worked out which recovers an additional 6 to 10 per cent of commercial product. This product, containing about 20 per cent of minus 1-mm. material, is about 5 per cent lower in grade than the washed rock of the same pit, but the small proportional tonnage allows the mixing of the two products without affecting the grade commercially. This additional classification, as well as recovering the extra tonnage, forms a constant check on the condition of the screens throughout the washer. Thus it prevents serious loss of rock, which under the system employed could easily occur and which, it is evident, from the old tailings pile, often has occurred in the past.

This method of mining and washing gives a large tonnage output, 1,500 to 2,000 tons in ten hours being about the average with 12-in. pumping equipment and two guns working. As will be seen from the figures given, the percentage of recovery is low, being on an average not over 50 per cent of the total phosphate contained in the bed.

A large part of the lost phosphate is in the soft phosphate and phosphatic clay which passes off as a fine slime. The sands also carry a large percentage, as the following typical screen analysis of the debris will show:

[1]Bone phosphate of lime.



Dry-storage bins in the Pebble district

Size	Part of Total Per Cent	Bone Phosphate Lime Per Cent	Sand Per Cent
Plus 20 mesh	6.1	64.02	13.65
Plus 40 mesh	29.8	35.36	49.90
Plus 60 mesh	33.6	24.35	67.25
Plus 80 mesh	18.5	29.97	64.80
Plus 100 mesh	1.8	25.53	63.15
Minus 100 mesh	10.2	20.79	71.40

As the specific gravity of the sand and phosphate rock are almost identical, and there is also great variation in the density of the phosphate rock, this waste sand material is not amenable to concentration; therefore any further saving must be along some different line.

Considerable work in an effort to recover the phosphate in the tailings by a distillation process in either an electric or oil-fired furnace with electric precipitation of phosphoric acid has been done, but as yet no process has been developed that it has been possible to operate commercially.

From the wet bins, the rock is hauled in standard-gage, hopper-bottom dump cars of 35-ton capacity to the wet-storage trestles, where it is dumped and stored with cranes for draining. These trestles are placed so as to give opportunity for the segregation of the different grades from the pits. Next it is reloaded and hauled to the wet feed bins at the driers. This drainage of the rock reduces the moisture content from 5 to 8 per cent and reduces the oil consumption in the driers from 1 to 2½ gal. per ton dried.

The driers are horizontal rotary machines 4 ft. in diameter and from 30 to 40 ft. long. They are oil fired, with the combustion chambers mounted on trucks which ride on a short track, thus making the shell easily accessible for repairs by rolling back the combustion chamber when desired.

The rock is fed from the wet-storage bins by belt conveyor to the cold end of the drier, and discharges at the hot end near the combustion chamber to steel elevators, which in turn discharge to belt conveyors carrying the rock to the dry-storage bins.

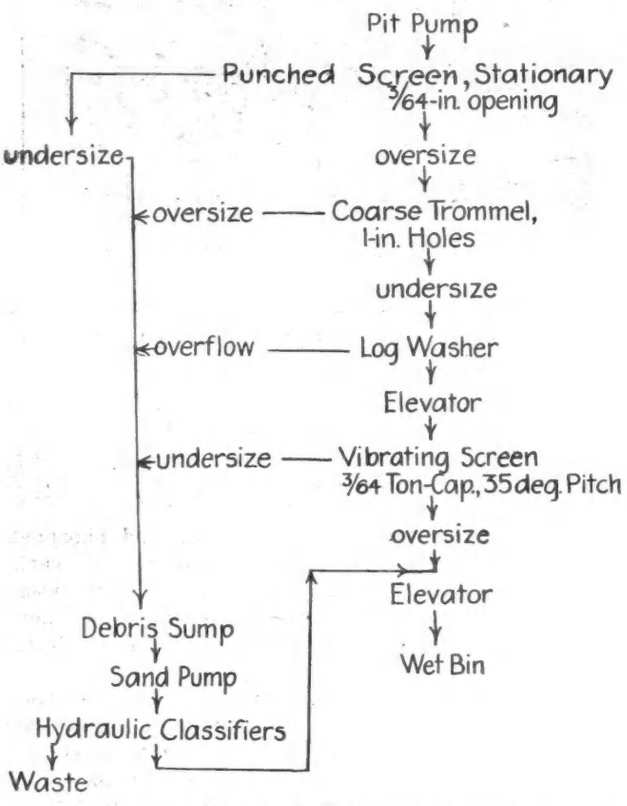
The rock fed to the driers carries from 14 to 17 per cent moisture and is discharged from them with 1 to 2 per cent moisture. The capacity per drier is 10 to 15 tons per hour.

Large Storage Plants Required

The dry-storage bins at the various plants are all of reinforced concrete, of from 30,000 to 50,000 tons' capacity, built in various designs, but each with several compartments, to allow of the segregation of

the different grades. They are constructed so as to admit the passage of trains underneath for loading.

The shipment to the docks which are at Tampa, West Tampa, and South Boca Grande is made in closed hopper-bottom cars, mostly of steel contruction. At



Flow sheet of a typical phosphate rock washer in the Pebble district

Tampa and West Tampa the material is discharged into hoppers, feeding to elevators which in turn discharge directly into the hold of the vessels; but at South Boca Grande the loading is by means of a conveyor belt on 600-ft. centers having a capacity of 600 tons per hour.

Hard Rock Deposits Are Irregular

The Hard Rock section of the Florida phosphate fields is about 100 miles north of the Pebble district and extends through a belt 75 miles in length approximately from Floral City to High Springs. The rock mined in this section is all of high grade, the minimum grade shipped being 77 per cent bone phosphate of lime and grading from this to 84 per cent. Practically the entire output is exported, the principal port of shipment being Fernandina.

The individual deposits are not of as great extent as in the Pebble district and are much more irregular, being surrounded and in many places divided by horses of limestone. They are similar to the Pebble deposits in that the phosphate bed is a mixture of sand, clay, and phosphate rock, but are dissimilar in that the phosphate rock varies in size from the finest particles to boulders weighing several thousand pounds.

The beds of phosphate in most cases extend below permanent water level, and this, together with the fact that much of the rock is of large size, has made mining by dipper dredge almost universal in the district. Where the deposits lie wholly above water level, hand mining is carried on. In earlier days this was the general method, and many deposits were worked to water level only. Today many of these are being reworked and are producing with dredges a larger tonnage below water level than they did previously above.

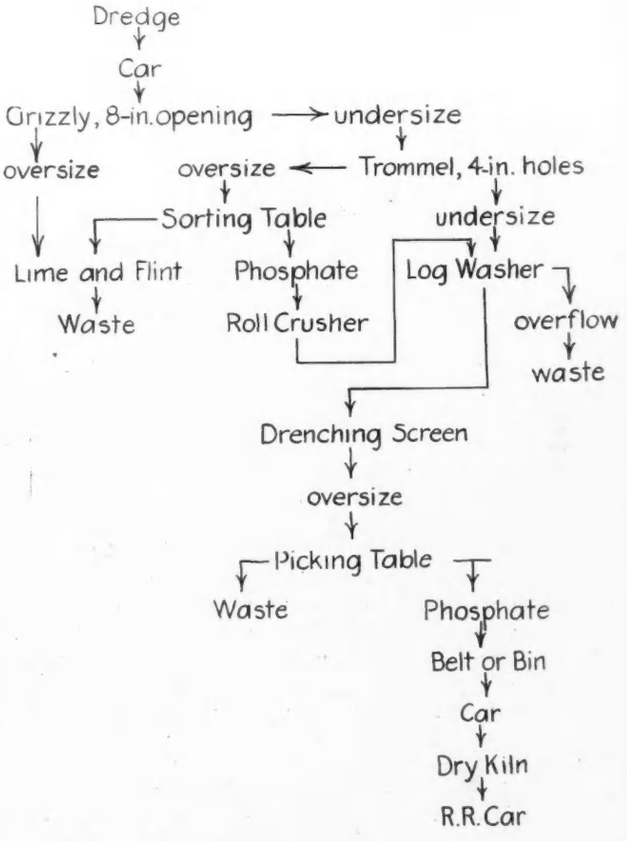
Steam Dipper Dredges Used

The power used is both electric and steam. A hydroelectric plant furnishes several properties, but is not sufficient for the whole district. The dredges are all steam operated, using in most cases wood as a fuel.

The prospecting is carried on in this district by the same method as used in the Pebble section, but, as much of the rock is large, the striking of boulders with the auger often stops work before the bottom of the deposit is reached. Accordingly, the results are not complete or accurate.

Prospecting Difficult

About the only data gained in the prospecting here is the depth of overburden and a general idea of the depth of rock and the grade of it. No figures by means of which to estimate the percentage of recovery, and thus the tonnage to be recovered, can be determined. Generally the operator judges by eye as to whether the rock taken from an auger hole is workable or not.



Flow sheet of a typical phosphate rock washer in the Hard Rock district

The overburden, as in the Pebble district, varies from 3 to 30 ft. Where shallow it is not removed before mining, but is dredged along with the rock and washed out in the washer. Where it is of greater depth it is hydraulicked and pumped off.

As already stated, most all of the mining is done with dipper-type dredges. Both wood and steel construction are used, with dippers from 1- to 2-yd. capacity. Often boulders are encountered which are too large to be handled by the dipper, and these are rolled with the dipper to the edge of the pond where they can be conveniently blasted.

The dredge discharges into a small car, usually of two dippers' capacity, carried on an incline trestle which is extended as the dredge proceeds and which runs to the top of the washer.

At the top of the washer the car is dumped on a coarse grizzly usually having from 8 to 12-in. openings. Here large lime boulders are removed and large boulders of phosphate are broken up. Also, at times large masses of clay require chopping with mattocks on this grizzly. A hydraulic gun is also mounted here to assist in breaking up the clay and in washing the material through the grizzly.

Log Washers and Sorting Tables Used

Below the grizzly is a coarse trommel having 4-in. round holes, the undersize from this passing directly to the log washers, the oversize being discharged onto a sorting table. On the table limestone boulders are removed and the clay and phosphate are fed to a roll crusher, which discharges into the logs.

The log washer discharges into a long drenching trommel with inside sprays and having $\frac{1}{8}$-in. round punched holes. The undersize from this screen goes to waste and the oversize to a revolving table, where it is hand picked. The waste material is thrown to a center bin, from which it is carried by a cable car to the waste dump. The phosphate rock is discharged either to a conveyor belt or to a small bin which carries it to the top of the dry shed. Here it is discharged to a car running on a track that passes through the top of the shed to the dry kilns.

Drying of the rock is done in wood kilns. The kilns are made by dumping rock to the thickness of 2 ft. on the floor and then placing a tier of wood on this about 3 ft. high. On the wood the rock is built up to the heigh of the track through the gable, which is about 12 ft. Through a vent placed in the side of the pile there is opportunity to fire the wood when desired. When lighted the pile is sufficiently open to allow of the burning of the wood slowly but completely.

Large Loss of Phosphate Results, Just as in the Pebble District

It requires about three weeks for a pile containing 200 tons to be burned and cooled sufficiently to be handled by hand. It is then loaded with wheelbarrows into closed cars and shipped to the docks.

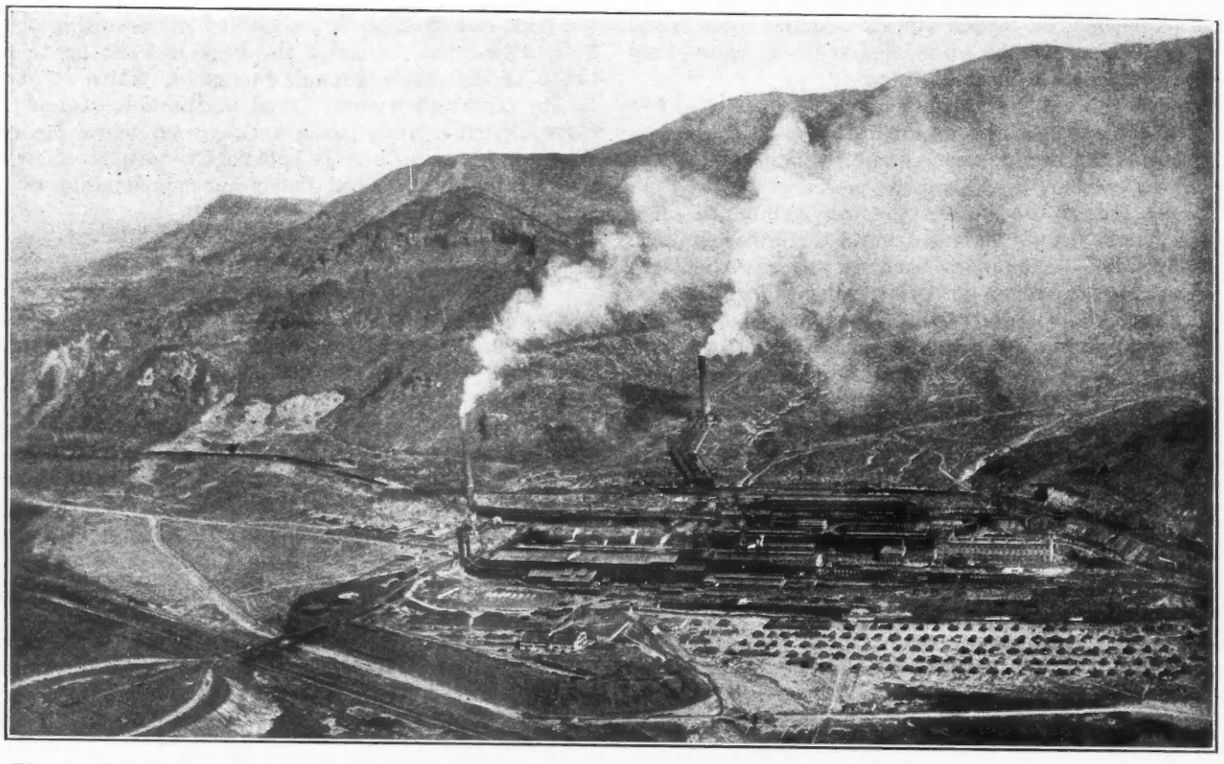
The average ratio of concentration in the district is three to one, but sometimes it runs as high as seven to one. As in the Pebble district, there is a large loss in phosphate in the washer waste, both as soft phosphate and as fine rock in the undersize from the screens. The same difficulties also are met in attempting closer concentration of the fines, and no successful attempt has been made to improve the operation other than the distillation process spoken of above.

All washers in the Hard Rock district, in consequence of the nature of the deposits and the method of mining, have small capacities compared with those in the Pebble district. The average output is from 10 to 15 tons per hour.

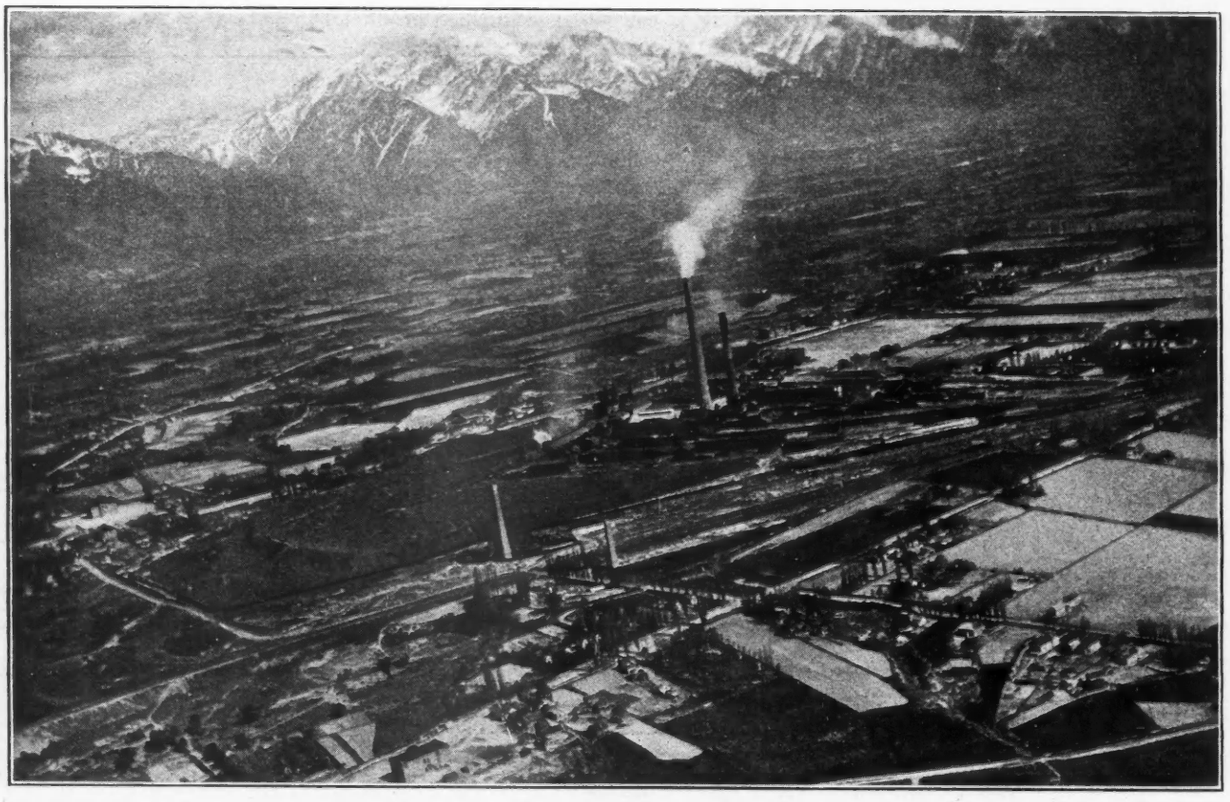
The cost of mining is much higher in this district, owing to the method used, but the lower cost of drying and storage and the smaller overhead equalize the cost of the finished product.

Removing overburden from phosphate beds in the Hard Rock district

Airplane Views of Garfield and Murray Smelters



The Garfield smelter of the American Smelting & Refining Co. chiefly handles the output of Utah Copper Co., twelve miles away. It is the second largest in the United States in tonnage treated and is near the shore of Great Salt Lake



The Murray lead smelter of the American Smelting & Refining Co. is the largest in the United States and has a capacity of 700,000 tons charge per year. It is situated in the fertile Salt Lake Valley and handles custom ores

Prospecting With the Eötvös Balance

A Method of Using an Instrument Which Detects Small Changes in the Force of Gravity Caused by Masses in the Earth's Crust

By Emanuel Wagner
Mechanical Engineer, Tokod, Hungary

THE LOCATION of orebodies, salt deposits, oil wells, and water has hitherto been found by prospecting, drilling, or geological research. Recently other methods have been developed for locating mineral resources, using certain peculiarities of the deposits to be sought. Such properties are magnetism, electric conductivity, rebound or absorption of electric or sound waves, and radioactivity. Each of these methods has limited possibilities of application; none is suited to locate any or all sorts of minerals, or give satisfactory answers to every problem. All these newer methods require some kind of a preliminary geological examination of the territory to be explored.

One of the least-known methods, working with most exact means, that should be known to all who are interested in geophysical research, will be briefly described here. The apparatus and its theory, use, and practical application was developed by the late Baron Lóránd Eötvös, professor of physics at the University of Budapest, Hungary, and was described by him in prints and lectures, almost thirty years ago. Since then, many researches have been conducted with the apparatus, which has been perfected and adapted for practical use, the measurements and data obtained by it are now more correctly interpreted, and its application has constantly extended.

The value of the instrument consists in measuring the extremely small changes in gravity caused by lighter or heavier masses in the earth's crust. The instrument is so sensitive that it enables one to measure differences of the force of gravitation with an accuracy exceeding many thousand times that of the most exact analytical scales. In principle it is identical with the torsional balance first used by Coulomb to investigate the laws of static electricity. This balance has been changed by Eötvös and has been altered so as to measure changes of gravity caused by subterranean masses of greater or smaller specific gravity, and has been perfected from a laboratory instrument to an apparatus that may be used anywhere in the field.

The force of gravity is nearly constant on our globe. It changes, however, with geographical altitude and with elevation above sea level. More minute changes or irregularities are caused by mountains and by heavier or lighter bodies in the soil, and may be detected and numerically determined by Eötvös torsional balance, with an exactness unapproached by any other known method.

Balance Measures Mass Attraction Only

The instrument determines the force of gravity only. The data obtained must be interpreted by the geophysicist carrying on the observation. Correct interpretation requires experience acquired from previous measurements with the instrument, and geological knowledge of the territory to be examined. Similarly, the examination of electric or magnetic conductivity furnishes useful data only if the physical properties of the occurring strata at the place of measurements are previously known to the investigator.

Baron Eötvös himself and also his pupils and followers in Hungary, Dr. Desiderius Pekár and Hugo Bökh, do not restrict themselves to the numerical determination of the force of gravity or aberration from this, but always include in these the determination of changes in magnetism, which they measure with an instrument also perfected by Eötvös. These measurements will in most cases furnish useful additional information to those obtained by the torsional balance scales.

The data and illustrations of this article are taken from the works of Eötvös, Pekár, and Bökh describing the instrument and its use.

To make the working of the apparatus clear, a few elementary explanations must be given. The instrument, as stated, measures the force of gravity. This force is caused, as is well known, by the mutual attraction of masses. In our case, it is the force exerted by the mass of our globe upon every body on earth. The direction of the force of gravity is given by a plumb bob. The force is measured by the weight of a certain unit mass, more exactly in the centimeter-gram-second (abbreviated c.g.s.) system, by the weight of one gram. The unit of force is then expressed in dynes, one dyne being the force which will give an acceleration of one centimeter to a mass of one gram. At an altitude of 75 deg. the weight of one gram is about 980 dynes.

The magnitude of gravity is determined by pendulum experiments. The time of oscillation of the same pendulum in two different places will give the values of gravity in these two places. The pendulum allows the calculation of the force of gravity by an exactness equal to one-thousandth c.g.s. unit; the torsional balance scales, when used for the same purpose, will give aberrations of the force of gravity exactly to $\frac{1}{10^9}$ c.g.s. units, or one million times as small. It is therefore many times more exact than the pendulum. The force of gravity itself is a resultant of two forces—namely, that of mass attraction and of the centrifugal force caused by the rotation of our globe around its axis. The magnitude of mass attraction is given by the law of Newton. Its value is independent of the quality of mass, and is expressed by the following formula:

$$F = f \frac{m_1 m_2}{r^2}$$

Where m_1 and m_2 are the masses attracting each other and r is the distance of their center of gravity. In the c.g.s. system the factor f is the force by which two masses of one gram each will attract each other if their centers of gravity are at a distance of one centimeter apart. The numerical value of this factor is very small and amounts, for instance, at Budapest, to .000,000,0663 dynes, equal to .000,000,000,0676 gram weight. The factor f is called the constant of gravity. That this force is so very small will not surprise us if we consider that the weight of one gram is caused by the attraction of the great mass of our globe upon the mass of one gram and that two masses of one gram each will therefore attract each other with a very much smaller force.

The influence of centrifugal force on gravity is much smaller than the force of mass attraction. This influence is zero on the poles and largest on the equator, but even there it amounts only to about part of mass attraction. In order to give some idea of the changes in gravity, I will state that an increase in elevation by 300 meters will decrease the weight of ten kilograms by one gram. This weight will decrease about as much again if we go south by one degree of altitude. These changes cannot be measured by ordinary scales, where the weights used as units of comparison themselves change; only instruments using the force of a spring which is not influenced by gravity allow such alterations of gravity to be detected.

The torsional balance devised by Eötvös uses the torsional resistance of a very fine wire as an unchanging means for measuring the force of gravitation and its changes.

Other Factors Affecting Gravitational Attraction

Besides the normal variations of gravity caused by geographical changes in altitude by elevation above sea level, irregular local changes are caused by the unevenness of the globe's surface and the different composition of the earth's crust. It is well known that large mountains will cause a plumb bob to deflect from the vertical. The uneven stratifications of denser or lighter masses in the soil will cause similar disturbances in gravity, which, owing to their small value, are, however, not detectable by a plumb bob.

Let us suppose that beneath the surface of the soil of light density is a body of greater specific weight and cone shaped, as indicated by Fig. 1. The changes in

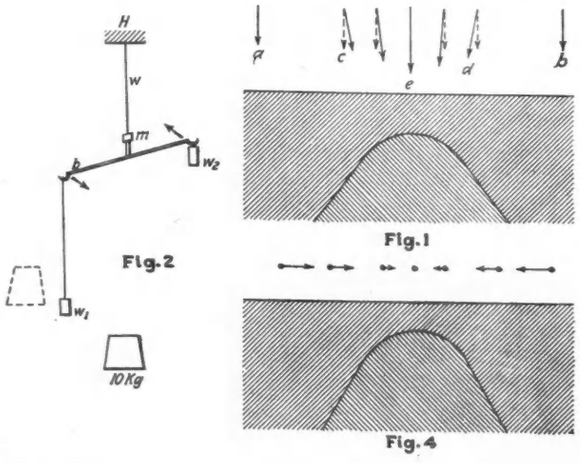


Fig. 1—How force of gravity is affected by a heavy mass. Fig. 2—Sketch showing principle of operation of Eötvös balance. Fig. 4—How a change of gradient is indicated.

gravity may be illustrated by arrows on an exaggerated scale as shown. In *a* and *b* the arrow indicates the magnitude of gravity not yet influenced by the subterranean denser mass. At the points *c* and *d* the force of gravity will be larger and will point toward the denser mass. At *e* the force will be at a maximum. In reality these changes will be much smaller than shown in the sketch; the greatest difference in magnitude will amount to only a few hundred thousandths of its value, and the divergence to only a few seconds of one degree. The apparatus of Eötvös, however, which has been developed for this purpose, will measure these small differences undetectable by other methods. The sensitiveness of the instrument is so great that it will measure the $\frac{1}{10^{12}}$ part of one gram; one milligram being only $\frac{1}{10^{3}}$ part of one gram, an analytical balance will compare with this instrument as a scale for weighing railroad cars compares with the analytical balance.

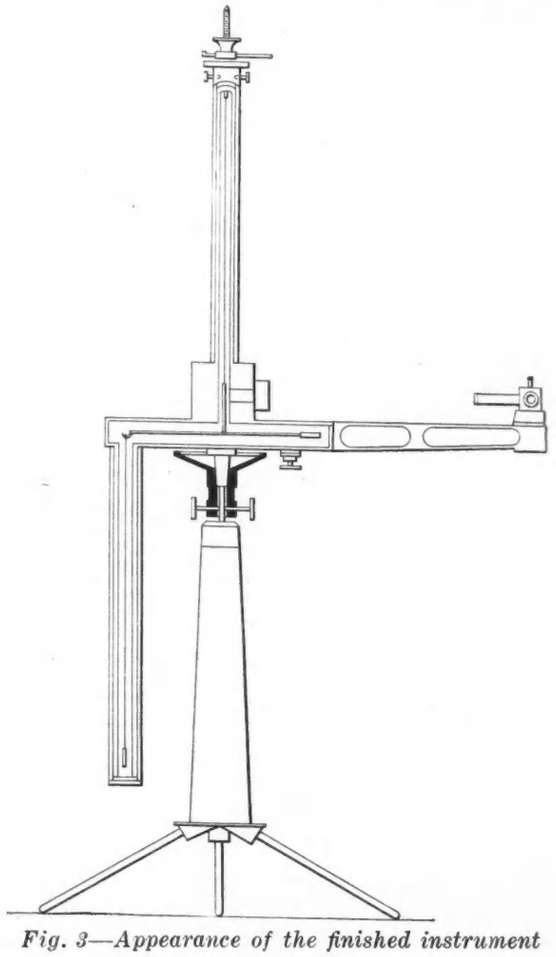


Fig. 3—Appearance of the finished instrument

The exactness of Eötvös' instrument may be illustrated by another example even more strikingly. The periphery of our globe is nearly 40,000 km. If someone were to take a piece of wire, having a weight of one gram, and would stretch it by some unknown means to encircle our globe twenty-five times, or to a length of 1,000,000 km., and cut off a piece of this invisible wire one millimeter long, the weight of this small piece of wire would be $\frac{1}{10^{12}}$ gram. The torsional balance of Eötvös measures forces with an exactitude equal to the weight of this minute piece of wire. No other scales can approach such sensitiveness. The weight of moving parts and friction encountered do not allow it. In Eötvös' instrument the moving parts are suspended, have no bearing friction, and are very light. The scales do not measure weight—that is, the large vertical component of gravity; only its much smaller horizontal component. A variation in the force of gravity would be much more difficult to detect if the whole large force of gravity itself be measured and its slight differences determined by successive measurements, than if the

variation of the small horizontal component alone is observed.

The principle of construction of the balance is shown in Fig. 2. From a torsion head H is suspended a fine wire w, about 100 to 150 cm. long. This wire carries a light bar b, which is about 40 cm. long. From the end of this bar are suspended two small and about equal weights w_1 and w_2. One of these is about 66 cm. lower than the other. The bar b occupies, therefore, a horizontal position, but can turn around a vertical axis, in a horizontal plane, as far as the resisting twisting force of the wire w will allow it to. The possible direction of the bar movement is indicated by arrows. The vertical component of gravity has no effect upon the system. To move the bar or to twist the wire a horizontal force is required. Movements of the bar can be observed by the aid of the small mirror m attached to it. In case the vertical forces acting on the two weights w_1 and w_2 are not exactly of the same magnitude, or do not have exactly the same direction, a resultant force is generated, having a horizontal component sufficiently large to move the bar in a horizontal plane.

Principle of Operation Illustrated

Let us suppose that a weight of 10 kg. is placed to the right of the weight w_1: the force exerted by this upon w_1 and w_2 will not be alike, and will not have the same direction. The difference in attractive force will be manifested by a movement of w_1 toward the weight of 10 kg. The weight w_1 will approach the weight of 10 kg. as far as the opposing force exerted by the twisting wire w will allow. If the weight of 10 kg. is placed in the position shown by the dotted lines, the bar b will move in an opposite direction. Knowing the angular movement of the bar, and the sensitiveness of the apparatus, the acting force may be exactly calculated. If the distance of the weight of 10 kg. or any other weight from the suspended weight w_1 is known, the magnitude of this weight itself may be determined.

The angular movement of the bar depends in this case also upon the position of the 10 kg. weight relative to the bar. If it had been placed exactly in line extending through the bar axis, the bar could not have turned. To obtain, therefore, complete information about an unknown mass of unknown location, exerting its mass-attractive force upon the balance, the apparatus itself, as a whole must be turned around the wire as a vertical axis, and measurements must be repeated in different positions. To be explicit, an apparatus as roughly shown in Fig. 2 would not indicate any movement if a weight of 10 kg. were placed near it. To observe the described motion, a real instrument as used by Eötvös had to be used.

The mass attraction of denser strata below the surface of the soil will exert a rotative action on the balance similar to that of the weight of 10 kg.

Many Measurements Required

It is evident that the examination of a larger territory requires several measurements. The area to be investigated is divided into fields like a checker board. The apparatus is then set up every 50 to 100 m.; measurements are taken, the apparatus is turned around, and readings of five or six different positions are recorded, and the apparatus is then carried to its next place of observation at a distance of 50 or 100 m.

The construction of the instrument is indicated in Fig. 3. Great skill and much care are required to build such an apparatus, as it is very difficult to obtain the accuracy required for the determination of the minute quantities in question. The torsion wire has a diameter of only one-twenty-fifth of a millimeter. It is made of an alloy of platinum and iridium. Quartz threads have not proved satisfactory, especially in field work. The wire is subjected to a special treatment before it is built into the apparatus. It must have as nearly constant and reliable properties as possible, for it is the soul of the instrument. The horizontal balance bar is made of aluminum. On one end is attached a small plate made of platinum and on the other is suspended a small cylinder of the same metal weighing about 30 gm. The movement of the bar is observed by a small mirror, telescope, and a scale divided into millimeters. The mirror is attached rigidly to the bar and moves with it. The telescope is placed on an arm extending opposite the mirror. The scale is mounted unmovably above the telescope. Any motion of the bar and mirror will be noticed in the telescope, which is provided with cross-hairs. The telescope will point to a division on the millimeter scale. Any angular movement of the bar can thus be determined exactly.

The moving parts of the instrument must be carefully protected against influences, such as air drafts and quick changes of temperature causing air movements. This is accomplished by giving the balance, torsion wire, and the suspended small weight a threefold housing of thick brass tubes. The instrument is provided with a tripod and a substantial base, and can be turned as a whole around a vertical axis toward any point of the compass. Measurements at one place are taken in at least five different positions. While moving the instrument through a horizontal angle, let us say, of $\frac{360}{5} = 72$ deg., the bar receives an impact and will oscillate for some time. The time of one oscillation will amount to from ten to twenty minutes. This movement may be diminished by a special damping device, so that the instrument will not be damaged and will come to a rest in less than an hour. Readings are then taken. Instruments of more recent design are provided with two balance bars and two vertical tubes independent of each other, requiring therefore only one-half the time for a complete set of the necessary readings.

The instrument may be taken apart into three pieces, measuring column, supporting column, and base. While moving from one place of observation to the next one, the instrument is taken apart and again set up 50 or 100 m. further. The moving parts of the instrument are provided with an arresting device, which can be handled from the exterior of the column, so that no damage will result during transport.

When making observations in the field, the instrument is housed in a tent, having insulating walls. For transporting the instrument a longer distance a special wagon is used, wherein the parts are rigidly fixed.

Corrections Must Be Made

To obtain a true value of the influences exerted by subterranean masses unbiased by the surface of the place of observation, a survey is taken of this surface to a radius of about 100 m. The influence of the surface at the place of measurement is then calculated by means of data obtained by the survey. These influences have to be deducted from the values found by aid of the balance. The influence of hills or mountains at a greater distance than stated previously is usually estimated, using some topographical map of the territory as a base. The meas-

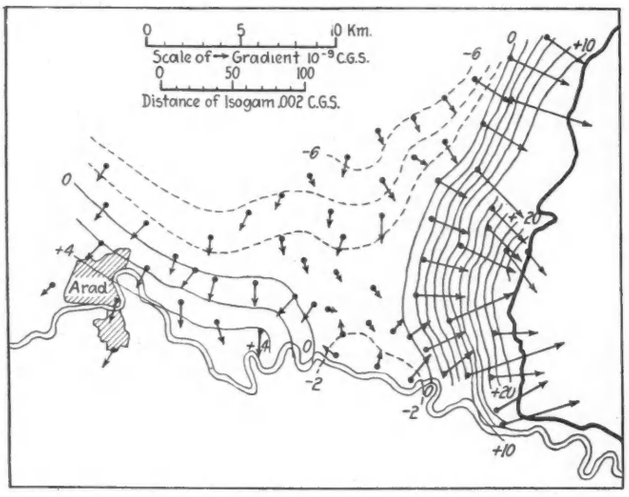


Fig. 5—The results obtained near Arad, Hungary

ured values of the force of gravitation are not affected by the geographical location of the place of observation. For practical use, however, the absolute value of the force of gravitation has little interest; it is only the variation from its normal that allows conclusions to be drawn regarding subterranean abnormalities. Therefore, the normal value of gravitation at the place of observation must be determined, taking into account altitude, elevation and other factors. Besides this, other supplementary measurements have also to be made—for instance, the specific gravity of the strata occurring must be determined and other observations taken.

The explanations heretofore set forth make it clear that the instrument measures the force of gravitation and its very small variations, caused by local conditions. The readings obtained represent absolute values, and do not require corrections if the place of observation is absolutely level and no hills or mountains are near by. In the latter case, however, corrections for unevenness of the soil above or below a theoretical sphere must be made.

Subtracting the surface influences of the near-by vicinity from the absolute values found by observation, the topographic value of gravitation for the place of observation is found. Deducting the normal value of gravitation from the topographic value, the variation from the normal—that is, local topographic irregularities or disturbances of gravitation, are obtained. The disturbances may be caused by invisible subterranean masses and by protuberances above the horizon. Subtracting further the influences of the visible masses above the horizon from the topographic value of disturbances, finally we obtain aberrations of gravity caused exclusively by subterranean masses, or the so-called subterranean disturbances. These correspond

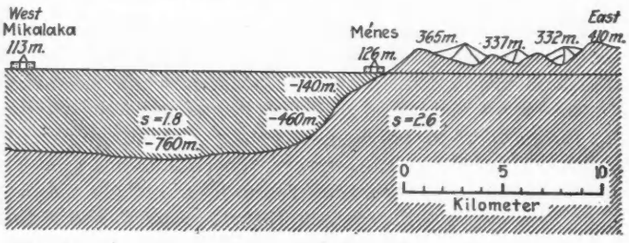


Fig. 6—Cross-section made from isogammas of Fig. 5

therefore with measurements taken on an ideal sphere, one that is perfectly level, with no valleys, hills, or mountains, the influence of these having been previously deducted from the values obtained by the instrument at the place of observation. From our standpoint these are the results sought for.

The Torsional Balance Has Supplementary Use

Other results obtainable by means of the Eötvös scales are that the instrument allows an exact determination of the earth's curvature, more exactly of a surface having equal force of gravity measurements—equipotential points. In a valley about 5,000 ft. deep, situated in Tyrol, Austria, the curvature of the equipotential surface at the edge of the valley, near the foot of the mountain, has been found as large as if the valley were on a sphere thirty times as large as our globe. Subterranean unevenness of masses has a similar but eventually smaller influence on the equipotential surface.

The measurements made by the instrument may further be used to ascertain the exact aberration from the vertical shown by a plumb bob. The plumb bob does not point exactly toward the centre of the earth, which direction is taken as a vertical.

From the data obtained by aid of the apparatus the variation of the force of gravity may be exactly calculated, as previously explained. Proceeding from a given point, the magnitude of gravity changes according to the direction taken. The change of gravity will be maximum in a certain direction. With the aid of the instrument the line of maximum change and the angle which this incloses with a north-south line may be determined. Besides the direction of maximum change, the data furnished by the torsional balance will also give information showing that the force of gravity will increase a certain number of dynes when moving one centimeter in any direction of the compass, and also in the direction of maximum change.

The increase in the force of gravity corresponding to one centimeter distance is called the "gradient." The numerical value of this gradient is very small and is expressed in $\frac{1}{10^9}$ c.g.s. units. The normal value of the gradient is 8.1×10^{-9} c.g.s. units. On the maps illustrating the results obtained by measurements, these gradients are represented by small arrows. The direction of the arrow coincides with the direction of maximum change and the length of the arrow indicates in a certain scale the numerical value of the gradient. A map containing these gradients will also give information about subterranean masses. The gradient will always point toward the greater mass.

Fig. 4 shows the change of gradients for a subterranean mass as given in Fig. 1. More complete information will be obtained if the territory to be examined is covered systematically by a net of observation points, and points giving the same numerical value for the force of gravitation are connected by a continuous line on a map prepared for this purpose. The lines having equal numerical values for the gradient are called "isogammas." The lines of subterranean isogammas will, under certain assumptions, represent in a certain scale the survey levels of the subterranean masses. The lines of isogammas are obtained by direct observations made with the instrument, in the manner already explained. To give these lines the proper interpretation, however, requires certain suppositions. The most simple assump-

tion is that beneath the crust of a softer upper layer, having a smaller specific density, are rock strata of greater density. In this case the lines of isogammas have a similar meaning to lines of elevation on a surface map.

The Deductions That Can Be Made

If several different layers of different densities rest upon each other, the lines of isogammas represent the resultant action of all these, and will not indicate therefore in a simple way subterranean levels. To distinguish between these cases, the aberration of the plumb bob from the vertical, the data obtained for the curvature of equipotential gravity surface, the geological structure, and composition of the territory must be approximately known and must all be taken into consideration.

data obtained with the torsional balance could be checked by borings made in the same place, the results proving the correctness of the observations and the conclusions drawn.

Interesting examples of the information obtained by this method were afforded by observations carried out in the vicinity of the town of Kecskemet and illustrated in Fig. 7. At this place a strong earthquake took place on July 8, 1911. The isogammas of this territory indicate that the subterranean mountain has a form of a volcanic peak, a crater in the center and around this a rising mountain, that falls off gradually, the diameter of the mountain being about 30 km. The epicenter of the quake *C* is close to the center of the volcano. The entire formation resembles a mountain on the moon.

According to the Hungarian geologist Hugo Bökh,

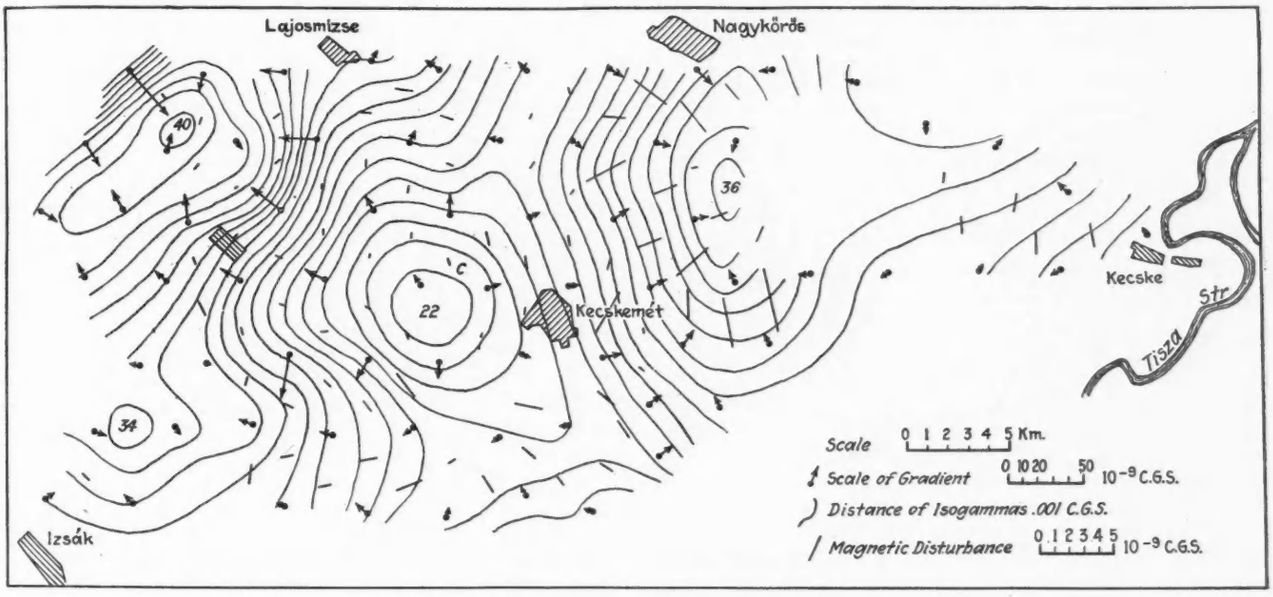


Fig. 7—Gravity measurements at Kecskemet

To give an example of the results obtained, measurements made by Eötvös in the vicinity of Arad, Hungary, are illustrated in Figs. 5 and 6. The map shows the isogammas and gradients. The cross-section Fig. 6 has been determined by the aid of these isogammas. The heavy line at the right of Fig. 5 represents the boundary of the plain. Beyond this rise the mountains of Transylvania, shown in the cross-section. The mass attraction of these mountains has been deducted from the data furnished by the torsional balance. The dot at one end of the arrow indicates the place of observation. A few of these have been omitted to make the drawing clearer. The length of the arrows represents, in the scale shown the numerical value of the gradient. The curved dash and dotted lines are the isogammas. Most of the arrows point toward the mountain range, indicating that these mountains continue beneath the lighter surface crust. The dotted lines indicate isogammas representing a value of gravitation below the normal of the territory. The specific gravity of the material forming the mountains is 2.6; that of the plain 1.8.

Similar conditions of the subterranean strata have been found in the vicinity of Budapest, similarly situated on the border line of the Hungarian lowlands. In this case the elevation of substrata as calculated by the the place of the crater, the center of the mass showing a smaller gravity, may be caused by a large body of salt, the specific gravity of which is lower than that of the rock formation. The short dash lines on the map represent the magnitude of magnetic disturbances. These indicate that the epicenter of the quake at *C* contains a material causing a smaller disturbance than that located in a northeasterly direction near isogamma and point 36, and that the strata are therefore of different composition. This example proves also the importance of making exact magnetic observations of the territory to be investigated. Borings to ascertain the correctness of these conclusions have not been made.

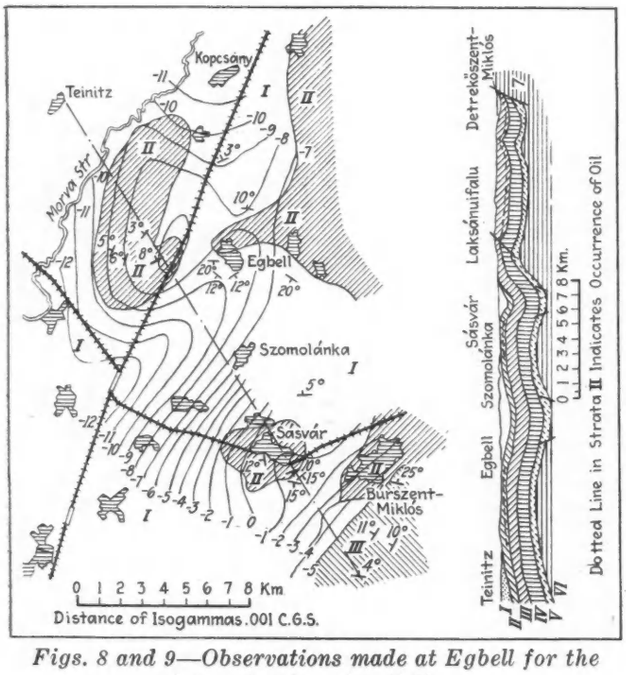
Another striking example of the results obtainable by Eötvös' torsional balance is illustrated in Figs. 8 and 9. The results were obtained by Hugo Bökh at Egbell, a place where borings have been made for oil wells. These are described by him in an article, "Determination of Brachy-Anticlines and Domes by Gravity Measurements Made With the Torsional Balance." Drill holes gave information identical with that obtained by the torsional balance, proving that the instrument was very useful in locating the drill holes at the right spot. Fig. 9 gives a cross-section of the territory along the dash and dotted line. The scales of the two drawings are different.

To interpret the data obtained by the torsional balance

correctly, all irregularities of gravity observed in its horizontal or vertical components must be taken into consideration. To gain as many data as possible, magnetometric observations are also made at the same time in connection with the gravity measurements.

Some Feats of the Instrument

Eötvös' instrument is very interesting from purely scientific, geophysical, geodetical, geological, and seismological standpoints as well. From a purely scientific standpoint it deserves attention, because exceedingly small forces can be measured by it. For instance, the weight of a man, sitting at a distance of one meter from the instrument, can be ascertained with a closeness of 1 per cent, by measuring the very small mass attractive force exerted by his body upon the torsional balance. Considering how small the constant of gravitation is—only $\frac{6}{10^8}$ of one gram—the force measured by the balance amounts only to a few millionth parts of one gram.



Figs. 8 and 9—Observations made at Egbell for the determination of anticlines

With the aid of this instrument Eötvös could prove that the inertia of a body and its gravity are always strictly proportional to each other. Einstein's theory of gravitation is based on measurements made by Eötvös with this instrument.

Another difficult proof was furnished by Eötvös using the torsional balance—that during and following chemical reactions the weight of the bodies taking part in the reaction does not change within $\frac{1}{200 \times 10^6}$ of their observed value and that gravity is therefore independent of the quality of mass.

From the standpoint of the geophysicist the instrument is useful for investigating the present structure of our globe and thereby gaining important information regarding the past and evolution of the sphere. The theory of isostasy may be investigated—that is, the assumptions that very large masses of our continents have settled as if they were floating in their surroundings.

From a geodetical point of view, it is important that the shape of our globe may be determined. The measurement of the length of geographical degrees dates back to early ages. The exactness of these measurements depends to a large extent on the determination of abnormalities in gravity. These are best determined by Eötvös' scales.

The geological information obtainable by means of the instrument has a very important practical meaning. The use of the Eötvös balance on flat land is simple. No corrections are required from the values obtained by direct measurements, and conclusions regarding subterranean masses are therefore easily drawn. In mountainous regions, the geologist will find many outcrops of strata, and he may determine their dip and inclination and may be therefore in the position to follow their course, to a certain extent, below the surface without additional aid. On flat land only expensive drillings will give such information. It is therefore important that bore holes be located at the most promising points. Previous observations made with Eötvös' scales will give this information and will allow drillings to be restricted to the most promising area.

The data obtained by these measurements permit conclusions to be drawn regarding location and construction of subterranean masses. In Transylvania salt deposits have been located by these means. The presence of oil, gas, or water has similarly been determined by such measurements. In the natural gas region of Transylvania, the locations of anticlines and synclines—that is, the highest and lowest points of the strata—have been found in this way. At Tokod, the writer's home, a fault has been located by Mr. Pekár, using Eötvös' scale, which fault is not observable from the surface.

From a seismological standpoint it is possible to locate tectonic lines—that is, lines of unbalanced faults, where movements of the earth's crust will cause very large disturbances. Measurements taken after a quake would show the dislocation of masses after readjustment. Observations near a volcano may even indicate the closeness of an eruption, and the movements of subterranean lava streams may be followed by the instrument.

A few words may be necessary to describe how measurements are made in practice. The instrument itself, and the auxiliary instruments as well as the outfit of the field party, are carried in special wagons. The instrument is taken in three pieces from its vehicle and set up at daytime under a tent. To protect the instrument from quick changes of temperature and to obtain readings uninfluenced by such changes, observations are made at night, when changes in temperature are much smaller than at daytime.

Instruments are now in use in the following countries: The geodetical institute of Potsdam, near Berlin, has made two instruments, according to information furnished. One of these is used by Professor Hecker, of the seismological institute at Strassburg.

Mr. Brilloin, a Frenchman, has conducted measurements in the Simplon tunnel, and the instrument which he used was made by himself.

The Italian professor, Mr. Venturi, of the University of Palermo, and Mr. Soler, professor at Padua, have acquired their instrument at Budapest, as did also the English Science Museum of London.

The Japanese professor Mr. Sinjo has made observations near Tokio with an instrument obtained from Budapest.

In Germany recently a concern has made a specialty of manufacturing these instruments, making them automatic. Readings are recorded by photographs. The instrument is moved automatically every hour by a small motor, so that no one has to stay in the tent with the apparatus.

According to latest information obtainable, instruments are also now in use in the United States and in Mexico. The observers and the results are not known to the writer. This wonderfully exact instrument deserves to be known more broadly, especially in America and by American institutes and engineering organizations.

The instrument will furnish many surprising data and even its field of application will be enlarged, but it is not a divining rod, and will furnish valuable data only in the hands of experts, having the necessary mathematical and geological knowledge. Its use is simplest on level lands. In high hills or mountains, where topographical influences cannot be calculated with the closeness required, its use is handicapped and reliable only as far as these influences may be properly taken into consideration.

Mineral Production of New South Wales

By R. H. Cambage
Under Secretary, Department of Mines, Sydney

PRIOR to 1850 coal was the only mineral mined in New South Wales, and the total value of the production to that date was £254,375. The discovery of gold in Australia in 1851 furnished the first impetus to the mining industry of New South Wales, and in that year the value of the production amounted to £493,882, of which gold contributed £468,336. The highest yield of gold was obtained in the following year, when it amounted to £2,660,946, and this branch of the industry comprised the bulk of the mineral production of the state until about 1874, when it formed approximately 50 per cent of the output. From then onward the yield steadily declined until 1894, when it again exceeded £1,000,000 yearly, largely as a result of the discovery of the Wyalong gold field. With the exception of 1901 and 1902 the yield was maintained over the million mark until 1907, chiefly as a consequence of the beginning of the gold-dredging operations and the extraction of gold from the copper ores of the Cobar district. Thence to the present day the yield of gold has steadily declined and has become a less and less important feature of the mineral industry of the state, until in 1922 the value of the gold won was less than 1 per cent of the total value of the mineral production.

In the early days of mining gold was of paramount importance, and this fact has apparently given rise to a popular belief that the decline in gold mining is indicative of a decline in the mineral industry as a whole. Further gold discoveries, some probably of considerable importance, will be made in the years to come, but it cannot be too strongly stressed that the future of the mineral industry in New South Wales lies not alone in the resuscitation of gold mining, but in the development of its economic minerals—coal (with its byproducts), iron, clays, building stones, slates, limestones and shale for the manufacture of cement, and the exploitation of the silver-lead-zinc resources. It is noteworthy that the most significant developments of recent years have taken place in non-metallics.

A cursory review of the mineral industry shows that the trend of coal and coke production is upward, the output of each having doubled during the last twenty years, and the future prospects are good. The area of productive coal measures is approximately 16,000 square miles, and though comparatively little is known of two-thirds of this area, the evidence of widely separated bores therein suggests that a tonnage of good coal reaching some thousands of millions of tons may be expected. The output during the last three years has been over 10,000,000 tons per annum, and, if necessary, this output could be greatly increased without fear of exhausting the coal resources within several centuries.

The value accruing to the state of the products of the silver-lead-zinc mines of New South Wales during 1922 was £3,731,566, notwithstanding that full operations have not been resumed at all the mines at Broken Hill since the recent prolonged strike. These figures convey an inadequate idea of the importance of this branch of the industry, as the ores are only concentrated in this state, the major part of the silver-lead concentrates being refined at Port Pirie, South Australia, and the zinc concentrates at Risdon, Tasmania. The value of the metals extracted in the commonwealth from ores mined in New South Wales during 1922 amounted to £5,585,501, or an additional value of nearly £1,750,000. Among all countries Australia ranks second as a producer of lead ores, third as a producer of zinc, and fifth as a producer of silver.

Prior to 1907, pig iron was manufactured chiefly from scrap iron, and the resumption of the smelting of iron ores in that year resulted in an output of 29,902 tons of pig iron. The growth of this branch of the industry is exemplified by the fact that the average annual output during the last five years has been about 75,000 tons. This output has been furnished from iron ores mined and smelted within New South Wales, and does not include pig iron manufactured in the state from ores mined elsewhere.

The expansion of the limestone branch of the mining industry has been rapid, the manufacture of portland cement having increased from 13,400 tons to 187,800 tons, and lime from 20,054 tons to over 33,000 tons during the last twenty years.

There is a decided expectation that the production of clays will increase. Clays of great variety are available in large quantity, and manufacturers in the state are now obtaining most of their raw material from local sources.

Mining for metals such as copper, tin, molybdenite, bismuth, and the tungsten ores varies in sympathy with the prices ruling in the world's markets.

The total value of the mineral production of the state has doubled itself during the last twenty years, and during the last ten years has fluctuated between 10,000,000 and 14,000,000 lb. per annum. The output for 1922 was valued at £14,274,770, and has been exceeded on only one occasion—namely, 1918, when the value of the mineral yield was £14,419,352.

New South Wales has great possibilities as a mineral producer, and it is confidently expected that the present high rate of production will be maintained, and that it will, moreover steadily rise with the increase in population and demand.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

How to Sell Mining Property

In Which Is Set Forth, Also, the Means Whereby the Professional Man May Capitalize His Abilities

THE EDITOR:

Sir—Oh, you little mining engineers plodding patiently along in staff positions, learning the ropes, and occasionally having your ears burn and your hearts tingle as inadvertently you overhear the skeleton plans of some big deal about to be framed within your hearing; and you big mining engineers who by sheer pluck have won your spurs and the right to sit in conference and dictate the terms to some poor wary owner of some valuable product of the earth awaiting your money and skill to convert it into a commercial product: hearken unto me while I relate the story of a new field open to us all wherein there is no competition, no stipulated salary, and wherein the prize is as big and the chances of gaining it are much greater than actually finding and selling a commercial ore deposit.

As a premise I am assuming that any red-blooded mining engineer after ten years of experience in the field is better equipped to recognize, examine, and put in condition for selling any natural product of the earth than any prospector or promoter living. I am further assuming that most mining engineers, between jobs, if they are independent and have ideas of their own, have some time to find, examine and sell good properties. It's a game that has more thrills, as many disappointments, and brings to the surface as much profanity, as driving a Ford car to a Nevada gold strike, and best of all sometimes you make a sale, and I will tell you why. We of this profession, if we only realize it, are best able to pick up, size up, and tie up, cheapest, a marketable enterprise, and the "powers that be," no matter how stern they seem and try to be, always have their weather eye open for a real commercial enterprise, and if one is square and is known to shoot straight—and this trait spreads fast among traders—real serious consideration can eventually be secured, and this is half of the sale.

The other half is this: You fellows who have read reports, made reports for fees, and analyzed reports for purchases just stop to consider what a world of experience is yours to capitalize and utilize in making a correct, vivid, exact report on your own deal where you can bust it wide open and tell the whole story with no seller to urge camouflage and no buyer's equation of safety. If it's no good in your own mind, of course you drop it, but if the proposition shows you, after weighing all the evidence, a reasonable risk for a reasonable profit, you can't help selling it, and I know because I just sold one, and, what's more, I firmly expect to sell a dandy before snow flies.

However, there's the other side, and listen to me: In taking your option, write it yourself, and then rewrite every day for a week for exercise, and then spend some money on a good lawyer, and remember that big companies are just as willing to get something as cheap as possible as you are, and it is fair if you let them get away with it.

Another point—and don't overlook this—especially here in California. To sell real estate—and all valuable products of the earth are traded in as real estate—is a misdemeanor without a broker's license covered by a $2,000 bond. I don't know why the "state dads" included the mining engineers with the real estate dealers, for they should know that selling a mine or even a nonmetallic is much harder that crawling through the eye of a needle, especially as the properties you will deal in will show a maximum of 15 to 25 per cent profit, as against your opponents or competitors, the professional promoters, who, with their elastic consciences and actual ignorance of modern operating costs, will offer anywhere from 100 per cent to infinity per cent in profit with no risk at all. However, these are a part of the rules of the game and a license must be had, and if you don't believe it write me, and with his permission, I will tell you the story of a well-known mining engineer whose ignorance of this little detail cost him much trouble, profanity, and half of his commission. In other words, the buyers had him over a barrel and made him like it to the tune of a very considerable amount of money which he had in my opinion honestly earned.

This is the new game, fellows, and when you get out of a job don't fill this paper with your wail for the low price of engineers, for it's true that the woods are full of them, and, like the products we help to produce, we are dependent for our income on that great natural law of Supply and Demand.

In conclusion, the question immediately arises in the mind of one about to attempt to make his first sale. How can I capitalize my labor and money? And don't forget that to sell first costs you money, and you must spend whatever necessary to get at the bottom of your problem, for unless you produce a finished job you are wasting your time, and the answer to your question is this: Hang onto it and saw wood, and invariably, if you have done the work well the original owners will approach you something like this:

Your option has run out, and you are no longer interested, and we would like to have the report, which, of course, you are no longer interested in. Your reply, much to their astonishment is this: "I am sorry, gentlemen, but that report is of very considerable value to me, and, what is more, I have a very considerable investment in time and money, which, of course, I am willing to sell at a reasonable price. And, gentlemen,

as my report is the key to your property, and as I infer that you have other parties in view, I feel that my report, now necessary to complete this transaction, is worth an additional amount." Then state the price, and make it plenty, being fair and in proportion to the amount involved, and you will sell your report.

This is the game, fellows. The sky is the limit, and yours is the opportunity, and what's more this is one way to get a new crop of properties, which seems to be worrying the present owners of the rapidly depleting present crop now on hand. ROBERT J. BURGESS.

Yankee Hill, Calif.

Further Data on the Weight of Steel Balls

THE EDITOR:

Sir—I have noticed R. D. Perkins' comments on the weight of steel balls published in the Sept. 15 issue of the *Journal-Press*. I believe that Mr. Perkins has not considered the matter in the right light. The problem was not to determine the percentage of volume of a vessel or receptacle that could be occupied by spheres of the same size, but, rather, to determine the percentages of solids and voids making up a cubic foot that might be theoretically cut from the center of a mass or pile of balls.

To even approach the actual condition existing within a mass of balls by inclosing them within a container or vessel, such vessel would have to be of such large size that the experiment would be difficult to carry out. The importance of the problem is not sufficient to warrant such a method even if it would be productive of more definite information, which, in my opinion, it would not.

The arrangement of balls within a ball mill approaches the theoretical closest arrangement possible with spheres of the same size. This is due to the large volume of the mill and to the fact that, because of the curved surface that bounds the mass on the lower side, the balls tend to arrange themselves in similar manner as if piled upon a flat surface. The theoretical arrangement exists within the mass in the latter case.

The reason for a larger percentage of voids being apparent when the spheres are "poured or tamped into a vessel" is that the spheres are not permitted to assume their natural arrangement, owing to the restriction of the walls of the vessel and to the fact that the voids between the outer spheres and the walls of the vessel are much larger than the others.

There are factors that enter into the problem that tend to increase the percentage of space between the balls themselves under actual operating conditions. Two of these factors are the addition of ore or material to be ground and the rotation of the mill. Note that the word "space" is used above instead of "voids" in the sense of distance between balls, occupied in operation partly by ore. To offset this possible increase in space between the balls, or even the actual voids, we have the gradation in sizes of balls that always exist in any mill that has been operating for some time. The determination of voids as being 26 per cent of the volume was based upon the assumption that all the balls were of the same diameter. The greater the variety of diameters the smaller will be the percentage of voids in any mass of mixed sizes of spheres.

The practical application of this knowledge is limited. The author had no idea that he was disclosing anything new, but wished to make as correct an application of the matter as possible to ball milling. Before the article referred to was published the data had been checked and verified by certain well-known authorities connected with the U. S. Bureau of Mines.

Chicago. D. H. FAIRCHILD.

Upkeep Costs of Air Separators

THE EDITOR:

Sir—Referring to the article "A Modern Talc Mill at Gouverneur, N. Y.," on page 359 of the *Engineering and Mining Journal-Press* of Sept. 1, 1923, we must take exception to one sentence—i.e., "These air separators have given general satisfaction, despite the fact that renewal and repair of baffles, bearings, and gears are a frequent source of expense."

We are inclined to think that the one interviewed at the Loomis plant rather magnified trivial repairs. We would call your attention to the fact that on the last two separators shipped the Loomis people there has been no repair cost whatever. On the first three separators, which have been in use approximately three years, running twenty-four hours a day, our ledger shows that we supplied the Loomis company repairs to the amount of $299.30.

When these separators were built we used cast-iron gears and a comparatively short drive head. In our present model we are using steel gears and a much longer head; moreover, the steel gears are inclosed and automatically lubricated, whereas the cast-iron gears run in the open and were simply slushed. Our reports on some of our old separators indicate that the steel gears last three times as long as the cast-iron gears, and as all separators shipped during the last year have been equipped with the steel gears this fact should be taken into consideration.

We are very sure there has been no cost for repair of baffles, as these are made of heavy-gage metal and should last a lifetime. These machines are fitted with what are known as baffle knocker rods. These are steel rods, projecting through the shell of the separator, and are intended to be pounded occasionally to jar loose any material which may hang up in the machine, and are designed to save the shell from being pounded. Fibrous talc has a tendency to cling, even to a vertical surface; consequently, the baffle knocker rods receive rather severe pounding; but this is what they are for, and they thereby save the rest of the machine.

The total cost of repairs which we have supplied for these machines has amounted to approximately $33 per year per machine. We have supplied one pair of gears per machine in three years and one thrust bearing per machine in three years. The bronze and steel thrust bearing has now been replaced by a roller thrust which has a much longer life than the old bearing. Only one pair of bearings has been supplied for three separators in three years. The cost for knocker rods has been approximately $4 per machine per year.

Now, rather than the repairs being a constant source of expense it seems to us that this record is the most wonderful we have seen in the many years we have been handling crushing and grinding machinery, and we doubt if any manufacture of any machine running twenty-four hours a day can show an upkeep cost of $33 a year. RUBERT M. GAY CO.

New York City.

Newly Elected President of the American Mining Congress

Hallock W. Seaman

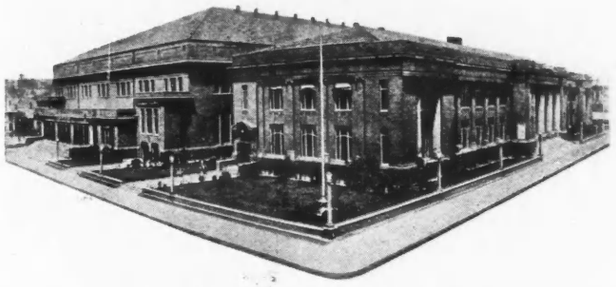
HALLOCK W. SEAMAN

BY A COINCIDENCE, the sixty-third birthday of Hallock W. Seaman, newly elected president of the American Mining Congress, fell in the week of the recent convention in Milwaukee at which he was chosen head of that organization. Mr. Seaman has long been actively interested in the Mining Congress and has given it his loyal support in many ways. His striking figure has been prominent at its conventions, and his aggressive, businesslike way of getting down to facts has been an invaluable aid in conferences. The honor done him is well merited.

Mr. Seaman's major interest in the affairs of the mining industries has been that of a producer of gold who is desirous of seeing the gold-mining companies get a square deal. When rising costs, coupled with a fixed price for gold, brought about a situation where it was imperative that something must be done if the gold producers were to continue their production, it was the Black Hills Chapter of the American Mining Congress, of which Mr. Seaman's company was a member, that first brought the matter to public attention. The Mining Congress undertook a nation-wide campaign and eventually the McFadden gold bonus bill—destined to fail because of adverse influence of banking and jewelry interests—was introduced at Washington. It was Mr. Seaman who was chosen to present the testimony for the McFadden bill before the Ways and Means Committee. The failure of this movement left all gold miners in a bad predicament and many mines shut down, some never to reopen. In the Black Hills only two producers remained: one, the great Homestake mine, at Lead; the other, the Trojan Mining Co., of which Mr. Seaman was, and is, president and the principal owner. The gold situation is one of his favorite topics, and he is still convinced that vital changes in the nation's policy are necessary to protect the gold standard.

Gold mining, however, is but one of Mr. Seaman's varied interests. His activities have brought into play his executive talents in banking, manufacturing and railroad construction and operation as well. He has been identified in his home town of Clinton, Iowa, with such interests, and is senior vice-president of the City National Bank of Clinton. In addition he is a director of the First National Bank of Deadwood, S. D., where the Trojan company has its local office. For many years he was chairman of the board of the American Wire Fabrics.

Mr. Seaman was born in Clinton on Sept. 26, 1860. He went through the local high schools there and in 1882 graduated from the engineering department of the State University of Iowa. He spent several years in the field in railroad engineering and on construction work. Chance caused him to undertake the study of law in Clinton, and eventually he was admitted to the bar, later becoming a partner of Judge Chase under the well-known firm name of Chase and Seaman. His active mind was always investigating something new and he formed a liking for geology and kindred subjects. Eventually this led to his becoming interested as an executive officer in the famous Buxton mine, in the Deadwood district, which proved to be a well-paying property. Later Mr. Seaman was chosen to amalgamate a number of properties in the Black Hills in which his friends were interested. This merger finally resulted in the formation of the Trojan company, of which he has been president from the start. Mr. Seaman is a member of the Union League Club of Chicago, in which city he has his headquarters. He says that he is the champion long-distance commuter between Chicago and Clinton, where he lives with his wife and son.



Public Auditorium, Milwaukee

American Mining Congress Meets in Milwaukee

Taxation, Standardization, and Equipment Problems Considered—H. W. Seaman Elected President—Open Forum Makes Good Beginning

COAL MEN, metal mining men and representatives of machinery manufacturers met in Milwaukee last week on the occasion of the twenty-sixth annual convention of the American Mining Congress. Approximately 50 per cent of those who registered were connected with machinery and supply houses who were interested in the National Exposition of Mines and Mine Equipment which was an adjunct and, at the same time, the most prominent feature of the convention. Further analysis of the registration list showed that at least 18 per cent of those present were directly connected with coal-mining companies and 10 per cent with governmental bureaus, educational bodies, and various publications. The balance included those directly interested in metal mining and others whose connection was not readily discernible from an inspection of the list. All mining states of the country, as well as Alaska, Canada, and Mexico, were represented in the delegations.

Convention headquarters were at the Hotel Wisconsin. The machinery exhibit was housed a few blocks away in the Public Auditorium, where also all sessions of the convention were held. Here the formal opening ceremonies took place on Monday evening, Sept. 24. Max W. Babb, vice-president of the Allis-Chalmers Manufacturing Co. and chairman of the Milwaukee Committee, presided. Addresses of welcome were made by the Mayor and by ex-Governor Phillips of Wisconsin, the president of the Milwaukee Association of Commerce. To these response was made by Sidney J. Jennings, president of the American Mining Congress during the past year. A message from President Coolidge to the convention was read, after which the exposition was formally declared open.

Two new features were on the program of the convention. These were the meetings of the Industrial Cooperation Division of the Mining Congress, over which W. A. Grieves, of the Jeffrey Manufacturing Co., presided; and the so-called "Open Forum" discussions of practical equipment problems. The latter were intended to give manufacturers of equipment an opportunity to meet those who were using it and to discuss with them whatever difficulties they were having with it.

Taxation and standardization remained the most important topics on the program, as was the case last year at Cleveland. Conferences on oil shale, public service and education, and tariff were provided for. Although the silver situation is perhaps more in the public eye today than any other phase of metal-mining conditions, it was not discussed—for good reasons, however, since it is even now being investigated by a Senate committee. On the other hand, although the McFadden gold bonus bill was dead before the convention in Cleveland was held, nevertheless many believe that measures must be taken to stimulate the production of gold and to protect the gold standard. An address on this subject was delivered by H. W. Seaman, president and principal owner of the Trojan Mining Co., of South Dakota. It will be found on pages 596 and 597 of this issue. Before the convention ended Mr. Seaman was elected to succeed Mr. Jennings as president of the American Mining Congress.

Results of Convention Embodied in Resolutions

The sentiment of the convention regarding questions of the day was summarized in resolutions that offered specific recommendations. Among the things recommended were the following:

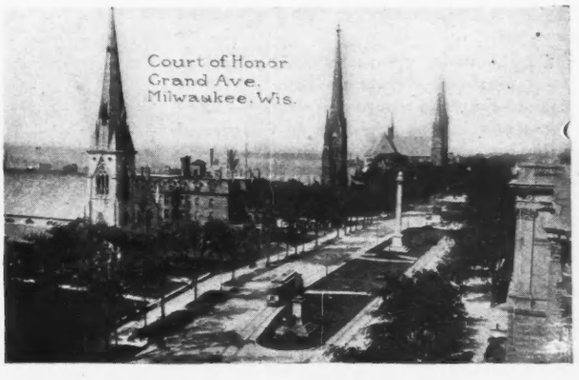
1. A concerted effort to bring about uniformity of all "blue-sky" laws, "to the end that, while every possible protection be given to the careful investor, encouragement be also offered to the prospector and small operator to raise capital for initial development of mineral resources." This resolution was against any effort to fortify state "blue-sky" laws by similar federal legislation and it condemned such measures as the Denison bill.

2. Selective immigration, operative prior to embarkation.

3. The appointment of a committee to further plans for the development of more systematic training of mine foremen and other section executives in the mining industries.

4. Appointment of a committee to investigate the gold situation and to recommend measures to protect the gold standard.

Another resolution expressed the



E. C. Porter
Convention Manager

James F. Callbreath
Secretary,
American Mining Congress

Paul Armitage
Chairman,
Taxation Division

Victor C. Alderson
Chairman,
Oil Shale Division

opinion that the status of the Treasury Department's action in revoking allotments of silver for subsidiary coinage rested upon the judicial interpretation of the Pittman Act alone and that steps be taken to bring the matter before the proper courts. It was stated that mandamus proceedings had been started.

State taxation was the subject of another resolution, which recommended that an effort be made to convince the public that the abnormal increase in cost of state and local governments was largely due to the demand of the people themselves and to the ignorance of officials as to how to spend public funds; and that executives be urged to study their governmental organizations to eliminate waste.

Double taxation in all forms, except during emergencies of war, was denounced in another resolution, which specifically mentioned the Capital Stock Tax. It was also urged that reciprocal action be built up between states, so that the situs of taxation for real estate and tangible personal property be its physical location, and that its intangibles be apportioned among the states according to business transacted in them.

A Tax Settlement Board of Court of Appeals was again recommended, as in 1920, to function independently of the Bureau of Internal Revenue, with broad equity powers to hear and decide all appeals in cases where the taxpayer claims to be aggrieved.

The sound, economic policy of the development of the country's waterpowers under conditions that will prevent monopoly and insure adequate power to industries was endorsed.

Recent recognition of Mexico and the presence of a special delegation from the Mexican Government were responsible for a resolution asking that the governments of Mexico and the United States appoint a joint commission to be made up of an equal number of representatives of the mineral industries of both nations to consider ways and means to facilitate the accord and co-operation of both science and capital in the development of the mineral resources of Mexico.

The following officers were elected by the directors just before the convention closed: President, H. W. Seaman, of Chicago; first vice-president, D. B. Wentz, of Philadelphia; second vice-president, E. L. Doheny, of Los Angeles; and third vice-president, L. S. Cates, of Salt Lake City. James F. Callbreath, the mainspring of all conventions of the Congress, was re-elected secretary. The executive committee chosen consists of H. W. Seaman, of Chicago; Albert J. Nason, also of Chicago; and S. J. Jennings, of New York.

Preceding this election, directors for a term of three years were chosen at the annual business meeting. These were: J. G. Bradley, of West Virginia; Stanly A. Easton, of Idaho; W. J. Loring, of California; and Hugh Shirkie, of Indiana. F. L. Morse, of Ithaca, N. Y., was chosen director for a term of two years. At this meeting the annual report of the secretary was read. A balance of $8,400 was reported; receipts were $166,967.

Several interesting papers were presented at the tax conference, which held a number of sessions during the week. The most notable of these was one on "Discovery Value," by George

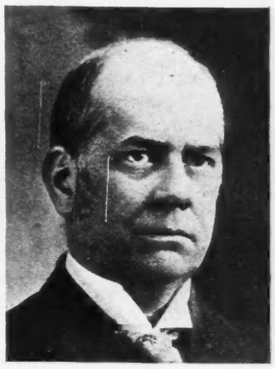
Problems of the Mining Industry, as Sidney J. Jennings Sees Them

"THE mining industry has two big problems to face," said Mr. Jennings. "The first is a fundamental one, and that is that all mines are wasting assets. There is one thing and one thing only that can be said truly of all mineral deposits, and that is that they have a limit. This fundamental fact should never be lost sight of, either by the legislator seeking to impose a fair share of the tax burden upon the mining industry, or by the investor who desires to see an adequate return on his capital invested.

"The second problem that concerns the mining industry is one which I think will tend in the course of time to correct itself. The problem is concerned with the enormously increased rate at which minerals have been extracted in the last generation. Consequent upon that tremendous outpouring of mineral wealth, there has probably been an unequal distribution of the resultant accumulation, which has tended in some degree toward the unrest of the world. From 1493 to 1921, inclusive, there have been produced, in round figures, $18,370,000,000 worth of gold. More than one-half of this has been produced in the last thirty years. During the same above-mentioned period of time of 429 years, there have been produced 12,740,000,000 oz. of silver. More than one-half of this has been produced in the last forty years. While the records of the production of coal have not been so well kept as those for gold and silver, it is probable that more than one-half of the total recorded production of coal has been produced within the last generation. I have said that I think that this probably will tend to correct itself. It is difficult to conceive that the rate of increase can continue in the future with the same momentum that it has in the past generation. It will continue to be a necessity for the leaders of the mining industry to strive by all available means properly to utilize our mineral deposits and by the use of more economical methods of extraction and production convert that which is now waste material into ore, thus prolonging the life of these deposits as far as it can be done."

Sidney J. Jennings, the retiring president of the American Mining Congress

McKinley W. Kriegh
Secretary,
Taxation Division



E. W. Parker
Secretary, Anthracite
Bureau of Information

W. A. Grieves
Chairman, Industrial
Co-operation Division

Bruce C. Yates
General Manager,
Homestake Mining Co.

E. H. Goodner, said by McKinley W. Kriegh, secretary of the Taxation Division of the Mining Congress, to be the first paper written on the subject. In it practical application of the provisions of the discovery clause of the Revenue Act is made to the taxation of mining ventures. The following principles in discovery were deduced by Mr. Goodner in the order given:

1. The right of a discovery value is restricted to the mining and oil and gas industries.
2. In cases of discovery it is the mineral that is discovered and not the mine or well.
3. In order to be "discovered" the existence of the mineral must have been unknown to the taxpayer prior to his own efforts in revealing it, whether in wildcat territory or not.
4. The deduction on account of discovery value is allowed to all the parties in interest at the time of the discovery, and only then.
5. The discovery must have taken place on or after March 1, 1913.
6. The property to be valued extends only as far as the discovery reasonably affects it, and is limited by those boundaries which are common to both lessee and lessor.
7. The value of the property must be materially in excess of the cost.
8. The value of the property must be as of the date of discovery of a substantial commercially valuable deposit, or within thirty days thereafter, and discovery does not take place until such a point in the exploitation and development of the property is reached.
9. The lessor is always entitled to a share of the depletion deduction in proportion to his interest in the fee property.

Other papers on taxation were: "Profit in Mining Ventures," by Wade Kurtz; "Retrospective Appraisals," by W. I. Kirkaldie; "Inventories," by H. B. Fernald; "Reorganization of Mining Companies," by Walter A. Staub; and "Taxation of Dividends and Other Corporate Distributions," by Arnold R. Baar. The last paper is an oddity in that the opinion in it is considered to be contrary to the interest of the mining companies.

The general sessions devoted to the subject of standardization opened on Thursday, Sept. 27. W. A. Durgin, of the Division of Simplified Practice of the Department of Commerce, delivered a remarkably lucid address defining what the department meant by "simplified practice" as compared with "standardization," and describing how it sought to accomplish its ends.

Albert W. Whitney, of the Engmeering Standards Committee, discussed the work of the committee. Colonel Warren R. Roberts, chairman of the coal mining branch of the Standardization Division of the Mining Congress, then spoke, taking for his subject "Public Interest in Standardization." Charles A. Mitke, chairman of the metal mining branch, was absent, being in California, where he is now recuperating from a severe illness. Colonel Roberts was followed by Dr. Porter, of the Canadian Engineering Standards Association, who described his organization's work.

In the afternoon, at a joint conference of both branches, reports of the various committees were presented and discussed. The addresses by the chairmen and members of the various committees were continued the following day, in the aggregate covering a wide range of subjects and setting forth a great mass of facts regarding mining practice and equipment.

Open Forum Discussions Well Attended

Attendance at the meetings of the Open Forum was excellent. Every session exceeded its allotted time, as might have been expected. D. E. A. Charlton, of the *Journal-Press*, presided over the discussion on Churn Drills vs. Air Drills for Strip Pit Work. One speaker said that churn drills making 6-in. diameter holes and driven by one man were displacing jackhammer drills on the Mesabi.

Mr. Gardner, of the Sanderson Cyclone Drill Co., said that while six years ago the Mesabi had five or six churn drills, now it had 150.

At the Mine Transportation meeting, with R. Dawson Hall, of *Coal Age*, as chairman, there was a short discussion on the advantages of standardized track gages by a representative of a coal-mining company. Other topics that came up were: "The Friction of Mine Cars in Relation to Track Curvatures, Wheel Diameters, Bases and Bearings," and "When and Where to Use Gasoline Trolley and Storage Battery Locomotives." It was said that in discussing the grade on which storage-battery locomotives could be used, the frequency with which steep grades must be negotiated must be considered; that with many grades of 10 per cent the storage battery would soon be bereft of power. Another subject was "Roller Bearings vs. Plain Bearings." One manufacturer said that if the roller bearing never saved any power (which, of course, it did) it would be amply justified by its other qualities. Another topic was "Advantages and Limitations of the Caterpillar-Mounted Shovel."

The annual banquet on Friday evening brought the convention to a close. Mr. Babb acted as toastmaster. The speakers were the newly elected president, Mr. Seaman; W. C. Johnson, vice-president of the Chicago & Northwestern Ry., who read a speech on "The Railroads and the Mining Industry" prepared by W. H. Finley, president of the road, who was unable to be present; and Senator Irvine L. Lenroot, of Wisconsin, whose topic was "The Government and Business."

Care was taken to see that the inveterate golfer had ample opportunity during the week to keep in form. For the first time, also, in the last few years one evening was left entirely open during the week for the delegates to fill in as they pleased. On Wednesday evening a smoker was given by the exhibitors, for which a varied program had been arranged.

Milwaukee is a city of many large manufacturing plants, including those of some important makers of mining machinery. Surprisingly few availed themselves of the opportunity offered on three afternoons by the largest of these manufacturers to visit its plant. Those that went were well repaid.

Many interesting exhibits were shown at the exposition. The display of several different types of underground loading machines in particular attracted many. In the aggregate a large sum of money was spent by the exhibitors—sufficiently large to have justified expectations of a far larger attendance.

Can the World Pay Its Gold Debts?*

A Gold-mining Viewpoint of a Serious World Problem

By Hallock W. Seaman
President, Trojan Mining Co., Deadwood, S. D.

AT THE END of our Civil War, the United States had incurred what at that time was regarded as a staggering national debt, but we gradually paid that off, until at the opening of the World War our national debt had been reduced to a negligible amount. There were not even enough government bonds outstanding to form more than a gelatin backbone for the National Bank note circulation of the country.

In all international debt transactions, a repayment in actual gold is nominated in the bond, and that gold in every case is the equivalent of $20.67 of American money for every ounce of gold so stipulated to be repaid. The gold debts of the various governments of the world now reach the huge total of more than $382,000,000,000, figured in American dollars. If we are to balance out the debts of the various world governments, one with another, this sum will, of course, be materially reduced, but no matter to what lengths we may go in offsetting one debt against another, the fact is, that the huge mountain of debt remaining will even then completely overshadow the pygmy stock of gold available for its redemption. To the extent, also, that some of these gold debt obligations may fail or be repudiated, the solvent governments must in some way levy an equivalent tribute upon their individual peoples to make up the deficiency.

The dominant governments of the world profess their adherence to the gold standard, and that gold alone must prevail as the ultimate measure of value is the best thought of our best economists.

We know full well that the world's financial structure is just now out of balance. It is a leaning tower. There is a question, also, as to whether its gold foundation is strong enough to support the weight of the gold debts piled upon it. The available monetary gold in the entire world is estimated to be less than nine billion dollars, while the combined government debts of the world, expressly repayable in gold, aggregate something like $362,000,000,000. This is a ratio of 9 to 42—or, reduced to its lowest denomination, one of 3 to 14—which is entirely out of line with the ratio of 40 to 60, or 2 to 3, in our own gold monetary system.

As you know, our Federal Reserve system aims to have on hand not less than a 40 per cent gold cover for its note issues; that is, for every $100 of face value of notes outstanding, it must have in its vaults $40 or more in actual gold for its redemption, the remaining $60 being pure fiat—or banker's "float," in other words. Experience has proved this ratio to be correct and that our gold currency system is sound to the core. We happen to have at the present time a gold cover of better than 72 per cent, but that refers only to the amount of gold actually on hand for the ultimate redemption of the Federal Reserve note issues. The gold reserve of the United States of around $4,000,000,000 has no such relation to the $24,000,000,000 or more of the outstanding obligations of our government which have been borrowed from our own people against Liberty Bonds and Victory Notes—all of which obligations are likewise expressly repayable in gold. Out of this $24,000,000,000 of requisitioned credit our government has loaned to other governments about $11,000,000,000—all repayable, principal and interest, in gold.

The outstanding financial problem today is whether or not we are juggling with the integrity of the gold standard itself. Is the government of the United States in any manner contributing by sins of commission or omission to the downfall of the gold standard? We must admit at the outset that there has been no overt act upon the part of the government of the United States that can be construed as opposed to the gold standard. Of all nations our government is its most pronounced adherent. It is only the acts of *omission* that we are now discussing—the failure of Congress to take such steps within its power as would tend to maintain a normal gold output from our mines, to the end that the sum total of the world's stock of gold would be augmented year by year, and that the foundation upon which the world's gold debts are based would be measurably strengthened thereby. The truth is that the world as a whole is simply muddling through with its promises to pay. We know full well that there is but one possible source from which new or virgin gold can be drawn, and that is right out of nature's storehouse—out of the very ground itself, as the result of mining operations.

But on every hand the statement is made that we already have too much gold in the United States and that every addition to the nation's stock of gold is but adding just so much to the menace of inflation. Some even go so far as to say that it would be beneficial to the nation's finances if all the gold mines in the United States were to be wrecked. Those of us who are acquainted with the details of the mining industry of the country cannot subscribe to such revolutionary and sinister propaganda.

In 1922 our mines produced $47,000,000 of gold, as against a total of $98,000,000 in 1915, when we began to get into the war—a decrease of over 50 per cent. Our national obligations, payable in gold, increased from practically nothing in 1915 to the present sum of $24,000,000,000 in 1923. The real reason why the Federal Reserve banks have stripped their correspondent banks of their gold coin is because they know that if the gold coin was to be placed in circulation it would quickly disappear into hiding, and thus not be available for Federal Reserve notes.

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While the present gold reserve of 77 per cent makes our currency system eminently sound, yet can as much be said for our nation's general debt structure, which is likewise founded upon this identical gold foundation, plus the debts owing us by foreign nations and their meager stocks of gold? Is there, for instance, any relation between the $4,000,000,000 stock of gold in the United States and the paper promises of the great powers of the world to redeem ultimately their obligations to us in gold? In other words, is the gold standard purely a national establishment, or is it a matter for international concern? Is not the United States, to the extent of our gold surplus, a *trustee* for that surplus for the other powers of the world? Do we expect the other nations of the world to redeem ultimately their obligations to us in gold? Do they expect to do so? If so, the problem is certainly an international one. It is then the solemn duty of this country not only to its own people, from whom it has borrowed $24,000,000,000, but also to the other nations of the world, which owe us $11,000,000,000, to put into motion all the machinery at its command to enable the gold mining industry of this country to produce its normal output of the yellow metal.

It is not good business for the United States to permit its production of gold to dwindle, when eventually every ounce of the world's possible supply will be required by our debtor nations to square their gold obligations to us. Even the interest on our own national debt of $24,000,000,000 at 4½ per cent reaches the enormous sum of over $1,000,000,000 annually, and we are producing less than $50,000,000 of gold with which to sponsor its payment.

To add further confusion to an already perplexing situation, we find that in every year since 1916, when gold has

*An address delivered at the convention of American Mining Congress Sept. 24-29, 1923.

been so badly needed for the world's monetary reserve, there has been an average of more than $60,000,000 of gold used in our domestic trades and arts. In 1920 this use alone amounted to over $82,000,000. In 1919 more than $56,000,000 of United States gold coin and gold bullion was melted down and converted into jewelry—an out-and-out *commodity* use of the jealously guarded precious metal—the basis of the world's monetary system. And for a purely non-essential purpose—to provide trinkets for personal adornment!

Economists agree that the free flow of gold at a stable price is one of the concomitants of a workable gold standard. But the bitter irony of the situation lies in the fact that these jewelry manufacturers are freely buying this enormous quantity of bullion gold right over the counters of the United States Treasury for an admitted *commodity use*, but at a base price of $20.67 per oz., which is much less than it can be produced for in normal volume by the gold-mining industry of the land. Less than $50,000,000 produced from our mines, and more than $60,000,000 demanded and withdrawn from the Treasury to be made into jewelry! During the war jewelry prices soared to a high level in sympathy with other commodities. The raw material costs were certainly not responsible. Did the miners participate in this riot of abnormal profits in the jewelry trade? The deserted mining camps of the mountain regions give mute answer to this inquiry. Flooded shafts, caving tunnels, locked-up mills and plants wasting for want of use, abandoned homes, scattered forces and ruined investments—all attest to the debacle of an essential industry that helped to win the war.

As I view it, our government is in the position of defaulting upon its moral obligations to sustain the gold standard, to the extent that we either designedly or incidentally withhold from the world's stock of gold our nation's normal contribution thereto.

It is our solemn duty to do the best we can to add year by year to the world's stock of gold and thereby so far as possible allow the debtor nations to meet their obligations to us in the stipulated way. If, as a matter of "happenstance," our gold holdings are in excess of the legal ratio against our distinctive Federal Reserve note circulation, then the logic of the situation must force us to the conclusion that to the extent of that excess we are but an international trustee.

One of two things is certain—either we must bring up the world's stock of gold to a ratio that will satisfy the world's stock of promises to pay in gold, or else we must reduce the stock of promises to such an extent that the gold stock will suffice to pay them within the approved ratio. It is a question between redemption in full—or redemption in part and repudiation for the balance.

We must make it physically possible for the gold standard to operate or else change the world's monetary standard to one of chips and whetstones. We cannot stress this point too forcibly. Therefore, in the light of known conditions it is apparent that what is needed is more gold, not less. The argument, also, that we have too much gold in our country is equally unsound. If we agree with the premise that a part of the world's gold is held by us merely as trustee for the rest of the world, then until that trustee-held gold stock is returned to those countries in the orderly conduct of business transactions, they cannot re-establish a suitable monetary system, without which they will be unable to do business either with themselves or with us.

Sooner or later our debtor governments that remain even partially intact after the smoke of battle shall have cleared away must undertake a more or less drastic reorganization of their finances. Then a resumption of that good old-fashioned practice of paying their debts will be their next order of business. An accumulation of actual gold or gold credits with the United States will be a prerequisite to this procedure; otherwise the much vaunted "gold standard" will have lost its present broad significance. We as a nation cannot afford to have the gold standard go out of fashion, either at home or abroad.

THE dependable source of the major gold production of the world is from its so-called low-grade mines. The low-grade gold mines of the United States are practically out of commission because of the abnormal cost of operation, and because gold is the one thing in the world that has a fixed price—one price for either monetary or commodity use. The gold producer is unable to pass on to the ultimate consumer this enhanced cost of production, inasmuch as anyone can secure from Treasury stock all the gold bullion he demands for the standard price of $20.67 an ounce.

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The Secretary of the Treasury stated that it would be contrary to the traditions of the Treasury Department to countenance the payment of a bonus, premium or subsidy to the gold producer. This position of the Treasury Department was the body blow that defeated the previous efforts of the gold producers to obtain constructive relief from Congress. But that statement was without justification as applied to the legislation then proposed, as it was not a bonus, premium, or subsidy any more than was the Pittman Act for silver. The Pittman Act provided for payment to the miner by the government of the increased price above invoice cost received for its sale of silver as bullion. The legislation proposed for gold provided for the payment to the miner of the increased price received from the consumer of gold in jewelry.

The government could have sold its silver bullion to the British Government for invoice cost and lost to the silver miners of the United States $200,000,000. But it wisely decided not to adopt that course. The government does sell its gold to jewelers and other converters at invoice cost, and thereby is closing up the gold mines in the country. Shall it continue to do so? Nor has the lapse of time proved the correctness of the contention of that other opposing factor—the self-seeking jewelry interests—that the prevailing high mining costs would be of short duration. Mining costs are higher now than they were then. The public is already paying to the jewelry manufacturers on a cost-plus basis. The government in effect is paying to the jewelers what amounts to a real bonus or subsidy by permitting them to buy their gold over its counters for less than it costs the miners to produce it. The cost-plus basis prevails in every line of industry save that of gold mining. Gold miners are the innocent victims of a "tradition."

We agree with the Treasury Department as to the fixed monetary price, but must emphatically disagree with its view as to the commodity phase of the problem. If there is a way out of the dilemma that will both increase the integrity of the world-wide gold standard, and will strengthen that necessary institution, and that will at the same time both conserve our gold resources and afford urgently needed relief to a great national and fundamental industry—then that relief should be forthcoming.

If the government can find an equitable way to differentiate between the monetary and the commodity uses of gold, so that commodity gold will be brought under the operation of that otherwise inexorable law of supply and demand, then it becomes the duty of the government to enact such constructive legislation as will harmonize practice with precept.

If the government descends from its high pedestal as an administrator of equal justice and occupies a common stall in the marts of trade as a trafficker in factory gold, then the government as a good merchant should observe the rules of trade. It should pay such a price for its wares to the producer and exact such a price from the consumer as will enable the producer to continue to produce.

Recent Technical Publications

Reviews, Abstracts, and References

The New Books

SEVERAL new books have reached our desk lately, which we hope to review in coming issues. "The Engineering Index" for 1922, the annual volume issued by the American Society of Mechanical Engineers, gives brief descriptive references, as usual, of all the more important technical articles published during the year. "The Chemical Resistance of Engineering Materials," by Hamlin and Turner, published by The Chemical Catalog Co., will be of interest to those who are called upon to select the best material for construction where acids or alkalies or other substances having an unfavorable chemical nature are to be used.

The McGraw-Hill Book Co. contributes the first edition of "English for Engineers," by Harbarger. This looks to be more readable than some books that we have seen on the subject; it has more to do with how to use words than with what words to use. From Longmans, Green & Co. comes "An Introduction to Mining Science," one of the Longmans' Technical Handcraft Series. This is an English book by Coppock and Lodge and looks rather elementary; it seems largely devoted to mine ventilation and coal mining. In the London *Times* we note a review of a small book published by Pitman entitled "Refractories for Furnaces, Crucibles, &c.," by Dr. Searle, but we have not seen a copy. Lastly, we chronicle a new edition, the tenth, of what we believe is the most generally useful reference book that there is t all varieties of engineers—"Kent's Mechanical Engineers' Handbook," published by Wiley. Like the circus, it seems to be bigger and better than ever, with its 2,247 pages—count 'em.

We note with appreciation an increasing amount of attention being given to authoritative articles on scientific matters by the daily newspapers. Mention has already been made in these columns of the excellent review of the Phelps Dodge Corporation's activities published by the *Bisbee Daily Review*. Now comes that excellent newspaper, the *New York Evening Post*, with a long critical review of J. E. Spurr's "The Ore Magmas," in its Sept. 29 issue. It is an encouraging sign when daily newspapers give such critical attention to a work which is essentially scientific, although it is one of the underlying sciences of an essential industry. The book is an important one and makes interesting reading for any scientific man. E. H. R.

Mine Ventilation—The results of experiments on fan-pipe ventilation installations carried out underground in a Butte mine by the U. S. Bureau of Mines, co-operating with the Anaconda company, are given in a 14-page paper issued by the U. S. Bureau of Mines, Washington, D. C., as *Reports of Investigations*, Serial No. 2,509. The main work described is the determination of friction factors using galvanized iron, rubber-covered fabric, and canvas. Copies of the paper may be obtained on request.

Mining in India—"Mining Methods at Bawdwin Mine" is the title of a 40-page paper published by the A.I.M.E., 29 West 39th St., New York City. The history and early work of this lead-zinc-copper mine is briefly described, followed by an account of the present working methods, ore reserves, production, and costs.

New Patents

Concentrating Device—No. 1,460,452. July 3, 1923. H. F. Snamiska, Bremerton, Wash. A frame supporting a chute, sloping sieve, and riffled flumes with means for rocking them.

Petroleum Drilling — No. 1,460,787. July 3, 1923. J. G. Burch, Bartlesville, Okla. A well casing jar coupling comprising a pair of telescoping sleeves each adapted for connection with a casing section.

No. 1,460,788. July 3, 1923. F. J. Carman, San Francisco. In drilling oil and gas wells with the aid of a mud circulation, the patent covers the addition of a material having a flocculating effect on clay.

Cooling Flue Gases — No. 1,460,872. July 3, 1923. H. H. Utley, Florence, Colo., assignor to River Smelting & Refining Co., St. Louis, Mo. A system for cooling the gases in a reverberatory furnace flue comprising individual cylindrical shells or pipes into and out of which the cooling medium flows.

Air Separator—No 1,460,960. July 3, 1923. W. A. Gibson and C. E. Needham, Allentown, Pa., assignors to Bradley Pulverizer Co., Boston, Mass. A separator for sizing dry material, the motive power being revolving baffles in an inner chamber which provides the necessary air currents for carrying the lighter and finer material into an outer chamber. Discharges are provided for two products.

Ore Treatment—No. 461,372. July 10, 1923. W. E. Trent, Washington, D. C. assignor to Trent Process Corporation, Washington, D. C. Crushed ore is sintered and projected against a collecting surface to form a coherent mass which is then smelted, the necessary equipment being illustrated and described in the patent paper.

Ore Separator—No. 1,461,647. July 10, 1923. A. E. Bookwalter, Coeur d'Alene, Idaho. A water box containing vertically movable plungers at the sides, and a horizontally moving frame with its lower side below the water level, for separating the coarse from the fine material of an ore pulp.

The Metallurgy and Chemistry of All the Metals

Metals and Metallic Compounds. By Ulick R. Evans. In four volumes: Vol. 1, pp. 468, $7; Vol. 2, pp. 396, $6; Vol. 3, pp. 270, $4.75; Vol. 4, pp. 350, $6. Longmans, Green & Co., New York.

This work has a dual utility; it serves both as a reference and a textbook. In the last three of the four volumes the author has covered the chemistry of the common and rare metals. The first, or introductory, volume is unusually well done, especially considering that subjects are summarized upon which some authors have written entire books, such as geochemistry, general metallurgy, metallography, and electrochemistry. Professor Evans has not hesitated to incorporate the latest scientific thought in explaining chemical phenomena, which adds considerably to the freshness of the résumé. A reading of the first volume is a splendid means of renewing acquaintance with those chemical topics that have grown rusty with disuse since university days. The book is to be recommended for anyone who wishes to obtain a clear picture of modern chemical theory and practice. It is noteworthy that the author does not use a fancy nomenclature in the text. The explanatory diagrams are exceptionally well prepared, and show only essential graphical details. The reader is not burdened with an extended bibliography, as only carefully selected references are given—those most likely to prove helpful to a fuller understanding of the subject discussed.

Volume II begins the treatment of the individual metals and includes the metals of the "A" group in the Periodic Table. The scope of the treatment accorded each metal can be illustrated by the manner in which aluminum—an important one of the group—is handled. The metal itself is described as to its chemical and physical properties, laboratory preparation, its compounds, terrestrial occurrence (mineralogy), metallurgy, and the manufacture and use of the metal and its compounds in aluminum materials and in the ceramic industry. The discussion is comprehensive enough for any but highly specialized requirements. This treatment is typical of the entire work.

Volume III, after giving an explanatory chapter on the general properties of the Transition Elements, deals with the metals of the Iron Group—iron, nickel, cobalt, ruthenium, rhodium, palladium, osmium, iridium, and platinum.

Volume IV is probably the most interesting to the non-ferrous metal miner, for it contains the treatment of the remaining metals—copper, lead, zinc, tin, gold, silver, mercury, antimony, arsenic, bismuth, and others of lesser importance. In simple language the picture is given of each of these metals, that summarizes its chemistry or metallurgy from production as a raw material to its chemistry in industry. F. E. WORMSER.

MEN YOU SHOULD KNOW ABOUT

W. W. **Mein** was in Los Angeles last week.

W. H. **Wiley** has been in Tonopah on professional business.

Samuel H. Dolbear is in San Francisco en route to Los Angeles.

W. L. **Honnold** is building a home in the Beverley Hills, Los Angeles.

Harvey Mudd has returned to Los Angeles after two years' residence in London.

P. N. **Moore** has returned from Europe, where he spent the summer on a vacation.

R. E. **Dye** has been appointed mill superintendent of the Vipond mines, in the Porcupine district.

N. H. **Emmons 2d** has made St. Louis his headquarters while examining the St. Francois County lead belt.

H. B. **Bulmer**, manager of the Comstock Leasing Co., has returned to Virginia City from San Francisco.

Peter Morbeck, U. S. Senator from South Dakota, recently visited St. Louis to get data on the petroleum industry.

M. H. **Caron**, mining and metallurgical engineer from Batavia, Dutch East Indies, is revisiting the United States.

B. B. **Gottsberger**, professor of mining at Yale, recently visited the plant of the Mesabi Iron Co. at Babbitt, Minn.

James J. Denny, metallurgist of the Nipissing company, is in New York He expects to go to Bermuda for a short visit.

F. W. **Watson** was inaugurated as president of the Chemical, Metallurgical and Mining Society of South Africa on Aug. 18.

Frank M. Manson, manager of the Western Ore Purchasing Co., has returned to Reno from a trip to California points.

C. P. **McCormack** has recently formed a business association in a consulting capacity with Crowell & Murray, of Cleveland, Ohio.

James A. Barr has just left Mount Pleasant, Tenn., for a two weeks' inspection trip through the phosphate mine district of Florida.

E. D. **Burchard** is en route from Honolulu to attend the conference of district engineers of the U. S. Geological Survey in Washington.

John M. Callow, president of the General Engineering Co. of Salt Lake City, expects to be at the company's New York office for several months.

William D. Cooper, former president of the Temiskaming mine, Cobalt, is in charge of exploration work on the property of the Rouyn Gold Mines, Ltd.

Eugene McAuliffe, who is now in charge of the coal department of the Union Pacific R.R. at Omaha, was a recent visitor at St. Louis, his old home.

D. B. **Reger**, assistant geologist of the West Virginia Geological Survey, is preparing a report on Mercer, eastern Summers, and Monroe counties, in that state.

William Sloan, Minister of Mines of British Columbia, recently made a visit to the underground workings of a number of properties in the Slocan district. The halftone shows Mr. Sloan equipped for mine inspection.

Hon. William Sloan

James Bartlett, late Provincial Inspector of Mines in charge of the Sudbury district of Ontario, has resigned to become associated with the Coniagas mine, in Cobalt.

Henry Wyman, general manager of the Calumet & Sonora Mining Co., Cananea, Sonora, Mexico, has left Cananea for an extended trip through the southern part of Mexico.

L. E. **Wemple**, formerly with the American Zinc, Lead & Smelting Co., has been appointed vice-president and general manager of the Illinois Zinc Co.

H. J. **McCann**, former general manager of the Dominion Coal Co., has been temporarily appointed to act as general manager of the British Empire steel plant of Sydney, N. S., until a permanent appointment can be made.

Dr. F. B. Laney, of the U. S. Geological Survey, has spent the summer in the Seven Devils district of Idaho and will soon publish a résumé of his investigations. He reports the district is worthy of most earnest consideration.

Professor Westgate and **J. L. Gilleen**, of the U. S. Geological Survey, have completed their work for this season at Pioche, Nev. The surface geology of the district has been studied this year and the underground work will be continued during 1924.

Dr. John L. Tilton, of the West Virginia Geological Survey, is conducting a geological study of formations above the Devonian, in Hampshire County, W. Va., assisted by **Paul Price**. The adjoining county of Harvey will be covered by **Dr. F. W. Prouty**.

Dr. F. W. McNair, president of the Michigan College of Mines, at Houghton, attended the meeting of the American Mining Congress, which met in Milwaukee, on Sept. 24-29, to deliver an address on "Engineering Education." **F. W. Sperr**, professor of mining at Houghton, was also present.

Sidney Paige, with the geological parties under his direction that have been surveying Naval Petroleum Reserve No. 4, on the Arctic Coast of Alaska, have returned to Nome. **James Gilluly** and **E. W. Berry** are on the way to San Francisco. The other members of the expedition are awaiting transportation to the States.

Richard W. Smith, assistant geologist, Tennessee Division of Geology, was engaged this summer in field work on the preparation of a detailed bulletin on the phosphate deposits of Tennessee. He was assisted by **Dr. R. S. Bassler**, of the U. S. National Museum, in investigating the geology and stratigraphy of the Mount Pleasant district.

Prof. H. E. T. Haultain, of the University of Toronto, has returned from an extended visit to Porcupine, where he has been making further motion-picture studies of tube milling and crushing with rolls. On his way to Toronto, Professor Haultain exhibited his films before the local branch of the Canadian Institute of Mining and Metallurgy in Cobalt.

Newton Cleveland, of the Yuba Manufacturing Co.; **Augustus Locke**, geologist; **Lindsay Duncan**, metallurgist; **Arthur W. Jenks**, metallurgist; **O. C. Ralston**, of the U. S. Bureau of Mines; **Walter S. Weeks**, of the University of California; **A. S. Eakle**, of the University of California, and **Walter M. Briggs**, mine operator, lost their homes in the recent fire at Berkeley, Calif.

OBITUARY

William Chalmers Agnew died at his home in Duluth, Minn., on Sept. 22. Mr. Agnew was one of the pioneers of the Mesabi iron range, arriving there in 1893 to develop the Mahoning mine and remaining as general manager of this mine for the Mahoning Ore & Steel Co. until recently, when he resigned, but still retained his position as general manager of the Buffalo mine at Hibbing, Minn., operated by the Rogers-Brown Iron Mining Co. Mr. Agnew wrote several pamphlets of the early days of mining on the Mesabi range and of the iron ore industry. He was seventy-four years old, and is survived by his wife and three sons.

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.

Summary of the Week

THE Butte & Superior Mining Co., at Butte, and the Callahan Lead-Zinc Co., in the Coeur d'Alene of Idaho, have both suspended production temporarily. Butte & Superior will retain 100 men to repair the shafts, and Callahan will continue development.

The Federal Mining & Smelting Co. will spend $500,000 developing its newly acquired Dome Mountain property in British Columbia.

Colorado mine operators are unable to suggest legislative methods for helping gold and silver mining.

The Consolidated Gold Fields of South Africa is progressing with development at Virginia City. A further payment is due about Nov. 1.

The Hollinger Consolidated has won its appeal in the damage suit for failure to deliver electric power. More than $1,500,000 is involved.

The War Minerals Relief Commission faces the possibility of exhausting its appropriation before large claims still pending are settled.

Production is started by the Seneca mining company in the Michigan copper country.

The "Journal-Press" correspondent who has just returned from London gives a further account of his experience with the British silver brokers.

The British Columbia government has announced that 2,000 Crown-granted mineral claims in the province are open for relocation.

Two new milling plants are nearing completion in the Oatman district of Arizona.

A widely experienced railroad man has been named as the operating head of the government's railway in Alaska.

Consolidated Gold Fields of S. A. Busy at Virginia City, Nev.

Developments "Encouraging" — Payment on Middle Mines Group, Due Nov. 1, May Be Made

The Comstock Merger, acting for the Consolidated Gold Fields of South Africa, continues active development work on the Middle Mines group on the Comstock Lode near Virginia City, in Nevada. It is at the present time sinking seven winzes, with the expectation of crosscutting the lode at a depth of over 500 ft. The lode is pretty well developed above the 465 level of the Chollar & Potosi on the south end and above the Hale & Norcross tunnel on the north end. Developments to date are generally regarded as encouraging and if they continue so to deeper levels it appears likely that payments due around Nov. 1 will be met.

Extensive development work is being done on the property of the Nevada Canyon Mines Co., situated six miles east of Virginia City, by the same company which is developing the Middle Mines group. Results are said to be satisfactory. The property is opened by tunnels, and development to date is only to a depth of 170 ft., with over 250,000 tons of ore already blocked out. Some work is being done on near-by properties, and this portion of the "outside" Comstock district is attracting serious attention.

Nova Scotian Gypsum Mine, Reopened, Employs 800 Men

After a lapse of eight years, gypsum mining at Eastern Harbor, Cape Breton, on the property formerly owned by the Great Northern Mining Co., has been resumed by the International Gypsum Corporation. The company employs 800 men in mining and auxilliary operations when producing gypsum at average normal capacity. The first cargo will go directly to Boston, whence the raw material will be distributed to various manufacturing plants.

Standard Chemical Co. Resumes Milling of Carnotite Ore

THE Standard Chemical Co., which, for many years, until the slump in the price of radium last year, was the largest operator in the carnotite fields of southwestern Colorado and eastern Utah, has again resumed operations at its large milling plant at Naturita. The company is now treating about 100 tons daily of what was formerly considered waste product or dump material, chiefly for its vanadium content. It is stated that there is enough low-grade ore to keep the mill in operation during the coming winter.

Declare Domestic Graphite Superior to Ceylon Product

Experiments Show That First-grade Steel-melting Crucibles Can Be Made With American Materials

As the result of experiments conducted by the U. S. Bureau of Mines, it is indicated that American graphites, bonded with American clays, can be used in substitution for foreign graphites in the manufacture of crucibles for the melting of steel. This is the principal use of graphite crucibles.

In the past, American crucible makers have given preference to graphite imported from Ceylon and Madagascar, the Ceylon graphite having been preferred, when available. In the recent experiments, graphites from Alabama, Texas, Montana, New York, and Canada were tested in comparison with graphites from Ceylon and Madagascar. When all factors were taken into consideration, the Texas and Alabama graphites gave superior service to those from foreign lands. The analysis of the steel after the first melts showed that the Texas and Alabama graphites carbonized the steel less than did the graphites from Ceylon. This low-carbonizing feature is important because it permits the production of a steel of more nearly the desired analysis. Serial 2,512, a preliminary report of the tests, may be obtained from the Bureau at Washington.

Cannot Legislate Prosperity Into Colorado Mining Industry

Operators Tell Troubles to Senate Gold-Silver Commission—Rising Costs Big Factor

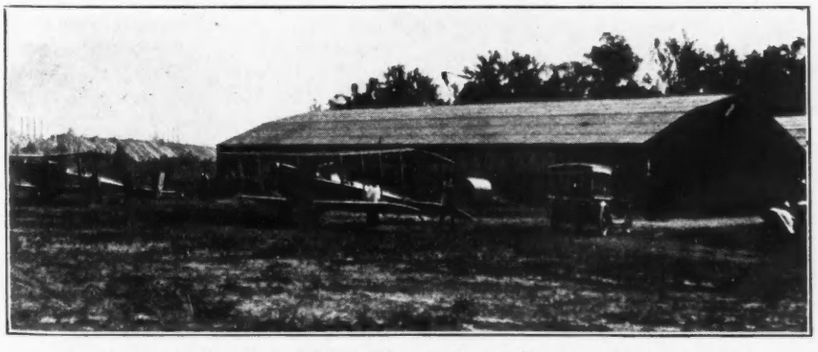
Hearings before the U. S. Senate Gold and Silver Inquiry Commission, conducted in Denver, Cripple Creek, Leadville, and Ouray, Colo., disclosed a general belief that Congress could do little at this time to improve conditions affecting the mining industry, and that the principal and outstanding obstacle to increased activity, or cause for depression, was high operating costs. This was exemplified by a comparative statement filed by operators from Clear Creek County, showing the cost of supplies, labor, and hauling in 1913 and 1923 as affecting mining operations in that district.

The statement showed that the price for powder had increased from $13.16 to $18.50 per ton; caps from 83c. to $1.75 per box; fuse from $26.50 to $43.50 per case; carbide from $5.13 to $8.25 per hundred pounds; rails from $3.15 to $5.50 per hundred pounds; blacksmiths' coal from $1 to $2 per hundred pounds; timbers from 1 to 2c. per foot; lagging from 2 to 4c. per foot; common labor from $3.25 to $4.25; skilled labor from $3.50 to $4.75; hauling from an average of 31⅛c. per ton to 57½c.

To these increases, which it was claimed amounted to at least a 50 per cent general increase in operating costs, was added increased smelting and freight rates, with the result that ores in the northern counties must contain, to be profitably mined, at least double the values required in earlier days. The situation in the territory tributary to Denver was unfavorably affected still further by the closing down of the Denver and Pueblo smelting plants, necessitating a much longer railroad haul to Leadville.

The testimony developed that Colorado railroads, particularly the Denver & Rio Grande, were maintaining a sympathetic attitude toward the metal-mining industry, and that readjusted rates from war-time schedules in most instances had been almost, if not quite, as low as pre-war figures; that burdensome increases in freight rates were due in practically every instance to a longer haul caused by the closing down of near-by smelters.

Testimony at Denver indicated that the increase in smelting rates was about in the same proportion to the increased cost of mine operation, and that the A. S. & R. Co. was spending large sums of money to improve its plants at Leadville and Durango.



Airplane and landing field at Birmingham, showing the plane used in rescue trials

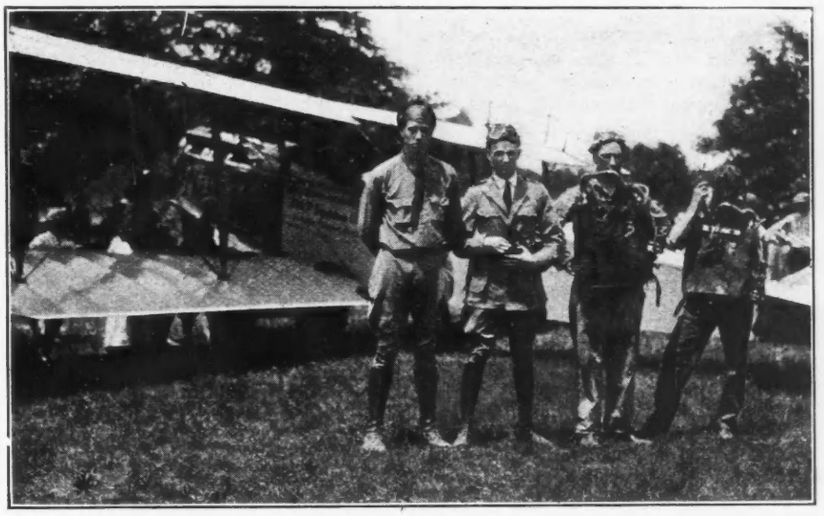
Canadian Mining Registry Established in England

The Canadian Mining Registry and Exchange has been established in England with a view of facilitating the investment of British capital in Canadian mining enterprises, under the presidency of T. J. Dallman, who is associated with the Financial Press Association, Ltd. of London, whose offices are at 13 Victoria St. London, S. W. A. It is proposed to conduct an active educational campaign in the interests of Canadian mining, publishing price lists of Canadian stocks and information as to mining activities. Much interest has been evidenced in London in mining shares based on both Ontario and British Columbia mines, and it is believed that a valuable service can be rendered in this connection.

Airplanes Save Time in Transporting Mine Rescue Apparatus

Aviators Carry Equipment and Helmet Men 60 Miles in 46 Minutes in Alabama

The use of airplanes for speeding up the work of rescue in mine disasters is a recent project of the U. S. Bureau of Mines, in connection with its safety work. The accompanying illustrations indicate the type of machine contemplated and show aviators and government enineers ready for flight.



Pilots and rescuers on trial airplane flight from Birmingham to Pine Hill, Ala.

The plane shown in the picture is one of two used in transporting five sets of rescue apparatus from Birmingham to Pine Hill, Ala., a distance of 60 miles. The trip took forty-six minutes. To have made the journey between the two points on a special train with clear right of way would have consumed three hours, as a minimum. A motor truck using the roundabout public roads would have required four hours. The load carried by the two airplanes included 200 lb. of rescue apparatus, two pilots, and two engineers. The pilots were from the Alabama National Guard, which co-operated in the work.

As a result of the successful tests, landing fields have been established at Carbon Hill and other coal-mining centers within flying range of the Birmingham mine rescue station.

The Bureau of Mines operates ten railway cars and seven motor trucks equipped for mine rescue, but much time is frequently lost in the journeys of this equipment to remote mining camps. The speed and mobility of the airplane, and its independence of railway schedules, are valuable factors in the use of this form of conveyance for saving time in cases of emergency. Time is frequently the most vital element in effecting rescues. If prompt action is taken, much can be done that would be unavailing after delay. The best plan would be to have every mine equipped with apparatus, but this is impracticable

Hollinger Wins Appeal in Power-Shortage Suit Involving $1,800,000

Besides Damage, Claims Contract Now Invalid—Two 20,000 Hp. Projects Are Under Way

Another chapter has been written in the tangled power situation in northern Ontario by the decision of the Appellate Court in allowing the Hollinger company's claim for damages against the Northern Canada Power Co. The Hollinger sued the Power company for $1,800,000 for loss sustained in 1921 as a consequence of shortage of power, but the action was dismissed by the trial judge. The Hollinger appealed, and the Appellate Court has given a decision in favor of the Hollinger. This does not mean that the the Hollinger is entitled to $1,800,000 damages, as the question of damages would have to be decided by a referee. Before this is done, however, the case will be taken farther, and it has been decided to jump the Supreme Court of Canada and appeal direct to the Privy Council. If the Privy Council upholds the decision of the appeal court, the Hollinger presumably will ask for further large damages for loss sustained during the power shortages of 1922-23, and this amount would, it is believed, be much larger than the original amount claimed for the 1921 shortage.

Serious as this case might appear to be, it is believed that the really vital question, as far as the Power company is concerned, is whether or not the Hollinger has to take its full quota of power from the Northern Canada Power Co. The Power company has sued the Hollinger, asking that this point be determined. To the laymen it would appear that if the Hollinger can obtain damages through the failure to supply power, thus recognizing a contract, it would presumably be held to be good. The Hollinger, however, not only claims damages, but also, in the suit which the Power company is bringing for enforcement of contract, holds that the contract has been broken, and has obtained rights from the government to develop power on the Abitibi River, where it has let contracts for the development of 20,000 hp. The Power company, on the other hand, is developing 20,000 hp. on the Quinze River, and this development has a total capacity of 60,000 hp., so that even without the Hollinger development, there will be a large surplus of power for the mining districts.

The Power company is paying the Quebec Government the highest rental that has ever been paid before for similar power in Canada, and in addition is spending several million dollars in development. If it were determined that the Hollinger does not have to abide by its contract with the Power company, that conclusion would be a serious blow to the latter. A decision in this case is expected soon, but no doubt will, in any event, be appealed.

Callahan Zinc-Lead Company Suspends Production

THE Callahan Zinc Lead Co., operating in the Coeur d'Alene district in Idaho, has suspended production for an indefinite period. High costs of operating and "low" market prices for lead and zinc are assigned as the reasons for being unable to continue. An attempt was made recently to purchase the Success mine in the hope of bolstering up operations of the present property. This fell through, however. Output was resumed on Nov. 1, 1922, after a shutdown of about two years. Development will continue.

Another complication has arisen through the fact that the Hollinger has prepared plans and ordered equipment on the basis of a 60-ft. head, and this would wipe out the Sault rapids, which would enfringe the rights of the Abitibi Paper Co. It is understood that the Hollinger's plans have not yet been approved by the government.

Federal Will Spend $500,000 on Dome Mountain Property

Shaft Planned—Concentrator Will Be Needed Ultimately—Gold and Arsenic in Ore

The Federal Mining & Smelting Co. is so satisfied with the result of its explorations at the Jefferson group, on Dome Mountain, 23 miles east of Telkwa, on the Grand Trunk Pacific Ry., in British Columbia, that it has paid a substantial deposit on the property and has undertaken to spend $500,000 in further development. This work will consist of sinking a shaft to at least 300 and possibly 500 ft., and driving levels in both directions at each 100 ft. The compressor is now in place and development work will proceed much more rapidly. Accommodation at the camp is being increased, as more men will be employed as the levels are started. An assay office has been erected. About ten miles of trail had to be broken to the property, and the first work next spring will be to convert this into a good wagon road.

Harry Tees, who is in charge of the work, states that a method for concentrating the ore has been determined, but work on the concentrator will not be started until late next year or possibly the spring after next, the first aim of the company being to determine the extent of the orebody. The group consists of thirty claims, and, besides the main vein on which exploration now is being concentrated, it contains about twenty-five veins.

In places the main lode is 70 ft. wide. The main value is in gold, which appears generally to be associated with arsenopyrite. The concentrate from the ore should have a considerable arsenic content.

Conference Sees No Relief for Mason Valley Smelter in Nevada

California Copper Concentrate Will Continue to Go to Utah—Nevadans Would Like to Help

At a recent meeting between railroad officials of the Southern Pacific and Western Pacific railroads and Governor Scrugham of Nevada and representatives of the Reno Chamber of Commerce at Carson, Nev., the railroad officials informed the Nevadans that no feasible plan had been devised for an agreement on ore rates between points in Plumas County, Calif., and Wabuska, Nev. At present the Walker and Engels mines are shipping their concentrates to Garfield and Tooele, Utah.

Some time ago the freight rates from Plumas County to Wabuska were considerably reduced by the Interstate Commerce Commission. The Western Pacific Railroad then established an open-car rate that was materially less than the closed-car rate. As a consequence the Thompson smelter, which had sought favorable rates so as to divert the Plumas County concentrates to its plant near Wabuska, Nev., was unable to secure the new business. Improvements contingent upon this business were postponed. Nevadans are anxious to have the Thompson smelter resume operations as a local outlet for ores which would in the opinion of many increase mining activity.

The Engels mine ships about 25,000 tons of concentrates per year, and the Walker mine, when the present additions to its mill are completed, will ship about 14,000 tons per annum. At present Engels has a contract with Garfield that has several years to run, and the Walker mine is a subsidiary of Anaconda and its concentrates are handled by the International at Tooele, another subsidiary. Three railroads would participate in the handling of the concentrates to Wabuska, Nev., the Indian Valley, the Western Pacific, and the Southern Pacific. On $50 concentrates the present rate in effect is $4.42 per ton to Wabuska. Of this rate the Indian Valley receives about one-half for its 21-mile haul and the other two roads divide the balance for a 162-mile haul. The latter two railroads state that they could not handle the business for the money if the Indian Valley road retained its present share of the joint rate. As the business of the Indian Valley railroad is relatively small, and principally has to do with Engels mine, of which it is a subsidiary, it is not likely that it will surrender any of its share of the rate in question. Distances favor the Thompson smelter, but existing business arrangements are such that it apparently cannot hope for a readjustment until the existing contract between Garfield and Engels terminates. The present situation is regrettable, and it is to be hoped that the Thompson smelter will find some feasible way of resuming its custom business.

Butte & Superior Suspends Operations for Indefinite Period

ON SEPT. 25 the Butte & Superior Mining Co. shut down its mine and mill at Butte, laying off approximately 700 men. The duration of the period of shutdown is not stated. About 100 men will be retained to repair Nos. 1 and 2 shafts, which have been a source of considerable trouble during recent months. Swelling ground has cracked many of the timbers, and a thorough overhauling is necessary. Zinc production has dwindled during recent months, and it is stated that the development of copper ore in the lower levels has not come up to expectations.

Chance To Get Mining Claims in British Columbia

Crown Grants, Once Forfeited, Now Open for Lease—More Than 2,000 in All Parts of Province

A list of British Columbia Crown granted mineral claims which have reverted to the Crown since 1919 for nonpayment of taxes and now are subject to lease under Section 180 of the Taxation Act has been issued. There are more than 2,000 such properties and they are to be found in every district of mining importance from Vancouver Island to the extremities of East Kootenay.

In the Kootenays, especially in the Slocan district and in the Boundary section, there are many of these dormant Crown-granted claims. For the reason that they have been to some extent developed and then abandoned, they have been shunned by the prospector. In the last few years there has been a marked change in the attitude of the prospector and the small operator. A considerable number of the old Crown grants have been taken under lease, given a further test, and there are many properties where the results have been surprisingly gratifying.

For the benefit of the mining man who may be looking for such an opportunity as is offered by these idle "prospects" it may be explained that the law sets out that:

"When a Crown-granted mineral claim has been absolutely forfeited to and vested in the Crown under the provisions of this act, it shall be lawful for the Gold Commissioner for the mining division in which the claim is situated to grant a lease thereof to any person for the term of one year upon payment of the sum of $25 and upon payment of a further sum of $25 to grant a renewal of the lease for a further term of one year, commencing on the expiration of the former lease, but for no longer period."

At the end of the two-year period, if the lessee's work has had good results, he may proceed to obtain a Crown grant in his own name.

New Freight Rates Will Aid Zinc Mining at Guerrero

Following a conference with miners from the State of Guerrero, Mexico, Ernesto Llano, director general of the National Lines of Mexico, has put into effect a special tariff on zinc ores and concentrates. It was demonstrated at the conference that it had been impossible to market zinc ores produced in the mines of Guerrero, but that reduced freight rates to ports of embarkation might make it profitable to ship some of the material.

For the purpose of establishing the new rates the station of Naranjo is taken as a basis as the most distant point from which ore will be shipped. The rate to Tampico is 12½ pesos per metric ton. For the benefit of mines which do not own concentrating plants, a rate of 11.79 pesos is made on ore hauled from Naranjo to Saltillo, Coahuila, where there is a custom plant for the concentration of zinc ore.

Two Mills at Oatman, Ariz., Near Completion

The erection of the new 50-ton mill at the Telluride mine, Oatman, Ariz., is progressing rapidly, and it is expected that it will be in operation before the end of the year. In addition to the company's output, the mill will treat ore from the Shank & Neilson property and it is likely that other custom ore will be handled. The Telluride is reported to have a large tonnage of low-grade ore that could not be mined profitably heretofore, but with the new mill on the property and the elimination of marketing and treatment charges, it is believed profits can be earned.

Another new 50-ton mill is also nearing completion in the Oatman district. The Gold Dust Mining Co. is expecting to start the operation of its new plant soon. Recent developments at this property were accompanied by the opening of ore that warranted the construction of the concentrator.

News from Washington

By PAUL WOOTON
Special Correspondent

"We Run With the Economic Tide," Say London Silver Brokers

Do Not Speculate—Have Almost Humble Quarters—Ridicule an American Silver Export Association—Possibility That a Representative of Producers Might Attend Meeting

Note—Mr. Wooton has just returned from England and France, where he covered several assignments for the "Journal-Press."—EDITOR.

ONE IMPORTANT FACT that can be brought forward on behalf of the four firms of bullion brokers in London, who give the world its daily silver quotation, is that they do not speculate on their own account. Enough transactions, both buying and selling, pass through their hands, they declare, to enable them to determine with accuracy the price reflected by the volume of buying orders on the one hand and the selling orders on the other. They declare that all they do is to hold the scale steadily. Their practice is said to be simply that of any commodity exchanged. However, there is, at least, the important difference that their operations are behind closed doors rather than on the open floor of an exchange.

The four firms which make up this so-called silver exchange are: Samuel Montagu & Co.; Mocatta & Goldsmid; Sharps & Wilkins, and Pixley & Abell. Only partners in the firms may sit in the price-fixing conference. The Montagu company usually is represented by Benjamin White, and Pixley & Abell by H. L. Baggallay. The partners in Mocatta & Goldsmid are E. L. de M. Mocatta, O. E. Mocatta and John R. Villiers. The partners forming Sharps & Wilkins are P. A. Wilkins, H. Beer, and L. Balfour.

The price-fixing conference convenes each weekday at 1.45 p.m., with the exception of Saturday, when the meeting is at 11.30 a.m. Usually only a few moments are required. Each member of the conference attends with the orders that have come to his firm, and from those figures a balance is struck. These orders from buyers and from sellers constitute a fair representation of the world's market, the brokers say. They claim they are powerless to take any action contrary to the economic forces which govern price.

Around transactions involving such large amounts as pass through the hands of these four brokers, one would expect to find some evidence of opulence. Quite the contrary is true. Mr. White, for instance, has his desk in a dark room below the sidewalk level. He shares it with his clerks and they work with artificial light all day. Janitors in an American office building would demand better accommodations and better furniture. Yet Mr. White has been with the powerful house of Montagu for more than forty years. He is the author of "Silver, Its History and Its Romance," and other widely read books on matters pertaining to silver and economics. The entrance to the office of Pixley & Abell is off an alley.

British bullion brokers do not believe

the producers of silver will be able to conduct an export association with success. They would have pitted against them, among others, the Indian bazaars and the Chinese traders, where are found the most astute judges of the silver market. The Hindus and the Chinese are just as ready to sell as they are to buy and seem to possess an uncanny ability to sense the silver market. To enhance the price, large stocks would have to be held by the association, the brokers believe, which might mean being left "to carry the baby," as one broker put it, "and a very heavy baby at that."

The brokers seem to be entirely unconcerned as to what action the producers take, or at least their attitude creates that impression. They simply will continue to hold the scales, they declare.

My investigations in London have convinced me that a new effort should be made to establish in New York an exchange which would be in a position to develop silver prices of its own. The benefits which flow from commodity exchanges generally cause even the British to wonder why we do not make use of that facility in our trading in metals and in coal. Pending any such development, it would seem desirable for the silver producers to arrange representation at the price-fixing meeting. In taking that matter up with the London brokers, I have reason to believe it would be diplomatic for the producers to point out that their agent would represent more than the silver producers of the United States. If it can be arranged, it should be proposed that he sit as the authorized agent of silver producers in various countries of this hemisphere. There is a feeling in England that Americans are a little too forward in asserting the increased strength of their financial and commercial position, and in consequence there might be sentimental opposition to the seating of a representative who would be acting for a group of American producers. Since Canadian, Mexican, Central and South American producers are just as much interested as are Americans, they probably would welcome such an opportunity.

If the brokers are in good faith in their assurance to me that producer representation can be arranged, they should be spared the embarrassment which might ensue were they to include in their price-fixing conference one authorized to speak for producers in the United States only.

New Jersey Zinc Gets Old Award

In a report to the Interstate Commerce Commission, its examiner recommends the payment of $12,096.46, with interest since 1918, to the New Jersey Zinc Co., covering unreasonable freight rates charged and collected on the movement of forty-one carload shipments of zinc ore from Laredo, Tex., to Collinsville, Okla., in the year mentioned.

The claims previously had been denied by the Director General of Railroads.

War Minerals Commissioner May Face Problem

Only $2,000,000 in Fund—Many Large Claims Still Pending—Favorable Decision Would Embarrass Commission —Suspension of Payments Suggested

WHILE the War Minerals Relief Commissioner still has available about $2,000,000 for the payment of claims and the expenses of administering the act, it is apparent that he is faced with a difficult situation as the end of the $8,500,000 appropriation nears. The balance doubtless would be adequate to meet such awards as he would recommend on the 400 claims which are yet to pass through the mill under the amended act. There are various contingencies, however, which might arise, that would result in increasing the demand on the fund. A court in the District of Columbia already has expressed the opinion that the purchase price of property is payable under the act. Former Senator Hoke Smith, representing the Chestatee Pyrites & Chemical Co., apparently is establishing a convincing case that interest on money borrowed for the operation of war-minerals properties constitutes an allowable item. The Anaconda company is making a good case in the support of its $550,000 claim. It is not at all improbable that it may establish that the conversion of manganese into ferromanganese is entirely comparable, legally, to the concentration of other minerals. Should the commissioner suddenly find himself in the position where some finding of the foregoing character would require large additional payments, it can be seen that the appropriation available would be inadequate.

In addition to the Anaconda claim, sight must not be lost of the fact that there are other large claims which are still unsettled and which are being pushed actively. A few of them are: Pacific Tungsten Co., $345,000; Western Chemical Manufacturing Co., $609,000; Pine Creek Tungsten Co., $296,000; Mineral Ridge Mining Co., $134,000; Manganese Associates, $220,000; Black Hawk Tungsten Co., $108,000. Claims are decided on their merits, and it is entirely possible that the commissioner may find himself in a position where he will have to approve large awards.

Though Commissioner Briar declines to speculate on what may happen, it is known that the suggestion has been made to him that no further payments be made until findings have been made in all cases. If it should be found that the awards exceed the appropriation, the balance could be prorated among the claimants. The law is specific in stating that the losses in excess of $8,500,000 may not be paid.

Bureau Engineers Seek Companies Interested in Zinc-lead Metallurgy

Possibility of Removing Small Amounts of Lead from Zinc Concentrate by Volatilization

In connection with experimental work on modifications of the chloride volatilization process, done by the Intermountain experiment station of the U. S. Bureau of Mines, it is announced that in several cases chlorides are left out of the ore mixture entirely and oxides are volatilized. Mixed zinc-lead ores may be so altered by roasting that the volatile lead oxide can be removed from the ore by further raising the temperature, using a rotary kiln for this latter step of the work. Lead can be almost completely cleaned and even some of the silver removed from roasted zinc concentrate containing the usual small amounts of lead. This has already been shown by tests on a semi-commercial scale at Harbor City, Calif. It is believed that not only can this method be used with possible profit by the zinc smelters, but that it is entitled to favorable consideration as a means of concentrating ore. This work is about ready for larger commercial tests and the Bureau is now desirous of getting in touch with organizations which would be benefited by the use of this modified process with a view to arranging co-operative work. Thomas Varley directs the station at Salt Lake City.

Alaskan Railroad Will Have Experienced Operator at Head

L. H. Landis, With Twenty Years of Railroading Behind Him, Becomes General Manager

Lee H. Landis, of San Francisco, has been appointed general manager of the Alaska Railroad, effective on Oct. 1. The appointment of Mr. Landis is a result of the decision of the Secretary of the Interior, now that actual construction of the road has been completed, to place an active and experienced railroad man in charge of its operation.

Mr. Landis has been in the transportation business for thirty years. He has served as station agent and train dispatcher on the Philadelphia & Reading; towerman on the Chicago, Burlington & Quincy; general agent of operating and traffic departments on the Santa Fe; general operating agent on the Southern Pacific; general manager of the Phoenix & Buckeye Railroad; general manager of the Ocean Shore Railroad; assistant to president of the Tidewater Southern Railway; president and general manager of the San Jose (Calif.) Terminal Railway; and general manager of the Fresno Interurban Railway.

At the outbreak of the war Mr. Landis became a major in the Engineering Corps and served for two years in Europe in various capacities as Chief

Transportation Officer of military districts of the American Expeditionary Forces. Since the close of the war he has been Industrial Commissioner of the Western Pacific Railroad System, with headquarters at San Francisco. He is now a lieutenant colonel in the Engineers Reserve Corps of the Army. He is endorsed by officials of a large number of roads. Mr. Landis has left for Anchorage, Alaska. In a short statement he outlined his future policy as follows:

"In taking over the management of the Alaska Railroad I want to assure all employees both in the traffic and operating departments that I do not contemplate any changes in the personnel of the road. My purpose is to operate the road efficiently and economically in the same manner as private transportation lines are run in this country, and I hope to have the aid and assistance of all the present workers on the Alaska Railroad in accomplishing this end."

News from Mining Districts

By Special Correspondents in the Field

London Letter

The "Empire" Seems To Have a Few Silver Mines of Its Own—Rhodesia Copper Prospects

BY W. A. DOMAN

London, Sept. 20—The proposal made in America to "control" the output and marketing of silver gives a pecular interest to a couple of important silver-lead discoveries reported within the last few days. One is in Chillagoe, Queensland, and is said to rival the Broken Hill field, and the other is in Burma. The former is stated to be very rich, but the difficulty in working it lies in the distance from a railway. If, however, further investigation should prove its value to be anything like suggested, this shortcoming may be remedied. The Burma discovery is in the Shan States at the end of the Southern Shan States line at a place called Heho. According to an agency message, the deposit is likely to prove one of the largest mines in the world. Should this be correct Burma will be one of the great producers of silver and lead

As regards the latter metal, the Weardale Lead Co. (England) announces that it has arranged for a lease of the Allendale lead mines, in Northumberland. These mines have in the past, it is stated, produced important quantities of lead ore, and there is said to be considerable promise in certain workings which will be more fully developed, though nothing special is expected under eighteen months.

A rumor is circulating that the Central Mining & Investment Corporation is angling after the mining rights of Rhodesia. No definite information can be obtained, but a figure of £4,000,000 has been mentioned. The Sherwood Starr gold mine, in Rhodesia, controlled by Abe Bailey, has given such satisfactory results that prospecting in the vicinity has been stimulated, and it is stated that another and equally important discovery has been made. Many more of such finds would probably induce the British South Africa Co. to bargain on a higher figure. Now that this company has more time to devote to the mineral development of the country, it is rumored that some of the present directors are to resign and to be replaced by others with pronounced views on mining and trading.

From a conversation I have had with a former head of one of the South African finance houses I gathered that London is looking to Rhodesia as one of the future most important sources of supply of the world's copper. According to him, it is to surpass even the United States. I remarked that the Union Minière is already producing between 40,000 and 50,000 tons of copper per annum. He replied that Bwana M'Kubwa is expected to outdo even the Union Minière. His views are based upon the Perkins process of recovery, which if it confirms its inventor's claims will enable vast quantities of low-grade ore to be profitably treated. Mr. Perkins is now in Rhodesia superintending the erection of a ten-ton experimental plant which should be making returns before the close of the year. He is so confident of success that he proposed the installation of a large capacity plant at the outset. The Minerals Separation people are not without experience and prefer to proceed on ordinary prudent lines. Nevertheless, if the copper is there, means ultimately will be found for treating the ore and putting the metal on the market.

QUEENSLAND

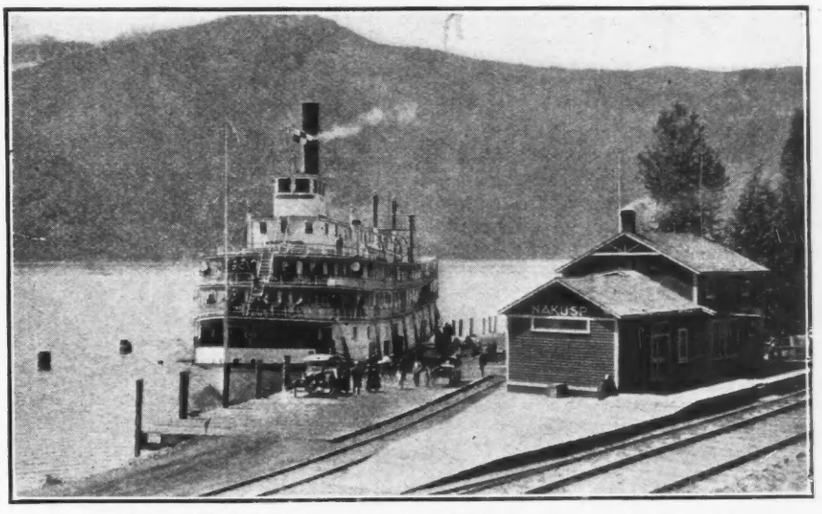
Cobalt Deposit Looks Big

Developments at the cobalt mine, in the Cloncurry district, north Queensland, have been such that it is considered by the chief government geologist to be the most important deposit of this metal in the world. Some very good specimens from the mine were shown at the annual Brisbane Exhibition, just held. They include stone from the surface outcrop, with its distinctive pink "bloom," and a large piece of the rich ore from the lowest depth reached in the mine workings, now nearly 200 ft. from the surface. During July, in a level 50 ft. down, a fine body of high-grade ore was cut. This oreshoot has been driven on for a distance of 60 ft., and the face is still looking well. The output of concentrates averages in the neighborhood of 100 tons per day.

BRITISH COLUMBIA

Premier Tunnel 700 Ft. Long

The new tunnel at the Premier mine is being pushed forward rapidly, and now is in nearly 700 ft. This tunnel, which will develop the main orebody at 500 ft. below the present bottom level, is being driven of a size to allow for double tracks and will form the main working tunnel at the mine. The new boarding house for the men and the apartment house for the staff has been completed, and the tennis courts, which have been cut out of a steep hillside, also are finished. Steady streams of crude ore continue to be sent to Anyox and Tacoma, and the mill is being crowded to more than 50 per cent above the capacity for which it was designed. Minor C. Keith, one of the principal shareholders, and H. C. Price, his consulting engineer, recently paid a visit to the mine. Mr. Price also examined the Fish Creek mine and the Georgia River property, on Portland Canal, where free-milling ore recently was discovered.



Prospectors in British Columbia travel by boat as well as by rail as indicated in this typical scene

United Comstock Opens Rich New Shoots, Is Report

IT IS said unofficially that a new orebody is being developed in its Crown Point mine by the United Comstock Mines Co., operating at Virginia City, Nev. The discovery was made in the footwall section of the lode in a southwest crosscut on the 200 level of the Yellow Jacket. It is said that the orebody has been drifted on for 120 ft., is 27 ft. wide and will average $25 per ton. No information is available regarding the grade of ore now being treated at the United Comstock mill, where daily tonnage handled averages 1,700 tons. The company is preparing comfortable steam-heated winter quarters for its men, one building under construction being large enough to accommodate 300 men.

Granby Bonds Claims

The Granby company has bonded several claims adjoining the Outsider mine, at Maple Bay, which it acquired recently, and it has purchased a compressor from the owners of the Dolly Varden mine and moved it to the Outsider.

Vein on Sunrise Group

A. N. McDonald and P. McBride, who have been exploring the Sunrise group, at Salmon glacier, report that they have traced an 18-in. vein for 400 ft. by a series of open cuts, and that the assays from it run from $70 to $180 in silver, gold and lead.

Esperanza Has Silver Ore

A 10-ft. vein of milling ore has been cut in the tunnel above the Baldy tunnel at the Esperanza mine, near Alice Arm. There is a 10-in. stringer of high-grade ruby silver ore on the footwall. As the gangue of the ore is almost all quartz, it is thought that a specially favorable smelting rate may be obtained, in which case it may be profitable to ship the whole of the vein matter.

Cork Province Ships Sixth Car of Concentrate

The Cork Province, at Zwickey, B. C., is milling ore; the plant makes six to eight tons of high-grade lead concentrates per shift as well as five tons of zinc concentrate. The ore from the mine carries from 15 to 22 per cent lead and 10 to 12 per cent zinc. Six carloads of concentrate has been shipped to the Trail smelter.

Gold Ore at Rossland

The O K mine, joining the I X L mine, at Rossland, is the scene of a new gold strike. High-grade ore 14 in. wide has been uncovered in an upper tunnel. The district has recently been the scene of a gold strike in the I X L also. Development work has been outlined by the management of both properties for future operations.

ONTARIO

McIntyre Mine Best Below 3,000 Ft.

At the annual meeting of the McIntyre it was stated that since the report had been printed, No. 9 vein had been cut on the 2,375 level, where it showed $18 ore over a width of 9 ft. This is the deepest level being worked in the Porcupine camp. Crosscuts are now being driven to intercept the same orebody on the 2,000 and 2,200 levels. Diamond drilling has also been done on the No. 3 vein on the Jupiter lot, intercepting the vein at a depth of 1,925 ft., where it showed $20 over a width of 20 ft. No. 10 vein had also been cut by a diamond drill at 2,375 ft., where it showed 8 ft. of $10 ore. Probably the most important statement made in the meeting was to the effect that values had been consistently improving with depth, and that the biggest production of the mine was expected to occur below the 3,000 level. The present equipment would not permit of efficient operations below 3,000 ft., and the time was in sight when a new shaft and plant capable of deep mining must be installed.

Vipond Will Start Mill Dec. 1

An official report on the Vipond property states that several new veins have been discovered, of which the most important is No. 10, on which a shoot of good ore has been developed from the surface to the 600 level. On July 15 ore reserves were estimated at 211,000 tons of $6.62 ore, having a gross value of $1,396,000. Of this, 75,000 tons was $9 ore, having a gross value of $675,000. Since that date there has been developed 100,000 tons of $10 ore, which is sufficient to keep the mill supplied for a period of two years. The mill is expected to start operations by the first of December, and will have a capacity of 150 tons a day. The company has between $160,000 and $170,000 cash on hand, which will be more than sufficient to put the property on a producing basis and provide a working capital.

IDAHO

Elk City Center of Activity

The American Eagle mine, at Elk City, is operating its stamp mill and turning out gold bullion in greater quantity than even before. Many other properties of the district are showing signs of activity. The Center Star, on the South fork of the Clearwater River, has been bonded for $100,000 by Frank Lee, of Boise, and R. Walker, of Salt Lake City. The French mine, on Hornet Creek, has cut 4 ft. of gold ore on the 150 level.

Golden Scepter Resumes

The Golden Scepter mine, near Port Hill, has resumed development work and will drive a new tunnel 400 ft. below the site of the present lower tunnel to explore an oreshoot encountered in the upper level. Should the downward extension prove satisfactory, a large block of ore will have been proved.

Gold Vein at Tide Lake, B. C., 1,000 Ft. Wide, 'Tis Said

W JANCOWSKI recently took to Stewart, B. C., samples of pyrite which assayed $8 in gold per ton, and some highly mineralized quartz, which ran up to $200 per ton. The ore came from a property that Mr. Jancowski and his partners are working at Tide Lake. He says that the vein is almost 1,000 ft. wide and is clearly visible up the side of the mountain for 3,000 ft. It is said to be almost solid pyrite, with here and there stringers of quartz. The property is situated on Tide Lake, which, despite its name, unfortunately is a long distance from tidewater, and it is likely to be some years before it will become a shipper. In the mean time Mr. Jancowski is doing assessment work.

ARIZONA

Wenden Mine Reopened

A recent strike of high-grade ore has been reported at the Wenden Copper mine, at Wenden. The ore is over 3 ft. wide, and samples of the vein have been found to contain 40 per cent copper, $10 gold, and some silver. The mine is owned by the Wenden Copper Co., a corporation that was financed largely by residents of the Globe-Miami district. The mine was operated during 1917 for some time, but was only recently reopened after long idleness.

Arizona-Binghampton Ships Concentrate Steadily

A recent cave-in that occurred in a main drift and for a while threatened to be serious, resulted in the discovery of a rich body of ore at the Arizona-Binghampton mine, at Stoddard. The Arizona-Binghampton company was recently granted a reduction of freight rates on concentrate shipped from Stoddard to the smelter of Hayden.

Soda Deposits Will Be Worked

It is reported that the Western Chemical Co. will start the operation of its lease on the sulphate of soda deposits, near Camp Verde. It is expected that an output of 300 tons per day will be attained by Jan. 1. A washing plant is to be erected, some of the machinery having already arrived. The deposits occur on state-owned lands, and are operated under a lease. Much of the material produced will be marketed through San Pedro to foreign customers.

Flux Opens Shipping Ore

The Flux Mining Co., operating at Patagonia, Ariz., has opened up a body of lead sulphide ore of shipping grade. The new find is in a winze below the company's lowest tunnel level. Shipping will begin in the immediate future, according to E. Bollonger, manager.

MONTANA

Butte & Western Makes Mill Test

The Butte & Western Mining Co. has shipped two cars of ore to the Timber Butte mill for a large-scale test. The ore assays 8.7 oz. silver, $3 gold, 12.3 zinc and 9.4 lead. The oreshoot has been opened for 200 ft., the vein averaging more than 2 ft. in width.

Shaft Will Be Deepened

The Butte & Burlington Mining Co. has taken over the Montana, Black Warrior, and Tiger claims, all situated in the western section of the Butte district. The shaft on the Montana claim, now 160 ft. deep, will be sunk to the 300 level before crosscutting is started.

WASHINGTON

Gladstone Mountain Develops New Orebody

The Gladstone mine, near Northport, reports the finding of a new chimney of ore. It is probably the largest found on the property, and was cut on the 150 level. The mine is a constant shipper of crude high-grade carbonate lead ore. The orebodies make at the intersection of fissures in a limestone formation. The property joins the Electric Point mine.

Federal Will Prospect Gold Hill

Reports from Marcus are to the effect that the Federal Mining & Smelting Co. has taken over and started operations on Gold Hill, a section which has lain idle for almost thirty-five years. Early operations uncovered some rich gold ore in the veins, and indications lately uncovered are promising enough to warrant considerable exploration.

NEVADA

Missing Link Opened on 500 Level

The shaft of the Red Hills Florence Mining Co., in the Gold Circle district, has reached the 500-ft. point, and a station is now being cut preparatory to crosscutting to the Missing Link vein, an estimated distance of less than 50 ft. The future of the mine depends on the showing on this level, and if the vein and values are as good on the 500 level as on the 270 level, present ore reserves, of estimated value $800,000, will be more than doubled. That orebodies persist to at least 1,000 ft. depth in this district has already been indicated in the near-by Elko Prince mine.

Standard Metals May Be Reworked

Eastern creditors of the Standard Metals mine, in Peavine Canyon, about six miles north from Reno, purchased the property of this company at the receivers' sale on Sept. 20. The purchase price was $183,500. Claims of outside creditors amount to only $12,625, which amount must be paid within thirty days. It is reported that purchasing creditors will organize a new operating company and proceed with development work in the near future.

Too Much Copper Money in China; Mints Suspend

COPPER coins in circulation in China now number about forty billions, according to the U. S. Department of Commerce. With the fall in copper prices and with the wholesale minting of these coins in China, including some light-weight coins, the value of the copper cent has continued to fall so that it now exchanges for about 190 to $1 silver. It has reached a level where it is no longer profitable for the mints to continue coining the copper cent pieces, and hence many have discontinued.

This situation has had a serious effect upon the economic life of the people for the reason that the copper is the coin of the masses, and its depreciation affects their purchasing power seriously. This is particularly true in the factories and modern industrial plants, where wages have been placed upon definite schedules. Among the farming population prices more easily adjust themselves so as to cover any depreciation of currency.

JOPLIN-MIAMI DISTRICT

New Shaft Contract Let

The Huttig L. & Z. Co. recently let a contract for a new shaft on the northeast corner of its No. 2 lease, where drilling has indicated a good orebody. It is at present working dirt from the No. 1 lease in its No. 2 mill, and so is getting enough dirt for capacity operation at this concentrator. A pump is being installed at two drill holes recently put down on the west forty-acre lease of the company, where drilling indicated another ore run. It will be unwatered and worked.

In order to take care of the additional output, it may be necessary to resume operations at the No. 1 mill.

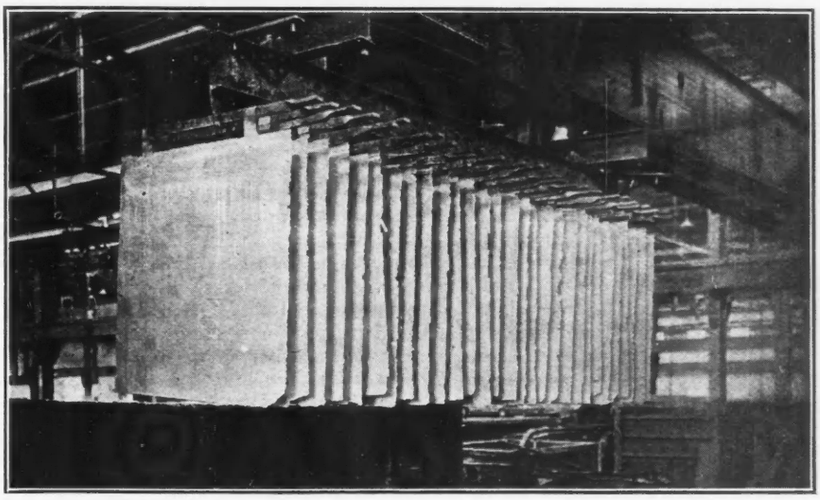
MICHIGAN

Seneca Has Started Milling

Seneca, in the Michigan copper district, already has sent considerable copper rock to the Ahmeek mill, and regular stamping was scheduled to begin soon after Oct. 1, when daily rock shipments were to be started. The initial shipments will come from Seneca shaft, and within five weeks Gratiot No. 2 shaft will begin production. Seneca will have the use of two stamp heads in the Ahmeek mill. Production will be brought up as speedily as possible to 600 tons per day from each shaft. No. 2 shaft, in which sinking is under way, has reached the 17th level. The shaft has 850 ft. to go to reach its destination of 3,200 ft., where it will connect with the 3d level drift north from Seneca shaft. Raising and sinking will then hasten the shaft work. The connection not only will afford ventilation but will make available a large amount of stoping ground. Seneca is employing 305 men.

Champion Mine Doing Well

Copper Range is producing in excess of 2,000,000 lb. of refined copper per month. The greater part of this output is from the Champion, the richest and lowest-cost producer of the three mines in the Copper Range group. Better than 2,000 tons of copper rock daily from Champion and Baltic are going to the Champion mill. New openings in Champion show no diminution in high values, and there is a steady improvement in Trimountain, where development work is under way. Not much drifting is being done in Baltic at present, this mine being well opened ahead at present rate of production. No mining is in progress at Trimountain, but rock from new drifts—a comparatively small tonnage—is being forwarded to the mill. The Trimountain force of men, for the most part, was transferred to Champion, where an extensive opening program is being followed.



Copper cathodes drawn from depositing tanks. Plant of the U. S. Metals Refining Co. at Chrome, N. J.

Situation at the Mines

By Arthur B. Parsons
Assistant Editor

COPPER MINE OPERATORS for the most part are marking time; production is neither increasing or decreasing. To mix the metaphor, they are waiting for something to turn up—a very definite something in this case—to wit, the trend of the market for the metal, which during September declined from 13½ to 13c. per lb. Anaconda, in furtherance of its policy of rigid economy, has suspended operations at three of its nine active mines at Butte. More energetic work at the remaining properties will permit the production of almost as much metal as during recent months (17,000,000 lb.) with a marked saving in operating costs. On the other hand, Anaconda's subsidiary in California, the Walker Mining Co., is increasing the capacity of its mill to 600 tons of copper ore per day and other California properties are contributing to swell the aggregate output. In Michigan, the Seneca Copper Co. has just started production, using part of the Ahmeek mill. Generally speaking, however, the situation has changed little during the past month. The "low-cost" properties are close to capacity production and those less fortunately situated are holding on rather than let their operating forces disintegrate. Many companies make no pretense of being able to make ends meet at the current market. Obviously, this cannot last indefinitely. If the price does not improve, shutdowns seem inevitable.

Anaconda Wants Coeur d'Alene Zinc Concentrate

The feature of the situation in zinc mining is the shutting down of Butte & Superior, in Montana, and Callahan Zinc-Lead, in Idaho. The latter produces lead as well as zinc, but has not been able to operate profitably. The suspension at these two properties has made it necessary for Anaconda to find more zinc for its Great Falls plant. She has turned to the Coeur d'Alene district, in Idaho, where a contract has been closed for the shipment of accumulated stocks as well as the current output from the Success mine. The Federal zinc concentrate also will go to Great Falls. Joplin-Miami output of zinc concentrate has picked up to around 12,000 tons weekly, in spite of a curtailed schedule of operation whereby mills are run only about twenty shifts per month. The starting of a number of new plants and more intensive operation of the others during running periods account for the increase. Operators naïvely explain that the curtailment is not designed to increase the price, which has remained around 6⅜c. during the last month, but "to prevent the creation of a surplus stock of ore which it is felt is a continual menace to prices."

Lead mining, with the market rising slowly during September from 6¾c. to 6⅞c., is in excellent condition. The mines in the "disseminated lead" belt in southeast Missouri are operating at maximum capacity. The new shaft of the National Lead Co., on the Pim tract, near Elvins, has been placed in operation. Incidentally, engineers said to represent Henry Ford are optioning lead-bearing lands in the district. Every flivver built requires about 50 lb. of lead, and the acquisition of an independent source of raw material is in line with the Ford policy. He uses around 50,000 tons of lead per year. Western lead mines are active, though production of lead-silver ores in Utah has declined somewhat, apparently as a belated echo of the letdown that followed the drop in the price of silver in June.

Silver producers from nine states and Mexico attended the conference held at Reno, Nev., under the auspices of the Senate Gold-Silver Commission in September and laid the foundation for the formation of a Silver Export Association. Representatives of the commission are holding hearings in various camps in an effort to see what ails the silver- and gold-mining industry. Colorado producers agree that the causes are economic, that the high cost of operating is the big trouble, and that they can prescribe no legislative medicine that is likely to cure.

The labor situation is noticeably better than it was a month ago. Except for the iron-mining districts around Lake Superior, Arizona, Colorado, and perhaps California, it is doubtful whether output would be increased even if more men were available at current wage scales. The release of 500 men by Anaconda and 700 by Butte & Superior has changed the complexion of the situation at Butte decidedly. The International Nickel Co., operating at Sudbury, Ont., has raised miners' wages from $4.25 to $4.75 with the idea of attracting a better class of miners rather than because there is any definite shortage. A compensatory increase is expected from the gold camps of Porcupine and Kirkland, which have always paid a little more than Sudbury, but this has not been announced as yet.

California gold and silver production remains steady; copper operations are expanding. In Nevada some improvement is reported in the outlook for United Comstock. The Consolidated Gold Fields of South Africa is actively developing its Comstock properties.

The entrance of Anaconda in the zinc market of the Coeur d'Alene has stimulated interest in the Pine Creek section. The Montana corporation will buy up to 5,000 tons of concentrate per month. Tamarack & Custer will increase the capacity of its concentrator to 300 tons per day. Shipments to Utah lead smelters from miscellaneous sources have decreased during the month, and some falling off is noted in the output of the larger regular shippers. September saw the initial shipment by the Columbia Steel Co. of ore from the extensive iron deposits in the southern part of the state. This marks the birth of the steel industry based on the natural resources of the West: the iron ore and coal both come from Utah.

Leadville, in Colorado, is looking forward to a distinct revival as soon as regular operations are started in two new mills, each of which is successfully concentrating one type of unmerchantable ore. Arizona copper producers are maintaining the status quo so far as production is concerned. Operations that cannot be conducted at a profit are of course in a critical situation. Among the concentrators to be started recently in the Joplin-Miami district are the Acme Lead & Zinc, the Empire Development, and the Anna Beaver.

Some Michigan Properties Work at Capacity

Output of copper in Michigan is around 11,500,000 lb. per month. Although there are only 4,200 men working in Houghton County, one-third of normal, it is not likely that output would be increased greatly if more were available. The C. & H. reclamation plant, Ahmeek, and Champion, sources of low-cost copper, are being worked at maximum capacity. The Calumet & Hecla merger became an accomplished fact during September.

Production in Ontario gold camps is limited by mill capacity. However, the Lake Shore, Wright-Hargreaves, McIntyre, and Hollinger plants are all being enlarged, and the Tough-Oakes and Vipond mills are expected to resume soon. More miners will be needed to meet these requirements. A significant event is the opening of rich ore at many points in the Noranda property, in the Rouyn gold area in northwestern Quebec.

In British Columbia, capacity copper output is the program for Granby, at Anyox, and Britannia, on Howe Sound. Construction of the new 1,500-ton concentrator at Anyox should be completed by the end of the year. Production at Copper Mountain presumably will await a better copper market, although repairs to the plant at Allenby are practically finished. The Federal M. & S. Co. is actively developing the Dome Mountain and Duthie mines.

A strike involving 4,000 employees in the A. S. & R. mines and mills at Chihuahua went into effect late in September. To date we have not heard of a settlement.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
27	13.25	40.75	41.25	6.875	6.65	6.30@6.35
28	13.125@13.25	41.00	41.50	6.875	6.65	6.30
29	13.125	41.00	41.50	6.875	6.65	6.30
Oct. 1	13.00	41.625	42.125	6.875	6.65@6.70	6.30
2	13.00	41.375	41.875	6.875	6.65@6.70	6.30
3	12.875@13.00	41.375	41.875	6.875	6.65@6.70	6.30
Av.	13.083	41.188	41.688	6.875	6.663	6.304

*These prices correspond to the following quotations for copper delivered: Sept. 27th, 13.50c.; 28th, 13.375@13.50c.; 29th, 13.375c.; Oct. 1st and 2d, 13.25c.; 3d, 13.125@13.25c.

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. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
27	62¾	63¼	67	198½	198½	26½	25⅝	33¼	32½
28	62⅛	62½	66¾	199	198¾	26½	25½	33	32⅜
Oct. 1	62⅛	62¾	66¾	202¾	202	26⅜	25⅞	32⅞	32⅜
2	61⅝	62¼	66	202	201⅜	26½	25¾	33	32⅜
3	61⅜	61⅞	65¾	200⅞	200	26⅜	25¾	32¾	32⅛

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

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
27	4.55⅛	64¾	31⅞	90s 6d	1	4.53¾	64½	32 1/16	90s 8d
28	4.54⅞	64	31⅝	90s 7d	2	4.53¾	64½	32¼	90s 9d
29	4.54¼	64⅜	31 15/16	.....	3	4.54	64⅛	31 15/16	90s 7d

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

Average Metal Prices for September

Copper:	
New York Electrolytic	13.323
London Standard	63.194
London Electrolytic	68.275
Lead:	
New York	6.856
St. Louis	6.700
London	25.688
Silver:	
New York, foreign	64.203
London	31.698
Sterling Exchange	453.901
Zinc:	
St. Louis	6.438
London	33.469
Tin:	
99 per cent	41.047
Straits	41.547
London	198.263
Antimony	7.633
Quicksilver	63.000
Platinum	116.000

Metal Markets

New York, Oct. 3, 1923

The metal markets have been quiet during the last week, but prices have been well maintained except in the case of copper, which has again declined to close to 13c., delivered, as a result of an almost total absence of inquiry.

Copper

The stronger tendency in the copper market which we reported last week proved short lived. Orders were placed at 13.50c. delivered last Thursday, but owing to the small amount of both domestic and foreign business this price was thereafter shaded by some sellers. In the last few days some sellers have held at from 13⅜ to 13.50c., but these quotations are admittedly nominal and business has been confined to carload lots or for points where the freight rate is above normal. Today 13.25c. could be done in several directions; 13⅛c. in one or two; and consumers have been given to understand that on a large order they could get the metal for 13.05 or 13.10c. It is likely that some attractive business could be obtained at 13c., but sellers have not been willing to meet this price.

The foreign market has also been quiet, with European business particularly poor.

Copper is obtainable into 1924 at the same prices as are asked for near-by deliveries.

Lead

The official contract price of the American Smelting & Refining Co. continues at 6.85c., New York.

Conditions in the New York market are unchanged from last week. A fair volume of business has been done at 6.85c. for November shipments. Occasional carloads of lead for prompt delivery have sold for 7c. In St. Louis some good orders were placed at 6.65c. on Thursday and Friday, but in the last three days there has been less disposition to sell at this price. In Chicago, the ruling price seems to be about 6.725c.

Zinc

Business has been in fair volume, mostly for October shipment. Prices are substantially the same for November and December, but inquiry for forward delivery has been light. Most of the business has been at 6.30c., though a couple of second-hand lots were disposed of at 6.20c., and 6.35c. has been obtained for carloads. Brass special has sold at 6.40c., and high-grade at from 8 to 8.50c., delivered. Prices in New York are, as usual, 35c. per 100 lb. above the St. Louis market.

Tin

Tin for October delivery is very scarce and forward deliveries are now obtainable at a discount of about one-quarter cent. The market has been quiet and no immediate price changes of consequence are expected.

Arrivals in September were 4,015 long tons, of which 2,615 was Straits; 930 English; 260 Chinese; 200 Banka and Billiton; and 10 Australian. Deliveries were 4,450. Stock, Sept. 30, 1,262, and landing, 1,100.

Treasury Circulation Statement

Stock of money in the United States Sept. 1: Gold coin and bullion, $4,109,052,543; standard silver dollars, $495,464,404; subsidiary silver, $269,510,124; United States notes, $346,681,016; Federal Reserve notes, $2,698,808,330; Federal Reserve Bank notes, $18,946,000; National Bank notes, $768,944,812; total, $8,707,407,229. In circulation, per capita, $42.85.

Foreign Exchange

Cable quotations for francs on Oct. 2 were 5.99c., and for lire, 4.5125c. Canadian dollars, 1⅛ per cent discount.

Silver

The demand in the New York market for local and San Francisco deliveries has fallen off considerably during the last week. In London the trading has been fairly active, but the market is a mixed one, with China and India alternately buying and selling. It would appear, however, that Indian bazaar bears have been forced to cover on a squeeze, and this condition is reflected in the London quotations on Oct. 2 of 32¼d. spot and 31⅞d. forward.

Mexican Dollars—Sept. 27th, 49⅜; 28th, 48¾; 29th, 49⅛; Oct. 1st, 49¼; 2d, 49¼; 3d, 48⅞.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 26@27c. per lb.; 98 per cent, 25@26c. London, 98 per cent, £115 per long ton.

Antimony — Chinese and Japanese brands, 7⅝@7¾c. W. C. C., 8¼c. Cookson's "C" grade, spot, 10¼@10½c. Chinese needle antimony, lump, nominal, 5.50c. per lb. Standard powdered needle antimony (200 mesh), 6@6.50c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 7.50c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—80@90c. per lb. London, 3s. 6d.

Cobalt—$3 per lb. for spot. Discounts on contracts. Oxide, $2.10@$2.25. London, 12s. for metal; 9s. for black oxide.

Iridium—$275@$300 per oz.

Magnesium—Sticks, 1¼ in., 99.9 per cent, $1.25 per lb. London quotes 3s. for 99 per cent.

[1]Molybdenum—99 per cent, $12 per lb.

Monel Metal—32c. per lb.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £125@£135.

Osmium—$107 per troy oz. in New York.

Palladium—$80 per oz. London, £17 nominal.

Platinum—$116 per oz. London, £25 for manufactured; sponge, £23.

Quicksilver—$62 per 75-lb. flask. San Francisco wires $61. London £8 10s.

Radium—$70 per mg. radium content.

Rhodium—$100@$105 per oz.

Selenium — Black powdered, amorphous, 99.5 per cent pure, $2.10 per lb.

Tellurium—$2 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $8 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, 97c.@$1 per lb. contained tungsten.

Metallic Ores

Chrome Ore—Indian chrome ore, $19.50 per ton, c.i.f. Atlantic ports. Rhodesian, $21.50 and New Caledonian, $24.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore, f.o.b. Port Henry, **N. Y.: Old bed 21 furnace, $5 per long ton; old bed concentrates, 63 per cent, $5.25; Harmony, cobbed, 63 per cent, $5.25; new bed low phosphorus, 65 per cent, $7.50.**

Manganese Ore — 39@42c. per long ton unit, seaport, plus duty; chemical ore, plus 82 per cent MnO_2, $75@$80 per gross ton, powdered.

Molybdenum Ore—75c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates.

[1]Titanium Ores—Ilmenite, 52 per cent TiO_2, ½@1c. per lb. for ore. Rutile, 94 per cent TiO_2, 10c. per lb. for car lots.

Tungsten Ore—High-grade wolframite, $8.75@$9; high-grade scheelite, $9.50@$10 per unit. Ordinary grades, $8.25@$8.50.

[1]Vanadium Ore—75c.@$1 per lb. of V_2O_5.

Zircon—$50 per ton.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 1.—No report received up to time of going to press.

Platteville, Wis., Sept. 29.—Blende, basis 60 per cent zinc, $40 per ton. Lead, basis 80 per cent lead, $82 per ton. Shipments for the week: Blende, 365 tons; lead, none. Shipments for the year: Blende, 23,065; lead, 560 tons. Shipments for the week to separating plants, 1,098 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $350@$500; No. 2, $250@$300; spinning fibers, $125@$150; magnesia and compressed sheet fibers, $75@$110; shingle stock, $50@$65; paper stock, $30@$40; cement stock, $17@$20; floats, $8@$12 — all per short ton, f.o.b. mines, Quebec.

No. 1 Rhodesian crude, $325; No. 2, $200 per short ton, c.i.f. New York.

Keen competition for business. Most activity in shorter fibers. Prices are very low.

Barytes — Crude, $7@$10 per ton; market active. Unbleached and bleached ground, $28@$30 per ton, f.o.b. St. Louis. Ground white, $15@$18; off-color, $12@$14, f.o.b. Baltimore.

Conditions improving. Lithopone manufacturers generally busy. Market for crude more active than for milled material.

Bauxite—American, crushed and dried, $5.50@$8.75 per gross ton; pulverized and dried, $12@$14 per gross ton; calcined, crushed, $20@$24 per gross ton, all f.o.b. shipping points.

Foreign red bauxite, French, 5 per cent SiO_2, $5@$6; Dalmatian, 2 per cent SiO_2, $6@$6.50 per metric ton, according to grade; foreign white grades, low iron content, $7.50@$8.50, c.i.f. Market fairly active. Consumers showing interest in 1924 contracts.

Beryl—4½c. per lb. f.o.b. Connecticut points.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 5¼c. per lb.; in bbls., 5½c. Boric acid, 10½c.

Chalk—English, extra light, 5c. Domestic light, 4½@4¾c.; heavy, 3½@3¾c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude No. 1, $7; No. 2, $6; washed, $8@$9; powdered, $13@$20, f.o.b. Virginia points. Imported lump, $15@$20, f.o.b. American ports; powdered, $45@$50, f.o.b. New York. 1A grade, refined, $15@$16 per ton, Delaware.

Diatomaceous Earth—Natural aggregate, $25 per ton; insulating powder, $45; filtration powder, $35; calcined aggregate, $45, f.o.b. plant, California. Market steady.

Emery—Greek Naxos, 8c.; Turkish, 7c.; Khasia, 6c. per lb., f.o.b. factory. American, 4@5c., f.o.b. shipping points, packed in 350 lb. kegs.

Feldspar—In Maine, No. 1 pottery grade, $19 per ton; market good. Grade 97 per cent pure offered at $10, f.o.b. quarry, water shipment.

In Connecticut, No. 1 spar, $7 per ton; No. 2, $6.50. Pulverized, from $18@$20 for 160 to 180 mesh to $25 for 200 mesh.

In New York, No. 1 crude, $8 per ton. Market strong.

In North Carolina, No. 1 ground, 140 mesh, $15@$16 per ton. No. 2 ground, 90 to 100 mesh, $10 per ton. No. 1 (less than 10 per cent flint) $6.50@$7; No. 2 (about 25 per cent flint) $5@$6, f.o.b. railroad sidings. Market strong.

No. 1 Canadian ground, $20 per net ton; f.o.b. mill. Market good.

In New Hampshire, ground, $16@$19 per ton. Market fair. Producers fear overproduction.

Fluorspar—95 per cent CaF_2, 3 per cent SiO_2, $20 per net ton, c.i.f. New York in bond.

Washed gravel, 85 per cent and over calcium fluoride, 5 per cent and under silica, $23.50 per ton; 85 per cent CaF_2 and not over 6 per cent silica, $23; 80 per cent CaF_2 and not over 5 per cent silica, $22.

Ground spar in package for glass and enameling trade, highest grade, $49; lower grade, $39 per ton.

No. 2 lump, 85 per cent CaF_2 and not over 5 per cent silica, $24 per ton.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

All above prices except where noted, f.o.b. Middle Western mines. Market quiet.

Fuller's Earth—16 to 60 mesh, $18 per ton; 16 to 30 mesh, $17; 30 to 60 mesh, $18; 60 to 100 mesh, $14.50; 100 mesh and finer, $7.50; f.o.b. Florida mines. Market fair.

Garnet—Spanish grades $60 per short ton, f.o.b. port of entry. Domestic Adirondack grades, $85 per ton f.o.b. shipping points. Others, $75@$85.

Graphite—Ceylon lump, first quality, 6@6½c. per lb.; chip, 5@5½c.; dust 4@4½c.

Gypsum—Crushed rock, $3@$4.50 per ton. Ground, $3.50@$8.50, f.o.b. shipping points.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ½ in. and larger, $1.10 @$1.75 per net ton. Agricultural limestone, pulverized, $2.50@$4.50 per net ton, f.o.b. eastern shipping points.

Magnesite—Crude magnesite, $14 per ton; calcined $35@$37, f.o.b. shipping point in California. Market very good.

Dead-burned magnesite in sacks, $40 @$42, Chester, Pa.; in bulk, $32@$34, Chewelah, Wash.

Caustic calcined, Grecian, $50@$51, c.i.f. New York.

Manjak—Barbados, in 1 to 5 ton lots, grade "C" lump, $330 per short ton; "C" fine, $250; grade "A," $185—all c.i.f. New York.

Mica—Domestic, No. 1 quality, 1½x2 in., 10c. per lb.; 2x2 in., 35c.; 2x3 in., 70c.; 3x3 in., $1.20; 3x4 in., $1.75; 3x5 in., $2.25; 4x6 in., $3.25; scrap, $25 per ton, North Carolina.

Scrap, $22 per ton; washer and disk, $8@$15 per ton, f.o.b. N. H. mill. Market good.

[1]**Monazite—Minimum 6 per cent ThO_2, 6@8c. per lb.**

Phosphate — 77 to 76 per cent tricalcium phosphate, hard rock, $7.50 per ton, f.o.b. Jacksonville; 77 to 76 per cent pebble grades, $6.75; 75 to 74 per cent pebble, $5.50; 70 per cent pebble, $4.25; 66 to 68 per cent pebble, $3.75, f.o.b. Tampa.

In Tennessee, 65 per cent ground rock, $5.50@$6.50 per ton; 72 per cent washed, unground, $5.50@$6 per long ton; 75 per cent lump, free of fines, $6.50; 78 per cent, lump, $8@$8.50 per long ton. Market quiet.

Freight to Hamburg, Rotterdam, Bremen, $3; Scandinavia and Baltic ports, $3.50@$3.75 per ton.

Pumice Stone—Imported lump, 3@ 40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Imported lump, 1 in. diameter and up, 11½c. per long ton unit; furnace size, 2½ in. diameter, 12c. per long ton unit; fines, through ½-in. mesh, 11½c. per long ton unit; cinder property of buyer, ex ship, Atlantic ports. Ore contains 50@51 per cent sulphur; cinder about 63 per cent iron.

Market limited for new contracts owing to the competition of sulphur producers in the United States.

Silica—500 mesh, $31; 350 mesh, $25; 200 mesh, $20; 100 mesh, $8; all f.o.b. Illinois plant, water ground and floated for paints and polishes.

Glass sand, $2@$2.50 per ton; brick sand, $2@$2.25; moulding sand, $2@ $2.25; building sand, $2@$2.25; motor sand, $2@$2.25.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Ground talc, 150 to 200 mesh, $6@$8 per ton, bags extra, Vermont.

Roofing grades, $5@$7.50 per ton; paper grades, $9@$17; Vermont.

Through 20 to 50 mesh, $7@$9 per ton; 100 to 200 mesh, $8@$16; steel workers' crayons, $1.25@$2.25 per gross, Vermont mills.

White talc, $25 per ton; gray-white, $8; yellow, $9; red, $12; North Carolina.

Grade A, 350 mesh, $22; grade B, 300 mesh, $18; grade C, $12 per ton, f.o.b. New York. Double air-floated talc, 325 mesh, $14.75 per ton.

Vermont producers report strong competition; market firm with various grades in good demand.

Tripoli—Once ground, rose and cream colored, $16@$25; white, $18@$27; double ground, r. and c., $17@$25; w., $19@$30; air-float, r. and c., $25@$30; w., $35; super air-float, r. and c., $35@ $40; w., $40@$45. All per short ton in 200-lb. burlap bags with paper liners, minimum car, 30 tons, f.o.b. Missouri.

Mineral Products

Arsenious Oxide (white arsenic)—11c. per lb. delivered over balance of year.

Copper Sulphate — 4.90@5c. with freight allowed, for domestic material.

Sodium Nitrate—$2.45 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate—Basis 90 per cent, $43.67 per ton.

Sodium Sulphate—$26@$28 per ton, New York.

Ferro-Alloys

[1]**Ferrocerium—$7 per lb.**

Ferrochrome—1 to 2 per cent carbon, 28@30c. per lb.; 4 to 6 per cent carbon, 12c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $110 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $45, f.o.b. furnace; 16@19 per cent, $44.

Ferromolybdenum—$2 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 12 per cent, $43 @$50 per gross ton, f.o.b. works; 50 per cent, $85 delivered.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten—89@91c. per lb. of contained W, f.o.b. works. Quiet.

[1]**Ferro-uranium—35 to 40 per cent U, $4.50 per lb. of U contained,** f.o.b. works.

Ferrovanadium—$3.50@$4.50 per lb. of V contained, f.o.b. works. Active.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

Metal Products

Rolled Copper—Sheets, 21¾c.; wire, 16c.

Lead Sheets—Full lead sheets, 10.25c. per lb.; cut lead sheets, 10.50c. in quantity, mill lots.

Nickel Silver—28c. per lb. for 18 per cent nickel Grade "A" sheets.

Yellow Metal — Dimension sheets, 19c. per lb.; rods, 16c. per lb.

Zinc Sheets—9.25c. per lb., f.o.b. works.

Refractories

Bauxite Brick—$140@$145 per M., Pittsburgh, Pa.

Chrome Brick—$50@$52 per net ton, f.o.b. shipping point.

Firebrick—First quality, $45@$48 per M., Ohio and Kentucky works; $45 @$48, Central Pennsylvania; second quality, $38@$42.

Magnesite Brick — 9-in. straights, $65@$68 per net ton, f.o.b. works.

Magnesite Cement—$47@$50 per net ton, f.o.b. Chester, Pa.

Silica Brick—$45@$47 per M., Pennsylvania; $53@$55 Alabama.

Zirkite—Powdered, 80 per cent ZrO_2, 5c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 75@95c. each.

The Iron Trade

Pittsburgh, Oct. 2, 1923

The volume of finished steel buying has decreased farther, practically all lines being almost stagnant. Industrial activity continues at a high stage, as shown by employment and transportation figures, and actual consumption of steel is nearly if not quite as heavy as at any time previously, but there is an indisposition to make commitments.

This week the sentimental tone of the steel market is reported better, probably because the light buying has not resulted in a break in prices. There are slight irregularities in the east in bars, shapes, and plates. Black sheets have been shaded by a few mills for two months and now there is a little shading in galvanized sheets. The major portion of the sales are at full prices in both cases.

Steel production has decreased about 5 per cent in the last month, following a decrease of about 15 per cent in the four months preceding. Additional curtailment is in prospect, but there is a fair backlog of substantial business on mill books for the winter.

Pig Iron—Over half the merchant furnaces in this territory are out, and additional stacks are going out, after accumulating a stock. A sale of 1,000 tons of Valley basic at $24, furnace, establishes the market at $1 decline, while foundry iron on sales to the Standard Sanitary Manufacturing Co. for October is off 50c. to $24.50, Valley, and bessemer has declined $1, to $25.50, in sympathy.

Connellsville Coke.—There is no demand, and asking prices have declined; Heating coke, $3.50@$3.75; furnace coke, $4@$4.25; foundry coke, $5.25@ $5.75.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1922	1923	1922	1923	1922	1923
January	65.450	65.668	35.035	31.928	421.750	465.053
February	65.290	64.313	33.891	30.875	435.511	468.631
March	64.440	67.556	33.269	32.310	436.912	469.269
April	66.575	66.855	34.080	32.346	440.715	465.220
May	71.154	67.043	36.023	32.611	444.106	462.252
June	71.149	64.861	35.900	31.611	444.615	461.132
July	70.245	63.015	35.644	30.942	444.165	458.025
August	69.417	62.793	34.957	30.952	446.069	455.714
September	69.515	64.203	35.305	31.698	442.800	453.901
October	68.015	.....	34.498	.....	443.583	.....
November	65.177	.....	32.882	.....	447.484	.....
December	63.905	.....	31.383	.....	460.440	.....
Year	67.528		34.406		442.346	

New York quotations cents per ounce troy, 999 fine, foreign silver. London pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1922	1923	1922	1923	1922	1923
January	13.465	14.510	65.226	64.494	72.321	71.409
February	12.864	15.355	60.250	67.700	66.125	74.500
March	12.567	16.832	59.245	73.851	65.739	81.464
April	12.573	16.663	58.799	73.169	64.028	81.331
May	13.111	15.440	61.092	67.460	66.554	76.568
June	13.575	14.663	61.988	66.607	69.333	73.238
July	13.654	14.321	63.137	65.278	70.321	72.364
August	13.723	13.822	63.784	64.034	69.932	70.000
September	13.748	13.323	63.113	63.194	70.917	68.275
October	13.632	.....	62.773	.....	70.693	.....
November	13.598	.....	62.795	.....	70.216	.....
December	14.074	.....	63.267	.....	70.132	.....
Year	13.382		62.123		68.859	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1922	1923	1922	1923	1922	1923
January	4.700	7.633	4.388	7.571	23.667	27.119
February	4.700	8.050	4.396	8.093	20.681	28.519
March	4.720	8.252	4.421	8.254	21.266	28.815
April	5.115	8.101	4.946	7.996	22.993	26.956
May	5.420	7.306	5.281	7.085	24.462	25.614
June	5.745	7.146	5.563	6.852	24.685	25.429
July	5.729	6.237	5.447	6.126	24.869	24.188
August	5.824	6.582	5.537	6.496	24.580	24.222
September	6.110	6.856	5.868	6.700	24.131	25.688
October	6.530	.....	6.338	.....	25.551	.....
November	7.047	.....	6.868	.....	26.199	.....
December	7.163	.....	6.978	.....	26.079	.....
Year	5.734		5.503		24.097	

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1922	1923	1922	1923	1922	1923
January	31.480	37.986	32.100	39.173	163.065	181.852
February	29.835	40.693	30.767	42.011	149.850	190.513
March	28.426	46.569	29.171	48.569	143.152	219.607
April	29.810	44.280	30.605	45.810	149.840	213.081
May	30.149	42.346	30.971	43.135	150.163	203.097
June	30.707	40.375	31.497	40.957	152.512	191.798
July	31.025	37.970	31.733	38.490	156.149	181.188
August	32.134	38.841	32.380	39.269	160.006	186.705
September	32.075	41.047	32.395	41.547	160.065	198.263
October	33.935	.....	34.600	.....	170.563	.....
November	35.911	.....	36.734	.....	179.341	.....
December	36.480	.....	37.695	.....	178.697	.....
Year	31.831		32.554		159.450	

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1922	1923	1922	1923
January	4.691	6.815	26.321	35.733
February	4.485	7.152	24.213	35.613
March	4.658	7.706	25.467	36.720
April	4.906	7.197	26.576	34.275
May	5.110	6.625	27.304	31.057
June	5.346	6.031	27.893	29.548
July	5.694	6.089	29.042	29.335
August	6.212	6.325	31.170	32.386
September	6.548	6.438	31.750	33.469
October	6.840	.....	34.528	.....
November	7.104	.....	38.011	.....
December	6.999	.....	37.757	.....
Year	5.716		30.003	

St. Louis quotations, cents per pound. London, pounds sterling, per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)	
	New York		New York		New York	
	1922	1923	1922	1923	1922	1923
January	4.463	6.884	49.960	72.731	97.260	112.462
February	4.416	7.290	48.295	70.636	89.545	113.273
March	4.319	8.885	50.204	70.808	87.500	110.846
April	4.980	8.380	52.280	69.200	87.500	116.840
May	5.467	7.477	54.885	68.000	85.529	115.007
June	5.145	6.839	55.115	67.769	87.212	115.615
July	5.091	7.097	55.000	66.980	90.180	116.000
August	5.315	7.753	57.593	65.212	98.370	116.000
September	6.580	7.633	67.640	63.000	117.280	116.000
October	6.905	.....	72.560	.....	109.440	.....
November	6.584	.....	71.521	.....	108.000	.....
December	6.382	.....	72.300	.....	113.600	.....
Year	5.471	.....	58.946	.....	97.618	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1922	1923	1922	1923	1922	1923
January	21.55	29.27	20.15	27.35	21.34	28.77
February	21.46	29.79	19.71	28.15	20.88	27.21
March	21.35	32.03	19.96	31.79	20.83	31.77
April	22.50	32.77	21.26	32.77	22.70	32.77
May	26.36	31.87	26.87	29.83	25.96	32.46
June	26.96	30.27	26.96	28.34	25.96	29.81
July	26.77	28.47	26.33	26.52	25.97	27.47
August	30.44	28.27	27.18	26.77	30.81	26.77
September	35.27	28.26	34.70	26.26	36.79	26.72
October	35.27	.....	31.77	.....	33.40	.....
November	33.52	.....	29.37	.....	30.55	.....
December	29.87	.....	26.34	.....	27.69	.....
Year	27.61	.....	25.88	.....	26.91	.....

In dollars per long ton.

Monthly Crude Copper Production

	1923			
	May	June	July	August
Alaska shipments	8,693,161	7,921,680	7,160,887	6,353,425
Washoe smelter	18,100,000	18,300,000	17,100,000	17,100,000
Calumet & Arizona	2,868,000	3,548,000	3,492,000	3,046,000
Calumet & Hecla	(c)	(c)	(c)	(c)
Other Lake Superior	(c)	(c)	(c)	(c)
Chino	4,539,540	3,995,788	(c)	(c)
East Butte	(c)	(c)	(c)	(c)
Inspiration	(c)	(c)	(c)	(c)
Miami	5,557,000	5,702,000	5,164,000	5,144,000
Nevada Consolidated	5,052,379	5,258,919	(c)	(c)
New Cornelia	3,631,906	3,497,788	3,183,192	3,372,243
Old Dominion	2,187,000	2,285,000	(c)	(c)
Phelps Dodge	8,947,000	7,965,000	8,478,000	9,745,000
Ray	5,951,344	5,408,067	(c)	(c)
Shattuck Arizona	(c)	(c)	(c)	(c)
Southwest Metals Co.	1,000,000	1,185,385	1,215,000	1,072,283
United Verde	(c)	(c)	(c)	(c)
United Verde Extension	3,759,012	3,517,744	3,579,748	3,553,046
Utah Copper	16,547,445	16,936,814	(c)	(c)
Others, estimated	16,000,000	14,900,000	12,000,000	18,000,000
Total United States	.....	.....	.....	.....
Imports: Ore and concentrates, matte	12,992,447	7,293,299	9,022,193	.....
Imports of black and blister, unrefined	29,961,531	46,540,898	35,213,686	.....
Imports of refined and old	38,150,650	10,971,718	9,131,647	.....
Grand total	.....	.....	.....	.....
Backus & Johnston	(c)	(c)	(c)	(c)
Boleo	1,389,150	1,484,421	1,409,64	1,422,148
Cananea	(c)	(c)	(c)	(c)
Cerro de Pasco	(c)	(c)	(c)	(c)
Chile	(c)	(c)	(c)	(c)
Cons. M. & S. of Canada	(a)	(a)	(a)	(a)
Falcon Mines	516,000	448,000	448,000	(c)
Furukawa	2,634,156	2,806,506	798,000	(c)
Granby Cons	2,771,179	3,199,366	2,485,651	3,436,369
Katanga	9,012,405	10,606,050	12,612,600	12,266,415
Mount Morgan	.....	900,000	784,000	(c)
Mount Lyell	1,128,000	824,000	(c)	(c)
Phelps Dodge Mexican	3,688,000	3,579,000	2,726,000	1,829,000
Sumitomo	2,643,944	3,565,169	2,372,289	2,372,289
Wallaroo & Moonta	609,793	302,585	816,523	(c)

Comparative Monthly Copper Production

	1920	1921	1922	1923
January	121,903,744	90,596,597	32,010,292	(b) 112,341,000
February	117,540,000	86,682,941	45,957,530	(b) 102,641,000
March	120,309,316	91,046,345	55,705,760	(b) 122,202,000
April	116,078,871	46,946,523	(b) 76,601,000	(b) 117,914,000
May	114,964,207	25,310,511	(b) 88,714,000	(b) 124,785,000
June	116,107,856	24,623,693	(b) 93,740,000	.....
July	109,729,610	22,033,739	(b) 91,000,000	.....
August	112,460,254	23,248,398	(b) 101,188,000	.....
September	104,919,562	23,855,316	(b) 96,408,000	.....
October	105,231,571	23,231,572	(b) 103,273,000	.....
November	106,700,178	28,341,442	(b) 102,845,000	.....
December	95,709,009	26,629,137	(b) 103,003,000	.....

(a) No copper produced during this month. (b) Department of Commerce. (c) Not available.

COMPANY REPORTS

McIntyre Porcupine Mines, Ltd.

Gold, Silver; Schumacher, Ont.

A report of the operations of the McIntyre Porcupine Mines., Ltd., for the year ending June 30, shows a net profit of $919,166.43, as follows:

Earnings: Bullion recovered		$2,249,741.62
Operating costs:		
Mining and development	$799,875.06	
Crushing and conveying	48,046.61	
Milling	265,911.11	
Miscellaneous camp costs	53,811.52	
	$1,167,644.30	
Administrative and general expense	166,873.06	
Total operating costs, less taxes and depreciation		1,334,517.36
Operating profit—less taxes and depreciation		$915,224.27
Non-operating revenue		56,519.50
		$971,843.77
Provision for municipal, provincial and Dominion taxes		52,677.34
New profit for the year, before depreciation		919,166.43

Balance sheet as of June 30, 1923, is given as follows:

Assets

Current assets:		
Cash in banks and on hand	$243,657.00	
Bullion in transit and on hand	202,825.34	
Victory bonds, 1934's, at par	300,000.00	
Demand loans	3,600.00	
Accounts receivable	42,053.27	
Supplies on hand at cost	161,833.52	
		$953,969.13
Investments: Blue Diamond Coal Co. and other properties		619,494.23
Fixed assets:		
Mining properties	$3,617,254.13	
Plant and equipment at July 1, 1922	$1,796,582.33	
Additions during year	191,865.10	
	1,988,447.43	
		$5,605,701.56
Deferred charges: operating and administrative prepayments		11,138.93
		$7,190,303.85

Liabilities

Current liabilities:		
Payrolls payable	$35,768.78	
Accounts payable	57,073.24	
Provision for municipal, provincial and Dominion taxes	53,364.00	
		$146,206.02
Reserves		
General reserve	$148,987.03	
Reserve for depreciation, plant and equipment	1,353,689.64	
Sunday contingent reserves	55,523.17	
		$1,558,199.84
Capital liabilities		
Capital stock authorized, 800,000 shares at $5 par	$4,000,000.00	
Capital stock issued, 738,056⅝ shares at $5 par		3,690,283.00
Surplus		1,795,614.99
		$7,190,303.85

Production amounted to 107,997.37 oz. gold and 26,377.86 oz. of silver. The ore had an average value of $9.96 per ton. Ore reserves are estimated at 858,504 tons at $9.92 per ton.

The lower horizons referred to in last year's record have been explored to only a limited extent, due to the recurrence for the third successive season of an acute hydro-electric power shortage, which greatly curtailed the development program and production. In view of such a serious handicap, the fact that ore reserves have been increased in excess of a million dollars is worthy of note, says the report. The power plant erected on the site released by the company at Sturgeon Falls, on the Mattagami River, was completed and put into operation the early part of July, and the company is now assured of an ample supply of power.

The mill is presently treating an average of 1,000 tons daily.

Trethewey Silver-Cobalt Mine, Ltd.

Silver; Cobalt, Ont.

A balance sheet of the Trethewey Silver-Cobalt Mine, Ltd., has been recently issued as of June 30, 1923. It is given as follows and shows a deficit of $1,199,567.04 for the period covered:

Assets

Castle-Trethewey Mines, Ltd., (400,000 shares) at par	$400,000.00
Mines Water & Supply Co. stock, (4,204 shares) at	1.00
Rochester Mines shares (566,503 shares) at	1.00
Mining claim and license of occupation	2.00
Accounts receivable	1.00
Equipment stored at Cobalt at depreciated value	1,000.00
Deficit	1,199,567.04
	$1,600,572.04

Liabilities

Capital stock authorized—2,000,000 shares at $1 par $2,000,000.00	
Issued and outstanding	$1,599,998.00
Account payable	574.04
	$1,600,572.04
Deficit July 1st, 1922	$1,199,137.50

Mining Dividends in September Showed Slight Drop

The following dividends were paid by mining and metallurgical companies during September:

Companies in the United States	Situation	Per Share	Total
American Metal	U.S. and Mex.	$0.75 Q	$402,000
American Metal, pfd	U.S. and Mex.	1.75 Q	87,500
American Smelting & Refining, pfd.	U.S. and Mex.	1.75 Q	875,000
California Rand Silver	Calif.	0.02 M	25,600
Calumet & Arizona, c	Ariz.	1.00 Q	642,522
Federal Mining & Smelting, pfd., s.l.	Idaho	1.75 Q	210,000
Hecla Mining, s.l.	Idaho	0.15 Q	150,000
Homestake, g	S. D.	0.50 M	125,580
Inland Steel	Minn.	0.625Q	629,379
Isle Royale, c	Mich.	0.50 Q	75,000
National Lead	Various	2.00 Q	413,108
National Lead pfd.	Various	1.75 Q	426,433
St. Joseph Lead	Mo.	0.50 Q	774,684
Texas Gulf Sulphur	Texas	1.50 Q	952,500
U.S. Steel	Various	1.25 Q	6,353,781
United Verde Copper	Ariz.	3.00 I	900,000
Utah Apex, s.l.	Utah	0.25 Q	132,050
Utah Copper	Utah	1.00 Q	1,624,490
Companies outside of the United States			
Chile Copper	Chile	0.625Q	2,375,000
Hollinger Consolidated Gold	Ont.	0.05 4 wks.	246,000
Lucky Tiger Combination, g	Sonora	0.07 M	50,074
McIntyre Porcupine, g	Ont.	0.25 4 mos.	182,014
Oroville Dredging, g	Colombia	9d. less taxes	£26,836
Ouro Preto, g	Brazil	10% less tax 4s.	7½d. per £

Q, quarterly; M, monthly; I, irregularly; c, copper; s, silver; g, gold; l, lead.

Ahmeek, Osceola, and Calumet & Hecla did not make their regular quarterly dividend payments, which would have totaled about $1,400,000. A reoganization has recently been effected under the name of the Calumet & Hecla Consolidated and a new dividend rate will no doubt soon be announced. Hecla has reduced its dividend from 50c. to 15c., doubtless owing to the recent fire at that property, which has forced a suspension of production. Insurance is now practically the only income of the company. Mohawk paid $1 in March and June, but its payments seem to be irregular, and the next has been declared for October. Nothing has been heard of a payment by Tamarack & Custer. Tintic Standard has declared a dividend of 15c., but we are unable to learn whether it is to be paid in September, as would be expected, or in October. United Verde paid $3 in September, which is $1 more than was paid in June. Utah Apex reduced its previous dividend of 50c. to 25c.

MINING STOCKS

Week Ended September 29, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	...	...	58	June 23, Q	$1.50
Alaska-Br. Col.	N. Y. Curb	*85	*70	*70	...	....
Alloues	Boston	...	...	*16	Mar. '19	1.00
Anaconda	New York	39⅜	38⅜	38⅜	Se. 15, Oc. 22, Q	0.75
Arcadian Consol.	Boston	1⅜	1⅜	1⅜	...	....
Ariz. Com'l	Boston	9¼	8½	8¾	July '23,	0.50
Calaveras	N. Y. Curb	...	...	2	...	....
Calumet & Arizona	Boston	47½	46	47	Se. 7, Se. 24,	1.00
Cal. & Hecla (New)	Boston	21	20	20	June '23, Q	10.00
Centennial	Boston	...	...	7	Dec. '18, SA	1.00
Cerro de Pasco	New York	39⅛	38½	39	Jy. 19, Au. 1	1.00
Chile Copper	New York	26⅛	25⅞	26	Se. 1, Se. 29, Q	0.62½
Chino	New York	16⅝	15½	16½	Sept. '20, Q	0.37½
Con. Cop. Min. (New)	N. Y. Curb	2	1⅞	1⅞	...	....
Copper Range	Boston	27⅓	26	26½	May '23, Q	1.00
Crystal Copper	Boston Curb	59	55	58	...	....
Davis-Daly	Boston	2¾	2½	2 11/16	Mar. '20, Q	0.25
East Butte	Boston	5¾	5	5⅛	Dec. '19, A	0.50
First National	Boston Curb	32	30	30	Feb. '19, SA	0.15
Franklin	Boston	1⅛	1⅛	1⅛	...	....
Gadsden Copper	Boston Curb	30	30	30	...	....
Granby Consol.	New York	17⅛	16½	16½	May '19, Q	1.25
Greene-Cananea	New York	17¼	16⅝	17¼	Nov. '20, Q	0.50
Hancock	Boston	...	...	1⅝	...	....
Howe Sound	N. Y. Curb	2⅜	2¼	2¼	Oc. 1, Oc. 15	0.05
Inspiration Consol.	New York	27¼	26¼	27	Se. 13, Oc. 1 Q	0.50
Iron Cap	Boston Curb	4	4	4	May 23, K	0.15
Isle Royale	Boston	20	19⅜	19⅜	Se. 1, Se. 15,	0.50
Kennecott	New York	33⅜	32⅜	33	Se. 7, Oc. 1,	0.75
Keweenaw	Boston	*75	*75	*75	...	....
Lake Copper	Boston	1½	1½	1½	...	....
Magma Copper	New York	29⅓	29	29	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1⅜	1⅜	1⅜	...	....
Mass Consolidated	Boston	1⅛	1⅛	1⅛	Nov. '17, Q	1.00
Miami Copper	New York	24	22⅝	23⅛	No. 1, No. 15, Q	0.50
Michigan	Boston	2	1⅞	1⅞	...	....
Mohawk	Boston	*39	*37⅝	*38	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	8½	8¼	8½	Je. 8, Je. 30, Q	0.50
Nevada Consol.	New York	12⅛	12	12	Sept. '20, Q	0.25
New Cornelia	Boston	*17⅛	*17⅛	*17⅛	Au. 3, Au. 20, Q	0.25
New Dominion	N. Y. Curb	3	2⅝	3	...	....
North Butte	Boston	2	1⅞	1⅞	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*74	*63	*70	...	....
Old Dominion	Boston	17	16½	16½	Dec. '18, Q	1.00
Osceola	Boston	...	...	31½	June '23, Q	1.00
Phelps Dodge	Open Mar.	†160	†145	...	Se. 20, Oc. 2 Q	1.00
Quincy	Boston	...	...	24½	Mar. '20, Q	1.00
Ray Consolidated	New York	12	10	11⅜	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	*62	*61	*62	...	....
St. Mary's Min. Ld.	Boston	33	31⅛	32	Mar. '23, K	3.00
Seneca Copper	New York	8	7¼	7½	...	....
Shannon	Boston	*46	*42	*42	Nov. '17, Q	0.25
Shattuck Arizona	New York	5¼	5⅛	5⅛	Jan. '20, Q	0.25
South Lake	Boston	...	...	*98	...	....
Superior & Boston	Boston	*99	*90	*99	...	....
Tenn. C. & C. cfs.	New York	9¼	9	9½	Se. 29, Oc. 15, Q	0.25
Tuolumne	Boston	1 1/16	1 1/16	1 1/16	May '13,	0.10
United Verde Ex.	N. Y. Curb	30	29½	30	Oc. 5, No. 1, Q	1.00
Utah Consol.	Boston	1⅛	1⅛	1⅛	Sept '18,	0.25
Utah Copper	New York	60⅜	59	59⅜	Se. 14, Se. 29, Q	1.00
Utah Metal & T.	Boston	*60	*50	*60	Dec. '17,	0.30
Victoria	Boston	*75	*75	*75	...	....
Winona	Boston	...	...	*40	...	....
Wolverine	Boston	6¾	6⅜	6¼	...	....
NICKEL-COPPER						
Internat. Nickel	New York	12⅜	11⅞	11⅞	Mar.' 19,	0.50
Internat. Nickel pfd.	New York	77½	77¼	77½	Jy. 19, Au. 1	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	2⅛	2	2⅛	...	....
National Lead	New York	118¾	117¾	118¾	Se. 16, Se. 29 Q	2.00
National Lead pfd.	New York	113	113	113	Au. 24, Se. 15 Q	1.75
St. Joseph Lead	New York	20⅜	19⅛	19⅛	Se. 9, Se. 20 Q, X	0.50
ZINC						
Am. Z. L. & S.	New York	7⅛	7⅛	7⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	32	29	29	Nov. '20, Q	1.50
Butte C. & Z.	New York	5⅜	5⅛	5⅛	Mar. '23,	0.50
Butte & Superior	New York	14¾	14¼	14	Je. 15, Je. 30, Q	0.50
Callahan Zn-Ld	New York	5	4	4⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	147	144	147	Oc. 31, No. 10, Q	2.00
United Zinc	N. Y. Curb	*50	*50	*50	...	....
Yellow Pine	Los Angeles	*70	*70	*70	June '23, Q	0.03
SILVER						
Alvarado	N. Y. Curb	...	...	2⅛	...	....
Batopilas Mining	New York	⅛	⅛	⅛	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*33	*31⅓	*32	May '20, K	0.03
Candelaria	N. Y. Curb	*5	*5	*5	...	....
Castle-Trethewey	Toronto	*36	*33⅓	*35	...	....
Coniagas	Toronto	2.50	2.45	2.50	May '21, Q	0.12½
Crown Reserve	Toronto	*62½	*59	*62½	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb	*6	*5	*5	...	....
Kerr Lake	N. Y. Curb	2¼	2¼	2¼	Oc. 1, Oc. 15, Q	0.12½
La Rose	Toronto	*28	*26	*26½	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*17½	*17	*16	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	3.20	3.05	3.10	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5¾	5¼	5⅛	Se. 3, Oc. 17, Q	0.30
Ontario Silver	New York	3⅝	3½	3½	Jan. '19, Q	0.50
Temiskaming	Toronto	*39	*36	*36	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛	...	....
Alaska Juneau	New York	⅛	⅛	⅛	...	....
Boundary Red M.	N. Y. Curb	...	...	*12	...	....
Carson Hill	Boston	4¼	3⅜	3⅜	...	....
Cresson Consol. G.	N. Y. Curb	3⅜	3⅜	3⅜	Se. 30, Oc. 10, Q	0.10
Dome Mines	New York	39½	38½	39½	Oc. 12, No. 1, Q	1.75
Golden Cycle	Colo. Springs	1.10	1.08	1.10	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	12.00	11.74	11.95	Se. 20, Oc. 8, M	0.05
Homestake Mining	New York	62½	61½	61½	Se. 20, Se. 25 M	0.50
Kirkland Lake	Toronto	*43	*42	*42	...	....
Lake Shore	Toronto	3.38	3.37	3.37	Au. 1	Au. 15'23, Q	0.02
McIntyre-Porcupine	New York	17	16¾	17	Au. 1, Se. 1, Q	0.25
Portland	Colo. Springs	...	...	*38½	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1⅜	1 1/16	1 1/16	...	....
Tom Reed	Los Angeles	*55	*53	*55	Dec. '19,	0.02
United Eastern	N. Y. Curb	1⅛	1⅛	1 11/16	Jy. '28, Q	0.15
Vipond Cons.	Toronto	*95	*90	*91½	...	....
Wright-Hargreaves	Toronto	3.05	2.90	3.05	Se. 15, Oc. 1, Q	0.02½
Yukon Gold	N. Y. Curb	1	1	1	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*15	*13	*15	...	....
Con. Cortez	N. Y. Curb	*45	*42	*45	...	....
Con. Virginia	San Francisco	9⅜	9	9	...	....
Continental Mines	N. Y. Curb	4⅜	4	4⅜	...	....
Dolores Esperanza	N. Y. Curb	1 1/16	1 1/16	1 1/16	Jy. 1, Jy. 10 Q	0.05
Jib Consol.	N. Y. Curb	...	...	*65	...	....
Tonopah Belmont	N. Y. Curb	*65	*58	*58	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*44	*43	*44	Se. 22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2 1/16	2	2	Se. 10, Oc. 1	0.05
Tonopah Mining	N. Y. Curb	1 1/16	1 1/16	1 1/16	Se. 30, Oc. 1	0.07½
Unity Gold	N. Y. Curb	3⅜	2⅝	3⅜	...	....
West End Consol.	N. Y. Curb	*79	*77	*79	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston	...	...	16½	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	*90	*87	*90	Dec. '20,	0.15
Chief Consol.	Boston Curb	3¾	3½	3⅝	Au. 1, '23, Q	0.10
Columbus Rexall	Salt Lake	*38	*33½	*33½	Aug. '22,	0.03
Consol. M. & S.	Montreal	26¾	25½	26	Oct. '20, Q	0.62½
Erupcion	Boston Curb	2⅛	2	2	Se. 15, Oc. 2	0.125
Federal M. & S.	New York	7	7	7	Jan., '09,	1.50
Federal M. & S. pfd.	New York	39¾	39	39¾	Au. 25, Se. 15,	1.75
Florence Silver	Spokane	*18	*17	*18	Apr. '19, Q.X	0.01½
Hecla Mining	N. Y. Curb	8	7⅞	7⅞	Au. 15, Se. 15	0.15
Iron Blossom Con.	N. Y. Curb	*35	*35	*35	July 16,	0.02½
Marsh Mines	N. Y. Curb	*12	*9	*12	June '21, I	0.02
Park City	Salt Lake	3.05	3.02½	3.05	Se. 15, Oc. 1 Q	0.12½
Park Utah	N. Y. Curb	...	...	3	Se. 15, Oc. 1 Q	0.15
Prince Consol.	Salt Lake	*¾	*¾	*¾	Nov. '17,	0.02½
Silversmith	Spokane	*38	*35	*36	Oc. 1, Oc. 10	0.01
Simon Silver-Lead	N. Y. Curb	....	....	*15	...	....
Snowstorm Silver-L.	N. Y. Curb	....	....	*45	...	....
Tamarack-Custer	Spokane	1.45	1.41	1.42	Je. 30,	K	0.02
Tintic Standard	Salt Lake	3.12½	2.97½	2.97½	July '23	0.15
Utah-Apex	Boston	3⅛	3	3	June '23, Q, X	0.50
IRON						
Bethlehem Steel	New York	49	46¾	47⅜	Se. 1, Oc. 1 Q	1.25
Char. Iron	Detroit	...	...	¾	...	....
Char. Iron pfd	Detroit	...	...	1⅞	...	....
Colorado Fuel & Iron	New York	26⅛	26	26⅛	Au. 10, Au. '25 Q	2.00
Col. Fuel & Iron pfd.	New York	...	...	102	Feb. '23, Q	2.00
Gt. North'n Iron Ore	New York	27⅜	26¼	27½	Apr. '23	1.00
Inland Steel	N. Y. Curb	...	...	46½	Au. 15, Se. 1 '23 Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	5	...	....
Replogle Steel	New York	11½	10	10	...	....
Republic I. & S.	New York	44¼	42½	42⅝	May '21	1.50
Republic I. S. pfd.	New York	87	87	87	Se. 15, Oc. 1 Q	3.75
Sloss-Sheffield S. & I.	New York	43½	42	42½	Se. 2, Oc. 1 Q	1.75
Sloss-Shef. S. & I. pfd.	New York	...	...	78	Je. 22, Jy. 2 Q	1.75
U. S. Steel	New York	88⅛	85⅞	86⅜	Au. 30, Se. 29, Q	1.25
U. S. Steel pfd.	New York	118⅝	116⅝	118½	Au. 7, Au. 30 Q	1.75
Virginia I. C. & C.	New York	...	...	56½	Je. 16, Jy. 2	2.00
Virginia I.C.&C. pfd.	New York	...	...	80	Je. 16, Jy. 2	2.50
VANADIUM						
Vanadium Corp.	New York	29½	28⅜	28⅜	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	45½	45	45	Se. 29, Oc. 15 Q	1.00
Asbestos Corp. pfd.	Montreal	...	...	70	Se. 29, Oc. 15 Q	1.50
SULPHUR						
Freeport Texas	New York	12¼	11½	12¼	Nov. '19, Q	1.00
Texas Gulf	New York	58	55½	57	Se. 1, Se. 15 Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	...	...	2⅛	...	....
MINING, SMELTING AND REFINING						
Amer. Metal	New York	44	43	43	Au. 20, Se. 1	0.75
Amer. Metal pfd.	New York	...	...	107½	Au. 18, Se 1	1.75
Amer. Sm. & Ref.	New York	57⅞	56½	57	Jy. 9, Au. 1	1.25
Amer. Sm. & Ref. pfd	New York	96	95½	96	Au. 10, Se. 1 Q	1.75
U. S. Sm. R. & M.	New York	24	23½	24	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	41½	41½	41½	Oc. 8, Oc. 15 Q	0.87½

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

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

New Machinery and Inventions

Standardization of Metal-Mine Ventilation From the Manufacturer's Standpoint*

FANS for ventilation of metal mines can be divided into two classes, one including the larger-capacity fans running around 50,000 to 300,000 cu.ft. per minute capacity, and which are generally installed on the surface, while the other class would include the smaller fans, such as used underground for ventilation and headings and general purposes.

These large fans seem to invariably run into special installation arrangements, depending upon the lay of the ground where they are to be installed, type of driving element, different arrangements of connecting the driving element to the fan, and different duties to be performed. Some fans are single intake, whereas others are double intake; some blow into the mine at all times, some exhaust at all times, and again others are of the reversible type, all requiring an extensive system of airways, dampers, and other control apparatus. Some have overhung fan wheels, others have the wheel supported between two bearings. Some are direct-connected to the driver; others are driven by chains or other power transmission devices. Some discharge their air up, others down, and others in the horizontal direction. With all these variables, and because of these large fans involving so much material, it becomes a hard matter to standardize. In general, each proposition as it comes up is gone over thoroughly, and all of these variable elements are worked down to a definite requirement, so that the fan manufacturer can make his bid on a fan which suits all the various conditions.

The small fans used for ventilation of headings and underground workings seem to lend themselves well to the proposition of standardization. As most of these fans are driven by means of alternating-current induction motors, consideration of the subject will be confined to that method of drive. In general, it can be said that the alternating current used in the mines will be either 25 cycles or 60 cycles. Motor frames can also be selected for the fans, so that for a given cycle and horsepower capacity one frame will be used, the same being wound for 220, 440, or 550 volts and either 2 or 3 phase as required. That is to say, a given fan can be designed with its motor base so that it will accommodate mounting a given motor frame wound for any of the above conditions.

In this service, a motor must, of course, be well protected against rather hard usage, dampness and dirt, and first thought might be of an inclosed motor. This type in an a.c. motor, however, is not a general standard on the market, because, in the first place, the squirrel-cage-type induction motor has no sliding electrical contacts and it has an almost indestructible rotor, generally of solid aluminum casting. Moreover, the so-called open-type squirrel-cage induction motors have end shields or bearing headings which are almost totally inclosed. That is to say, the openings in these end covers are small, and, therefore, all rotating parts are thoroughly protected against mechanical injury due to foreign substances dropping into them. With direct-current motor, this argument would of course, not hold.

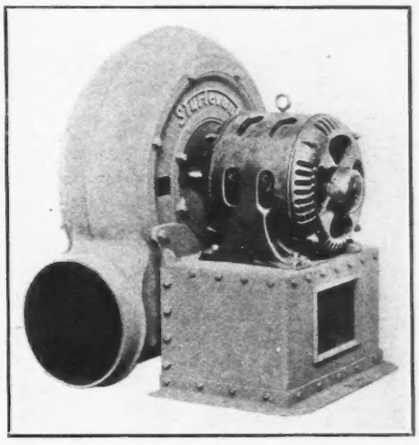
Motor manufacturers today put out a line based on 40 deg. C. rise when operating at full load; also another line based on 50 deg. C. rise at full load. For mine service, it is thought the 40 deg. motor should be adhered to as a general proposition.

Taking into consideration the various diameters of ventilating pipes in general use in mines, and the volume of air required, this small fan field can be covered with about three sizes of fans, making six combinations in all for 25-cycle and 60-cycle work. Since the fans are of the convertible type, the direction of discharge can be swung around to any position desired by means of taking out two or three bolts. A cut of this convertible fan is shown.

The accompanying table gives the various duties which these three fans could perform. The length of the ventilating pipe which they could handle as a maximum is given in one of the columns and beyond that length another fan would be installed as a booster, so that in long systems two or three fans might be used.

The performance of the three sizes of fans with 25-cycle and 60-cycle motor will be found in two sheets of curves on page 616. These curves show the static pressure or resistance in inches of water which the fans will overcome and the horsepower which will be required when delivering different volumes of air in cubic feet per minute at sea level.

The question which probably now comes to mind is just what would be the procedure in using these data on some case which might come up in the field. My suggestion would be to take



Small field fan of convertible type

the following formula, which is a formula for resistance of a length of air duct and has the form

$$\text{Res.} = \frac{L}{29.8\ D^5 \times 1{,}000^2} \cdot \frac{Q^2}{} \cdot \frac{d}{}$$

Where
L = length pipe in feet
Q = C.F.M.
d = Weight 1 cu.ft. air, lb.
D = Diameter pipe, feet

It is possible to calculate the resistance for different diameters of pipe assuming some certain density of air, for instance sea level, and thereby to simplify the formula to the following:

$$\text{Res.} = \frac{L\,Q^2}{K}$$

where K is a constant depending on the size pipe. These constants are as follows:

Size Pipe	
8 inch	52.3 x 1,000²
10 inch	160 x 1,000²
12 inch	397 x 1,000²
14 inch	857 x 1,000²
16 inch	1,675 x 1,000²

The fan performance curves are based on standard density at sea level, so it would be well to work out a resistance which the air pipe would have if it were at sea level. The mining engineer will know from his particular problem the approximate length and cubic feet per minute desired, and can calculate the resistance for different

60 Cycles

Duty: C.F.M.	Diam. Pipe, Inches	Length Pipe	Resistance, Inches Water	B.Hp.	R.P.M.	Size Monogram Fan	Motor: Type	Motor: Rated Hp.	Unit Weight
500	8	1,200	6.9	1.0	1,725	4	Open 40 deg.	3	420
1,000	10	950	6.5	1.6	1,725				
1,500	12	1,000	6.5	2.4	1,725	5	Open 40 deg.	5	560
2,000	14	1,000	5.25	2.9	1,725				
3,000	16	1,000	6.0	5.1	1,725	6	Open 50 deg.	7½	830

25 Cycles

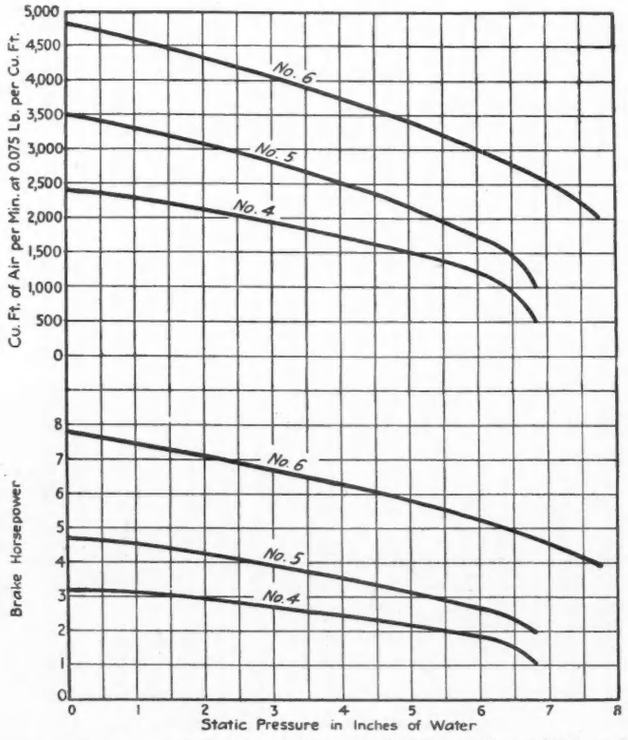
500	8	1,000	5.9	.9	1,435	4	Open 40 deg.	3	450
1,000	10	850	5.2	1.3	1,435				
1,500	12	1,000	6.5	2.4	1,435	5	Open 40 deg.	5	640
2,000	14	1,000	5.5	2.9	1,435				
3,000	16	1,000	6.0	5.1	1,435	6	Open 40 deg.	7½	870

*A paper by E. B. Williams, manager of the mines department, B. F. Sturtevant Co., presented at the convention of the American Mining Congress, Milwaukee, Wis., Sept. 24-29.

sizes of pipe and select any size of pipe best suited to his condition. He could then go to the performance curve of the fan above referred to, and find the size fan necessary. The fact that he might be working at an elevation considerably above sea level would simply mean that in the actual installation he would obtain the volume taken from the performance curve, but it would of course be at the lesser density, caused by the altitude, and this would in turn reduce the resistance in inches of water and horsepower in the same proportion which the density bears to sea level density. This would not be objectionable, as it would tend to reduce the load slightly on the motor, and on the other hand the motor does not exactly become underloaded with this condition, since its capacity decreases to some extent with altitude, and, therefore, the fan load and the motor capacity in a way run along hand in hand with different altitudes.

In the selection of these fans, the manufacturer is considerably restricted or limited by the fact that he must hold to standard alternating-current motor speeds. This has required special consideration in the design of fan wheels placed in the standard size fan casings, yet though these fan wheels are not of the exact dimensions or proportions of standard pulley-driven fans, they can be considered as standards for metal-mine ventilation work, and readily carried as spares, if desired.

The motor frames have been selected so as to have sufficient capacity to take care of driving fans on considerably shorter lengths of pipe than the maximum lengths stated in the table. That is to say, the rated horsepower of the motor will be seen to be considerably more than the horsepower required by the fan when delivering air through the maximum length of pipe given in the table. As the length of the pipe is decreased, the fan delivers a greater volume of air and requires more horsepower, all of which is taken care of by the selection of the larger horsepower rating motor.



Performance curves of three sizes of fans with 25-cycle and 60-cycle motor

New Sullivan Factory

August 11 was observed as a holiday at the general offices of the Sullivan Machinery Co., at Chicago. On that day the new western works of the company at Michigan City, Ind., was formally opened and manufacturing begun. The buildings were completed some time ago, and during the past month the machinery and equipment have been moved from the company's old plant at Chicago to the new quarters. The new plant is designed to permit manufacture of the company's products (consisting, at the Western Works, of air compressors, diamond core drills, drill steel sharpening machines and cutter bit sharpeners) in the most efficient and economical manner. The new buildings are one-story, and equipped with all modern appliances for manufacturing and handling the product rapidly and at low cost. The plant is served by the Pere Marquette Railroad. With these facilities, which will give an initial manufacturing capacity double that of the old works at Chicago, the company will be able to meet the increased demands from its field.

Hardy & Ruperti Take New Agencies

Charles Hardy & Ruperti, 115 Broad St., New York, has been appointed United States and Canadian agents for Alff & Co., Hankow, China, for the sale of their antimony regulus, needle antimony and antimony oxide; also A. Victor Leggo & Co., of Melbourne, Australia, for the sale of their arsenic.

J. P. Bonardi Promoted

The Mine & Smelter Supply Co. announces the promotion of J. P. Bonardi to the position of sales manager of its New York office, succeeding E. S. Tompkins, who resigned recently. For the last two years Mr. Bonardi has been manager of the assay and chemical department of the Denver house, and the company states that his record there accounts for his transfer to New York. Mr. Bonardi is a chemical and metallurgical engineer, a graduate of the University of New Hampshire, and of the Colorado School of Mines. After leaving the latter institution he was connected with the U. S. Bureau of Mines until coming to the company's employ. He has had broad practical experience as well as technical training.

Link-Belt Co. Acquires Meese & Gottfried

The Link-Belt Co., which for some years has maintained sales and distributing offices at San Francisco, Los Angeles, Portland, and Seattle, has realized for some time that the Pacific Coast was growing increasingly self-supporting and self-dependent and that sales and distributing offices alone were no longer sufficient to take care of Pacific Coast needs unless supplemented by manufacturing facilities. Recognizing this trend, the company has just acquired the business and manufacturing facilities of the Meese & Gottfried Co., which for many years have occupied the position of the leading manufacturers of transmission and conveying machinery on the coast. It is the intent of the new owners to increase facilities, enlarge stocks and improve methods of distribution so that the demands of customers can be met promptly and completely.

Pulverzied Fuel System Catalog Just Issued

"Lopulco Pulverized Fuel Systems" is the title of a new catalog offered by the Combustion Engineering Corporation, Combustion Engineering Building, Broad St., New York. This is the first publication the company has issued that describes both the theory and mechanical features of its powdered coal system, which, within the past year, has been installed in connection with some of the most notable boiler plant projects in the country. The catalog is printed on dull coated stock in duo-tone ink.