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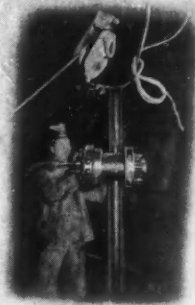
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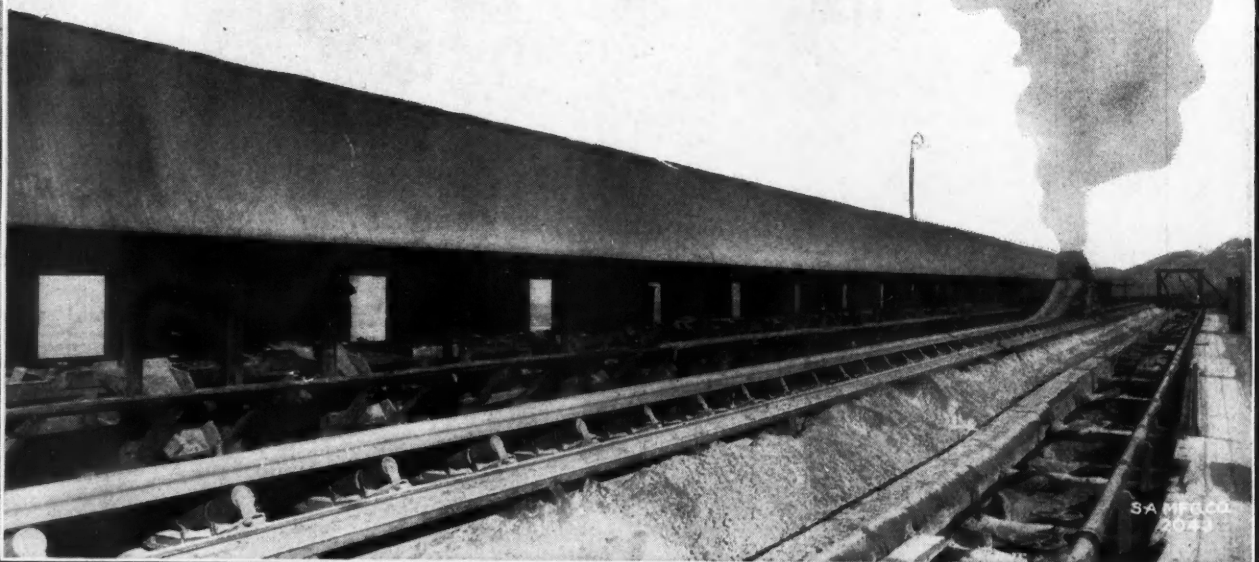
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LOOKING NORTH FROM A POINT NEAR THE BORAX DEPOSITS. IN THE FOREGROUND ARE TERTIARY LAKE BEDS

The Sink of the Amargosa*

By GEO. J. YOUNG

Death Valley, the sink of the Amargosa River, has long been an interesting region to the prospector and the geologist. It has been thoroughly examined for the presence of workable deposits of potash salts, and, though some brines of moderate potash content have been discovered, the results of the explorations have been disappoint-

ing. The colemanite deposits, occurring as veins and beds in the Tertiary lake beds in the Furnace Creek area, are among the most important deposits of borax in existence. They are being steadily worked. No notable metalliferous deposits have been discovered in the region, although prospectors have searched diligently.

ONE of the unique topographical units in the United States is Death Valley, the sink of the Amargosa, in Inyo County, California. It is a narrow valley, trending northwesterly and southeasterly, 120 miles long and varying from 3 to 10 miles wide. On the east side is the Amargosa Range, which is formed of three units, respectively known as the

Grapevine Mountains, the Funeral Range and the Black Mountains. On the west side is the Panamint Range. The eastern mountains are of Cambrian, Silurian and Tertiary age and the western of similar periods.

The Panamint Range reaches its maximum elevation at Telescope Peak, 11,045 ft., an air-line distance of about 12 miles from the 200-foot contour of Death Valley. The Amargosa Range reaches an elevation of 6397 ft. at Funeral Peak, a distance of six miles from the —200-foot contour; 6725 ft. at Pyramid Peak, a

*Part of this article was excerpted from a report made to the U. S. Bureau of Soils; Bull. 61, "Potash Salts and Other Salines in the Great Basin Region."

distance of about 12 miles from the —200-foot contour; and 5420 ft. at Chloride Cliff Peak, a distance of 10 miles from the —200-foot contour in Death Valley. The Panamint Range averages from 7000 to 9000 ft. altitude, and the Amargosa from 6000 to 7000 ft. The maximum grade on the west from Telescope Peak to the valley is 920 feet per mile (9.8°), and on the east, measured from Funeral Peak, 1066 feet per mile (11.4°). The canyons leading to the valley do not approximate these grades, except in their upper ends, but the average grade is steep. In consequence of these steep grades and the torrential character of the occasional rain storms, alluvial fans and mountain aprons have been developed on a vast scale.

Death Valley receives the drainage area of the Amargosa River. The total area of the valley and its tributary drainage is over 20,000 square miles. The lowest point is —280 ft., referred to sea-level.

FLOOR OF SINK IS LEVEL AND OCCUPIED BY SALT DEPOSITS

The floor of the valley is practically level, but on the flanks are low hills, some of Tertiary sediments and some made up from alluvial material, the remnants of previous alluvial fans left by recent erosion. Mesquite flat in the northern part is largely covered by sand dunes. There are no evidences of a Quarternary lake, although in the lowest portion of the valley there are indistinct lines that suggest the presence of a shallow lake in recent times.

An enormous deposit of salt distributed in several well-marked areas occupies the lowest depressions. This deposit is in the characteristic form of deposits of salines that are found under similar circumstances in regions of great aridity. The principal area of salt begins south of Salt Creek and extends to a point south of Mesquite Spring. Over a large portion the salt appears as a crust composed of pinnacles and fantastic, twisted masses. It is said that some of the pinnacles reach a height of 6 ft., although the average height of those that I saw ranged from $1\frac{1}{2}$ to 2 ft. It is difficult accurately to estimate the thickness of the salt crust, but a thickness of from 1 to $1\frac{1}{2}$ ft. is probable. Below the rough salt area is mud and thinner crusts of salt.

There is a smooth salt area in the sink northeast of Bennetts Wells and about 18 miles south of Furnace Creek. On the eastern edge of the valley this is separated by a narrow rim of mud and rough salt from the alluvial wash of the Amargosa Range. On the north the area is bounded by rough salt which extends across the floor of the valley. The first foot of the smooth salt area is composed of layers of crystalline salt 2 or 3 in. thick, separated by thin seams of mud and sand. Brine comes to within a fraction of an inch of the surface. A slight scraping of the surface is followed by the flowing in of the brine. The surface of the salt is divided into small polygonal areas by thin cracks through which the underlying brine has been drawn and in crystallizing has left low welts of crystallized salt cementing the cracks together.

In the rough salt area, holes show a brine to be within 1 or 2 ft. of the surface. Within this area also occur potholes, circular openings from 2 to 4 ft. in diameter and of varying depth and filled with brine. The interior of the holes is lined with salt crys-

tals. About the edges, surface tension has drawn the brine up and the margin of the hole is crusted with efflorescences of salt. Near the "land" edge of the rough salt area many holes are to be seen, some more or less arched over by salt crusts and dry mud, and always containing water. Areas of soft red mud also occur between the rough crusts and the outer margin. These are often difficult and dangerous to cross.

The slow consolidation of the mud, as well as the banking up of the ground water on the periphery against the mud mass, accounts for the upward movement of the brines that apparently takes place in the rough salt areas and in the mud areas bordering them. Surface tension draws this brine up upon the rough masses of salt, and its evaporation there builds up the irregularities of the salt.

The smooth area of salt is built up by fresh accessions of brine coming from the action of rain water upon the neighboring rough salt areas. Shallow channels (sloughs) meander through the rough salt and collect part of the brine formed by the occasional rains, discharging it upon the smooth salt, where it is speedily evaporated. Wind-blown material collects in the thin sheets of brine and mingles with the salt crystals. The general admixture of soil impurities in the rough salt is also explained in this way. It is evident that the smooth salt area would eventually reach a level that would permit little or no drainage to collect, and the salt bed would no longer be built up. Slow consolidation of the silts and clays in the lowest depressions would extend the differentiation of level over a long period.

The presence of the enormous accumulations of saline material in Death Valley raised the hope early in the search for potash deposits that potash-rich brines similar to those discovered at Searles Lake, or even buried deposits of the valuable salines, might be discovered. An extensive search was made by the U. S. Geological Survey, but though some brines were discovered that contained potash, no notable quantity was found. A number of shallow bores and at least one deep bore were put down, but no deposits were encountered. The outlook for potash deposits in this area is not encouraging. At one time the playa borax deposits occurring at several places in the valley were worked for borax, but these were abandoned long ago.

COLEMANITE DEPOSITS IN TERTIARY LAKE BEDS

The only important saline deposits are in Tertiary lake beds that occur in the area of low hills southeast of Furnace Creek Ranch. These are deposits of colemanite and among the most important and extensive of the known deposits of borax minerals. They have been worked by the Pacific Coast Borax Co. for a long time and are their principal source of supply.

In spite of the extreme aridity and the excessive temperatures of the summer months, much prospecting has been done in the mountain areas bordering the valley, but no notable metalliferous mines have been discovered. While the results have been disappointing on the whole, the entire area has by no means been thoroughly prospected. The Tertiary lake bed formations will be an important source of borax for a long time to come, and the valley itself will in time become one of the scenic wonders of the West.

The Advent of Modern Mill Mechanism To Nitrate Leaching

BY DONALD F. IRVIN*

Recent experimentation and the introduction of mechanical pulp thickeners, drag classifiers, and continuous filters to the leaching treatment of nitrate ores have made higher extractions possible and should make profitable large areas of low-grade nitrate deposits. The concomitant waste of heat in the treatment of crushed ore in boiling strong solutions is in advanced practice supplanted by the use of weak tepid solutions, and improved evaporators giving greater heat economy. A revision of the government's fixed royalty and export duty charges per ton of crude ore would greatly encourage development of lower-grade nitrate deposits in Chile. Production cost details.

DURING the last three years various writers have described, in the technical publications of Chile and the United States, the methods and results obtained in mining and treating the crude sodium-nitrate ores of Chile, which are there known as *caliche*. All have agreed that the percentage of recovery of sodium nitrate and the methods in general use are inefficient and wasteful; but no definite system of treatment to supplant the one now in use, which has the tacit approval of 40 to 50 years of established operations behind it, had until recently been presented.

NITRATE EXTRACTION OF 60% BY SHANKS PROCESS

At present the nitrate industry is beginning to suffer a metamorphosis in its technical development, which may properly be compared to that which revolutionized the hydrometallurgical industries, particularly cyanidation, between 1903 and 1913. In both cases, the beginning of the era found the industries well established as regards knowledge of the chemistry of the respective processes, but the mechanical equipment required had lagged far behind.

The residue from ore treatment (*ripio*, a term for any kind of tailings in Chile) carries away not only much of the original nitrate in an undissolved state, but also considerable material in the form of a sticky, thin slime pulp, composed of the pregnant nitrate solution, mixed with a fine, natural clay-slime, called *borra*. This is the case to such an extent that it is probable that a common extraction figure for the nitrate content of *caliche* is only about 60%. Furthermore, it is undoubtedly a fact that for any one ore made up of a certain proportion of fine and coarse insolubles the percentage of nitrate in the tailings will be constant, regardless of considerable variations in the original nitrate content of the crude ore. Therefore, the percentage of recovery generally obtainable is dropping steadily in proportion to the content in nitrate of the average ore, which has also dropped gradually in grade, due to the selective working of the richer nitrate areas and their practical

exhaustion at the present time. Some of the early-day operations were on a truly bonanza basis; the present relations of gangue material and nitrate content being reversed in the old ores that were worked in the "Peruvian days," or the era before the war of 1879-1881 between Chile and the Peruvian-Bolivian allies which gave the nitrate fields to Chile. Enormously productive *oficinas* during that epoch accumulated relatively small tailings piles, although these are usually rich in nitrate.

Since the cost of mining and treating a ton of nitrate ore remains much the same, in so far as number of units of fuel, labor and general supplies is concerned, the actual cost of production per unit of nitrate is bound to increase with a lessening nitrate content in the crude ore, to which there is added the present great increase in unit costs of fuel, supplies, and labor in Chile, not forgetting the skyrocket advance in Chilean exchange. The latter item acts as an increase of labor cost, since the nitrate producer sells his product for bills of exchange on London, with which he must buy the excessively appreciated Chilean peso to pay his labor or any other account originating in Chile.

LEACHING NITRATE IN BOILING SOLUTIONS

There is a great incentive to improvement in technique by the nitrate producers (known as *salitreros*) since cyanide practice has provided such a useful field for a choice of adaptable equipment. In order properly to indicate the direction taken by the new system of nitrate recovery, it is well briefly to outline the standard form of treatment, from which the newer forms are diverging more or less radically. So much has been written about this old process that it is sufficient to say that it depends essentially on the following simple points:

1. Continued leaching of a given lot of ore by successively poorer and poorer solutions derived from previous lots under treatment, ending finally with a water wash.

2. The first solution removed from contact with a fresh lot of ore goes to the crystallizing plant. In its essentials this process is similar to a common decantation, or sand-leaching, system.

3. Great solubility of the saline contents of nitrate ore at high temperatures, and subsequent precipitation of common salt when cooling begins, leaving nitrate in solution. This leaves much of the salt content in the discharged tailings.

4. Later crystallization of nitrate from the solution derived from the ore undergoing treatment is obtained by allowing the supersaturated hot solutions of nitrate to cool for a number of days in shallow tanks. The mother liquor remaining in these tanks after crystallization is known as *agua vieja*, and goes back to be re-used in another cycle of treatment, leaving crystallized nitrate in the tanks as the ultimate finished product.

The actual operations of dissolving are carried out in large rectangular steel tanks containing coils of steam

*Mining and Mechanical Engineer, Antofagasta, Chile

pipe which serve to bring the whole mass up to a boiling temperature. These tanks receive the crushed ore in most cases as the entire product from Blake crushers, set to a 2-in. or 3-in. opening, and this feed will naturally contain much fine material as well as coarse.

Even the coarsest lumps, when broken down by the dissolving action of hot solution, will liberate still more fine insoluble material locked up until that moment within the solid mass of soluble crystallized salts, so that the actual separation of included fines from existing sands cannot be completed by dry sizing or screening, and therefore the tailings from coarse ore, carefully prepared by screening, may easily be contaminated by slime, carrying with it much pregnant solution, and thus occasioning high losses in residue, because of the dissolved nitrate content.

These conditions disclose the specially weak features of the Shanks process, as bearing on the imperfection of recovery; but the serious matter of heat losses is a further consideration of importance. The heat given to a mass of pulp in the boiling tanks is not preserved, since the tailings are discharged to waste and the solutions, although transferred in turn from one mass of pulp to another, finally reach the crystallizing vats, where they definitely and completely give off their heat to the atmosphere. The Shanks process offers as advantages a comparatively simple, though relatively costly, means of obtaining nitrate from the raw material, with the disadvantages of losing large quantities of the original nitrate content, and the initial handicap of a large and expensive plant for treatment. The heat losses also cause proportionately excessive fuel costs. Until recently, improvements in the system of nitrate making had been limited to gradual refinements of mechanical operations of plant auxiliaries, such as power equipment and transportation of crude ore, etc.; but the essentials of the problem had not been changed in any substantial manner.

SLIME TREATMENT FIRST PROGRESSIVE STEP

An attempt to adopt modern hydrometallurgical methods, such as had been developed by cyanide practice, using a tube mill and vacuum filters, was launched in 1915 at the Agua Santa property in Tarapacá, Chile. This scheme of treatment undertook only a partial change, and adhered to the old process for the larger part of the daily tonnage. Four-fifths of the crushed ore was still treated in the boiling-tanks by the Shanks process, and the remaining one-fifth—6 mm. size—was separated by a shaking screen and fed to a Hardinge mill in a pulp with 25% solids. From the Hardinge mill, without further classification, the pulp passed, via an agitator, to the filter unit, and was there filtered and washed in accordance with experience gained in the cyanidation process.

A removal of slime from the boiling tanks in any amount whatever is beneficial, and reduction of moisture in discharged tailings is also helpful, so the net result at Agua Santa showed some commercial advantage from their installation. Although this was an improvement there was still a problem untouched by this scheme, the solving of which was essential to make a perfect system of treatment; and the nitrate producers refused to accept the method adopted at Agua Santa as one generally applicable or satisfactory for a universal process.

In fact, the process simply offered a means of recovering the pregnant solution from the screened undersize.

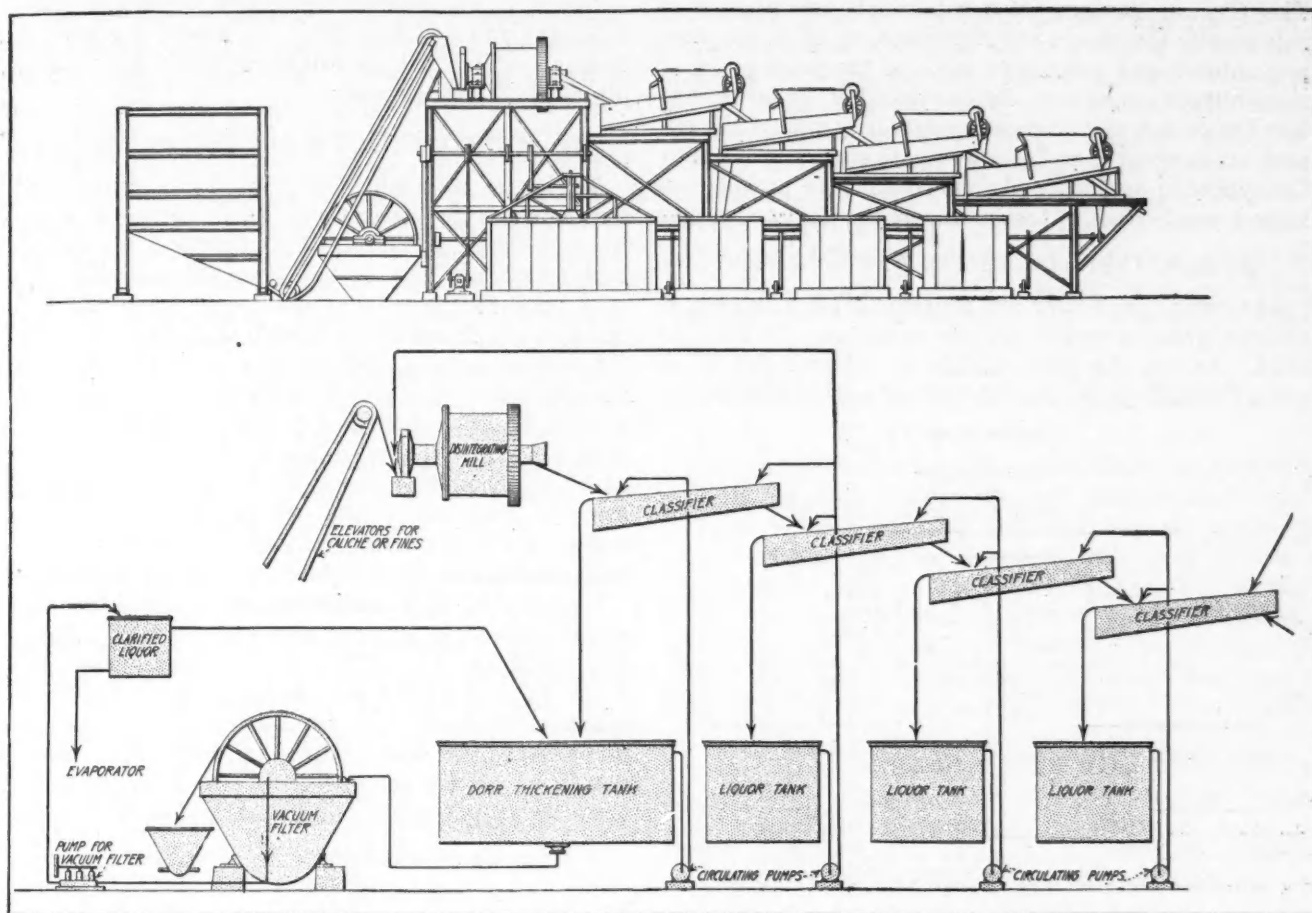
Instead of sending the tailings to waste directly from the treatment plant, bearing the usual portion of nitrate in the poorly classified or really unclassified mass, the idea was next advanced that the impoverished tailings from the plant should be re-treated before final rejection as waste. Such a plan was thought to offer a better chance for proper use of classifiers and filters than on the untreated ore; furthermore, it was suggested that the practice of screening the material from the crushers be continued, and the untreated fines from the screens be treated jointly with the tailings from the coarse material, already treated separately by the usual method. This permits the oversize from screens to pass through the regular Shanks process, while the untreated fines and once-treated tailings jointly undergo classification, thickening, dewatering and filtering.

The *oficina* Delaware of the Du Pont de Nemours Powder Co. interests is equipping a plant in Taltal, Chile, on this basis. The re-treatment section of the plant is introducing mechanical classifiers to separate sand and slime, with mechanical thickeners and a continuous drum filter to treat the slime produced. The comparatively weak solutions from this re-treatment plant can be profitably used as weak solution washes in the main portion of the *oficina*, while the latter section of plant provides pregnant solution of the proper strength to crystallize the nitrate. Grinding is not needed in comminuting the ore in order to expose all the nitrate content to the action of solutions, because all nitrate existing in the ore can be obtained by solvent action, if this is sustained for a sufficiently long period. No nitrate exists within the actual rock particles, as in the case of gold or silver minerals. Therefore, tube mills or fine grinders generally are not needed.

Although nitrate may be recovered by simple dissolving, this action carried to excess creates large quantities of weak solutions from which the nitrate content may not be crystallized on a commercial basis. These solutions may, however, be brought up to required strength by partial evaporation, and this becomes an important factor in new methods aiming at a high extraction. Evaporation rapidly gains in economy by utilizing the "multiple-effect" system, which has been considered not economical on the rich liquors from nitrate treatment, because of the harmful effect produced in evaporators by the liberation of volatile iodine. If this corrosive action can be avoided, it is easily seen that evaporation of weak liquors offers a more profitable and more logical field for heat application than the boiling of liquids and solids together in the ordinary boiling tanks.

TREATMENT OF LOWER-GRADE ORES POSSIBLE

If the slimy types of nitrate ore can be treated with metallurgical efficiency, thus adding to the present reserves of ore many millions of tons that are now untreatable, and if, by large reductions in treatment costs, lower-grade ores can be handled, Chilean nitrate may regard artificial nitrate as a competitor without undue fear. Sharp competition might mean continued use of the present grade of nitrate ore, but the situation could be met by the much improved extraction and the lower cost of treatment.



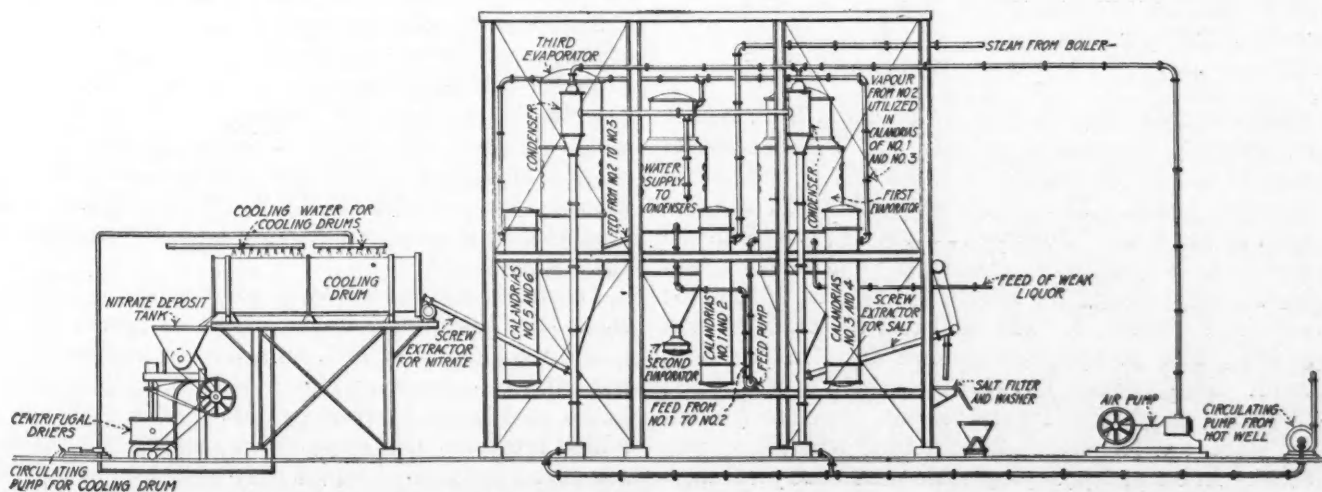
LIXIVIATION PLANT AND CYCLE OF OPERATIONS USED IN NITRATE LEACHING

A modern method using a treatment that secures the high extraction of nitrate by use of tepid weak solutions in Dorr classifiers and thickeners and Oliver filters, combined with multiple-effect evaporation, has been devised by the technical staff of Gibbs & Co., a large English corporation with extensive interests in Chile, and is being put into effect at its property near Antofagasta. This plan of treatment is based on several years' experimental work in Chile and London, in the course of which many tons of nitrate ore was treated in a plant of several tons' daily capacity.

This property being one that yields a rather low-grade nitrate ore, of a slimy nature, the results are awaited with decided interest, as, if profitable, it would mean an

immensely increased tonnage of nitrate ore that could be treated, while, simultaneously, lessened costs of operation would permit the nitrate producers of Chile to meet confidently the bogie of artificial nitrate that will surely confront them after the war.

The Chilean government still possesses large tracts of unsold nitrate ground, the total nitrate content of which is not known definitely, since large areas of promising character have not been drilled as yet. These grounds, when surveyed and drilled, are auctioned publicly at different times on the basis of the estimates of the Chilean government engineers. The price fixed by the government as a minimum tender price is usually the equivalent of 40c. to 50c. U. S. Cy. per ton of crude ore in place.

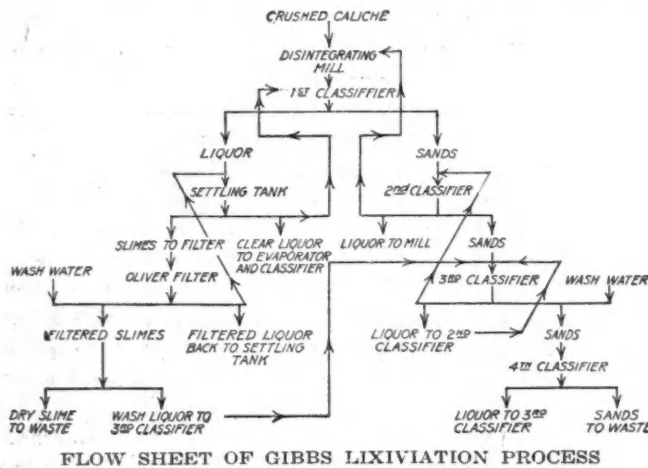


ELEVATION OF PLANT DESIGNED TO SECURE MULTIPLE-EFFECT EVAPORATION IN NITRATE LEACHING

The Chilean government must adopt an enlightened policy as to the export tax on nitrate, which is 28 pence per quintal, and practically 50% of the total costs of some nitrate companies. Rather than kill the goose that lays the golden egg, it should voluntarily reduce the export tax in order that Chilean nitrate may compete with the synthetic product, and thus continue to provide the largest single item in the income of the Chilean nation.

AVERAGE COSTS UNDER PRE-WAR CONDITIONS

The costs that follow are representative of standard Chilean practice under pre-war conditions, in 1910 to 1914. Among the other points of interest should be noted the high proportion of the fuel cost in the nitrate



FLOW SHEET OF GIBBS LIXIVIATION PROCESS

industry, which waste is inseparable from the standard or Shanks process. The figures are recalculated into U. S. weights and currency from the original Chilean weights and money and figures are based on the 2000-lb. ton. Data were obtained from "Salitre"—a monograph on the nitrate industry by Nicolás Ugalde (1916).

The proportional costs of mining in per cent. of cost per ton were: Superintendence, 6; general labor, 3; assaying and sampling, 1; actual mining (day's pay), 10; actual mining (contract), 66; explosives, 10; repairs and supplies, 4; the total cost per ton was \$0.50. The proportional costs of transportation in per cent. were: Superintendence, 5; labor (loading), 20; labor (general), 1; labor (railway), 8; repairs on carts, 4;

TABLE I. SUMMARY OF OPERATING COSTS

	Cost per Ton	Per Cent. of Cost
Mining	\$0.500	30
Transport	0.283	17
Treatment	0.833	50
General	0.050	3
Total	\$1.666	100

repairs in railways, 15; supplies on carts, 2½; supplies on railways, 2½; feed of animals, 30; maintenance of way, 2; coal and water, 10; the total cost of transportation was \$0.283. The proportional costs of treatment were in per cent.: Superintendence, 1½; crushing and elevating, 8; leaching, 4; discharging and stacking tailings, 9; crystallizing the nitrate, 2½; repairs, 6; fuel, 55; water, 8; supplies, 5. The total cost of treatment was \$0.833. The proportional general costs in per cent. were: Staff salaries, 30; staff household expenses, 35; hospital (including police and school), 10; office (including stable and telephone), 25; the total general cost was \$0.05. In an accompanying table a summary of operating costs is given.

Power is not entered separately anywhere, but the following ratio of fuel to ore is given: 1 ton of Australian coal per 24.3 tons dry ore; and 1 ton California oil per 43.3 tons dry ore.

EXPORT TAX AND SEA FREIGHT PAID BY CONSUMERS

There are no available figures for a representative cost analysis for operations under present-day conditions, as supplies and freights fluctuate widely under war influences. The costs as given are the really significant ones to the nitrate producers, since the export tax and sea freights are simply added to the price of the refined nitrate and are a dead-weight charge to the consumer. Ordinarily, the variable cost element of nitrate, or that which is capable of variance, is represented by the tabulated costs. The various oficinas which supplied this composite cost sheet reported an average grade of nitrate ore at 18.9% nitrate, with tailings of 6.7%, or an extraction of 64.5%—probably somewhat higher than the general average of extraction.

Recovery of 64.5% on nitrate ore containing 18.9% nitrate gives 244 lbs. per ton; equivalent to 2.40 quintals of 101.4 lbs. These 2.40 quintals cost \$1.666 U. S. Cy., or \$0.694 per quintal. Assuming that £1 equals \$4.80 U. S. Cy., the above cost per quintal becomes 34.7d. or 35d. Agreeing, then, that 35d. per quintal of nitrate for operating cost is representative, the interesting comparison shown in Table II results:

TABLE II. COMPARISON OF OPERATING AND TOTAL COST

	Pence	Per Cent.
Operating cost	35.0	48.8
Rail freight to tidewater	6.0	8.4
Lighterage charges	0.8	1.1
Brokerage; Nitrate Association and sundry charges	2.0	2.8
Export duty	28.0	38.9
Pre-war total cost	71.8	100.0

The nitrate lost in the tailings with a 6.7% tailings content is 134.7 lbs., and the pre-war price of nitrate was normally about 7s. 6d., or, say, \$1.80 U. S. Cy. per quintal of 101.4 lb.; about 1.77c. U. S. Cy. per lb. At that figure the tailings loss is equivalent to \$2.38 U. S. Cy. per ton, but at present the fantastic price of 14s. per quintal is quoted, making those same tailings worth \$4.45 per ton.

Finally a review of the nitrate situation in Chile reveals an industry in which two facts are painfully evident; first, that the government tax accounts for 40% of the total normal cost of production; and, second, that the tailings loss of unexpected nitrate amounts to \$2.50 to \$4.50 per ton of crude ore handled. Furthermore, probably half of the average cost of production is payable in Chilean currency (wages, local supplies, etc.), which currency must be bought by the proceeds of sales of nitrate abroad. When the Chilean peso is soaring around 15d. (3.33 per \$1 U. S. Cy.) stationary wage scales in Chile become a steadily increasing burden on the business.

To complicate the troubles of poor extraction and high costs, the Chilean government exacts its export duty in Chilean gold pesos of 18d., an arbitrary and practically non-existent currency, which is entirely in government hands, and is sold by them against foreign exchange at a high premium, or *recargo*, when needed. For the reason given, the normal export duty of 28d. is now climbing toward 40d. to the exporter.

However, these various drags on the industry should not, and probably will not, prevent its course of development; for with an ore of 20% nitrate content worth at normal prices 7s. 6d. per quintal (\$7.10 per ton of crude ore) and at 14s. (\$13.25 per ton) the room for profitable exploitation is ample. Fear of destructive competition by synthetic nitrogen, as developed by war needs, is probably over-apprehensive, since the Du Pont powder interests acquired in April, 1917, large and valuable additional holdings of nitrate-bearing ground at Peña Grande, in the province of Tarapacá, Chile, at the regular auction of the Chilean government. It is hardly necessary to indicate that such a step would not have been taken by an organization whose sources of technical information are so accurate and extensive had there been the possibility of an abundant supply of synthetic nitrogen available soon at a price competitive with the natural Chilean product.

SYNTHETIC NITROGEN IN COMPETITION WITH THE NITRATE INDUSTRY

It is to be hoped, as a measure of national benefit and a patriotic safeguard, that synthetic nitrogen sources may be established rapidly in the United States on a sound and self-maintaining basis, and the efforts of United States Government in that direction will probably bear fruit before long. In the meantime, the action of the Du Pont powder interests indicate an intention to rely for some time to come on the known resources of natural nitrates.

The German *ofcinas* in Chile worked and stored nitrate as long as they possibly could till the pressure of Allied resources gradually closed them all, fuel oil from the United States, tank steamers, and jute bags from British India being practically indispensable in nitrate making. This shows a German belief that even the resources for production of synthetic nitrate in Germany cannot flood the market—not even their own at home; as it is evident that the German *ofcinas* in Chile would not tie up thousands of dollars in manufactured nitrate, till the close of the war, save on a sound basis of business calculation. The monthly turnover of nitrate shows no net effect resulting from the stoppage of the German plants, since others have reopened or increased their product, so that the year will probably show a record figure for output—upward of 60,000,000 quintals, the quantity being dependent only on shipping facilities.

Sea freights to Europe or North America from the west coast of South America are enormous; in the first case, 160s. and upward, and \$25 to \$35 U. S. Cy. in the second. Bottoms are so scarce that freight rates are almost a matter of personal barter and arrangement, what with arbitrary brokerage, etc. The west coast is now depending heavily upon the United States for ocean freights, and both the nitrate and copper industries of Chile must have American fuel oil to keep in operation. It is not remarkable, therefore, that the nitrate producers of Chile are eagerly investigating anything which promises to reduce the cost of production in the *ofcinas*, or to make possible the profitable treatment of nitrate ore hitherto regarded as too difficult or too low grade to work.

The logical developments of the research work done in nitrate treatment by various investigators point to

an acceptance of a treatment similar to if not in all phases identical with the Gibbs process, which embraces as a prime necessity the well-known and satisfactory machinery borrowed from present-day metal-mining practice, in the form of drag classifiers, mechanical thickeners, and continuous drum filters. Concurrent with the use of these machines runs the practice of employing weak tepid solutions to gain a high percentage extraction, and a scientifically designed evaporator to effect economical precipitation of nitrate, together with a great saving in heat-units, over present practice.

Identification of Molybdenite

BY F. C. FUCHS*

During the course of an investigation for molybdenum, I happened to find a most accurate and rapid method of identifying its principal mineral, molybdenite. A small piece of caustic potash is melted in a fragment of a broken porcelain dish and then a little of the suspected mineral is added. Within five minutes, if the sample is molybdenite, it swells, dissolves rapidly, giving the mass an intense red yellowish color, and not a single speck of the brilliant scaly mineral is to be seen. When cool, if a few cubic centimeters of water be added to the residue of fusion, and afterward some drops of hydrochloric acid, the color begins to change and in spots appear the blue, green, yellow and red.

The reaction can be explained as follows: Molybdenite (MoS_2), having two atoms of sulphur, gives up one of them to the molten potash and forms a double sulphide of red color, just as the one created in an ammonium-sulphide solution and which is familiar to most chemists. Although the monosulphide of molybdenum has not yet been isolated, probably due to its instability, the indicated reaction tends to prove that it exists in combination with alkaline sulphides.

I utilize this same reaction for quickly getting into solution the molybdenite, in the determinations of the metal, and it constitutes a convenient and rapid method; while it takes a long time to dissolve molybdenite by means of aqua regia, nitric or hydrochloric acid, or even through the powerful oxidizing action of chlorine gas on a concentrated solution of caustic potash.

Domestic Platinum in 1917

According to figures compiled by J. M. Hill, of the U. S. Geological Survey, only 605 oz. of crude platinum was sold by placer mines in 1917. This is less than the sales in 1916 by about 100 oz. The imports of crude platinum amounted to 31,921 oz., not counting the 21,000 oz. of Russian crude platinum which was received by the Government late in December.

During 1917, refiners handled about 33,000 oz. of platinum, 4300 oz. of palladium, 833 oz. of osmiridium, and 210 oz. of iridium, which can be called "new metals." Of this amount about 7400 oz. probably originated from domestic materials.

The saving of scrap platinum of all classes resulted in much larger recoveries of secondary platinum metals than in previous years, a total of 72,000 oz. being recovered, as compared with 48,000 oz. in 1916.

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Length of Service and Care of Hoisting Ropes

A modulus of twelve to fourteen million pounds per square inch of wire section is customary in hoisting ropes. The best Lang lay rope is probably one of six strands of seven wires; it is more flexible than the regular lay and will take shorter bends. Opinions differ as to when a rope should be removed. In the anthracite regions it is the practice to remove it when the stretch is out. Ropes should be re-cut and re-coned once every three to six months to prevent undue recurrence of strain at certain fixed points. Reversing of ropes, end for end, likely to give a false sense of security. Interlocking, locked-coil and galvanized ropes rarely used in hoisting.

SUBSEQUENT to the selection of a suitable rope for hoisting, the safety problem, as brought out in the discussions of the paper on hoisting ropes¹ presented by M. A. Sigafos at the meeting of the mining section of the Sixth Annual Congress of the National Safety Council in New York, resolved itself into considerations governing the length of service that may be expected from ropes and the necessary precautions that should be exercised.

WIRE SECTION ONLY 50% OF A 6 x 9 ROPE SECTION

The ropes generally used for hoisting purposes in the United States are drawn to about 85 or 90 long tons per square inch. The practice among operators has been of late to favor the use of plow steel, which ranges from 105 to 120 long tons per square inch, but many manufacturers prefer to avoid it as much as possible because of the fact that this material will undergo fatigue sooner from winding around a drum, the higher carbon contents of the steel being responsible. Reverse bending over sheave and under drum injures higher-carbon steel much more rapidly than it does lower-carbon steel.

The modulus of 28,000,000 lb. per sq. in., referred to by H. C. Behr, applied to a square bar. In a wire rope there is a much different condition to consider, as the rope consists of wires which work upon each other when the rope passes around a drum or over a sheave, and the compression of the inner wires will take up some of the bending stress; that is, will reduce the modulus. In figuring out bending stresses in ropes, a modulus ranging from about 12,000,000 to 14,000,000 lb. per sq. in. is used. In using 29,000,000, a bending stress close to the ultimate breaking strain of the rope is obtained, which is not good practice. The cross-section of the wires entering into a 6-strand 19-wire rope is about 50% of the area of the cross-section of the rope itself, which will reduce the 29,000,000 to some extent. In figuring out the bending stress of a $\frac{5}{8}$ -in. rope, using the 29,500,000-lb. modulus is bound to nearly equal the ultimate breaking strain of the rope.

About 120 long tons is the highest tensile strength adopted for the material used in flat rope. It is neces-

sary in the lacing or threading of flat ropes to use a soft wire. This accomplishes a two-fold purpose: It makes a neater job where the thread is turned back and laced through the different ropes, and it prevents inside abrasion of the wires in the rope itself. The soft annealed wire used as a lacing gets all the abrasion, and the strands themselves get little.

LANG LAY ROPES GIVE LONGER SERVICE

Comparative data of service given by ropes of the regular and Lang lay, operating under similar conditions, show that at two or three mines where 1 $\frac{1}{2}$ - and 1 $\frac{1}{4}$ -in. ropes are used, the average service of a regular lay rope has been about 24 months. Afterward the Lang lay rope was installed at the mines and the average service, working under practically identical conditions, has been over 30 months. In one instance, the Lang lay rope that was put on gave 34 months' service, as against an average of 24 months from the regular lay. The mines worked every day, and their tonnage outputs were practically the same per day, so that the tonnage hoisted in one year was about equal to that of the next.

The wires in a Lang lay rope are not laid as tightly as in the regular lay, because of the strand construction. The wearing surface of the wires is much greater, and they will stand shorter bends without breaking than those of a regular lay rope. The rope is more flexible, and for some purposes gives better service than the regular lay type. Also, Lang lay rope is less likely to kink, as it will tend to spring out and get away from a kink. It should be used with both ends fastened firmly; in other words, one end to the drum and the other with a closed socket, not a swivel socket. In the early history of Lang lay rope, particularly in the United States, the ropes were quite "twisty"; but now they are made so that they will lay as inert as the regular lay rope. After being in service a short while, they do not give any trouble. A Lang lay rope working on a clam-shell digger using a 6-strand 19-wire construction ran 90 days, as against 25 days with a rope of the regular lay with the same quality of steel in both.

BEST LANG LAY SIX STRANDS OF SEVEN WIRES

The Lang lay is undoubtedly the best lay for a hoisting rope, and the best type of Lang lay is a rope with six strands of seven wires in a strand. This is true provided the size of sheaves and drums and other conditions which it has to work under are adapted to a 6 x 7 rope.

The New Jersey Zinc Co. is using such a 6 x 7 rope with good success. The best basis of comparison is not the length of time that a rope has been installed, but the amount of foot-tons which it has performed, because one rope may be lying idle a proportionately greater length of time than another.

A 6 x 7 rope is more compact than a 6 x 19 construction. The greater number of wires there are in a rope, the greater chance there is for softening or opening of the strands, and this seems to apply more especially to the Lang lay rope, because of the fact

¹Eng. and Min. Jour. Nov. 10 and Dec. 22, 1917.

that the strands and wires are twisted in the same direction, whereas in the regular lay they are twisted in the opposite direction. The wires are not as tight in a 6 x 17, or 6 x 19 as they are in a 6 x 7 construction.

A 1-in., 1½-in. or 1¾-in. rope of 6 x 7 construction with plow steel wires is a rather stiff rope, whereas the 6 x 15 or 6 x 17 construction in sizes larger than one inch, although not as tight as a regular lay rope, is less likely to open up or "bird-cage." There is one advantage in the 6 x 19 construction. When a number of the outer wires are broken, there is still a good factor of safety left in the core of the strands, or in the inner wires of the rope, which, in the majority of cases, in 6 x 19 rope constitutes a section having about 40% of the breaking strain of the rope.

REMOVE ROPES WHEN STRETCH IS OUT

As to the proper time to remove and renew a rope: There is a large coal company in the western part of Pennsylvania that uses ropes 1½ in. and 2 in. in diameter for the purpose of hoisting men, and this company does not remove its rope until the rope shows 50 broken wires in any one foot. There are a great many people who, not well acquainted with the construction and the breaking strain of ropes, would look at a rope with 50 broken wires in any one foot and think it was dangerous to use for hoisting men, but the Pennsylvania company to which reference is made has never had an accident, and as the rope had stretched after being taken off with that number of broken wires, there still was a large margin of safety. This was demonstrated after the inspectors condemned the rope, as the manufacturer claimed that it was still safe. It was thoroughly tested, and the fact was brought out that it still retained about 60% of the original breaking strain.

In the anthracite region, operators believe that a good rope is the best insurance they can have. During the last 10 years they have lost 17 lives by ropes breaking, but it is still a question as to when the rope has rendered its service and when it should be removed. A certain mine in this region takes the rope off when the stretch is out, and if the stretch is not out in two years, the rope is removed anyway. All ropes are re-coned and are re-cut every six months, regardless of broken wires. It is an excellent rule to follow. If any broken wires are discovered or reported, that rope comes off at once.

UTILITY OF INTERLOCKING ROPES

Interlocking ropes have been tried for shaft sinking with good results, and they are all right for a small load, as for a bucket, and give good service. One rope that was used in sinking a deep shaft has at the present time been in use between six and seven years, and it is still in good condition. It is re-coned every six months. The time to take off a rope depends on the nature of its operation and the condition of the rope. Operators differ in their opinions on this matter.

About 12 years ago in the anthracite region a rope broke and dropped 10 men to the bottom of a shaft, killing all. The rope had been in operation, according to record, about nine years, and mine officials did not know how much longer. A sample of the rope

about eight feet back from the fracture was taken and every wire of it tested. The wires in the rope were tested about three feet from the fracture, after they had already been subjected to a breaking strain, and it required 35 tons to break them a second time. The load which broke the rope was the weight of the extended rope, plus the weight of the cage and 2000 pounds.

The engineer claimed that the rope broke while the cage was being lowered, and that he knew nothing of it until the end of the rope came into the engine room. It is hard to conceive of a man running a direct-connected engine and being unaware of the break at the time. The engineer was coming to a stop when the rope broke; he knew something happened, but did not know just what. The men on the rope were supposed to stop at the level, and they were about at the landing when the rope broke. The cage had no counter-balance, being a single-hoisting man cage, and was lowered by jerks. One of the last jerks was at that level, and it is thought this broke the rope. The rope, no doubt, was able to take care of the load it was supposed to handle, and there must have been an undue strain put upon it, but whatever it may have been, the cause was not brought out at the inquest. If that rope could stand 35 tons after it had already been broken, there must have been more strain than that put on it when it broke. It was pretty well rusted, but, nevertheless, required considerable strain to break it three feet from the point of fracture.

The original rating of this 1½-in. rope was 47 tons. If it had shown a considerable amount of corrosion, it is safe to say that there was not much more corrosion at the point where it broke. It is not likely that corrosion would take place in the middle. If it was a cone where the dampness was liable to collect, it would be at that place, but it is hard to see why corrosion should take place at a certain spot in a rope away from any obstruction.

It was not known whether the rope was ever dressed or lubricated. It broke about 150 ft. above the cage, and the shaft was some distance from the engine room. There can be some relation to the position of that break and the position it occupied on the sheave. The lower end of the rope was always under tension, as the cage was left standing with the brake on the drum. When the rope broke, it was at a point coming right under the drum, which was wound with an underbend.

ROPES RE-CUT AND RE-CONED TO REMOVE POSITIONS OF RECURRING STRESS

Ropes should be re-cut and re-coned, preferably every three months. When three or four feet of rope are removed from the drum end, the spots in the rope that have become set, due to cage stops occurring in the shaft always at the same point, are shifted, and the effect is removed to other points on the rope.

Reversing a rope, as before stated, is likely to give a false idea of safety, because most of the breakages have been in the lower end, and that end has been subjected to greater strain than the upper end. A writer on the subject has said the rope should be tapered the other way, in view of results. For moderate depths that may be all right, as there is a great

margin of safety for a small depth. When the depth becomes great, such procedure is dangerous, and care must be taken in regard to the size of the rope, as well as to factors of safety. In an instance where two interlocking ropes were used, one of the ropes ran perfectly, but the other rope "bird-caged," opened up, an incident that caused the operators to abandon this type of rope. Reversing the rope has been the practice of some companies. When they had occasion to take the ropes off they frequently changed them end for end, on the theory that it would prevent a special strain on any one point, but this is taken care of by the re-cutting and re-coning.

GALVANIZED ROPES NOT POPULAR IN AMERICA

Galvanized hoisting ropes have been little used in this country, as the galvanizing chips off readily on operating over sheaves and drums, and is then of little or no value. They are used along the river front in New York City, hoisting on lighters, a little more successfully. The majority of such ropes are imported. American manufacturers are making few galvanized ropes for hoisting purposes. Galvanizing has some effect on the actual bending strain of the wire itself. It varies from 7½ to 10%, according to the size of the wire. Lock coils are rarely used for hoisting purposes, but are popular for tramways and cableways, because of the great wearing surface and considerable resistance to friction for the over-running carriage.

Texas State School of Mines

BY WILLIAM D. HORNADAY

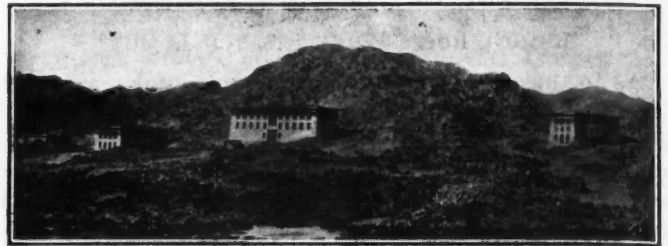
The Texas State School of Mines and Metallurgy, at El Paso, is a branch of the University of Texas. The school was established in 1914 by act of the Legislature, and, notwithstanding the adverse conditions that have prevailed since then, it has succeeded in achieving a recognition that presages much for its future growth. The mineral resources of the Southwest and Mexico favor the establishment of a state school for the study of mining engineering in Texas. Immediately tributary to El Paso are the mines of west Texas, New Mexico, Arizona and a large area of the mining country of Mexico. Not only is the situation of the school at El Paso advantageous from the standpoint of possible attendance, but it should stimulate the mining industry of the state.

The upper Rio Grande border region of Texas contains mineral deposits of importance. Already considerable progress has been made in the development of this wealth. One of the largest producing quicksilver mines in the United States is situated at Shafter, and the quicksilver mines in the Terlingua district of Brewster County are among the largest in the country.

The head of the Texas School of Mines is S. H. Worrell, who is well and favorably known to the mining world. The original site of the institution was on the mesa above Fort Bliss, the old military institute buildings being used for the purpose, but these were destroyed by fire on October, 1916. Upon the destruction of the original school buildings, the citizens of El Paso raised a fund and purchased a site better suited for permanent structures and equipment. The

new buildings have been erected on the south flank of a spur of Mount Franklin at the edge of the residential district of El Paso. The school is situated near the smeltery of the Kansas City Consolidated Smelting and Refining Co., so that students are given the opportunity of investigating and inspecting the various operations at close range. It is purposed to establish a practice mine in the hills at the rear of the institution grounds, and this will be operated in the same manner as a real producer of ore.

A modern ore-reduction mill, situated in the main arroya of the school campus, is now under construction and will have a capacity of 200 lb. of ore per hour. Mill-run tests of ore are made for owners of



TEXAS STATE SCHOOL OF MINES AT EL PASO, TEXAS

claims and properties without charge, although freight charges and assaying costs are paid by the owner and all ore sent to the testing mill becomes the property of the school.

The new buildings, representing an expenditure of \$175,000, are of massive stone and concrete fire-proof construction, after the architectural type of the Bhutanses of Thibet. The main building, the center of the group, contains the executive offices of the dean and the faculty members. Here also are the lecture rooms and laboratories of the engineering and geological departments, the drafting room, the library and the geological museum, which contains an excellent collection of minerals and rocks. The physics laboratory is completely equipped and represents an expenditure of \$2000. The chemistry building, which contains the chemistry and assaying laboratories, balance room, lecture rooms, store rooms and the office of the head of the chemistry department, is southeast of the main building. A dormitory building to the northeast of the main building has accommodations for 50 students, as well as a large dining room and kitchen.

The faculty consists of Dean S. H. Worrell, John W. Kidd, engineering; H. D. Ballister, geology and mining; E. H. Seamon, chemistry and assaying, and instructors in mathematics, economics, languages and other branches.

British Regulate Trade in Tin

The purchase or sale of tin situated outside of the United Kingdom has been prohibited by the British Ministry of Munitions as of Apr. 25, except for the purpose of carrying out contracts, according to a consular report from London. Further, no person may purchase or take delivery of tin situated within the United Kingdom or sell or deliver such tin without a license. All persons are required to make monthly returns of tin held by them in stock or otherwise under their control on the last day of the preceding month.

A Simple Automatic Wind-Direction Recorder

BY JAMES ROBERTSON

It is often desired to secure a continuous record of wind directions, and without the necessary and proper apparatus the work would be most expensive, to say nothing of the degree of accuracy secured. Where there is urgent need for the result and when standard apparatus is not available or procurable on short notice, the question is, how to secure the results with the least cost and in the quickest time.

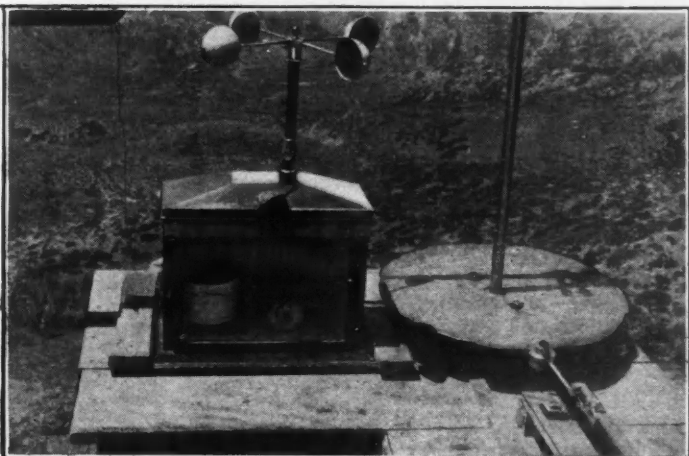
The problem of determining wind directions came up before the engineers of a large copper smeltery when it was found advisable to purchase land adjacent to a new smeltery site at the beginning of a program of expansion. The time in which the wind records could be secured was limited, and it was impossible to procure standard apparatus in less than three months' time. After considerable experimenting, a simple and cheap recording device was designed and built from materials obtainable at the plant, and from the start the apparatus has given satisfactory results.

different radii, each covering a sector of 45° , the shortest being $9\frac{1}{2}$ in., and the longest $11\frac{1}{2}$ in. Commencing with the shortest radius clockwise the radii for the 45° sectors are: 10, $10\frac{1}{2}$, 11, $11\frac{1}{2}$, $11\frac{1}{4}$, $10\frac{3}{4}$ and $10\frac{1}{4}$ in., so that the design allows a regular stepping up, or down, and permits of the cam being turned through 360° without requiring a reversal in either direction in order to come back to the point of starting. The cam is bolted to a U bearing-plate, which rests on one exactly similar, but bolted to the observation platform. An extension of the standard, approximately four feet in length, passes through the platform bearing and thence through a thrust bearing bolted to a support fastened to the lower parts of the platform posts.

The recording mechanism consists of a mechanical time recorder (converted from an electrical time recorder) actuated by a plunger having a roller which travels along the perimeter of the cam. The motion of the plunger is transmitted by means of a series of levers to the arm and pen of the recorder. A spring was used to keep the plunger roller pressing against the cam, but it has been found advisable for this purpose to substitute a weight acting on a cord and pulley.



WIND STATION WITH RECORDING APPARATUS FOR DIRECTION AND VELOCITY



PLATFORM OF WIND STATION SHOWING ANEMOMETER AND CAM OF RECORDING APPARATUS

A Negretti & Zambra recording anemometer, procured locally, and the automatic wind-direction recorder, designed and made at the plant, constituted the apparatus first used at the station, and later a Friez hydrograph, or humidity recorder, was added. In designing the wind recorder, the only chart-carrying clock instrument available was a standard electric time recorder, minus the electrical attachments, and with this as a nucleus the rest of the recorder was built. The completed apparatus consisted of two parts, the vane and the recording mechanism.

CHANGES OF DIRECTION OF WIND TRANSMITTED BY ECCENTRIC CAM

The wind vane consists of a 1-in. wrought-iron pipe standard to which is clamped about two feet from the top and in a horizontal position another 1-in. pipe carrying on one extremity a 4 x 5-ft. vane, the frame of which is made of 3 x $\frac{1}{2}$ -in. wood, and on this is tacked a sheet of heavy canvas. An eccentric cam, the essential feature of the whole apparatus, is welded to the pipe standard four feet from the top. This cam has eight

Several tests were made to determine the sensibility of the apparatus, and it was found that, with a vane having an area of 24 sq.ft., a wind velocity of five miles per hour is sufficient to cause a movement of the vane under all conditions. When not changing sectors, velocities as low as two miles per hour will move the vane.

A proposed wind station having an automatic direction recorder is shown in the sketch. The only part of the complete apparatus which must be purchased is the mechanical time recorder, which may be of three different makes and have a chart for changing once in 12 or 24 hours, or seven days. The cost of such a recording instrument would be from \$30 to \$50. The essential features of the apparatus as described above, two of which are in successful operation, have been incorporated in the proposed design. The principal difference is in the improved main bearing, of the roller type and designed after the U. S. Weather Bureau standards, and the placing of the cam and plunger under the platform, instead of above.

The drawings show a spring-actuated plunger which would be satisfactory, although it would be preferable

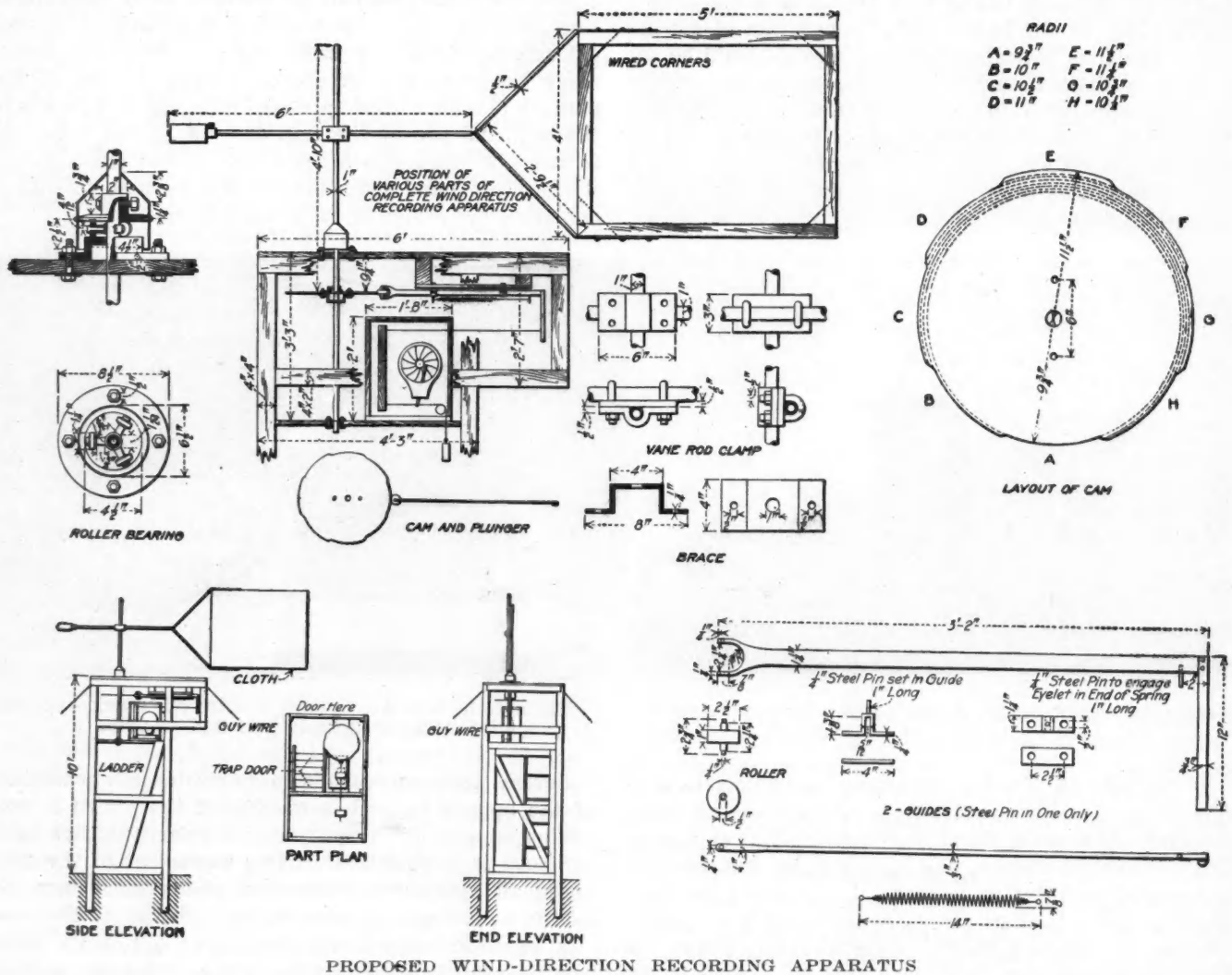
to substitute a weight which would always exert an equal roller pressure against the cam. Also, the drawings show the recorder pen arm connected to the plunger by means of a wooden reducing lever and wire, whereas metal levers and metal bars instead of wire are superior, since they will not break, bend or stretch. The radii of the cam vary by $\frac{1}{2}$ in., a difference which may be necessary if the most accurate machine work cannot be done. With the best machine work and proper alignment, differences of $\frac{1}{2}$ in. would be much superior, and the sensibility of the apparatus would be doubled. A larger vane will also increase the sensibility.

An automatic wind-direction recorder such as that described may be easily and cheaply built; it is durable and needs little attention. Considering the proposed

Quality of Batesville, Ark., Manganese

Manganese ores mined in the Batesville, Ark., field are divided into three classes, Class A, Class B and manganiferous. Class A covers all ore running from 40% manganese and upward; Class B includes grades from 17% to 50%, and the manganiferous covers all those ores in which iron is one of the predominating qualities.

Shipments from the district in 1917 totaled 16,682.29 tons. Of this amount, 8430.76 was manganiferous, the remaining tonnage being equally divided between Class A and Class B grades. In an interview, Walter Dennison, sales agent for the field, stated that probably 25% of the ores now sold under the classification of Class B could be brought into Class A grade by washing.



PROPOSED WIND-DIRECTION RECORDING APPARATUS

design and the suggestions as to improvements, an accurate, durable, and sensitive apparatus may be built and installed, and while not conforming exactly to the U. S. Weather Bureau requirements and conditions, it serves the purpose admirably.

Sulphuric Acid, phosphate rock, acid phosphate and other raw materials are referred to whenever fertilizers and fertilizer ingredients are mentioned in Government regulations regarding licensing of the fertilizer industry. The other raw materials include the following: Bones (raw, ground or steamed), bone black, basic slag, sodium nitrate, ammonium sulphate, cyanamid, calcium nitrate, potash salts, cement dust, blast furnace dust, kelp ash, kelp char, potassium nitrate, mixed fertilizers and sulphur.

The accompanying furnace determinations on eight cars, shipped from different parts of the field in March-

ANALYSIS OF CLASS A, BATESVILLE, ARK., MANGANESE ORES

Car Number	Moisture, %	Manganese, %	Phosphorus, %	Silica, %	Iron %
1	7.49	49.75	.....	3.45	5.53
2	2.24	52.27	.....	5.45	3.93
3	1.36	57.13	.....	8.02	1.62
4	1.23	58.03	0.147	7.58	1.31
5	2.04	56.63	.....	7.88	1.92
6	2.13	58.20	.....	1.42	1.01
7	2.31	55.81	.....	0.92	2.53
8	1.95	58.02	.....	0.65	1.21
Average,	2.47	55.73	.....	4.44	2.38

Cars 1 and 2 were shipped from Batesville (Pfeiffer); 3 and 4 from Anderson; 5 from Penters Bluff (Cummins Hollow); 6 and 7 from Polk Southard and car 8 from Rogers mine.

1918, show the quality of the tonnage that is being shipped in Class A.

Stellite—Alloy of Cobalt, Chromium, Tungsten and Molybdenum*

BY ELWOOD HAYNES†

It is a noteworthy fact that the metals found in their native state on the surface of the earth are, generally speaking, extremely rare. Besides meteoric iron and native copper, they include gold, silver, mercury, and the metals of the platinum group. If Nature produced other metals during the formation of the earth's crust, they have long since combined with other elements, and exist only as compounds, chiefly oxides, sulphides, arsenides, carbonates, chlorides, etc.

It is extremely desirable, however, to have for use metals or alloys which remain permanent under atmospheric conditions, and at the same time have such physical properties as will enable them to be manufactured into instruments and utensils for daily service. Metals which are not at all permanent in the air, such as iron, lead, manganese, etc., produce compounds with oxygen or sulphur which remain practically unchanged under ordinary natural conditions for many centuries, but these compounds are not workable, nor in any way suitable to direct manufacture into implements for daily use. Their physical properties, such as strength, hardness, and workability, are not such as would recommend them for such instruments. Copper, alloyed with zinc, produces brass, and alloyed with tin, produces bronze, but none of its combinations is permanent in the air, and all of its alloys are inferior in strength and hardness to steel.

The so-called "noble metals," with the exception of silver, are permanent in the air, but are so rare that implements made of them would be extremely costly, particularly if of considerable size.

DESIRABLE QUALITIES SOUGHT IN NEW ALLOYS

It was with a view to producing an alloy which would combine the permanence of the noble metals with the strength and hardness of steel that the writer made a long series of experiments, which finally resulted in the production of a series of such alloys.

As early as 1899, an alloy was produced by heating the mixed oxides of chromium and nickel with metallic aluminum. A small button was obtained which showed considerable malleability when cold and when polished exhibited a bright luster which was not dimmed when the metal was boiled in either strong or dilute nitric acid. Moreover, the acid showed not the faintest color after such test. This alloy was somewhat harder than untempered steel, and could be readily worked under the file or in the lathe.

The mixed oxides of cobalt and chromium were afterward reduced by the same method, but the little pellets of the alloy thus produced were thrown from the crucible by the violence of the reaction. A few of these were collected, and found to be very much harder than the corresponding nickel alloys. They showed the same resistance to nitric acid and were only attacked very slowly by hydrochloric and sulphuric acids.

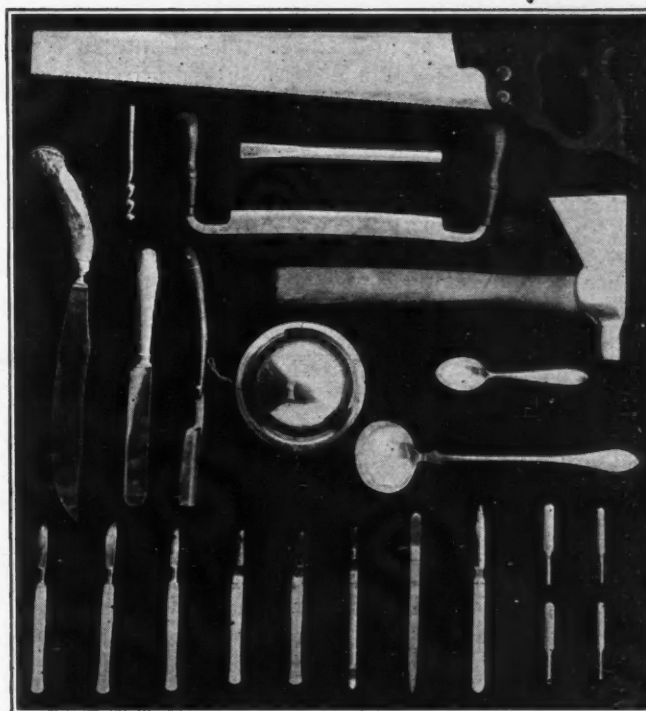
Later, the mixed oxides were reduced by means of carbon, and it was found possible to cast the alloy into bars, which showed remarkable strength, rigidity, and hardness, as well as complete immunity to all atmos-

pheric influences. Polished samples of the alloy were exposed to the fumes of the chemical laboratory for months, and in some cases their surfaces became covered with a deposit of ammonium chloride, but this could be easily rubbed or washed away, and the alloy showed the same brilliant surface as before.

These binary alloys of cobalt and chromium were so hard that they would take a cutting edge, and could be used in the place of steel for pocket-knife blades and table knives. They were found to be malleable at a bright orange heat, even when the chromium content rose to 45% or more. These high chromium alloys were very hard to forge, but after forging into pocket-knife blades, for example, they showed extremely fine grain, high elasticity, and a hardness equal to that of the best quality of steel pocket-knife blades. The permanence, general utility, luster, and color of these blades are very remarkable.

AN ALLOY RIVAL OF STEEL

This alloy may be truly termed steel's first rival, since it constitutes the first metallic combination yet discovered, so far as the writer is aware, which takes and holds an edge at least equal to that of the best steel, and



ARTICLES MADE FROM STELLITE

at the same time it can be produced in almost any form in which steel is utilized. It is of course much more costly, owing to the high price of its constituents. This, however, does not preclude its use for the following articles: 1, table-knife blades; 2, pocket cutlery; 3, surgical instruments; 4, dental instruments; 5, small evaporating dishes; 6, spoons, forks and scissors. Lancets made of this hard alloy are now in use by many expert surgeons, and are proving highly satisfactory for this purpose, since they are immune to all antiseptic solutions employed in surgical work, and at the same time take a keen edge, equal to that of the best tool steel.

The first paper was read on the binary alloys of cobalt and chromium, before the American Chemical Society, in 1910, at San Francisco.

*Reprinted from "Metallurgical and Chemical Engineering."

†Kokomo, Indiana.

Later, the elements tungsten and molybdenum were introduced into this alloy, either of which increased its hardness to a remarkable degree. In fact, alloys of this character can be made so hard that they will scratch any steel yet produced.

NATURE AND PROPERTIES OF THE ALLOYS

Just what is the nature of these combinations has not yet been fully determined. They seem to consist, however, of a cement of the hard cobalt-chromium alloy, which binds together minute crystals, possibly composed of the double carbides of chromium and tungsten or chromium and molybdenum. The above is little more, however, than a conjecture, as no real proof of such an assertion has yet been made.

These alloys can be readily cast into various forms, and melt at a lower temperature than the binary alloys of cobalt and chromium. The most remarkable property of these triple alloys is their ability to retain a cutting edge at high temperatures, and it is for this reason that they excell all high-speed steels in their ability to perform rapid work on the lathe.

Lathe speeds which would instantly destroy the edge of the best high-speed steels can be readily maintained with stellite tools without injuring the cutting edge. This advantage is so pronounced that stellite is coming into very extensive use as a substitute for high-speed steel tools, notwithstanding its comparatively high price. Machine shop superintendents and production men generally are keenly alive to the fact that because other costs in the manufacture are so much greater than that of the tools, they are fully justified and save large sums of money on labor, equipment, floor space, and so forth by using highly efficient tools.

The following articles have been made from the hard alloys: lathe tools, milling cutters, saws, drawing dies, boring tools, drills, etc. These tools must be cast to the proper form, as they cannot be forged nor otherwise manipulated except by grinding. At first sight, it would seem desirable that the tools should be of such a nature that they could be tempered and forged, but a moment's reflection will render it evident that such a property would be detrimental, since in order that it might be forged, it would be necessary that it should soften under heat and would thus lose its most valuable property. The same would be to a certain extent true regarding tempering or hardening, since it is the inherent stability of the alloy at all temperatures which gives it its highly desirable qualities as a lathe tool.

At the instant of casting, and just as the metal is changing from the liquid to the solid state, minute crystals of extreme hardness are formed, and these crystals remain unchanged in their properties under practically any series of temperatures below the melting point of the alloy. Prolonged annealing does not soften it, and it is not hardened by heating it to a high degree and quenching in water. It does not take up carbon to any appreciable degree, even when surrounded by carbonaceous material in a closed vessel for days at a bright orange heat, say 1000° C. or more.

All of the polished alloys, when heated in an open fire, take on a thin film of oxide, which finally terminates in a deep blue-black color. This oxide is so firmly adherent that it absolutely prevents further oxidation of the metal, so that even though the sample may be

heated for days at this temperature, it will not show the slightest gain or loss.

Thus far, the lathe tools, surgeons' scalpels and dental instruments are the only forms of stellite which have been placed on the market. It is hoped, however, that other articles will soon be forthcoming. Among these will be table and pocket cutlery.

Table knives made of alloy have been in use for a period of six years, and show not the slightest tarnish. In fact, they retain their original flash and brilliance far better than any known alloy. The wear on these knives is remarkably slow. A teaspoon which was weighed before and after six months' use showed no weighable loss whatsoever. At the rate of wear after one year's service it seems certain that the spoon will last at least a thousand years and still be serviceable.

EFFECT OF ACIDS AND ALKALIS

All of the alloys are attacked by sulphuric, hydrochloric and hydrofluoric acids or by mixtures of the same. They are also attacked by the fused alkalis. As already stated, they change color at a dull red heat, but after once becoming coated with oxide, they undergo no further change and may be maintained for days at 1000° C. without loss or gain in weight. They are practically immune to all organic acids in solution, as well as to all antiseptic solutions, including bichloride of mercury, phosphoric acid, etc. They are likewise unaffected by solutions of the caustic alkalis, and are practically immune to nearly all neutral chemical solutions, including ammonium chloride, which so readily attacks iron and steel.

Table-knife blades made of the alloy remain brilliant and untarnished after years of service. The cutting edge of the table knife wears very well indeed, and from the experience already gained, a set of stellite knives will, if properly taken care of, last at least a generation for ordinary service.

The elastic limit of hammered stellite is not equal to that of tempered steel, but it sufficient for all ordinary requirements. In stiffness it is superior to steel and in fact to any other alloy or combination in practical use. Table-knife blades can therefore be made quite thin and still be stiff enough for practical purposes.

The Effects of High Temperature On Workers

According to Dr. J. A. Watkins in *The Iron Trade Review*, though the temperature of the body in health fluctuates somewhat during the day, it is maintained in rather narrow limits by regulation of the amount of body heat produced and the amount lost. The normal temperature of the body (about 98.5° F.) is an expression of the resulting balance between heat production and heat loss. The ill effects of high external temperature upon the body are the result of a disturbance of this state of equilibrium.

The loss of heat by the body is a physical process. It takes place principally by conduction and convection, by radiation and by evaporation. Without means by which the body heat could be lost as it is produced, the temperature of the body would soon rise to a degree at which bioplasm is destroyed and life must cease. When the loss of body heat is only partly prevented,

severe symptoms rapidly ensue. The rate of heat transfer, other conditions being equal, diminishes as the temperature of the air rises. The rate of heat loss by evaporation diminishes as the relative humidity increases. As a general effect of diminished heat loss, the temperature of the skin is raised; i. e., its specific radiating power is increased, which, besides aiding in evaporation, facilitates heat transfer. A decrease in the amount of heat lost by one means is compensated by an increase in the rate of that lost by another.

While, if the loss of body heat be prevented, severe symptoms rapidly ensue, it should be understood that the ill effects of a disturbance of the heat equilibrium do not become manifest solely in acute illness, such as heat stroke or heat exhaustion; but that the most common effect of chronic exposure to excessive heat is lower physical efficiency of the worker so exposed and diminished resistance to fatigue and disease. Workers exposed to heat hazard eventually drop out because of decreased working powers, poor health or some degenerative disease for which predisposition has been created by reason of the working conditions.

It is unusual, however, to find the heat hazard to which the worker has been exposed assigned its true rôle as the cause of this poor state of health. The conditions of heat and humidity in many working locations are such that it is a physiological impossibility for full bodily efficiency to be maintained, not only because of the attendant discomfort, but because the body encounters physical and physiological problems with which it was never constituted to cope continuously. Many of those who have been continuously employed on the so-called "hot jobs" will state to a visitor that they have become "used to" the conditions present. In most instances, however, casual observations of the physical condition or appearance of such persons is sufficient to show that their statements are made to impress the questioner who is much inconvenienced by the conditions present. In some instances limited adaptation apparently has taken place. This is probably a result of experience rather than the true physiological adaptation, for such exposed men soon learn to reduce the amount of physical exertion to a minimum, to dress to meet the conditions, and in some instances instinctively to alter their diet.

The effects of long-continued exposure to this hazard are slow and insidious and are evidenced in degenerative changes such as arthritic and muscular rheumatism, chronic skin disorders and arteriosclerosis. In addition, long-continued exposure to excessive heat will gradually but surely lower the general physical tone, even if no disease conditions become evident.

The effects of undue exposure of workers may be mitigated by preventing the heat from reaching the workers after it has been radiated. In order to minimize heat radiation, the source should be insulated. Clothing acts as an insulator and interferes both with heat transfer and evaporation of moisture because it is usually made of substances of feeble conductivity which entangle air in the mesh. Thus, if the conductivity of silver be taken as 493, that of wool or cotton is about 0.04 and that of air is 0.000288. Therefore, where high temperatures must be sustained, exposure of the body surface is indicated. This, however, cannot be carried out in working locations where

the abnormal conditions of temperature are due to radiant heat, as the workers are forced to wear additional clothing to avoid actual injury to the skin.

In practice it is found that by wearing clothing of a certain character, heat transfer is facilitated, for the clothes become wet with perspiration, and as water is a better conductor than air, a more rapid loss of body heat takes place. It has been shown experimentally that an arm inclosed in a calorimeter and wrapped in flannel will lose in an hour about 4.5 calories. If the flannel is wet, however, the loss is increased to 22.7 calories. In addition evaporation takes place as rapidly from the surface of the clothing if heated from the body as it will from the surface of the body itself. The type of clothing, therefore, indicated as of best service is thin, light and with good absorptive properties. Cotton clothing meets these requirements. However, the use of such garments adds a hazard, for the worker, after leaving his place of work in a hot and wet condition, cools off too rapidly, and symptoms of internal congestion and catarrhal conditions of the respiratory tract may ensue. Workers cannot be relied upon to take the necessary precautions to avoid the hazard. Woolen clothing, therefore, is better, as it does not allow too rapid cooling.

Since so much body water is lost under conditions which provoke free perspiration, it is important that an ample amount of water be drunk to replenish the tissues thus deprived of their normal water content. Without this, their proper functions will be hampered, and health and efficiency cannot be expected. The worker should be furnished an abundant supply of water, together with drinking facilities which are clean, attractive and placed so as to be conveniently accessible at all times. The water should never be below 55° F. in temperature, as the drinking of cold water is likely to cause gastro-intestinal disorders. The jet sanitary fountain is the best drinking facility. Though under ordinary conditions the amount of heat lost in bringing the temperature of water up to that of the body is small, this amount, by judicious drinking, can be increased. Water should be drunk in small quantities and at frequent intervals.

The amount of heat generated by the body may be diminished by, first, reducing the amount of physical work, and, second, by regulation of the diet. With the invention of new machinery and the introduction of many labor-saving devices, much physical work has been done away with, as, for example, by mechanical stoking devices. There is still, however, much work of a laborious character to be done. Such activities produce a great deal of body heat. Thus it has been shown that a soldier weighing 154 lb. while at rest produces 1.3 calories per minute, but while he marches with a load of 68 lb., he produces 7.8 calories per minute. This amount of heat is sufficient to raise the body temperature 1° in less than nine minutes. Workers, therefore, exposed to abnormally high temperature or humidities should not be required to perform much physical work in the aggregate. It is worthy of note that by means of diet the rate of heat production has been experimentally increased by 44%. Where work must be performed under heat conditions, the intake of meats and fats should be reduced and the consumption of starches, fruits and green vegetables increased.

Salt Deposits of Death Valley, California



ROUGH SALT AREA AT EASTERN EDGE OF DEATH VALLEY, SHOWING TALUS SLOPES IN BACKGROUND



RECENT TERRACES NORTHWEST OF BENNETTS WELLS, WEST SIDE OF DEATH VALLEY



VIEW NEAR EASTERN EDGE OF SMOOTH SALT AREA, DEATH VALLEY



LOOKING NORTH IN DEATH VALLEY, SHOWING ROUGH SALT AREA EAST OF BENNETTS WELLS

Annual Meeting of the New York Section, American Institute of Mining Engineers.

THE annual meeting of the New York section of the A.I.M.E. was held in New York on May 23, 1918. Minor changes were made in the bylaws, and the following officers were elected for 1918: Chairman, A. H. Rogers; vice chairmen, Forest Rutherford, H. C. Parmelee; treasurer, Frederick T. Rubidge; members of executive committee, J. E. Johnson, Jr. and P. G. Spilsbury.

The meeting was a symposium on the iron-ore resources of the world in relation to national economic conditions after the war. The chairman, J. E. Johnson, Jr., in introducing the speaker, commented upon the importance of iron and steel in relation to war activities. E. C. Harder, Waldemar Lindgren, C. M. Weld, A. C. Spencer, H. Foster Bain and Sidney Paige addressed the members present on different phases of the subject.

THE BRAZILIAN IRON SITUATION

E. C. Harder, of the University of Minnesota, presented a paper on the Brazilian iron situation. His remarks are here summarized:

That Brazilian iron ores would now be offered in European and American markets had not the necessary capital been diverted for war purposes is not to be questioned. It is considered equally certain that they will be a prominent factor in the reconstruction of Europe. The Brazilian iron-ore field takes rank among the five great iron-ore districts of the world, the others being the Lake Superior district of the United States, the Lorraine ore field of Northern France and Southern Germany, the Northern Sweden deposits and the ore fields of Oriente, Cuba. The Brazilian field is the greatest known undeveloped iron-ore district in the world, and its aggregate tonnage is variously appraised by estimates running up to three and a half billion tons. The largest deposit contains at least five hundred million tons, and deposits containing from ten to fifty million tons are numerous.

The iron-ore district is about 100 miles square and is in the State of Minas Geraes, its center being about 250 miles north of Rio de Janeiro, with which city it is connected by the Central of Brazil Ry. A new railroad, the Victoria a' Minas, designed for ore transportation, is now under construction from Victoria.

Two types of ore occur. The more important interbedded variety gives a high-grade hard ore averaging 69% iron, low silica, and less than 0.02% phosphorus, and a low-grade soft ore averaging 60 to 68% iron, depending upon the amount of silica, and from 0.01 to 0.07% phosphorus. The other type is a product of weathering and is of lower grade, but ranges up to 65% iron and a phosphorous content of from 0.1 to 0.3 per cent.

Previous to 1910 practically all these deposits had been owned by Brazilians, but soon after that date they gained publicity and were rapidly acquired by English, American, French and German interests. The English and American holdings are more important and include practically all of the deposits which will derive benefit from the new railroad. The German and French interests are tributary to the old railroad, which is scarcely able to handle its present manganese business.

It is still questionable as to just what use these ores will be put. Brazil itself does not at present offer a market and possesses no coal deposits suitable for iron manufacture. This lack of coal has been the great factor in retarding the development of the iron deposits; it necessitates exporting this great national resource of Brazil, which

fact has caused the Brazilian government much concern, but is now accepted as inevitable.

England has imported annually during the last few years about 4,500,000 tons of iron ore from Spain, about 1,000,000 tons from Northern Africa and about 800,000 tons from Scandinavia. It is hoped that the Brazilian output may eventually reach 10,000,000 tons annually, which will be sufficient to supply England's demands for foreign ores and leave a surplus for the United States and for other countries.

In the United States the Brazilian ores will probably be found to be a very desirable furnace mixture for low-grade ores and for more refractory ores. They will doubtless also be used in the bessemer furnaces to replace the gradually decreasing supply of domestic bessemer ores.

The great fleet that will be necessary to carry the iron ore to the United States and Europe will be used to carry return cargoes to Brazil. This will offer cheap transportation for such products as coal, iron and steel manufactured articles and cement. It will aid greatly in the industrial development of the country, and perhaps eventually it may be possible to operate small iron and steel plants in Brazil at a profit to supply the domestic needs of iron and steel products.

SWEDISH IRON-ORE DEPOSITS

Dr. Lindgren discussed the Swedish and Norwegian iron-ore deposits. He stated that the deposits in the central part of Sweden were divided into three groups. The first group consisted of high-grade magnetites imbedded as lenses in limestones and dolomites. There are small quantities of these ores, and they are of no importance for export. They are used in Sweden in the production of high-grade iron. Associated with the magnetites are banded hematites, which are also of only local interest. The apatite iron ores of Central Sweden are of importance, as the reserves amount to 100,000,000 tons and a considerable exportation of them is carried on. The total reserves of Central Sweden amount to 122,000,000 metric tons. These deposits are of minor importance to the world as a whole.

The Lapland deposits in Northern Sweden, at Gellivara, were stated to be of the greatest importance, as the ore reserves total 1,150,000,000 metric tons and are concentrated in a comparatively few large deposits. The iron ores are rich in phosphorus, only a small proportion being as low as 0.05% phosphorus. The bulk of the ores average 58% iron and from 1.5 to 3% phosphorus. The deposits are opened by a railroad which extends from the Baltic to the Arctic Ocean, and, while the severe climatic conditions interfere with operations, a production of 7,000,000 tons per annum was made, according to the last reports. Under pre-war conditions one-third of this ore was shipped to England and two-thirds to Germany. The iron ores of Norway are of less importance and total 280,000,000 metric tons. As much of this ore is low grade, its exploitation is dependent upon the success of concentration methods.

A description of the Cuban iron-ore deposits was given by C. M. Weld. He estimated the total reserves at three billion tons. The ores are underlain by serpentine and are lateritic in origin. They form surface blankets of great extent, averaging from 15 to 25 ft.

and ranging from 1 to 70 ft. in thickness. There is no overburden. The ore is high in hygroscopic and combined water, the total of water reaching 35%. The phosphorus content is below 0.02% and the ores contain 0.5 to 1% nickel and 1.5% chromium. The steel made from the ore has valuable properties. The deposits are of first importance.

CHINESE IRON-ORE DEPOSITS

The iron-ore deposits of China were briefly reviewed by H. Foster Bain, of the U. S. Bureau of Mines. Mr. Bain made the following statement:

While it is still too early to make complete estimates of China's resources, enough is known to warrant approximate figures. Stated in the briefest terms, the approximate probable tonnage of the known deposits suitable for modern uses is 402,000,000. Of this the Chinese government retains title to about one-third, Chinese companies claim somewhat less than one-third, and Japanese or Sino-Japanese companies have over one-third. These estimates do not include all of the iron ore, as doubtless there are deposits still to be discovered, and in the smaller bodies suitable only for native furnaces or far in the interiors there is not probably 300,000,000 tons additional. The figures first given do, however, cover virtually all the iron ore in China which needs to be taken into account in planning a modern industry.

Dr. Bain described five types of deposits—ancient banded ores, sedimentary carbonates and hematites, sedimentary oolites, contact deposits and residual deposits.

IRON ORES OF CONTINENTAL EUROPE AND NORTHERN AFRICA

An interesting set of charts was discussed by A. C. Spencer, of the U. S. Geological Survey. These charts showed the rate of increase in the production of iron and steel by the Allied countries (then England, France and Italy), France, the United States, England and Germany for the period from 1893 to 1913. Mr. Spencer gave the following figures for the reserves: Continental France, not including Alsace-Lorraine, 2,000,000,000; Spain and Portugal, 730,000,000; Austria-Hungary, 200,000,000 to 300,000,000; Greece, 100,000,000; Algeria, 150,000,000. The quantities named are in metric tons.

The importance of the iron-ore deposits of Alsace-Lorraine was discussed by Dr. Sidney Paige, of the U. S. Geological Survey, and this closed the interesting and important meeting.

Potash Production in Chile

The consul general at Valparaiso reports that *El Mercurio*, of that city, recently published an interview with Roberto Nordenflycht, a Chilean chemical engineer, who has been studying the question of the recovery of potash from the nitrate deposits in the north of Chile. Mr. Nordenflycht was quoted as saying that his experiments with the nitrate mined by 37 "oficinas" showed an average of available potash of 1.73%. He estimates that at least 30,000 tons of potash are contained in the 3,000,000 tons of nitrate of soda exported yearly from Chile, and that by a proper method of extraction for potash, both from the refined nitrate and from the wastage in refining, over 300,000 tons of potash could be recovered.

Some of the first economically successful experiments in the recovery of potash were carried out by the "oficina Delaware" of the Du Pont Nitrate Co. The most successful process of extraction has been by means of refrigeration, and the cost of extraction is said to be from 20 to 30 centavos (about 5 to 7½ c.) per kilo (2.2046 pounds).

Production of Aluminum Salts in 1917

The output of aluminum salts in the United States in 1917 was 198,452 short tons, which is a decrease of 28% from the quantity made in 1916, as reported by the U. S. Geological Survey. The production of alum decreased considerably, but the production of aluminum sulphate increased. The price of these chemicals shows a considerable increase, the average price of all alum sold in 1917 being \$51.60 a short ton and that of aluminum sulphate \$32.15 a short ton.

Foreign Trade in Lead and Zinc

Lead imports in February, March and the first three months of 1918 are reported by the Department of Commerce as follows:

Articles and Countries	February, Contents, Lb.	March, Contents, Lb.	Jan.-Mar. Contents, Lb.
Lead Ore:			
Canada.....	1,205,828	2,084,554	4,142,927
Mexico.....	1,155,459	1,078,412	3,576,204
Others.....		753	753
Chile.....		427,787	427,787
British South Africa.....		3,311,510	3,311,510
Totals.....	2,361,267	6,903,016	11,459,181
Lead—Base Bullion and Bullion:			
Peru.....			5,086
Mexico.....	7,208,437	14,340,440	37,120,479
Totals.....	7,208,437	14,340,440	37,125,565
Lead—Pigs, Bars, Etc.:			
Panama.....		20,232	28,332
Canada.....	1,350,514	478,605	4,434,753
Guatemala.....		1,950	5,624
Mexico.....	1,128,745	560,217	4,286,730
Others.....	40		340
Totals.....	2,479,299	1,061,004	8,755,779

The gross weight of lead ore imported in March was 12,416 long tons.

The actual tonnage of zinc ore imported in March amounted to 6144 long tons. The countries of origin and the metal contents were as follows:

Countries:	February, Contents, Lb.	March, Contents, Lb.	Jan.-Mar. Contents, Lb.
Canada.....	1,092,000	992,380	3,123,046
Chile.....	2,297,316		2,297,316
Mexico.....	6,239,977	3,808,956	13,722,367
Totals.....	9,629,293	4,801,336	19,142,729
Zinc in Blocks, Pigs, Etc.:			
Costa Rica.....	2,730		3,408
Japan.....			22,630
Cuba.....		1,403	9,933
French Oceania.....	2,671		2,671
Panama.....		2,968	3,168
Others.....	740		1,356
Totals.....	6,141	4,371	43,166

Exports of lead and zinc were as follows:

	February, Contents, Lb.	March, Contents, Lb.	Jan.-Mar. Contents, Lb.
Lead:			
Pigs, bars, etc., produced from domestic ore.....	10,436,237	16,363,220	35,811,583
Pigs, bars, etc., produced from foreign ore.....	10,200,170	1,998,566	18,409,449
Zinc:			
Pigs, etc., produced from domestic ore.....	5,320,616	12,875,541	37,275,086
Pigs, etc., produced from foreign ore.....	1,421,741	4,072,900	13,826,388
Sheets, etc.....	1,130,287	1,831,980	4,729,529

Imports of zinc dust in March amounted to 11,200 lb. from Japan. Total for the first three months was 11,846 pounds.

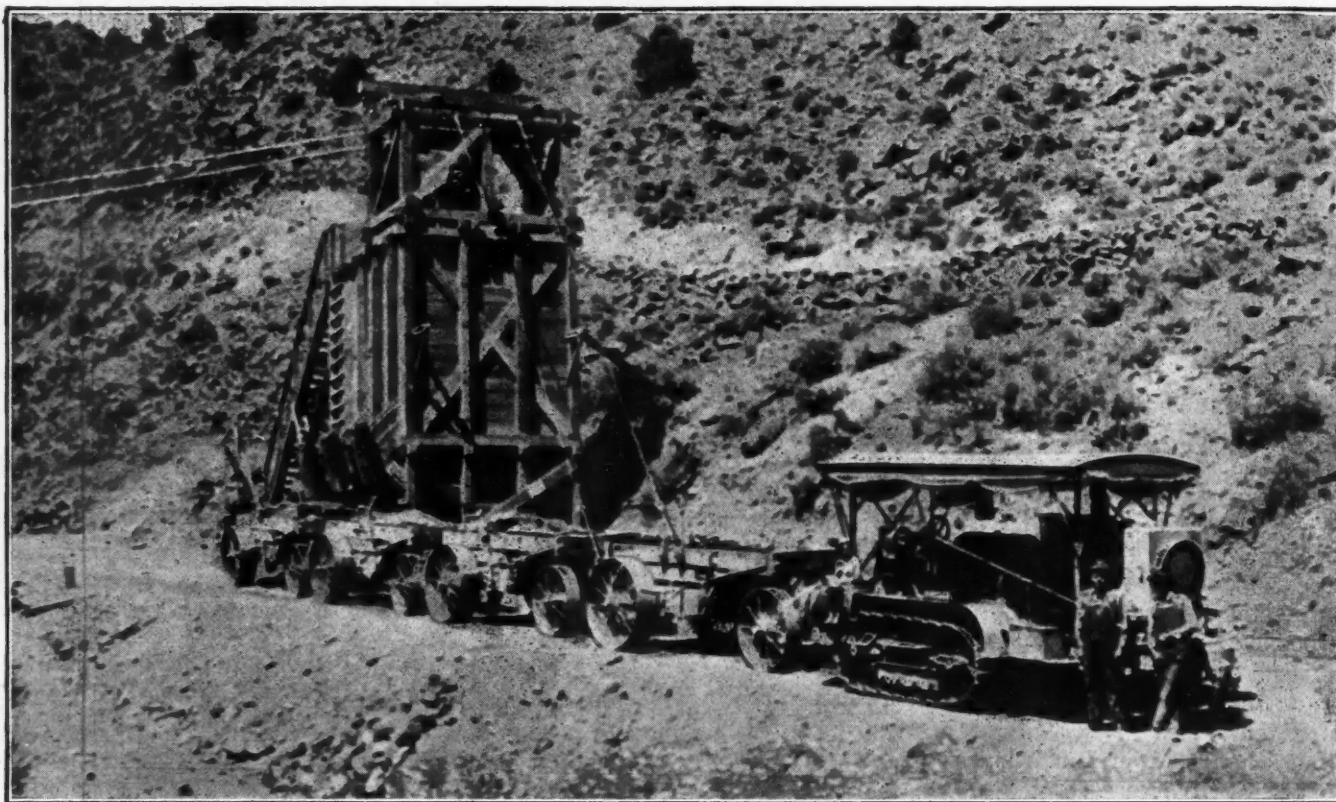
The Versatile Tractor

By H. A. MORRISON*

Current discussion of "tank" activities calls to mind an unusual job successfully handled by two Holt "75" tractors at the Silver Dike Tungsten Mine, near Sodaville, Nev. The mine was equipped with a jig-back wire-rope tramway, which conveyed ore from the mine bins to the tractor-train loading bin, 2000 ft. below. Holt 75 hp. caterpillar engines were used to haul the ore trains from the lower terminal bin to the mills at Sodaville. A normal load was 30 tons, as the train was composed of six 5-ton trailers.

The standing ropes of the tramway were 1½-in. cables, 2000 ft. long, and one cold afternoon the anchor bolt of the south cable failed at the upper end, the cable slacking and finally coming to rest in the canyon several hundred feet away. Fortunately no one was

new anchor bolt. The bolt had been wedged in place and a 1:1 concrete poured around it to entirely fill the remaining space in the drill hole and in the recess under the anchor block. This part of the work had all been completed at 2 o'clock in the afternoon of the day following the accident, and by that time the two tractors had arrived at the lower terminal and were viciously shooting up black smoke rings. Both "cats" were backed into position on the road below the lower anchor block and chained in tandem so that they could pull as one unit. The pulling cable attached to the lower end of the main cable was then made fast to the rear tractor, and a man stationed at a high point midway between terminals gave the signal to pull. The two tractors settled down to the work most cheerfully, and hauled the slack cable back to proper tension in ship-shape condition. The turn-buckle was adjusted and tightened until it took the strain, and the job was finished.



HOLT CATERPILLAR TRACTORS HAUL ORE IN TRAILERS FROM THE TERMINAL BINS OF A WIRE-ROPE TRAMWAY TO THE RAILROAD AT SODAVILLE, NEVADA

injured and no great damage was done. However, quick work was imperative, or the mills would be down in 48 hours for lack of ore.

First, a 2½-in. hole was drilled through the upper concrete anchor block and a new 2½-in. anchor bolt fitted with a heavy washer and nut at the lower end was prepared. While this was being done a spare piece of 1½-in. cable, 500 ft. long, was attached to the lower end of the fallen rope with clips and by releasing the turn-buckle proper allowance for slack necessary to draw the cable back to the upper anchor bolt was made. A length of ½-in. cable was then made fast to the upper end of the fallen cable, and, by means of a horse-driven winch, the heavy cable was dragged back up the mountain side and permanently secured to the

*Goldfield, Nevada.

The tramway was operating at normal speed and tonnage in less than 24 hours after the breakdown occurred, no time having been lost at the mills. In this emergency, the loyal and efficient team-work of the mine crew must be recognized, but the tractors made it possible.

Bauxite Produced in Georgia in 1917

In 1917 the Georgia bauxite mines increased their production of 1916 by 31%, to a total of approximately 52,000 long tons, according to the U. S. Geological Survey, in cooperation with the Georgia State Geological Survey. Mines near Gordon, McIntyre, and Toombsboro, Wilkinson County, produced the most bauxite, and yielded 37,000 long tons.

Company Reports

Anaconda Copper Mining Co.

The report of the Anaconda Copper Mining Co. for the calendar year 1917 shows a total operating revenue of \$156,205,156.76, which exceeded the operating expense by \$37,498,379.77. Income from other sources was \$2,749,083.47. After charging off \$5,913,711.47 for depreciation and interest, the net profit for the year was \$34,333,751.77, bringing the surplus to \$82,729,614.30. Of this amount, \$19,815,625 was paid in dividends, leaving an undivided surplus on Dec. 31 of \$62,913,989.30.

The company's mines during the year produced 4,193,624.13 tons of ore and 10,011.83 tons of precipitate, totaling 4,203,635.96 tons, of which 3,906,901 tons was treated at the company's reduction works, chiefly at Anaconda. In addition, 449,513 tons of ore from other companies was treated at the reduction works. The total production of the copper plants at Anaconda and Great Falls was 253,508,332 lb. of fine copper; 9,031,025.78 oz. of silver and 58,545.604 oz. of gold. Of this, the bulk of the copper and silver and all of the gold came from mines of the company. The electrolytic copper refinery at Great Falls produced 141,517,768 lb. of cathodes, of which 9,427,854 lb. was shipped to the Raritan Copper Works for melting. The copper leaching plant at Anaconda treated during the year 598,370.16 tons of tailings, producing therefrom 5019.67 tons of cement copper.

The zinc plants at Anaconda and Great Falls treated 326,479.14 tons of ore and other zinkiferous material, of which 257,849.93 tons came from mines of the company. The Great Falls plant, which was completed during the year, produced 50,624,524 lb. of electrolytic zinc. A bag house for collecting lead fume was also completed.

Development work in the mines of the company during the year totaled 34.61 miles of drifts, crosscuts, winzes and raises, against 42.06 miles in 1916. Shafts were deepened a total of 2809 feet.

The principal construction at Anaconda was the building of an additional 50-ton acid plant, which was started in July. Work was also begun on a new stack and Cottrell treater system, as well as on a new reverberatory for smelting the Cottrell flue dust. No. 2 brick plant was enlarged, to furnish brick for the stack, bricks being made from flotation tails. Work is progressing satisfactorily on a rod and wire mill capable of rolling 100 tons and of drawing 80 tons of copper per day to market specifications.

The coal mines of the company in Wyoming and Montana produced 1,054,510.90 tons of coal, of which 436,739.75 tons was sold commercially. The sawmills cut 87,330,500 ft. of lumber and purchased 16,476,014 ft., of which 57,205,887 ft. was shipped to the company's mines, 50,534,133 ft. was sold commercially, and 1,455,703 ft. was used at the mills for repairs and construction. The tonnage carried by the Butte, Anaconda & Pacific Ry. was 6,800,161.

Of the company's subsidiary corporations, the International Smelting Co., at Tooele, Utah, produced during the year 17,385,090 lb. of fine copper, 84,726,315 lb. of fine lead, 4,439,290.33 oz. of silver, and 31,495.23 oz. of gold. The copper smeltery at Miami, Ariz., produced 138,762,411 lb. of fine copper, 201,859.51 oz. of silver and 2953.64 oz. of gold. The International Lead Refining Co. at East Chicago, Ind., produced 117,922,724 lb. of common and corroding lead, 11,525,365 lb. of antimonial lead, 5,259,738.1 oz. of silver, and 24,672.62 oz. of gold. The Raritan Copper Works at Perth Amboy, N. J., produced 411,933,742 lb. of fine copper, 19,938,375.48 oz. of silver, and 137,465.11 oz. of gold. The Emma mine, leased from the Butte Copper and Zinc Co., produced 42,248.46 tons of zinc ore, which was concentrated at Anaconda and reduced at Great Falls. Satisfactory test shipments of hitherto worthless rhodochrosite ore were made from this property to Eastern steel plants.

Of the company's South American properties, that of the Andes Copper Mining Co. was put in such condition, as far as possible, as will enable the company to complete the construction of its mining and metallurgical works with the utmost expedition upon the resumption of normal conditions. Sixteen drill holes were finished, totaling 12,000 ft., showing an addition to previously developed ore of 5,434,081 tons, averaging 1.5411% Cu. Work on the Lo Aguirre mines of the Santiago Mining Co., which was begun in March, 1914, had developed more than 6,000,000 tons of ore by the summer of 1917, averaging 1.75 to 3.5% Cu, the average of all tunnel samples being about 2.44% Cu. Development work on the Africana property has shown ore running from 4½ to 9% Cu, desirable for its excess sulphur content.

Butte & Superior Mining Co.

The annual report of the Butte & Superior Mining Co. for the calendar year 1917 shows an operating income for the year of \$6,716,437.14. Operating expenses were \$4,368,941.26, leaving a gross profit on operations of \$2,347,495.88. After reserving \$1,941,129.66 for depreciation and depletion, the net profit was \$406,366.22. Other income brought the total to \$509,557.25. The reserve for excess profits and income taxes, etc., was \$236,646.72, leaving a net income of \$272,910.53, compared with \$6,365,398.61 in 1916. The dividends paid, \$5.40 a share, amounted to \$1,567,057.09, or approximately \$1,300,000 more than the net earnings for the year. A Red Cross dividend of 40c. per share is included in the total. A capital distribution of \$1.25 per share was also made. The undivided surplus on Dec. 31, 1917, was \$651,721.15.

The total tonnage of ore mined during the year was 462,744, against 626,803 tons in 1916, the decrease being due to disturbances and interruptions in operation. The average mining cost was \$5.15 per ton, exclusive of

taxes. Development work during the year included 9160 ft. of drifts, 4466 ft. of crosscuts, 3030 ft. of raises, 350 ft. of stations and 724 ft. of shaft. Estimate of ore reserves as of Dec. 31 showed 1,059,200 tons, averaging 17.6% zinc and 5.9 oz. of silver per ton.

The total ore milled for the year was 461,953 tons, averaging 15.47% zinc and 5.80 oz. of silver. Recoveries averaged 91.13% of the zinc. The direct cost of milling was \$2.52 per ton of ore, which was 36% higher than in the previous year. Zinc concentrates produced amounted to 138,661 tons and lead concentrates totaled 2543 tons.

The ore mined during the year averaged .00908 oz. gold; 5.8003 oz. silver; 0.1717% copper; 1.0913% lead; and 15.4692% zinc. The average assay of zinc concentrates shipped was .0277 oz. gold; 17.8348 oz. silver; .4705% copper; 3.3498% lead and 47.3636% zinc. The lead concentrates assayed on an average .0296 oz. gold, 21.362 oz. silver; .2917% copper; 35.56% lead; and 13.754% zinc.

The important features of the year were the readjustment of flotation practice to conform with the findings of the Supreme Court in the Hyde case and the interruptions to operations because of labor troubles.

Shannon Copper Co.

The report of the Shannon Copper Co. for the calendar year 1917 covers an actual production period of about seven months, operation having been either wholly or partly suspended during the rest of the year because of labor troubles. It covers expenses for the full year, however.

The income for the period of operation was \$1,824,947.18, and operating expenses were \$1,536,401.28, which, with added interest, made the total income \$312,294.90. Expenses during the strike were \$127,327.19, leaving net profit for the year of \$184,967.71. The surplus balance was thus brought to \$1,337,771.43. From this \$161,455.10 was set aside for depreciation, depletion and outside exploration work. Four dividends, aggregating \$525,000, were paid during the year, three of 50c. each and one of 25c. per share.

During the period of operation, 157,000 tons of ore from company properties was mined and treated, as well as 13,800 tons of custom ore, a total of 171,000 tons, from which was produced 6,138,219 lb. of copper, 1,096.21 oz. of gold, and 51,771.35 oz. of silver.

Phelps Dodge Corporation

Total metal production from the ores of the Phelps Dodge Corporation in 1917 amounted to 153,974,692 lb. of copper, 8,136,356 lb. of lead, 1,524,632 oz. of silver, and 24,423 oz. of gold. In addition, ores were purchased or smelted on toll at reduction works which yielded 51,907,525 lb. of copper, 946,921 oz. of silver, and 10,957 oz. of gold. The following is a summary of finances for the year: Gross income, \$62,262,185.72; operating expenses, \$39,805,279.40; net income, \$22,456,906.32. Dividends paid amounted to \$10,800,000 and depletion charges, \$5,516,526.67, leaving a balance of \$6,140,379.65.

The Copper Queen Branch reports the following production of metals from its mines in 1917: Gold, 19,156

oz.; silver, 828,665 oz.; copper, 93,618,409 lb.; and lead, 6,870,128 lb. This is a reduction from last year's product, but is attributed to the fact that local labor troubles necessitated complete suspension of operations for four months. At the reduction works, a total of 1,276,817 tons was charged. Silver and copper content of this tonnage showed an increase over that in 1916, and though labor troubles at the mine curtailed the ore output, the large production was made possible by stocks on hand at the smeltery and increased shipments of custom ore. Exploration and development work at limestone mines totaled 58,518 ft. Fire-doors, operated by compressed air and closed from surface or stations, were installed, in addition to sprinkling systems in some of the shafts. Stripping operations, begun in January, 1917, at Sacramento Hill, removed 290,771 cu.yds. of waste during the year. Average number of men employed during 1917: Mine department, 2264; reduction works, 1485; and hospital, 24. Four fatal accidents occurred, one in the smeltery and three in the mining department. Compensation paid for accidents amounted to \$80,019.53.

Total production of ore at the Morenci branch amounted to 333,264 tons of copper ore, which yielded 13,203,401 lb. of metal. Mines and plants were operated only about seven and a half months during the year, owing to strikes. At the concentrator, 312,224 tons of ore were treated and produced 46,047 tons of concentrates assaying an average of 11.201% copper. The blast furnace smelted 118,596 tons of charge during the year. Average number of employees: Mining, 822; concentrating, 120; smelting and converting, 107; mechanical 89, and miscellaneous, 54.

The net production of ore from the Burro Mountain branch amounted to 58,469 tons of concentrates, precipitates, and lease ore, and yielded 14,253,391 lb. of copper and 39,404 oz. of silver. Ore mined and delivered to concentrator was 473,443 tons, having an assay value of 1.972% copper. Mining costs per ton decreased, but the grade dropped from 2.117% in 1916. Considerable drilling was done in 1917; a total of 30,542 ft. Leaching operations on the old ore dump at No. 2 shaft yielded about 280,090 lb. of copper. Average number of men employed was 928.

The Copper Basin mine shipped 17,299 dry tons of ore, containing 934,781 lb. of copper. Development and prospective work amounted to 1250 ft. On the Senator group, 600 ft. of new openings was driven, and 800 ft. of the Snoozer Tunnel was cleaned out and repaired preparatory to mining.

The coal mining branch of the Phelps Dodge Corporation in 1917 produced 1,406,079 tons of coal. Coke produced amounted to 306,455 tons, an increase of 5918 tons over 1916. Labor conditions were satisfactory, excepting for the shortage which existed throughout the country.

Total ore production from the mines of the Mochtezuma Copper Co. amounted to 330,897,858 lb., and this yielded 40,196,264 lb. of copper, 2677 oz. of gold, 538,826 oz. of silver, and 35,630 lb. molybdenum. Mining costs show an increase over previous years, due to the increase in development work, higher costs of labor and supplies, high exchange rate of Mexican money, and the general inefficiency of Mexican labor. Ore milled

at the concentrator amounted to 750,897 tons, averaging 3.179% copper.

Development work at the Bunker Hill mine was 11,598 ft. A total of 69,418 tons of ore was mined, and at the mill 16,075 tons of gold-silver-lead ores were treated, and 28,672 tons of manganese ore. Gross sales and transfers of the Phelps Dodge Mercantile Co. in 1917 amounted to \$9,789,638.67, and resulted in a net profit of 8.42% to the company. An average of 620 employees was employed at the various stores and in the general office.

Annual Report of the Alaska Gold Mines Co.

The sixth annual report of the Alaska Gold Mines Co. for the year ended Dec. 31, 1917, shows a net addition to surplus of \$270,721 from a gross production revenue of \$2,009,631 and a miscellaneous income of \$12,071. In 1917 the company acquired \$299,920 par value of the Alaska Gastineau Mining Co.'s stock, and since the end of 1917 additional stock of the par value of \$12,500, making the total holdings \$11,756,100 par value out of a total issue of \$12,000,000. During 1917 there were no changes in the holdings of the Alaska Gastineau Co.'s bonds.

Detailed comparison of 1917 and 1916 operating costs per ton of the Alaska Gastineau Mining Co. shows an increase of \$0.02345, as detailed in Table I, of which \$0.01178 represents an extraordinary expense incident to a severe snow-slide. Table II gives comparative

TABLE I. ALASKA GASTINEAU MINING CO.'S OPERATING COSTS PER TON

	1917	1916	Increase	Decrease
Mining:				
Breaking	\$0.31130	\$0.29324	\$0.01806	
Tramming	.07607	.06445	.01162	
Transportation	.03548	.02643	.00905	
Milling:				
Coarse crushing	.02904	.02292	.00612	
Fine crushing	.09617	.10626		\$0.01009
Concentrating and retreatment	.05271	.05887		.00616
General mill expense	.08234	.08076	.00158	
Shipping and smelting charges:				
Bullion	.00639	.00676		.00037
Concentrates	.02883	.02621	.00262	
Administration and general expense	.04528	.06604		.02076
Total	\$0.76361	\$0.75194	\$0.01167	
Add extraordinary expense (snow-slide)	.01178		.01178	
Total expense	\$0.77539	\$0.75194	\$0.02345	
Less miscellaneous profits through operation	.0052	.01954		.01433
Net cost of operation per ton	\$0.77018	\$0.73240	\$0.03778	
Net profit from operations per ton	\$0.12684	\$0.23828		\$0.11144

analysis of production and operating costs for both years on the basis of the consolidated profit and loss of the Alaska Gold Mines and Alaska Gastineau companies, which involves a slight additional cost, chargeable to administration and general expense.

A record output was milled in 1917, amounting to 2,240,346 dry tons, and although this output amounted to 347,558 tons more than in 1916, the average grade of mill heads had a gold value of \$0.0906 per ton less. The mill extraction, however, was only 0.01% lower, notwithstanding the lower-grade ore, and the average value in mill tails was decreased by a gold value of \$0.0159 per ton. The mill operated 352 days, with a daily average of 6350 tons.

Production was seriously curtailed after the United States entered the war, on account of scarcity of labor

resulting from conscription, voluntary enlistment and the attraction of the higher-wage copper camps. In 1917, ore broken in stopes amounted to 1,092,534 tons, as against 2,634,912 tons in 1916. A resurvey of the broken reserves at the end of 1917 showed that as a result of caving pillars the actual broken reserve amounted to 2,357,588 tons, as against a book record of only 991,420 tons, indicating an addition of 1,366,168

TABLE II. COMPARATIVE PRODUCTION AND COST DATA PER TON, ALASKA GOLD MINES CO.

	1917	1916
Production		
Ore milled, dry tons	2,240,346	1,892,788
Mill heads, value per ton	\$1.103	\$1.193
Mill tails, value per ton	.2061	.222
Mill extraction, per cent.	81.32	81.33
Recovery, per ton	\$0.89702	\$0.97068
Expenses, per ton:		
Mining	\$0.42285	\$0.38412
Milling	.26026	.26881
Shipping and smelting charges	.03522	.03297
Administration and general expenses	.05141	.12978
Total operating cost per ton	\$0.76974	\$0.81568
Mining profit per ton	\$0.12728	\$0.15500
Miscellaneous income per ton	\$0.00539	\$0.01965
Less extraordinary expense	.01178	
Total	\$0.00639	\$0.01965
Total operating profit (before depreciation)	\$0.12089	\$0.1746

tons without the cost of breaking. During the year there was a total development of 15,472 ft. of drifts, crosscuts and raises and 12,754 ft. of diamond-drill holes, but no new orebodies of special consequence were discovered. It is estimated on the basis of results obtained from various operations, that on Dec. 31, 1917, there was approximately 9,000,000 tons of ore available for milling, of an average value of about \$1.06 per ton in gold.

No new construction work was undertaken during the year, although a small amount of equipment, such as storage battery locomotives, cars for the main railroad and vanners for the re-treatment plant, were added. All improvements were charged to operations, and amounted to approximately 3c. per ton. An interesting feature of the report is a comparison of the increase in costs of 1917 with 1916 and with pre-war conditions. The report states that the average wage of men on the payroll was about 7% greater for the year 1917 than 1916, and the actual average increase in cost of all supplies used amounted to 25.05%, as compared with 1916 and 42.66% as compared with 1915. The operating cost per ton, however, showed a decided improvement over previous years, but was largely due to an increased tonnage, of which a large percentage was drawn from broken reserves, and to perfections in organization and direct operation. A careful calculation of the actual increase of labor, materials and transportation costs over pre-war times shows that under normal conditions 1917 operating costs would have resulted in a decrease of not less than 15c. per ton.

The mine is in a condition to furnish a maximum tonnage of ore whenever the necessary labor is available. The milling plant has shown a capacity of not less than 10,000 tons per day, and the transportation system, both underground and from the mine to the mill, is in a position to supply this tonnage. The metallurgical results obtained have been excellent, showing improvement in practically every department, with a decrease in grade of tailings, maintenance of extraction and a minimum cost per ton.

Events and Economics of the War

With over \$146,000,000 obtained, the Red Cross campaign closed on May 27, after achieving a great success. A new plan of railroad control was announced by Director General McAdoo under which a Federal manager, reporting only to the regional director of the Railroad Administration, will have direct charge of each road, thus supplanting the president thereof as operating head. The recommendations of the Railroad Wage Commission were approved, after some revision, and ordered into effect by Mr. McAdoo, who also named a board of six experts to correct any injustices that may be involved in the wage increase of over \$325,000,000 awarded to railway employees; increases in freight charges of 25% and of passenger fares to 3c. per mile were ordered by Mr. McAdoo, effective in June. A new tax bill striking excess profits, incomes and luxuries was urged by the President on Congress. In an amendment to the Army bill, the President was authorized to draft as many men from year to year as can be equipped, trained and used during each fiscal year until the end of the war. All registered in the draft must fight or else engage in essential work, Provost Marshal General Crowder has ordered. The British troopship "Moldavia" carrying American troops, was torpedoed on May 23 with the loss of 57 lives.

Abroad, the Germans, renewing their offensive on May 27, stormed the Chemin-des-Dames ridge in an attack extending from opposite Soissons to Rheims and after crossing the Aisne captured Fismes on the Vesle, taking 15,000 prisoners; a simultaneous attack in Flanders southwest of Ypres gained no result. American troops captured Cantigny, on the Picardy front. Costa Rica declared war upon the Central Powers on May 24.

Fuel Administration Plans Fuel Saving In Power Plants

The U. S. Fuel Administration has announced the appointment of Thomas R. Brown, of Pittsburgh, as administrative engineer for the Pittsburgh district, and C. P. Billings as special staff assistant. These appointments were made as a preliminary step toward putting in operation a general plan for fuel conservation in power plants. This plan is the result of conferences with the Federal fuel administrators and their committees for the group of states which together consume about 70% of all the coal used in the United States, exclusive of railroads. The plan has received the indorsement of the fuel administrators of all these states, as well as approval of the U. S. Bureau of Mines and a committee representing the engineering council of the four national engineering societies.

The slogan of the campaign is "Maximum production with minimum waste." In other words, the object is to operate all industries at full capacity, but at the same time to make a pound of fuel perform its maximum serv-

ice in power, light, and heat. In laying the foundations for the organization, it has been anticipated that this work should become a permanent service of the Government.

From 10 to 20%—that is, from 25,000,000 to 50,000,000 tons of coal per year—can be saved, it is said, by the correct operation of steam-power plants, using their present equipment, in the industries, in office buildings, hotels, apartment houses and like establishments. It is considered most important that all existing fuel-conservation committees, committees of chambers of commerce and national defence, manufacturers' associations, and other bodies be continued in full force, and that the work of such organizations be consolidated with the national program, which comprises these fundamentals:

1. Personal inspection of every power plant in the country.
2. Classification and rating of every power plant, based upon the thoroughness with which owner of said plant conforms to recommendations.
3. Responsibility of rating the plants will fall upon an engineer in each district, the rating to be based upon reports of inspectors, who will not express opinions, but will collect definite information. The State Fuel Administrator, in his judgment, may entirely or partly shut off the consumption of coal to any needlessly wasteful plant in his territory.
4. Inspectors are to be furnished from one or more of the following sources: (a) Inspectors of the steam-boiler insurance companies; (b) state factory inspectors; (c) engineering students from technical colleges; (d) volunteers.

The ratings will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in Class 1, 2, 3, or 4. The ratings will be based upon existing equipment. The difficulty, delay, and expense involved in the installation at this time of improved power equipment are fully recognized, but experience has proved that 10 to 20% of fuel now used in power plants can be saved by improvements in operation alone.

In advance of the first inspection, a questionnaire will be sent to every power plant in each district, with notice to the owner that within 60 or 90 days his plant will be inspected personally, and the questionnaire will be checked up by the inspector upon his visit. This will prepare the minds of plant owners for what is to follow. It will operate to induce proper care in furnishing information and produce a desire on the part of owners and operators to improve their plants, if necessary, so that they may be rated in a high class by the time the inspector calls.

It is recommended that a board of competent engineers be attached to the conservation committee in each

state; also a corps of lecturers to arouse public interest and disseminate engineering information.

The Fuel Administration has prepared a 50-minute film of moving pictures showing good and bad operation in the steam-boiler plant, and methods of testing boilers and fuels. These pictures will be available for each state in connection with its educational propaganda.

The administration is also preparing a series of official bulletins on engineering phases of steam and fuel economics. Some of these are now ready for printing. They cover the following subjects: Boiler and furnace testing, flue gas analysis, saving steam in heating systems, boiler-room accounting systems, saving steam and fuel in industrial plants, burning fine sizes of anthracite, boiler-water treatment, oil burning, and stoker operation.

In addition to this service, a list of competent engineers has been prepared in Washington for each state and is available for use of each local administration. As the work develops, still further constructive assistance is contemplated for helping owners to bring their plants up to a high plane of economic operation.

5 8 0 4

A new riveting record for the United Kingdom, and incidentally for the world, was made on May 23 at Barrow, England, by William Moses, an employee of Vickers, Ltd. Using a 28½-lb. riveting hammer on fring beams for 9.2-in. howitzers, Moses drove 5804 rivets in nine hours. The rivets were of two kinds, countersunk and snaphead, and the tools employed had been in use for twelve months.

Moses made a slow beginning owing to defective heating arrangement, and at noon, which was half-time, the score stood at 2620. At 1 o'clock it was 3285. One of the directors of Vickers had offered £25 if 5000 rivets were driven, £10 if Moses beat the mark of 4422 made by Thomas Devine on the Clyde last week, and £5 if Devine's mark was equaled.

War Finance Board Begins Work

The first loan made by the War Finance Corporation is said to have been received by the Northwestern Electric Co., amounting to \$1,000,000, for the purpose of providing more power for use in shipbuilding. The directors of the corporation met on May 21 for the first time, to take up the work of considering applications for financial aid for activities essential to the conduct of the war. Believing, apparently, that the corporation is a source of easy money for development projects of various kinds, many have applied for advances to aid them in promoting new enterprises which they assert will contribute to the war's success.

Applications have been classified, and the directors are endeavoring to get full information on cases which appear worthy. Loans may be made within the next few weeks in some cases that appear urgent. Accommodation is said to be sought by concerns which have been unable to obtain loans from banks with which to enlarge plants making war materials. Applications have been made for a number of public utilities which have been hard hit by rising costs of materials and supplies and the difficulty of increasing service rates proportionately.

Other applications seem to reflect an unwillingness on the part of various banks to extend credit to institutions which they have formerly financed, without adequate assurance from the War Finance Corporation that the loan will be covered from the Government fund.

According to a statement authorized by the Treasury Department, the corporation will advance funds to banks and trust companies that are financing operations necessary or contributory to the prosecution of the war. These loans will be made for periods not exceeding five years and in sums not more than 75% of the face value of the loans made by the borrowing banks to finance said operations. The notes of the borrowing banks taken by the corporation for these loans will be secured by adequate collateral.

Prices of Oil to Allies Fixed

The price of gasoline to the Allies was fixed on May 24 by the oil division of the Fuel Administration as follows:

Free on board Gulf ports, 21c. a gallon; free on board Atlantic seaboard, 23½c. a gallon; U. S. Navy specifications in both cases.

At the same time the price for aviation naphtha was fixed as follows: Thirty cents a gallon Gulf ports; 32c. a gallon Atlantic seaboard; British specifications, 302° F. final boiling point in both cases.

Fuel-oil prices were fixed at: Gulf ports, 5½c. British Admiralty specifications; 5½c. U. S. Navy specifications; Atlantic seaboard, 7½c. U. S. Navy specifications.

The price of standard white refined kerosene was fixed at 7½c. at Gulf ports and 8½c. at Atlantic seaboard; Mexican reduced oil was fixed at 6c. Atlantic seaboard. Though these prices apply only to the Allies, it is expected they will stabilize the domestic market. The prices became effective May 20 for 60 days.

British Draft Coal Miners for Army

As a result of the British government's decision to proceed with the recruiting of 50,000 coal miners, the certificates of exemption issued on grounds of employment to persons working in coal mines were withdrawn from all coal miners between the ages of 18 years and 8 months and 25 years as at Jan. 1, 1918, who on Nov. 22, 1917, were unmarried or widowers without children to support. The order went into effect on Mar. 21, 1918, says the *Iron and Coal Trades Review*. Persons to whom exemption certificates were issued, on grounds of employment, since Nov. 22, 1917, are not affected by the order.

Of the pre-war miners it was proposed to call to the colors only those men up to the number authorized by the government who should be found to be in Grade 1, the remainder to be allowed to return to their civil occupation and to be provided with a suitable protection certificate. Adequate safeguards were to be arranged so as to permit the retention in the mines of persons considered indispensable for their safe working.

It is the intention of the government to return to the coal mines from the army a number of pre-war miners who are unfit for combatant duty either in Great Britain or overseas. The proposed recruitment of 50,000 men from the mines, it was thought, would have the effect

of accelerating the return to the mines of these men. The recruitment was to be carried out by the regional directors of national service, who were requested to give every consideration to the prevailing local conditions, and in particular to afford the local miners' association an opportunity of adopting a ballot as a method of selecting the mine quotas, should that method commend itself to the miners of any particular districts.

"Coal Week" From June 3 to 8

"Coal week," the period from June 3 to 8, has been selected by U. S. Fuel Administrator Garfield for an intensive and specific drive on the early ordering of coal. From some states has come the objection that the trouble about the coal supply does not come from the consumers, industrial or domestic, but from the dealers, who complain that they cannot get sufficient coal to deliver. In spite of this, the Fuel Administration desires that the early ordering campaign be vigorously pushed. By keeping coal orders constantly accumulating, the resulting pressure, it is believed, will have the effect of keeping production at the highest possible point during the summer months.

Coming Wednesday Is Registration Day

All male citizens or aliens reaching the age of 21 since June 5 of last year, including medical and divinity students, must register for the draft on June 5, 1918, in accordance with a decree issued by Provost Marshal General Crowder. The only exceptions under the draft law are those who are actually in the military or naval service. This registration will yield 750,000 men, it is estimated. Of the 10,000,000 persons, approximately, who registered a year ago, about 10%, or 1,000,000, were 21 years old at the time. About the same number should come of age this year, of which three-quarters, or 750,000, should be available after allowance is made for all probable exemptions. Registration will be conducted as before with the local boards.

Schwab's Program a Ship a Day

A ship a day for the next six months was the program laid down by Charles M. Schwab, Director-General of the Emergency Fleet Corporation, in his address upon the occasion of the launching of the 7500-ton steel ship "Englewood" at the yard of the Standard Shipbuilding Corporation on May 18.

"Our bit for the next six months," said Mr. Schwab, "is one great ship a day, and, for six months after that, two ships a day, and thereafter three or four ships a day. The rate at which we are turning them out now is making the Kaiser sick. In a year from now it will be killing him, and God speed the day!"

Later in the day Mr. Schwab stated that we are producing 10,000 tons of shipping a day at present, and that production will be doubled in six months and trebled or better by the end of a year.

"We will absolutely produce 3,000,000 tons of shipping at American yards this year," declared Mr. Schwab. "For some reason some critics seemed to have the idea at the beginning of our war that the United States ought

to turn out 6,000,000 tons a year right away. Of course, this is ridiculous. Even Great Britain, whose facilities are immensely superior to ours, never has been able to produce much better than 3,000,000 tons, and we will double that by the time we have been going a year."

Senate Against Efficiency Methods

With the so-called anti-efficiency section retained, the Naval Appropriation bill, carrying \$1,615,000,000, went to conference on May 22, after passing the Senate with little debate. Most of the discussion of the bill bore on the amendment providing that no part of the appropriation should be available to maintain a stop-watch or similar device upon Government employees in war work. The clause forbidding the payment of premiums or bonuses to employees, however, was stricken from the amendment, which was adopted by a vote of 37 to 22.

No reason for holding a watch over labor was apparent to the Senators urging the adoption of the amendment. In their belief, labor was patriotically doing its duty in the war, and such checks were unnecessary. The failure in aircraft and ordnance manufacture was pointed out by Senator Thomas, of Colorado, who declared that in the present emergency the nation had a right to a full day's work from every man and should make sure that it got it. Senator Townsend, of Michigan, declared that the "stop-watch" in Government arsenals in Michigan had brought production up to 100% efficiency.

Help Catch a Submarine

The Navy Department still desires that patriotic citizens shall loan it their binoculars and spyglasses, which, if possible, will be returned to the owners after the war. It should be remembered that opera glasses are not wanted, as they are not powerful enough. Glasses needing repair are not required at present.

Glasses may be mailed direct to Hon. Franklin D. Roosevelt, Assistant Secretary of the Navy, care of U. S. Naval Observatory, Washington, D. C., or delivered to the office at 78-80 Broad St., New York, or any of the branch hydrographic offices at Boston, Baltimore, Savannah, Galveston, Portland, Ore.; Cleveland, Buffalo, Philadelphia, Norfolk, New Orleans, Seattle, Duluth, Chicago, San Francisco or Sault Ste. Marie. Glasses may also be sent to the nearest navy recruiting station.

Imports Barred Unless Approved

Effective as of May 27, according to an agreement just reached by the War Trade Board, no commodities, except in a comparatively few cases covered by general import licenses, shall be approved for shipment to the United States by the consuls in any country in the world until applications for licenses have been acted upon favorably by the War Trade Board and the number of the United States license covering the shipment is submitted. This practice has been effective in connection with the restricted list, but the present ruling makes it applicable to all commodities.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

For and Against Minerals Control

Despite the weight of testimony that has been presented to the Senate Committee on Mines and Mining, during the hearings on the Minerals-Control bill, to the effect that the mineral industries had best be left free from further Governmental control, it is evident that the committee believes control is necessary. While material changes doubtless will be made in the House bill, it appears likely that the Senate will restore to the measure the price-fixing power and the appropriation of \$50,000,000. The proposal of a War Minerals Corporation is receiving attention.

D. G. Kerr, vice president of the U. S. Steel Corporation, told of the demoralized condition in the manganese trade, in which he sees a dangerous menace to the steel industry. He stated that the Brazilian railroad is no longer bringing manganese into Rio de Janeiro, and says it would be dangerous to allow imports of manganese ore to fall below 35,000 tons monthly. He expressed the opinion repeatedly, in his testimony before the committee, that the ferroalloys committee can accomplish, without legislation, the results, so far as alloys are concerned, sought by the Minerals-Control bill. Mr. Kerr further said that the committee could handle allocation with less friction than could be hoped for under proposed Governmental regulations.

A potent measure of relief could be afforded the mining industry, Mr. Kerr pointed out, if a change were made in the system of rate-making on Western ores. He called attention to the restraining tendency of a rate made on a basis of the smelter's valuation of the ore. The miner should know, he said, when the ore is brought to the shipping point on a transcontinental line, what he is going to get for it. Mr. Kerr believes that the payment of 80% of the estimated value of the ore, which is now supplanting the former practice of paying 50%, will help greatly to stimulate production. A matter discouraging to production could, moreover, be avoided, he asserted, if producers of manganese and chrome ores were better supplied with cars.

Mr. Kerr declared that he knows of no domestic deposits of manganese where an increase in the price would bring forth an additional tonnage, but that the Steel Corporation is perfectly willing to try out an increase in price, in the hope that it may encourage the owners of small deposits.

Speaking of the recent steel meeting at Pittsburgh, Mr. Kerr said: "It developed that some steel makers were using as high as five pounds of chrome ore per ton of ingots. Other were using as low as one pound. In some instances, none was used. It was the opinion, however, that the elimination of chrome would decrease production of steel probably 5%. That determined that it was out of the question to eliminate it altogether. It was decided that 1½ lb. of 35% sesquioxide and under should be used for each ton of ingots

produced. If any steel manufacturer feels that his conditions require a larger proportion than that, he should make a request through the alloys committee and get the committee's approval."

Mr. Kerr told in some detail of the experiments being made by his company with 60 to 63% ferromanganese. If they are successful, he said, the change in practice would be adopted by other companies. The Steel Corporation began buying Cuyuna ores six weeks ago, he said. C. F. Kelley expects a production this year of 200,000 tons of 40% manganese ore from Montana.

Intimations that the legislation is desired principally by the Government bureaus were made by several witnesses. Ravenel Macbeth went so far as to make the following statement:

"Long experience with bureaus and state officers leads me to say that I never have seen the head of any bureau that did not desire to have the scope of his authority extended."

George Otis Smith, director of the U. S. Geological Survey, recognizing this feeling, prefaced his testimony with a statement that he had no part in the preparation of the bill, and consequently is not influenced by pride of authorship. No enlargement of the functions of the Geological Survey is contemplated, and, for that reason, he asserted that it would be unfair to credit his support to the bill to bureaucratic motives. In his testimony, he said in part:

"My support of the legislation is based upon a strong conviction of the need of larger power being given to the Government at the present time in handling this important matter of the supply of raw material.

"Price-fixing must include the time element as well as the price element. Stimulation of the domestic industry involves the creation of confidence in the market. That means the quantity of production that can be sold as well as the price at which it can be sold. A high price put on any mineral products for a few months would result in only a feverish impulse. It would not be of lasting benefit to the industry, as compared with the much lower price that would be assured for one or two or three years. The legislation would provide for the fixing of a minimum price for a definite period, with this primary idea of stimulating production. The minimum price is most effective in the case of raw materials, while in the case of some manufactured products or some derivatives, the maximum price may be found advisable.

"I agree with the principles of the income tax and the excess-profits tax, but I am not assured that they will catch all excess profits. I question whether there are not many cases where the present system of taxation would fail to take up the slack between the large, successful company and the smaller company that is operating with relatively higher costs.

"Each of these different metals presents a somewhat different problem. For that reason, more and larger powers must be asked to handle the whole situation."

H. F. Black, assistant to the president of the Midvale Steel and Ordnance Co., of Pittsburgh, declared "it would be a mistake to put a minimum price on domestic ores. A flat fixed price sufficiently high to give the producer a substantial profit would be much more preferable." He asserted that the legislation is not necessary. The situation can be met adequately, he said, by agreement between manufacturers and the War Industries Board. In explanation of the decision to advance the price of manganese 18c. a unit, Mr. Black said further:

"It is the feeling that it is advisable to adopt a price list on ore—a schedule of prices that would be more in harmony with the average price prevailing. This would enable the producer to ascertain what he could realize on his ore." He also said:

"This country never will be able to produce anything like 900,000 tons of manganese ore in any one year. Production at the present time would not be materially stimulated even though the price of ore be doubled. There is ample incentive to the producer today to get out all the ore he can at the profit he is realizing."

J. M. Flannery, a producer of radium, uranium and vanadium, with mines in Colorado, a refinery in Pittsburgh and a factory in Callensburg, Penn., thinks the bill would not encourage production, would do no good and probably would do harm.

Acheson Smith, general manager of the Acheson Graphite Co., of Niagara Falls, also objected to the bill. He believes the licensing feature would be harmful to industry and expressed the opinion that the privileges granted by the bill could be accomplished in a five-minute talk with Mr. Baruch.

Charles A. Buck, vice president of the Bethlehem Steel Co., does not believe the bill is necessary and thinks coöperation with the War Industries Board is enough. He fears that the bill may impress upon the industries of the country practices which would make them so inefficient as to mar results.

Charles A. Gray and H. R. Layng, of San Francisco, urged the fostering of the domestic antimony industry. Mr. Gray suggested that a price of 20c. would bring out the American production. It was evident that the committee did not regard these proposals with favor.

H. G. McMahon, of Goldfield, Nev., suggested that a large part of the waste sulphur gas from smelteries should be made directly into brimstone. A. E. Wells, of the Bureau of Mines and the War Industries Board, urged that the thio-gen process be utilized as a war measure to obtain sulphur.

Joel Hurt, of Atlanta, Ga., who is engaged in mining manganese ores in Georgia, favors the bill. He told how his mines had been forced to close down on 10 different occasions by lack of coal and as a result of the Government's bidding up of the labor price.

Mr. Macbeth, who is the most outspoken of the opponents of the bill, told the committee that any appropriation that the bill might carry would be wasted.

Anthracite shipments are now absolutely barred to 24 states—half of all the country—except upon special permit. The sections so cut off are the least dependent upon anthracite for fuel; in fact, can get along without it.

Bureau of Mines News

Superintendents of all experiment stations of the U. S. Bureau of Mines spent last week in Washington in conference with Director Manning and other officials of the Bureau. Roasting experiments on the different sizes of mercury ores have been completed by Ven Sih Chow at the Berkeley station, where he is working on several problems in which the Chinese government is interested. He also intends to make similar experiments on mercury ore briquets.

A means of metallizing and separating the iron in siliceous Cuyuna ores has been devised at the Lake Superior station. The iron can be metallized by the Jones process, but cannot be separated magnetically from the manganese or by crushing, screening, tailing or by any combination of these methods. Metallization and separation can be accomplished if the ore first is melted to a homogeneous glassy slag, the Bureau believes.

To assist in the additional work on war minerals which is being undertaken by the Bureau, the following additions have been made to its technical staff: George D. Dub, Franklin Furnace, N. J.; Donald E. Fogg, New York; Frank T. Eddingfield, Hibbing, Minn.; Herbert W. Fox, Westport, Conn.; Roger Gannett, Minneapolis, Minn.; Louis D. Huntoon, New York; Guy Ingersoll, Minneapolis; Alfred W. Stockett, Bee Ridge, Fla.; John S. Scoles, Butte, Mont.; Henry C. Morris, Washington, D. C.; Carl O. Lindberg, Los Angeles.

Agree on Zinc Prices

After investigation by the price-fixing committee of the War Industries Board, in conjunction with the Federal Trade Commission, as to the cost of production, the President has approved an agreement that the maximum base price on Grade A zinc of 12c. per lb., f.o.b. East St. Louis, be continued until September 1.

The President also has approved an agreement with the producers of sheet and plate zinc whereby the maximum base price of 14c. per lb., f.o.b. plant, for plate zinc, and 15c. per lb., f.o.b. plant, for sheet zinc, subject to the usual trade discounts and extras or differentials that were in effect Feb. 13, 1918, will be continued until Sept. 1. Sheet zinc shall be considered as including all gages of $\frac{1}{8}$ in. and less in thickness, and plate zinc as including all gages thicker than $\frac{1}{8}$ inch.

The agreements also continue the following conditions: That the producers will not reduce wages now being paid; that they will sell to the Allies, to the public and to the Government at the same price; that they will take the necessary measures to prevent the products from falling into hands of speculators, and that they pledge themselves to exert every effort to maintain maximum production.

Nickel Price

No change is to be made in the arrangement with nickel producers and the War Industries Board during the coming quarter. The investigation made by the board shows that despite increased costs and greater demand the prices have remained practically the same, with the possible exception of a limited number of transactions with small dealers.



Serving the Mining Regiment

Instead of a flag a fund, and dollars instead of stars. The Comfort Fund spells "Service" to the mining regiment—service of whatever kind, whenever needed; whatever will add to their comfort and welfare and thereby keep up their efficiency, the men may have for the asking. Tobacco, of course, has been and will continue to be furnished the men as wanted; but that is only one item contemplated in the program of service. Of the money spent to date on three companies of the regiment, less than 10% has gone for tobacco, the remainder representing athletic goods and many other things.

Almost \$14,500 has already been contributed to the fund, which is being drawn upon to meet the needs and desires of the regiment as they arise. Much more will be needed. The equipment provided for the pleasure of the men is short-lived at the front, like all the rest of a soldier's outfit, and must be renewed from time to time. This means money and more money, some of which is on hand now, but most of which is still to be raised.

Underground, you would follow a promising lead, of course, lest you should miss something worth while. As a mining man, you should also follow the lead of those who have contributed to the Comfort Fund. No doubt you have felt repeatedly that it was up to you to do your share for the mining regiment, but you let it slide for one reason or other. Act now instead of thinking about it. Send in your check today. The list of those who have contributed to the fund is as follows:

Previously acknowledged.....	\$13,664.00
Students of Wisconsin Mining School.....	50.00
A. M. Plumb.....	5.00
C. W. Snow.....	2.50
Charles A. Mitke.....	5.00
A. A. Hassan.....	10.00
A. A. Hassan, Jr.....	5.00
Emin A. Hassan.....	5.00
Bernard MacDonal.....	5.00
C. F. Rand.....	50.00
Calumet & Arizona Mining Co. and New Cornelia Copper Co.....	400.00
Oscar Lachmund (fourth contribution).....	10.00
C. N. Bell.....	10.00
C. S. Witherell.....	25.00
W. G. McBride.....	25.00
Karl Eilers.....	50.00
R. T. Hancock.....	5.00
E. E. White.....	100.00
S. Ringlund.....	10.00
H. Foster Bain.....	10.00
Marc Bailey.....	10.00
Charles le Vasseur (second contribution).....	5.00
Total.....	\$14,461.00

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Because of the work involved in administering the Comfort Fund contributions are acknowledged only by publication in the *Journal*.

Australian Zinc Concentrates

According to the Consul General at London, Robert R. Skinner, the Board of Trade and the Zinc Producers Association, Proprietary, of Australia, has agreed to the purchase by the British government of the stocks of Australian zinc concentrates existing at the end of last year to a maximum extent of 250,000 tons per annum for the period of the war and one year thereafter, and 3,000,000 tons per annum for nine years subsequently. The agreement provides for a flat rate of prices up to the end of five years after the war; for the remainder of the period, prices will be determined by market conditions, with the flat rate as the minimum.

Change to Metric System Undesirable

BY FREDERICK A. HALSEY*

I am in receipt of an official copy of the final report of the (British) Committee on Commercial and Industrial Policy After the War. From this voluminous report, I give below a few extracts from Chapter X, on weights and measures:

Having given full consideration to the subject, we are unable to recommend the compulsory adoption of the metric system in this country. In our opinion, it is absolutely certain that the anticipated uniformity could not be obtained for a long period, if ever. There is, further, the serious objection that if we induced certain countries to change over to the metric system we should be surrendering to Germany the advantages which our manufacturers now enjoy over hers, both in their markets and our own. We are informed that even in France, which has made the metric system nominally compulsory for more than half a century, the "pouce" (or inch) is used in textile manufacture and numerous local measures still survive.

In referring to these considerations, we have to point out that there is no unanimity even as to the theoretical merits of the metric system as compared with our own. The practical argument that its adoption is desirable in order to secure uniformity in the markets of the world has been shown to be unfounded. We are not satisfied by any evidence which has been brought before us that trade has actually been lost to this country owing to the fact that the use of the metric system is not compulsory. But to attempt to make the use of the system universal and obligatory in this country would cause great loss and confusion at a particularly inopportune moment for the sake of distant and doubtful advantages. We are convinced that, so far from assisting in the reestablishment of British trade after the war, such a measure would seriously hamper it.

As regards the educational advantages claimed for the change, we have been referred to a statement quoted by the Select Committee of 1895 that no less than one year's school time would be saved if the metric system were taught in the place of that now in use. The information which we have received does not support that statement, and, even if it

*Commissioner and Secretary, American Institute of Weights and Measures.

were well founded, it must be remembered that, for at least a generation children would have to learn both the new and the old measures and how to convert from one to the other.

It is often popularly supposed that the introduction of the metric system would render possible the immediate sweeping away of many complicated and varying weights and measures. As we have already indicated, this belief is, in our opinion, wholly fallacious. We are not convinced that the metric system is, upon the whole, even theoretically superior to the British system, and we are satisfied that the practical objections to the proposed change are such as decisively to outweigh any advantages which are claimed for it.

It is to be noted, moreover, that while in an appendix to the report several members of the committee, which consists of 19 members, file reservations regarding certain items, there is no reservation regarding the chapter on weights and measures. In other words, the report, so far as this chapter is concerned, is unanimous.

Marketing Bolivian Tin Ore

Accompanying this is a paragraph from a letter received from a British importer of tin and tin ores; also a copy of the note of comparative results to which he refers. This letter and comparison were submitted to a man prominent in the tin industry in the United States, who has replied to the letter and comparison. I regret very much that the name of the American may not be published, as it would add much weight of authority to the reply.

There is only one thing lacking to make this story complete, and that is *definite figures* showing what percentage of tin smelted from Bolivian ores on contracts based on London prices is sold on the same basis, and what percentage is sold at New York spot prices. Manifestly, the question of profit depends largely on these relative percentages.

MARK R. LAMB.

New York, May 16, 1918.

EXTRACT FROM THE BRITISH LETTER

I also hand you on a separate sheet a note of the comparative results of a sale today in Liverpool and New York, respectively. You will notice from these figures that while British smelters have to be contented with about £17½ per ton of ore to cover carriage to and from their works, fuel, labor, loss on treatment, market risk, and profit, their American competitors get £70 per ton of ore.

On the basis of an average tin concentrate with an analysis of 62½%, the price of Straits tin in London being £316 sterling and the price of refined tin in New York being 85c. a pound (equivalent to £400 sterling per ton), we obtain the following figures:

1. In Liverpool the price obtained for the metal is as follows:

£316 × 62½% — smelting charge	£17½	=	£180.0
Marine freight,	£13.0		
Insurance,	7.0		
Commissions and minor expenses,	4.1		24.5

Net value aboard ship in Chile, £155.5

2. In New York the price obtained for the metal is as follows:

2240 lb. × (67c. per pound, less 2c. = 65c.) × 62.5%		=	\$807.0
× 98% — smelting charge of \$75 per 2000 lb. of metal		=	\$170.0
at the exchange of \$4.75		=	11.5
Freight (\$30), insurance, commission, etc.,			

Net value aboard steamer in Chile, £158.5

From these figures three very interesting points may be noted:

1. The English smelter takes £10 sterling per ton of ore more than his American competitor.

2. In spite of this, a Bolivian miner receives about £3 sterling per ton more aboard steamer at Chilean port on sales made in New York, due to the saving in freight and war insurance.

3. While the English smelter has a margin of £17½ to cover all of his smelting and transportation expenses, loss in treatment, market and profit risk, the American smelter has a margin of £70 sterling, or four times as much.

It should not be forgotten that the New York market for concentrate is limited to the capacity of two or three smelters, while the Liverpool market has a much greater capacity.

COMMENTS OF AMERICAN AUTHORITY

The deductions which your correspondent draws from his comparative figures are wrong, and, as a matter of fact, his premises are wrong also, but I am sure that his erroneous statements are due to ignorance of the situation in the United States, for I do not believe he would knowingly write an article which depicted the American smelter as being a mercenary moneymaker obtaining unreasonable profits when such is not true.

Suppose before we discuss this matter we stop for a moment to consider the business situation as it exists today. If we will only take the time to do this, I am sure we will have more charity and more consideration for what may appear to be the unreasonable demands of those with whom we do business.

Before the great conflict violently disrupted the business methods which had been established for years, the buying and selling of tin were conducted on rules which had been adopted by the English, who had control of the tin markets of the world. Germany was just beginning to become restive and to assert itself as a competitor in the tin trade when the war began. Since then, as Germany has been shut in, England obtained supreme control of the tin business of the world, as the smelting of tin in the Straits Settlements and all shipping have been practically under English direction. Therefore, if your correspondent finds fault with the conditions which obtain today, should they not justly be attributed to England, which has dictated the policy which has resulted in these conditions, rather than to blame the United States, which has simply endeavored to cooperate with England? But why blame any one? Why not admit the fact that this gigantic struggle is so much greater than anything that any one could foresee, that no one, Englishman or American, could possibly arrange for so abrupt a change in business administration without disorganization? Business men have made mistakes, and one of the greatest mistakes has been to continue to make contracts based on pre-war standards, whereas they should recognize that the war has changed everything, and therefore it is absolutely necessary that all ideas of contracts should be based on the new conditions, and these conditions may change day by day, as all private business must be subordinated to the necessities of the different governments. If we can put our minds in the friendly condition to recognize this upset state of affairs we can have more charity for one another's troubles.

The cause of the high prices in the United States is the English regulation prohibiting the export of tin from British possessions except by license. This statement is

not intended to criticise England for adopting the license plan. On the contrary, it was probably necessary for England to do so, but it has resulted in eliminating competition and has put the importation of tin into the United States in the hands of a few persons, nearly all of them English firms. After the rule prohibiting the export of tin from British possessions except under license was enforced, the enormous profits of the English exporters and the trouble of the United States began. At once the buyers of tin in the United States were separated into three classes:

1. Those who could obtain licenses to buy tin from the Straits Settlements either directly or through their agents.
2. Those who bought tin for shipment from the Straits Settlements from the English export houses, this tin being sold, as a rule, to arrive in from three to six months from the time of purchase. The buyers in the second class were limited to those concerns to whom the British government would issue permits, and also to concerns which were willing to take the risk of fluctuations in the market in buying tin for future arrival.
3. Those buyers who were unable to obtain licenses to buy tin from the English exporters, or who feared to run the risk incidental to buying tin so far in advance.

It is the people in the third class who have been so unfortunate during the last year or so as to run up the price of tin in the United States to such high prices. They have been compelled to struggle for any lots of tin which may have remained unsold after they arrived in this country. At the same time, however, they constitute in the aggregate but a small faction of the consumers of tin in this country, the great majority of the tin used in the United States being bought by people constituting the first two classes, but the people in South America and the general public in the United States do not know this. They think the American dealers are making the enormous profits which have existed between the price of tin in England and in the United States, whereas, as a matter of fact, it is the English merchant who is being enriched—he who can get licenses in England to buy and export tin, and who sells it through his agent in New York. The New York agent makes the sale and draws the contract, but his profit is only a small commission, which is paid him by the English firm which actually transacts the business and gains the enormous difference of 10 to 20c. a pound between the cost in London or Singapore and the resale price in the United States.

Your correspondent's example is wrong in that he assumes that the American smelter sells his tin at the quoted spot price in the United States, in this instance 85c.; but, as a matter of fact, the larger American consumers do not pay so great a toll to the English importer; they do not buy tin in the United States at the spot price. On the contrary, they buy in England, Singapore, Batavia or China—it is true, as a rule, through English firms. But they do not buy spot tin in the United States; they buy for delivery two, three, four, five or six months in the future, thereby getting a much cheaper price than if they should buy for immediate delivery. This is the crux of the whole situation. Your correspondent assumes in his example that because there is a quoted price of tin of 85c. a pound, the American

smelters sell their tin at that price. This has not been so. The price of 85c. a pound is paid only by a few buyers who have not been sufficiently thoughtful to buy tin abroad for future delivery, but, of course, the American smelter cannot depend upon such buyers. The American smelter is not a speculator. He makes contracts for the purchase of his *barilla* based on the price of tin in London, less a returning charge. He makes contracts for the sale of his refined tin based on the price of tin in London plus a small margin and is satisfied with his legitimate profit as a smelter regardless of what speculations the English importers may be carrying on. It is exceedingly doubtful whether the profits of the American smelters have been as great as those of their English competitors during the last few years.

The most unfortunate part of this whole situation is not that some American buyers have been forced to pay an enormous profit to the English exporters, for that is a war condition which must be philosophically submitted to, but because the American business man has been held up all over the world as being a profiteer and as making an outrageous profit when this is not a fact and when the profit has been made by England.

In one of his fables Æsop tells of the wolf that muddied the water of a stream in which, below, the lamb was drinking. It did the lamb but little good to refute the statement that he was responsible for the offense, and it probably will not do us in the United States much good to try to explain the true situation, because the fabled profits of the United States dealers have had such wide circulation that it will be impossible to contradict them effectively.

Trained Men Lacking for War Work

There is a splendid opportunity for the technically trained man who cannot take part in the actual fighting to help materially in the prosecution of the war program by entering the great civilian army of specialists back of the men behind the guns. The U. S. Civil Service Commission announces that the War and Navy departments are badly in need of experts to work in connection with the production of war material. Among the positions now open are the following:

	Usual	Entrance	Salary
Chemical engineer.....	\$1600	to	\$6000 a year
Assistant chemical engineer.....	1200	to	1600 a year
Powder and explosives chemist....	1600	to	2400 a year
Assistant powder and explosives chemist	1000	to	1600 a year
Metallographist	1500	to	2000 a year
Assistant chemist	1800	to	2000 a year
Metallurgical chemist	1600	to	2400 a year
Assistant metallurgical chemist....	1000	to	1600 a year
Assistant chemist and metallurgist			2000 a year
Metallurgist			3000 a year
Assistant inspector of engineer-			
ing material	\$4.00	to	\$4.48 a day
Subinspector, mechanical	3.52	to	6.00 a day
Mechanical draftsman	4.00	to	8.00 a day
Engineering draftsman	3.04	to	7.04 a day
Metal furniture draftsman	4.00	to	6.00 a day
Apprentice draftsman			\$480 a year

The Civil Service Commission calls particular attention to the fact that all necessary information concerning civil service positions, and application blanks therefor, may be obtained free of cost by applying to the representative of the commission at the post office in any important city, or by addressing the "United States Civil Service Commission, Washington, D. C."

Editorials

The Price for Copper and the Supply

THE copper producers went to Washington on May 22 to discuss with the Price-Fixing Committee of the War Industries Board the matter of the price for copper after June 1. They confidently expected an advance, in view of the sharply risen cost of production, the complications respecting smelting and refining contracts, etc. They were disappointed. Mr. Brookings, the chairman, told them that the committee had previously made up its mind that the price was to remain unchanged. The plights of the high-cost producers and of the smelters and refiners received no friendly consideration. The copper producers might just as well not have gone to Washington. Incidentally, the polite fiction respecting the arrangement of the price for copper by mutual agreement has vanished. The War Industries Board tells the producers what it is going to do. The producers have nothing to do but plead and bow to the decision.

However, the main question is whether the War Industries Board is pursuing a wise or a shortsighted policy. There is really no use in talking about cost of production, "reasonable profit," etc. The prime question is, and ought to be: "Are we getting copper enough?" The simple fact that the price for copper has remained at 23½c. since last September implies that we are not. Some people are having to go without the copper they need. Whether the deprivation pertains to essential or non-essential uses, who can say? It would be very risky to postulate that the price for copper has been adjusted exactly to the essential uses. If it has not been so adjusted, the shortage has delayed some branch of work of more or less importance in the prosecution of the war. That there has been and is now a shortage is evinced by the maintenance of the 23½c. price.

It does not require any consideration of economics, but, rather, is it simply a matter of logic to show that a fixed maximum price is either (1) inoperative, by virtue of being fixed so high that the market is moving freely beneath it; or (2) is restrictive of supplies, for if the market price sticks at the fixed maximum it means that supply is deficient. If for any reason supply should be increased in some way, perhaps fortuitously and suddenly, the market price would recede immediately from the maximum, which would then cease to be of any effect. Exactly this happened recently in the case of high-grade zinc. It follows, therefore, from inescapable logic, that if a commodity sells at a fixed maximum price, there is not enough of that commodity, and somebody is being deprived of it, who, perhaps, ought not to be, even in time of warfare. Since Sept. 21, 1917, no seller of copper has been willing to part with a pound for anything less than 23½c. The refiners have been unable to fill all their orders, and domestic consumers have practically been rationed. Who can say surely that none of those consumers is being ham-

pered in doing work that is of military importance? Would it not be better to let the natural restraint of price determine automatically what work should not be done? Having reduced our copper business to a hand-to-mouth basis, with nothing but a trifling stock of refined, where should we be if some sudden, unforeseen exigency required a great deal more copper in a hurry?

Manifestly, the thing that obscures the vision of the Price-Fixing Committee is that some of the big copper producers turn out their products at relatively low cost and make a good deal of money in spite of the recent advances in cost. They overlook that those conditions result from immense outlays of capital prior to the war, specifically made for the purpose of obtaining low costs and large profits. If some of the present high-cost producers had been equally enterprising, they also might be in a more favorable position today. The disfavor with which the Price-Fixing Committee regards the low-cost producers leads logically to only one conclusion; namely, the penalizing of capital expenditure for the improvement of mining and metallurgical methods, and that in the end spells the destruction of our industries.

Adherence to the present policy means nothing but the crowding out of the high-cost producers. The big producers cannot do any more than they are doing at present, if we judge correctly from the monthly statistics, and by rising costs they are gradually being crippled in what they are doing. There are theorists in Washington who say that the high-cost copper is relatively small in amount and that a higher price will not bring out any more copper than we are getting now. The first of these premises is not untrue, but the present danger of copper shortage is so threatening that we cannot afford to lose *any* production. The second of these premises is so fallacious and amateurish that persons who, entertaining it, are undertaking to direct our copper supply cannot be regarded as otherwise than dangerous. Every one who has tried to bull the copper market, from M. Secrétan down, can offer the advice of experience to the contrary. Instead of eliminating the high-cost production and destroying any incentive to the big producers to provide new plant, the Price-Fixing Committee ought to encourage production by maintaining the high-cost production and getting more of it, not less.

The *Engineering and Mining Journal* is so old-fashioned in its economic ideas that it looks upon that capitalist as praiseworthy who invests ten million dollars in improved plant so as to get 90 lb. of copper out of a ton of ore that previously yielded only 70 lb., even if he were inspired by the hope of increasing profits by ten million dollars per annum and reducing cost of production to 10c. per lb. It looks upon him as a public benefactor who saved what previously was wasted, and thinks he should be rewarded rather than penalized.

The War Industries Board views only the surface of things, and is blind to underlying conditions. Its fatuity begins to exhibit itself, however, when it perceives the disturbances that its policy has produced among producers of different efficiencies, and contemplates correction of inequalities by special treatment. That any such thing should even be considered is in itself a confession that the whole situation has been handled improperly, uneconomically; in short, bungled.

But inequities and injustices are minor considerations. The major thing is to get copper enough and to get it quickly enough. The unvarnished fact is that 14 months after our entering the war we are not producing so much copper as we were previously, and our refiners are struggling to meet the demand.

The stock of copper is less than it should be and the refiners are booked with enormous orders for forward delivery. While danger signals are flying, the authorities in Washington are mulling over cost of production (which they do not understand) and are babbling about the large profits that are realized by some fortunate concerns, although neither of those things has anything to do with the economics of the situation.

We may conceive of such a fuddling about zinc in 1915-16, when the price for that metal rose from about 5c. per lb. to about 25c.; we can conceive of a Governmental price-fixing body shaking its head over the huge profits that were being realized by some concerns, preventing high-cost producers from retrieving old plants from the scrap heap, and, by stifling any increase of production through the stimulus of high prices, losing the war for lack of zinc with which to make ammunition. The main thing now is to have copper and to have plenty of it. Every other consideration is subordinate.

The Price-Fixing Committee is not only taking a grave responsibility in maintaining the present situation for the sake of its theories, but, also, we believe that in the long run it is going to cause the country to pay more for its copper than if it stimulated production. The country has already had to pay a high price for the absence of perspective, lack of patience, and commercial education of this committee and its predecessors. Let us hope that what is still to be paid will not be too high.

The Situation in Tin

THERE is perhaps no one of the major metals in which such utter chaos has developed as in tin. The events in the recent commercial history of this metal have reflected official shortsightedness, the governments having early intervened, and incidentally we get a sidelight upon price-fixing. This case is more distinctly an international affair than any other. We may well introduce our discussion of it by quoting an editorial in *The Mining Journal* of London, Apr. 27, as follows:

The week which has passed is perhaps the most remarkable which has ever been experienced in the history of the metal. The official price in London has been advanced from £330 to £350 per ton, and that without any dealing in the metal ring. This advance, moreover, follows on other upward movements in the preceding fortnight since the price was fixed at £316, which it was widely believed would be a flat rate. Movements of these dimensions, especially when the absolute record prices for tin are taken into consideration—for £233 was the highest figure ever known before the war—are sufficient evidence that the

market is under the influence of extreme speculation. Such a result cannot be any surprise to our readers, for, as we have frequently pointed out, with the possibility of bear sales taken away, all power of controlling price, other than by government regulation, is gone. Moreover, as tin is a world commodity in much request, if the London market is done away with, buyers will endeavor, in accordance with natural economic laws, to find a substitute elsewhere, and if the price is pegged here and not in the Straits, the Eastern market immediately becomes the chief center of interest, this development being further assisted by the fact that most of the shipments now go direct from thence to the chief consumer—the United States. We have, therefore, had the spectacle of the London price being dragged up after that in the East; but as it is always kept below it, dealings cannot be done on the basis of the London prices. In fact, for the time being Singapore becomes the nearest approach to a world's market that we have.

Since then the London official quotation, which is arranged under governmental auspices, was advanced to £380, subsequently being reduced to £360. At the same time Singapore was quoting Straits tin c.i.f. London anywhere from £20 to £40 higher and was going up, while the London official price was being put down, or *vice versa*. It has been well recognized in the trade that the London official quotation is only nominal, and that the price in Singapore is more nearly a criterion; but Singapore itself is not a free market, governmental regulations permitting only two American concerns and six or seven British to buy there at all. Even this shows, however, how ineffectual the British price-fixing of tin has been.

With the exhaustion of all stocks of tin in the United States and the scantiness of arrivals not contracted for previously, the spot market in New York disappeared. For January and February we determined arbitrary average prices for settlements, on data afforded by the remnants of the supply, but with March that became impossible, and for the last three months transactions in tin in this country have been only sporadic and at highly irregular prices. Banka tin became as unavailable as Straits, and practically the only supplies obtainable were Chinese and a small part of the Bolivian tin smelted in this country, the latter being relatively small, owing to the disposition of much of it on average-price contracts, based on the London price, previously arranged.

The fundamental trouble with tin is of course that there is not enough of it produced. The tremendous rise in price tells that story. The statistics show, moreover, that during recent years the world's production has been about at a standstill. In another year or two, however, they may show a gain, by reason of the stimulus of the phenomenally high price. The tremendous rise has happened during the last six months. Although previous to that time the price was relatively high, it was offset in Malaya, Banka, China and Bolivia—the chief tin-producing countries—by the rising price for silver. Tin was exchanged for more gold, but the gold was exchanged for less silver with which to pay the labor. The present value of tin, however, is creating a feverish activity in many parts of the world, especially in Bolivia, which has much-vaunted resources. While this is stimulating production in Nigeria, in Australia, and even is keeping alive the old Mount Bischoff mine in Tasmania, it is clearly to Bolivia that we ought to look for early, important additions to

our supplies. The approaching completion of a smeltery in this country in which Señor Patiño, a large Bolivian producer, is interested, will afford new means for the conversion of ore into metal.

The Bolivian producers are finding an impediment, however, in the unsatisfactory conditions of doing business. Some correspondence that is published elsewhere in this issue discloses this. The reply of the American authority reveals the real situation, but perhaps it does not go far enough. The Bolivian producer of ore is likely to ask, Why should the American smelter continue to buy and sell on the London quotation, which is only arbitrary anyhow? Why should not he sell his tin after it is produced at prices that American buyers will bid and give the ore producer some of the benefit?

The answers to these questions would be involved with the considerations that the American tin-smelting industry is still in the infantile stage; that the production of metal here is still small; that previously existing contracts (immensely to the advantage of the consumers who entered into them) cannot be broken; that arrangements for the disposition of new product on a different basis will tend to relieve the situation in the United States and reduce the spot price to the general level of the world's markets; and, finally, that the smelter cannot afford to buy ore in Bolivia on the basis of the present extraordinary prices for spot metal in this country except at a huge margin, to allow for the enormous risks that would be incurred. The spot market in the United States is not a major market for tin. Nobody can say surely what the price here now is, or ought to be. Nobody can say surely what is the London price. Nobody can even with approximate accuracy correlate Singapore, Batavia and Hong Kong from day to day, or correlate the values of the different kinds of tin. In short, the tin market is without either compass or barometer. With increasing production in Bolivia and elsewhere, and with the minimum of governmental interference with price-fixing, licensing, commandeering, etc., conditions will gradually regularize themselves. In the meanwhile, people will have to get along as best they can.

The American Zinc Industry

THE zinc producers of Missouri, Kansas and Oklahoma are considering the organization of an association to promote the welfare of their industry. The idea is to get miners and smelters to work together for the general good. The conception is praiseworthy. It exhibits the right spirit.

There never was a time when an industry was more in need of coöperation and intelligent fostering. The price for spelter was recently down to 6½c. per lb. It is now about 7½c. When it was at the lower figure we estimated that the industry was on about the same basis as 3½c. would have been before the war. Continuance at such a level would spell the extinction of many producers. The case would resolve itself simply into the survival of the fittest.

Resulting from the developments in 1915-17, the smelting side of the industry now finds itself enormously overbuilt. The mining side is over-developed and over-equipped. The economics of the situation are clearly

defined. There must be either an enormous throwing away of plant and writing it off from capital account, or else there must be an expansion in the consumption of the metal that will maintain the usefulness of existing plant or a larger proportion of it than there will be if nothing be done.

The zinc industry has got to help itself. It has got to find new uses for zinc. If the industry does not do this, nobody else will, at least not quickly enough. There was never a better time to think about this than the present, when many metals are very dear, while zinc is very cheap. A multitude of consumers will be interested in substituting the cheap metal for the dear ones, if they be shown how to do it, and in showing them the industry will be not only helping itself, but also will be performing a national service.

The individual producer cannot reasonably undertake to do this, but many producers in combination can do it, and that is the sort of action that they ought to think about, just as they are. We want them to listen to us, however, when we tell them such action ought to be contemplated only in a big, broad-gaged way. An effective propaganda will cost a lot of money, and liberal funds should be provided for it. A million dollars spread over five years will not be too much. Moreover, the plan should be entered upon only with ideas of patience and a broad perspective. Rightly directed, some beneficial results ought to be realized promptly, but the full development of such a campaign will be a matter of five years, at least.

The Taxing Program

THE decision of the President that Congress should remain in session to frame a new tax bill must command the approval of business men. Every one knows that more money must be raised. The method of raising it must necessarily be retroactive to some extent. Therefore let it be known as soon as possible, so that plans to meet it may be made in good season. The postponement until 1919 of the fixing of taxes to be collected out of earnings in 1918 would have been thoroughly unsettling of business. The recommendation, moreover, that Congress should devise an entirely new bill, and not attempt to tinker the present monstrosity, which nobody yet understands, is also satisfactory.

However, before Congress sets to work, it is to be hoped that Mr. McAdoo will favor it with a carefully estimated budget, instead of the slap-dash talk in which he has proved so erroneous on previous occasions. In 1917 he indicated something like \$18,000,000,000 as being required for the present fiscal year, but 1918 was still young when it seemed probable that \$12,000,000,000, including loans to our Allies, was a more likely figure. The prognosis for 1918-19 is now about \$25,000,000,000, and it is contemplated to raise about one-third of it by taxation. It is uncertain whether we can spend so much, even if we want to. It is highly questionable whether so large a sum as \$8,000,000,000 should be raised by taxation. These are some of the fundamental things that Congress must consider in framing the new legislation.

BY THE WAY

An old Joplin man, who departed from that famous zinc district a few years ago, recently paid a visit to his former field of activity. He communicated to us his impressions as follows: "Those zinc producers back there all seem to have gone crazy—want to dump 10,000 tons a week on the market, when they can't sell more than 6000, and on top of that want to drill about a million holes, and sink a thousand shafts to prove that it is still there. Costs them about \$60 a ton, and they are getting \$52. Nothing in that for yours truly."

At the supreme moment of the battle of the Marne, when victory or defeat seemed to hang in the balance by a feather-weight, a corps commander hurried to General Foch with anxiety and despair written all over his face. According to the *Boston Post*, the following conversation ensued: "My men are tired out and at the last gasp," he reported. "They can fight no longer." General Foch wheeled upon his corps commander almost fiercely. "So are the Germans," he snapped back. "You are to attack at once!" That attack smashed the famous Prussian Guard of the German center, and compelled the German right to beat an overnight retreat.

John D. Ryan, at the age of 17, was selling calico in one of the chain of general merchandise stores run by his uncle in the mining district of Michigan, says a writer in *Leslie's Weekly*. At 25 he was selling lubricating oil through the Rocky Mountain section from Montana to Mexico, and at 35 he was in charge of the affairs of the Amalgamated Copper Co. He is a modest man and does not care to talk about his own achievements. Recently he was asked to tell something about himself for the inspiration of younger men.

"No!" replied Mr. Ryan, holding up both hands in protest. "You cannot write a picturesque story about me, picturing me sweating in miner's togs at the bottom of a shaft, for I never did a day's mining in my life. I wasn't a prodigy at school, and I haven't worked harder than lots of other men."

"Then do you want me to assume that you have got where you are because of influence?"

"Influence!" broke in Mr. Ryan. "Influence is the worst handicap any young man can have. When any young engineer or college graduate or anybody else comes to me asking for a letter to enable him to get a job at our works, I say to him just what I have told you."

A Canadian captain who participated in the attack on Vimy Ridge recounted to a Brooklyn audience his experience in that battle, and cited the bravery of an American cinematographer, says the *Wall Street Journal*. After the most careful mathematical preparations had been made to insure success, it was decided to begin the attack. Contrary to their expectations of a violent artillery bombardment, as had heretofore preceded a forward movement, the German front trenches were raked with a barrage fire, under cover of which the Canadian soldiers advanced. The first line was taken

easily, and the men were preparing for the next objective, when a voice far down the trench called out: "Where the deuce does this ditch end?" The captain immediately went to reconnoiter and was amazed to discover a Yankee cinematographer. Having been lost in the attack, yet determined not to miss the opportunity, he had settled in this precarious position. With his own experience a criterion, the captain was certain there was no question of the fighting qualities of the Americans, whether with guns or cameras.

A correspondent who has been assisting us in recruiting the 27th Engineers reported the following story: "One applicant, Jack Thomson, a man who has mined for 20 years, as hard as a nail, passed upon by local physicians as in A-1 condition, fell down in the examination given by the U. S. Recruiting officer, because of false teeth. 'What,' Jack said, '— —; do you want me to ate the damn Germans after I've killed them?'"

Mining Dividends

Dividends paid in May, 1918, by 22 United States mining and metallurgical companies making public returns amount to \$10,543,897, as compared with \$11,327,547 paid by 31 companies in May, 1917.

Interesting features of the month were: The dividend by Eagle & Blue Bell, payable in United States 4% bonds of the Second Liberty Loan, fractions of less than \$50 being paid in War-Savings and Thrift stamps; the Tennessee Copper and Chemical Corporation's initial payment of \$1 per share, the first since

United States Mining and Metallurgical Companies		Situation	Per Share	Total
Am. Zinc, Lead & Sm., pfd.	U. S.		\$1.50	\$120,810
Anacosta, c.s.z.	Mont.		2.00	4,662,500
Aris. Cop., pfd.	Aris.			53,840
Barnes King, c.	Mont.		.10	40,000
Caledonia, ls.	Ida.		.03	78,150
Chief Cons., s.l.	Utah		.10	88,420
Cresson Cons., g.	Colo.		.10	122,000
Eagle & Blue Bell, s.l.	Utah		.10	(a) 89,315
Golden Cycle, g.	Colo.		.03	45,000
Homestake, g.	S. D.		.50	125,580
Internat. Nickel, pfd.	U. S.-Can.		1.50	133,689
Iron Cap, c.	Aris.		.25	36,203
Miami, c.	Aris.		1.00	747,114
Nevada Wonder, s.g.	Nev.		.10	140,840
New Jersey Zinc	U. S.		4.00	1,400,000
Tamarack & Custer, ls.	Ida.		.03	53,288
Tenn. Cop. & Chem., c.	Tenn.		1.06	391,498
Trimountain, c.	Mich.		5.00	500,000
Union Cons., s.	Nev.		.05	10,000
United Eastern, g.	Aris.		.05	68,150
United Verde, c.	Aris.		1.50	450,000
United Verde Ex., c.	Aris.		.75	787,500
Canadian and Mexican Companies		Situation	Per Share	Total
Amparo, g.s.	Mex.		.03	60,000
Coniagas, s.	Ont.		.12½	100,000
Granby Cons., c.	B. C.		2.50	374,963
Greene Cananea, c.	Mex.		2.00	1,000,000

(a) Payable in Liberty Loan bonds, War Savings and Thrift stamps.

this corporation succeeded the Tennessee Copper Co., about two years ago; and the dividend by Trimountain, which was the first since 1913.

The only holding company which paid in May was the White Knob Copper and Development Co., which disbursed 5c. a share, or \$10,000.

According to published reports, only four Canadian and Mexican companies paid in May, 1918, the amount being \$1,534,963, compared with \$2,011,745 last year.

The totals for the first five months are as follows: Mining and metallurgical companies, \$65,100,172; holding companies, \$753,433; Canadian, Mexican, Central and South American companies, \$7,066,244.

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for \$1.33 for \$5, and 100 for \$15. When remittance are made in even dollars, we will return the excess over an order in coupons if so requested.

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IRON ORE DEPOSITS, MINING, ETC.

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IRON AND STEEL METALLURGY

- 9273—CANADA—The Production of Iron and Steel in Canada During the Year 1916. John McLeish. (Can. Dept. of Mines, 1917; 50 pp.)
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LEAD AND ZINC

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- 9284—WISCONSIN Zinc District. H. C. George. (Bull. 135, A.I.M.E., Mar., 1918; 4 pp., illus.) Discussion of paper previously indexed.

OTHER METALS

- 9285—ALUMINUM and Its Alloys. Chas. H. Eldridge. (Metal Ind., Apr., 1918; 1¼ pp., illus.) 20c.
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- 9305—ZIRCONIA—Uses of Zirconia in Steel Metallurgy. (Iron Age, May 16, 1918; 1¼ pp.)

NONMETALLIC MINERALS

- 9306—BARIUM CARBONATE—Possible Sources of Barium Carbonate. Samuel H. Dolbear. (Min. and Sci. Press, May 4, 1918; 1¼ pp., illus.) 20c.
- 9307—GRAPHITE—Ceylon vs. Alabama Graphite. George E. Long. (Eng. and Min. Journ., May 4, 1918; 1 p.) The author is connected with the Joseph Dixon Crucible Co., and gives data regarding its experiences in using Alabama graphite, which is not as suitable as the Ceylon product. 20c.

9308—LIME in 1916. G. F. Loughlin. (Mineral Resources of the U. S., 1916—Part II, Mar. 11, 1918; 30 pp.)

9309—NEW YORK—The Mining and Quarry Industry of New York State; Report of Operations and Production During 1916. D. H. Newland. (Bull. 196, N. Y. State Museum, Apr. 1, 1917; 58 pp.)

9310—NITRATE—Source of Nitrate and Iodine. A. W. Allen. (Min. and Sci. Press, Apr. 13, 1918; 1 p., illus.) 20c.

9311—PHOSPHATE in Egypt. E. Cortese. (Bull. 134, A.I.M.E., Feb., 1918; 5 pp., illus.)

9312—PYRITE AND PYRRHOTITE RESOURCES of Ducktown, Tenn. Jos. H. Taylor. Bull. 134, A.I.M.E., Feb., 1918; 4½ pp.)

9313—SULPHUR—Texas Greatest Mineral Production Plant. (Texas Mineral Resources, Mar., 1918; 2 pp.)

9314—SULPHUR, PYRITE—The Situation in Regard to Manganese, Sulphur, Pyrite and Some Other War Minerals. J. E. Johnson, Jr. (Proc. Eng. Soc. of W. Penn., Jan., 1918; 16½ pp.)

PETROLEUM AND NATURAL GAS

9315—ALABAMA—Possible Oil and Gas Fields in the Cretaceous Beds of Alabama. Dorsey Hager. (Bull. 134, A.I.M.E., Feb., 1918; 8 pp., illus.)

9316—ESTIMATION OF FUTURE PRODUCTION—Some New Methods for Estimating the Future Production of Oil Wells. J. O. Lewis and Carl H. Beal. (Bull. 134, A.I.M.E., Feb., 1918; 28 pp., illus.)

9317—GAGING AND STORAGE of Oil in the Mid-Continent Field. O. U. Bradley. (Bull. 135, A.I.M.E., Mar., 1918; 10 pp., illus.)

9318—GEOLOGY—Revision of the Structural Classification of Petroleum and Natural Gas Fields. Frederick G. Clapp. (Reprint from Bull., Geol. Soc. of Am., Sept. 30, 1917; 50 pp., illus.)

9319—GULF COAST OIL FIELDS—An Interpretation of the So-called Paraffin Dirt of the Gulf Coast Oil Fields. Albert D. Brokaw. (Bull. 136, A.I.M.E., Apr., 1918; 3½ pp.)

9320—KANSAS—The Petroleum Industry in Kansas. W. A. Whitaker, Clarence Estes and F. W. Campbell. (Eng. and Min. Journ., May 4, 1918; 5 pp., illus.) 20c.

9321—KENTUCKY Oil Fields. W. N. Thayer. (Eng. and Min. Journ., Apr. 27, 1918; 4 pp., illus.) 20c.

9322—MISSOURI—Oil and Gas Possibilities in the Belton Area. Malcolm E. Wilson. (Mo. Bureau of Geol. and Mines, 1918; 39 pp., illus.)

9323—MONTANA—Phosphatic Oil Shales Near Dell and Dillon, Beaverhead County, Montana. C. F. Bowen. (Bull. 661-I, U. S. Geol. Surv., Jan. 12, 1918; 6 pp., illus.)

9324—OIL SHALE—Treatment of Oil Shale in Colorado. F. A. Wadleigh. (Eng. and Min. Journ., May 18, 1918; ½ p., illus.) 20c.

9325—OIL-SHALE INDUSTRY. The. Arthur J. Hoskins. (Min. and Sci. Press, Apr. 13, 1918; 7½ pp., illus.) 20c.

9326—PETROLEUM GEOLOGIST. The Work of the. George E. Burton. (Eng. and Min. Journ., May 4, 1918; 2½ pp.) 20c.

9327—PROSPECTING—Principles and Problems of Oil Prospecting in the Gulf Coast Country. W. G. Matteson. (Bull. 134, A.I.M.E., Feb., 1918; 39½ pp., illus.)

9328—SOUTH AFRICA—Mineral Oil, Solid Bitumens, Natural Gas and Oil Shale. Percy A. Wagner. (So. Afr. Journ. of Ind., Oct., 1917; 27 pp., illus.)

9329—VALUING—Methods of Valuing Oil Lands. M. L. Requa. (Bull. 134, A.I.M.E., Feb., 1918; 19½ pp., illus.)

9330—WATER—Reduction of Water-Infiltration in Oil Wells. R. P. McLaughlin. (Min. and Sci. Press, Apr. 13, 1918; 2½ pp., illus.) 20c.

9331—WYOMING—Present Status of Oil Industry in Wyoming. Howard W. Baker. (Salt Lake Min. Rev., Apr. 30, 1918; 1½ pp., illus.) 20c.

MINING—GENERAL

9332—ACCIDENTS—Coal-Mine Fatalities in the United States in 1917. Albert H. Fay. (U. S. Bureau of Mines, 1918; 37 pp.)

9333—BLAST—Powder Blast at the Perseverance Mine, Juneau, Alaska. R. L. Healy. (Eng. and Min. Journ., May 18, 1918; ½ p., illus.) 20c.

9334—BLASTING—Initial Priming Substances for High Explosives. Guy B. Taylor and W. C. Cope. (Tech. U. S. Bureau of Mines, 1917; 32 pp.; Paper 162.)

9335—CEMENT GUN—Use of the Cement Gun in the Coeur d'Alene Mining District. (Eng. and Min. Journ., Apr. 27, 1918; 2½ pp., illus.) 20c.

9336—CHUTES—Fixing a Chute Mouth Without Emptying Chute. C. T. Rice. (Eng. and Min. Journ., May 18, 1918; ¾ p., illus.) Practice at Hecla Mine, Idaho. 20c.

9337—HOISTING—Factor of Safety of Wire Ropes Used for Winding in Mine Shafts. J. A. Vaughan. (Journ. So. Afr. Inst. of Engrs., Jan. and Mar., 1918; 11¼ pp., illus.) Continued discussion of article previously indexed.

9338—NEW YORK—The Mining and Quarry Industry of New York State—Report of Operations and Production During 1916. D. H. Newland. (Bull. 196, N. Y. State Museum, Apr. 1, 1917; 58 pp.)

9339—ONTARIO—Statistical Review of the Mineral Industry of Ontario for 1916. Thos. W. Gibson. (Vol. XXVI, Ann. Report, Ont. Bureau of Mines, 1917; 66 pp., illus.)

9340—QUARRY ACCIDENTS in the United States During the Year 1916. Albert H. Fay. (U. S. Bureau of Mines, 1918; 58 pp.)

9341—REPORTS—The Standardization of Directors' Reports for Mining Companies. T. O. McGrath. (Eng. and Min. Journ., May 4, 1918, 3 pp.) 20c.

9342—SAFETY—How to Organize for Safety. S. C. Dickinson. (Bull. 81, Univ. of Ariz., 1917-18; 52 pp.)

9343—SHAFTS—Fireproofing Mine Shafts of the Anaconda Copper Mining Co., E. M. Norris. (Bull. 135, A.I.M.E., Mar., 1918; 3 pp., illus.)

9344—SIGNAL—A Responsive Shaft Signal Device. B. Angwin. (Bull. 161, I.M.M., Feb. 28, 1918; 3 pp., illus.)

9345—TAXATION—The Incidence of Taxation upon Metalliferous Mining in the British Isles. Henry Louis. (Bull. 161, I.M.M., Feb. 28, 1918; 21 pp., illus.) Discussion of article previously indexed.

FLOTATION

9346—ADDITION AGENTS in Flotation, the Effect of. M. H. Thornberry and H. T. Mann. (Met. and Chem. Eng., Jan. 15, and Mar. 1, 1918; 9½ pp., illus.) Second and third instalments; first was published Dec. 15, 1917.

9347—DRYER—Improved Flotation Dryer. S. Paul Lindau and W. E. Evans. (Min. and Sci. Press, May 11, 1918; 1 p., illus.) 20c.

9348—SILVER ORE—Flotation of Semi-Oxidized Silver Ore. E. J. Atckison. (Min. and Sci. Press, Apr. 27, 1918; 2½ pp., illus.) 20c.

ORE DRESSING—GENERAL

9349—BUCKET-ELEVATOR OPERATION. Some Practical Hints in. A. M. Nicholas. (Bull. 134, A.I.M.E., Feb., 1918; 2 pp.) 40c.

9350—CRUSHING—Notes on Theory and Practice of Ball-Milling Particularly Peripheral Discharge Mills. Pierre R. Hines. (Bull. 134, A.I.M.E., Feb., 1918; 13¼ pp., illus.)

9351—DRY SIZING as a Means of Preparing Feed for Concentration. George V. Bland. (Eng. and Min. Journ., May 18, 1918; 4 pp., illus.) 20c.

9352—FLOW SHEETS—Determining Flow Sheets in New Mills. A. Schwarz. (Eng. and Min. Journ., Apr. 27, 1918; 1½ pp.)

9353—SEPARATION—A New Method of Separating Materials of Different Specific Gravities. Thos. M. Chance. (Bull. 134, A.I.M.E., Feb., 1918; 7½ pp., illus.)

9354—TONNAGE-SAMPLING—Chart for Tonnage-Sampling and Dilution-Control. Hallet R. Robbins. (Min. and Sci. Press, Apr. 27, 1918; ½ p.) 20c.

METALLURGY—GENERAL

9355—PYROMETERS—Standardization of Rare-Metal Thermocouples. Paul D. Foote, T. R. Harrison and C. O. Fairchild. (Met. and Chem. Eng., Apr. 1, 1918; 6 pp., illus.)

9356—SLAGS—Classification of Furnace Slags. Herbert Lang. (Min. and Sci. Press, May 4, 1918; 2½ pp.) 20c.

9357—STELLITE—Alloys of Cobalt, Chromium, Tungsten and Molybdenum. Elwood Hayes. (Met. and Chem. Eng., May 15, 1918; 1¼ pp., illus.)

MINING AND METALLURGICAL MACHINERY

9361—AIR COMPRESSOR—Testing an Air-Compressor. Walter S. Weeks. (Min. and Sci. Press, Apr. 6, 1918; 3½ pp., illus.) 20c.

9362—HOISTING—Electric Winding Engines; a Comparison of Various Systems and Some Aspects of the Problem in the Event of Centralization. John F. Perry. (Iron and Coal Tr. Rev., Feb. 1, 1918; 4 pp., illus.) 40c.

9363—POWER—Economy of Electricity Over Steam for Power Purposes in and About Mines. R. E. Hobart. (Bull. 134, A.I.M.E., Feb., 1918; 9 pp., illus.)

9364—PUMPS—A Liquid Speedometer. Wm. Alexander. (Journ. So. Afr. Inst. of Engrs., Feb., 1918; 6 pp., illus.)

INDUSTRIAL CHEMISTRY

9365—AMMONIA—El Procedimiento Haber para la Sintesis Industrial del Amoniaco. Alejandro Bertrand. (Bol. Soc. Nac. de Minería, Jul-Aug., 1917; 28½ pp., illus.)

9366—CHEMICAL APPARATUS—The Use of Wood in Chemical Apparatus. A. W. Schorger. (Met. and Chem. Eng., May 15, 1918; 3½ pp.)

9367—CHEMICAL PLANT—Acid-Resisting Iron and Its Uses in Chemical Plant. S. J. Tungay. (Journ. Soc. Chem. Ind., Mar. 30, 1918; 3½ pp.)

9368—NITRIC ACID—Production of Nitric Acid from Nitrogen Oxides. Guy B. Taylor, Julian H. Capps and A. S. Coolidge. (Journ. Ind. and Eng. Chem., Apr., 1918; 5 pp., illus.) 60c.

9369—POTASH—The Concentration of Potash from Raw Materials Containing Only a Trace of This Element by Means of the Electric Precipitation of Flue Dust and Fume Cement Kilns. B. F. Erdahl. (Journ. Ind. and Eng. Chem., May, 1918; 3 pp.)

9370—SODIUM MANGANATE—The Manufacture of Crude Sodium Manganate for Use in Mines. F. Wartenweiler. (Journ. Chem., Met. and Min. Soc., Jan., 1918; 1½ pp.)

9371—SOUTHERN STATES—The Possibilities for the Development of Chemical Industries in the Southern States. Richard K. Meade. (Met. and Chem. Eng., May 1, 1918; 3½ pp.)

9372—SULPHURIC ACID and Fertilizer Industries. (Chem. Tr. Journ., Mar. 9, 1918; 4½ pp.)

9373—SULPHURIC ACID SITUATION in the United States. L. B. Skinner. (Met. and Chem. Eng., Jan. 15, 1918; 4 pp.)

MISCELLANEOUS

9376—CALIFORNIA STATE MINING BUREAU—Catalogue of the Publications of the California State Mining Bureau. (Bull. 77, Calif. State Min. Bureau, Dec., 1917; 44 pp.)

9377—DEPRECIATION AND OBSOLESCENCE. (Eng. and Min. Journ., Apr. 6, 1918; 2½ pp.) From a pamphlet issued by Loomis, Sufferin and Fernald, Public Accountants, New York. 20c.

9378—LABOR—A Dietary for Miners. S. H. Brockunier. (Eng. and Min. Journ., Apr. 6, 1918; 3 pp.) 20c.

9379—LABOR—Development of Community Interest. Chas. F. Willis. (Eng. and Min. Journ., May 4, 1918; 32 pp.) 20c.

9380—LABOR—Feeding and Housing Railway Maintenance of Way and Construction Employees. (Eng. and Contr., Apr. 17, 1918; 4 pp.)

9384—LABOR—The Employment Manager and the Reduction of Labor Turnover. Thos. T. Read. (Bull. 134, A.I.M.E., Feb., 1918; 13 pp., illus.)

9385—LABOR—Training of Workmen for Positions of Higher Responsibility. F. C. Stanford. (Bull. 134, A.I.M.E., Feb., 1918; 11½ pp.)

Personals

Have You Contributed to the Association of the 27th Engineers?

C. M. Weld, who has returned to New York from Canada, will be in Tennessee for two weeks.

Arthur W. Burgren, mining engineer, is now with the Lawrence Mining Co. at Lordsburg, New Mexico.

Thomas F. Cole, president of the North Butte Mining Co., has been in Butte inspecting the company's properties.

Harry J. Wolf, of the Malm-Wolf Co., recently examined silver and copper properties in Saguache County, Colorado.

George Ackerman and Bert Jones, dredgers of Oroville, Calif., have gone to Bolivia under contract to the Bolivia Tin Corporation.

John Seward has been commissioned a major on the General Staff, Executive Division, and will be stationed at Washington.

H. G. Ferguson, of the U. S. Geological Survey, is enroute to Santo Domingo to investigate the manganese resources of the country.

E. S. Bastin, of the U. S. Geological Survey, has been appointed an associate member of the Committee on Mineral Imports and Exports of the U. S. Shipping Board.

L. M. Hartzell, manager of the Bessemer department at the Homestead works of the Carnegie Steel Co., has been made assistant sales manager in the company's Cincinnati office.

Prof. J. Volney Lewis, of Rutgers College and the University of New Jersey, will devote a considerable part of the summer to professional work in the Southern Appalachians.

P. R. Bradley, consulting engineer of the Alaska Treadwell Gold Mining Co., made a tour of inspection of the company's molybdenite mines near Shakan in the latter part of April.

Frederick J. Nagle, until recently with the Vindicator and Portland companies, Cripple Creek, has been appointed mine superintendent of the Sunnyside mine at Eureka, Colorado.

James E. Harding, formerly superintendent of the Minas de Ojanco Nuevo of the American Smelting and Refining Co., has been transferred to examination work for the same company, and is now at Santiago, Chile.

R. P. McLaughlin, oil and gas supervisor of the California State Mining Bureau, left San Francisco on May 10 for Washington for conference with Federal officials who are investigating oil lands and oil production in California.

Gordon Land, of Seattle, Wash., has resigned as vice president of the Land Mines Corporation, which was engaged in hydraulic mining near Crescent City, Calif., and will engage in other mining work on his own account.

William C. Potter has resigned as an officer of the various companies controlled by Guggenheim Bros., of which firm he is a member, in order to devote his entire time to work in connection with the Aircraft Production Board.

D. L. H. Forbes, who has returned from France, has been appointed manager of the Teck Hughes mine at Kirkland Lake, Ont., succeeding L. W. Ledyard, who recently became manager of the Kirkland Porphyry property.

H. B. Patton is engaged in geological work for the Union Pacific interests, and is making a land classification survey of the company's lands in Colorado. This appointment does not interfere with his usual geological consultation work.

George E. Burton has resigned as assistant director of the Oklahoma Geological Survey to accept the position of resident geologist for the Empire Gas and Fuel Co. He has been assigned to sub-surface work in Southwestern Oklahoma, with headquarters at Norman.

William C. Russell, formerly general manager of the Caribou Mines and Mills Co., at Cardinal, Colo., and who established an engineering office in Denver upon the shutdown of the property, is at present engaged in making oil-shale examinations in Garfield County, Colorado.

A. K. McDaniel, of Denver, has been appointed general manager of the Greenback mine, at Leadville, Colo., which was recently purchased by the Western Chemical Manufacturing Co. Hugh C. Watson, for-

merly superintendent of the Yak Mining, Milling and Tunnel Co., is in local charge of the mine.

Frank H. Probert has been appointed dean of the College of Mining of the University of California. He recently left Berkeley to examine copper properties in White Pine County, Nevada, after which he will go to Washington to take up war work with the U. S. Bureau of Mines during the summer months.

William M. Keck has been appointed consulting engineer to the petroleum and gas department of the California State Mining Bureau by Fletcher Hamilton, state mineralogist. Mr. Keck has had charge of drilling operations in all the California fields and has consented to devote the necessary time to the work without compensation during the period of the war.

Lieut. Col. Campbell N. Watson, D. S. O., King's Liverpool Regiment, was severely wounded by a shell in recent fighting. One leg has been amputated, but it is hoped that the other, which was badly fractured, will be saved. Colonel Watson, who is senior partner of the firm of H. A. Watson & Co., metal and mineral brokers of Liverpool, was immediately awarded a bar to his D. S. O., upon the field of battle.

R. M. Catlin was the recipient of the honorary degree of Doctor of Science at the recent commencement of Rutgers College, given him "in recognition of his high attainments in science, his expert knowledge in the field of his profession, his notable engineering work in this country and in South Africa and in other parts of the world, and his present great usefulness in the oversight of a great mining industry of New Jersey and the nation."

Obituary

Charles Siekal, a California pioneer of '49, died at Martinez, Calif., on April 24.

John Gordon Battelle, former president of the Columbus Iron and Steel Co., died at his home in Columbus, Ohio, on May 10, aged 73 years, after a connection of nearly half a century with the iron and steel industry. He held a commission as colonel in the Ohio National Guard.

John Ryan, one of the discoverers of the great borax deposits of Death Valley in California, and for 30 years president of the Pacific Coast Borax Co., died at Oakland, California, May 7. He was also a director of two Oakland banks and the Ironopah & Tidewater R. R. He was born in Ireland 70 years ago.

Societies

Engineers' Society of Western Pennsylvania. At the regular meeting on May 21 in Pittsburgh, a paper entitled, "The Caisson Method for Foundations and Mine Shafts," was presented by George R. Johnson, district manager of the Foundation Company, Pittsburgh, Pennsylvania.

Teknik Club, of Denver, held its annual meeting at the Shirley Hotel on May 14. Following the regular dinner, two papers were read, one by M. F. Coolbaugh on "Electrolysis of Cyanide Solutions," and the other by E. G. Graham on "Multiple Effect Evaporation." H. B. Lowden, of the Colorado Iron Works Co., was elected secretary for the ensuing year.

Franklin Institute—Mining and metallurgical section met on April 11. Arthur F. Taggart, assistant professor of mining engineering in the Sheffield Scientific School, delivered a lecture entitled "An Explanation of the Flotation Process." The paper was discussed by Dr. Sadtler, Professors Dubois and Taggart, Drs. Carl Hering, Alleman and Hepburn, and others.

Birmingham Metallurgical Society, Birmingham, Eng., appointed a committee at its meeting on Apr. 11 which eventually will form a trade research association. This association will collect data, trade secrets and like material on the various alloys in which the metal trades are interested. The information will be pooled and placed at the disposal of all the members of the society.

American Electrochemical Society elected the following officers for the ensuing year at Kingsport, Tenn., in the course of its tour of the Appalachian South during the week of Apr. 28: President, F. J. Tone; vice presidents, Acheson Smith, H. W. Gillett and R. Turnbull; managers, C. F. Burgess, E. L. Crosby and C. G. Schluenderberg; treasurer, P. G. Salom; secretary, J. W. Richards. The amendment to the constitu-

tion providing for the election of honorary members was adopted. The Niagara Falls section held its annual meeting on Apr. 17 when the following officers were elected: President, L. E. Saunders; vice president, F. M. Becket; and secretary-treasurer, F. A. J. Fitzgerald. The next general meeting will be held at Princeton University, New Jersey, on Sept. 30, Oct. 1 and 2. A symposium on "Electrochemical Industries After the War" is being organized for the meeting.

American Society of Mechanical Engineers will hold its Spring meeting at Worcester, Mass., on June 4-7. Among the papers to be presented are the following: "Foundry Cost and Accounting System," W. W. Bird; "The Public Interest as the Bed Rock of Professional Practice," Morris L. Cooke; "Moisture Reabsorption of Air-Dried Douglas Fir and Hard Pine, and the Effect on the Compressive Strengths," Irving H. Cowdrey; "A High-Speed Air and Gas Washer," Lieut. J. L. Alden; "The Safety Engineer," L. A. DeBlois, safety engineer, E. I. du Pont de Nemours and Co.; "New Course of Instruction in Safety Work," George N. Folland, professor of commercial engineering, Carnegie Institute of Technology; "Efficiency of Gear Drives," C. M. Allen and F. W. Roys; "Air Propulsion," Morgan Brooks; "The Elastic Indentation of Steel Balls Under Pressure," C. A. Briggs, W. C. Chapin, H. G. Hell; "Electric Heating of Molds," Harold E. White; "Stresses in Machines When Starting or Stopping," F. Hymans; "An Investigation of the Fuel Problem in the Middle West," A. A. Potter. A topical discussion on "Fuel Economy" has been arranged for the fuel conservation committee of the Engineering Council. A report on the "Metric System in Export Trade" will be offered for discussion.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Amalgamation—Amalgamator. John I. Lefors, Boise, Idaho. (U. S. No. 1,260,781; Mar. 26, 1918.)

Gases—Apparatus for Segregating and Recovering. Utey Wedge, Ardmore, Penn., and Frederic A. Eustis, Milton, Mass. (U. S. No. 1,260,493; Mar. 26, 1918.)

Iron—Process of Smelting and Purifying. Gustav R. Gehrardt, Oak Park, Ill. (U. S. No. 1,260,660; Mar. 26, 1918.)

Iron, Steel—Treatment of to Prevent Corrosion. William H. Allen, Detroit, Mich. (U. S. No. 1,260,740; Mar. 26, 1918.)

Iron, Steel—Process of Case-Hardening. John R. Messersmith, Cincinnati, Ohio. (U. S. No. 1,260,787; Mar. 26, 1918.)

Mercury—Process for Recovering. Charles H. Fulton, St. Louis, Mo., assignor, by mesne assignments, to Metallurgical Laboratories, Inc., Chicago, Ill. (U. S. No. 1,264,629; Apr. 30, 1918.)

Mine Cage—William C. Alsman, Sullivan, Ind., assignor to Sullivan Manufacturing Co., Sullivan, Ind. (U. S. No. 1,260,290; Mar. 26, 1918.)

Ore-Car. James W. Silver, Salt Lake City, Utah. (U. S. No. 1,262,108; Apr. 9, 1918.)

Rock Drill—Thomas E. Sturtevant, Dover, N. J., assignor to McKiernan-Terry Drill Co., Dover, N. J. (U. S. No. 1,263,143; Apr. 16, 1918.)

Siliceous Fire Brick and Method of Making the Same. Harry A. Kennedy, Clearfield, Penn. (U. S. No. 1,260,398; Mar. 26, 1918.)

Smelting—Distilling Process for Recovering Metals from Ores and Metal-Bearing Materials. Charles H. Fulton, St. Louis, Mo., assignor, by mesne assignments, to Metallurgical Laboratories, Inc., Chicago, Ill. (U. S. No. 1,264,628; Apr. 30, 1918.)

Smelting—Generation of Steam from the Heat Contained in Slags. Claude Vautin, London, England. (U. S. No. 1,264,229; Apr. 30, 1918.)

Smelting—Method of Treating Siliceous Ores. George H. Wigton, Eureka, Utah. (U. S. No. 1,264,586; Apr. 30, 1918.)

Smelting—Condensing Gases from Electric Furnaces. Ingenuin Hechenblekner, Charlotte, N. C., assignor to Southern Electro-Chemical Co., New York, N. Y. (U. S. Nos. 1,264,510; 1,264,511; Apr. 30, 1918.)

Sulphur Fumes, Process for Treating. Stewart W. Young, Palo Alto, Calif., assignor to the Thiogen Co., Wilmington, Del. (U. S. No. 1,262,295; Apr. 9, 1918.)

Editorial Correspondence

SAN FRANCISCO—May 25

Chrome Mining in Humboldt County is confined chiefly to the copper region on Horse Mountain, but is not so active as might be expected. The chrome miner is not usually a diligent prospector. It has been coming easy for chrome miners in other counties, where prospects are known and have been partly developed. And the chrome miners in Humboldt County evidently think chrome deposits should be discovered without prospecting.

Elk Hills Oil-Land Fraud Suit may be reopened by the Government. The suit was recently decided against the Government by the U. S. Circuit Court of Appeals, the decision awarding to the Southern Pacific Co. the lands embracing 6109 acres in the Elk Hills, Kern County. The petition for rehearing is expected to be filed before June 3. As the decision of the Court of Appeals covers the same legal points involved in the so-called "billion-dollar" suit now pending in the U. S. District Court before Judge Bledsoe, of Los Angeles, the Department of Justice is doubly anxious to reopen the Elk Hills case. The suit pending involves 162,000 acres.

Chrome Mining in Del Norte County is moving at a pace that threatens the records of some of the earlier producers of this metal. There is a scarcity of labor, creating a wage of \$4.50 for an eight-hour day and 75c per hour for overtime. The men are said to work 10 hours and are making \$6 per day. If this is true, those who are working more than eight hours in 24 are violating a state law, approved May 30, 1913, which provides for violation a penalty of fine or imprisonment or both. The law does not mean and does not say merely that the employer cannot demand more than eight hours' labor, but also that "all persons engaged in underground mines in search of minerals, whether base or precious or employed and engaged in any other underground workings or employed in smelteries or other reduction works . . . shall not exceed eight hours, and such work shall be consecutive."

Regulation of Explosives, under the Federal Explosives Act of Nov. 15, 1917, is in California under the supervision of John M. Griffin, Madera. There are in the state over 700 persons equipped and commissioned to issue licenses. They are chiefly justices of the peace, notaries and county clerks. The U. S. Bureau of Mines is charged with the enforcement of the law, which provides that violations of the provisions or the rules and regulations made under the law shall be punished by fine of not more than \$5000 or imprisonment of not more than one year, or both. Mr. Griffin is endeavoring to disseminate information regarding the law and its enforcement in California that may be of value to persons having explosives or their ingredients in their possession or who have legitimate use for explosives. Location of licensors or other information regarding the law can be obtained by communicating with him at Madera. The law covers dynamites, blasting and shotgun powders, caps and many other commodities. To obtain a license the applicant must appear in person and state under oath his place of birth, and, if a naturalized citizen, must give the date and place of naturalization. Licenses will not be issued to enemy aliens or subjects of any country allied with the enemies of the United States. Subjects of neutral countries are entitled to licenses if they are known to be loyal and responsible, or recommended by reputable loyal citizens. Appeal from the refusal of a licensor to issue a license may be taken to the National Council of Defence at Washington. The purpose of the act being to prevent disloyal persons from obtaining explosives, and to keep explosives out of the hands of persons too careless to guard them properly from theft by disloyal persons, the hearty cooperation of every loyal citizen in the state in any way interested in the use of explosives is invited and expected. There are 58 counties in California, and in practically all of them powder is used in some form of mining. The mining men have a particular interest in the law and its observance, since operation of the mines necessitates the employment of many foreigners.

DENVER—May 20

Tungsten Producers of Colorado, and also producers of pyrite and manganese, believe that they could double their output if the Government would establish an adequate and stable price for their ores or products. Officials of the Federal Government appear to be aware of the necessity of securing an increase in the domestic production of minerals heretofore largely imported, in order to relieve shipping or to make the country self-sustaining in the extremely remote possibility of an effective blockade of our ports. Most of these minerals can be produced in abundant quantities in this country. Colorado producers do not look with favor on Government interference further than the establishment of an agency to maintain a fixed and stable price. A Government subsidy, bonus, or cost and percentage agreement to stimulate production does not appeal to them. All that they ask is that they be protected from cheaply produced imports. With such protection, it is believed that they can render substantial aid to the Government in increasing domestic production of these much-desired products.

Ore Sales Committee which was appointed at the annual meeting of the Colorado Metal Mining Association in January held a meeting recently for the purpose of organization, and to consider how it could accomplish the purposes for which it was appointed. All members of the committee were present. The committee decided that it was not practicable for it to attempt to negotiate with smelters and ore buyers as outlined in the resolution which created it, and asked to be discharged from further action with reference to the said resolution. It was the sense of the committee that progress toward the underlying purpose of the "Ore Sales Committee" resolution might be attained by the appointment by the president of the organization of a small permanent committee on conciliation to consider grievances of ore producers and endeavor to adjust disagreements by conference with representatives of the smelters and ore purchasers. It was suggested that such committee be empowered and directed to consider, in consultation with representatives of smelters and ore purchasers, whether existing smelting and ore-purchasing schedules might not be remodeled and simplified. Further, the committee recommended that the Commissioner of Mines be authorized to make and enforce suitable regulations for the supervision and licensing of custom sampling works and sampling works in connection with smelters and ore purchasers, and of umpire assayers; and that the Legislature make an appropriation of funds for the effectual carrying out of this purpose. The requests and recommendations of this committee will be acted upon by the executive committee of the association at its next regular meeting.

SALT LAKE CITY—May 23

Sulphuric Acid from Pyritic Ores in Utah makes it easy to obtain a large supply with minimum delay. The ores are in properties already thoroughly opened and equipped, so that quantity production could begin immediately without prospecting or other preliminary work. Transportation conditions are excellent, with good railroad service from the mines to the valley reduction plants, only a few miles distant. One of these plants is already producing acid, and with additional units could handle many times the quantity of ore now being treated.

An Early Supply of Winter Coal is urged by the United States Fuel Administration here, so as to keep the mines busy at this season and to conserve the working forces, which, if work is slack, would easily be diverted to other employment. During February, March, and the first half of April mines in this state worked only half time through lack of orders. Also at this time hauling facilities are ample, as farm crops have not yet begun to move, and householders are asked to be forehanded in their own interest, as well as from a sense of patriotic duty, as later, especially with the constantly increasing volume of war materials having the right of way, the railroads will be taxed to the utmost. At present coal

45c per ton allowed by Washington on nut and lump coal, but the advance may be made at any time at the option of the coal-mining companies.

Deposits of Pyritic Ores in Utah, notably in the Bingham district, deserve attention in connection with the Government's interest in the domestic production of war minerals. These deposits can be made to contribute largely to the supply of sulphuric acid if adequate encouragement be given to their development and exploitation and if existing facilities for reduction advantageously situated with respect to the mines be somewhat amplified. There is much pyrite in practically all of the Bingham ores. Some of this ore carries a small amount of copper—probably 0.5 to 1.5%—and a little silver and gold. In some of the mines there are low-grade sulphides carrying, besides the pyrite, a little lead and zinc. Pyritic ores are found in the Utah Apex, Yampa (which latter property has furnished pyrite for acid manufacture to the Hercules Powder Co. at Bacchus), the Bingham Mines, Dalton & Lark, Fortuna, Montana-Bingham, Utah Consolidated, Utah Metal and Tunnel, and others. The former Boston Consolidated, now part of the Utah Copper, had immense bodies of low-grade pyritic ores, and some of these, on account of their low copper content, are undoubtedly still available. Massive pyrite occurs on the lower levels at a number of properties. In addition to the Bingham deposits, there are pyritic ores in other parts of the state—at Ophir in Beaver County, and in other districts. Encouragement to the production of pyrite and a ready market for this material would bring about the opening of other higher-grade orebodies or oreshoots, such as are frequently found in connection with the pyrite.

BUTTE, MONT.—May 23

That the Ranks of Miners in the Butte district may not be depleted, Provost-Marshal General Crowder will further reduce draft calls on Butte to the actual number of men available. Last call required Montana to furnish 2038 men, with Silverbow County called upon for 251 from a list of 166 available in Class 1. In the city of Butte, wherein practically all of the population of Silverbow County resides, the call is for 463 men, with only about 800 qualified.

Miners for Service in France are being recruited by Army officers now in the city, as the Government is sorely in need of men to handle high explosives, dig trenches and do such work as the miner is capable of performing in a skilled manner. Although the miner is getting \$5.25 per day for eight hours, and has not to endure the hardships of war, many nevertheless are responding to the call to duty. The recruiting officers announce that they want 100 from this district, and they will probably get that number.

JOPLIN, MO.—May 20

Overlapping of the Oil and Zinc regions in Oklahoma seems proved by the Rettet Mining and Oil Co., which has just finished casing a 380-ft. gas well preparatory to piping it to its drill rigs at the No. 2 hole, about 20 miles south of Miami, in Delaware County. The drill entered the sand about Apr. 1 and flow of gas has increased steadily, until it now amounts to about three million feet per day. Many leases have been taken in the vicinity by oil men, and more drilling is under way. H. Townsend Salter, an oil man of Okmulgee, is president of the Rettet company. He expects to find oil.

Discoverers of New Uses for Zinc are to receive a prize from a \$10,000 fund, of which \$500 is an initial contribution by the United Producers Smelting Co., which is erecting a zinc smeltery and rolling mill at Henryetta, Okla. F. C. Shoemaker, president of the company, proposes that \$5,000 be given in cash to the first person who discovers a new use for zinc whereby 50,000 tons of the metal will be used within a year; \$3000 to the first person to discover a new use for zinc that will take 30,000 tons in the same time; and \$2000 to the person who brings about the utilization of 20,000 tons of zinc. He suggests that the contest close Jan. 1, 1919, and that

the prizes be awarded soon after that date. The judges, according to the plan, will comprise a chemist, a practical miner and a business man, to be named by the Miami Business Men's League.

Standardization of Assaying Methods in this district is to be undertaken as a result of suggestions to that effect by the buyers of high-grade ore, backed by the approval of Government authorities. Since the qualifications of high-grade ore have been made more exacting, it is evident that even a small error on the part of the assayer might result in losing a producer as much as \$20 per ton for his product. It is argued that if all assayers use exactly the same methods in their work, mistakes are less likely to occur. A committee has been appointed from the assayers to proceed with the standardization work.

DULUTH, MINN.—May 16

Iron-Ore Shipments for head of the Lake docks have been heavier than expected since opening of navigation. On May 2, 44 steamers arrived at Duluth-Superior harbor, and the tally was 40 on May 4. Ore docks have been working at capacity. There is an inclination to revise early estimates of 54,000,000 tons of iron-ore shipments for current season. Attention is drawn to growing demand for pig iron in connection with manufacture of munitions and other Government supplies. Oliver Iron Mining Co. and independent operators on Mesabi and Vermilion ranges have been endeavoring to increase ore shipments to docks. In view of high wages paid, outlook as regards possibility of labor troubles is felt to be steadily improving. Iron interests estimate that shipments of manganese ore from Cuyuna range this season will exceed 600,000 tons. Buying of manganese ores by the United States Steel Corporation has been a factor this spring. It is understood the corporation desires 200,000 tons for 1918 delivery.

TONOPAH, NEV.—May 3

The Manhattan Apex Decision was rendered by Judge Averill of the District Court here yesterday in the long-contested suit brought by the Manhattan White Caps Mining Co. against the Manhattan Morning Glory Co., the decision upholding every contention of the plaintiff company. The White Caps company sought an injunction to prevent the Morning Glory company from sinking its shaft through the White Caps property in an effort to follow an apex claimed by the defendant company as its own by right of discovery.

VICTORIA, B. C.—May 22

Lead Marketing Conditions Have Improved to such an extent that the Consolidated Mining and Smelting Co. of Canada has notified custom shippers of lead-bearing ore that dating from May 1, full advances on the 90% basis on the apparent value on preliminary settlements for lead ore would be resumed. This followed an announcement to custom shippers, issued months ago, that the company, owing to the lack of a market for lead, could advance but 25% of the values, the balance of the 90%, if so desired, to be pooled with the company's lead ores until a market could be found.

The Consolidated Mining and Smelting Co. of Canada announces that the large increase in the various items entering into the mining and smelting of Rossland ores, without adequate compensation in receipts by increased metal prices, coupled with increased taxation, have made it necessary for the company to suspend shipments from the Rossland mines indefinitely. The company will endeavor to keep a small force on development work, and to place the remainder of the Rossland employees at the smelter, the Sullivan mine, Kimberly, and other lead-silver properties of the company. Rossland ores contain only a few pounds of copper per ton, their value being mostly in the gold contained. It is the intention, therefore, to make shipments sufficient only, with the augmentation of custom ores, to keep one copper furnace at the company's smelter at Trail in operation.

The Customs Smeltery at Ladysmith, B. C., is to be blown in about June 20. This smeltery was active for a while last year, but closed down in order to reorganize and to provide a continuous supply of ore. Both of these objects have been accomplished. The company will operate, under lease and bond, the Willow Grouse group, in the East Sooke district, Vancouver Island, from which property several satisfactory shipments have already been made. There is about 2000 tons of coke on hand at the smeltery, as well as about 2000 tons of basic copper ore, which has been held over pending the supply of a siliceous fluxing ore. The Hon. William Sloan, Minister of Mines, has taken a keen interest in the effort to develop conditions that would warrant the reopening of the smeltery, not temporarily, but with reasonable assurance of being able to continue, and he is satisfied that the small-mine operators of the island and of the coast sections of the mainland of the province will find the smelting facil-

ties thus provided a real boon. The resident engineers for the Coast Mineral Survey districts, George Clothier and W. M. Brewer, report there should be several mines developed during the coming season to a sufficient extent to assure regular shipments of such size as to keep the plant working to capacity.

TORONTO—May 24

The Water Route From Elk Lake to the Fort Matachewan district is open, and a launch is being run from Elk Lake to Indian Chutes, where a short portage is made to another launch operating to Fox Rapids. It is purposed to forward passengers and supplies by team the rest of the way. The journey can be made in a day. A number of prospectors and others are going into the district.

AUSTRALIA—Apr. 24

All Australian Zinc Concentrates were reserved under contract when the Hon. William Morris Hughes, the Australian Prime Minister, visited London last year and entered into negotiations with the British government for the sale of the whole output for the period of the war and 10 years thereafter. In announcing the closing of the contract along these lines, Mr. Hughes stated recently that on his previous visit to London he arranged a contract for the sale to the British government of 100,000 tons of zinc concentrates and 45,000 tons of electrolytic zinc and spelter per annum for 10 years. The new arrangement goes still further, and stocks of zinc concentrates on hand at Dec. 31 last were to be purchased by the Imperial Government, less a definite percentage reserve. Thereafter the Imperial Government was to take 250,000 tons per annum for the period of the war and one year thereafter, and 300,000 tons per annum for the following nine years. The Imperial Government also secured an option over the remainder of the production of Australia. At the same time provision had been made for supplying adequately the requirements of Australian zinc-refining works for the whole period covered by the British contract, and the fulfilling of existing contracts with Japan. Under normal conditions the Australian output of zinc concentrates, averaging from 46 to 48% zinc, is about 400,000 tons per year. The production of zinc from distillation works (Associated Smelters, Port Pirie) has been about 5000 tons per annum. The first unit of the Electrolytic Zinc Co.'s plant at Risdon, near Hobart, is now turning out 60 to 80 tons of the highest grade zinc per week.

The Mining News

ALASKA

ALASKA SHIPMENTS of domestic copper ore, matte, etc., to the United States were: Gross tons, 13,009; copper contents, 3,579,920 lb.; evaluated at \$843,631.

FAIRBANKS GOLD (Fairbanks)—Construction on new dredge to be erected on Fairbanks Creek has been started by the Union Construction Co. of San Francisco.

JOSEVIG-KENNECOTT CO. (Kenne-cott)—Operations soon to be resumed. Sufficient supplies for year are on hand.

KENNECOTT COPPER CORP. (Kenne-cott)—Reported to have declared a lock-out against miners joining the American Federation.

ALASKA TREADWELL (Treadwell)—A general average increase of 50c. per day in wages affecting all departments has been granted upon suggestion of a committee representing the Douglas Island Labor Union.

COPPER KING PROPERTY (White-horse)—Plant recently destroyed by fire. Mine has been steady shipper and damage to be replaced.

ALABAMA

Jefferson County

WOODWARD IRON CO (Birmingham)—Work begun on new vertical shaft in Sec. 24, T 19 S, R 4 W. Shaft 14 by 22 ft. and to have four compartments. To be sunk about 1400 ft. Work being done by E. J. Longyear & Co., of Minneapolis, with Captain Holman in charge.

ARIZONA

Cochise County

DENN-ARIZONA (Bisbee)—Sinking to 1600 level. Station being cut on 1500 level for pumps. Additional equipment to be installed to handle water.

Greenlee County

ARIZONA COPPER CO. (Clifton)—Copper production in April was 4,200,000 pounds

Mohave County

MISSOURI-MOHAVE MINING CO. (Cerberat)—Hoist, compressor, and other machinery installed. Mines opened to depth of 100 ft. G. W. Marks is manager.

TUCKAHOE MINE (Chloride)—Installed electric pump.

BELLA UNION MINE (Chloride)—Shipped first bullion for some time. Company installed bullion furnace. J. J. Robinson is general manager.

GOLD ROAD MINES CO. (Goldroad)—A Marcy mill to be installed at mouth of tunnel.

GOLD ORE MINE (Oatman)—Drift now being extended east on 650 level. Mill just completed first run of 30 days.

UNITED EASTERN (Oatman)—Main shaft down 965 ft., with crosscuts driven to vein on 303, 465, 565, 665 and 965 levels. First bar bullion of May output recently shipped.

Navajo County

ARIZONA MOSSBACK (Snowflake)—To install compressor, 40-hp. hoist and 60-hp. engine.

Pima County

NARRAGANSETT MINE (Tucson)—Developed new ore.

SAN XAVIER EXTENSION (Tucson)—Drifting toward crosscut at 275 level from old shaft and on 229 level from new working shaft. Charles F. Sturtevant is in charge.

Santa Cruz County

FLUX MINE (Patagonia)—Taken over by Fred Kollberg and associates under lease and bond. New machinery has arrived.

Yavapai County

GADSDEN COPPER (Jerome)—Shaft sinking attained depth of 900 feet.

HAYDEN DEVELOPMENT CO. (Jerome)—Cyanide mill treated 60 tons of gold ore per day in March.

JEROME COPPER CO. (Jerome)—Option by General Development Co. allowed to expire.

JEROME VERDE CO. (Jerome)—A 170-gal. pump installed on 550 level and 130-gal. pump to be moved to bottom.

LOUIS LeBARRA GROUP (Prescott)—Property consists of 16 claims in Copper Basin formally taken over by International Syndicate of Mines and Smelters.

TIP TOP MINE (Prescott)—Reported under option to H. C. Wilmot, of New York.

Yuma County

BLACK GIANT MINES (Parker)—Recent strike attracting attention to Cuprite camp.

ARKANSAS

Baxter County

WILSON (Mountain Home)—Discovery of manganese ore reported on the Three Brother Mountains 12 miles north.

Boone County

IOLA (Zinc)—To install battery of tables in mill.

TAR KILN (Zinc)—To install battery of tables in mill.

CALIFORNIA

Alameda County

WESTERN MAGNESITE CO. (San Francisco)—Master in Chancery H. M. Wright has ordered James J. Cummings, Jr., and Joseph E. Stock, stockholders, to pay the company \$26,883 for magnesite ore extracted from the mines near Livermore. In a hearing before Judge Van Fleet in the U. S. Circuit Court recently Cummings and Stock were ordered to return the magnesite claims to the company and render an accounting. They contended in the master of chancery hearing that they had expended \$61,000 in development and extraction of ore, but this claim was denied, and the defendants were ordered to pay for the ore.

Amador County

CENTRAL EUREKA (Sutter Creek)—Shaft sinking discontinued and crosscutting on 3500 level to be started to develop orebody disclosed in 3300 and 3400 levels. Henry Warrington is acting superintendent since the resignation of Fred Jost.

OLD EUREKA (Sutter Creek)—Development on upper levels not to be pushed until shaft sinking is completed.

Butte County

BUTTE CONSOLIDATED (Forbestown)—Reported to resume operation about June 1.

PACIFIC GOLD DREDGING CO. (Oroville)—No. 4 dredge has exhausted its ground, and the dredge to be dismantled and machinery used elsewhere. Company still operating in Trinity, Yuba and Placer counties. Oroville field nearing end of its dredging history.

TABLE MOUNTAIN G. M. CO. (Oroville)—New company formed by Oroville men to develop Butterfly mine. Gordon Nesbit, president; Charles Fisher, superintendent; R. S. Kitzick, secretary; C. L. Bills, treasurer; C. F. Belding, director.

Calaveras County

MURPHYS DISTRICT is showing renewed activity. Condit mines at Collierville preparing for work under P. E. Condit. Briggs mine at Sheepranch showing quartz in tunnel.

LIGHTNER (Angels Camp)—Work preliminary to deepening shaft 400 ft. started.

VICTOR GRAVEL (Angels Camp)—Mining to be resumed. Has been in litigation for several years.

FEDERAL GOLD (Carson Hill)—Reduction plant nearing completion.

MORGAN (Carson Hill)—Test run of ore reported encouraging.

Del Norte County

CHROME MINING active in northern part of county. Principal districts are French Hill, Gordon Mountain, and Monumental, and large tonnage ready for extraction.

Eldorado County

GEORGETOWN DISTRICT is attracting attention in the development of chrome properties.

EL DORADO LIME AND MINERALS (Sacramento)—Contemplates extensive development of property near Shingle Springs.

Humboldt County

MANGANESE DEPOSITS 5 miles from Shelter Cove, owned by F. A. McKee, said to be high-grade ore. Deposit traced 200 ft. along outcrop. Easy shipment to water transportation.

Nevada County

GRASS VALLEY CON. (Grass Valley)—Shaft, mill and cyanide plant being planned to cost \$225,000. Proposed capacity 29,000 tons per annum. W. L. Williamson is in charge.

SIERRA ASBESTOS CO. (Washington)—Preparations being made to crush the ore. Tramway being built between the mine and the mill, and a three-span bridge being constructed over Yuba River.

Plumas County

ENGLÉS COPPER CO. (Keddie)—Opening wide bodies of excellent ore, and another 750-ton flotation plant to be provided before summer.

CRYSTAL LAKE (Taylorsville)—Manganese property worked under lease by Edward and Warren Smith. Four men employed sinking shaft and making preparations for taking out ore for shipment as soon as the roads will permit.

Riverside County

VILLMAN (Mineral)—Extracting high-grade zinc ore carrying silver, gold and copper.

San Luis Obispo County

WELCH MANGANESE (San Luis Obispo)—Three motor trucks hauling ore from Los Osos Valley to railroad, transporting a total of 30 tons per day. Ore shipped to Heroult, in Shasta County.

Shasta County

MAMMOTH COPPER CO. (Kennett)—Centering activities in development of Shasta King mine of Trinity Group. Ore, in addition to a high copper, carries gold and silver. Heavy tonnage developed.

AMERICAN GOLD DREDGING CO. (Redding)—Timber and machinery being assembled for construction of 6-cu.ft. bucket dredge; wooden hull, 132 ft. long, 44 ft. wide. Large area along Sacramento River, already drill prospected, proved suitable for gold dredging.

BULLY HILL (Winthrop)—Old smeltery being converted into flotation plant, of 150-ton initial unit capacity. House to accommodate 100 men under construction. Mine shipping 115 tons of ore daily to Kennett.

Sierra County

MONTE CARLO (Brandy City)—Acquired by Brandy City Hydraulic Mines Co., to be worked in conjunction with other mines. Tailings to go to reinforced-concrete dam to be constructed this summer.

MOUNT FILLMORE (Gibsonville)—Driving 3000-ft. tunnel to tap Mount Fillmore channel. F. A. Stewart is superintendent.

SIERRA CENTRAL CANAL (Port Wine)—Application to State Water Commission for 500 second feet of water to be taken from Gold Lake by J. H. Wilkie, of Yuba City. Gold Lake is an important body of water situated on the northern edge of Sierra County and about 18 miles east of north from Port Wine, which is on the western edge of the county. The company proposed to carry the water by ditch, use it for placer mining and return the water into Slate Creek, on which the gravel mines to be worked are situated.

TABLE ROCK MINING CO. (Table Rock)—Contract let for driving 500-ft. tunnel. J. H. Hartley, of Berkeley, is superintendent. Felix E. Wormser, of New York, is consulting engineer.

Sonoma County

SOCRATES (Pineflat)—Quicksilver mine to be reopened after being idle one month. Walker Smith is superintendent.

Trinity County

ESTABROOK (Trinity Center)—Dredge sunk, bow down, Apr. 19. Cause of sinking not known at the time, though probably from an ordinary leak or a hole punched through wooden wall of the hull by running into heavy boulder. Boat was built in the summer of 1908, installed on Scott River, Siskiyou County, by Scott River Dredging Co. Went out of commission and the machinery was sold to Alta Bert Gold Dredging Co. and dismantled and moved to Trinity County in the summer of 1910. About one year ago it was sold to the Estabrook Gold Dredging Co. New hull and some changes in machinery were adopted when installed at Trinity Center. Company is building a new dredge and expected to take this one out of commission; so it will not be rebuilt, though some of the machinery may be used again.

Tuolumne County

SPRINGFIELD TUNNEL (Columbia)—Transformers installed and connection made with Sierra and San Francisco Power Co. line. Three shifts started on new tunnel.

CONFIDENCE (Confidence)—Shaft passed 1100-ft. point, and new orebody persisting. Trial run at mill to be made soon. Work on cyanide plant being rushed.

EUREKA (Tuolumne)—Group of mines and mining claims and Fisher Gold Development tunnel, grizzly mill site and 20-stamp mill. New Albany mill site and water rights purchased under judgment of court sale for \$10,000 by Francis F. Prentiss, of Cleveland, Ohio.

COLORADO

Boulder County

BLUE JAY (Jamestown)—Property under lease to J. T. Woods, of Boulder. Mine to produce fluor spar under management of Louis Markdt.

Clear Creek County

EMPIRE-DULUTH (Empire)—Development resumed under management of Frank Brady. Mine recently cleaned up and placed in working order. Two shifts employed.

TERRIBLE MINE (Georgetown)—Operated by Denhigh Mining Co. Ore opened on 14th level has been developed by raises to 11th level. Regular shipments good-grade lead-silver ore being made.

IDAHO M. R. T. & T. CO. (Idaho Springs)—Operating Gem mine and Newton mill. Building addition to mill to double capacity. Flotation to be used.

RANDOLPH GOLD (Idaho Springs)—Recently incorporated by Charles Ferguson, F. T. Henry and H. E. Hamilton. Acquired property of Empire Tunnel Co. Both Empire and Empress tunnels to be reopened and equipment placed in good condition.

AMERICAN SISTERS (Lawson)—Property, consisting of 13 patented and 14 unpatented claims, has been shut down on account of litigation for a period of 14 years. A group of Denver investors secured bond and lease, and began development under management of Robert Christenson. Main tunnel advanced 115 ft. last month. New company purposes to work through Elida tunnel and open American Sisters vein by means of crosscut at depth of 1300 ft. Raise then to be driven to connect with the upper workings. The property recently examined by Louis S. Noble, of Denver.

TEDDY BEAR (Lawson)—Developing recent strike. Silver occurs with gray copper. Mine on Red Elephant Mountain.

Custer County

BUFFALO HUNTER M. & M. CO. (Silver Cliff)—New 100-ton mill completed and in operation, twenty tons of concentrates being produced per day. Experiments being made to improve quality of product. Recent mine developments encouraging. Company contemplates installation of additional milling equipment. L. D. Miller is general manager. H. J. Wolf is consulting engineer.

Gilpin County

EVERGREEN (Apex)—Capacity of mill increased to 100 tons. Twelve-drill compressor now in operation. Good-grade copper concentrates being shipped.

PACTOLUS (Central City)—Stated this placer to be operated by company reopening Perigo mine, and that dredge to be installed. Placer near Perigo mine.

PERIGO (Central City)—Perigo, Gold Dirt and War Eagle claims to be operated in conjunction with Gold Dirt mill by S. J. Gish and W. R. Kinney. Gold Dirt mill to be electrically operated and concentrating and flotation machines installed.

Gunnison County

GUNNISON COPPER CO. (Whitepine)—Driving tunnel to cut large low-grade copper orebody.

VICTOR (Whitepine)—Lessees driving from Morning Star shaft to cut vein.

Lake County

GREENBACK (Leadville)—Sold recently to Western Chemical Co. Mine contains large reserves of heavy pyritic ore, low in silver. Some zinc sulphide also opened up. Mine to be extensively repaired, new equipment purchased, and better accommodations built for men. A. K. McDaniel is manager.

Ouray County

WEWISSA (Ouray)—To be reopened by lessees. Mine developed by 500-ft. crosscut adit, and equipped with power plant. Ore carries lead, copper and silver, with some rich pockets of ruby silver.

Saguache County

KAPI MINING & MILLING (Bonanza)—In April Maybelle crosscut advanced 83 ft. to a total of 893 ft. Small vein cut containing high-grade copper and ruby silver ore. To continue 100 ft. to Shawmut vein. Company recently installed electrically operated compressor plant. Harry J. Wolf is consulting engineer.

San Juan County

SAN ANTONIO (Red Mountain)—Developed and operated by Summit Copper Mining and Milling Co. Payable ore opened at 200 level. To perform considerable development work as soon as railroad is open. George Hockel is manager.

San Miguel County

TELLURIDE DISTRICT has adopted new scale of wages effective May 15, as follows: Machine men in drifts, \$4.75; machine men in stopes, \$4.50; timbermen, \$4.50; miscellaneous mine labor, \$4. Former bonus system discontinued.

STANDARD CHEMICAL (Paradox Valley)—Twenty trucks hauling carnotite ore to railroad at Placerville.

Teller County

ROOSEVELT TUNNEL (Cripple Creek)—In April headings were advanced as follows: Main heading, 100 ft.; Cresson drift on Funeral dike, 212 ft.; Portland lateral, 198 ft.; total, 510 feet.

CRESSON (Cripple Creek)—Station completed for diamond-drill operations at point 600 ft. from main tunnel in Cresson lateral. This point in United Gold Mines Co. ground, and at depth of 1800 feet.

MARY MCKINNEY (Cripple Creek)—Lessees Lacey & Woodward shipping milling-grade ore from dump on Block 20.

VINDICATOR (Cripple Creek)—Large shoot ore assaying 1 to 4 oz. gold per ton opened on middle vein of Vindicator system by Hayes Leasing Co. Shoot over 12 ft. wide in places.

IDAHO**Mineral County**

TARBOX MINING CO. (Saltese)—Company has developed large body lead-zinc ore on 800 level, and now to sink winze 200 ft. further in ore. Plan to build mill of 300 tons' capacity this summer.

Shoshone County

DOUGLAS (Beeler)—Anaconda Copper Mining Co., which has been operating property last two years, has surrendered lease. No reason given, but presumably on account of abandonment of railroad construction on Pine Creek. Douglas company expects to operate property.

CARBONATE HILL (Mullan)—Under bond to W. D. Greenough. Large underground station being cut to install Lidgerwood hoist, preparatory to sinking 1000 feet.

SENATOR MINING CO. (Mullan)—Recently organized and has taken over bond held by Ed Ehrenberg on Flynn group for \$500,000, expiring 2½ years from July 1. Property on divide between Mullan and Canyon Creek. Crosscut being driven from Star workings to cut vein in about 600 ft. at depth of 1500 ft. Crosscut has now been advanced 200 feet.

AMAZON-MANHATTAN (Wallace)—Beaver Creek branch open, and company to begin shipments. Using Ray-Jefferson mill. Accumulation concentrates now being moved and mill running half time.

DREADNOUGHT (Wallace)—Oreshoot struck at 300 ft. Controlled by Duluth and Spokane capitalists.

RED MONARCH (Wallace)—Two and one-half feet of clean galena and about three feet of lower-grade lead ore discovered in raise.

KANSAS**Joplin District**

BIG LEAD (Baxter)—Sinking two shafts on Cooper land five miles west of Baxter. To erect 250-ton mill. J. A. Settle, of Muskogee, is president.

NIX-KNIGHT-MICHELL (Baxter Springs)—A 75-ton plant to be built. Estimated cost \$50,000. C. M. Mitchell is in charge.

SUNFLOWER M. & M. (Baxter)—To build modern mill seven miles west of Baxter, adjoining Lucky Jew mine. A. E. Straehley, of Admore, Okla., is president.

COMMERCE M. & R. (Miami, Okla.)—New Webber mill started up in Kansas just north of Blue Mound. First day's run produced 76,000 lb. concentrates from 182,000 lb. crude ore on dump. R. L. King is mine superintendent.

SOUTHERN (Miami, Okla.)—Completed 500-ton mill one mile north of Treece. Mill electrically equipped throughout. Mine not yet opened up.

MICHIGAN**Copper District**

CALUMET & HECLA (Calumet)—Copper production in April, 11,734,820 lb. Producers were: Ahmeek, 2,333,191 lb.; Allouez, 545,080; C. & H., 5,863,748; Centennial, 204,179; Isle Royale, 1,013,910; La Salle, 207,910; Osceola, 1,147,364; Superior, 211,776; White Pine, 207,662 pounds.

FEDERAL SYNDICATE (Calumet)—Enlarging test pit into shaft started May 16. George North, of Hancock, elected first vice president.

SENECA (Calumet)—New vertical shaft sunk 100 ft. during first half of May.

COPPER RANGE (Painesdale)—Completing houses for 75 families.

MICHIGAN (Rockland)—Lode cut on 6th level 6 ft. wide and on 8th level 17 ft.; contains much stamp copper.

HOUGHTON COPPER (Winona)—Will continue crosscut with hope of finding Superior lode.

WINONA (Winona)—To sink King Philip No. 1 shaft.

Marquette Range

OHIO MINE (Michigamme)—To close June 1. Ore too low in phosphorus to be salable at present. This closes the last iron mine operating at Michigamme.

MONTANA**Silverbow County**

ANACONDA (Butte)—At annual meeting retiring directors were re-elected.

NEVADA**Nye County**

MANHATTAN CONSOLIDATED (Manhattan)—Crosscut started southeast on 500 level and advanced 35 ft. Water receding and pumps working at half capacity.

UNION AMALGAMATED (Manhattan)—Crosscutting, raising and drifting on 600 level midway between Earl and Bath shafts. Water inflow easily handled.

WHITE CAPS (Manhattan)—Pumping 60,000 gal. per day, or at one-fourth capacity of plant.

TONOPAH DISTRICT ore production for the week ended May 11 was 10,155 tons of an estimated gross milling value of \$172,635. Producers were: Tonopah Belmont, 2050 tons; Tonopah Mining, 3550; Tonopah Extension, 2356; Jim Butler, 650; West End, 1025; MacNamara, 453; Halifax, 37, and miscellaneous, 34 tons.

Washoe County

NIXON-NEVADA (Reno)—Smeltery returns from last carload of ore shipped show 33.36% copper, \$10.80 gold and \$13.98 silver per ton.

PENNSYLVANIA**Lancaster County**

CHROME LAND LEASED—Two leases covering tracts in lower Lancaster County, Chester County and Maryland, aggregating more than 1000 acres, have been filed in the office of the recorder by W. Frank Gorrecht and Harry B. Cochran.

OKLAHOMA**Joplin District**

MCCURDY (Hockerville)—Completed 250-ton mill south of Hockerville and started operations. Dr. H. E. Snodgrass, of Purcell, is president.

C. F. DIKE (Jopkin)—Sunk shaft in rich ore near Bilharz Bluebird mine.

LIGHTFOOT OIL & MINING (Miami)—Ground drilled and shaft down 70 ft. Expect to let contract for new mill soon.

ALEXANDER (Picher)—To erect 500-ton mill near Larsh mine. One shaft down to ore. M. F. Bayless, of Stratford, is president.

KELTNER (Picher)—Completed 500-ton mill and started operations. F. W. Evans, of Joplin, Mo., is president.

OKO (Picher)—Resumed operations after several weeks' shutdown. Southland mine has also resumed development operations.

BRINSON-KIRTLEY (Quapaw)—Completed new 200-ton mill in town limits and started operations.

OKLAHOMA MINING CO. (Seneca, Mo.)—A \$75,000 plant to be built. In charge of C. T. Jacobs.

UTAH**Juab County**

MAMMOTH (Mammoth)—Closed down owing to labor difficulties.

VICTORIA (Eureka)—Car worth \$8000 reported shipped recently in charge of armed guard.

EAGLE & BLUE BELL (Eureka)—Station cut and drifts started on 2000, but work stopped temporarily owing to labor shortage. Ore of good grade being shipped from all levels between 1000 and 1780. Sixty-seven cars shipped in April.

Piute County

FLORENCE M. & M. CO. (Marysville)—A 100-ton potash plant is under course of construction. A new-type furnace is being installed. J. A. Cullen is in charge of mill. Mine development in charge of Jacob Young.

WISCONSIN**Zinc-Lead District**

MIFFLIN DISTRICT shipments for week ended May 4 were: Coker, 125 tons; Big Tom, 83 tons, all to the Point. Vinegar Hill shipped 238 tons to Cuba, and from the Senator mine 47 tons. Grunow Mining Co. shipped 64 tons to National Separators at Cuba.

LONGHORN LEASE (Benton)—Zinc ore on this lease has proved exceptionally good.

OLD MEXICO MINE (Harrison)—Have again started to operate mine. Raymond Piquett, of Platteville, is in charge.

MINERAL POINT ZINC CO. (Highland)—Shipments of zinc ore last week were five cars going to smelters at De Pue direct. No shipments made from Saxe mine.

NEW JERSEY ZINC CO. (Highland)—Mine development in progress south of village.

M. & H. (Platteville)—Large pile of tailings being milled.

CANADA**British Columbia**

SHIPMENTS TO SMELTERY AT TRAIL for the week ended Apr. 21 amounted to 7729 tons, as compared with 8821 tons the week previous. Shipments by districts were as follows: Rossland, 4316 tons; Slocan and Ainsworth, 479; Nelson, 37; Boundary, 600; East Kootenay, 1901; other B. C. mines, 178, and American Mines, 218 tons.

CANADA COPPER (Princess Camp)—Completed deep Copper Mountain tunnel 2900 ft. long. Average rate of advance 18.6 ft. per day. Tunnel section 9 x 11 ft. A 720 ft. raise to be driven from tunnel. W. P. Tierney, of Vancouver, has been awarded the contract for the 15-mile railroad construction from Princeton. There will be 27 trestles and four large tunnels along the line, as well as several deep cuts and steep fills.

Ontario

T. C. 177 (Gowganda)—A wide vein, reported to carry high silver content, has been discovered on 200 level.

BEACON (Elk Lake)—Preparing to begin work near the Lucky Godfrey.

KRIST-THOMPSON (Porcupine)—Directors to surrender the charter on receipt of shares in the new Thompson-Krist Mining Co., each old share of the par value of \$5 to be replaced by three shares of the new company, which shares have not yet been assigned. The stock is held largely by German investors, whose shares will be deposited with the Secretary of State.

NORTH DAVIDSON (Porcupine)—Diamond drilling resumed and to continue to 1000 ft. When completed shaft to be put down to orebody at 300 level.

PORCUPINE CROWN (Porcupine)—Mine closing down. Hugh Lee will be left in charge.

WHELPLEDALE (Porcupine)—Property lying north of Hollinger incorporated in company of same name with \$2,500,000 capital.

KERR LAKE (Cobalt)—April production, 201,000 oz. silver, as compared with 207,100 oz. in March.

MCKINLEY DARRAGH (Cobalt)—Started new mill to treat old tailings by flotation.

NIPISSING (Cobalt)—In April mined ore of estimated value, \$329,617, and shipped bullion and residue of estimated net value, \$308,786. Several small but promising veins cut in No. 73 shaft.

KIRKLAND LAKE DISTRICT—Without power, the transmission line from Cobalt having gone out of commission, small line from Charlton is working, but is sufficient only to keep pumps running and lights on. Heavy winds cause of disrupted service. Line is 60 miles long.

BURNSIDE (Kirkland Lake)—Some ore has been cut at 125 feet.

LIGHTNING RIVER DISTRICT—On account failure to complete road, supplies for property left six miles from claims. Will have to be hauled in on skids at greatly increased cost of operation.

Quebec

BRITISH AMERICA NICKEL CORPORATION—Contract for construction of a nickel and copper refinery at Deschenes let to Bate, McMahon & Co. Site being surveyed and erection of plant to begin. Col. Robert Low to be in charge of the work. The plant to be constructed entirely of concrete, and building and machinery estimated to cost over \$1,000,000.

The Market Report

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver		May	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
23	4.7550	99½	48½	27	4.7550	99½	48½
24	4.7550	99½	48½	28	4.7550	99½	48½
25	4.7550	99½	48½	29	4.7550	99½	48½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May	Copper		Tin		Lead		Zinc	
	Electrolytic	Spot	N. Y.	St. L.	N. Y.	St. L.	N. Y.	St. L.
23	*23½	†	@ 7.00	@ 6.90	@ 7.20	@ 7.25	@ 7.20	@ 7.25
24	*23½	†	@ 7.02	@ 6.90	@ 7.20	@ 7.25	@ 7.20	@ 7.25
25	*23½	†	@ 7.02	@ 6.90	@ 7.20	@ 7.25	@ 7.20	@ 7.25
27	*23½	†	@ 7.02	@ 6.95	@ 7.20	@ 7.25	@ 7.20	@ 7.25
28	*23½	†	@ 7.02	@ 6.95	@ 7.20	@ 7.25	@ 7.20	@ 7.25
29	*23½	†	@ 7.02	@ 6.95	@ 7.20	@ 7.25	@ 7.20	@ 7.25

* Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

† No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) 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 the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 20c. per 100 lb. above St. Louis.

LONDON

May	Copper			Tin		Lead	Zinc
	Spot	3 Mos.	Electrolytic	Spot	3 Mos.		
24	110	110	125	355	355	29½	54
25							
27	110	110	125	355	355	29½	54
28	110	110	125	355	355	29½	54
29	110	110	125	355	355	29½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at \$4.7515. £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—May 29, 1918

The chief subject of discussion this week was the disappointing attitude of the War Industries Board with respect to the price for copper. In the markets the interesting features were the further and more emphatic strength in lead and a further easing in the tin situation.

We shall not compute and report the monthly averages for May until Monday afternoon, June 3.

Copper—The producers did not receive the decision of the Price-Fixing Committee of the War Industries Board until very late Wednesday afternoon. The outcome has created a bad feeling in the industry. The matter is discussed broadly in our editorial pages.

The demands for copper have been very large, and the producers are in an over-sold condition; i.e., they are far behind in deliveries that ought to have been made by June 1.

By decision of the War Industries Board, the price for copper continues at 23½c. until Aug. 15. The agreement between the British government and the Australian producers, which is at about the same price, expires with June 30.

Prof. L. C. Graton has been appointed secretary of the Copper Producers' Committee, to which he will devote his whole time, attending especially to statistical matters. Professor Graton is highly experienced in this subject, and his appointment is in all respects admirable.

Copper Sheets are quoted at 31½c. per lb. for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26½c. f.o.b. mill, carload lots.

Tin—The situation became easier right from the beginning of the week. At the beginning, metal of 99% grade sold in this market at 96c., and at the close it was down to 90c. Banka tin for shipment as early as possible was offered at the close of the week at 87@88c., and Chinese No. 1, for June shipment, at 85@86c. Singapore quoted Straits tin yesterday at £373, c.i.f. London, the London official quotation being £355.

Lead—Transactions were larger than in the previous week, and the market firmed up considerably, especially in St. Louis. The smaller producers now seem to be as well sold out as the larger. Lead production continues to run smaller, much below the rate of 1917, and the statistical position is strong.

Zinc—The market was very dull, all the reported sales of the week being covered by the range of 7.20@7.25c., the higher figure being realized on July-August contracts, while spot and June were bought for less. The Government placed an order for a round lot. About the only other feature of interest was some sales for export.

The War Industries Board has renewed the maximum prices of 12c. for high-grade spelter, 14c. for plate zinc, and 15c. for sheet zinc, the last two being subject to the usual discounts. This arrangement does not mean that the producers shall be paid such prices, but rather that they may not ask anything in excess of them.

The United Zinc Smelting Co., of Mounts-ville, W. Va., reports scarcity of labor.

Zinc Sheets—Unchanged at \$15 per 100 lb., less usual trade discounts and extras as per list of Feb. 4.

Freight Rates—According to the new railway freight order, copper and lead bullion are raised 25%, excepting that rates from Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Utah and Washington to New York shall be \$16.50 a net ton, with differentials to other Atlantic ports, and rates from Colorado, El Paso and Texas to the Atlantic seaboard shall be increased \$6.50 a ton.

Aluminum—The price quoted is the Government price of 32c. per lb.

Antimony—Dull and easier. We quote spot at 12@12½c. at the close. Nobody quotes futures.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at \$3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—This metal is quoted at \$1.40 per pound, unchanged.

Nickel—Market quotation is 40@45c. per pound.

Quicksilver—Steady at \$118@120 for California virgin. San Francisco reports, by telegraph, \$113, strong.

Gold, Silver and Platinum

The A. S. & R. Co., according to the "Tribune," has received official notice from the Mexican Government of the revocation of the decree requiring a gold return equivalent to the full value of the gold and 50% of the value of the silver in ores and base bullion exported from Mexico.

Mexican Dollars at New York: May 23, 77; May 24, 77; May 25, 77; May 27, 77; May 28, 77; May 29, 77.

Platinum, Palladium and Iridium—Prices fixed at \$105, \$135 and \$175, respectively.

Ore Markets

Joplin, Mo., May 25—Blende, per ton, high, \$76.90; basis 60% Zn, premium, \$75; class B, \$55; prime western, \$47@43; calamine, per ton, base 48% Zn, \$35@30; Average selling prices: Blende, \$45.62; calamine, \$32.96; all zinc ores, \$45.22.

Lead, high, \$37.85; basis 80% Pb, \$36@80; average selling price, all grades of lead, \$82.17 per ton.

Shipments the week: Blende, 7749; calamine, 250; lead, 1331 tons. Value all ores the week, \$471,060.

Shipments five months: Blende, 185,998, calamine, 8777; lead, 32,123 tons. Value, all ores five months, \$11,513,370. The calamine shipment is just half that of last year. Blende gained 5386 tons and lead is short 504 tons.

Though there is a large reserve stock of ore in the Oklahoma field, buyers claim the "gettable" quantity is no more than the weekly needs. This was the cause of advanced prices this week on prime western stocks to supply the demand of a smelter not regularly in the market.

In the "Journal" of May 18 our Joplin correspondent reported erroneously that the Fort Smith Spelter Co. had closed its plant owing to unwillingness to enter the \$75 agreement for high-grade ore, and there were further errors respecting previous suspensions of smelting at this plant. In fact, the plant has been operated continuously, save for spasmodic shut-downs of a few days, when there was inability to secure ore on account of transportation difficulties, and in one case owing to a labor dispute. The closing of May 3, 1918, was due to the American Zinc Products Co., an affiliated concern, having an overstock of spelter at its plant at Greencastle, Ind. Smelting will be resumed at Fort Smith in a few days.

Platteville, Wis., May 25—Blende, basis 60% Zn, \$75 base for limited quantity of premium grade. The highest price reported paid for the week's best product was \$70.25 per ton, the price ranging down to \$45 per ton base for second grade high lead blende. Lead ore, basis 80% lead, \$80 per ton. Shipments reported for the week are: 2270 tons of blende, 174 tons galena and 1792 tons sulphur ore. For the year to date the totals are 52,461 tons blende, 2879 tons galena and 22,822 tons sulphur ore. During the week 2856 tons of blende were shipped to separating plants.

Other Ores

Chrome Ore—Business reported done at \$1.50, f.o.b. shipping points, for 40% ore.

Manganese Ore—Unchanged at \$1.20@1.30 per unit for metallurgical ore, 48% grade. The schedule price is \$1.20, but ore has fetched better than \$1.25, ex-dock, New York.

Molybdenum Ore—Quoted nominally at \$1.25 per lb. of molybdenum sulphide in ore of 90% grade.

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight. Domestic pyrite is quoted at 30c. per unit, f.o.b. mine.

Tungsten Ore—Unchanged at \$24 for scheelite and \$19@24 for wolframite. Ore of 65% grade, containing impurities, sold as low as \$20, while the highest grade of ore, free from tin and copper, realized \$24.

Iron Trade Review
PITTSBURGH—May 28

The new price regulations in iron and steel promulgated last week in a long statement by the committee of the American Iron and Steel Institute affect only an extremely small proportion of the products of the industry. Some descriptions of Southern charcoal pig iron are advanced, though Lake Superior charcoal iron is, in the main, unchanged. An advance has been made on chain to meet objections of chain makers to the original schedule. Rivets are reduced \$5 per ton on structural and \$3 on boiler rivets. An advance is made of about \$8 per ton on bands, to meet the objections that, under the original schedule, bands were too low, comparatively to hoops. The original prices were 2.9c. on bands and 3.5c. on hoops, both being base prices, with separate lists of extra, and 12-gage down for bands and 13-gage up for hoops. A single base price of 3.5c. is made for both products, with a list of extras running through all gages, these extras being substantially the former hoop extras, for 13-gage and up and the old band extras, reduced by about \$4 per ton, from 12-gage down. Thus the base price for bands is raised \$12 per ton, though the extras are reduced about \$4, making a net advance of \$8. Cast-iron water pipe is advanced \$6 per ton.

These advances represent exceptional cases and furnish no basis for expectation that there will be general advances in the iron and steel price schedules when the matter comes up for adjustment as to what prices are to rule after June 30.

There has been a practically complete shutting off of supplies of pig iron and steel products to consumers who are not engaged in filling war orders, direct or indirect, or are not catering to the peace industries most helpful toward winning the war.

Later there will undoubtedly be somewhat more steel for the general trade, perhaps much more, but it is uncertain whether this steel will reach users through their being placed on preference lists or through ordinary commercial distribution.

Furnace and mill operations continue to increase slightly, and production of both pig iron and ingots is at record rate, probably over 42,000,000 tons a year in pig iron and over 44,000,000 tons a year in steel ingots.

Pig Iron—Answers to the merchant furnacemen's questionnaire to customers will probably be completed soon, and it will then be known just what consumers purpose doing with the pig iron they have on order, and the proportions of war and peace operations, can be analyzed to determine whether it will be necessary to allocate all the merchant pig iron as made. Meanwhile the merchant furnaces are shipping scarcely any iron except to those who have war orders. The new price regulations promulgated a week ago do not affect the local market, as they relate chiefly to charcoal iron and copper-bearing bessemer iron. Bessemer iron, free from copper, was formerly merely defined as being 10% above basic; now it is specifically stated that this applies to iron up to 3% silicon, there being extras for higher silicons. The market remains quotable at the set limits: Bessemer, \$35.20; basic, \$32; malleable, \$33.50; No. 2 foundry, \$33; forge, \$32, at furnace, freight to Pittsburgh from the Valleys being 95 cents.

Steel—There is practically no unfinished soft steel in the open market, but mills engaged in war work can sometimes pick up odd lots. Shell-discard steel has also practically disappeared from the market. A few months ago, when mills were making about half as much shell steel as now, discard steel rolled into billets was bringing \$2 to \$3 below the set prices for soft steel, while now the full prices would be paid, and still consumers cannot get any. Set prices remain: Billets, \$47.50; small billets, \$51; slabs, \$50; sheet bars, \$51; rods, \$57.

Ferroalloys

Ferromanganese—The market is quiet. Various steps taken have reduced the prospects of a shortage later, though there are ample stocks at present. Ferromanganese is quoted at \$250, delivered, for 70%; 16% spiegeleisen being \$70 at furnace.

Coke

Connellsville Coke—The market is quiet, there being limited offerings and also limited demand. Blast furnaces are now fairly well supplied. Connellsville production is running 240,000 to 350,000 tons a week, with fair car and labor supplies. Byproduct production has increased slightly and will increase much more in the next few months through completion of additional ovens.

STOCK QUOTATIONS

Table of stock quotations for N.Y. EXCH. and BOSTON EXCH. listing various companies and their prices.

N. Y. CURB*

Table of stock quotations for N. Y. CURB listing various companies and their prices.

BOSTON CURB* May 28

Table of stock quotations for BOSTON CURB listing various companies and their prices.

SALT LAKE* May 27

Table of stock quotations for SALT LAKE listing various companies and their prices.

SAN FRAN.* May 27

Table of stock quotations for SAN FRAN listing various companies and their prices.

STOCK QUOTATIONS—Continued

Table of stock quotations for COLO. SPRINGS and LONDON listing various companies and their prices.

MONTHLY AVERAGE PRICES OF METALS

Table showing monthly average prices of metals for Silver, Copper, Tin, Lead, Spelter, and Pig Iron.

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Table showing monthly average prices of metals for Copper, Tin, Lead, and Spelter.

Table showing monthly average prices of metals for Tin, Lead, and Spelter.

Table showing monthly average prices of metals for Lead, Spelter, and Pig Iron.

Table showing monthly average prices of metals for Spelter, Pig Iron, and Foundry.

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

Table showing monthly average prices of metals for Pig Iron, Foundry, and various other metals.

As reported by W. P. Snyder & Co.