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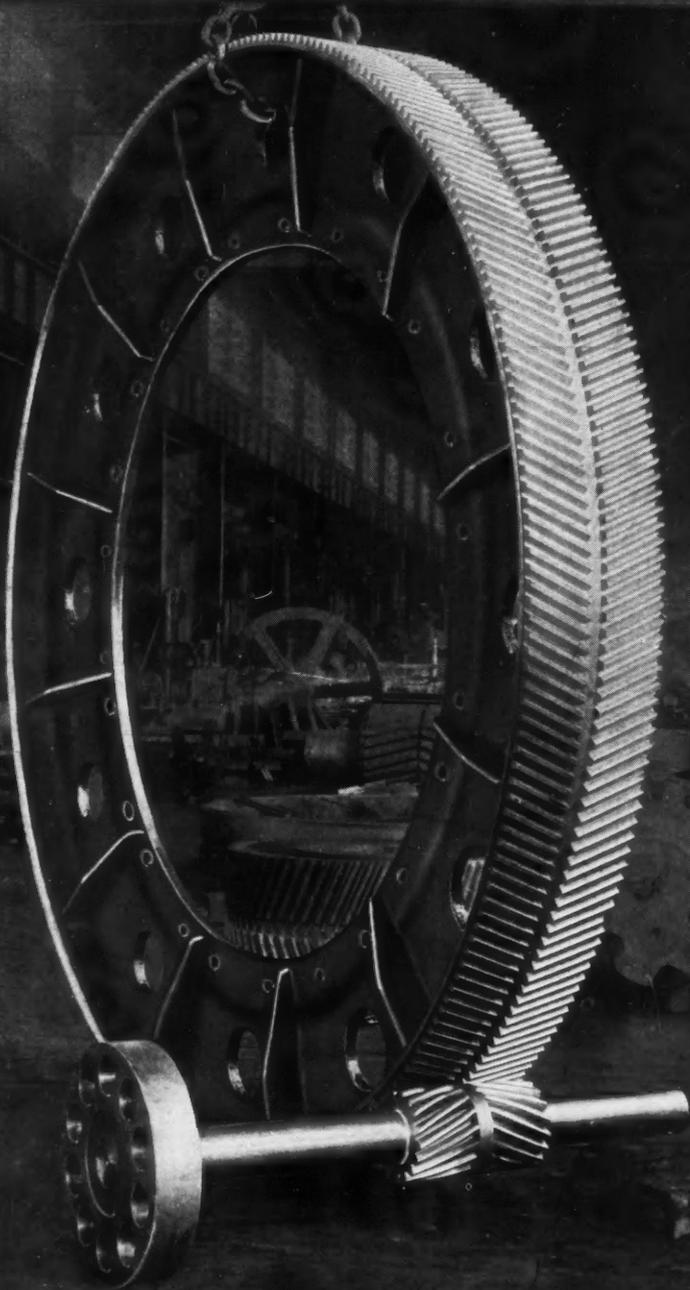
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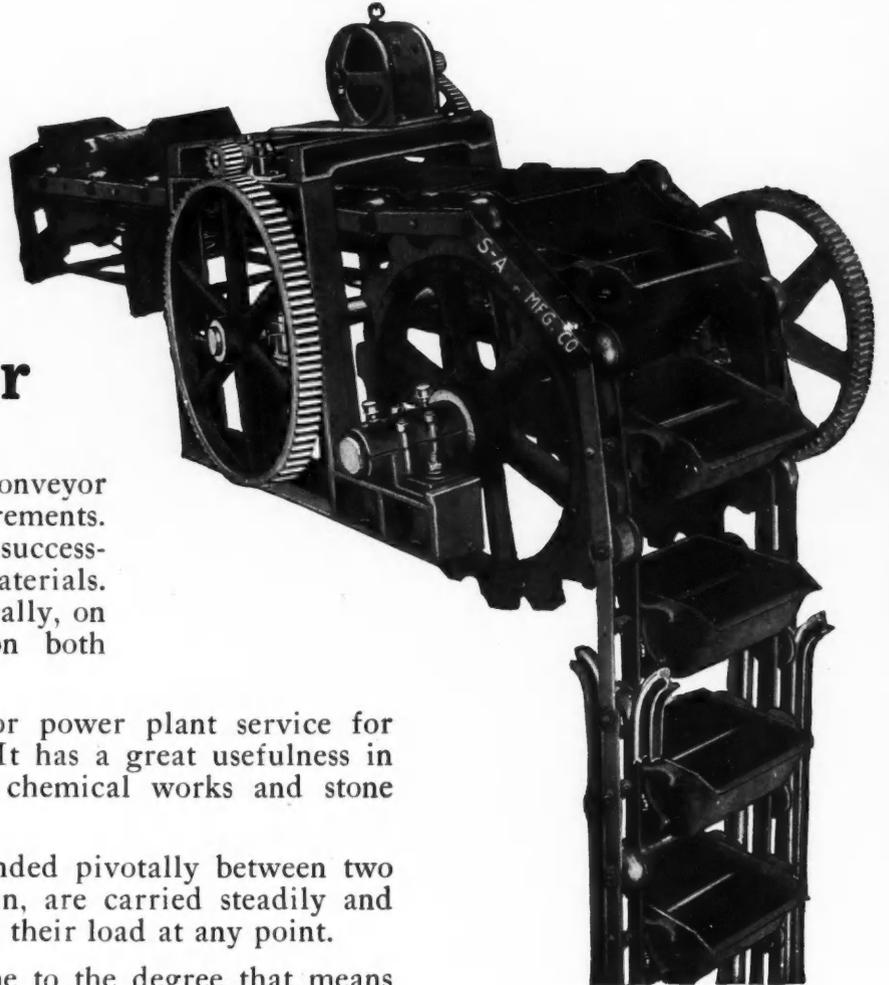


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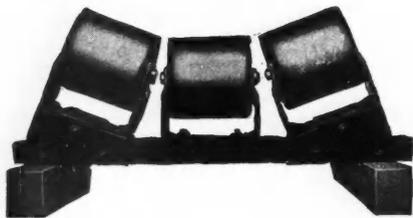


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FIG. 1. VERTICAL KILNS AT ALLEN QUARRY NEAR VALLEY, WASH., AMERICAN MINERAL PRODUCTION CO.

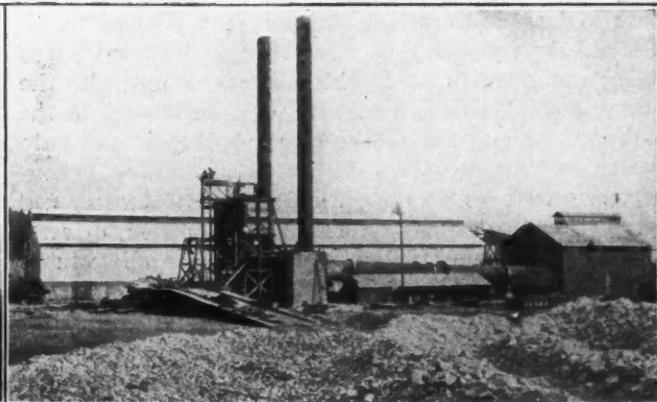


FIG. 2. ROTARY KILNS AT THE FINCH QUARRY AT CHEWELAH, WASH., NORTHWEST MAGNESITE CO.



FIG. 3. VIEW IN ALLEN QUARRY

Magnesite Deposits of Washington

BY R. W. STONE*

Production of magnesite in Washington began in 1916, when 715 tons was shipped. By the end of 1917, the deposits of the state, situated in Stevens County, had yielded 100,000 tons, which figure

will probably be doubled in the present year. The rapid development is due to the demand caused by cessation of supplies from Austria-Hungary. Modern industrial uses varied and important.

THE effect of the war on some branches of the mineral industry in the United States is well illustrated by the development of magnesite deposits in the State of Washington. The occurrence of these has long been known, but their development was commercially impracticable because of the high cost of getting the ore to a railroad and shipping across the continent to the principal consumers, and because of the low cost at which European magnesite could be imported. In 1916, when the steel industry was running short of refractory material by the stopping of imports of magnesite from Austria-Hungary, and prices on the

Atlantic Coast were high enough to pay for trans-continental shipment, development of the Washington deposits was undertaken. The output started with 715 tons, shipped in December, 1916.

In 1917, Washington produced nearly 100,000 tons of magnesite, a respectable showing for a new industry. It is estimated that if present demand continues and there is no interference by strikes, railroad embargoes, car shortage, or other causes, the output in 1918 will be over 200,000 tons of crude magnesite. Most of this will be calcined before shipment, which will reduce the weight about one-half.

The Washington magnesite deposits are situated about 60 miles north of Spokane and 5 to 12 miles west

*U. S. Geological Survey. Published with the permission of the Director.

of the Great Northern R.R. The shipping points are Chewelah and Valley, in Stevens County. The geographic relation of the deposits to the railroad is shown in Fig. 5. The distance of the quarries from the railroad retarded development in the past, but now that the new Spokane, Valley and Northern R.R. is in operation over part of its route at least, shipping conditions are easier.

The first magnesite quarried was hauled from the mountains on sleds. In the spring of 1917 the unimproved roads were deep in mud, and transportation was a serious proposition. The shortest haul was seven miles over a rough road, which became worse with the heavy traffic. Throughout 1917, ore was hauled to the railroad and supplies to the camps by teams and auto trucks. At the height of production as many as 75 conveyances were so employed, and nearly 500 men were engaged in the industry, including quarrymen, drivers, mill men, and construction gangs, not including those on the new railroad.

Delivery to the railroad was greatly facilitated early in 1918 by the completion of a five-mile aerial tramway from the Finch quarry of the Northwest Magnesite Co. to the kilns at Chewelah, and the operation of a broad-gauge railroad from the Allen quarry of the American Mineral Production Co. to Valley. This railroad is being extended up Deer Creek, and when completed will make it possible for the product of the Red Marble and Double Eagle quarries to be shipped with ease.

NORTHWEST MAGNESITE CO. LARGEST PRODUCER

In the following description, the quarries are noted in order of their geographic situation from north to south:

The Finch quarry is situated five miles on an air line southwest of Chewelah and north of Browns Lake. It was operated by R. S. Talbot, of Spokane, until May 1, 1917, when it was acquired by the Northwest Magnesite Co., R. S. Talbot, president. This property was the largest producer in 1917. The quarry floor is about 200 ft. long as developed at present, and the working face is about 40 ft. high. The workings appear as yet only as a scar on the face of a hill 300 ft. high on which magnesite outcrops from base to top. The illustration in Fig. 4 is a view along the face of this deposit. The rock is drilled by compressed-air drills, shot down, and trammed to bunkers in steel mine cars.

During 1917 the lump rock was hauled to Chewelah by wagon and auto truck, but now that the aerial tram is in operation, the rock is broken in a large jaw crusher at the quarry. The crushed rock delivered at the plant in buckets is ground in Fuller-Lehigh pulverizers before calcining. At the works, which are one mile south of Chewelah, there are three rotary kilns, 105 ft. long and 8½ ft. in diameter, fired with powdered coal. These are shown in Fig. 2. A corrugated iron warehouse about 160 ft. long, with concrete floor and foundation, has been built beside the railroad for storage and shipment of the calcined magnesite. The men at the Finch quarry occupy a large bunkhouse 190 ft. long, which is divided into 33 rooms for two men each, and equipped with flush toilets and shower baths.

The Allen and Moss quarries of the American Mineral Production Co. are west of Browns Lake, one-half and three-quarters of a mile, respectively, south of the Finch

operations, and about seven miles northwest of Valley, the office and shipping point of this company. The two quarries are about 1000 ft. apart and near the opposite ends of a magnesite lense about one quarter mile long. The thickness of the lense varies, but is about 200 ft. at the Moss quarry, which is so situated that a working face about 75 ft. high can be developed. The magnesite beds, together with the overlying quartzite and underlying shale and slate, dip at high angles. A fine grained, green igneous rock, possibly diabase, outcrops at a few places close under the magnesite. A general view of the Allen property as it appeared late in September, 1917, is shown in Fig. 3. Besides shipping crude magnesite, the Allen and Moss quarries are supplying ore to four vertical stack kilns (Fig. 1) on the bank above Browns Lake and about 900 ft. east of the Allen quarry. These kilns originally were oil-burning, but were converted to wood-burning in August, 1917, a shortage of fuel oil and an abundance of wood at the kilns being responsible for the change.

AMERICAN MINERAL PRODUCTION CO. RANKS SECOND

The second largest magnesite producer in the Stevens County field in 1917 was the American Mineral Production Co., and most of its output came from the Allen and Moss quarries. Delivery of the output to the railroad at Valley cost \$2.50 per ton in 1917, and was very difficult at times, on account of the condition of the road. The new railroad built directly to these quarries in the fall of 1917 will make it easy to produce a much larger quantity of magnesite in 1918.

The Woodbury quarry of the American Mineral Production Co. is one and one-half miles southwest of the Allen plant and six miles from Valley. It was one of the first to be developed, and is equipped with two vertical-stack kilns. After a few months of experimenting and production, work was discontinued at this quarry, on account of the better quality of the magnesite in the company's other properties.

MAGNESITE FORMERLY SOLD AS MARBLE

Ten miles by road west of Valley is the Keystone quarry of the Northwest Magnesite Co. This was formerly worked by the United States Marble Co., which from 1898 to 1903 sawed, polished and sold dressed stone to the value of \$100,000. The so-called marble thus sold was magnesite, and it was from this quarry that R. S. Talbot, of Spokane, made the first shipments of Washington magnesite as such in December, 1916. The deposit is high on the mountainside, and consists of beds pitching at an angle of 45° into the mountain. The magnesite outcrops in large ledges for 300 or 400 yards along the upper slope of a ridge. It is safe to say that there is 1,000,000 tons of magnesite in sight and probably much more. The magnesite partly replaces a lense of dolomite, and beds of dolomite are interspersed with it. Quartzite lies above the deposit and shale below. Igneous intrusives occur in the shale. The Keystone quarry has not been utilized since early in 1917, because the Finch quarry, owned by the same company, is much nearer the railroad. The new railroad from Valley to Deer Creek passes within one and one-half miles of the Keystone quarry, and will make possible the operation of this property when needed.

The Double Eagle quarry of the Valley Magnesite Co. is next on the south. This deposit was discovered and developed by Prof. F. M. Handy, of the State College, at Pullman, Wash., who was in large measure instrumental in opening up the Stevens County deposits. The property of this company is on the north side of Deer Creek near the top of a high ridge and about 800 ft. higher than the terminus of the railroad on the creek bottom three-quarters of a mile away. The deposit has been opened at two points several hundred yards apart. The magnesite beds dip at an angle of about 50° and show many variations from fine to coarse grained, mottled and banded, with coarse black magnesite crystals common on bedding planes and joints.

A bank of vertical-stack kilns was built below the quarry in the summer of 1917, and shipments of both crude and calcined magnesite were made by wagon and auto truck in the second half of the year. Supplies for the camp and shipments of ore had to be hauled 12 miles over a rough road at a cost of \$4.50 per ton. The larger development of the property, like that of the Red Marble quarry of the American Mineral Production Co. on the opposite side of the valley, has been dependent on the completion of the railroad.

The southernmost magnesite deposit, not shown on the accompanying map, is known as the Red Marble. Years ago attempts were made to develop a marble quarry at this place, the magnesite being mistaken for marble, but, so far as known, shipments were not made. This deposit, which was acquired by the American Mineral Production Co., extends along the top of a ridge on the south side of and about 900 ft. above Deer Creek. Its red color is a striking characteristic of the magnesite on this property. In spite of the color, the magnesite has a low iron content. The rock varies from fine to coarsely crystalline, and some of it can be distinguished from dolomite only by chemical tests. This deposit is about one-quarter mile long and from 200 to 300 ft. thick, consisting of beds dipping at about 45° and extending to unknown depth. The country rock is slate, schist, and quartzite, intruded by a dark green igneous rock like diabase. The magnesite wholly or partly replaces an original dolomite lense. If 50% of the deposit is commercial magnesite, it is reasonable to estimate 2,000,000 tons within 50 ft. of the surface.

AERIAL TRAMWAY WILL CONNECT RED MARBLE QUARRY WITH RAILROAD

Development of the Red Marble quarry has been retarded by its situation. It is 12 miles west of Valley by a poor road. In the last mile there is an ascent of 900 ft., which is a stiff grade for a team with a heavy wagon, and which has been ascended by only a few auto trucks. An aerial tram one mile long from the Red Marble quarry to the end of the new railroad on Deer Creek, and a long, high quarry face, will make possible a large production in 1918. This company has built a two-story brick office building and chemical laboratory at Valley, and purposes building its principal kilns at the same place.

Several miles south of the Red Marble quarry and 18 miles west of Springdale a deposit was developed by the United States Magnesite Co., of Spokane, in the spring of 1917, and some ore was shipped. Work was

discontinued, however, in August, 1917, due, it is reported, to the low grade of the rock.

The Stevens County magnesite deposits are in mountainous country, where forests cover and hillwash conceals most of the bedrock, and as the outcrops are discontinuous and the depth of the deposits is unknown, estimates of the quantity of commercial magnesite available may vary widely. It is safe to say that there are several million tons of magnesite in the district,

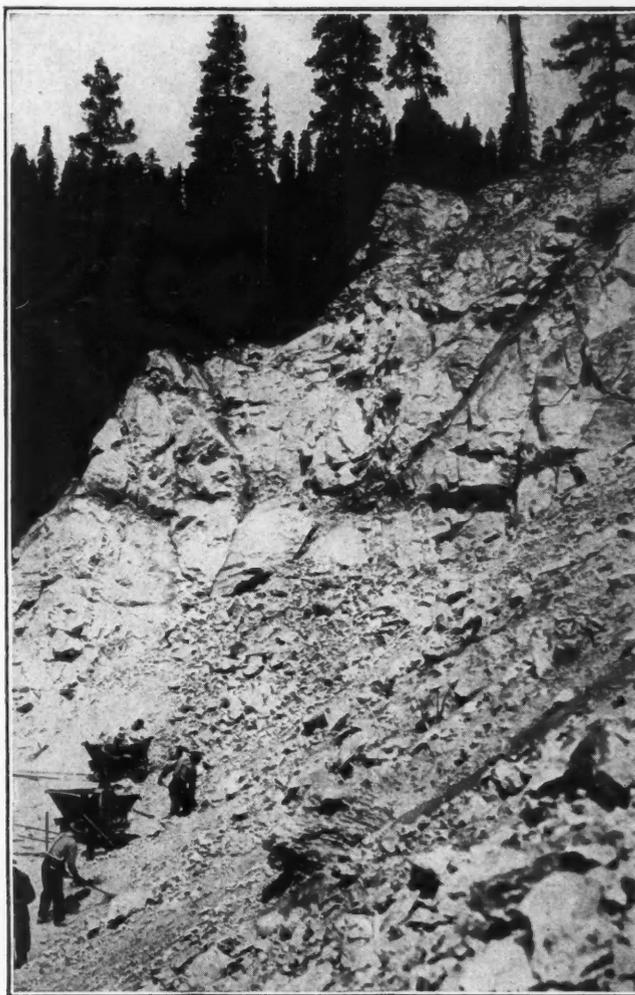


FIG. 4. PORTION OF FINCH QUARRY, SEVEN MILES WEST OF CHEWELAH, WASH., NORTHWEST MAGNESITE CO.

and exploratory drilling may confirm the impression that the deposits extend to a considerable depth. Unlike California magnesite, which is white and microcrystalline, the Washington magnesite is fine to coarsely crystalline, and white, gray, and red in color. A visual examination is not enough to determine the quality of the ore, for, as shown by chemists employed at the quarries, two pieces of the rock that look almost identical may differ 20% in lime content and 10% in silica.

Washington magnesite discloses, on analysis, more silica and less iron than Canadian or Austro-Hungarian magnesite. Canadian magnesite differs particularly from the others in being very high in lime. Washington magnesite commonly carries from 42 to 45% magnesium oxide and from 1 to 2% ferric oxide. It is sold crude under specifications fixing a limit of not more than 3% silica or more than 2% lime. In 1917, the crude magnesite sold at Valley and Chewelah, Wash..

for about \$7.50 per ton f.o.b., and the calcined magnesite for \$32.50 per ton.

All of the Washington magnesite deposits thus far developed are so situated that they can be worked by open quarries, and they are so regular and free from inclusions that there is comparatively little waste rock to handle. The output in 1917, when all the properties were in the development stage, was over 95,000 tons of crude rock. Nearly 65,000 tons was shipped crude; the remainder was burned, making over 15,000 tons of calcined magnesite.

The demand for magnesite in the eastern states was good throughout 1917, and most of the Washington output was shipped to Chicago and to eastern points,

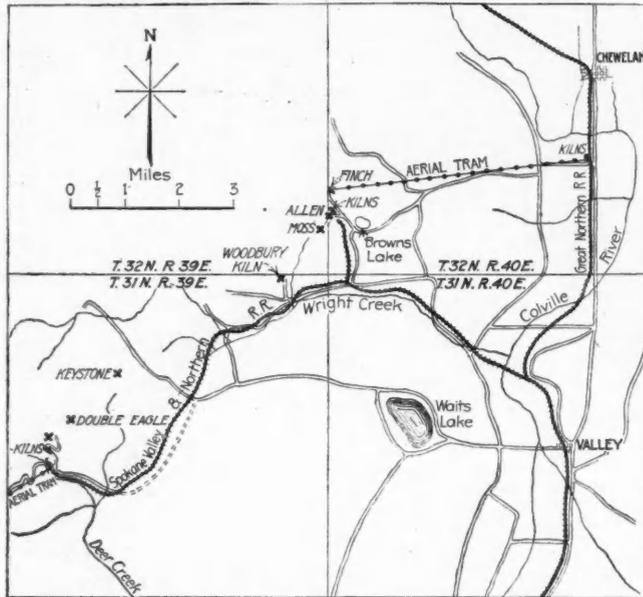


FIG. 5. MAP SHOWING SITUATION OF MAGNESITE DEPOSITS NOW BEING WORKED IN STEVENS COUNTY, WASHINGTON

paying a freight rate of \$10 or more per ton. A freight embargo on railroads east of Chicago hindered the shipment of Washington magnesite during the last winter, but it is believed this is only temporary and that when the embargo is lifted the industry will grow apace.

WASHINGTON MAGNESITE GOOD MATERIAL FOR REFRACTORY BRICK

Magnesite from Washington is used in large part for making refractory brick for the lining of steel and copper furnaces, and will always be in demand for this purpose. Magnesite is used also for making composition flooring, in fire-resistant paint, in the sulphite process of wood-pulp paper manufacture, as a heat insulator or covering for steam pipes and boilers, and in magnesia cement. Magnesia cement flooring is now used instead of wood or other material for the decks of ships, and for the floors of hospitals, railroad cars, office buildings, kitchens and other places where easy cleaning is required. Magnesia cement has also been employed in the war for making gun emplacements, its advantage for this use being that it sets quickly and has some resilience.

Remember the Comfort Fund of the 27th Engineers.

Production of Pig Iron in 1917

A total of 38,647,397 gross tons of pig iron was produced in the United States in 1917, according to statistical bulletin No. 1 (1918), issued on Mar. 18 by the American Iron and Steel Institute. This compares with 39,434,797 tons in 1916 and 29,916,213 tons in 1915. The production by states in 1917 was as follows: Pennsylvania, 15,539,728; Ohio, 8,518,603; Illinois, 3,483,096; Alabama, 2,953,705; Indiana and Michigan, 2,657,503; New Jersey and New York, 2,417,527; Wisconsin and Minnesota, 738,541; West Virginia, Kentucky, Georgia and Mississippi, 561,951; Virginia, 520,311; Missouri, Iowa, Colorado, Washington and California, 453,742; Maryland, 422,212; Tennessee, 369,951, and Massachusetts and Connecticut, 10,527 gross tons. The greatest increase in production over 1916 was in Massachusetts and Connecticut, where it was 84.07%. Virginia gained 30.12%; Indiana and Michigan, 19.62%; Alabama, 6.91%; Tennessee, 4.10%. Missouri, Iowa, Colorado, Washington, California, West Virginia, Kentucky, Georgia, New York and New Jersey, grouped as above, made small increases. Production decreased compared with 1916 in these states: Maryland, 15.80%; Illinois, 11.20%; Wisconsin and Minnesota, 8.97%; Pennsylvania, 5.86%; Ohio, 0.98%.

Production of pig iron by grades in 1917 was as follows: Basic, 17,671,662 gross tons (0.07% decrease from 1916); bessemer and low phosphorus, 13,714,732 (decrease 4.91%); foundry and ferrosilicon, 5,328,258 (decrease 4.06%); malleable, 1,015,579 (increase 10.21%); forge, 345,707 (decrease 0.76%); spiegeleisen, 193,291 (decrease 0.37%); ferromanganese, 286,000 (increase 29%); all other, 92,168 (increase 3.28%).

In 1917, a total of 11,676,513 gross tons of pig iron was made for sale in the following grades: Bessemer, 2,406,742; basic, 2,614,875; forge, 128,061; foundry, 5,186,498; malleable, 1,014,025; all other, 326,312. The total pig-iron production (38,647,397) was cast or delivered as follows: Molten condition, 23,193,439; sand cast, 6,238,567; machine cast, 7,649,684; chill cast, 1,532,575; direct castings, 33,132 tons. Basic pig iron manufactured in 1917 was cast or delivered by following methods: Sand cast, machine cast, chill cast, etc., 3,975,062; molten condition, 13,696,600; total 17,671,662 tons. Bessemer and low-phosphorus pig iron made in 1917 was cast or delivered by following methods: Sand cast, machine cast, chill cast, etc., 4,227,782; molten condition, 9,486,950; total, 13,714,732 tons. A total of 376,525 tons of cold and hot and warm blast charcoal pig iron was made in 1917, as follows: Cold blast, 5219; hot and warm blast, 371,306 tons. Total includes a small tonnage made with charcoal and coke.

In the above figures all pig iron and ferroalloys are included, whether made in blast or electric furnaces. Low-phosphorus pig iron (under 0.04% phosphorus) is included in bessemer pig iron. Pig iron containing 0.04 to 0.1% phosphorus is classified as bessemer. Nearly all the charcoal iron is classed as foundry pig iron, which latter also includes ferrosilicon. Pig iron containing 7% or more silicon is classified as ferrosilicon. Under "all other grades" are included white and mottled iron, direct castings and miscellaneous ferroalloys. When not separately stated, ferromanganese and spiegeleisen are included in "all other."

Theory and Practice of Ball-Milling

By PIERRE R. HINES*

The ball-mill has become an important fine-crushing appliance in western ore-dressing establishments. The theory of its action, the nature of the product under varying conditions, the power requirements, the special field for ball-mill crushing, and the operating features of peripheral discharge mills are presented by the writer in a manner that should prove especially valuable to the mill designer, engineer and operator.

THESE notes are based on observations made while on a recent trip through the West for the purpose of studying the practical operation of the ball-mill. While there are several types of ball-mill on the market, particular attention will here be given to

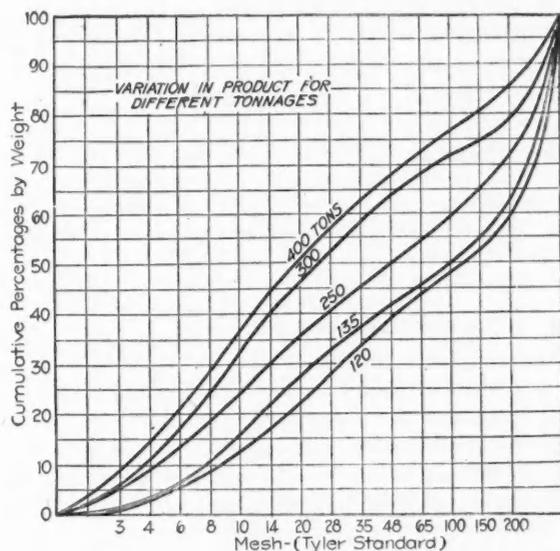


FIG. 1. RELATION BETWEEN TONNAGE AND MESH-SIZE

the diaphragm type, as the open-trunnion type, especially the conical mill, has been thoroughly discussed in the *Transactions*. There is a prevailing impression that the ball-mill is a recent development; however, ball-mills were used extensively in Montana and other western states for crushing ores for concentration as far back as 1898. Its present prominence is due in part to its recent successful application by one of the large copper companies. Without any reference to dry grinding, the first successful ball-mill for wet crushing, which is still in operation, was built 10 years ago.¹ This mill, designed by Erminio Ferraris for crushing Sardinian ores for concentration, is of more than passing interest. It embodies the peripheral discharge with grates, large forged-steel balls, and the principal features of the modern ball-mill. The results approach present-day practice, the chief differences being that the mechanical construction has been improved in the modern types.

*Excerpt of a paper presented at the February meeting of the A. I. M. E.

¹Erminio Ferraris: "The Mechanical Preparation of Ores in Sardinia." *Trans., A. I. M. E.*, Vol. 39, p. 88.

The action of the balls and the principles of crushing have been studied by several investigators.² Their conclusions are confirmed by results obtained by the writer in experimenting with a small machine built at the Allis-Chalmers factory, and serve to explain the reasons for some of the results obtained in practice. A ball-mill may be revolved so fast that the balls will cling to the shell during the entire revolution, while at slower speeds they will be carried up only a short distance and roll back. On the other hand, at the critical speed, they will cascade. At the critical speed the balls ascending on the layer next to the shell start from rest and cling to the shell without revolving or rolling, which has often been ascribed to them. These balls are held at rest by centrifugal force until they reach a point the location of which is dependent on the speed of rotation. Beyond this point, gravity overcomes centrifugal force, and the balls fall with increasing velocity in a parabolic curve which is the resultant of the above two forces, the force of the impact being expended in crushing the material. The several layers of balls lying on top of those next to the shell follow a similar cycle except that, due to relative difference in the two forces, their paths

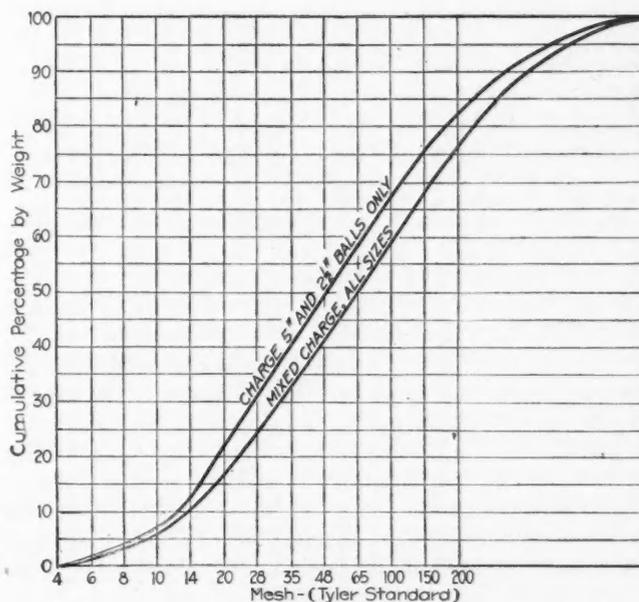


FIG. 2. RELATION BETWEEN KIND OF BALL CHARGE AND MESH-SIZE

become more nearly vertical. The outer layers, spreading more than the inner layers, increase the area in the zone of the falling balls. Within the circuit thus formed is a neutral axis or a sluggishly rotating kidney-shaped mass in which little actual work is performed.

The material being crushed is thoroughly distributed throughout the mass by filling the interstices between the balls, and follows in the same circuit. It is, therefore, evident that the material is crushed mainly by

²Hermann Fischer: "Der Arbeitsvorgang in Kugelmühlen, insbesondere in Rohrmühlen." *Zeitschrift des Vereines deutscher Ingenieure* (1904), Vol. 48, p. 437. Walford R. Dowling: "The Use of Scoop Discharges in Tube Mills." *The Journal of the Chemical Metallurgical and Mining Society of South Africa* (1915), Vol. 15, p. 214.

impact of the striking balls as the whole mass falls. There can be very little grinding by attrition due to the rotation of balls, except at the point where the shell picks up the mass and accelerates it to the rotative speed of the shell. The argument has often been advanced that fine material cannot be produced by impact alone and that fine grinding is done entirely by attrition or rubbing of adjoining balls. It is only necessary to break up a few small pieces of rock on an anvil with a hammer to prove that fines are unavoidably produced by impact. Screen analyses of the discharges from tube-mills in open and in closed circuits lead to the conclusion that

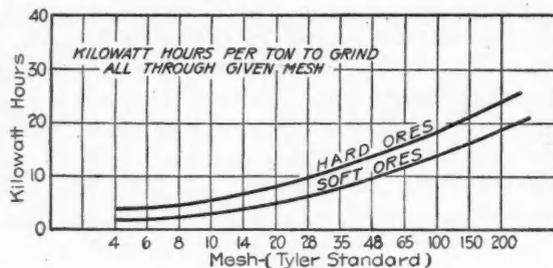


FIG. 3. RELATION BETWEEN POWER AND MESH-SIZE

in many instances an ore fragment may pass through the mill six to eight times before it is crushed to the desired fineness. Quoting directly from the article by Hermann Fischer referred to:

The grinding action, therefore, depends upon the height of the drop of the balls, that is, the height of the curve vertex above the point where the ball strikes, the speed of the shell, the weight and number of balls. The speed of the drum must be so determined that the curves can develop themselves properly. The weight of the balls and the height of drop are interrelated, and their product must be sufficient to break the ore according to its size and hardness. Hard materials require heavier balls or greater height of drop than soft ones, and steel balls in small diameter cylinders will do the same work as flint pebbles in large diameter cylinders.

The free fall of the balls is dependent upon the volume of ball load. With a charge equal to or greater than half the volume of the mill, the free fall of the balls is decreased, the charge is held together, and the size of the inactive kidney-shaped mass is increased. When the charge is about one-third of the volume of the mill, the size of the kidney-shaped mass is reduced and the balls fall from their maximum free height. Operating results bear out the above facts in that the greatest number of tons crushed to a certain mesh per kilowatt-hour are obtained with ball charges equal to approximately one-third the volume of the mill.

CONDITIONS DETERMINING FINENESS OF CRUSHING

There is a general impression that the grate acts as a screen or sizer. This is true to a limited extent, but it is not of primary importance. The fineness of product delivered by a ball-mill, the size of feed, ball charge, and speed remaining constant, depend upon the tonnage fed, the density of the pulp (water to solids ratio), size of balls, and, when operating in closed circuit, on the efficiency of the external classifying apparatus. The screen analyses plotted in Fig. 1 show the effect of varying tonnages, other factors remaining constant. They are from actual results with a 6 x 4-ft. mill. The experience of operators at two Western plants verifies the statement that an assorted charge, containing a certain percentage of small balls, is desirable for a fine

product. The screen analyses plotted in Fig. 2 show the difference in product when the initial charge included only 5-in. and 2-in. balls, and when the same charge contained a larger percentage of 4, 3 and 2-in. balls. In some respects, these results do not agree with what would be expected.

The peripheral-discharge mill differs from a trunnion-discharge mill in the character of its product, in that a small amount of moisture will give a fine product and a large amount a coarse product. As the discharge is entirely at the periphery, and does not depend upon any classifying action to overflow the finished product, the greater the amount of water added the quicker the pulp will pass through the mill and the coarser the product. In mills provided with means for raising the discharge or pulp level from the periphery to some intermediate height between the periphery and the trunnion, the fineness and the amount of oversize can be controlled within certain limits. No figures are available showing these differences, but from practical results in the field it appears that a wide variation can be obtained by this means. The grate should retain some oversize, but its action can be carried to extremes, especially when a fine product is desired, as the consequent diminished capacity is not compensated by the reduction of oversize. In all cases when a fine product is desired, it is advisable to run the mill in closed circuit with an efficient external classifier. The principal function of the grate

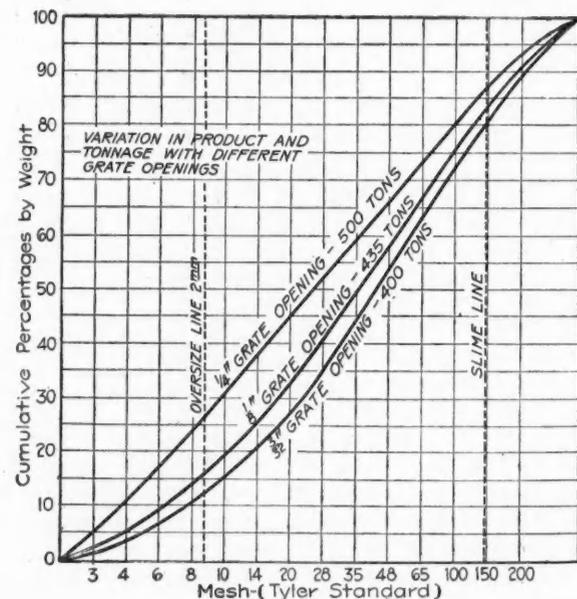


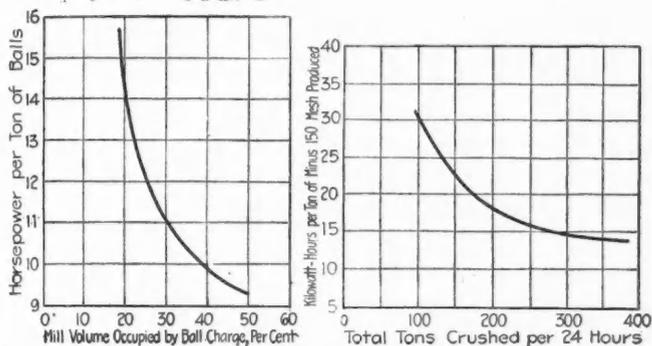
FIG. 4. VARIATIONS IN ADJUSTMENT OF BALL-MILLS

is to retain the ball charge in the mill, while permitting a peripheral discharge. The efficiency of the classifier, when a ball-mill is run in closed circuit, directly affects both tonnage and fineness.

Capacity of ball-mills depends upon the following factors: fineness of grinding, weight or volume of ball charge, hardness of material, size of grate openings, and size of balls, other factors remaining constant. The most important limiting factors for capacity have been the size of the feed opening in the trunnion, the type of trunnion liner, and the type of feeder. As previously stated, tonnage and fineness are interrelated, and the capacity of a ball-mill should be figured on the following basis when sufficiently reliable figures have been

collected: The kw.-hrs. required to crush a ton of ore from and to a certain mesh should be arrived at from average operating conditions. A ball-mill has a certain definite maximum power rating, depending upon its ball load. Multiplying the kw.-hrs. per ton by the tons required to be crushed per hour, the product will represent the power required, and the mill nearest to that power rating should be selected. Fig. 3 is a preliminary power curve based on the recommended maximum ball charge, together with all available data at hand. An approximately correct curve would require 60 or more power records.

Operating a mill at less than its maximum capacity for a given ball charge will result in excessive wear on lining and balls and produce a finer product than necessary. To crush a ton of ore of a certain hardness and size to a given fineness represents a definite amount of work; hence the capacity of a mill depends upon (a) the hardness, and (b) the ratio of reduction, the latter affecting capacity far more than the former. It is use-



FIGS. 5 AND 6. POWER REQUIREMENTS OF BALL-MILLS

less to expect a larger capacity from a mill operated with balls of a size too small to crush the ore, or when the balls are of a composition that will not withstand the shock of impact and shatter themselves to fragments. Hard ores, when fed directly from a crusher, require a proper percentage of 5-in. steel balls to do effective work. A 4-in. steel ball is often sufficient for some of the softer porphyry ores. Smaller steel balls may be used for regrinding work, but the charge should contain a percentage of 2-in. steel balls when working on hard ores. For regrinding soft ores, cast iron or composition balls may be used where cost is an important factor.

Where a fine product is desired together with a minimum amount of oversize, the grate opening should not be diminished. Smaller grate openings will reduce the amount of oversize, but the decreased tonnage is not compensated. In such cases it is advisable to depend on an external classifier and operate the mill in closed circuit; the grate bars should be set with at least 1/2-in. opening. Where a coarse product is desired, for example for concentrating table work, the grate may be used as a sizer and an open-circuit scheme adopted. Fig. 4 shows a typical example of the variation as to both tonnage and product that can be obtained with different grate openings.

When the mill is operated in closed circuit the efficiency of the classifier directly affects the capacity, and it is important that the classifier be of proper size and properly operated. In one case observed, a classifier of the mechanical drag type was set with the wrong slope;

correcting the slope approximately doubled the capacity of the mill. Classifiers of the mechanical drag type, in order to make an efficient separation, must be operated with proper consistency of pulp in the classifying zone, the slope and length of the sand plane must be correct, and the speed of the drag must be suited to the material.

ELEMENTS INFLUENCING BALL-MILL POWER

Power depends principally upon the weight of ball charge, an approximate figure being 9 to 10 hp. per ton. Moreover, the power per ton of balls will vary according to the percentage of volume the ball charge occupies in the mill. An approximate curve from data at hand is given in Fig. 5, from which it will be seen that the power required per ton of balls is least when the mill is loaded half full and that the curve rises very rapidly as the ball load is reduced. A charge greater than half full causes a balancing effect until, when the mill is full, the power required is practically only that necessary to take care of friction after starting. When the volume of ball charge is reduced, within certain limits, the power consumption per unit of ball charge is increased, because the center of gravity of the charge is further from the axis of the mill; but as the mass of balls is more active and circulates more freely, the crushing efficiency is increased proportionately to the increase in power consumption per ton of ball load.

There are a number of ball-mill installations for fine crushing in the West. Most of these are arranged in two or more stages where a product finer than 100-mesh is desired, and there seems to be little difference of opinion as to the advantage of such an arrangement. Where coarser products are desired, say through 48-mesh, both single-reduction and stage-crushing installations are found. Stage crushing seems to have higher efficiency, but when first cost and simplicity are considered, the single-reduction installation seems to be more desirable, especially for small plants.

The curves (Fig. 6) plotted from recent tests show the power required per ton of material crushed under varying capacities. It can be seen that the power rises rapidly at the expense of capacity when a fine product is desired, and when compared with an average power curve it would make a saving to run a large tonnage through several stages. The phrase "single reduction" as applied to ordinary ball-mill practice is misleading, because in the most common application of the ball-mill, running in closed circuit for preparing feed for flotation, a great deal of the material is returned from once to six or seven times before it is finally reduced. The most efficient installations in practice are undoubtedly those which have a large return circuit and in which the mill is crowded, making a small reduction at each pass through the mill, but handling a large tonnage at the same time.

SPECIAL FIELDS FOR BALL-MILL CRUSHING

The ball-mill is not to be recommended for all and sundry problems in the milling field. It is not suitable for concentration work where the ore contains a large amount of coarse mineral easily pulverized. Where crushing to 12-mesh and finer is necessary to release the mineral, the ball-mill makes a suitable product when properly operated, and is as good as any other regrinding machine. The installation of concentrating tables

within the mill circuit, as practiced at Stoddard, Ariz., is a notable advance in this class of work. The special field of the ball-mill, however, is for products 20-mesh and finer.

The use of ball-mills for reducing crusher product to 85% below 200-mesh in two stages, as practiced at the United Eastern, Tom Reed, and Montana mines, in Arizona, is a distinct advance in fine crushing. The simplicity, small floor space and large capacity of these installations are especially notable. While there is not such economy in power nor so small a number of repairs as compared with a stamp-battery and tube-mill plant of the same capacity, the operating troubles and attendance are much reduced. The curves in Figs. 7 and 8 show typical screen analyses of ball-mill products, to give a better indication of the class of work that may be expected.

BALL-MILL FEEDING

The most desirable method of feeding coarse material is the arrangement installed at the Tom Reed mill. The crusher product is fed direct from a bin to an apron feeder, the speed of which is controlled by a Reeves vari-

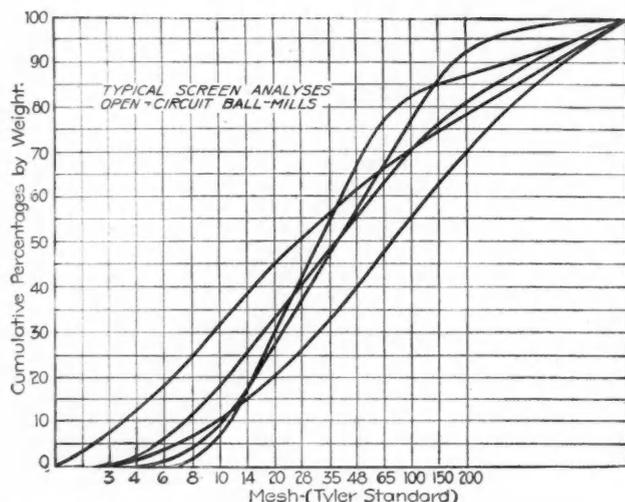


FIG. 7. SCREEN ANALYSIS OF PRODUCTS FROM OPEN-CIRCUIT BALL-MILLS

able-speed transmission device. This insures absolute control and allows quick changes. When a ball-mill having proper crushing load is rotated at the critical speed, the balls strike at a point on the periphery about 45° below horizontal. An experienced operator is able to judge by the sound whether a mill is crushing at maximum efficiency, or is being over- or under-fed. Excessive rattling denotes under-feeding; a sound of impact at a point 30° below the horizontal indicates overloading; while under proper conditions the impact will be heard at a point 45° below the horizontal.

When a ball-mill fitted with a diaphragm is over-fed, the mill fills up to a certain level, then stops crushing and discharges any additional feed back through the feed trunnion. Once over-fed, it takes from 30 min. to two hours to free itself. Ball-mills, therefore, should be provided with a central opening in the diaphragm connecting with the discharge trunnion, to prevent over-feeding and the delays incidental thereto. The greatest difficulty in feeding most ball-mills, when running on large tonnages and coarse feed, say, $\frac{1}{2}$ to 3 in., is due

to the restricted area of the feed trunnion, which limits the quantity of coarse material that can be fed through it. A few simple calculations will show the velocity necessary to pass a given quantity feed through the trunnion. It can also be shown mathematically that the average spiral in the trunnion liner does not advance the feed rapidly enough; therefore, instead of aiding, it retards the feeding. These results are confirmed in practice. A smooth liner, tapering from the feeder into the mill, does not retard the flow of the feed, and is, therefore, more efficient than the spiral. Experiments with small models, as well as experiments in the field, corroborate these conclusions. A short trunnion with large diameter is essential for feeding a large tonnage to a ball-mill.

The engineering department of the Allis-Chalmers Manufacturing Co. has recently conducted some experiments with feeders modeled after the various types in use, on a scale of 1 in. per foot. The feeders were operated at constant speed conformable with present practice, the material delivered in a given time being weighed. The following conclusions were drawn: "The intake of a single-scoop feeder has far greater

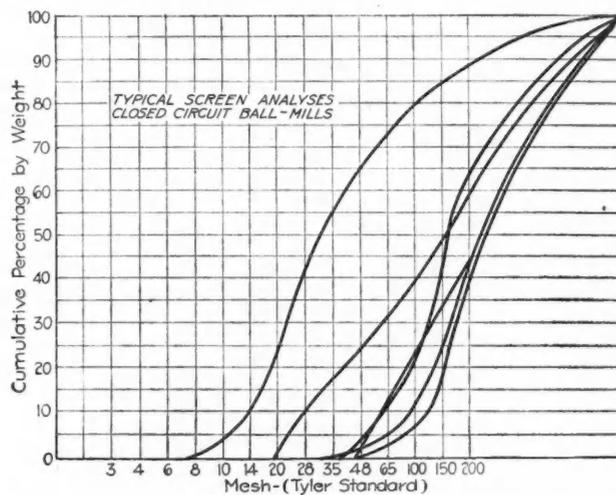


FIG. 8. SCREEN ANALYSIS OF PRODUCTS FROM CLOSED-CIRCUIT BALL-MILLS

capacity than the throat or trunnion of the mill, and there is no good reason for using a double- or triple-scoop feeder, the capacity of the feeder not being controlled by the quantity it will pick up, but by the quantity that it can discharge through the throat or trunnion." These experiments further demonstrated that the capacity of a spiral feeder is in direct proportion to the length of the path of the spiral. In other words, a spiral feeder embodies all the principles of the Frenier sand pump, in which the long path of the spiral increases the pressure which forces the feed into the trunnion opening.

The ratio of moisture to solids is important in ball-mill work. From actual operation it has been observed that fine grinding is best done when water constitutes 33 to 40% of the pulp, or the water-to-solids ratio is 1:2 or 1:1½. Where a minimum of fine material desired, 50% and upward of water is desirable.

Ball consumption varies with the fineness of the product, hardness of the ore, quality of ball, and whether a mill is run in closed or open circuit. The ball consumption

for mills delivering a coarse product, all passing 8-mesh and containing 10 to 20% below 200-mesh, the mill being run in open circuit, is about $\frac{1}{2}$ lb. per ton for steel balls and 1 lb. for cast composition balls. The average ball consumption for mills in closed circuit has been plotted in Fig. 9 for steel balls and for cast composition balls. Enough data are not available to plot curves for hard and soft ores, and individual figures will vary considerably from the average of the curves, which are given merely as a guide as to what may be expected and also to show the increased consumption with finer grinding. It should be noted that the curves given are merely to guide as to what may be expected and also to show the increased consumption with finer grinding. It should be noted, too, that the curves apply to products practically all of which are finer than the meshes indicated, up to 65-mesh. Points on the curves representing finer products are for mills generally regrinding 10- to 20-mesh feed; hence corresponding amounts must be added to give the total ball consumption for reducing from crusher size to 100-mesh and finer.

AVERAGE CONSUMPTION OF LINERS

Average consumption of shell liners, for both chrome and manganese steel, is $\frac{1}{2}$ lb. per ton of ore crushed. The consumption of lining seems to be fairly constant regardless of the hardness of the ore, fineness of prod-

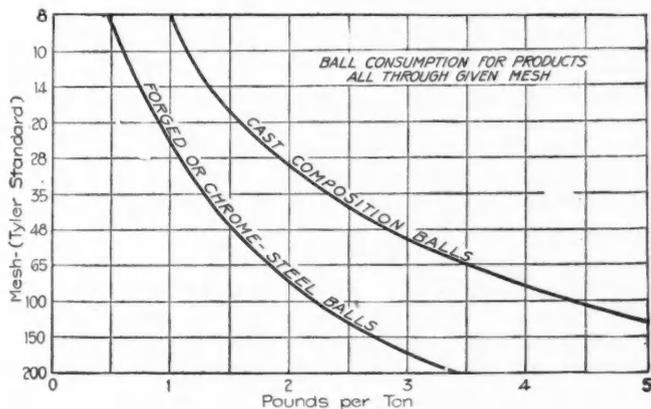


FIG. 9. STEEL BALL CONSUMPTION

uct, or other conditions. The greatest wear on the lining is probably caused by the impact of the balls and by their slippage on the shell during the period of acceleration. If the mill is running below capacity the wear will increase. There are numerous types of liners on the market, and improvements are constantly being made, but the greatest improvement made recently is the general increase in weight and thickness. The proportion of scrap has been high, and the consumption stated above may be reasonably expected to be diminished with heavier and thicker liners. Regarding the shape of liner, there is considerable difference of opinion. The smooth liner is probably as efficient as any of the others if run at slightly higher speed. Hard-iron liners have not been found satisfactory when used with balls of 5- and 4-in. diameter, as they have invariably failed by cracking and breaking, but with balls of 2-in. diameter and smaller they are sufficiently durable. It is possible that a heavy hard-iron liner backed and set in cement mortar might be successful,

but this has not yet been tried so far as is known.

The loosening of liners may be avoided by using deeply countersunk bolts of large diameter with double nuts. When the liners are first put in place, after running the mill for several hours the bolts should be gone over again and the nuts tightened with a short wrench and hammer. Later, after the feed is on, they should be gone over once more. Leakage around bolt holes is caused entirely by loosening of the bolts due to lack of tightening or a worn-out lining. If candle-wicking is used as packing around a bolt, between the shell and the washer, and the nut is kept tight, no leakage will occur until the liners are worn out.

Urgent Call for Artillery Officers

BY ROY V. MYERS*

At this time an unusual opportunity is offered young men to gain rapid promotion to the rank of commissioned officers in the artillery arm of the service. The vacancies to be filled are as follows: Commissioned officers in the batteries, reconnaissance officers in the battalion and regimental details, staff officers with battalion, regimental and higher organizations, specialists in telegraphy, radio telegraphy, telephony, photography, mapping, etc., aerial observers to make reconnaissance and direct artillery fire from aeroplanes and balloons.

All officers assigned to the above branches must have training in the artillery service, with the artillery units in camp and in either the special schools in artillery fire or in aviation. This call is especially directed to young men with the following qualifications:

A working knowledge of algebra, geometry and plane trigonometry; a working knowledge of surveying and other lines of engineering is quite desirable, but not essential; map making and reading is essential for nearly all artillery officers. This would not be a requirement for an applicant, but he should show some capacity for acquiring such ability. The applicant should have a voice with sufficient volume to enable him to make himself heard clearly up to 75 yards; experience in handling men in a supervising capacity would be much to his advantage; a working knowledge of the Morse code would be given considerable weight; a knowledge of the practical operation and adjustment of the gas or internal combustion motor would be valuable. The usual army standard as to physical fitness would govern in the acceptance of applicants; the restrictions governing the classification of men for the selective draft would have to be removed by the proper authorities.

Any one desiring to enlist should inventory his qualifications as outlined above. He should then write an artillery officer whose name and location he knows, and express his desire for a preliminary examination. Such examination may enable the examining officer to advise the applicant to enlist immediately, with the expectation of securing promotion. Upon enlisting, he will be given the training of the soldier and promoted as rapidly as his progress warrants. If he secures a commission, his training in camp will be supplemented with special training at a school for such officers.

*Major, 114th Field Artillery, National Guard.

Potash in the Pintados Salar, Tarapacá, Chile

By HOYT S. GALE.*

The scarcity of domestic potash has stimulated search not only in the United States but also in foreign countries. Reports of rich potash deposits in close relation to the Chilean nitrate deposits have been frequent. The present paper is a conservative description of a deposit of probable importance that occurs in the Chilean nitrate area. It is followed by a paper by Roger C. Wells, in which the methods for the extraction of the potash, with results achieved, are described.

OCCASIONAL accounts of the occurrence of potash in deposits in Chile have been published, but as many of these have been in the nature of prospectuses, the estimates of value and of workability of the deposits contained therein have not always been of the most convincing sort. It is, however, well known that potash does occur in rather unusually large proportions in some of the nitrate and other salt deposits of Chile, and much consideration has been given to the possibility of making a commercial recovery of the potash from such sources.

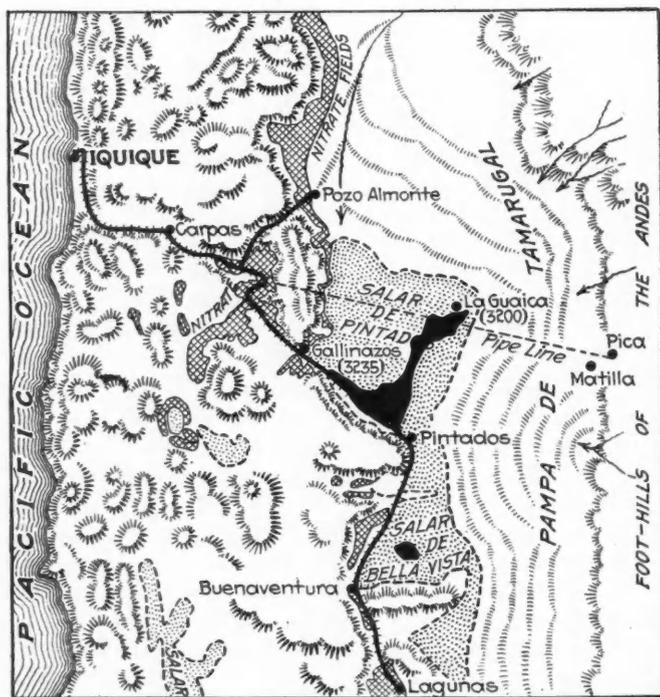


FIG. 1. RELATION OF THE SALARS AND THE NITRATE FIELDS TO THE COAST RANGES AND THE PAMPAS

In the early spring of 1916 I made a careful investigation of the saline deposits in the Pintados Salar. The following account pertains mainly to the general features of the deposit and to such factors as have a most obvious bearing on the possible utilization of the material. There are many interesting features in the geological and geochemical record that deserve further discussion, which it is hoped will be brought out later

Only a small part of the detail of the data obtained can be recorded here. The analytical work and preliminary technologic investigations on processes for treatment of the salts were conducted by Dr. Roger C. Wells, by whom some of the main results are discussed in a paper that follows.

The Pintados Salar is situated in the pampa of Tamarugal, about 50 miles southeast of the nitrate port of Iquique, from which it is conveniently reached by way of the nitrate railroad. The Lagunas branch of the Nitrate Railways Co., Ltd., passes directly through the southwestern margin of the Pintados Salar, between the stations Gallinazos and Pintados, the latter being 60.57 miles by railroad measurement from Iquique. Gallinazos is at the extreme western edge of the main pampa, and lies, according to the railroad elevations, 3235 ft. above sea level, the Pintados station, further out on the pampa, being 3204 ft. The Salar, lying between these places, is but slightly below these levels, and its surface is thus approximately 3200 ft. The general situation of the Salar and the position of the principal settlements in the vicinity are indicated in Fig. 1, which also shows the distribution of the principal nitrate fields in the same vicinity. These data are taken chiefly from the official survey maps of Chile, the details with respect to the Pintados Salar being added.

RELATION OF THE PINTADOS SALAR TO THE PAMPA

To any one familiar with the geography of northern Chile, even in a most general way, the relation of the Pintados Salar to the pampa, or interior desert-like plateau, will be readily understood from the map. The west coast of Chile, as, in fact, of most of South America, is a precipitous mountain wall, rising almost everywhere directly at or near the water's edge. Beyond this wall is an irregular belt of mountain ranges, which may be designated the coast ranges, from the similarity in position and geologic structure to the coast ranges of our own Pacific Coast. These mountains are of the block-faulted type, and include basin-like valleys, many of which have no external drainage outlet. East of the coast ranges is the interior plateau or pampa, along the west side of which the nitrate fields are situated.

This pampa is a broad, plateau-like area of low relief, which extends from north to south throughout the northern part of Chile, and is bounded by the coast ranges on one side and the high Andes Mountains on the other. It is crossed by some of the larger drainage lines from the Andes, which cut through the coast ranges to the sea, but in places the pampa is divided into basin-like areas bounded by the merging slopes of broad alluvial detrital fans that have been distributed from the flanks of the Andes.

Much of the surface drainage in the country is of such an intermittent character, and the water supply of so small a total amount, that it merely distributes itself on the pampa, and, sinking, is lost in the underground flow or through evaporation. The soluble salts, derived from the decomposition of the rock minerals

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through weathering, and collected by the drainage waters, are accumulated in the undrained depressions of the desert area, which, as they ordinarily form dry deposits of saline crusts, are commonly known as salares. These salares usually consist chiefly of common salt, but include borax and other constituents.

Owing to the little rainfall in the region, the basins in which the salares are found have not lately been flooded to a height at which they will overflow to any considerable extent; otherwise, the soluble constituents would have drained away. The salts left by the evaporation of occasional or periodic surface flows, or from the seepage of ground waters toward the bottom of the basins, naturally accumulate, chiefly in the lowest depressions. Wherever such deposits have been flooded to a shallow depth and the surface salts redissolved, the dust and sediment have settled, so that, as the salts again crystallize, the surface has assumed essentially a water level.

As such salt deposits are exposed to the dry air and the hot sun, and the surface crust is commonly in contact with ground moisture at shallow depth, cracking and recrystallization of the crust, which are constantly taking place, tend to break up the level surface of the salts as first deposited. Thus, the more massive salar crusts commonly assume intensely rugged surfaces, though maintaining approximately water level in general elevation. These features are to be observed in many deposits of the salar type in both North and South America, as well as in other parts of the world.

PINTADOS SALAR ONE OF THE LARGER SALINE DEPOSITS

The Pintados Salar is one of the larger deposits of the type in northern Chile. It is situated in a low corner of the pampa, or desert. As one approaches along the railroad, it has somewhat the appearance of a huge field turned up by a plow. Irregular blocks of massive salt crust lie, apparently loose, all over the surface, and the whole has a dirty earthen color. When the dirty blocks are broken into, the salts are white or only slightly stained, for the most part, and have a granular crystalline texture, like finely crystalline limestone or marble.

In spite of the dirty appearance, usually not more than a small percentage of the crust in the main Salar is insoluble in water, as shown by the many samples that have been taken and analyzed. This crust is very hard, and the individual blocks are compact or massive. The hard crust forms the central or lowest part of the Salar surface, while toward the edges of the deposit the character of the crust varies in the several different types of surface. To the east, the salt-crust ground rises, at first almost imperceptibly, over a low, flat alluvial slope that originates at the far eastern edge of the pampa, 18 or 20 miles due east of Pintados station. This is a slope of detritus spread mainly from one of the larger stream channels that may be seen opening into the pampa at the base of the Andes foothills.

The ground near the Salar is heavily charged with soluble salts, but these seem to be mainly sodium chloride mixed with so much sediment that little significance as to potash is attached to this part of the deposit. Locally, layers in this part of the margin have been found to contain borate minerals, which were formerly

worked. An alluvial slope similar to that from the east occupies the pampa to the north, and the margins of the Salar are marked by sand dunes and low salt-crust ground, mixed with much sand and earthy material.

Near the center of the main Salar a channel-like area enters from the north, the surface of which is covered with a soft crumbling deposit of mixed salts. This surface is quite distinct from the hard salt crust, and differs markedly from it in chemical composition. The main Salar skirts closely the foot of the Pintados hills on the southwest, where the hard Salar crust extends almost to the foot of the hills. The slopes of detritus that have been spread over the surface of the pampa thus seem to have determined the position of the basin in which the Salar salts accumulated.

There is distinct evidence that occasional storms have spread their waters over the surface of this area, the channels and deposits left by such floods being clearly visible. Ground water in these alluvial slopes indicates that there is undoubtedly a continuous flow into the pampa, originating mainly from the mountains and trending toward the low parts of the basins.

The hard, rugged, weathered crust is the richer potash-bearing portion of the Salar. This is the area that is shaded black in the general map, Fig. 1, and shown in more detail in the second plan. The boundary of this hard potash-bearing salt crust is not everywhere distinct or even recognizable in the field except by the chemical tests. The line of demarcation between the hard crust and the soft crumbling surface in the north-central part of the deposit is very distinct, but the limit shown in the western part of the area mapped as potash-rich is based on chemical distinctions entirely.

CHILEAN DESERT

In the long narrow arm of the deposit that extends toward the northeast the hard Salar crust is bounded by a broken-crust surface, more or less thickly covered with a kind of brush which also grows to a certain extent within the Salar. It is known as soronal. Contrary to the prevailing notions concerning the Chilean desert, there are many groves of good-sized trees about the Salar. These are practically the same as the mesquite of our western United States, and are known in Chile as algarroba and tamaruga, two somewhat differing varieties of the same species. All of this vegetation depends for its growth on the presence of ground water at shallow depth in the vicinity of the Salar. The fact that ground water near or even directly under the salt crust is comparatively fresh is also generally credited as strange, since a dense brine might be expected in proximity to so much salt.

STRUCTURE OF THE SALAR CRUST

The hard Salar crust is a fairly definite layer, the blocks of which may usually be pried loose with a bar. Underlying this is a loose granular deposit, extending to a depth of several feet. The underlying deposit was examined in many places and found to be made up largely of glauberite, a double sulphate of sodium and calcium, represented by the formula $\text{Na}_2\text{SO}_4 \cdot \text{CaSO}_4$, although in places this under layer is supposed to consist partly, or largely, of gypsum. The granular deposit is usually moist, and ground water is

generally encountered by digging to shallow depth.

The thickness of the surface hard salts crust varies, according to recorded measurements, from about 8 to 25 in., with an average of about one foot or a little more. This measurement is not a definite figure, as it had to be made from an assumed mean surface in a very irregular crust. The bottom of the crust is, however, a much more definite plane. The character of the Salar crust is illustrated by Fig. 2.

COMPOSITION OF THE CRUST

The composition of the Salar crust has been determined by sampling and analysis, which was conducted, for the greater part of the area, in a careful and systematic manner. A few examples of these analyses will serve to represent the character and variation of the chemical composition of the hard Salar crust. The other types of crust will not be discussed at this time. Each of these samples was obtained by crushing and averaging approximately a quarter of a ton of the whole crust taken from a specified unit of area on the Salar. All of the samples used for analysis in estimating the tonnage of potash constituents in the Salar were of this character. Typical analyses are given in Table I.

TABLE I. ANALYSES OF HARD SALAR CRUST FROM THE PINTADOS DEPOSIT

Sample No.	Chemical Determinations				
	124 Per Cent.	174 Per Cent.	186 Per Cent.	190 Per Cent.	192 Per Cent.
K.....	5.8	6.7	5.1	4.9	2.8
Na (calc.).....	25.2	28.8	31.9	32.1	35.3
Ca.....	2.4	0.9	0.5	0.4	.....
Mg.....	1.0	0.7	0.1	0.2	.....
Cl.....	45.7	41.4	40.6	45.8	47.1
SO ₄	7.5	17.1	19.4	12.3	13.1
H ₂ O.....	9.8	2.4	0.7	0.8	1.3
Insoluble.....	2.0	1.9	0.8	3.1	trace
	99.4	99.9	99.1	99.6	99.6
	Calculated Salts				
K ₂ SO ₄		14.9	11.3	10.9	6.3
KCl.....	11.0	5.9	17.2	6.8	14.4
Na ₂ SO ₄		68.2	66.9	75.5	77.6
NaCl.....	64.3	3.1	1.7	1.5	.....
CaSO ₄	2.3	3.5	0.5	1.0	.....
MgSO ₄	2.0				
MgCl ₂	9.8	2.4	0.7	0.8	1.3
H ₂ O.....	2.0	1.9	0.8	3.1	trace
Insoluble.....	2.0	1.9	0.8	3.1	trace
	99.4	99.9	99.1	99.6	99.6

It will be noted that sample No. 124 is of somewhat different character from the rest. This was from the hard crust near the edge of the Salar. That is, the site was only about 100 yd. from a thickly vegetated border. Its composition shows a transition to that of the soft granular crust referred to before. Although this crust was exceedingly rugged on the surface, it was not of the same hard and massively crystalline character in the mass as that found in the main central part of the Salar. It crushed readily to a soft sugary texture. The sample when pounded fine was snowy white.

The four other samples may be taken as typical of the central hard Salar crust of the deposit. No. 174 also came from a point not far from the edge of the Salar, but there the crust was hard and massive throughout. No. 186 was from the center of the hard Salar crust in the same general vicinity as those already described, this being in the Salar about opposite Alta de la Luna. Sample 190 came from a site near the railroad northwest of Mosquitoes station. Here the crust is exceedingly hard and unusually thick, and of dirty appearance. Ground water in this part of the Salar is exceptionally deep.

No. 192 is from the center of the broader southern part of the Salar. This part of the crust is rugged and fairly uniform in character, with a thickness of about 21 in. The sample was evidently very clean salts, and crushed to a white dry mixture. This has the lowest potash content of the several samples discussed here, but is quite typical of much of the Salar crust. The portion sampled included a layer about nine inches thick, composed at the bottom of pure white compact granular salt. Experience has shown that this lower white salt layer is generally nearly pure sodium chloride, containing very little potash.

DISCUSSION OF SALINE CONSTITUENTS

The hard Salar crust is therefore largely sodium chloride, the remainder being mainly sodium and potassium sulphates. Examination under the microscope of samples like No. 190 has served to identify the sodium chloride as present in excess in the mixture. No sylvite (KCl) could be found, although this should be readily

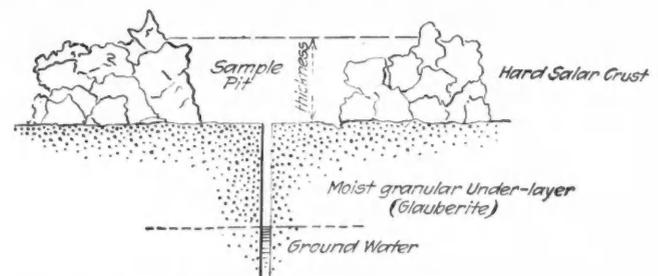


FIG. 2. STRUCTURE OF THE CRUST AND UNDERLYING DEPOSITS ON THE PINTADOS SALAR

recognized if present by its index of refraction, which is lower than that of the halite or sodium chloride. The only potash-bearing mineral recognized was glaserite (aphthitalite of Dana), which is composed of the sulphates of sodium and potassium represented by the formula $(K.Na)_2SO_4$. This, according to a theoretical composition given, might carry potash as high as 42.5%, equivalent to 78.6% potassium sulphate in a pure specimen.

The analyses show that the potassium content of the Salar crust varies considerably from place to place. Calculations of the tonnage of Salar crust were made by considering the deposit as divided into areas according to the percentage of potash in the samples obtained.

TABLE II. SUBDIVISIONS IN THE WESTERN HALF OF THE PINTADOS SALAR

Acres	Areas and Tonnage of the Salar Crust			Average Potash as Sulphate (K ₂ SO ₄), Per Cent.
	Unit Weight per Square Meter of Surface, Kilograms	Estimated Gross Weight, Short Tons		
1,800	200	1,650,000		11.6
1,580	250	1,760,000		7.4
1,630	200	1,450,000		6.5
890	500	1,980,000		8.9

Thus separate estimates were made for the areas of richer and poorer crust, considered from the potash standpoint.

Fig. 3 represents, on a somewhat larger scale than the first map, the outline of the rugged salt part of the Salar. This is the principal potash-bearing portion of the deposit. The total area thus classified is about 20 square miles, or approximately 12,800 acres. Some of the individual units estimated in this area are given in Table II.

The figures given in the table do not include any statement for the northeast corner of the deposit, some of the samples from which gave higher potash determinations than the samples from any other part of the Salar. Likewise the total of the figures given herewith is not a total estimate for the whole deposit, but the estimates quoted will serve to show the potash composition of different parts of the main Salar crust.

OWNERSHIP OF THE DEPOSIT

Control of the deposit is divided among several groups of claimants. The majority of the claims are now held under an organization controlled by Chilean interests, which have from time to time sought foreign financial and technical assistance for the exploitation of the deposit. From a practical point of view, it must be ad-

usually clear and satisfactory in the explanation that it affords concerning the nature and origin of the deposit on the surface, and this record affords little basis for assuming the existence of similar or related deposits at depth. One cannot, of course, state that no deposits of value can be found by drilling in the Chilean pampa, or anywhere else, but there is no particular reason for supposing that such deposits would be found below the surface.

Other salares exist in South America that have been reported, on what appears to be substantial evidence, to contain potash salts of unusual richness. Analyses quoted in several old scientific essays give clues that may some day be worth following up. If extraction of the potash from the salts of the Pintados Salar is ever commercially successful, undoubtedly investigation of other salares will follow.

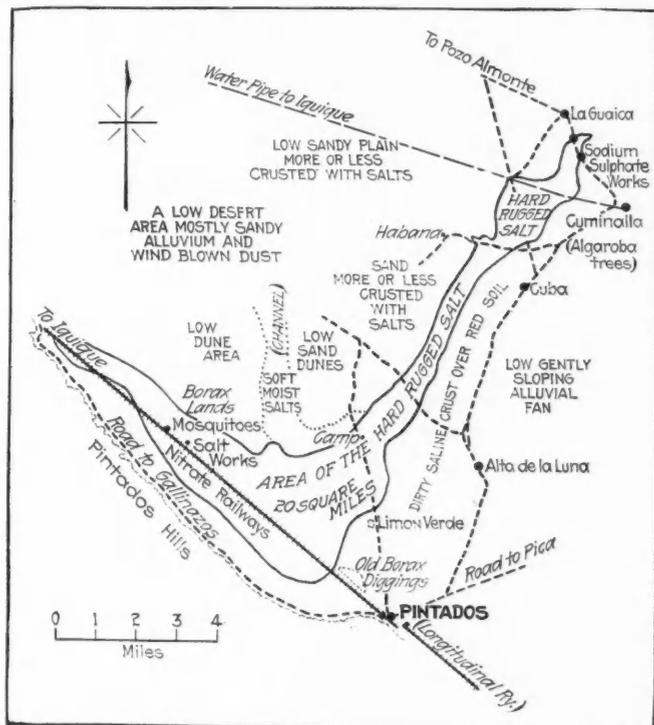


FIG. 3. DETAILED FIELD MAP OF THE PINTADOS SALAR

mitted that the Salar crust is at best but a low-grade potash material, and that the question of feasibility of commercial separation of potash salts is one that cannot be determined by any simple process of reasoning, but can be approached only through systematic investigation.

Many suggestions have been offered for the accomplishment of the separation of potash from a crude mixture of this type. A considerable amount of laboratory work has already been done on this problem. Probably the next logical step is to carry out experimental runs on raw material brought to this country, where such work can be handled more expeditiously than it can be in the Chilean pampa. At present, of course, the shipping problem is a serious obstacle to any such plan.

The question of drilling in this region with a view to discovering if possible the source of the potash found in the surface deposits has been frequently broached. Speculation of this sort is naturally interesting. In the present case, however, the geological record seems un-

Ferromanganese Plant at Anaconda Will Save Ships

In a recent letter to Secretary Lane relative to the manufacture of ferromanganese from the low-grade manganese ores at Butte by the Anaconda Copper Mining Co., John D. Ryan says in part:

"In ordinary times these ores would have no value, and to transport them in the raw state and manufacture the ferromanganese in the East, even under war conditions, is impracticable on account of the car shortage and difficulties of transportation. To manufacture these low-grade ores into an 80% ferromanganese product within a very short distance of where they are produced, by the use of hydro electric power that is available, without taking it from any other use, seems to me in itself a matter of much interest in these times; but the greatest accomplishment in doing this will be the release of the equivalent of ships of 5000 tons each now used in bringing manganese from Brazil. These ships can, even under war conditions, providing none of them is lost, carry 300,000 tons of food and material annually from our Atlantic ports to Europe.

"The Anaconda Copper Mining Co. will equip and operate the plant, the installation of which can be accomplished quickly, by the use of buildings which it has available, and which are equipped with cranes, tracks, and facilities that would take a long time to provide if they had to be constructed specially. We think it can be put in operation in about four and a half months.

"The power is available from the Holter development, completed within a month by the Montana Power Co., as a reserve and in advance of its market requirements. This plant is capable of furnishing 40,000 kw., 24 hours daily, the year round. The ferromanganese plant will be constructed in Great Falls in the buildings and yards of the present smeltery of the Anaconda company there, and the ores will, as I said, be produced from the Butte mines.

"The offer to erect and equip this plant and go into the ferromanganese business was made by the company to the War Industries Board and received very prompt and satisfactory attention; every encouragement was promised, and every help obtained to bring about early completion and operation.

Extraction of Potassium Salts from the Pintados Salar

By ROGER C. WELLS.*

The search for deposits of potassium salts has been extended by the U. S. Geological Survey to foreign countries. Not less important than location is the method of working such deposits when they have been discovered. The treatment of saline crusts found in Chile and carrying low-grade potassium salts is described. The process consists in the use of limited quantities of water to dissolve the potassium salts without at the same time dissolving excessive quantities of associated salines. The article coordinates with the preceding paper on Chilean potash by Hoyt S. Gale.

THE salts forming the crust of the Salar de Pintados, Tarapacá, Chile, which is described by Hoyt S. Gale in a preceding paper, have been shown by many analyses to carry from a trace up to about 7.0% of potassium, K, in a form easily soluble in water. From the proportion of sulphate, SO₄, it is inferred that the potassium mineral generally present is glaserite, (K, Na)₂SO₄. Thenardite, Na₂SO₄, is probably present also, with the excess of halite, NaCl. The presence of small percentages of calcium and magnesium in the salts, however, suggests that some of the double sulphates of calcium, magnesium, sodium, and potassium may be present embedded in the much greater mass of the salts first mentioned.

SALTS OCCUR IN ASSOCIATION WITH NUMEROUS OTHER MINERALS

Gale found excellent crystals of glauberite in one locality, and according to van't Hoff and Chiaraviglio the minerals that may be expected to accompany glauberite, besides halite, are reichardtite, MgSO₄·7H₂O, schoenite, MgK₂(SO₄)₂·6H₂O, bloedite, MgK₂(SO₄)₂·4H₂O, thenardite and glaserite. For practical purposes, however, the salts may be considered to be chiefly sodium and potassium sulphate and chloride. Table I gives the results of some analyses made on typical samples of the crust of the Salar.

TABLE I. ANALYSES OF THE CRUST, PINTADOS SALAR, TARAPACA, CHILE

Sample No.	16	52	54	57	60	160
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Insoluble.....	0.8	1.9	2.0	trace	3.0	.....
H ₂ O.....	0.7	2.4	9.8	1.3	0.8	.....
Ca.....	0.5	0.9	2.4	.....	0.4	.....
Mg.....	0.1	0.7	1.0	.....	0.2	.....
K.....	5.1	6.7	5.8	2.8	4.9	5.0
Na.....	31.9	28.8	25.2	35.3	32.1	32.2
Cl.....	40.6	41.4	45.7	47.1	45.8	41.3
SO ₄	19.4	17.1	7.5	13.1	12.3	17.3
	99.1	99.9	99.4	99.6	99.6	95.8

Some parts of the Salar carry considerably more insoluble matter—largely calcium sulphate—water and calcium, and less potassium than the samples of Table I, but the present discussion will be limited to the richer potassium-bearing salts which form the central hard portion of the deposit.

*Physical Chemist, U. S. Geological Survey, Washington, D. C.

The economical extraction of potassium salts from this relatively low-grade material is a problem in chemical engineering, but any process must obviously rest on a knowledge of the behavior of the various salts involved at different concentrations and temperatures. Fuel, water, and labor could probably all be obtained, if desired, at rates comparable with those quoted at the nitrate oficinas. In fact it has been proposed to treat the Salar salts by the process used in extracting sodium nitrate from caliche, but several objections to applying that process directly to the Salar salts will be noted in the following discussion. The procedures suggested may or may not be commercially successful, but the results show how the salts behave under definite conditions and furnish a basis for studying the processes from a technical standpoint.

RAPID EXTRACTION OF POTASSIUM POSSIBLE

Experiments actually performed on the crust of the Salar show that a large proportion of the potassium can be extracted by a rapid treatment of the crushed material with water at ordinary temperature, that is by an amount of water insufficient to dissolve all the sodium chloride, and a concentration of the potassium thereby effected. The last column in Table II. gives the percentage composition of the salts obtained in this way by extracting 10 grams of sample 60 for 15 min. with 10.3 c.c. of water at about 20° C., filtering with suction, and washing once with two c.c. of water. The filtrate contained 52.6% of the material taken.

TABLE II. RESULTS OF EXTRACTING THE SALAR SALTS WITH A LIMITED AMOUNT OF COLD WATER

	Salar Salts Per Cent.	Per Cent. of Each Constituent Extracted	Percentage Composition of Salts Extracted
Ca.....	0.35	8.9	0.06
Mg.....	0.17	28.0	0.09
K.....	4.9	78.7	7.3
Na.....	32.1	52.8	31.8
Cl.....	45.8	50.4	43.9
SO ₄	12.3	70.4	16.5
	95.6		99.7

It will be observed that the percentage of potassium in the cold water extract is only as high as that in the best samples of the Salar crust. In another experiment in which the extraction was allowed to proceed for three days at room temperature the potassium amounted to 8.0% of the total salts extracted. Therefore, al-

TABLE III. PERCENTAGE COMPOSITION OF SOLUTIONS SATURATED WITH NaCl, Na₂SO₄, AND GLASERITE, AND PERCENTAGE COMPOSITION OF DISSOLVED SALTS

	Solution 25° Per Cent.	Salts 25° Per Cent.	Solution 83° Per Cent.	Salts 83° Per Cent.
H ₂ O.....	66.7	.....	64.4	.....
K.....	3.1	9.3	6.0	16.8
Na.....	10.3	30.9	9.0	25.3
Cl.....	14.7	44.2	16.5	46.4
SO ₄	5.2	15.6	4.1	11.5
	100.0	100.0	100.0	100.0

though the process suggested would suffice with relatively simple apparatus to convert the lowest grade material into a better grade, there is a definite limit beyond which no further concentration is possible without introducing another factor. In the next experiments the extraction was made at a higher temperature.

Theoretically, the quantity of water used should be no more than that required to dissolve the glaserite, and one may obtain an idea of the necessary quantity of water by reference to the data of van't Hoff for 25° and 83° C., shown in Table III.

At 25° the quantity of water required for each 100 parts of material taken should be about 21 times the percentage of potassium, and at 83° about 11 times; presumably the quantity required at the boiling point of the solution would be about seven times the percentage of potassium. This is barely enough water to make a thick slurry of the mixture.

METHODS OF TREATMENT

Based on the above reasoning, 100 grams of sample 160, crushed to pass a 35-mesh sieve, were mixed with 37 c.c. of hot water in a flask, and stirred for 15 min. by rotating the flask (by means of a tube passing into a cork which served as a handle) in boiling brine at 106° C. The mix was then thrown on a centrifuge, drained, and washed twice with a "displacement wash" of 5.5 c.c. of hot water each time. The total volume of the extract was 37.2 c.c. The proportion of potassium extracted, of all the potassium in the sample, was 63%. The proportion of potassium, K, in the total salts extracted was 18.3%. An analysis of the salts extracted, shown in the third column of Table IV, is as follows: K, 18.3%, Na, 24.3%, SO₄, 12.2%, Cl, 45.2%, respectively. This whole hot-water extract might simply be evaporated to dryness and shipped as a crude potassium salt.

The extract described, however, deposited about 30% of its dissolved salts on cooling to room temperature and evaporating somewhat. The deposit was a mixture of salts analyzing as follows: K, 23.5%, Na, 19.4, Cl, 35.0%, SO₄, 22.2% respectively. This composition was computed by difference, knowing the composition of the original solution and the remaining mother liquor. The rearrangements effected by the treatment with hot water are shown in Table IV.

TABLE IV. RESULTS OF EXTRACTING THE SALAR SALTS WITH HOT WATER

	Salar Salts Per Cent.	Per Cent. of Each Constituent Extracted	Percentage Composition of Salts Extracted	Percentage Composition of First Crop of Crystals from Extract	
				Percentage Composition of Salts Left in Mother Liquor	
K	5.0	63.5	18.3	23.4	16.1
Na	32.2	13.1	24.3	19.4	26.4
Cl	41.3	18.9	45.2	35.0	49.5
SO ₄	17.3	12.3	12.2	22.2	8.0
	95.8		100.0	100.0	100.0

Two tendencies are strikingly brought out by the results shown in Table IV. (1) The potassium is greatly concentrated in the hot-water extract, and (2) the sulphate is largely removed from that solution by crystallization on cooling and evaporating. A number of possible variations at once suggest themselves at this point, and the choice of procedure will largely depend on whether a single pure salt is an essential requirement or not. The first crop of crystals and the mother liquor might be given further treatment separately, looking toward the preparation of pure potassium sulphate or chloride respectively.

For technical extraction of the Salar salts by hot water, a continuous process would probably be most efficient, in fact necessary. The apparatus necessary to reproduce the conditions of the experiments de-

scribed would be, for example, a combination of a continuous rotary mixer, designed to operate at a temperature near the boiling point of the solution, and a continuous vacuum filter of the revolving-drum type.

OTHER METHODS OF EXTRACTION

A few words may be devoted to other proposals that have been made for extracting the potash. One suggestion is to extract the salts by a cyclic process, using, at least in part, the final mother liquor to extract a fresh portion of the original salts. This process is analogous to that used in extracting sodium nitrate from caliche. It has been found, however, that the hot extract of the Salar salts does not deposit a pure potassium salt on cooling. This is illustrated by the first crop of crystals in Table IV and was confirmed by several other experiments. Sodium nitrate is obtained successfully by this process, on account of its greater solubility and because the caliche is far richer in it than the Salar salts are in potassium salts.

The yield of potassium chloride and sulphate per cycle would be less than for sodium nitrate. Also, the residue after boiling would have to be washed or drained thoroughly of its liquor in order to obtain an efficient extraction. Lastly, the size of lump that could be treated efficiently remains to be determined. In the nitrate process fairly large lumps of caliche are used, and the liquor permeates them, dissolving the sodium nitrate; this might not occur with the potassium salts. The nitrate process seems, therefore, to be inapplicable to the Salar salts without modification.

There is one modification, however, that might well be tried. It is well known that potassium nitrate can be made from sodium nitrate and potassium chloride. The mother liquor of Table IV might be treated with sodium nitrate to yield potassium nitrate, or, what would probably amount to the same thing, the Salar salts and caliche might be treated together by the usual nitrate process so as to produce a mother liquor rich enough in potassium to yield that salt finally by simple crystallization. The whole problem in this case is whether the gain in potash would warrant the reduction in the efficiency of the nitrate extraction. The chances are that as a process this procedure would be no better than the direct extraction of the Salar salts by hot water, but it might save equipment, inasmuch as the nitrate plants are already available at no great distance from the Salar.

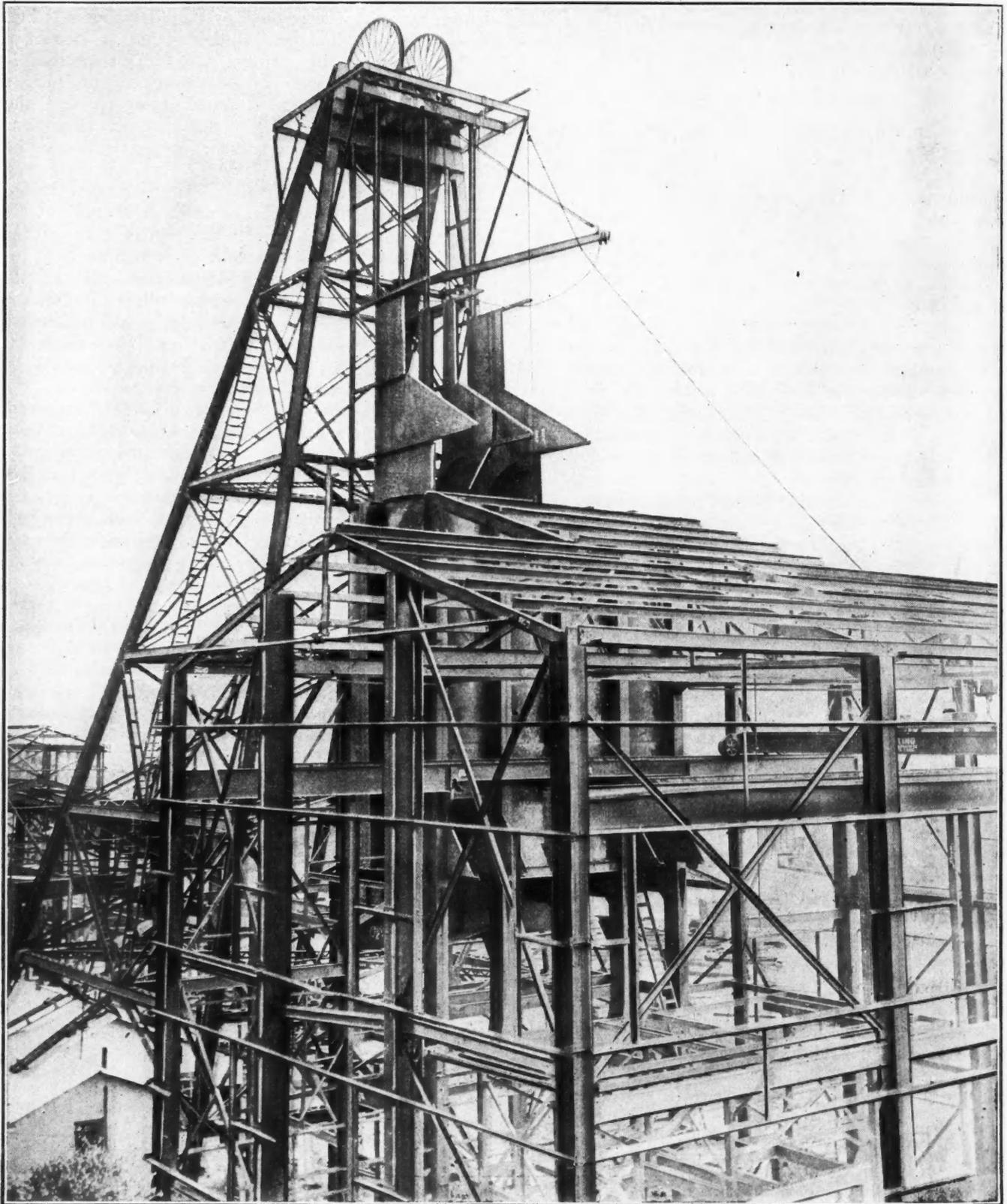
Transvaal Gold Output—1917

The Transvaal gold mines in 1917 produced in the aggregate 9,022,212 oz. of gold. The monthly production is given by the *South African Mining Journal* in the following table:

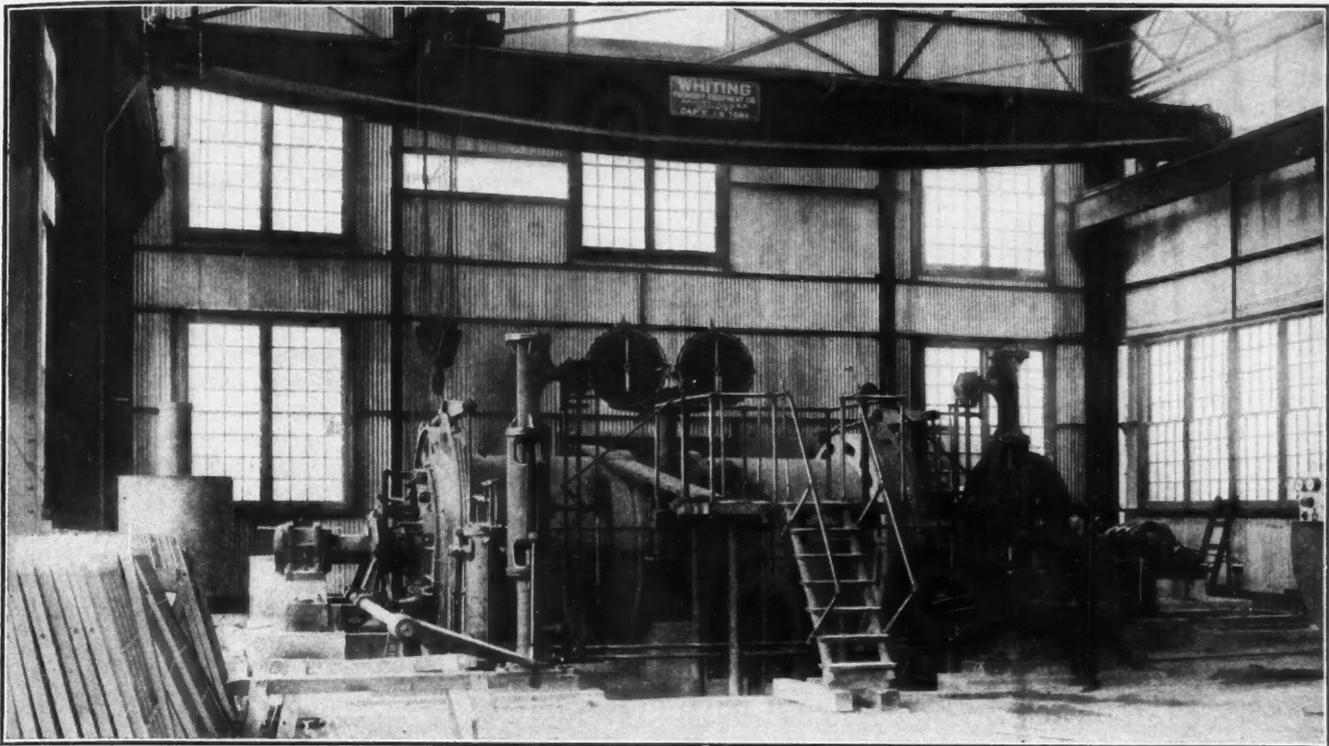
	Ounces		Ounces
January	782,634	July	757,839
February	721,321	August	756,658
March	787,094	September	738,231
April	742,778	October	751,290
May	779,385	November	722,839
June	759,724	December	722,419

Increasing Use of Sulphur at numerous points throughout the country is indicated in the applications being made by various carriers for permission to increase their rates on this commodity.

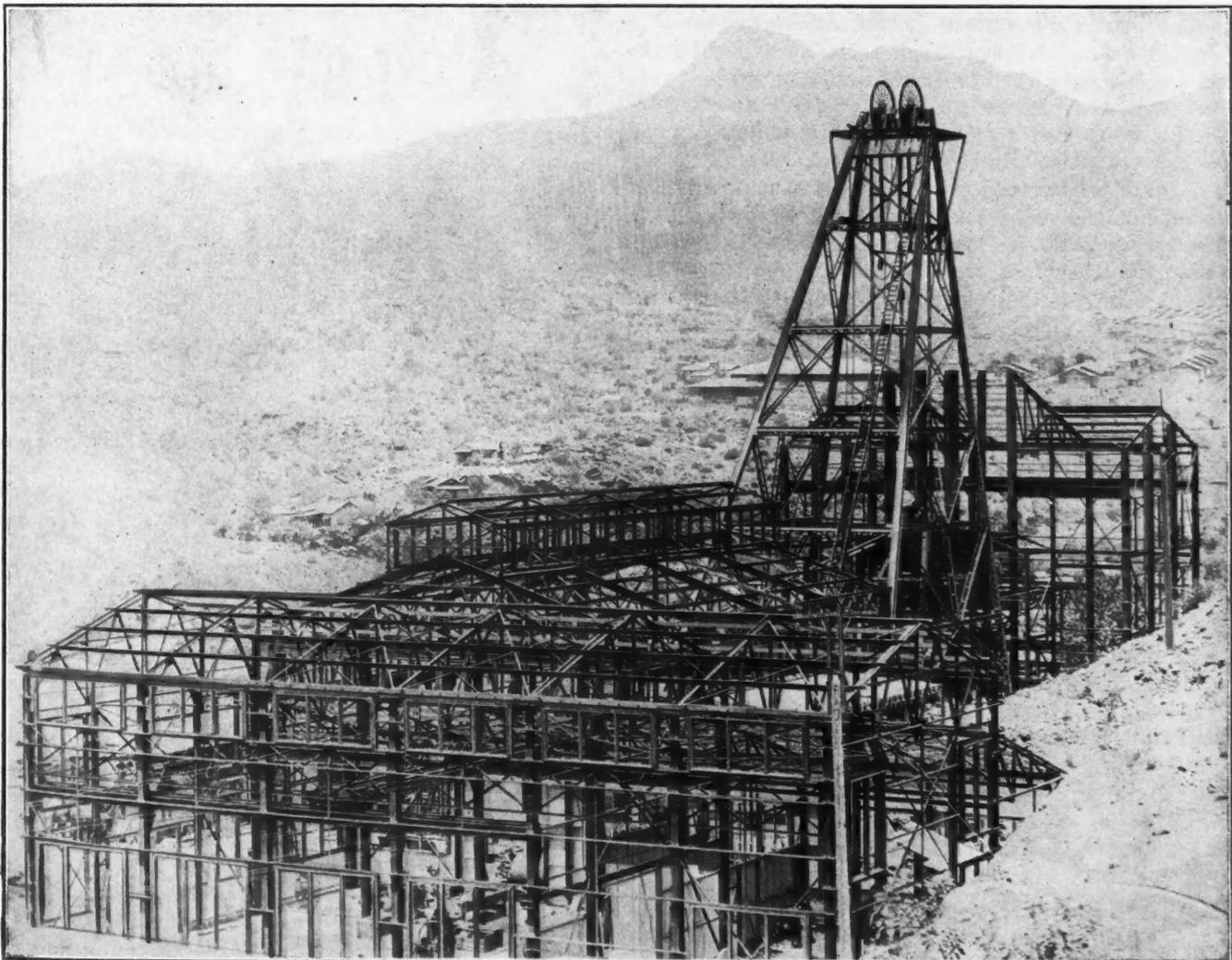
Photographs from the Field



HEADFRAME AND SHAFTHOUSE—ARIZONA HERCULES COPPER CO., RAY, ARIZONA



NORDBERG ELECTRIC HOIST AND TRAVELING CRANE—ARIZONA HERCULES COPPER CO.



GENERAL VIEW OF SURFACE PLANT CONSTRUCTION—ARIZONA HERCULES COPPER CO.

American Smelting and Refining Co.

The earnings of the American Smelting and Refining Co. and its subsidiary companies for the fiscal year ended Dec. 31, 1917, after deducting general expenses (\$1,482,458.30), corporate taxes (\$3,849,970.73) and fixed charges (\$1,234,248.44), aggregated \$25,035,938.44, or \$206,358.67 less than the preceding year. Corporate taxes were \$2,864,005.44 in excess of the year 1916. From these earnings \$4,954,482.39 was further deducted for depreciation and depletion, \$600,000 for life insurance and pension funds, and \$985,830.95 for miscellaneous charges, leaving \$18,495,625.10 as total earnings applicable to dividends.

The company's income was derived as follows: Net earnings of smelting and refining plants and dependent industries, \$24,125,684.68; net earnings from mining properties, \$4,069,242.80; interest, rents, dividends received, commissions, etc., \$3,407,688.43; total gross income, \$31,602,615.91. Of this amount \$18,757,899.51 was earned in the first half year, when copper, lead and silver were at their highest point. The serious decline in these prices, together with that of zinc, due partly to Governmental action, reduced the earnings to \$12,844,716.40 in the second half. In the face of fixed receipts, smelting and refining costs have steadily mounted, supplies and building materials, for example, having increased from 50 to 150% in cost. The shortage of labor is the greatest difficulty to be met, however.

Of the \$18,495,625.10 applicable to dividends, the amount declared on preferred stock for the year 1917 totaled \$4,712,665.75, leaving \$13,782,959.35 applicable to dividends on common stock, which is equal to 22½% on outstanding common stock. Regular quarterly dividends at 6% per annum, and an extra Red Cross dividend of 1%, were declared on the common stock, the total being \$4,269,860. The balance of \$9,513,099.35, together with the surplus on Dec. 31, 1916, brought the total surplus to \$32,955,394.40. Of this amount, \$6,000,000 was appropriated for enlargement and extension during 1918, leaving a surplus of \$26,955,394.40 at the end of 1917.

During 1917, \$6,605,690.88 was spent for enlargement and extension principally upon the copper smelteries at Garfield, El Paso and Hayden and copper refineries at Baltimore, Perth Amboy and Tacoma. The smelting and refining capacity of the company has thus been brought to 1,150,000,000 lb. of electrolytic copper per annum, and production is actually at a rate of 1,000,000,000 lb. per annum. A zinc plant at Henryetta, Okla., was also placed in operation. Great difficulties have surrounded all construction work. Much must be spent at the Mexican properties during 1918 on labor-saving devices, etc., as changed conditions there compel reductions in operating costs.

Metal stocks of the company on hand were valued at \$36,339,499.57, an increase of \$8,861,849.42. Metals carried for toll customers decreased from \$77,776,414.66 to \$43,987,303.14, due to the large refined stock on hand Dec. 31, 1916, which was distributed to trade during year. Materials and supplies on hand were over \$3,000,000 greater in value than a year ago, due to increased cost. These factors necessitate large cash resources to carry on this increased business at present inflated

values. Bad weather and freight congestion toward the end of 1917 cut into the company's cash resources by locking up material in transit and hindering plant operation.

The following statistics relate to plant operation during 1916 and 1917.

OPERATING STATISTICS AMERICAN SMELTING AND REFINING CO.

	1916	1917
Number of men employees, excluding Mexico.	21,073	24,698
Total wages and salaries, excluding Mexico	\$17,047,944	\$24,497,836
Average wages per 8-hour day	\$2.70	\$3.31
Tons charge smelted	4,789,474	5,918,924
Tons bullion refined	677,460	706,875
Tons coal used	724,595	787,890
Tons coke used	454,468	592,765
Barrels fuel oil used	1,107,285	1,560,535
Cubic feet gas used	2,130,460,328	3,032,908,373
Tons ore mined	244,807	259,499
Tons coke produced	140,961	186,107
Metal Production:		
Gold, oz.	2,662,011	2,496,693
Silver, oz.	71,868,451	69,841,061
Platinum and palladium, oz.	868	1,597
Lead, tons	279,144	275,266
Copper, lb.	789,438,000	848,888,000
Best select copper, lb.		68,086,000
Spelter, lb.	47,807,547	52,522,000
Nickel, lb.	1,224,328	682,715
Tin, lb.	4,522,000	12,130,000
Sulphuric acid, lb.	25,842,000	66,174,000
Arsenic, lb.	9,090,000	9,132,000
Copper sulphate, lb.	13,046,000	7,598,000
Byproduct metals, lb.	5,671,827	4,131,709
Copper and brass manufactured products, lb.	31,597,489	39,767,274
Test lead and litharge sold, lb.	417,898	426,472
Number loaded cartridges sold	15,338,000	14,180,000
Sheet lead, pipe, etc., sold, lb.	21,713,331	13,678,245
Mixed metals sold, lb.	2,831,617	5,188,045

The company continued to spend large sums for safety devices and on perfecting its safety organization. It spent over \$100,000 on welfare work. It carried insurance on 6062 employees, face value of policies totaling \$5,037,500. Pensions were granted to 34 beneficiaries during 1917.

Requa Addresses Petroleum Congress

"This war cannot be won without an amply supply of petroleum products," said Mark L. Requa, director of the Oil Division of the U. S. Fuel Administration, at the Petroleum Congress held in Chicago on Mar. 29. "We must have, if we are to succeed, not only fuel oil but gasoline, kerosene, and lubricants as well; for them there is no known substitute. It is not possible to single out any one product and say that it is the most important for the winning of the war."

Mr. Requa pointed out that the United States has produced 4,250,000,000 bbl. of oil since the first well was drilled in 1859. The production was 330,000,000 bbl. in 1917, and, at the average rate of increase, 460,000,000 bbl. per annum will be required by 1927. He said further:

"We are beginning to realize that our resources are not limitless. It is the consensus of opinion that the Appalachian, Lima (Indiana), and Illinois fields can add little in the way of increased production, leaving but three great known fields to meet our future requirements—the Mid-Continent, Gulf, and California.

"In viewing the petroleum industry from the Governmental standpoint, it necessarily means the viewpoint of national welfare, in contradistinction to individual gain; it means the wise husbanding of our available resources, so that they may last the greatest possible length of time, in contradistinction to producing the greatest quantity in the least time and converting it into money.

"With the exhaustion of our oil, or its advance in price, we have, of course, the alternative of producing

oil from shale. That there are enormous areas of such shales in the United States is well known among geologists and others who have taken the pains to investigate. These shales will undoubtedly in time be mined for oil, but we must remember that to produce a quantity of oil equal to our present production we shall have to mine a daily tonnage of shale in excess of the tonnage of coal now mined daily. The magnitude of such an undertaking is obvious. It will not be the growth of a day, but of years. And it is entirely likely that because of plentiful supplies of oil, which may be brought to the United States by water—cheap oil from Mexico and Central America—it will be many years before these shales are utilized.

"Business is not 'as usual' and will not be so long as the war lasts. Each month during the war the priority demands of the Government will become more and more insistent, the duty of the citizen to supply those demands more and more clearly defined.

"If zonal distribution of petroleum products is necessary to supply national needs, zonal distribution will be accomplished. If pooling of tank cars and ships will more efficiently meet national demands, those facilities will be pooled. If well-drilling supplies must be allocated in order to produce the greatest quantity of oil to meet the increasing demands for oil, well-drilling supplies will be allocated. If licensing of jobbers and others is necessary, they will be licensed. If the petroleum industry or any part of it is so unwise as to engage in profiteering, ways and means will be found to correct that condition. In short, whatever the national needs may be, everything that is necessary will be done to meet those requirements.

"Government control does not necessarily signify disaster to an industry. It may be entirely necessary to assist the industry controlled in performing its normal functions, which because of war's dislocating effects are impossible of performance in the normal way. We face a condition of shortage today in many lines of basic products. Whether it be actual shortage or lack of transportation, the result is the same; there is not enough to go around and satisfy all demands. The manufacturer of oil well supplies finds it difficult, if not impossible, to secure raw material to meet his manufacturing needs; the owner of tank cars is unable to secure satisfactory deliveries of cars ordered months ago; the refiner of oil is harassed because of inability to supply his plant with the materials necessary to permit continuous and efficient operation.

"Single-handed, or even united by trade associations, the individual stands but little chance in competition with Governmental departments possessing all the power of priority orders and commandeering. Unless there is some Governmental department charged with sympathetic supervision, it is quite conceivable that in the fierce competition for priority the unrepresented interest will fare badly.

"I do not want you to misunderstand my meaning or to conclude that because certain possibilities are discussed action will follow. We must endeavor to consider and discuss every phase and angle of the question, and to anticipate the needs of the time; we must cooperate in finding solution for the problems as they are presented; and if the industry cannot effect the solution, the function of the Oil Division is to step in

and help; keeping always in mind a few simple fundamentals that may be summed up in the statement that normal channels of trade should so far as possible go undisturbed, that detail operation of business should be left in the hands of those men who have made it what it is, and that the function of the Oil Division is to assist with Governmental aid in making possible those obvious changes which the industry cannot accomplish alone and that when accomplished permit more effective discharge of the obligations and the performance of the patriotic duty owed to the nation."

Great Britain's Manganese Resources

Manganese requirements of the United Kingdom normally could be supplied from sources within the British Empire, the *Statist* claims. These were little over 400,000 tons before the war, but have tripled since then and are steadily increasing. About 500,000 tons were brought from Brazil alone in the first half of 1917, and about 750,000 tons from other sources, principally Burmah. Brazil's prosperity arising from the war, the *Statist* points out, is due to that country's foresight in developing her manganese deposits. As a result of Brazil's preparedness to meet the sudden abnormal demand for these ores, an adequate supply of shipping was placed at her disposal, which has enabled her greatly to extend her trade, particularly her export trade, in other ways as well.

There are small deposits of manganese ores in Carnarvonshire, Wales, and in Cornwall and Devonshire. British India produced about 600,000 tons before the war, of which about one-third was shipped to Great Britain. Russia, a source of supply before the war, was cut off when hostilities began. In addition to these imports, Great Britain has been accustomed to import ferruginous manganese ores from Spain. It is estimated that the deposits in India alone, if properly developed, would more than meet Great Britain's normal demand.

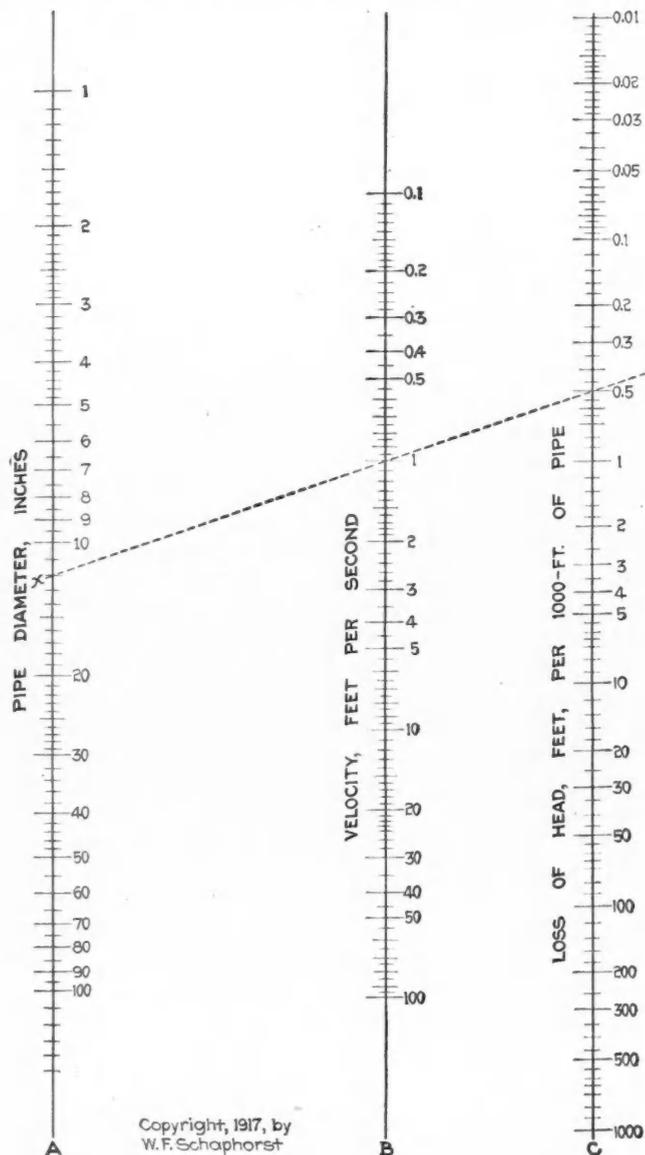
There are deposits of manganese ores in Queensland, New South Wales, Victoria, South Australia and West Australia, but they are either worked to a small extent or are not worked at all. Russian manganese was imported to supply even Australian needs before the war. Deposits exist in New Zealand, as well. They likewise occur in Canada. Nova Scotia annually produced a small quantity before the war for several years. Extensive low-grade deposits exist in Newfoundland. South Africa possesses bodies of manganese ore which have never been worked on a scale sufficient to determine their value. Egypt has large manganese deposits that are comparatively poor in manganese but rich in iron. These could be worked to advantage at a period like the present.

Madagascar Exported the Following Minerals in 1916, according to a supplement to *Commerce Reports*, dated Mar. 4, 1918: Corundum, 1532 metric tons; Graphite, 26,209 metric tons; other minerals not specified, 20,663 metric tons. In 1915, the corundum exported amounted to 334 tons, and graphite, 12,189 metric tons. The actual production of graphite in 1916 was 25,480 metric tons, a good increase over 1915, when 15,000 metric tons were produced. It is estimated that the output for 1917 will total more than 30,000 tons. The number of graphite claims at the end of 1916 was 2371, compared with 1509 at the end of 1915.

Mining and Metallurgical Machinery

A Chart for the Determination of Pipe Diameters, Flow and Loss of Head*

The flow of water through a given pipe will decrease in time because of surface conditions within the pipe. Decreased flow and greater loss of head results



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W.F. Schaphorst

CHART FOR THE DETERMINATION OF DIAMETER
VELOCITY AND LOSS OF HEAD IN PIPES

from an increase in internal pipe friction, which is brought about in varying degree through corrosion, rusting and scaling, effects varying in amount according to the quantity and nature of impurities in the water and to the length of time the pipe has been in use.

In order to compute the diameter of a pipe of a size sufficient to take care of such losses under average

normal conditions in terms of velocity of flow and losses in head that will arise in time from an increase of pipe friction, the given formula has been derived:

$$L = \frac{0.5V^{1.95}}{D^{1.25}}$$

Where

L = The loss of head in ft. per 1000 ft. of pipe length.

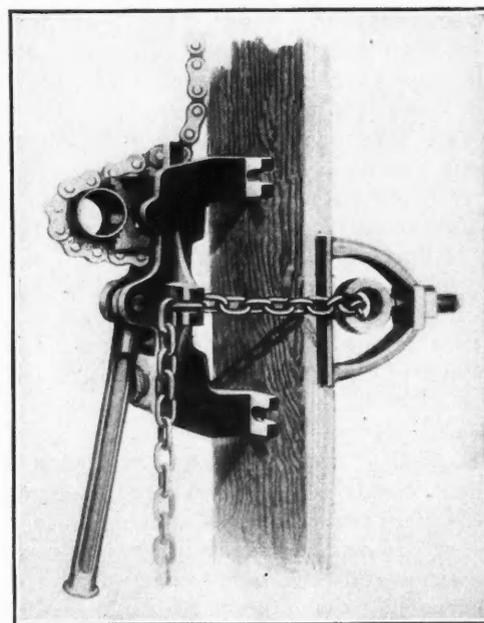
V = The velocity of flow in ft. per sec.

D = The actual diameter of pipe in feet.

From this formula the accompanying chart has been plotted whereby the relations between actual diameter of pipe in inches, velocity of flow in ft. per sec. and the loss of head in ft. per 1000 ft. may be obtained. A straight line XY drawn through any two of the lines A , B or C in the chart at points represented by known data will be solved on the third line at the point of intersection of the extension of the line XY upon it.

"Chaingrip" Pipe Vise

A simple, portable vise, which can be moved from one place and mounted at another in a short time, has been placed on the market by the Gerolo Manufacturing Co., Old Colony Building, Chicago. It may be fastened to any horizontal or vertical support, whether round, square or flat, and without the use of bolts. It locks



"CHAINGRIP" PIPE VISE IN POSITION ON SQUARE
TIMBER

any size pipe or conduit within its limits, by the slight push of a lever, and no previous adjustment is necessary.

The base support of the pipe vise forms an inverted V, at the sides of which are lugs that can be used in case the vise is to be permanently bolted in one position. Hence it will conform to a round, square or flat surface. A clamp support on the opposite side of the column is

*F. W. Schaphorst, mechanical engineer, New York.

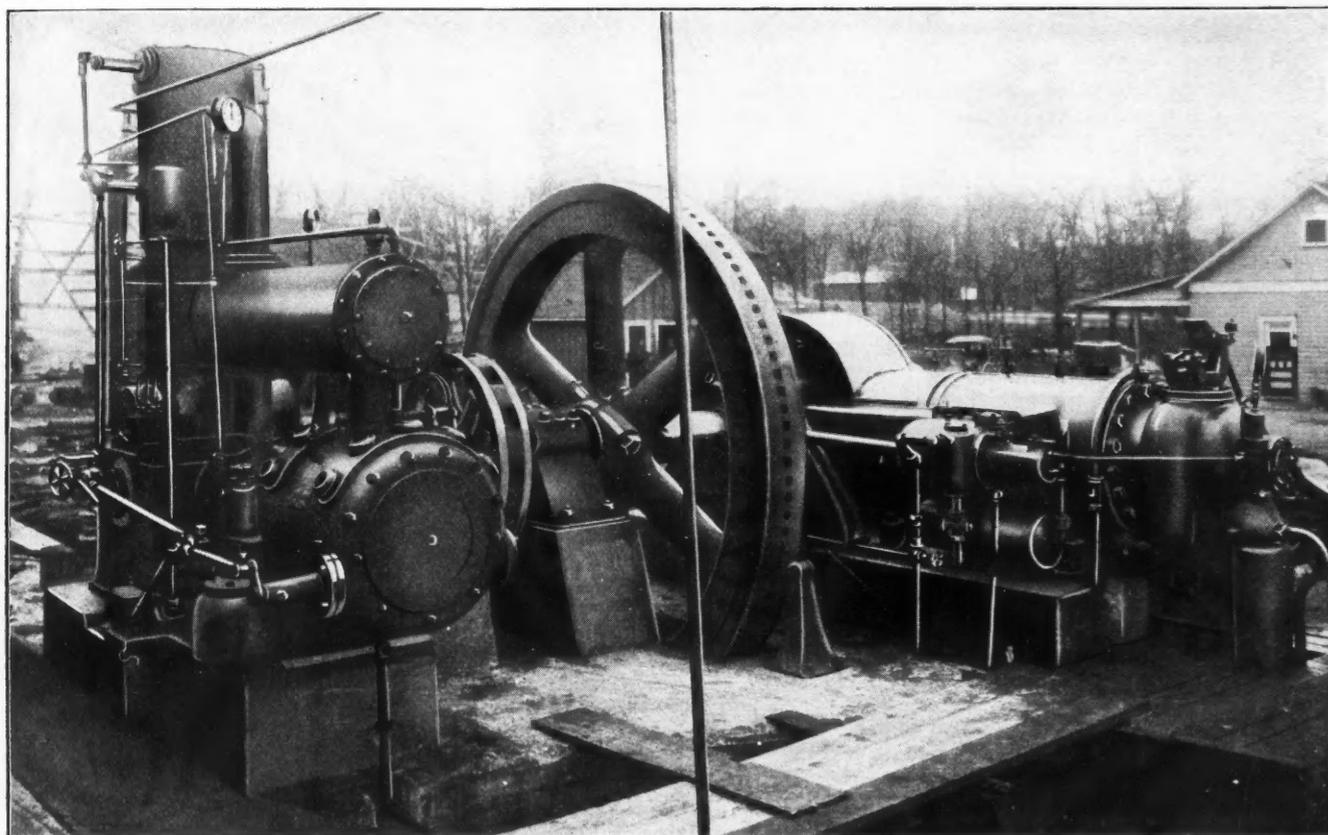
a part of the equipment. It is a bell section shape, having a boss at the top, through which a threaded supporting eye-bolt passes free. A heavy nut rests on the top of the boss, and engages the threaded eye-bolt and adjusts the tension of the chain passing through the eye of the eye-bolt. The base of the clamp support is squared out in a manner similar to the vise base, in such a way that it fits the same shaped surfaces. A heavy wrought-iron chain is riveted on one side of the vise base and passes around the supporting column, through the eye of the eye-bolt in the clamp support, and thence to the other side of the vise base, a link being held securely in position in a socket. Tightening of the eye-bolt nut tightens the supporting chain and holds the vise rigidly in position.

The "Chaingrip" vise locks a pipe or conduit firmly between a double set of steel pipe jaws on one side and a heavy close-linked steel chain on the other. The lock-

Economical Air-Compressor Drive

An unusually economical type of air-compressor drive at the plant of the Flannery Zinc Co., of Sarcoux, Mo., with a Sullivan angle-compound, class WJ-3, air compressor, direct connected to a four-cycle Diesel oil engine, is described by R. D. Willets¹ in *Mine and Quarry*. The dimensions of the compressor are low-pressure cylinder 20 in., high-pressure cylinder 12-in. diameter by 14-in. stroke. The common speed of the compressor and engine is 175 r.p.m. The engine is a single cylinder, size 21 x 30, 160 hp. machine of an improved type, manufactured by the National Transit Pump and Machine Co., of Oil City, Penn. Air is compressed to 100 lb., and at the above speed the compressor has a displacement of 890 cu.ft. per minute.

The Diesel engine is operated on fuel oil, which is in this case crude oil from which the lighter products, such



DIRECT-CONNECTED ANGLE-COMPOUND AIR COMPRESSOR AND DIESEL ENGINE IN SOUTHWEST MISSOURI

ing motion is secured by moving the handle toward the vise. The handle fulcrums on a steel pin, which projects through two bosses, one on either side of the frame of the vise. Directly beneath this fulcrum point, the handle takes the shape of a cam, which in turn operates against a movable horizontal bar. To one end of this bar is riveted the steel gripping chain, which passes around the pipe or conduit and locks in a steel socket. The other end, or fulcrum point, of the bar is supported by a threaded bolt, the enlarged head of which rests upon a boss on the base of the vise. Rotation of the head of the bolt raises or lowers the fulcrum point of the bar, and forms an adjustment of pressure exerted by the other end of the bar on the gripping chain when the handle of the vise is in a locked position.

as gasoline, benzine, and kerosene, have been removed. At this property, oil having a specific gravity of 24° Baumé is used, but the engines have operated successfully on oil running from 16° to 36° Baumé. At the present time fuel oil cost is \$1 per barrel of 42 gal. at the refinery. The fuel consumption of this type of oil engine is one-half pound of oil per hp. per hour. The engine consumes approximately 2 bbl. per 8-hr. shift, assuming full-load operation throughout the period. On this basis the cost of fuel for operating the compressor is practically $\frac{1}{4}$ c. per hp., an exceedingly low rate for fuel.

The accompanying illustration shows this compressor installed and running on its foundation before the power house was constructed over it.

¹Joplin, Mo.

Events and Economics of the War

By intense efforts to widen their salient during the week, the Germans advanced closer to Amiens, though suffering heavy losses; blows against both French and British gained comparatively little ground; at various points the German line was forced back, though the Allies have attempted no counter stroke; American troops in France not yet brigaded are to be absorbed in the Allies' units. Air raids were made on the German cities of Coblenz, Treves and Cologne. Cession of its territory to the Turks under the Brest-Litovsk treaty will not be recognized by the Caucasus, it is reported.

The Third Liberty Loan campaign began on Apr. 6 on the anniversary of America's entry into the war. In a speech at Baltimore on this day President Wilson declared that "force to the utmost" will be used against Germany. From Washington it was intimated that about 1,500,000 men will be drafted during the next 12 months. A plan to put the resources and industries of the country on a sound war basis was announced by the reorganized War Industries Board. E. R. Stettinius and Frederick Keppel were appointed second and third assistant secretaries of war, respectively. House conferees on the Agricultural Appropriation bill rejected the amendment establishing \$2.50 per bu. as the price for wheat. All woolen mills in the country were ordered to hold their looms at the Government's service until July 1.

Third Liberty Loan Will Mature in Ten Years

The third issue of Liberty Loan bonds will mature in 10 years, on Sept. 15, 1928, and will bear interest from May 9 next, payable semi-annually on Sept. 15 and Mar. 15. The amount is \$3,000,000,000 and over-subscriptions. Payment in full may be made with the application on or before May 4, it was announced by the Treasury, but bonds will not be delivered before May 9 on any subscription for an amount exceeding \$10,000. Under the instalment plan, after the initial payment of 5% on subscription, instalments of 20, 35, and 40% would be due respectively on May 28, July 18, and Aug. 15. Full payment may be completed upon subscriptions for any amount on May 9 or any subsequent instalment date.

Payment of any instalment, including the first one of 5%, or payment in full, may be made in Treasury certificates of indebtedness except those maturing Apr. 22 and June 25. Qualified depository banks and trust companies may make payment by credit upon the subscriptions of themselves and their customers, but only to the extent that they cannot make payment in Treasury certificates of indebtedness. The third loan campaign will last for four weeks. It started on Apr. 6 and will end May 4. Banks will be given five days after the campaign's close to tabulate and report subscriptions. The bill authorizing the issue of the new bonds was signed by the President on Apr. 4.

National Labor Program Outlined

Creation of a National War Labor Board¹ for the period of the war, to meet in Washington or any other convenient place, was recommended to the Secretary of Labor on Mar. 29 by the War Labor Conference Board that was recently appointed to aid in forming a national labor program. The functions and powers of the proposed board are to be as follows:

To settle by mediation all controversies between employers and workers effecting the conduct of the war, except where there is, by agreement or Federal law, a means of settlement which has not been invoked; to provide the machinery for securing such settlement by appointment of local committees to sit where the controversies arise; to summon the parties to the controversies before the national board in case the local committees fail.

In case the national board fails to effect conciliation, its members are to select an umpire by unanimous vote. Failing such choice, the name of the umpire is to be drawn by lot from a list of 10 suitable and disinterested persons to be nominated for the purpose by the President of the United States.

The action of the national board may be invoked in respect to controversies within its jurisdiction by the Secretary of Labor or by either side in a controversy or its duly authorized representative. The board, after summary consideration, may refuse further hearing if the case is not of such character or importance to justify it.

The board and the umpire, when mediating, are to be governed by certain principles, the foremost of which is that there shall be no strikes or lock-outs during the war. The right of workers to organize and to bargain collectively through representatives is not to be denied or interfered with in any manner by the employers. The rights of employers so to group themselves and bargain collectively is likewise not to be interfered with by the workers. The latter are not to be discharged for membership in trade unions nor for legitimate trade-union activities. Workers are not to coerce, or attempt to coerce, others into joining their unions or their employers into bargaining with them.

Further principles that must govern the action of board and umpire are that union standards as to wages, etc., are to be maintained where the union shop already exists; the continuance of the open shop where such already exists is not to be considered a grievance; health and safety regulations already established are not to be relaxed. If women are employed on men's work, they must receive equal pay for equal work and must not be given too heavy tasks.

The basic eight-hour day is to be recognized where existing law requires it. In other cases the question of

¹The board, whose appointment was announced in the "Journal" of Mar. 2, was the War Labor Conference Board and not the National War Labor Board, as stated.

hours of labor is to be settled with due regard to Governmental necessities and welfare of the workers. Maximum production is to be maintained in war industries and methods of employers or workers that tend to lessen such production are to be discouraged. A permanent list of skilled and other workers available in different parts of the country is to be kept on file by the Department of Labor, to make possible the rapid and effective distribution of labor. Such information is to be furnished by State and Federal Employment agencies, by the labor unions, and by managers and operators of industrial establishments. Local customs as to wages, labor standards, etc., are to be regarded. The right of all workers to a living wage is declared, and minimum rates, when established, are to be sufficient to maintain the worker and his family in health and reasonable comfort.

May Cancel Contracts for Coal

The U. S. Fuel Administration is considering recommendations that all contracts for the delivery of coal by producers be cancelled as of Apr. 1. Throughout last winter, the Administration allowed all coal contracts to stand, although it had the authority to invalidate the agreements. This was despite the fact that, with practically the entire output on contract, it was difficult during the winter to secure "free" coal for general distribution.

It was felt that the Administration should allow the contracts to continue, pending the organization of a complete Federal plan of distribution, which has now been developed and which became effective Apr. 1. But a small percentage of contracts now remains in effect for a small part of the country's coal output. Some of these will be automatically cancelled by the limitations placed on coal by the new zone system of distribution of bituminous coal. Such cancellation will place the entire coal output of the country directly under the control of the Fuel Administration.

Under regulations already issued, all new contracts for delivery must be made at prices prescribed by the Government. Many of those in force up to Apr. 1 were made at a time when prices were abnormally high. The cancellation of these will bring the whole coal production into the market at Government prices and under Government control and regulation of distribution. It would eliminate all high-priced coal.

Great improvement in the quality of bituminous coal is expected to result from an order issued on Mar. 29 by the Administration, under which operators, for eliminating impurities from their product, will be permitted to add 20c. a ton to the Government price for coal at the mines. The object in this is to stimulate production and to insure a better quality of coal to consumers dependent upon such mines.

The offer is effective from Apr. 1 to July 31, 1918. The permit will be extended beyond Aug. 1 in all instances in which it appears proper to take such action. Operators holding permits will be required to make monthly reports to the Administration, and the allowance to each will be based upon the expense shown to be involved in eliminating impurities from the product.

Retail dealers will not be permitted to add these

allowances to their prices, unless they also obtain permission. All coal prepared in conformity with the requirements of the Administration will be designated by cards placed in the cars, and by notations on the invoices for the coal.

Year's War Expense Below Estimate

Nine billion dollars is the approximate cost to the United States of one year of war. More than half of this has gone in loans to Allies, and will be repaid eventually. More than a third has been spent for the Army and military establishment, one-tenth for the Navy, and one fifteenth for shipbuilding. Just one-sixth of this big war cost has been raised by taxation and other ordinary sources of revenue. The balance has come from sale of Liberty bonds and certificates of indebtedness.

These expenditures are less than Great Britain's and are only about two-thirds of the estimates made by officials less than a year ago. Slow progress of the shipbuilding program and the retarding of the outpouring of war supplies are regarded by officials as the chief reasons why expenses did not equal estimates. Government expenses now are running about a billion dollars a month, with somewhat less than half going to our Allies, who spend the greater part of their loans for war supplies in this country.

Webb Bill Soon To Become Law

The conference report on the Webb Bill for the promotion of export trade has been presented to both houses of Congress. Only minor changes were made by the conferees, and it is expected that the bill will be signed by the President within a few days.

Some of the minor amendments presented in the report have the effect of excluding from the comprehensive definition given of "export trade" the selling of goods, wares and merchandise for resale, as well as for consumption, within the United States or any territory thereof. Other amendments have the purpose of making the language of the bill clear where it accurately defines the things which an association formed under its provisions cannot do and be protected by the said provisions.

Want Drafted Coal Miners Returned

With the Fuel Administration canvassing the increasing and new requirements of the country for coal, the need for more mine-workers in the anthracite region becomes increasingly apparent. It is said there is now a loss of 24,000 men in the regions, due to the draft and other causes, from the normal mine workers' army of 177,000 men in 1915. Operators are signing hundreds of affidavits for employees in the draft, asking for deferred classification on the ground that the men are skilled laborers. Boards of trade are preparing to exert their influence to have the Fuel Administration intervene with the War Department to have men already drafted returned to their places at the mines, as the British government found it necessary to do.

It is felt that these absent men, if returned, could aid

the nation more effectively by mining the coal so essential for war needs than by work in any other branch of the national service. If the supply of anthracite is to be increased, which is very necessary, every citizen should support the proposition that the mine labor force in Pennsylvania's anthracite region should be maintained and, so far as possible, be increased to meet the constantly growing demand.

Employment Zones Demarked

Division of the country into 13 employment districts to facilitate the transfer of labor of all kinds from districts where a surplus obtains to those where a shortage exists was announced recently by the U. S. Employment Service. Homogeneity of industries and employment problems governed the division. The districts and the states included in them follow:

1. Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.
2. New York, Connecticut, and New Jersey.
3. Pennsylvania and Delaware.
4. Ohio and West Virginia.
5. Maryland, Virginia, North Carolina, and South Carolina.
6. Georgia, Florida, Alabama, Mississippi, and Louisiana.
7. Indiana, Illinois, Michigan, Wisconsin, and Iowa.
8. Kentucky, Tennessee, Missouri, and Arkansas.
9. Minnesota, North Dakota, South Dakota, and Montana.
10. Nebraska, Kansas, Oklahoma, Colorado, and Wyoming.
11. Texas and New Mexico.
12. Arizona, Utah, Nevada, and California.
13. Washington, Oregon, and Idaho.

Americanization Conference Meets

A determined fight was made by many of the delegates to the Americanization Conference, which opened in Washington on Apr. 3, to put an end to the practice of permitting the use of any other language than English in elementary schools. Resolutions were adopted for carrying out which Congress will be asked to pass legislation. The resolutions read:

1. The adoption of the policy that the Federal Government should cooperate with states and through the states with the local communities in carrying on an extensive, intensive, and immediate program of Americanization through education, especially for non-English-speaking foreign-born adults.
2. That the industries employing large numbers of non-English-speaking foreign-born persons should cooperate with local communities, state, and Federal governments in carrying out this proposition.
3. That adequate appropriations should be provided by the Congress to be expended through appropriate Governmental agencies for the foregoing purpose.
4. That in all schools where elementary subjects are taught they should be taught in the English language only.

Supplemental resolutions recommended that all aliens in the United States who were qualified to do so should take out naturalization papers by July 15, and that all newspapers printed in the German language should be subjected to the strictest censorship.

Canadian Steel Industry Grows

The Canadian iron and steel industry has been stimulated by the entry of the United States into the war, according to a consular report from Halifax. Exportation of steel to Canada was largely curtailed except where absolutely necessary. In spite of the shortage of important supplies, scarcity of labor, and delays in

transportation, the production of steel ingots and direct castings in the Dominion in 1917 approximated 1,736,500 tons. The greatest annual production previous to this was 1,428,249 tons in 1916. A total of 40,329 tons of ferroalloys was produced in 1917.

The production of pig iron was also heavy, the estimate being 1,200,000 tons, as compared with 1,150,000 tons in 1916. The use of the electric furnace is being rapidly extended, about 45,000 tons of steel having been produced by this method in 1917, as compared with 19,000 tons in 1916.

Excess Profits Tax Reviewers Named

A board of 14 reviewers has been appointed by the Internal Revenue Commissioner to examine excess profits tax returns. The following men will serve: T. S. Adams, economist, of Yale University, chairman; J. E. Sterrett, accountant, New York; Stuart W. Cramer, of the National Council of Cotton Manufacturers, Charlotte, N. C.; E. T. Meredith, agricultural publisher, Des Moines, Iowa; William N. Davis, engineer and oil expert, Bartlesville, Okla.; Thomas E. Lyons, member of Wisconsin State Tax Commission, Madison, Wis.; R. C. Allen, state geologist, Lansing, Mich.; Ralph Arnold, geologist and petroleum engineer, Los Angeles, Calif.; John Marks, lawyer and sugar planter, Napoleonville, La.; A. P. Ramstedt, mining, smelting, and refining expert, Wallace, Idaho; George M. Cornwall, lumber expert and editor of the *Timberman*, Portland, Ore.; Carl H. Nau, accountant, Cleveland, Ohio; H. H. Bond, Massachusetts income tax deputy, Boston, Mass.; L. F. Speer, deputy commissioner of internal revenue. A number of these reviewers served as advisers in constructing the regulations for the administration of the excess profits tax law.

Four advisory members have also been appointed who will be called in for conference on important questions: These advisers are Cordell Hull, member of the Ways and Means Committee, House of Representatives; Wallace D. Simmons, president Simmons Hardware Co., St. Louis, Mo.; Henry Walters, chairman of the Atlantic Coast Line and the Louisville & Nashville Railway, Baltimore, Md., and John Burke, Treasurer of the United States.

Agents Unnecessary To Get Licenses from War Trade Board

The following announcement was issued to exporters and importers by the War Trade Board on Mar. 28, 1918:

It has come to the attention of the War Trade Board that various individuals, firms and corporations have been advertising their services to be rendered in the matter of securing export and import licenses. The War Trade Board suggests that it is not necessary for exporters and importers to consult such agencies. The various bureaus of the War Trade Board will supply all the information desired on receipt of requests therefor. The Board desires to place as little inconvenience and expense upon importers and exporters as possible, and, therefore, this suggestion is made in order that they may not be put to the expense of employing such agencies to obtain licenses, unless they so desire.

Remember the Comfort Fund of the 27th Engineers.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Mineral-Control Bill Before House

Several of the objections to the original draft of the Mineral-Control bill have been met in the measure as finally agreed upon by the House Committee on Mines and Mining. The most important change was to specify that the powers granted are to be exercised through the Secretary of the Interior. Additions were made to the list of minerals covered and the measure was made to read so that control may not be extended to any mineral not specifically mentioned. Mr. Hoover's suggestion that provision be made for converting into the Treasury any profit that violators may make was adopted. The appropriation for administering the bill was cut from \$1,000,000 to \$500,000. A sentence was added providing that "nothing in this act shall be construed to authorize entering into contracts under this act after the termination of the war."

The minerals covered by the bill as introduced are: Antimony, arsenic, ball clay, bismuth, bromine, cerium, chalk, chromium, cobalt, corundum, emery, fluorspar, ferrosilicon, fullers earth, graphite, grinding pebbles, iridium, kaolin, magnesite, manganese, mercury, mica, molybdenum, osmium, sea salt, platinum, palladium, paper clay, potassium, pyrites, radium, sulphur, thorium, tin, titanium, tungsten, uranium, vanadium, zirconium, and other rare or unusual elements the supply of which may, in the judgment of the President, but inadequate for war and industrial needs.

While numerous changes were made in the wording of the original draft, no material changes were embodied in the bill, which has been formally introduced by Representative Foster, chairman of the committee.

Minerals Administration Favored by Hoover

Every ship saved by curtailing mineral imports is equivalent to the immediate construction of a ship. Apparently with this thought uppermost in his mind, Herbert Hoover, the Food Administrator, urged the passage of a mineral administration bill when he appeared before the Committee on Mines and Mining at the hearing which was concluded last week. Mr. Hoover expressed the opinion that stimulation of production of minerals now largely imported cannot take place rapidly enough to meet the nation's demands unless Government aid is extended.

Since the bill follows the general lines of the Food Control bill, Mr. Hoover was able to give the committee some valuable suggestions as to the weak points of the general plan. He urged a provision calling for a small fine as a penalty for profiteering. A heavy penalty, he said, is likely to act as restraint to legitimate trade. The revocation of a license, thereby causing an offender to close up his business entirely, even if for a limited period, is too drastic, Mr. Hoover said. He suggested that the bill should provide punishment

for those who attempt to limit transportation, production or manufacture. It is Mr. Hoover's idea that violators of such laws as those governing the Food Administration should be forced to turn into the Treasury whatever their iniquities have profited them in money.

In reply to questions from members of the committee, Philip N. Moore expressed the opinion that there is no danger of production being stimulated by the bill to the point of overproduction, with consequent loss to the Government. Mr. Moore believes the bill should cover the entire mineral industry.

Adverse action toward the bill probably would have been taken by the Board of Directors of the A. I. M. E., had it not been for the personal arguments for the measure presented by Van H. Manning, director of the U. S. Bureau of Mines. This was revealed by Bradley Stoughton, secretary of the Institute, when he testified before the committee. In view of the reasons advanced by Mr. Manning, the Board of Directors, many of whom are executives of important mining operations, voted 14 to 2 in favor of the proposed legislation.

America Leads in War Savings

For their respective first three months the American war-savings campaign is running ahead of the English campaign. America is pouring its savings into the Treasury at the rate of about \$2,000,000 a day—over \$75,000,000 up to date. The direct comparison is: England: first month, \$5,172,000; second month, \$2,719,000; third month, \$3,402,000; total, \$11,293,000. America: first month, \$10,236,451; second month, \$24,559,722; third month, \$41,148,244; total, \$75,944,417.

The \$75,944,417 already put at the service of the Government by the buyers of war-savings securities has transferred to the National Treasury command of the labor and materials to build a fleet of about one hundred 5000-ton ships.

Imports Not Absolutely Prohibited

Importers of minerals and other commodities on the list of restricted imports see some encouragement in the following announcement from the War Trade Board:

The importation from Europe of most of the commodities on the restricted list is not absolutely prohibited, but will be permitted under certain circumstances, such circumstances being generally that the goods may be shipped if it will not interfere with the speedy operation of vessels carrying troops and supplies from the United States for the European battle fronts. For license to make such importations, new applications must be made and the applicants must show in such applications the facts under which it is claimed that shipment can be made without delay to vessels. These applications will be especially considered and applications granted where it appears that no delay will occur.

Remember the Comfort Fund of the 27th Engineers.

The Expedition of the Ten Thousand

Ten thousand iron men mobilized to fight the forces of gloom—almost one division! Ten times that are needed. Over \$10,000 has been contributed to the Comfort Fund for the mining regiment of 1500 men, but what is that among so many? Figure it out for yourself, if you think otherwise.

You are appointed recruiting officer. How many iron men can you supply? Get them for the Twenty-seventh. There is a loyalty issue involved in this—the loyalty of mining men to the mining regiment. After all is said and done, the fact remains that under the flag today there is a mining regiment recruited from the mining camps. Your brother, your friend, perhaps, at any rate your fellow worker, is in that regiment. Men instinctively take sides in any issue and back up their own. It is the most natural feeling on earth that we—that you—should want to do something for the men of the 27th Engineers, who represent our industry or profession in the service. We mining men of America stand back of every man with the colors, but our particular pride is and should be the mining regiment. Have you this organization spirit? If you have not, the Comfort Fund may lose your money, but you are the greater loser.

Those who have contributed to the fund so far are:

Engineering and Mining Journal.....	\$1000.00
New York Engineering Co.....	1000.00
A Friend, Nov. 23.....	5.00
H. H.....	5.00
D. E. Charlton.....	5.00
H. W. Hardinge.....	1000.00
Frank N. Spencer.....	5.00
W. L. Coursen.....	5.00
J. H. Polhemus.....	5.00
J. H. Janeway.....	10.00
Albert D. Beers.....	10.00
J. E. Hayes.....	10.00
J. A. Van Mater.....	25.00
L. Vogelstein & Co.....	100.00
"Cuprite".....	10.00
R. H. Bassett (Hanna Ore Mining Co.).....	10.00
A Friend, Dec. 10.....	10.00
P. A. Mosman.....	10.00
American Zinc, Lead and Smelting Co.....	100.00
J. G. H.....	5.00
Daniel Guggenheim.....	100.00
A. H. H.....	5.00
Willard S. Morse.....	25.00
August Heckscher.....	100.00
Anaconda Copper Mining Co.....	1000.00
F. W. Bradley.....	100.00
Charles Le Vasseur.....	5.00
A Friend, Dec. 13.....	50.00
Freeland Jewett.....	10.00
Herman A. Wagner.....	5.00
Francis P. Sinn.....	10.00
R. C. Gosrow.....	5.00
D. C. Jackling.....	100.00
"V".....	10.00
J. H. Brickenstein.....	5.00
E. E. Northrup.....	5.00
Rogers, Mayer & Ball.....	50.00
Denver Technical Staff, American Metal Co., Ltd.....	30.00
A Friend, Jan. 9.....	100.00
E. B. Coolidge.....	10.00
J. V. N. Dorr.....	200.00
Pope Yeatman.....	50.00
W. H. Aldridge.....	50.00
C. E. Hart.....	5.00
Robert I. Kerr.....	5.00
Engineers of Washoe Smeltery, Anaconda Copper Mining Company.....	205.00
Harry C. Graham.....	25.00
Utah Copper, Nevada Consolidated, Ray Consolidated and Chino copper companies.....	1000.00
A Friend, Jan. 23.....	5.00
John Gillie.....	25.00
J. N. Houser.....	5.00
C. K. Lipman.....	50.00
Theodore Sternfeld.....	50.00
Hinton H. Crane.....	500.00
T. Wolfson.....	10.00
William H. Hampton.....	10.00
W. E. Merriss.....	10.00
J. Parke Channing.....	100.00
Miami Copper Co.....	250.00
J. H. Means.....	10.00
C. W. Goodale.....	25.00
P. G. Beckett.....	50.00
F. R. Foraker.....	25.00
Charles A. Chase.....	25.00
E. Fleming L'Engle.....	5.00
Calumet & Hecla Mining Co.....	250.00

J. G. Ferguson.....	18.00
ay E. Van Gundy.....	10.00
Franklin Osborn.....	10.00
Oscar Lachmund.....	10.00
W. T. Swoyer.....	10.00
Interest.....	10.00
Quincy Mining Co.....	100.00
American Metal Co.....	250.00
William H. Fairbanks.....	25.00
D. E. Curry.....	5.00
W. R. Ingalls.....	50.00
H. A. Guess.....	25.00
J. Mc. C.....	5.00
Engineers' Club of Northern Minnesota.....	85.00
B. B. Inayer.....	50.00
R. H. Sales.....	25.00
Albert C. Burrage.....	100.00
Edward H. Clark.....	25.00
P. Rutherford.....	5.00
Adolph J. Martinson.....	2.00
Frank R. Edwards.....	5.00
C. H. Munro.....	100.00
E. E. McCarthy.....	25.00
J. L. Bruce.....	15.00
D. Ford McCormick.....	10.00
Louis D. Huntoon.....	5.00
P. G. Spillsbury.....	10.00
C. T. Brown.....	10.00
M. C. M.....	3.00
James F. McCarthy.....	50.00
United States Smelting, Refining and Mining Co.....	250.00
L. O. K.....	10.00
Herman A. Prosser.....	25.00
J. E. Johnson, Jr.....	5.00
A. W. Hahn.....	5.00
L. D. Hudson.....	10.00
Lane Pearl.....	5.00
Arthur K. Adams.....	10.00
L. L. Wilcox.....	5.00
E. J. Longyear Co.....	100.00
Pick and Shovel Club, Mining Department, Case School of Applied Science.....	11.00
L. S. Cates.....	25.00
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Dome Mines Co.....	50.00
Butte Copper and Zinc Co.....	100.00
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William A. Nicholls.....	10.00
Robert S. Lewis.....	10.00
Earl R. Pembroke.....	10.00
East Butte Copper Mining Co.....	50.00
Job H. Winwood.....	10.00
Fred Hellmann.....	50.00
Total.....	\$10,284.00

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

Mineral Imports Committee Discusses Minerals Administration

Responsibility for increasing the domestic production of necessary minerals had best be placed in the hands of the War Industries Board, in the opinion of the Committee on Mineral Imports and Exports. This view was expressed by J. E. Spurr, for the committee, in a letter to Senator Henderson, of Nevada, the chairman of the Senate Committee on Mines and Mining. In anticipation of the fact that the Senate committee will have some very decided opinions as to the mineral administration bill, the Committee on Mineral Imports and Exports apparently is taking early opportunity to impress its own views upon that body.

The bill was drafted by the War Minerals Committee, the letter points out, only after it had "urged this matter upon the attention of the Government for a long

time without commensurate results." The committee also came to the conclusion that the existing Government machinery is not adequate to afford executive control of the mineral situation and that a war administration of minerals is necessary. The bill as drafted, however, did not meet public approval, concerning which the Committee on Mineral Imports and Exports says:

"When the mining public was sounded as to its attitude on the question of a metals administrator, it was found that the industry was very much opposed to it. This feeling was accentuated by popular criticism of the Fuel Administration, which arose at about that time. It was pointed out that this bill would put under the control of the metals administrator the gold, silver, copper, lead, zinc, iron and other industries which were getting along very well as they were, and that legislation in regard to them could do very little good and might do a vast amount of harm if the mineral administrator, or dictator, should not be an absolutely ideal selection."

Mr. Spurr's letter recounts that the bill was held in abeyance as a result of opposition on the part of the industry, and that curtailment of imports and exports led the War Minerals Committee to revise the bill by excluding the major metals and confining its provisions and control to certain specified minor metals. The Committee on Mineral Imports and Exports says:

"Instead of a limited list of mineral commodities mentioned in the bill, any further control and organization by the Government should embody the possibility of including all the mineral commodities.

"The next question is the amount of control which exists and the further functions which it is necessary for the Government to create and grant. The required authority for regulating domestic production is fully covered in the bill. In the hands of the ideal executor it doubtless will work out most satisfactorily. As there is always some question, however, as to the ideal personality, the question arises whether it is not possible to increase existing authority and functions up to the requisite limit without going the entire length of the program. Apparently some closer study should be made of existing Government functions to see whether some of these powers, thus to be given to a new official, do not already exist, scattered through different branches of the Government, and whether they could not be exerted if it were manifestly advisable. The purchasing bureaus of the War and Navy departments and the purchasing organization of the War Industries Board apparently have it within their power, if they are advised that it is essential, to contract at a fixed price for Government purchase of commodities over as long a period as will be desired. Purchases of platinum already have been made by the Government, and it would seem perfectly feasible, for example, for the Government to contract for a certain amount of chromite covering a period of two years.

"Through its close contact with the industries, the War Industries Board could provide, perhaps, for even larger financial operations by arranging with the different industries to purchase commodities, for which the Government is contacting, at a fixed price.

"Financial assistance is opening up. Operation of mines apparently is contemplated in the bill for a war finance corporation, which is being pushed by Secre-

tary McAdoo and which apparently has a good chance of going into effect soon. In short, it is a question as to whether the existing functions of the Government, working in harmony, cannot accomplish most of the objects aimed at in the bill."

Chronology of Mining for Month of March, 1918

Mar. 1.—Government took over control of production, refining, distribution and use of crude and refined platinum for the period of the war.

Mar. 1.—Committee on Military Affairs reported favorably on the Chamberlain bill, introduced in the Senate on January 8, for control of the lumber industry.

Mar. 4.—Price of aluminum fixed by the Government at 32c. per lb.

Mar. 5.—Plant of Little Martha property, in Joplin, Mo., destroyed by fire.

Mar. 8.—The trial on appeal of the Minerals Separation Co., Ltd., *vs.* the Butte & Superior Mining Co. was opened at the United States Circuit Court of Appeals at San Francisco.

Mar. 23.—List No. 1 of restricted imports issued by War Trade Board. Articles named include asbestos, graphite, pyrites and zinc, cryolite and nickel.

Mar. 23.—A decision was rendered in the cast of the Federal Mining and Smelting Co. *vs.* the Star Mining Co. in favor of the Federal Company by Judge F. S. Deitrich of the U. S. Court for the District of Idaho.

Mar. 29.—War Labor Conference Board submits national labor program to Secretary of Labor William B. Wilson.

Mar. 31.—At 2 a. m. all clocks in the United States were set forward one hour, as provided by the Daylight Saving law.

Sweden's Iron Trade in 1917

The exports of iron ore from Sweden in 1917, according to the Consul General at Stockholm, showed an increase over the previous year of 135,184 tons, the total aggregating 5,702,808 tons. Various kinds of iron were exported, to the amount of 495,701 tons, a decrease of 77,366 tons from the total for 1916. Imports of iron fell by 201,879 tons to 102,006 tons. The general results of the iron-trade year were good, though profits were considerably reduced.

Of pig iron, the 1917 production was 837,184 tons, an increase over 1916 of 88,088 tons. Bessemer ingots were produced to the amount of 78,130 tons, an increase of 1118 tons, while martin ingots amounted to 497,332 tons, a decrease of 36,568 tons. On Dec. 21, 104 blast furnaces were in operation, an increase of nine, as compared with the same period in 1916; 147 Lancashire furnaces, a gain of three; 10 bessemer furnaces, as compared with seven, and 59 smelting furnaces, an increase of seven over 1916.

Petroleum Output from the Comodoro Rivadavia fields, in Argentina, has increased steadily since 1911, as shown by the following figures of production taken from *Commerce Reports*: In 1911, 1920 metric tons; in 1912, 6850 tons; in 1913, 19,050 tons; in 1914, 40,530 tons; in 1915, 75,900 tons; and in 1916, 116,000 tons.



Shall the Civilization of the Ages
vanish before
the Devilization of the Hun?
One hundred million freemen answer

NO—

Editorials

The Position of the Smelting Industry

IN THE last report of the American Smelting and Refining Co., Daniel Guggenheim, its president, is very outspoken when he says the following:

It has always been the policy of the company to make long-time contracts for ore and bullion, at a fixed price for smelting and refining, which has permitted continuous running of our works, and plans could always be made intelligently and without risk for enlargement or of making expenditures to reduce costs. While the charge in such contracts was fixed, the company had a certain interest in the metal recoveries. Under economic laws, if costs of operation increased, it would be on account of generally increased values, and the interest of the company in the metal recoveries would equal the increased cost of smelting and refining.

The company is now suffering from the entire lack of economic law, and is operating under the direction of Governmental commissions, whereby the value of the metal products of the company is fixed. But the cost of labor and supplies is not fixed; in fact, owing to the various Governmental contracts for shipbuilding and other construction of great magnitude, which have been made on the basis of cost plus a commission, the contractors have no interest in holding labor costs at a point where a profit can be made, and, in fact, their own interests are in favor of as high a cost as can be in any way justified.

By these two Governmental actions, first, by reducing the value of our product, and, second, by constantly increasing our cost, this great corporation, producing what is absolutely necessary to the Government in carrying on the war, is having its ability to pay a fair return to its stockholders seriously jeopardized. While it may be said that the previous profits were excessive, had it not been for such profits, the company would not have been able to enlarge its works and increase its output, all of which has been of vital necessity to the Government. These enlargements have been effected at a cost of fully \$15,000,000, all of which has been taken out of the earnings of the company, and the enlarged capacity will doubtless be entirely useless after the war demand ceases.

The casual reader will be mystified by this when he turns to the accounts of the company and observes the record of its large earnings in 1917, but the expert will understand that Mr. Guggenheim had in mind not the results of 1917, but the situation existing today.

We know that the entire smelting and refining industry is today in a desperate condition, especially the refining. Both branches have been in the past based on long-time contracts, (10, 20 and 25 years), conservatively as it was thought, but this is now proving to be their undoing. For, while tolls remain fixed, costs have risen enormously, even 100% in some cases. To the plight of the refiners the Government has been directly contributory, in its competition with them for labor, nearby contractors operating on the cost plus 10% principle calling away their men or forcing them to meet the reckless offers that the cost plus 10% system permits. The Government further cripples the refiners by fixing the price for copper and precluding any chance of their recouping themselves. The smelters are more or less in the same fix.

If it were not for collateral interests, the custom smelting and refining industry would today be bank-

rupt. Yet so important is this industry that let it be checked and both Europe and America will cease to get copper. The smelters and refiners have made representations in Washington, but how to relieve them of their predicament it is not easy to see. An advance in the price for copper will help, in that it will offset increased costs in the cases of those who refine their own bullion, or those mining companies that have assented to increases in the refining tolls, but those smelters and refiners who are on a straight toll basis will not be helped, for any advance in copper price will accrue to their clients, not to them. Governmental abrogation of contracts is something that we do not like to think about. Even if such a thing were ordered, it would simply mean passing the increased cost on to the mines, which would be contributory to curtailment of their production. The real alternatives seem to be the awarding of a Governmental bonus to the smelters and refiners or the Government itself taking over the works and standing the loss in operation. The Government cannot disclaim responsibility for the situation.

Labor Must Do Its Bit

THERE should be both inspiration and admonition in the recent declaration of General Pershing regarding the achievements of our engineer units in France. The General is reported to have expressed great satisfaction that the men in the engineers' corps, many of whom had a short time previously been fighting at home for higher wages and shorter hours, had, since their enlistment, not given the question of wages or hours a thought, but were unreservedly supporting the men in the trenches. Praise from Sir Hubert is praise, indeed. We know that the engineers deserve it.

The stress and exigencies of war early convinced organized labor in Great Britain that many privileges and prerogatives won only after years of effort must be suspended in order that indispensable military supplies might be produced. The British unions yielded, rightly placing the national interest first, and that there should be no possibility of employers trying to make war-time practice and regulations carry over after the restoration of peace, Parliament enacted legislation restoring, when peace shall come, all rights abrogated at the government's request; and, furthermore, an official bureau was created to collect and record all data bearing on the subject, that full justice might be accorded the workers. Indications point to the approach of conditions in the United States that may compel recourse to measures as to hours of labor and working conditions similar to those necessary in Britain.

The one clear call from every section of the country has been to *speed up*. Criticism from press and platform has found its base on the failure of departments, bureaus, boards, works, shipyards and myriad industrial

establishments to get things done. The military slacker has been jacked up; Maryland and New Jersey have put a penalty on idleness; but the industrial slacker and the profiteer operate—or fail to—unchecked and uncontrolled. A concomitant of the increasing needs of Army and Navy has been a disposition—among manufacturers, jobbers and labor alike—to overreach and diddle for excess profit, privilege and advantage and to let the war go hang if it interfered with “business as usual.”

As there is no business so vitally important as mining to the production of military supplies, it is incumbent upon every man connected with our industry forthwith to do his bit. If labor can, with the eight-hour day, meet the country's need, well and good; but that need must and shall be met, no matter what the hours or working conditions.

It will probably be expedient to pattern our practice after the British agreement, in order that, while all sacrifices necessary to victory are made willingly and with good grace, no injustice ensue under the guise of patriotism.

The directors and responsible officers of many of our most essential industries would do well to bear in mind that much of the prevailing industrial discontent is inspired by the general belief that contractors and manufacturers are profiting inordinately from the extraordinary urgency created by war conditions, and as speedily as may be, so arrange their affairs as to be able conclusively to demonstrate that with a temporary lengthening of hours—if that must come—there will develop no grasping for super-normal profits.

Finally, all overtime earnings should be figured by labor as *velvet*—and put into Liberty Bonds.

Cut Out the Waste

IN THESE times we are all urged to cut out wastefulness and to concentrate on things of vital importance to the winning of the war—food, munitions, transportation. Little else matters. The energies of the nation must be centered on the production of the prime essentials. People who are doing other things are verging dangerously close to the state of the slacker: those who are buying products they do not actually need are not only using money that should be invested in thrift stamps or war bonds, but are employing labor that is badly needed in the essential industries, and thus in an indirect way thoughtlessly handicapping our soldiers. If the cumulative effect of the failure to concentrate on the serious duties of war preparation could be translated into terms of the lives of a specific number of soldiers—due to our delay in getting “over there” in force—people generally would be horrified at the results of their thoughtless delay of necessities.

Some of the delays began a good while ago—the I. W. W. (or shall we say, Bolshevik) strike in the copper districts last year, the strikes in the shipyards, and, long before that, the lack of preparation of our Government in the “He-kept-us-out-of-war” days. The exact cost in lives of these delays one shrinks from attempting to measure at this time. Our slowness in getting started in the war has permitted many things to happen, and only historians may be able to say what

these delays have meant—both in lives and treasure—by extending the period of the war.

What is past is past; but what of the present and the future? Shall we be more thoughtful and more efficient in the future? Our delays through shipping congestion are another form of indirect “slacking.” Mr. Hoover recently sounded the alarm that a food crisis seriously affecting our Allies necessitated the prompt provision of cars. The country generally is hardly yet awakened to the importance of sacrificing non-essential activities to provide for this year's crops so as to be able to feed ourselves, our Allies and the neutrals dependent upon us for foodstuffs. Food, ships and munitions—everything that does not contribute to their production should be curtailed to the lowest limit compatible with healthful conditions at home.

The people are frequently urged to give up the patronage of luxury industries, both by local and Federal authorities. In many localities serious-minded persons are undertaking by act and precept to increase the saving of food and other essentials. But what of the Government? Has it cut its non-essentials or even reduced them to a reasonable point? Is it not continuing many of its non-essential activities right in Washington, where they are so short of office space, of clerks, of stenographers? Are not many Government employees at present engaged on prosaic peace-time reports presenting the merits of civic centers or preparing tomes on abstruse scientific subjects which have nothing to do with winning this war? Eight months after we declared war, the Government Printing Office issued a 1200-page volume of this character, involving the use of much white paper and the most expensive kind of typesetting for over 1100 pages, while important reports on war minerals and other timely subjects are held up by congestion in the Public Printer's department.

Visitors to the Capital tell of bureaus that are doing work on the “business-as-usual” basis, instead of curtailing their work to immediate necessities and turning over the remainder of their facilities to the winning of the war—the one big job ahead of democracy now. Let Washington set an example to the country and reduce its own waste.

The Zinc Industry

THE zinc industry of the United States is fast approaching a crisis which will end only with the survival of the fittest. Enormously overbuilt by the stimulus of the high prices of 1915-16, it has been staggering during the last six months under a great accumulation of unsold stocks, and the market has become severely depressed. If the general advance in prices since the middle of 1914 is represented by the index of 1.85, the present price of 6½c. for common spelter corresponds with a pre-war price of about 3½c. We remember how badly hurt the smelters used to be with spelter below 4½ cents.

Many smelters have hung on lately, considering that their product would be needed in warfare, but, not being called upon, they are now yielding to the pressure and are not only closing their plants, but also are dismantling them in many cases. This movement, like all such movements, is likely to go too far. The national danger is that the industry will become unduly dis-

organized and will not be in a position to respond quickly to a renewed demand that may arise in an emergency.

Our Economic Policy

OUR economic policy is based on the theory that inflation must be avoided at all costs. As a first step we enter upon a program of price-fixing. Price-fixing checks production, and another artificial measure becomes necessary. This is called eliminating the non-essentials. Then the blight upon business spreads. The logical conclusion is the happy state of the natives of the South Sea Island who lived by doing each other's washing.

But the natural law cannot be balked any more than water can be made to run up hill. It will sweep away the whole price-fixing policy, whether the Administration wants it or not.

The Pennsylvania Railroad in 1917.

THE progress of the war is widening our appreciation of the importance of certain fundamentals of our life, the production of raw basal-products, the manufacture of them into necessities and their transportation to consuming and shipping centers. In particular, transportation commands attention. The annual report of a great railroad system is illuminating and important to engineers. In 1917 the public service of the Pennsylvania R.R. was equivalent to 48,749,320,471 ton miles in freight moved and 5,828,039,051 passenger miles in passenger traffic. The freight traffic was over 60% greater than the combined annual ton-mileage before the war of all the railroads of the United Kingdom of Great Britain and Ireland and the Republic of France. The previous high records of 1916 were greatly exceeded.

The net income for 1917 was \$39,281,585, which, after provision for sinking and other reserve funds, represented 7.4% on the capital stock of the company. The net income was \$12,994,919 less than in 1916, in spite of the increased public service. This was due to increased cost of labor and supplies. Out of every dollar of transportation revenue, 85c. was required to pay operating expenses and taxes, a proportion exceeding any previous year.

An average force of 250,000 is employed, and it was necessary to hire and distribute over this system 278,000 new employees during the year. The property investment at the close of the year totalled \$1,722,281,514, and the return on this investment, after payment of operating expenses and taxes, was 4.5%. Over 2,000,000 troops were transported, and unprecedented traffic converged upon the system, which serves the largest centers of population and industry east of the Mississippi River and the chief sources of coal, coke iron and steel.

The condition of the equipment owned by the company at the end of the year showed 86.72% of all locomotives, 96.96% of the passenger cars and 93.5% of the freight cars in service. The average cost of operating a locomotive 100 miles was \$41.55, as compared with \$28.38 the previous year. The greatest increase in cost was in fuel, which jumped from \$9.60 per 100 miles in 1916 to \$18.15 in 1917. Repairs and depreciation in-

creased \$3.29, lubricants 7c. and engine house expense 76c. per 100 miles. With fuel the total increase was \$12.67. The equipment available for the service of the public at the close of the year was:

Total locomotives, 7600.
Total passenger cars, 7707.
Total freight cars, 277,038.
Total tank cars, 451.

This is equivalent to:

Total tractive power, 284,150,778 pounds.
Total seating capacity, 318,402 persons.
Total carrying capacity, 13,891,038 tons.
Total carrying capacity, 41,990 barrels.

The entire system burned during the year 17,557,309 tons of coal, an increase as compared with 1916 of 1,360,800 tons.

Arbitrate!

THERE is a lesson for labor in the war. Germany refused to arbitrate. She struck. And her appeal to force—to might instead of right—has drenched the earth in blood and put so huge a burden on generations yet unborn that imagination quails and falters before mere contemplation of it.

This is no time to adjudicate the merits of open shop vs. closed shop. Justice to labor will be done—is being done—in most trades and avocations in full measure. No question can arise that will not be more fairly settled through arbitration, negotiation and agreement than through appeal to the strike or the lock-out.

Our men "Over There"—flesh of our flesh—in first line trench, are offering their all, while, safe at home, many are quibbling over details of working conditions and pay for service necessary to make effective the presence of our soldiers at the front.

No man or body of men, in the present temper of America, need hesitate to rest the equity and justice of any issue with those departments of the Government charged with the responsibility of deciding it.

One question—only one—overshadows all: We must win the war. Nothing else matters.

Preliminary Report on the Mineral Production of Canada for 1917

In our issue of March 30, p. 590, we inadvertently included two paragraphs on molybdenum, the first of which should have been credited to the Ontario Bureau of Mines and the second to the Quebec Bureau of Mines. The record of molybdenum ore treated in 1917 applies only to the Province of Ontario. The paragraph on magnesite that follows should have been credited to the Quebec Bureau of Mines and applies to the Province of Quebec.

Accidents in Canadian Mines

In our issue of March 30, p. 597, we erroneously assumed that the report of accidents applied to Canada as a whole instead of the Province of Quebec. The report which appeared should be corrected to read "Accidents in Quebec Mines."

Current Prices of Mining Supplies will be published in the Milling Number, Apr. 20, 1918.

BY THE WAY

Mexican petroleum pumps smoothly on, despite revolution after revolution, remarks the *Sun*. This is partially because all of its properties are in the district controlled by Manuel Pelaez, better known as "King" Pelaez. The "King" has protection to sell, and since it is high-grade protection, of a kind that protects, the oil companies of the Tampico and Panuco districts buy it from him. They chip in to make up a purse of something like \$20,000 a month for him. But not a single oil well has been fired since he sold the protection to them, so well has he the district under control.

One has to talk with Daniel C. Jackling only a few minutes to realize that he is a big man, says the *Boston News Bureau*. He is big enough to acknowledge an error of judgment. He makes no attempt to side-step the Alaska Gold failure nor by involved explanation to tell why early anticipations were not realized. He recently remarked to a friend: "Alaska Gold is my imbecile child. We nursed and tended it as faithfully as we did our successful porphyry copper mines, but this child just didn't have the stuff. I regret beyond words that any of my friends may have lost money by following me in this enterprise. Perhaps they have made enough in the porphyries to compensate fully for Alaska Gold. I certainly hope so."

When the credit man makes a mistake, it is good night. But when a plumber makes a mistake, he charges twice for it; when the lawyer makes a mistake, it's just what he wanted, because he has a chance to try the case again; when the carpenter makes a mistake, it's just what he expected, because the chances are 10 to 1 he never learned his trade; when a doctor makes a mistake, he buries it; when a judge makes a mistake, it becomes the law of the land; when a preacher makes a mistake, nobody knows the difference; and when an electrician makes a mistake, he blames it on the induction, the meaning of which nobody knows. The foregoing is from the *Pittsburgh Credit Bulletin*. To it we add that when the mining engineer makes a mistake, it all depends upon whether he may be relied upon not to make the same mistake twice. If he can be relied upon, he is likely to be a more valuable man. However, mistake-making mining engineers are not popular.

Many a mining engineer acquires local fame in a mining district, yet remains in blissful ignorance of the fact. The owners of an old mine in Cuba engaged an expert to study the workings and plan future operations. A Gallego miner of the extreme squarehead type chanced to find the card of the engineer, and, being unable to read the small-type inscription "Mining Engineer and Geologist," sought the assistance of one slightly more educated than himself. The next day, the squarehead boasted loudly among his fellows of the unparalleled scientific ability of "Meester Schwab, Ingeniero de Minas y Teólogo." A quarrelsome Andaluz snorted,

"Huh, teólogo! What value ees one priest for thees mine? *Por su madre!*" "De Ud! Paso!" replied the Gallego, knocking wood and then gesticulating wildly; "but thees Americano he ees not *Católico*. Of religion those crazy Americanos have many kinds. For me, I think thees one ees *espiritista*. One theologist of that kind he can talk with those dead miners that work here many years ago. *Por supuesto*, they tell heem where ees the reech ore; he keep hees mouth shut about those miners; he say to Don Jorge to work thees place and that place. *Claro, pues*, one *teólogo* can make more money than one ordinary engineer from mines."

The Engineers*

(Tune: "Son of a Gambolier")

Who is the man who views the mines and promptly turns them down?

Who is the one that thinks this is the short cut to renown?
Who is it gives the bum advice to the innocent financier?
The knowledge-feigning, theory-straining mining engineer.

Who steals our gold and silver, and copper, zinc and lead?
Who takes the joy all out of life and strikes our high hopes dead?

Who never wrote a schedule that to anyone else was clear?
The sulphur-belching, miner-welching smelter engineer.

Who is the man designs our pumps with judgment, skill and care?

Who is the man that builds 'em and who keeps them in repair?

Who has to shut them down because the valve seats disappear?
The bearing-wearing, gearing-tearing mechanical engineer.

Who buys his juice for half a cent and wants to charge a dime?

Who when we've signed the contract can't deliver half the time?

Who thinks a loss of twenty-six per cent. is nothing queer?
The volt-inducing, load-reducing electrical engineer.

Who is it takes a transit out to find a sewer to tap?
Who then with care extreme locates the junction on the map?
Who is it goes to dig it up and finds it nowhere near?
The mud-bespattered, torn-and-tattered civil engineer.

Who thinks without his products we would all be in the lurch?

Who has a heathen idol which he designates Research?
Who tints the cheeks, perfumes the air, and makes the landscape drear?
The stink-evolving, grass-dissolving chemical engineer.

Who is the man who'll draw a plan for everything you desire?

From a transatlantic liner to a hairpin made of wire?
With "ifs" and "ands," "howe'ers" and "buts" who makes his meaning clear?
The work-disdaining, fee-retaining consulting engineer.

Who builds a road for fifty years that disappears in two?
Who changes his identity, so no one's left to sue?
Who covers all the traveled roads with filthy, oily smear?
The bump-providing, rough-on-riding highway engineer.

Who takes the pleasure out of life and makes existence hell?

Who'll fire a real good-looking one because she cannot spell?

Who substitutes a dictaphone for coral-tinted ear?
The penny-chasing, dollar-wasting efficiency engineer.

ANONYMOUS.

*Sung at a meeting of the Engineering Society of Buffalo and sent by a correspondent.

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 remittances are made in even dollars, we will return the excess over an order in coupons if so requested.

COPPER

- 8919—ANALYSIS—A New Method of Determining Copper, James Moir. (Journ. Chem. Met. and Min. Soc. of So. Afr., Nov., 1917; 2½ pp.)
- 8920—ANALYSIS—Sulphur and Copper Oxide Determination. C. G. Maier. (Eng. and Min. Journ., Feb. 23, 1918; 1½ pp.) 20c.
- 8921—ARIZONA—Ajo Copper Mine. Courtenay De Kalb. (Min. and Sci. Press, Jan. 26 and Feb. 2, 1918; 8½ pp., illus.) 40c.
- 8922—ARIZONA—Gold, Silver, Copper, Lead and Zinc in Arizona in 1916. V. C. Heikes. (Mineral Resources of the U. S., 1916, Part I, Dec. 21, 1917; 37 pp.)
- 8923—BRITISH COLUMBIA—Notes on the Copper Deposits of the Northern Interior of British Columbia. John D. Galloway. (Bull. Can. Min. Inst., Jan., 1918; 6 pp.)
- 8924—CALIFORNIA—Further Remarks on the Ores of Engels, California. L. C. Graton and D. H. McLaughlin. (Econ. Geol., Mar., 1918; 18 pp.)
- 8925—CALIFORNIA AND OREGON—Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1916. Chas. G. Yale. (Mineral Resources of the U. S., 1916—Part I, Dec. 3, 1917, 53 pp.)
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- 8927—CENTRAL STATES—Silver, Copper, Lead and Zinc in the Central States in 1916. J. P. Dunlop and B. S. Butler. (Mineral Resources of U. S., 1916—Part I, Oct. 27, 1917; 105 pp.)
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- 9077—CRUCIBLES—Notes on the Crucible Situation. A. V. Bleining. (Journ. Am. Inst. of Met., Dec., 1917; 19 pp.)
- 9078—FLUXES—Note on the Question of Fluxes. E. A. Frohman. (Journ. Am. Inst. of Met., Dec., 1917; 4 pp.)
- 9079—HARDNESS—Notes on Testing Hardness of Metals. J. W. Craggs. (Journ. Soc. Chem. Ind., Feb. 15, 1918; 5 pp., illus.)
- 9080—HIGH TEMPERATURES—Automatic Control and Measurement of High Temperatures. Richard P. Brown. (Journ. Ind. and Eng. Chem., Feb., 1918; 3 pp.) 60c.
- 9081—ITALY—Le Développement des Industries Minière et Metallurgique en Italie. (Génie Civil, Nov. 17, 1917; 2½ pp., illus.)
- 9082—REFRACTORIES—Unusual Conditions as to Refractories; Production of Fire-Brick Reduced on Account of Coal Shortage—Prices of Magnesia Brick Reduced—Some Effects of the War. (Iron Age, Mar. 7, 1918; 1½ pp.) 20c.
- 9083—REFRACTORY MATERIALS—Furnace for Testing Refractory Materials Under Load at High Temperatures. Robert J. Montgomery. (Met. and Chem. Eng., Jan. 1, 1918; 2 pp., illus.) 40c.

SAMPLING AND ASSAYING

- 9084—ALUMINUM—Estimation of Manganese in Aluminum Alloys and Dust. J. E. Clennell. (Eng. and Min. Journ., Mar. 2, 1918; 4 pp.) 20c.
- 9085—BRASS OR BRONZE—The Analyses of Brass or Bronze and Babbitt. E. W. Hagmaier. (Journ. Am. Inst. of Met., Dec., 1917; 11 pp.)
- 9086—CUPELS—Bone-Ash Cupels. Frederic P. Dewey. (Advance copy, Trans. A.I.M.E., Feb., 1918; 29 pp.)

- 9087—LABORATORY—U. S. Metals Refining Co.'s New Laboratory at Chrome. N. J. B. B. Hood. (Eng. and Min. Journ., Mar. 9, 1918; 3 pp., illus.) 20c.
- 9088—POTASH SALTS—Some Methods of Analysis for Nebraska Potash Salts and Brines. A. H. McDowell. (Journ. Ind. and Eng. Chem., Feb., 1918; 1½ pp.) 60c.
- 9089—PRECIPITATIONS—Suggestions on Some Common Precipitations. Geo. H. Brother. (Journ. Ind. and Eng. Chem., Feb., 1918; 1 p.) 60c.
- 9090—SILICA—Dosage du Silicium dans les Ferro-Siliciums. Paul Nicolardot and Jean Koenig. (Rev. de Met., Nov.-Dec., 1917; 5 pp.)
- 9091—SULPHUR—Improved Method of Sulphur Analysis. F. G. Hawley. (Eng. and Min. Journ., Feb. 23, 1918; 1½ pp.) 20c.

FUELS

(SEE ALSO PETROLEUM AND NATURAL GAS)

- 9092—BRIQUETTING of Anthracite Coal. W. P. Frey. (Bull. 133, A.I.M.E., Jan., 1918; 7 pp., illus.)
- 9093—CANADA—Fuels of Canada. B. F. Haanel. (Can. Engr., Jan. 31, 1918; 5½ pp.)
- 9094—COAL—Resources and Its Full Utilization. Chester G. Gilbert and Joseph E. Pogue. (Bull. 102, U. S. Nat. Museum, 1918; 27 pp.)
- 9095—COAL RESOURCES—Review of the Coal Situation of the World. Geo. S. Rice. (Bull. 133, A.I.M.E., Jan., 1918; 10½ pp.)
- 9096—COKE—The Byproduct Coke Industry in 1917. C. J. Ramsburg. (Iron Age, Jan. 3, 1918; 1 p.) Lists of completed plants and those under construction.
- 9097—LIGNITES—Carbonizing and Briquetting of Lignites: Economic Possibilities. W. J. Dick. (Bull. Canada Com. of Conservation, 1917; 24 pp.)
- 9098—PULVERIZED COAL and Its Future. H. G. Barnhart. Part XII of a series of articles on Methods of More Efficiently Utilizing Our Fuel Resources. (Gen. Elec. Rev., Feb., 1918; 3½ pp.) From paper read at a meeting of the Engrs. Soc. of Northwestern Penn. and the Erie Section of the Amer. Soc. Machan. Engrs. Nov. 13, 1917. 40c.
- 9099—SAMPLING COAL—Directions for Sampling Coal for Shipment or Delivery. Geo. S. Pope. (U. S. Bureau of Mines, 1917; 15 pp., illus.)

MINING AND METALLURGICAL MACHINERY

- 9100—ELECTRICAL MACHINERY—Some Developments in the Electrical Industry During 1917. John Liston. (Gen. Elec. Rev., Jan., 1918; 49 pp., illus.) Deals with locomotives, hoists etc. 40c.
- 9101—GASOLINE ENGINES—Suggestions for the Safe Operation of Gasoline Engines in Mines. R. H. Kudlich and Edwin Higgins. (Tech. Paper 174, U. S. Bureau of Mines, 1917; 19 pp., illus.)

INDUSTRIAL CHEMISTRY

- 9102—ELECTRO-CHEMICAL INDUSTRIES; Prospects and Possibilities of Their Establishment in South Africa. H. Boyle and C. D. van der Merwe. (So. Afr. Journ. of Ind., Nov., 1917; 28½ pp.)
- 9103a—FERTILIZER INDUSTRY and Its Power Requirements. J. E. Mellett. (Gen. Elec. Rev., Feb., 1918; 14½ pp., illus.)
- 9103—NITROGEN—État Actuel de l'Utilisation Industrielle de l'Azote Atmosphérique. L. Pierron. (Rev. Chim. Ind., Dec., 1917; 6 pp.)
- 9104—POTASH—Bibliography on the Extraction of Potash from Complex Mineral Silicates, Such as Feldspar, Leucite and Glauconite (Greensand Marl). E. C. Buck. (Met. and Chem. Eng., Jan. 1 and 15, 1918; 10½ pp.) 80c.
- 9104a—POTASH—Direct Heat Treatment of Cement Mill Dust to Increase Its Water-Soluble Potash Content. Alber R. Merz. (Journ. Ind. and Eng. Chem., Feb., 1918; 3½ pp., illus.) 60c.
- 9105—POTASH—Effect of Coal Ash on the Liberation and Nature of Cement Mill Potash. N. S. Potter, Jr., and R. D. Cheesman. (Journ. Ind. and Eng. Chem., Feb., 1918; 2 pp., illus.) 60c.
- 9106—POTASH—Extraction of Potash and Other Constituents from Sea Water Bittern. Joel H. Hildebrande. (Journ. Ind. and Eng. Chem., Feb., 1918; 10 pp., illus.) 60c.
- 9107—POTASH—A Neglected Chemical Reaction and an Available Source of Potash. E. A. Ashcroft; also discussion. (Bull. 159 and 160, I. M. M., Dec., 1917, and Jan., 1918; 43 pp., illus.)
- 9108—POTASH—Recovery of Potash from Blast-Furnace Dust. R. A. Berry and D. N. McArthur. (Journ. Soc. Chem. Ind., Jan. 15, 1918; 4½ pp.)

MISCELLANEOUS

- 9109—HEALTH—Mosquito Control at Messina. W. R. Greening. (So. Afr. Min. Journ., Nov. 17, 1917; 1½ pp.)
- 9110—LABOR—Cost of Industrial Health Supervision; Records from 47 Metal-Working Plants, 300,000 Employees and 2,000,000 Cases. Reginald Trautschold. (Ind. Management, Jan., 1918; 6½ pp., illus.) 40c.
- 9111—LABOR—Industrial Housing. H. Walter Forster. (Proc. Engrs. Soc. W. Penn., Dec., 1917; 33 pp.)
- 9112—METRIC SYSTEM—Shall Great Britain and America Adopt the Metric System? Walter Renton Ingalls. (Bull. 159, I. M. M., Dec. 13, 1917; 10 pp.) Further contributed remarks.
- 9113—PERUVIAN PROSPERITY. Wm. A. Reid. (Bull. Pan. Amer. Union, Dec., 1917; 16½ pp., illus.)
- 9114—POWER—Production of Electricity by Steam Power. Alex. Dow. (Advance copy, Am. Electrochem. Soc., Oct., 1917; 18 pp.)
- 9115—RUSSIA—Extracts from the Diary of a Bolshevik Smelterman. J. P. Hutchins. (Eng. and Min. Journ., Mar. 9, 1918; 2 pp.) 20c.
- 9116—TAX—War Excess-Profit Tax. Philip Wiseman. (Min. and Sci. Press, Dec. 29, 1917; 3 pp.) 20c.
- 9117—WEIR MEASUREMENT—V-Notch Weir Measurement. D. Robert Yarnell and G. A. Binz. (Min. and Sci. Press, Mar. 2, 1918; 4 pp., illus.) 20c.

Personals

Have you contributed to the Association of the 27th Engineers?

Phillips B. Dolman is geologist with the Carter Oil Co., at Tulsa, Oklahoma.

Wallace E. Pratt is chief geologist for the Humble Oil and Refining Company.

George B. Rodgers is with the Air Nitrate Corporation, 36 Madison Av., New York.

James P. Gaskill has opened an office in the Security Bldg., Los Angeles, California.

Joseph A. Mills is superintendent of the Wabi Iron Works at New Liskeard, Ontario.

A. R. Fletcher has entered the employ of W. R. Grace & Co., and is at Oruro, Bolivia.

Alexander L. Feld is with the National Carbon Co., Cleveland, Ohio, in its research laboratories.

M. M. Monte Flores is in charge of the Papacobras manganese mine, in Brazil, of the Suffern Co., Inc.

Eugene Laws became manager of the Northport Smelting and Refining Co., Northport, Wash., on Apr. 1.

Francis J. Strachan is superintendent of concentrators, Cananea Consolidated Copper Co., Cananea, Sonora, Mexico.

H. St. J. Somerset, Jr., is plant superintendent at the Broken Hill Associated Smelters, Port Pirie, South Australia.

Robert W. Handley is employed as ore-dressing engineer with the Anaconda Copper Mining Co., at Anaconda, Montana.

H. L. Christensen has resigned as superintendent of the Alaska Juneau mill and will be in San Francisco until Apr. 18.

J. Murray Riddell is with the Wickwire Mining Co., Iron River, Mich., having resigned as chief engineer of the Florence Bates Iron companies.

R. H. Stewart has entered into partnership with **A. G. Larson** and **Arthur Lakes**, of Spokane, as consulting mining engineers, with offices in Vancouver and Spokane.

W. S. Allen, for many years chief chemist of the Laurel Hill plant of the General Chemical Co., has been transferred to New York. **J. B. Barnett** is the new chemist in charge at the laboratory.

D. C. Jackling, was elected a director of the Nova Scotia Steel and Coal Co., New Glasgow, N. S., at the annual meeting of shareholders. **Robert M. MacGregor** was appointed to the board to succeed his father, the late James D. MacGregor.

A. F. Brigham, late general manager of the Jaegers Fontein diamond mines, South Africa, has been appointed general manager of the Hollinger Consolidated Gold Mines, Ltd., at Porcupine, Ont. The former general manager, **P. A. Robbins**, will be managing director.

E. E. Barker, formerly mine superintendent for the Chile Exploration Co. at Chuquicamata, Chile, has recently resigned his position with that company to become superintendent of mines for the Cerro de Pasco Copper Corporation, at Cerro de Pasco, Peru.

Evander B. Schley, recently elected president of the Howe Sound Co., has been appointed a director of the American Smelting and Refining Co. **W. E. Meriss**, secretary of the latter company, was also elected a director. **Frank W. Hills** was elected to the American Smelters Securities board.

Charles B. Henderson, U. S. Senator from Nevada, has been made chairman of the Senate Committee on Mines and Mining. He takes the place of Senator Walsh, of Montana, who becomes chairman of the Pension Committee. Senator Walsh retains his membership on the Committee on Mines and Mining.

John A. Traylor has resigned his position as western manager of the Traylor Engineering and Manufacturing Co. but is retaining the general Western agency of the Cement Gun Co., Inc. He will devote most of his time to his mining interests. His headquarters will remain in the Newhouse Bldg., Salt Lake City.

Prof. Elmer P. Kohler, of the chemistry department of Harvard University, will be stationed at the American University experiment station of the U. S. Bureau of Mines as assistant to the director in charge of research problems. Professor Kohler's work at Cambridge will be carried on by **Prof. Forris J. Moore**, of the Massachusetts Institute of Technology, and by **Dr. G. Albert Hill**, of the Harvard chemical department.

W. C. Capron, assistant chief engineer Copper Mining Co., has been promoted to be mechanical superintendent of the plant. **George Tryon**, formerly chief draftsman of the Washoe works, is now assistant chief engineer of the Great Falls Reduction Works and is succeeded at the Washoe works by **W. E. Meals**, formerly constructing superintendent. **W. Jurdon** has been promoted from draftsman to be superintendent of construction, succeeding Mr. Meals.

William M. Burton has been awarded the 1918 Willard Gibbs gold medal by the Chicago section of the American Chemical Society. In 1889 he entered the employ of the Standard Oil Co. of Ohio as chemist. In 1890 he went to the Standard Oil Co. of Indiana, where he has been successively chemist, assistant superintendent and general superintendent of the company's refinery at Whiting, Ind., and now is vice president of the company, in charge of all manufacturing activities. In 1913 Dr. Burton brought out a practical pressure-still process for converting high boiling point products of petroleum into those of low boiling point, thereby largely increasing the supply of gasoline and other naphtha products.

Obituary

Bernard P. McEnaney, owner and operator of the McEnaney Gold Mines, at Porcupine, Ont., was found dead on Apr. 4 in his apartments in Toronto.

Major Ernest Holland, a prospector of Northern Ontario, has been killed in action. He went to the front three years ago with the Borden battery of artillery and rose to the rank of major.

Capt. Ira J. Penberthy, mining engineer on the staff of the Calumet & Hecla Mining Co. until his enlistment last June in the 1st Michigan battalion of the 107th Engineers, died in France on Mar. 29 from injuries received in a motor accident. His is the first death in the battalion since its formation at the Michigan College of Mines last summer. The battalion sailed for France on Feb. 1.

George J. Jackson, president of the Conduit and Cable Co., died suddenly on Apr. 8 at his home in New York, aged 57 years. He was secretary and treasurer of the National Brass and Copper Tube Co., and secretary of the National Conduit and Cable Co. of London, and was also connected with various other companies. Mr. Jackson was deputy grand master of Masons of New York State, and a member of the Metropolitan, New York Yacht, Sleepy Hollow Country, Republican, and Automobile clubs.

Societies

Chemists' Club, New York. A portrait of the late Herman Frasch was given to the club on Mar. 3 by Mrs. Frasch. The presentation took place at a luncheon at the club tendered by the board of trustees to Mrs. Frasch and a party of her friends.

National Chamber of Mines of the State of Nuevo Leon, Mexico, was recently organized in Monterrey, N. L. The following board of directors was appointed: President, Faustino Roel; vice president, Vincente Ferrara; secretary, Santiago Zambrano; assistant secretary, José Treviño García; treasurer, Antero Valdez Gómez; assistant treasurer, Antonio Rodríguez; F. T. Anderson, Julio Monreal, Rómulo Laralde, Eusebio Cueva, Luis Guimbarda.

American Society of Mechanical Engineers—New York Section and metropolitan student branches met on the afternoon and evening of Apr. 9, 1918, in New York. Addresses on the salient features of how engineers are helping win the war were made by Charles Whiting Baker, formerly editor-in-chief of "Engineering News-Record"; F. R. Low, editor of "Power"; C. T. Main, president of the society; C. R. Mann, director Carnegie Foundation; M. H. Avram, G. A. Orrok, and others.

Utah Section, American Institute of Mining Engineers, met in Salt Lake City on Apr. 4. Addresses were made by visiting officials of the institute, who discussed institute policies, plans and activities, and public mining affairs, including important war service. A paper by V. S. Rood and J. A. Norden, entitled "Engineering Problems Encountered During the Recent Mine Fire at the Utah Apex Mine at Bingham, Utah," was presented. Officers of the section were elected for the ensuing year.

Society of Chemical Industry, New York section, held a joint meeting with the New York section of the American Chemical Society and the American Electrochemical Society in Rumford Hall, 50 East 41st St., New York, Apr. 12. The following papers were presented: "Planning a Research Laboratory for an Industry," by Dr. C. E. Kenneth Mees, of the Eastman Kodak Co.; "Hydrophilic Colloids and Their Biological and Technological Importance," by Dr. Martin H. Fischer, of the University of Cincinnati. The New England section has been discontinued and its membership transferred to the New York section.

American Association of Engineers and the Committee on Engineering Cooperation will hold their joint annual meeting at the City Club, Chicago, 315 Plymouth Court, on May 14. Invitations have been extended to all technical societies to send one or more delegates. It is proposed to effect a plan whereby all national engineering societies may coordinate their efforts effectively. The annual election of officers and regular national business of the association will also take place. The bill incorporating the American Academy of Engineers, which has passed the Senate and is before the House, will be discussed. Members of the association in Cleveland, Ohio, made application to the national board of directors for a charter to form a Cleveland chapter. T. J. Brennan is chairman and C. M. Shafer secretary. The New York chapter met at the McAlpin Hotel on Apr. 10. The meeting was addressed by Garrett P. Serviss, whose topic was the "Glory of the Engineer."

Tulsa Section, American Institute of Mining Engineers, held its organization meeting at Tulsa, Okla., on Feb. 25, 1918, at which by-laws were adopted and the following officers elected: Chairman, Alf. C. Heggem, Tulsa, Okla.; vice chairman, Alexander Deussen, Houston, Tex.; Arthur C. Terrill, Lawrence, Kans.; Charles H. Taylor, Oklahoma City; secretary treasurer, James H. Gardner, Tulsa; junior past chairman, M. M. Valerius, Tulsa. Owing to the limited attendance and the fact that outlying districts were not represented, it was decided that the officers named above, and who formed a majority of the executive committee, should appoint the remaining members of the committee for the rest of the present fiscal year, having in view a distribution in accordance with geographical situation as well as diversity of industries.

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.

Aluminum Soldering Flux. John William Bear and Jeremiah Franklin Thomas, Clifton Forge, Va., (U. S. No. 1,259,590; Mar. 19, 1918.)

Borax Process of Treating Borax Ores. Henry Blumenberg, Los Angeles, Cal., assignor, by mesne assignments, to Clifford I. Hinman, Los Angeles, Cal. (U. S. No. 1,259,717; 1,256,718; 1,259,719; Mar. 19, 1918.)

Classifier. Alfred L. Blomfield, Denver, Colo., assignor to the Dorr Co. (U. S. No. 1,260,135; Mar. 19, 1918.)

Cyanide Process of Making. William H. Wright, Indianapolis, Ind. (U. S. No. 1,259,702; Mar. 19, 1918.)

Drill Rotary Drilling Apparatus. Edgar E. Greve, Pittsburgh, Penn., assignor to Oil Supply Co., Pittsburgh, Penn. (U. S. No. 1,259,852; 1,259,853; 1,259,854; 1,259,855; Mar. 19, 1918.)

Potash Process of Recovering Potassium Salts. Frank K. Cameron, Salt Lake City, Utah, assignor to Alaska Products Co., New York, N. Y. (U. S. No. 1,259,486; Mar. 19, 1918.)

Tin—Art of Detinning Tin-Scrap and the Like Material.—Otto K. Zwingenberger, Tompkinsville, N. Y. (U. S. No. 1,260,119; Mar. 19, 1918.)

Titanium Alloy, Alloy of Iron, Titanium, and Silicon, and Process for Production. Napoleon G. Petinot, New York, N. Y., assignor to United States Alloys Corporation. (U. S. No. 1,260,037; Mar. 19, 1918.)

Vanadium, Method of Recovering Values From Byproducts and Ores. John J. Boericke, Merion, Penn. (U. S. No. 1,259,595; Mar. 19, 1918.)

Zinc—Treatment of Zinc-Bearing Material Containing Iron—Involving Leaching of the Zinc and Recovery by Electrolysis. Anson G. Betts, Asheville, N. C. (U. S. No. 1,259,594; Mar. 19, 1918.)

Editorial Correspondence

SAN FRANCISCO—Apl. 3

Union Consolidated, the leading producer of the Northend Comstock mines, paid \$50,000 in dividends in the first quarter of 1918 which may be attributed largely to correct engineering methods applied to the unwatering and development of the lower levels and careful financial conduct of company affairs. These dividends have been paid out of monthly earnings, and represent 25% payment on the capital stock. The last \$10,000 of the total dividends was payable April 1. Unwatering and development extend from the Con. Virginia on the south to the Sierra Nevada on the north, including the Ophir and Mexican. The water is now at the 2900 level and development is in progress on the 2700 and exploration on the 2900. At the Union, the ore is mined chiefly from the 2400 and 2500 levels, at the Con. Virginia important orebodies are being opened on the 2000 level and work is proceeding to the 2100 and on to the 2700. Ophir is producing from the 2000 level and Sierra Nevada is prospecting and developing good ore in the 2500 level. The engineering department is under superintendent Whitman Symmes and the financial department under Manager H. L. Slosson, Jr. The \$50,000 dividends from the Union were earned within eight months from lowering of the water to the 2900 level. It is believed that within the present year every mine on the Northend lode from the Con. Virginia to the Sierra Nevada will be producing regularly. Production would be greatly hastened by a second upcast shaft sunk after the unwatering of the Combination. The Comstock lode is again in the list of active mines not only at the Northend but at the Southend, and the Middle mines are expected soon to be coming into their own.

Oil Drilling Operations in California fields, as shown by reports to the State Mining Bureau, declined in the first quarter of 1918 as compared with the same period in 1917. From Jan. 1 to Mar. 23, or 12 weeks of the present year, 166 new wells were started, an average of 12.8 per week. During the same period of 1917 the total of new wells started was 270, an average of 22.5, or a decline of 104 wells. The bureau report makes no comment except that the falling off in new work probably indicates the effect of shortage in casing. There is no doubt this is largely the cause. But it is also probable that the unsettled condition of the relation of the Government to the holders of oil lands has as much to do with the decline in new work. In the matter of deepening or re-drilling of wells, there has been no marked decline. The number in the first 12 weeks of 1918 totaled 172, as against 178 in the same period of 1917. This work is largely in the nature of maintaining production, which proceeds regardless of legal disputes between the operators and the Government. Production has been steadily falling below the marketing demands, and the evil cannot be cured by other means than speeding up of new drilling, which the Government can materially aid by speeding up the settlement of its disputes with operators. It is likely that some of the lands were improperly, if not illegally, acquired. If that is true, it is not necessary to wait until the war is over to prove the fact. The recent appointment of receivers for some of the companies charged with improper holdings is expected to give some relief. But the holder of oil lands held in dispute is not keen to proceed with the starting of new wells which may be taken away from him after he has them finished and producing.

DENVER—Apl. 3

Timber for Mining Purposes, according to a bill recently passed by the Senate, may be cut by corporations organized in one state and conducting mining operations in another. The bill purposes that it shall be lawful for the Secretary of the Interior to grant permits to companies incorporated under either the Federal law or under the laws of a state of territory other than the state in which the privilege is requested, provided that all such corporations shall first have complied with the laws of that state so as to entitle them to do business therein.

A Governmental Department of Mines has been advocated by Western mining men,

who take the position that the mining industry should not be subject to the rulings and decisions of a sub-department or any group of sub-departments of the Federal Government, but should be under the executive control of a department of mines, the executive head of which should be a member of the Cabinet. An effort is being made to bring this proposal to the attention of the President, members of Congress who are interested in the welfare of the mining industry, and the country and all other individuals and organizations that may be influential in furthering such a movement.

Federal Cooperation in Mining is favored by Colorado mine operators provided its activities are limited to the production of such metals and minerals as molybdenum, tungsten, manganese, chromium, pyrites, potash, and nitrates, the supply of which is known to be inadequate for the nation's need. Mining men favor the encouragement of the production of these minerals, by subsidy or in any other way. However, mine operators do not favor Government control or operation of mines producing gold, silver, copper, lead, zinc, or any other metal or mineral, unless a shortage should develop therein. It is believed that the production and supply of copper, lead, and zinc is ample to meet current demands, that there is no reason to anticipate any marked changes in these conditions for several years to come, and that there exists neither occasion nor justification for Government control or operation of mines producing these metals.

Excess-Profits Tax is giving Colorado mine operators considerable concern, as it is feared that many companies have already invested the profits from their 1917 business and will find it difficult to pay this tax except from the profits of 1918. Payment in a lump sum of large amounts will cripple many enterprises. This is true of all progressive business, but applies with special force to the mining industry. Mining men are much interested in H. R. 10,526, by Mr. McFadden, providing for the payment of the excess-profits tax in four bimonthly installments, the first being made payable June 15th. It is estimated that the war excess-profits tax, which under the law is payable June 1, will call for between three and five billion dollars. It appears that large business interests cannot depend upon their banking connections to finance them in the payment of this tax, and business organizations which have not already set aside the amount of the tax may find difficulty in meeting its payment. In view of the fact that the law is *ex post facto* in its operation, and the bill did not become a law until Oct. 3, it is urged that the Government should extend the time of payment. Mining men think that the Treasury Department should issue additional bonds if necessary in order to grant relief in meeting this extraordinary tax.

SALT LAKE CITY—Apl. 4

Conkling Mining Co. vs. Silver King Coalition of Park City, asking judgment for damages for the extraction of ores from adjoining ground, a three-quarter interest in which was owned by the Conkling, has been awarded the plaintiff by the U. S. district court. In the decision, the method according to which the net value of the ore is to be computed is defined by the court, and plaintiff and defendant are directed to make computations following the method specified. Figures submitted by the plaintiff place the award at \$548,000. The defendant's figures, not yet presented, are expected to be lower.

The Alta and Big Cottonwood Districts are preparing as usual, at this season, early shipments when the roads clear up and the more favorable shipping season begins. At Alta this year transportation facilities will be added to within a month or six weeks by the operation of the new narrow gage line of the Little Cottonwood railroad company running from Wasatch to Tanner's Flat. The company has two light Shay engines suitable for work over the light rails, and 40 six-ton cars. It is planned to make two or three trips daily, with trains consisting of 10 to 15 cars and carrying 60 to 100 tons per trip. Ores from the Michigan-Utah, sent down thus far over this company's aerial tram, will be taken on at Tanner's Flat. Extended a little further,

the road would reach the ore bins of the South Hecla, Sells, and Wasatch Mines.

The Foster, or Mines Dictator, Bill, which was to empower the President to take over and operate any mineral deposit, plant or mine, and to regulate, limit, or prohibit production, has been given hearings before the House committee. The bill has now been amended so that the measure includes only rare metals, and authorizes taking over only idle mines and plants for Government operation. No action has been taken in regard to this bill by the Utah Chapter, which, however, is keeping in close touch with the matter of mineral dictatorship, so as to confine that movement as far as possible to what the mining interests regard as its reasonable field.

The Bureau of Mines Transfer from the Department of the Interior to the War Department, as provided in an amendment to the Overman bill offered by Senator Hoke Smith, of Georgia, a few days ago, has been strongly opposed by the Utah Chapter of the American Mining Congress, and the following telegram was sent to Utah Senators and Representatives in Congress: "Unless there is some preponderating reason not known to us, we are strongly opposed to removal Bureau of Mines from Interior Department, except to convert the bureau into a separate Cabinet department. We believe efficiency of bureau could not be increased by transfer to any other existing department."

The Kelly Bill, Introduced in Congress by Representative Kelly, of Pennsylvania, January 16, and referred to the Committee on Interstate and Foreign Commerce, authorizes the President to requisition and take over any or all coal, oil, copper, iron, and timber lands in contiguous areas of not less than 100 acres each, and all rivers and streams from which power is or may be developed, with or without plants and equipment, and also provides that no compensation shall be paid for the value of any resources in the land, and further that "organizations of the persons employed in such undertakings shall not only be recognized but encouraged, and such organizations shall have an equal voice in the management, operation and control of such undertakings." The Utah Chapter has issued a circular letter regarding this bill, which states that "ordinarily this sort of propaganda is too wild to command serious attention, but in view of the fact that the advocates of the measure have recently appeared in its support before the House committee, it seems advisable to register opposition, and the Chapter has written to Utah Senators and Representatives in opposition to the bill, and suggests to mining men that, if convenient and agreeable, they do likewise. The opinion is expressed that parts of the bill are worthy of the I. W. W., when working at its greatest efficiency, and that all possible efforts should be used to discourage the spread of such dangerous doctrine. The Utah Chapter is also occupied in clearing up the situation regarding war-excess profits tax, the leasing bill, and the price of silver.

BUTTE, MONT.—Apl. 5

Growing Activity in Phillipsburg Granite County is enjoying a state of prosperity the district has not known since the days when its mines were numbered among the principal silver producers of the world. This is largely due to the demand for manganese and to the fact that silver is bringing higher prices now than for many years. Between 700 and 800 men are now employed in the manganese mines. These properties are producing large quantities of manganese to help meet the great demand by American steel producers. Some of this ore goes to Birmingham, Ala., some to Chicago, a great deal to Pittsburgh and other steel manufacturing centers. New mines are being developed and the district bids fair to assume as great importance as a manganese producer as it once had as a silver producer.

In the Elm Orlu Suit the San Francisco court has affirmed the decision of the lower court, which also found that the ores taken out by the Butte & Superior, in violation of the plaintiff's rights, justified an award of damages, plus interest, in the total sum of \$177,707. The actual amount and the value

of the ores extracted is a matter awaiting final adjustment between the two companies. Concerning the loss to the Butte & Superior company of 300 ft. along the Rainbow lode, the area forms about one sixth of total length of the lode developed within the Butte & Superior company's claims, in all parts of which, above present working levels, profitable ore has been or is now being mined. While that part of the Rainbow lode decreed to the Elm Orlu is admitted by the Butte & Superior to include a valuable block, its loss is not considered vital or its production impaired either at present or for an indeterminately long period. The orebody in 1500 ft. of the lode remains in the possession of the Butte & Superior company and appears to fully warrant this prediction. There is still pending a settlement of the Elm Orlu company's claim that it is entitled to a further extension eastward on the orebodies developed in the Black Rock by virtue of its apex rights through what is known as the Pyle Strand, which the plaintiff claims, is an easterly extending branch of the Rainbow lode. To what extent this may affect further portions of the Rainbow lode lying within the Black Rock claim can be determined only by future developments and decisions. At all events, the outcome will leave unaffected large and valuable parts of the developed orebodies lying entirely east of the east end of the Elm Orlu and therefore under no possible circumstances involved in any apex rights the Elm Orlu company may assert. Butte, hopes that the recent and still pending decisions will in no way affect the future activity of the Butte & Superior company, which has contributed so largely to the prosperity of the community and which it would therefore like to see continued for many years.

VICTORIA, B. C.—Apr. 2

Bills Now Before the British Columbia Legislature, if made law, will limit the working day in coal and metal mines to eight hours. It also is reported that a similar measure is to be introduced for smeltery employees, inside and out. The Hon. Wm. Sloan, minister of mines, is responsible for the first measures. He argues that the surface men in coal mines have long struggled for the shorter day, to which they are entitled. His belief is that, with this grievance removed, much industrial trouble will be

avoided. The metal miners, it is maintained, have a right to the eight-hour day. Their complaint of discrimination compared to coal miners has much of justification. The proposed law will give those of this class employed underground an eight-hour day from surface to surface while the day of those working on the surface, while of the same duration, will start when they pick up their tools. This adjustment of the men's troubles, it is thought, will obviate the possibility of a repetition of the disastrous strike which occurred last year in connection with the Crow's Nest Pass Coal Co.'s collieries; the lock-out that took place at Rosland later on, and the strike that closed down the immense plant of the Consolidated Mining and Smelting Co. Ltd. of Canada for a month or more. These cessations of mining activities cost British Columbia heavily in mineral output in 1917.

QUEBEC—Apr. 3

Allied Preference on Asbestos Shipments has been assured by the action of the Imperial government in entering into an arrangement with the producers whereby their demands are to receive first consideration. Anything not required for this objective may be disposed of by the producers in the open market. Rupert Turner, of Turner Bros. Ltd., Rochdale, England, has been appointed representative for the Imperial government, with offices at Montreal. T. H. Crabtree and James Dickenson have been appointed Imperial inspectors for all shipments and all such shipments must conform to fixed standards of inspection. Incidentally, it may be remarked that this is the first organized effort to obtain some basis for the control of shipments. The brisk demand for asbestos has resulted in bringing four new operators into the field. The Berlin Asbestos Co., and the Regent Asbestos Co. at Robertson Station, are reopening their properties, which have been idle since 1911. The new plant of the Bennett-Martin Asbestos Co. being erected at Coleraine is rapidly advancing and will be operating early in the season. The Windsor Asbestos Co., at Coleraine, is expected to begin operations this month. A fire burned the crushing and elevator plant of the Quebec Asbestos Corporation at East Broughton, which is causing a suspension of operations for four or five months. E. J. Wilson, who has been manager of the Jacob's Asbestos Co., at

Thetford Mines, has retired to take up consulting work in New York. He is succeeded by Norman R. Fisher, of Cobalt, Ont.

The New Gold Discovery at Fort Matachewan is still commanding considerable attention. Only one large deal of importance has been made, which was for the Otisse properties, on which \$10,000 was paid on a total purchase price of \$250,000 for a 70% interest. Machinery has been installed, and this spring sufficient work will be done to see whether or not the extravagant statements regarding values on this property were justified. The reported deal for the Davidson claims has not gone through.

An Ample Supply of Flotation Oils has been secured for mine operators at a greatly reduced price as the result of an important discovery made by the Forest Products Laboratory of the Forestry branch of the Canadian government service. In view of the shortage of pine oil from Southern pine for oil flotation purposes, the Forestry branch was instructed to see whether pine oil could be produced from the less resinous pines of Canada. After eight months of work it was found that not only could pine oil be produced from red pine stumps, but that a much cheaper substitute was obtainable in a creosote oil thrown off as a by-product in wood distillation. Tests of these oils in the ore-dressing station of the mines branch at Ottawa have proved that they are suitable for oil flotation.

TORONTO—Apr. 4

Government Grants Permission to work the claims recently staked near Mileage 66 on the T. & N. O. Ry. This section is in the Timigami forest reserve, and work will have to be subject to the inspection of the forest rangers. It was staked 10 years ago, but at that time the department would not give permission to work the claims. A good deal of confusion has been caused by the fact that, on account of this action of the government, persons who staked claims then still have the prior right, provided they have kept their mining license renewed. Owing to this fact, the status of a number of claims is still uncertain. The geological conditions are favorable, being similar to Cobalt. The formations are conglomerate, diabase and Keewatin. On account of the government refusing permission to work, the country has never been prospected, and offers excellent possibilities for discoveries of importance.

The Mining News

ARIZONA

Cochise County

LEADVILLE MINE (Courtland)—Operated by leasers.

SHATTUCK (Bisbee)—Lead-silver ore mill expected to be in commission this Spring.

WOLVERINE AND ARIZONA (Bisbee)—Hoisted in February 1200 tons of ore, of which 90 tons came from the old oxide stope workings in the Higgins tunnel. Marc Bailey is superintendent.

Graham County

ARIZONA COMMERCIAL (Globe)—Development east of Budget fault delayed by heavy flow of water. Pumping plant installed and gradually draining ground.

GLOBE DOMINION (Globe)—Plan to install a pumping plant large enough to handle at least five times the present flow of water in the mine and add to this if necessary.

Maricopa County

ABE LINCOLN COPPER CO. (Wickenburg)—Gallows frame, skip dumping equipment, 50 hp. hoist and a five-drill compressor installation completed and shaft down 300 ft. Charles Nathorst is manager.

Mohave County

TOM REED GOLD MINES CO. (Oatman)—Favorable developments reported on Bald Eagle orebody.

GOLD ROAD MINES CO. (Goldroad)—Reported construction of new mill contemplated at east end shaft on the Billy Bryan.

Pima County

NEW CORNELIA (Ajo)—Three steam shovels at work on ore.

BLUE EAGLE MINE (Tuscon)—Reported recently purchased by E. A. Shaw,

of New York. Development to begin under management of John Glasson.

Final County

MAGMA CHIEF (Superior)—Watson tunnel advanced 1660 ft. Two shifts working.

POTTS CANYON M. CO. (Superior)—New enterprise. Hoist to be purchased and shaft sunk. J. L. Holland is interested.

RAY HERCULES (Ray)—This company will build its own spur line to connect the 1500-ton concentrator to the Ray & Gila Valley Railroad. Ore reserves reported at 9,500,000 tons, averaging 1.77% copper, of which an 80% mill extraction is expected.

Santa Cruz

BLACK GIANT MINES CO. (Parker)—Hoist and three-drill compressor installed.

Yavapai County

ARIZONA BINGHAMTON (Stoddard)—Milling 5000 tons and driving 700 ft. in development per month. Ore reserves continually increasing.

KAY COPPER CO. (Canon)—Purchased by interests connected with United Eastern. Large crew put to work. Surface and plant improvements to be made. G. W. Long is interested.

GADSEN (Jerome)—Shaft at depth of 865 ft. Occasional flecks of chalcopryite as well as a fair amount of pyrite appearing. Expect to sink another 100 ft. and to drift considerably laterally. Property adjoins U. V. X., and the Calumet and Arizona have an option on about 70% of the capital stock.

CALUMET AND JEROME (Jerome)—South crosscut 1300 ft. from shaft station on 600 level and advancing rapidly through schist showing sulphides of iron and some chalcopryite and chalcocite in small

quantities. North No. 6 crosscut has advanced 130 ft. in sheared schist showing evidence of mineralization and increased flow of water.

ARKANSAS

Boone County

TAR KILN (Zinc)—Leased by Magnolia Mining Co., of Oklahoma, intend to overhaul mill and start active mining operations at once.

Marion County

ONWATA (Dodd City)—Leased by C. G. Rogers, who intends to erect mill this summer.

BEATY (Dodd City)—Has been taken over by Oklahoma company, which will build new mill.

WILLETT (Yellville)—Purchased truck to move ore from mine to depot at this place. Mine operated by Liberty Zinc and Lead Co.

COWAN BARREN (Yellville)—Report strike of ruby jack in drill hole from 150 to 185 ft. thick and cuttings average will show a mill recovery of 12 per cent. sulphides.

CALIFORNIA

Amador County

OLD EUREKA (Sutter Creek)—Shaft crew engaged in cutting station at 2200 level and building ore chutes and bins. Sinking to continue to the 3200-ft. point.

ARGONAUT (Sutter Creek)—The month's cleanup of the 60-stamp mill reported to be about \$85,000. N. S. Kelsey is manager.

Kern County

YELLOW ASTER (Randsburg)—Reconstructed mill in operation, and satisfactory extraction reported. Opening new ground and reclaiming caved section.

Butte County

WESTERN ORE CO. (Oakland)—Installation of plant 40 to 50-ton per day for concentrating chrome ores nearing completion.

Nevada County

ALLISON RANCH (Grass Valley)—Conditions reported encouraging. C. E. Uren is consulting engineer.

WASHINGTON DISTRICT reports the discovery of manganese along the Smith Yuba river, about a mile below the town of Washington.

San Bernardino County

WANDERER MINING CO. (San Francisco)—Sited in Silver Lake mining district, embracing 13 claims previously worked. Lower tunnel is to be reopened and advanced.

MOJAVE UNITED (Baxter)—Development of copper-gold properties in progress, including 300 feet of churn drilling. Reported that Manager Leitzow has stated that a large tonnage has been exposed, assaying as high as 7% copper and carrying gold and silver.

Siskiyou County

HAPPY CAMP MINES—Are reported actively operating, including the Grey Eagle, Davis Consolidated, George Crumpton, Classic Hill, Hanson-Beeson, Schuler-Park and several small placer mines.

BLUE JEANS (Etna Mills)—Installation of mill equipment nearing completion, and expect to be in operation in April. Large tonnage of ore exposed. Property largely owned by Seattle and Grants Pass men.

Tuolumne County

BLACK OAK (Soulsbyville)—Reported large new ore shoot recently disclosed. Property has been large producer, but recently production was reduced to give more attention to new exploration.

RAPPAHANNOCK (Jamestown)—Deposit of chrome ore discovered several years ago in a well sunk near the end line of this mine is now being mined by W. E. Booker and associates. Large tonnage has been extracted.

Yuba County

BRANDY CITY HYDRAULIC (Brandy City)—Large dam contemplated on north fork Yuba River near Bullard Bar, in Yuba County, for impounding tailing from this Sierra County property. Reported at Marysville that contract made with William Mandery for hauling 20,000 tons of cement from Marysville for the construction. Work will be under supervision of George E. Taylor, mine manager and Sierra County Surveyor. First unit will stand 40 ft. high and will span the river a distance of 300 ft. Dam now in use by company will be filled to capacity this season, so that the new dam will be in demand as soon as completed. The site for the new dam will admit of raising the structure to a total height of 150 ft. as may be required.

COLORADO**Boulder County**

SYLVANITE (Magnolia)—Developed by L. H. Dobson and associates. Crosscut tunnel cut Poorman vein, and the west drift advanced 40 feet. Additional mining equipment probably will be required in near future.

CATASTROPHE (Boulder)—Developed and operated under bond and lease by I. N. Blair, G. M. Newmeyer, and L. K. Guiler. Lower crosscut tunnel extended, and 120 ft. of sinking performed in last three months. Pockets of ferberite ore opened assaying 25% tungstic oxide.

TUNGSTEN PRODUCTS MINING CO. (Boulder)—New company, \$2,500,000 capital, purpose to acquire the Lucky 2 mines and other property to secure an independent ore supply for the Tungsten Products Co., manufacturing tungsten alloys. The mining company plans to develop Lucky 2 property, which is well equipped with electrically driven machinery. W. F. Biecker is president.

LA PLAISANCE (Crisman)—This with the New Enterprise, both gold and silver properties, to be developed and operated by the newly incorporated La Plaisance Mining and Milling Co.; capital, \$50,000. Incorporators, E. V. Grant, Alfred Dawson, and F. A. Fair. The property equipped with new hoisting and compressor plants. Recent development opened some high-grade silver ore.

MALMO MINING AND MILLING CO. (Boulder)—New company; capital \$25,000. To develop and operate properties on Left Hand Creek. Plan to purchase mining machinery, and drive tunnel to open the veins at a depth of 400 ft. Veins several feet wide, containing low-grade milling ore which encloses pockets of high-grade copper

pyrite assaying from 6 to 30% copper. Some shipping ore carries 2 oz. gold and 90 oz. silver per ton. C. E. Bradenberg is president and manager.

Clear Creek County

TWO SISTERS (Lawson)—Property secured under lease and bond by T. M. Burbridge and associates. Lessees plan to drive 500-ft. tunnel from the Jo Reynolds property to the Two Sisters vein, and operate through this connection.

URAD MINES (Empire)—Production started at this molybdenum mine of the Frimos Chemical Co. Milling plant of 200 tons capacity, 2400-ft. tramway, and mine buildings finished. Crew of 40 men employed to start. In milling plant, electric power used, with individual motor drive.

LITTLE GIANT (Lawson)—Mill completed and in operation. Equipment includes ball-mill, concentrating tables and flotation. High extraction being made. Reported enough low grade blocked out to keep the mill in operation two years. Recent development on the St. James vein opened an ore shoot two to three feet wide and 150 ft. long, at a depth of 600 ft. Flotation concentrate from the mill valued at \$50 per ton. H. E. Minier is manager.

Garfield County

MOUNT BLAINE OIL SHALE PRODUCTS CO. (De Beque)—To erect oil-shale distillation plant of 100 tons capacity.

Gunnison County

DOCTOR (Almont)—Hauling ore from mine to railroad is temporarily discontinued on account of spring break-up of snow road in Taylor canyon. Good ore supply developed, and hauling to be resumed as soon as possible.

Montrose County

RARE METALS TESTING PLANT and sampling works to be built, it is stated, at Montrose. San Juan mining region adjacent is producer of uranium, vanadium and tungsten ores, fluorspar, etc., as well as many common minerals and metals. Plant will give outlet for sale of rare metal ores, as well as testing for radium in uranium ores.

Ouray County

ROSE (Ouray)—Shipments being made.

WANAHKA (Ouray)—Lessees shipping heavy iron sulphide ore assaying well in gold and silver to Salida smelter.

BEAVER & BELFAST (Ironton)—Lessees making production of good-grade lead ore assaying several ounces silver.

WEDGE (Ouray)—Old stopes being worked over, and considerable tonnage 50-oz. silver ore being recovered.

CUMBERLAND (Ouray)—Regular shipments being made from this mine in Sneffles district. Adjoins new property of Tomboy on Sidney flats.

BARSTOW (Ironton)—Regular production of fluorspar being made. Difficulty of sled transportation from mine to Ouray, distance of 12 miles, limits production.

MOUNTAIN TOP (Ouray)—New ball mill recently installed. Capacity of plant increased. Tramway to Governor Basin completed, making transportation to Ouray possible all year. Car of ore recently shipped assayed 350 oz. silver.

OURAY CONSOLIDATED MINING & REDUCTION CO. (Ouray)—Will operate Hammond or Treasury tunnel at Red Mountain in conjunction with other mines at Ironton, and custom milling plant now being completed at Ironton. Colonel Crawford, president.

SILVER POINT MINES CO. (Ouray)—Recently incorporated to work old mine under lease and bond. Capitalization, \$50,000. President, A. E. Bundson, of Denver. Property in Bear Creek section. Development work under way with promising results. Property an old silver producer.

San Juan County

MINNEHAHA (Gladstone)—Taken over and to be developed and operated by the newly organized Minnehaha Mining and Milling Co. George Bibb is local manager.

CONGRESS (Red Mountain)—Developed in 1917 under lease by Alvin Kramer and associates, and considerable payable ore is reported opened.

LACKAWANNA (Silverton)—Developed in 1917 by the D. L. & W. Mining and Reduction Co., of which H. M. Kingsley is president. Recently installed new mining machinery, including air compressor and new wire-rope tramway. Has taken lease on the Contentment mill recently equipped for flotation. Mill to be remodeled to treat Lackawanna ore. Recent development has opened 8-ft. vein of milling ore at a depth of 700 ft. Sampling indicates payable grades of gold, silver, copper and lead, and suggests

that certain rich streaks may be sorted out for direct shipment. It is estimated that simple concentration will result in a high extraction.

San Miguel County

BLACK BEAR (Telluride)—Operating steadily, and shipping over 100 tons daily to Smuggler mill of Smuggler-Union Mining Co. for treatment.

PERINO MILL (Telluride)—Will begin treating Carruthers Lease ore as soon as electric power available. New Huntington mill installed, increasing capacity. Carruthers lease is on block of Smuggler-Union property. Much ore developed and broken.

Summit County

MOLYBDENUM PRODUCTS CO. (Buffehrs)—Construction of milling plant and other necessary improvements considerably delayed by slow freight deliveries.

JUNE BUG (Breckenridge)—Worked by lessees. Shoot iron-silver ore assaying 300 oz. silver per ton opened. Broken ore stored until snow blockade opens.

PINGREE COMPANY (Buffehrs)—Company now holds large acreage molybdenum-bearing ground in Climax district. Driving three prospect tunnels with encouraging results. Plans being made for extensive improvements, including construction of milling plant in spring. O. A. King, manager.

Teller County

CRIPPLE CREEK PRODUCTION in March was 67,467 tons; gross value, \$1,044,052; average value per ton, \$15.49.

INDEX (Cripple Creek)—New hoisting equipment installed and operations resumed by lessees and sub-lessees.

BONANZA (Cripple Creek)—Operated by Granite Gold Mining Co. Making regular shipments.

CAROLINE (Cripple Creek)—Lessees Fink and Casson, on blocks 3, 7 and 14, making regular shipments.

DANTE (Cripple Creek)—Rich strike made recently on 600-ft. level by sub-lessee from Big Toad Mining Co., operating property under lease.

PETRAL GOLD MINING CO. (Cripple Creek)—Property being operated under lease by Pete Peterson. Ore hauled through Squaw Mountain tunnel. Shipment of 4-oz. ore made recently.

KEENER TUNNEL (Cripple Creek)—Trial shipments have given satisfactory returns, and entire dump will be shipped to Golden Cycle mill. Railroad spur being built to dump.

MODOC CONSOLIDATED (Cripple Creek)—Production not now large until new hoisting plant installed at Frankenburg shaft. Daily production will then be made. All stopes worked on shrinkage system.

IDAHO**Shoshone County**

FLYNN GROUP (Mullan)—Twenty patented claims adjoining Morning Mine have been purchased by Edward Ehrenberg and associates.

REX CONSOLIDATED (Wallace)—Absorption of old Rex Mining company completed; an extension of 700-ft. shaft down to 1000 ft. to begin next month. This work to be followed by extensive exploration of ground from new level. In meantime the upper workings and mill have been leased to N. C. Sheridan, superintendent of the Rex, who has about 12 men at work.

KENTUCKY**Crittenden County**

FEDERAL SPAR CO. (Hopkinsville)—Incorporated with capital of \$150,000. Active operations mining fluorspar are to start soon. T. J. McReynolds and T. J. Wall are incorporators.

Livingston County

SUWANEE IRON CO. (Grand Rivers)—Capital \$500,000. Planning to construct or purchase iron furnaces and manufacture iron, charcoal and wood byproducts. J. M. Overton, of Nashville, is president.

MICHIGAN**Copper**

MAYFLOWER (Houghton)—Sinking proceeding rapidly.

QUINCY (Hancock)—Daily output of ore, 4500 tons from three shafts.

MOHAWK (Houghton)—Has over 30 miles of drifts opened in profitable ground.

NORTH LAKE (Lake Mine)—New lode identified in southeast; opened for 20 feet.

WOLVERINE (Kearsarge)—Production for February 403,736 lb., as compared with 350,957 for January.

NEW BALTIC (Houghton)—In sinking shaft below 275 ft. level has run into ore.

LA SALLE (Laurium)—Average output 600 tons daily. Ships to Centennial-Allouez mill. Ore coming from two shaft on Kearsarge lode.

FRANKLIN (Demmon)—At 18th level bottom of No. 2 shaft is finding in south drift much better ore than in the ground south of No. 1. Daily tonnage about 1100.

FEDERAL SYNDICATE (Calumet)—First diamond drill hole Sec. 3-56-35, down 340 ft. in sandstone; probably Western or Freda sandstone; drill is possibly too far west.

OSCEOLA (Houghton)—North Kearsarge mine has installed three storage battery locomotives with five-ton cars. No. 1 shaft now sinking below the 38th level. Drifting on the 35th and soon to start on the 36th.

SENECA (Calumet)—Osceola lode just passed through by shaft showed true width 6 ft. quartz and calcite seam 5 in. wide rich with copper, but little copper elsewhere in formation. Footwall sometimes appearing at Calumet & Hecla and Osceola was not found here; shaft down 170 ft.

CALUMET & HECLA (Houghton)—Subsidiaries suffering considerable loss through the continuance of the fire which has been burning steadily for two weeks in the soft coal storage at Dollar Bay. Fighting fire costly task and not yet under control, although two steam shovels and 60 men have been removing the coal steadily. Storage pile contained over 100,000 tons.

Iron

CLEVELAND-CLIFFS CO. (Marquette)—Has let contract to Arnold Construction Co. to rebuild refining house destroyed by supposed incendiary fire a month ago. Also has let contract for \$105,000 for sawing and splitting mill for its furnace and chemical plant at Kipling, Delta County.

MISSOURI

Joplin District

LITTLE MARTHA CORPORATION (Joplin)—Remodeling shaft and power equipment. To purchase 500-ft. gas-driven compressor, hoist and building lumber. H. B. Wolcott in charge.

MONTANA

Lewis and Clark County

HELENA MINE (Helena)—Shipped 50 carloads silver-lead ore.

ROCK ROSE MINE (Helena)—New lead with north-south strike cut in west crosscut from main shaft.

LEE MOUNTAIN MINE (Rimini)—Sinking from lower tunnel closed lead carrying gold, silver, copper, lead and zinc.

THOMAS CRUSE DEVELOPING CO. (Helena)—New air hoist in place on 640 east level. Sinking on gold, silver-lead ore.

CRUSE CONSOLIDATED (Helena)—New 100-hp. boiler added to surface plant. Shaft to be deepened from present 185-ft. depth with Jackhammer drills.

BELLBOY MINE (Marysville)—Rich strike reported. Owned by Dr. O. M. Lanstrum and associates, of Helena, and operated by leasers since last August. Vein from 7 to 10 ft. wide, and contains galena, gold and silver.

TUOLUMNE MINING CO. (Butte)—Shipped in 1917 to smeltery 30,972 tons of ore averaging 2.43% copper, 1.47 oz. silver and 0.0072 oz. gold per ton. Shipped from Main Range property, in eastern section of district, 10,967 tons of ore averaging 1.97% copper, 9.42 oz. silver and 0.0078 oz. gold per ton. Edward Hickey is president.

Silverbow County

BUTTE AND SUPERIOR (Butte)—Production in March was 15,000,000 lb. zinc and 285,000 oz. silver, compared with 12,500,000 lb. zinc and 250,000 oz. silver in February.

ANACONDA (Butte)—Hoisting 16,000 tons of ore daily from its various mines and employing over 13,000 men. It is believed that the company will soon be producing copper at a rate equal to the early part of 1917.

NORTH BUTTE (Butte)—Working at full capacity and production expected to be around the average previous to the fire in the Granite Mountain shaft. Company pushing development in eastern part of district. Shaft sinking at the Sarsfield.

NEVADA

Mineral County

WEDGE CON. COPPER CO. (Reno)—Development started.

Nye County

TONOPAH ORE PRODUCTION for the week ended March 23 amounted to 9931

tons, of gross milling value \$168,827. Producers were: Tonopah Belmont, 2251 tons; Tonopah Mining, 3450; Tonopah Extension, 1916; Jim Butler, 517; West End, 1013; MacNamara, 526; Montana, 205; North Star, 53 tons.

MANHATTAN CONSOLIDATED (Manhattan)—South crosscut on 500 level started toward downward extension of east orebody.

WHITE CAPS (Manhattan)—No. 503 crosscut advanced 414 ft. week ended March 28. Considerable water coming in at face. Indications improving.

UNION AMALGAMATED (Manhattan)—Drift 604 continuing along footwall of limestone. Drift 622 driving 300 ft. west from Earl shaft. Swanson orebody well developed and will be mined from 600 level when mill is put in commission.

Storey County

CON. VIRGINIA (Virginia)—Sent to Mexican mill 63 tons of \$15.72 per ton ore, from 2000 level. Work continued in 2100 and 2700 levels, showing porphyry, clay and quartz.

UNION CON. (Virginia)—Extracted at Mexican mill in the week 343 tons of average value \$31.20, and 159 tons from the dump, of average \$17.44. Shipped five bars bullion to Selby. Ore mined from 2400 and 2500 levels varied from \$7.63 to \$33.10 per ton.

SOUTH DAKOTA

Custer County

SPOKANE LEAD AND SILVER (Custer)—All machinery for 100-ton concentrator being installed. New plant to be in operation early this summer.

Lawrence County

CUSTER PEAK (Roubax)—Main shaft being enlarged from two to three compartments. Some additions to be made to mine and mill equipment before resuming concentration.

DEADWOOD LEAD AND ZINC (Deadwood)—New ten-stamp concentrator buildings completed and machinery installation continues. Plant expects to be placed in commission in May.

Pennington County.

DAKOTA CONTINENTAL (Hill City)—Diamond drilling to be started from lower level within short time.

BLUE LEAD (Hill City)—Old workings being retimbered for continued operations. Car shipped from dumps returned over 6% copper.

LITHIA MINES (Keystone)—Rheinbold and Standard Essence again loading cars for shipment to New Jersey. Difficulty with transportation east of Chicago has prevented marketing since November. This, however, has been adjusted and regular output to follow.

TENNESSEE

Rhea County

DAYTON COAL, IRON & R. R. CO. (Dayton)—Capital \$5,000,000, old plant of the Dayton Coal & Iron Co. Company owns large coal and ore lands on the Tennessee-Georgia line and plans re-equipping some of its mines and plants and starting developments on a large scale.

UTAH

Summit County

PARK CITY shipments in February were 7250 tons of ore and concentrates as compared with 10,547 tons in January, shipments in the later month having been held down by weather conditions.

Juab County

MAY DAY (Eureka)—Several blocks of ground given over to lessees. Work on 700 and 1000 levels on company account to be continued.

IRON KING (Eureka)—Shaft has depth of 600 ft.—225 ft. below tunnel level. Shaft being sunk at rate of about 100 ft. monthly.

EUREKA BULLION (Eureka)—Shaft at depth of 800 ft. has reached limestone mineralized with iron. To be continued to between the 800 and 900 levels. John Bestelmeyer is manager.

ZUMA (Eureka)—New equipment on ground soon to be installed. Includes electric hoist, Winze from 500 level down 125 ft., drifting started; showing encouraging. Ore also being followed at another point near main working shaft.

UTAH ZINC (Tintic Junction)—Second shipment from this West Tintic property hauled to loading station. Orebody stated to have been opened far enough to promise shipments once or twice a month, with small working force operating.

MONTANA-BINGHAM (Bingham)—Assessment of 10c. a share delinquent May 8 levied, to bring in about \$230,000. Will meet liabilities and provide funds for improvements of Fortuna mill, including increased capacity and better recovery, leaving working fund of about \$50,000 to be used in development. Development being done on Montana-Bingham tunnel level. South drift in the mineralized ground of Mayflower vein, about 1200 ft. below Fortuna workings. C. G. Ballantyne president and general manager.

WASHINGTON

Pend Oreille County

LEAD & ZINC CO. (Metaline)—Surface equipment offered at public sale and a bid made by the Union Iron Works, of Spokane. Equipment includes flotation and other concentrating machinery.

METALINE ORIOLE MINING CO. (Metaline)—Contemplating immediate erection of 50-ton mill to treat a lead-zinc-silver-gold ore. Frederick N. Davis is president and manager.

CANADA

British Columbia

CANADA COPPER CORPORATION (Princeton)—The contract for construction of 14 miles of railroad from Princeton to Copper Mountains property is reported to have been let by the Kettle Valley railroad. Company is building a 3000-ton mill.

Ontario

KIRKLAND PORPHYRY (Kirkland Lake)—Operations resumed.

WEST DOME (Porcupine)—In April to mill 1000 tons of ore in the Dome Lake mill.

PROVINCIAL (Cobalt)—Installing small flotation plant with a capacity of 50 tons per day.

DOVE EXTENSION (Porcupine)—Has decided not to carry out diamond-drill programme.

KERR LAKE (Cobalt)—February production was valued at \$175,784, profit from which was \$122,640.

CASEY COBALT (Cobalt)—Diamond drilling. New mill built and shipments of concentrates to start.

WHITE RESERVE (Maple Mountain)—A 27-in. vein of cobalt and niccolite carrying silver found on the 140 level.

ELLIOTT-KIRKLAND (Kirkland Lake)—Oreshoot found at 425 level penetrated for 100 ft. and maintains consistency.

LAKE SHORE (Kirkland Lake)—Treating 60 tons per day in new mill. Heads first two weeks averaged \$23 per ton.

TEMISKAMING (Cobalt)—Geological examination being made to determine if there is any ground left for further prospecting.

NEWRAY (Porcupine)—Arrangements effected for development by the McIntyre. Strike made at the 400-ft. level; vein widened to 30 ft. and stated to average \$25 per ton.

ANCHORITE (Porcupine)—Main vein cut at 270 ft. and shows width of 10 to 12 ft., with fair grade of ore. Shaft being continued to 500 ft. level.

APEX (Porcupine)—Directors have decided to exercise option on Bilsky property. Two out of four diamond drill holes showed good grade of ore at depth.

DAVIDSON (Porcupine)—Small five-stamp mill now in operation. Will be used for the purpose of sampling the vein from the 200 ft. level.

BURNSIDE (Kirkland Lake)—New shaft down 90 ft. and No. 2 shaft below 100 level. Ore found at present depth with pay streak one foot wide stated to average \$127 per ton.

WRIGHT-HARGRAVES (Kirkland Lake)—No. 3 shaft passed 300-ft. level and being sunk lower. Trouble caused by water drifting on 300 level, but vein maintains width and grade.

PATRICIA (Boston Creek)—Installing mill with daily capacity of 60 tons. Development continues satisfactory. Main shaft is down 140 ft. and considerable drifting done.

NIPISSING (Cobalt)—In February mined ore of an estimated value of \$295,546, and shipped bullion from Nipissing and customs ore of an estimated net value of \$197,252. A large amount of silver is being held in expectation of increased prices.

LA ROSE CONS. (Cobalt)—Change made in plan of operations on Violet property. Result of work at the 410 level below the diabase was not encouraging, as vein shows low silver content. Point of operation to be changed to the diabase above contact.

The Market Report

SILVER AND STERLING EXCHANGE

Apr.	Sterling Exchange	Silver		Apr.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
4	4.7530	91 1/2	45 1/2	8	4.7530	91 1/2	45 1/2
5	4.7530	91 1/2	45 1/2	9	4.7530	91 1/2	45 1/2
6	4.7530	91 1/2	45 1/2	10	4.7530	91 1/2	45 1/2

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

DAILY PRICES OF METALS IN NEW YORK

Apr.	Copper		Tin		Lead		Zinc
	Electrolytic	Spot	N. Y.	St. L.	N. Y.	St. L.	St. L.
4	*23 1/2	†	6.95	6.90	@6.85	6.82 1/2	@6.85
5	*23 1/2	†	6.90	6.85	@6.85	6.82 1/2	@6.85
6	*23 1/2	†	6.90	6.85	@6.85	6.82 1/2	@6.85
8	*23 1/2	†	@6.90	6.82 1/2	6 1/2	6.77 1/2	@6.82 1/2
9	*23 1/2	†	@6.90	6.82 1/2	6 1/2	6.77 1/2	@6.82 1/2
10	*23 1/2	†	@6.90	@6.82 1/2	6 1/2	6.77 1/2	@6.82 1/2

*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 17.5c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 13c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Apr.	Copper		Tin		Lead	Zinc
	Standard	Electrolytic	Spot	3 Mos.		
	Spot	3 Mos.	Spot	3 Mos.		
4	110	110	125	316	316	29 1/2
5	110	110	125	316	316	29 1/2
6	110	110	125	318	318	29 1/2
8	110	110	125	320	320	29 1/2
9	110	110	125	322	322	29 1/2
10	110	110	125	322	322	29 1/2

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. £29 1/2 = 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—Apr. 10, 1918

Further weakness in lead and zinc and increased stringency in the situation in tin were the chief features in the metal markets this week.

Copper—The output of the refineries is slowly increasing, and the demands of consumers are being met pretty well. However, there is much discontent in the in-

dustry, especially on the part of the producers. Some of the smaller producers find that their costs have risen so much that there is no longer any adequate profit in their production. These producers have organized a special committee to advocate their interests. The electrolytic refiners are involved in the predicament arising from fixed tolls and costs that have doubled. The insatiable demands of labor, the increasing inefficiency of labor, and the unwillingness of a portion of their force to work more than one-third of the time are things that get on the nerves of the works managers. In the counting rooms the continued tardiness of the Government in making settlements creates financial embarrassments. The Government is said to owe the copper producers something like \$16,000,000.

Copper Sheets are quoted at 31 1/2c. per lb. for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26 1/2c. f.o.b. mill, carload lots.

Tin—The situation weekly becomes worse. There is no spot tin and no market to quote. It is even impossible to buy Straits tin or Banka tin for shipment. Some Chinese tin comes in, and there is sharp bidding for it at rising prices. A sharp advance in price in London was cabled today. This reflected reduction of stocks in England to about 2000 tons, compared with 4000 tons that the authorities figured upon keeping there. Export licenses are consequently now held up. The plain truth of the tin situation is that the world's production has failed to increase materially, and a disagreeably large quantity of tin has been sunk.

Lead—The large producers, being well sold up, continued out of the market. Consumers, being well supplied, obtaining stocks that had previously been locked up in railway cars, also continued out of the market. Some of the smaller producers, being desirous of selling lead and not easily finding buyers, offered the market down with the hope of inducing buying. They were not very successful, their sales being relatively small, but, on the other hand, there was no exhibition of pressure anywhere, and the general atmosphere of the market was that as soon as any real buying interest became evident there would be a rally. A steady influence has been the strike at Herculaneum, which is still in force, and has cut off pig-lead production by the St. Joseph Lead Co. for the last four weeks.

Zinc—Business in lots of 100 and 200 tons was reported every day, at further concessions in price. At the close the market was on a basis of 6.80c. Opinions as to the immediate future differ. Some think that the price will go still lower, while others are disposed to hold aloof for a while and observe. Nobody is looking for an advance. Conditions must first compel a curtailment of mine production, as even at present prices smelters are able to buy ore on terms permitting the selling of spelter at a profit. The Miami district of Oklahoma has a bearing upon this subject. On the other hand, it is reported that the present prices give Butte & Superior no profit.

Other Metals

Aluminum—The market is unsettled and practically at a standstill. The price quoted is the Government price of 32c. per lb. Small lots have been sold at higher prices.

Antimony—Unchanged at 12 1/2c. for spot, while futures are nominal at 11 1/2c., c.i.f. in bond. Antimony can be had in 10-ton lots at 12 1/2c., but probably no very large quantity could be bought at that price. With the decreasing arrivals, stocks are being absorbed, and therefore, the technical position of the market is improving. The Chinese producers are not selling, saying that present prices are below their cost of production.

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.

Nickel—By an agreement between representatives of the International Nickel Co., Bernard M. Baruch and the council of National Defense, a price was fixed at 40c. per lb. for the highest grades nickel and 38c. per lb. for the lowest grade. Unchanged since Apr. 2.

Quicksilver—We quote this market at \$120@125, with some dealers shading prices. San Francisco reports, by telegraph, \$117, steady.

Gold, Silver and Platinum

Silver—Market has ruled quiet during the last week at 45 1/2 to 45 1/4. Shipments to London for the week ending Apr. 6 were about 600,000 ounces.

The general stock of money in the U. S. on April 1 totaled \$6,480,181,525; of this \$3,042,708,319 was in gold coin and bullion, \$568,269,513 in standard silver dollars, and \$225,971,720 in subsidiary silver.

Mexican Dollars at New York: Apr. 4, 74; Apr. 5, 74; Apr. 6, 73 1/2; Apr. 8, 73 1/2; Apr. 9, 73 1/2; Apr. 10, 73 1/2.

An Administration Bill, introduced in the Senate on Apr. 9, by Senator Pittman, as an emergency war measure, proposes the reduction to bullion of 250,000,000 silver dollars now in the Treasury and the use of the bullion or the proceeds from its sale to pay trade balances and to repurchase silver at \$1 per oz. If enacted, according to the New York Tribune of Apr. 10, the measure would virtually fix a standard price for silver at \$1 per oz. This bill also is intended to stimulate silver production and to use the Treasury's reserve stocks of silver to settle this country's commercial trade balances in the Orient and elsewhere.

Platinum—We quote refined ingot unchanged at \$108, but this price is more or less nominal. There is considerable uncertainty respecting the Government price of \$105 per oz., which was decided upon by the Chemical Section of the War Industries Board, no proclamation to this effect being deemed necessary. This Section was authorized by the Secretary of War to take possession of platinum, for which "just compensation is to be ascertained and paid by the United States." Refiners have in certain cases, we understand, been directed to bill out platinum at \$105. On the other hand, importers of crude platinum are required by the War Trade Board to enter into an agreement with it, according to the terms of which "the price to be paid for the platinum shall be not more than \$105 per oz. on the basis of the platinum content."

Palladium—Very strong at \$150 per oz.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 6—Blende, per ton, high \$57.60; basis 60% Zn, premium, \$55@50; medium to low, \$47.50@40; average basis, \$47.50; calamine, per ton, 40% Zn, \$35@30. Average selling prices: Blende, \$50.50; calamine, \$36.42; all ores, \$49.89 per ton.

Lead: high, \$86.75; basis 80% Pb, \$84; average selling price, all grades of lead, \$84.80 per ton.

Shipments the week: Blende, 8084; calamine, 442; lead, 1612 tons. Value, all ores the week, \$562,170.

The company that was paying the fancy price of \$6 to \$10 over any other company for premium blende, dropped price quotations this week to within \$5 on one lot and within \$2.50 per ton on all other purchases compared with other buyers. Rumors of mills closing down are regular, but few are verified, while the Billharz mills that closed two weeks ago are to be restarted Monday.

Plattsville, Wis., Apr. 6—(By telegraph)—Blende, basis 60% Zn, \$50 base for premium grade down to \$45 base for second grade. Lead ore, basis 80% lead, \$85 per ton. Shipments reported for the week were 3407 tons blende, 267 tons galena and 892 tons sulphur ore. For the year the totals are 33,554 tons blende, 1461 tons galena and 11,783 tons sulphur ore. During the week 3183 tons of blende were shipped to separating plants.

Chrome Ore—Charles Hardy reports that considerable material running from 40 to 43% chromic oxide is being offered at \$1.50@1.60 per unit, delivered in the East.

Manganese Ore—While the schedule prices remain at \$1.20 for 48% metallurgical ore, ore available for prompt delivery fetches a premium. We quote the market at \$1.20@1.30.

Molybdenum Ore—Very dull. Great Britain, France and Italy are all out of the market. Molybdenite is quoted here at \$1.80 per lb. of MoS₂, but this is only nominal.

Pyrite—Spanish lump is not quotable. It is expected that full Government regulations controlling the pyrites situation will be made public before the next market report.

Iron Ore—Shipments from Lake Erie docks in March were 1,651,564 tons, showing a good improvement over February, and leaving 7,841,788 tons Apr. 1. Strenuous efforts are being made to clear docks as far as possible against the Lake movement. A late opening is expected, on account of the cold winter, and little ore may be shipped from the head of the Lakes this month. Last year's contract price for Lake carriage (including dock charges), \$1, has been affirmed for this year, to include wild tonnage also. Ore prices remain on the basis of \$5.05 for Mesabi non-bessemer at Lake Erie dock.

Tungsten Ore—Large sales were reported this week. Scheelite realized \$24.50, while wolframite ranged from \$19@24, according to grade, i. e., from 60% to 70%, prices being influenced also by percentages in impurities, size of lots, etc.

Iron Trade Review

PITTSBURGH—Apr. 9

There has been a further increase in trade facilities afforded all branches of the iron and steel industry, and shipments and production have been increasing all along the line. Connellsville coke shipments have also been increasing, but are still not entirely adequate. One setback occurred week before last, with poor car supplies in the region, and in due course this was reflected in decreased furnace operations, half a dozen Valley furnaces being banked from last Saturday until today, there being rather heavy receipts of coke this morning. Pig-iron production in the country at large is now within 10% of capacity, which may be estimated at 43,000,000 tons a year. Production in March was at the average rate of fully 38,000,000 tons a year, while late in January and early in February the rate had been down to about 25,000,000 tons. Shipments of pig-iron from furnaces are fully keeping pace with increased production. The steel works are still short of pig-iron, when with normal relations obtaining the increased production should give them nearly a full supply.

Pig Iron—Despite the fairly heavy production of pig iron in the last five or six weeks, production being now nearly at capacity, the market shortage is as great as ever. Evidently the ability of consumers to take iron has increased concurrently with improving conditions as to its manufacture. Basic is in heaviest demand, the sequence as to grades being: Basic, malleable, bessemer, foundry, forge. The market remains quotable at the Government maximum limits: Bessemer, \$35.20; basic, \$32; foundry, \$33; malleable, \$33.50; forge, \$32, f.o.b. furnace, freight from Valley furnaces to Pittsburgh being 95c. There has been some talk about prices on silicon irons being uncertain, with the revision effective Apr. 1, making basic \$32 instead of \$33.

Ferromanganese—Following the recommendation of the authorities that the use of 70% ferromanganese be encouraged, as it can usually be employed as well as 80%, and leaner ores can be used in making 70% alloy, practically all the producers are now quoting 70% instead of 80%, but they are quoting the same base price, \$250, delivered. It is reported that before this change some 80% had brought \$275 instead of the old price of \$250. The unit differential, for adjusting variations from 70%, is usually taken at \$3.125. The spiegeleisen standard has been reduced to 16 to 18%, having formerly been 13 to 22%, the new base price being \$70.

Connellsville—More cars have been put into the trade in the last three or four weeks, and they are moving faster, both loaded and empty, resulting in better shipments, now nearly equal to requirements. Byproduct ovens are operating substantially full now, and sometimes have a surplus for sale to furnaces normally depending on beehive coke from the Connellsville region.

STOCK QUOTATIONS

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

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

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

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

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

Table of stock quotations for TORONTO 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 (Silver, Copper, Tin) for New York and London from 1916 to 1918.

Table showing monthly average prices of metals (Copper) for New York and London from 1917 to 1918.

Table showing monthly average prices of metals (Tin) for New York and London from 1917 to 1918.

Table showing monthly average prices of metals (Lead) for New York and London from 1917 to 1918.

Table showing monthly average prices of metals (Spelter) for New York and London from 1917 to 1918.

Table showing monthly average prices of metals (Pig Iron) for Bessemer, Basic, and No. 2 Foundry from 1917 to 1918.

As reported by W. P. Snyder & Co.