

Bonus System on Los Angeles Aqueduct

Rules of Operation and Method of Computing Bonus Footage and Earnings

It is a significant fact that before the paying of bonuses to the men working on the Los Angeles Aqueduct no records for work of any kind were broken or even equaled, whereas within a few months after bonus payments began, record smashing advances were made. When bonus payments increase a man's wages by \$1.50 or more a day, as was the common case on the aqueduct tunnels, similar results may be looked for elsewhere. The following rules governing the payment for bonus footage in tunnel work may prove useful as a guide in other somewhat similar work. These rules were approved by the Board of Public Works of Los Angeles and were amended from time to time. The following are the rules:

1. *Length of Period and Time of Measurements.*—Ten days shall constitute a period. The first period to be from the 1st to the 10th of the month, inclusive; the second from the 11th to the 20th, inclusive; the third from the 21st to the end of the month. Bonus payments shall be allowed upon the basis of measurements made at the close of each 10-day period.

2. *Employees Entitled to Bonus.*—The following named classes of employees shall be allowed to participate in bonus payments: Tunnel foremen, when in charge of more than one bonus crew; shift bosses, miners, muckers.

3. *Tunnel Foreman.*—The tunnel foreman shall not be considered as one of the "shift crew." If he is in charge of more than one bonus crew he shall be allowed bonus based upon the "mean" bonus progress per shift of all bonus crews under his supervision.

4. *Shift Boss.*—The shift boss shall be considered as one of the shift crew. He will participate in the bonus on the same basis as the men of the crew under his direction. An exception to this rule is made when a shift boss is placed in charge of two or more shifts in different headings. In this case he would be placed on the same basis as a foreman, to wit, not be considered as one of the crew, and would be allowed bonus based upon the mean bonus progress.

5. *Number of Shifts Allowed.*—The number of shifts worked in a heading during a day of 24 hours shall be deter-

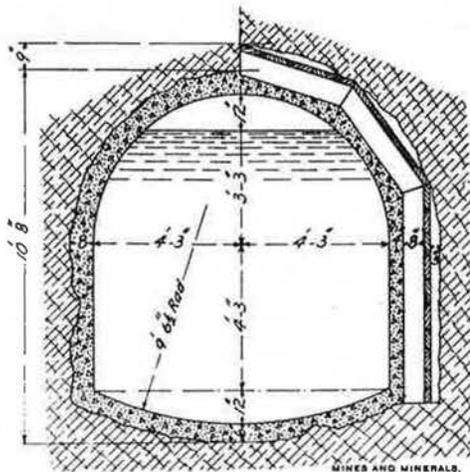


FIG. 1. SECTION OF TUNNEL NO. 17, JAWBONE DIVISION

mined by the engineer or superintendent in charge of the work after consultation with the chief engineer.

6. *Trimming and Timbering.*—All trimming must be done by the crew sharing the bonus. If the timbers are placed by the miners from the standard crew in a given 10-day period, then that portion of the tunnel shall be considered as a timbered section; otherwise it shall not be so considered.

7. *Continuous Work and Exceptions.*—Only men who work continuously through the 10-day period—with the following exceptions—shall be entitled to the bonus:

(a) Any employe, entitled to bonus earnings, who is injured or becomes ill during a period from conditions arising directly from tunnel construction, shall participate in bonus in



FIG. 2. INTERIOR OF JAWBONE TUNNEL

proportion to the number of shifts worked by him during said period.

(b) If an employe, entitled to bonus earnings, is transferred during a period from a heading to another part of the work for reasons other than his own request, he shall participate in bonus in proportion to the number of shifts worked by him on such heading.

8. *Interruptions of Work.*—If the work is interrupted by the failure of power, shortage of material or supplies, floods, cave-ins, or other causes beyond the control of the men, the men shall be entitled to bonus pay in proportion to the number of shifts worked by them during period in which such interruptions occurred.

9. *When Both Timbered and Untimbered Work Is Done by the Crew in the Same Period.*—To establish a uniform system of computing bonus earnings in above case the following formula will be used:

FORMULA.—

$$\frac{x+y}{\frac{x}{a} + \frac{y}{b}} = \text{average base rate per shift.}$$

EXAMPLE.—

Let x = timbered progress = 25 feet;
 y = untimbered progress = 30 feet;
 a = required timbered per shift = 2 feet;
 b = required untimbered per shift = 2.5 feet;
 s = number of shifts during period = 20.

Then

$$\frac{x}{a} = \text{shifts required at base rate;}$$

$$\frac{y}{b} = \text{shifts required at base rate.}$$

Or, substituting values,

$$\frac{25}{2} = 12.5 \text{ shifts required at base rate}$$

$$\frac{30}{2.5} = 12.0 \text{ shifts required at base rate}$$

Total, 24.5 shifts required at base rate

$$\frac{25+30}{24.5} = 2.245 \text{ average base rate.}$$

$$20 \times 2.245 = 44.9 \text{ feet = bonus footage.}$$



FIG. 3. PORTAL OF FINISHED TUNNEL, SAUGUS DIVISION

10. *Computations of Bonus Footage and Earnings.*—The computation of bonus footage shall be made by dividing the total number of feet run during the period by the total number of shifts worked during the period. From this average footage per shift there shall be deducted the base rate of progress required, and the remainder, if any, will be the bonus footage per shift. The bonus earned *per man* during the period, will be the number of shifts in which he worked, times the average bonus footage, times the bonus price per foot. (Provided all conditions as outlined in these rules are complied with.)

EXAMPLE 1.—Three shifts working 10 days.

Total progress for period, 150 feet.
 3 shifts × 10 days = 30 shifts worked.
 150 feet ÷ 30 shifts = 5 feet per shift
 Base rate of progress = 3.5 feet per shift
 Bonus footage 1.5 feet per shift

Bonus earned for period *per man* = 1.5 feet × 10 shifts × 25 cents per foot = \$3.75.

EXAMPLE 2.—One shift working 10 days.

Total progress for period 50 feet.
 1 shift × 10 days = 10 shifts worked.
 50 feet ÷ 10 shifts = 5 feet per shift
 Base rate of progress = 3.5 feet per shift
 Bonus footage 1.5 feet per shift

Bonus earned for period *per man* = 1.5 feet × 10 shifts × 25 cents per foot = \$3.75.

11. *Interpretation of Rules.*—If any of the above rules are not clear to the engineers or superintendents in charge of work, such rule must be referred to the chief engineer for interpretation.

12. The chief engineer shall determine what tunnels shall be given certain base rates and bonus per foot as outlined in the schedules for the various divisions.

The base rate for determining the bonus depended on whether the rock was soft or hard, on whether the excavation was timbered or untimbered; on the number of men on each shift advancing the work; whether the work was done by machine drills or hand drills, and finally on the square feet of cross-section for the tunnel. Bonus schedules were prepared and approved for tunnel driving on the Little Lake division, Boulder Peak and Grapevine sections of Division 5-A; the Jawbone division; the North Antelope division; the Elizabeth tunnel and the Saugus division. As the Los Angeles Aqueduct is 217 miles long it follows that there were different kinds of rock which varied in hardness, consequently the bonus footage varied. Two schedules, one for the Jawbone division and the other for the Saugus division of the tunnel, are given:

BONUS SCHEDULE FOR TUNNEL WORK IN THE JAWBONE DIVISION

Capacity of Tunnel Second-Feet	Class of Rock	Timbered or Untimbered	Class of Work	Base Rate Per Shift Feet	No. of Men Per Shift	Bonus Per Man Per Foot Per Shift Cents
430	Soft	Untimbered	Hand	4.0	9	25
430	Soft	Timbered	Hand	4.0	9	25
430	Hard	Untimbered	Hand	2.5	10	25
430	Hard	Timbered	Hand	2.0	10	25
430	Hard	Untimbered	Machine	3.0	11	40
430	Hard	Timbered	Machine	2.3	11	40

BONUS SCHEDULE FOR TUNNEL WORK IN THE SAUGUS DIVISION

Capacity of Tunnel Second-Feet	Class of Rock	Timbered or Untimbered	Class of Work	Base Rate Per Shift Feet	No. of Men Per Shift	Bonus Per Man Per Foot Per Shift Cents
1,000	Hard	Untimbered	Hand	2.3	13	40
1,000	Hard	Timbered	Hand	2.0	15	40
1,000	Hard	Untimbered	Machine	3.0	15	40
1,000	Hard	Timbered	Machine	2.5	17	40
1,000	Soft	Untimbered	Hand	3.0	13	35
1,000	Soft	Timbered	Hand	2.5	15	35
420	Soft	Untimbered	Hand	4.0	11	25
420	Soft	Timbered	Hand	3.5	11	25
420	Soft	Untimbered	Machine	5.0	11	25
420	Soft	Timbered	Machine	4.5	11	25

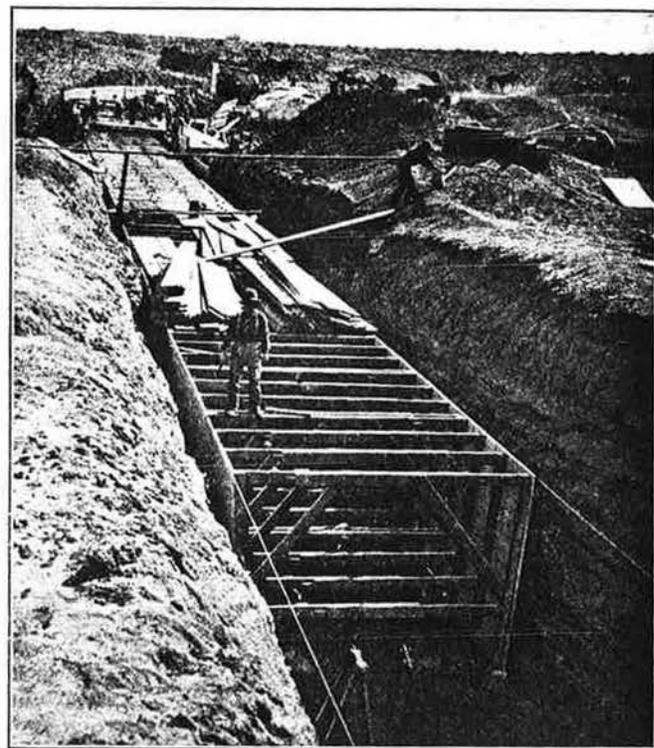


FIG. 4. CONDUIT FORM, MOJAVE DIVISION, LOS ANGELES AQUEDUCT

The Bureau of the Los Angeles Aqueduct gave the aggregate length of the aqueduct as 217.56 miles and the material to be worked through as follows:

Unlined canal, 21.08 miles; lined canal, 152.25 miles; rock tunnels, 17.24 miles; earth tunnels, 11.08 miles; siphons crossing cañon, 14.19 miles; flumes, 1.72 miles. The Sagus division was driven through 54,000 feet of tunnels composed of compact sand and gravel free from water, and also some soft shale. This tunnel required cement lining as shown in Fig. 3. The Jawbone division had 59,448 feet of tunnels that were driven by hand through sand and cement gravel, and some decomposed granite. A section of this tunnel is shown in Fig. 1, but the entire excavation was 13 feet wide and 12 feet 3 inches high. The ground was drilled by hand augers and the holes charged with 40-per-cent. dynamite or with black powder either of which broke the material so fine it could be rapidly shoveled. Of course such material could be advanced rapidly, in cases 11.7 feet per shift and at the low cost of \$6.45 per linear foot. The tunnel was lined with concrete as shown in Fig. 2, which is reproduced from a flash-light photograph.

From the data given it will be noticed that the major part of the aqueduct was lined canals. That division known as the

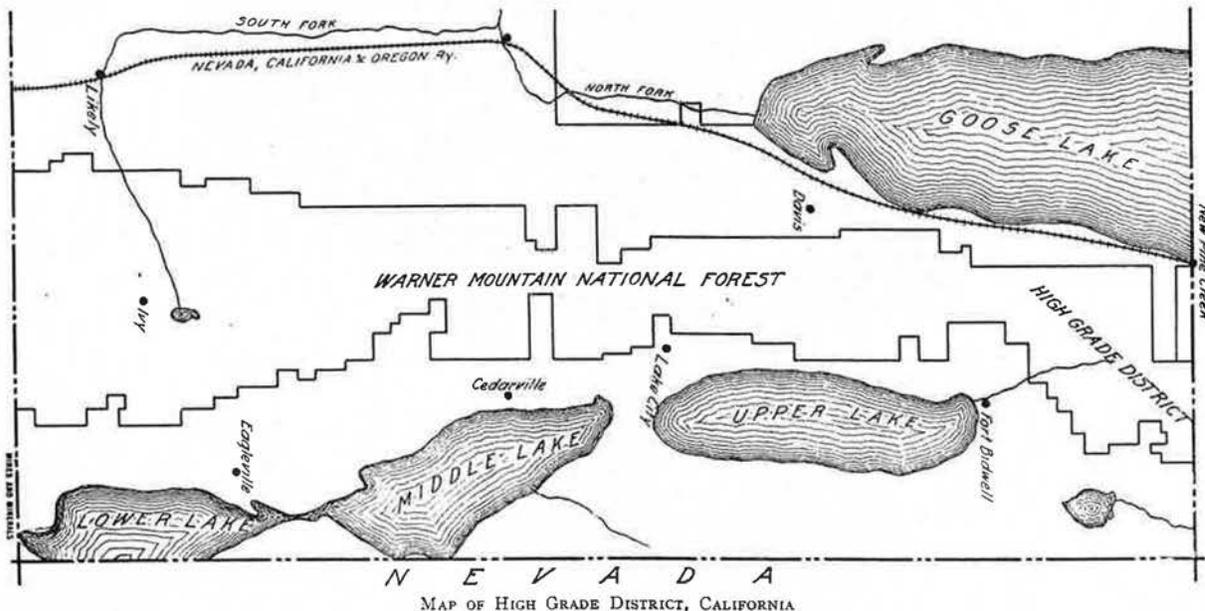
it was discovered is only about 2 hours drive from Almeria, Spain. No work has as yet been done to show the real nature of the deposits, but the owner is said to have estimated the quantity at 60,000,000 tons. The lode extends about 3 miles. Señor Calafat is said to be erecting works near Madrid to put the mineral to a practical test and several carloads have been shipped for treatment in the furnaces. The analysis is given as follows: Anhydrous sulphuric acid, 34.77 per cent.; oxide of aluminum, 37.98 per cent.; potash, 9.64 per cent.; water, 17.61 per cent. The specific gravity is 2.75; hardness, 2.50 to 3.

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The High Grade Mining District

Much is being said about a small area in northeastern California that is going to show wonderful results this coming summer. While not in a position to state anything about the real virtues of this district, a sketch map is published to give the reader some notion as to its position.

As will be seen, it is right in the very corner of the state. It is in the Warner Mountains National Forest Reserve, directly east of Goose Lake. New Pine Creek is the nearest railroad point. This town is 225 miles from Reno, on the Nevada, California and



Mojave, which crosses the western end of the Mojave desert, is practically all lined canal. The ground in this desert is such that seepage would be exceedingly great, and this, added to evaporation, would diminish the flow of water to such an extent that probably Los Angeles would receive little of the supply were the canal not lined with concrete. The forms used when lining the Mojave ditch are shown in the foreground, Fig. 4, while in the background is shown the concrete plant and some of the finished work.

In Vol. 31, page 102 of MINES AND MINERALS will be found an article by W. C. Austin, who was superintendent of the South Portal of the Elizabeth tunnel, in which the details and costs of driving are given.

In the same volume, page 135, R. L. Herrick, one time Western Editor of MINES AND MINERALS, describes the Los Angeles aqueduct in detail with suitable maps and illustrations.

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The New Ore, "Calafatita"

Acting Consular Agent James Murison, at Almeria, Spain, states that the new mineral Calafatita is a double sulphate of aluminum and potash (sulfato doble alumico-potasico) and is named after its discoverer, Señor Calafat. The district in which

Oregon Railroad. New Pine Creek is about 8 miles from the center of the new field, so far as the present developments have determined ore bearing formations.

Fort Bidwell is said to be the preferable center of supplies for the district for the reason that the wagon roads become free from snow 1 month earlier in the spring and remain open much longer in the fall. To reach Fort Bidwell, one leaves the same railroad at Alturas (188 miles from Reno) and travels 55 miles by stage.

It is hoped that this new district will not be overestimated as most of the precious-metal-mining districts usually are. If it is really worthy, let it be so treated and permitted to stand upon a reputation and not a notoriety. The coming season will probably tell the tale.

A recent letter from a man on the ground reads: "There is considerable ground open for location in the district. There is any amount of open ground in the outlying foot-hills that have not been prospected. Timber is abundant, and there is plenty of fine water everywhere in the hills." It is said that the country is of eruptive formation, the prevailing rocks being rhyolite, andesite, and porphyries. The ore is found in veins that are well defined by walls, and in some cases traceable on the surface. This latter feature, probably is limited, for heavily timbered areas usually have a deep soil that conceals the rocks in place.

Reducing California Dredging Costs

Economies That Have Resulted From the Use of Dredges Having Buckets of Larger Capacity

By Al. H. Martin

An industry's merit is measured by its earning power. Every reduction in the expense account means a corresponding augmentation of gross profits. Consequently the mining industry is vitally concerned in methods contributing to an increase in profit. Since the days of 1898, when the first California dredge was commissioned, the tendency has been to cut down operating costs to the extent that gravel of low quality might be economically handled. The dredges yield annually approximately \$9,000,000, and the industry has made strides in this state unexampled in any other section of the world.

The best low cost record ever attained by any dredge operating under like conditions is reported from the Yuba River fields, where Yuba dredge No. 13 in January, 1912, handled 320,000 cubic yards of gravel at a reported cost of 1.85 cents per cubic yard. Other dredges have accomplished work at lower costs than this, but not under the difficulties encountered. The dredge is operating in the Yuba River field, Yuba County. The deposit of auriferous gravel ranges in depth from 60 to 70 feet, the old river channel being overlaid by an enormous quantity of hydraulic tailing washed into the valley from the foot-hills of the Sierra Nevada Mountains. The tailing in the Yuba Basin ranges in depth from 10 to 40 feet. While this carries some gold, it is not sufficient to encourage dredging. Below this immense mass of tailing is found the true deposit, resting on a volcanic ash rock.

The gold content ranges from 10 to 30 cents per cubic yard throughout the deposit. Occasional drill holes from 90 to 110 feet deep show gravel and some gold below the bed rock. Generally, however, gold occurs only above the true bed rock. In dredging, a portion of the soft, sticky bed rock is handled. The water level varies from 4 feet below the surface to several feet above.

Yuba No. 13 went into action August, 1911. The boat was built by the Yuba Construction Co. The hull has a length of 150 feet, with a width of 58.5 feet, and 12.5 feet depth. The housing overlaps the hull 5 feet on each side, giving a total width of 68.5 feet; 820,000 feet of lumber was consumed in building the hull and housing, the best of Oregon pine and other favored timber being employed. The digging ladder excavates to a depth of 65 feet below the water line, is of plate-girder design, and carries ninety 15-cubic-foot buckets of the close-connected type. Total weight of digging ladder and bucket line is about 700,000 pounds. The 111,721-pound washing screen is 50.5 feet long, with a diameter of 9 feet. It is of the revolving type and roller driven. The two steel spuds each have a weight of 44 tons. The gold-saving tables are of the double-bank type, with an approximate riffle area of 8,000 square feet. The main tables are reinforced by a "save all," located to catch any gold escaping during the passage of the buckets over the well. The stacker hoist weighs 3,732 pounds. The tailing sluices are arranged to facilitate the discharge of sand close to the boat, or at considerable distance behind. By this means the hampering of the dredge by immediate deposits of waste is escaped. The conveyer stacker has a length of 275 feet by 42 inches wide and is an ordinary belt conveyer. The stacker ladder is 142 feet long and of the lattice girder type. Nine motors are employed to operate the machinery and pumps, the total electrical capacity having a rating of 1,072 horsepower. The total weight of the fully equipped dredge exceeds 232 tons. Most of the machinery for this boat was furnished by the Bucyrus company. This is the largest dredge in the world digging at a depth of 65 feet below water level.

Two or three years ago a California dredge handling gravel around 3 cents per cubic yard was considered a brilliantly successful machine. And conditions were more favorable for the establishing of low working costs than prevail in the Yuba River field. The average costs ranged from slightly over 4 to past 5 cents per cubic yard, with many companies reporting costs exceeding 6 cents. These results were obtained with dredges of less than 13-cubic-foot capacity. With the installation of the larger 13.5-cubic-foot and 15-cubic-foot boats, costs were cut down to from 2.15 to 2.60 cents per cubic yard. The best record ever reported from any dredge was given out by the California State Mining Bureau, in Bulletin 57, which states that a 13.5-cubic-foot boat handled 230,636 cubic yards of gravel at an average cost of 1.60 cents per cubic yard. This dredge was digging to a depth of about 18 feet. Two or three other boats reported dredging costs ranging from 1.84 to 2 cents per cubic yard, with conditions generally favorable for low operating costs.

The greatest factor in the reduction of costs per cubic yard has been the steady gain in capacity of the buckets. Where the 5-cubic-foot bucket dredge handled gravel at an average cost of over 5 cents per cubic yard, the 15-cubic-foot type does the same work at about 2 cents. The difference is due largely to the vastly larger percentage of material handled, although increased gold-saving facilities and other improved features have had an important influence.

The company reporting the best record in reducing dredging costs is Natomas Consolidated of California, operating the largest number later-type dredges in the state. From January 1, 1909, to July 1, 1911, this company handled 44,542,141 cubic yards of gravel at an average cost of 4.13 cents per cubic yard. The greater part of this work was done with 13.5, 9, and smaller cubic-foot bucket dredges. In the first half of 1911, with several 13.5 cubic-foot boats active, and one 15-cubic-foot dredge operating part time, the cost was cut down to 3.77 cents per cubic yard with 10,793,891 cubic yards treated, following the installation of dredges of larger capacity, showing a net profit of over \$800,000 in six months. The treated ground yielded an average recovery of 9.82 cents per cubic yard.

The Oroville Dredging Co., Ltd., that has been operating with small dredges in the Oroville field reports average working costs of about 5.05 cents per cubic yard. Dredging conditions are favorable in this district, the gravel being excavated without difficulty to an average depth of 20 to 30 feet. The Yuba Consolidated Gold Fields, operating the deep deposits in the Yuba River field, handled 13,970,728 cubic yards of material in 1910 at an average cost of 5.67 cents per cubic yard. In 1911 approximately 15,000,000 cubic yards were treated, at costs considerably under the 5-cent point. The later dredges of the Yuba Consolidated Gold Fields and Natomas Consolidated of California, the two principal dredging concerns of the state, are of the 15-cubic-foot type.

It is evident, therefore, that in the future reduction in California dredging costs will result mainly from the installation of still larger dredges, some engineers predicting the building of 18 and possibly 20-cubic-foot buckets within a few years. It has been demonstrated that the more ground there is handled, the smaller is the operating cost per cubic yard.

It is interesting to note that power plays one of the principal parts in operating costs, the consumption of electricity representing an average of 15 per cent. to 21 per cent. of total expense. The installation of large motors on the new giant dredges has naturally forced the power cost upward. In the earlier dredges the average amount of electricity used was about 150 to 200 horsepower. On the new dredges the rated capacity of the electrical equipment has been increased to 1,700 horsepower. Labor and materials average about 22 per cent. to 27 per cent. Repairs and maintenance form the bulk of the remaining costs. Water is plentiful in all the fields, and its employment is attended with slight expense.



Gypsum in the Maria Mountains of California

By Gordon Surr.

As the large gypsum deposits of this region have not heretofore been described, some observations, made during a brief visit to the locality, may be of interest. The writer looked over the district in company with E. E. Schellenger, from whom he obtained much information, and he, being both a keen observer and familiar with the region, pointed out many things which otherwise might have escaped attention.

LOCALITY.

The main gypsum locality is in north-eastern Riverside county, California, being some 17 miles, in an air-line, south of Blythe Junction, a station on the "Parker Cut-Off" of the Santa Fe railway. The distance by road from Blythe Junction is about 23 miles to the middle of the eastern end of the district, this point being about the same distance by road from the settlement of Blythe in the Palo Verde valley, through which flows the Colorado river. Blythe is 40 miles from Blythe Junction and 60 miles from Glamis, the latter being on the main line of the Southern Pacific railway, and from both places Blythe may be reached by regular automobile service. A railroad connecting Blythe Junction with Blythe, crossing the narrow divide over which the wagon road passes, would be but 2 or 3 miles from the eastern end of these gypsum deposits.

EXTENT OF THE GYPSUM AREA.

The main gypsum area is about 2½ miles long, easterly and westerly, 2¾ miles wide at the east end, and a mile in width at the west end, the country being flat and covered by "wash," both to the east and to the west. Some 5 miles easterly, however, gypsum beds again appear, and there are large gypsum deposits in the Palen mountains, about 15 miles westerly from the west end of this district.

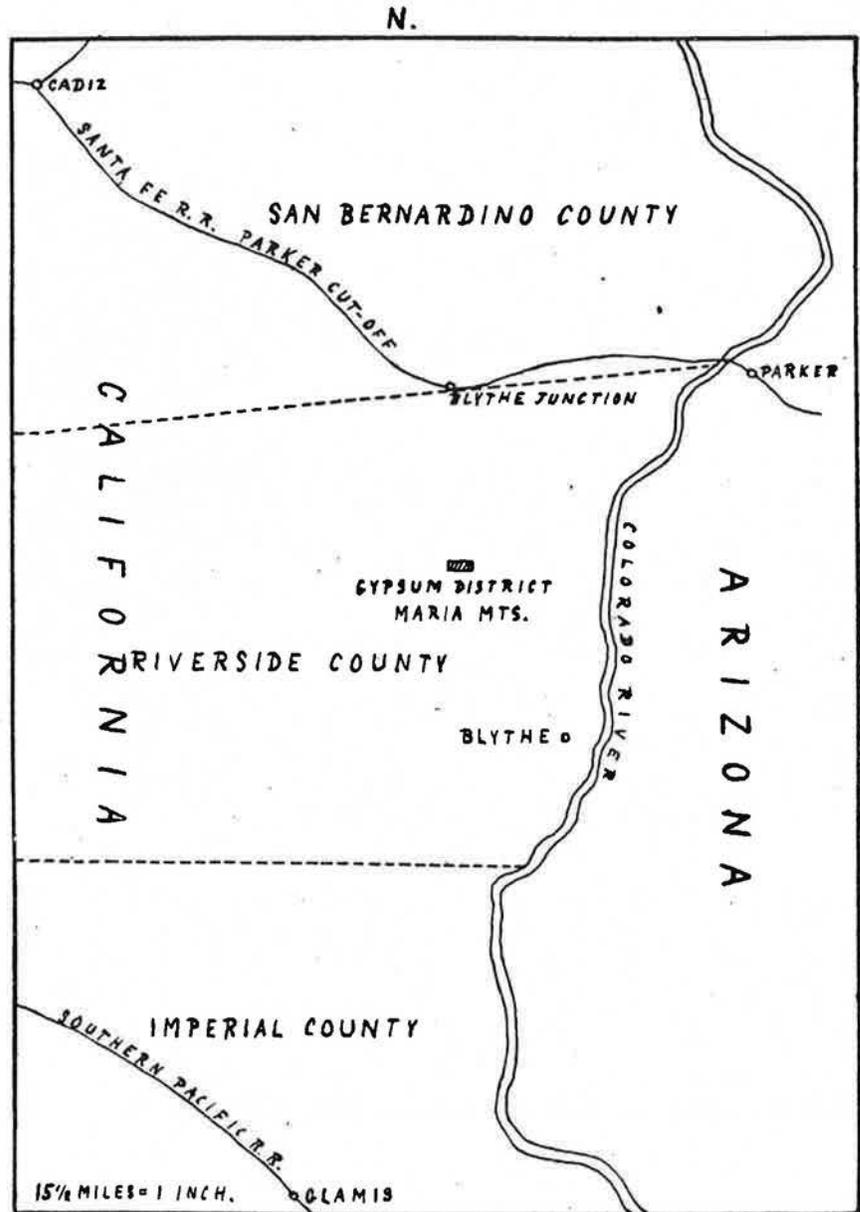
GENERAL GEOLOGY.

The gypsum in the Maria mountains occurs as beds, with an easterly and westerly course, in general, and usually a northerly dip, varying at the outcrops from 20° to almost vertical. In places the formation is nearly flat, and so doubtless are the underlying gypsum deposits. The gypsum and immediately associated rocks have evidently been laid down under water, upon the bottom of an ancient sea or lake, and obviously therefore the gypsum deposits were once practically flat, and the tilting and bending of the beds and formation must be attributed to later movements of the crust of the earth. Throughout the region, the strains have been largely relieved by the bending of the rocks, indicating gradual rather than violent movements. The gypsum beds vary in thickness from 10 to over 100 ft., being interbedded here and there with limestone or shaly material. Much of the gypsum, however, shows no sign of the presence of any other material and, in general, the separation appears to

be sharp between the gypsum beds and associated rocks.

Rocks associated with the gypsum.—A rough cross-section, from south to north and a little over a mile in length, was made of the western part of the district, commencing with a range of gneiss which forms the southern boundary of the gypsum area. This gneiss is largely made

of biotite, titanite and magnetite as primary minerals, with secondary epidote and muscovite. The rock is of igneous origin, being a monzonite, and would be technically styled quartz-monzonite-gneiss. This rock is probably intrusive into the overlying beds, in which case it doubtless played a part in the tilting and bending of the formation, although nowhere was the gneiss seen to cut the gypsum. In one place, however, at the



Map Showing Gypsum Deposits of Maria Mountains, California.

up of coarse, translucent feldspar of a grayish or purplish tint, quartz, biotite and epidote. Many feldspar crystals are over half an inch in diameter, and the other minerals mentioned were plainly seen with the naked eye. The gneiss, viewed from afar, has a greenish tint. Microscopical examination of a thin section shows orthoclase, plagioclase, quartz, microcline,

eastern end of the district, a tongue of gneiss was observed with sedimentary rocks on each side. The gneissic structure is "an outward and visible sign" of the metamorphism the monzonite has suffered. The layers of the gneiss here dip about 40° northerly, and the gneiss grades into a schist, near and at the contact of an overlying belt of light-colored

quartzite on the north. Next to the quartzite comes limestone, and, here and there, between the limestone and the quartzite, a quartz vein outcrops which is stained with copper in places. A gypsum bed overlies this limestone, the gypsum being separated from the limestone by light-green, fragmentary, shaly material of varying thickness, a band of this material, likewise varying in thickness, also occurring in the gypsum bed. Under the microscope this shaly material is seen to consist of kaolin scales, sericite, zoisite, quartz, albite and calcite, so the term "shaly material," is about as concise as any other name for such a mixture.

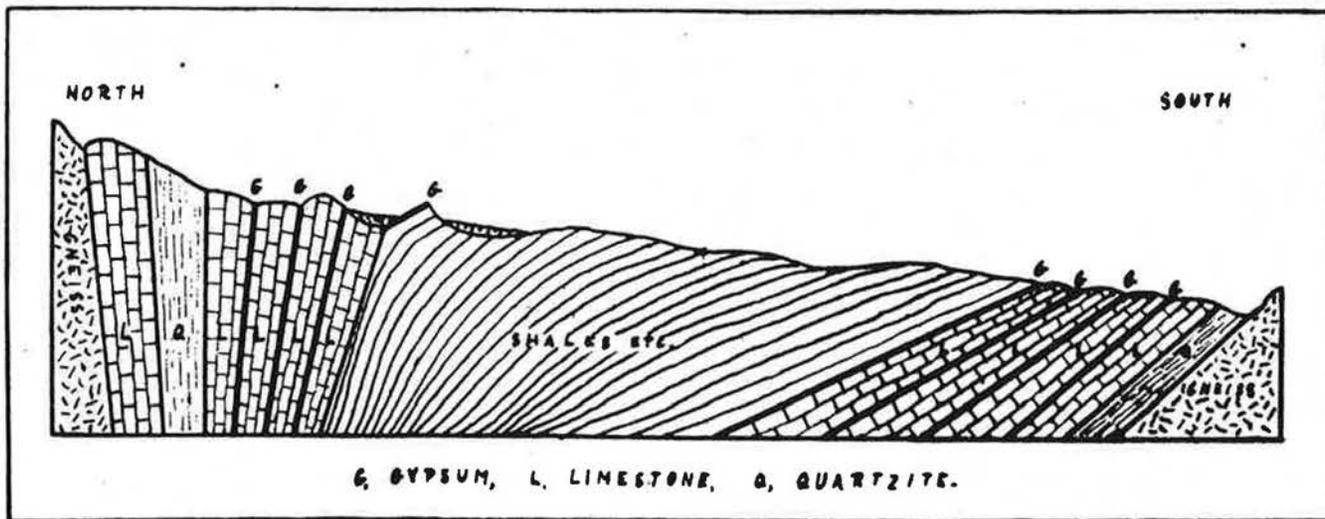
Then follow three more gypsum beds, separated from each other by limestone, the upper gypsum bed of this series dipping here about 25° northerly. Green shales overlie this upper gypsum bed, and a narrow band of limestone occurs in places between the gypsum and the shale. On the hanging wall of this gypsum bed a

laid down in a depression in the ancient sea-bottom, which did not reach far south. On the other hand, the northern limestone-gypsum series may have been deposited upon the shales, for, in the eastern part of the district, there are beds of limestone and gypsum covered by schists and shales, upon which lie more limestone and gypsum beds. If this is the case with the northern gypsum beds, they are probably cut off on their dips by the range of gneiss. To work out the geologic structure of a region is a matter of time, often involving the making of a topographic map and the plotting thereon of numerous outcrops and dips.

It is thought that the gypsum deposits to the north are not exposed from the faulting up of the southern beds, for the succession of rocks should then be the same. Faults may be more numerous than a hasty inspection of the surface would indicate, although throughout what was seen of the Maria mountains, the

Igneous rocks other than the gneiss.—Intrusions of igneous rocks in the gypsum beds seem to be conspicuous by their absence, for, with the exception of the gneiss, only in the extreme southeastern part of the gypsum area was an intrusive mass of any size observed. This rock is of medium grain and of a redish color, quartz, feldspar, and biotite being plainly visible to the naked eye, while no gneissic structure was seen. Microscopical examination of a thin section shows the rock to be a granite-porphry, with quartz, orthoclase, plagioclase, biotite and magnetite as primary minerals, and quartz also present as a secondary mineral. The base is fine holocrystalline. The three microscopical determinations mentioned were made by the well-known petrographer, W. Harold Tomlinson, of Swarthmore, Penn.

The granite-porphry occurs both in the gneiss and between the gneiss and the overlying quartzite, and is evidently younger than the gneiss and the beds im-



Cross Section of 1/4 Miles of Gypsum District.

soft, fibrous, whitish or light-green mineral was seen at one point which is probably asbestos, resulting from the alteration of some magnesian mineral, such as tremolite or serpentine. The shales gradually flatten to the north, but the dip increases farther north, where limestone again appears, followed by four more outcrops of gypsum beds separated by limestone from each other. Then comes more limestone, then quartzite, then limestone again, and finally gneiss, which latter forms a prominent range and has a steep, southerly dip at the contact with the limestone. The gneiss on both sides of the gypsum area is identical, to all appearances, and is believed to be the northern and southern boundaries of the gypsum and immediately associated rocks. The thickness of the limestone, between the gypsum beds, is from 100 to several hundred feet.

The gypsum beds to the north may be the same as those exposed on the south, and similarly, the quartzite to the north may be a continuation of that on the south, seeing that it bears the same relation to the gneiss, with the exception of the limestone between the two on the north. This limestone, however, may have been

strains have evidently been largely relieved by the bending of the rocks. A prominent ridge of limestone, for example, with an easterly and westerly course, shows bending but no sign of faulting across it, yet this ridge is over 2 miles in length. The limestone, next the northern mass of gneiss, is, however, marked by a band of fragments later cemented together at the contact, resulting probably from crushing attendant on the intrusion of the monzonite. The rocks immediately associated with the gypsum also show striations or grooves in places, indicating movements parallel with their dips.

The green shales of the region pass into sandstone in some places, and in others grade into schists containing mica and epidote, while the limestone is in general, fine in grain and light in color with the exception of narrow, persistent blue bands. On breaking some of this blue limestone a strong smell of sulphuretted hydrogen was perceived, which was not the case with the neighboring limestone of light color. Fine needles of what may be tremolite were noted with a lens in some of the limestone, particularly in that in the northwestern part of the district.

mediately above. Of particular interest is the condition of the limestone near the intrusion, a large area having been converted into a marble, mostly light in color, seamed with black veins of manganese oxide, and showing no stains of iron. The seams are from one-sixteenth, or even less, to over one-half an inch in thickness, and one parallel series crosses another parallel series at an oblique angle, giving the marble a sort of checker-board appearance. The seams are from 1 in. to 2 ft. apart, and marble of almost any pattern can be had by cutting blocks at different angles. Some 280 acres have recently been located for a marble quarry, and there may be commercial possibilities here with the advent of a railroad. The seams do not appear to weaken the stone, but in places cavities are present, which are probably due to solution of the limestone at the time of the intrusion of the porphyry. The marble rests upon the quartzite, overlying the porphyry, and the manganese oxide, which can readily be traced to the border of the intrusion, is probably the mineral psilomelane. In one place seen, the granite-porphry is directly against limestone, and there are veins and seams of manganese oxide in

the limestone, at and near the contact, but while unquestionably responsible for the manganese, no other minerals were observed to which the intrusion had given rise.

Not far from the granite-porphry a dark, fine-grained, vertical dike, 12 to 18 ins. thick, was noted, which crosses a gypsum bed, the gypsum showing little or no sign of alteration at the contact. This small dike can be traced but a short distance. An altered rock, containing much epidote and probably a dike, was also seen in the southwestern part of the gypsum region, in the schist into which the gneiss grades. With the exception of the granite-porphry and the little dike, no other intrusions were observed in the gypsum beds.

Age of the gypsum deposits.—About 15 miles westerly from the west end of this gypsum district lie the Palen mountains, the gypsum deposits of which have been ably described by E. C. Harder, in Bulletin No. 430, U. S. Geological Survey, pages 407 to 416. The gypsum of the Maria mountains was probably laid down at the same time, in fact the gypsum and associated rocks of both regions are likely the same belt. Mr. Harder states that "the age of the gypsum-bearing series is unknown," but thinks that it may be pre-Cambrian or possibly Paleozoic. No fossils or other definite indications of age were seen in the Maria district, and about all that can be said is that the rocks have, in general, an ancient appearance, the gneiss and schists having experienced much metamorphism. Evidently the gypsum beds are not things of yesterday.

THE GYPSUM.

As gypsum is soft and comparatively soluble in water, these gypsum beds do not weather into prominent outcrops, while the associated limestone, on the other hand, stands out as bold ridges in many places. Consequently fragments of limestone and of other rocks, are apt to cover the gypsum which otherwise would be exposed, a fact to be borne in mind in the investigation of deposits of this kind. All over the district, to a depth of from a few inches to 2 or 3 ft., the gypsum is porous, having what may be termed a fibrous or columnar structure, developed in weathering. Rain water has evidently soaked into the gypsum and dissolved some of it, and has later been brought to the surface by the heat of the sun, resulting in the formation of countless, small, closely-spaced, hollow tubes, one-sixteenth of an inch in diameter or less, the diameter and distance apart being about the same. That this structure is secondary is plainly shown, not only by its superficial character, but also by its being practically invariably vertical, whatever the dips of the beds. The gypsum at the surface is therefore soft, and on walking over outcrops, everywhere covered by rock fragments, there is a sense of yielding and a hollow sound. Below this alteration, the gypsum is compact and finely crystalline, in general, the individual crystals being usually but a fraction of an inch in diameter, less than one-sixteenth, although in places the

flakes are one-eighth of an inch or more across. Only at one point in the entire region was any coarse gypsum seen, a small quantity occurring at the junction of the porous, surface gypsum with the compact. Here the gypsum is in translucent plates, several inches across, recrystallization having taken place. Throughout the region, most of the gypsum is snowy white, some however having a grayish tint, or showing grayish bands. At and near the surface, there are reddish, iron-stained seams and streaks in places, but the openings show that these tend to die out with depth, as is to be expected where such are due to surface agencies. Messrs. Hess and Larsen, of the U. S. Geological Survey, examined a sample of gypsum from this district, under the microscope, and state that neither anhydrite, quartz nor clay appear to be present, the only impurity they found being lime carbonate, roughly estimated to form less than 10, and possibly less than 5% of the sample. This sample was taken 5 ft. below the surface, and is apparently representative of much of the gypsum in the district. In Bulletin No. 430, mentioned above, E. C. Harder gives an analysis, by George Steiger of the Survey, of picked samples of gypsum from the Palen mountains, Mr. Harder's deductions from this analysis showing 87.31% of gypsum, 1.31 of anhydrite, 6.53 of lime carbonate and 3.16 of surplus carbon dioxide. The analysis of gypsum is not a simple matter owing to the difficulty of distinguishing between moisture and combined water.

The practical man, however, usually cares little about analysis of gypsum, providing that good plaster can be produced, and innumerable calcining tests have been made of the gypsum on the property of the U. S. Gypsum Co., Chicago, a corporation owning some 30 plaster mills, which has recently acquired over 1000 acres in the Maria mountains. In the calcining test, which may be made in a common saucepan, three-fourths of the water of crystallization is driven off, and the gypsum is thereby converted into plaster of paris, the object being to ascertain the quality of the plaster the gypsum would yield in a mill. According to report, excellent plaster was made in these tests from material 10 ft. or more below the surface. The writer happened to see only one of the lumps of plaster resulting from the tests, which piece was both white and hard, that is, of course, hard for plaster of paris.

Anhydrite is often associated with gypsum but apparently the anhydrite in this district, when in quantity, is apt to be immediately above or below the gypsum beds, and generally on the upper sides. In places, however, it is inter-bedded with the gypsum, and naturally anhydrite may be present in gypsum of which no sign appears to the naked eye. The anhydrite here is white and, unlike the gypsum, seems to be granular rather than crystalline. Whether pure or mixed with lime carbonate can not be said as no tests have as yet been made of the material. Some of it in weathering breaks down into a gritty powder. Anhydrite is both harder and heavier than gypsum and

acts like so much dead or inert matter in plaster of paris.

Salt, which is also a common associate of gypsum and an undesirable ingredient in plaster, was observed nowhere in the region. Possibly the waters from which the gypsum was laid down, did not become sufficiently concentrated by evaporation to deposit salt, which latter is far more soluble than either lime carbonate or gypsum. There may have been a wetter climate after the gypsum was deposited, or the sea or lake bottom may have been converted into dry land by movements of the earth's crust, or salt may have been deposited and later washed away, or the waters may have contained little salt in the first place. Salt is, however, common in surface waters, and had much been deposited, some would likely now remain. Moreover, the waters depositing the gypsum were probably close to concentrated sea-water in composition, so all things being considered, it seems probable that these ancient waters did not finally dry up in the gypsum region. The climate was doubtless dry when the gypsum was laid down, and the shales and sandstones, above the gypsum and limestone beds, indicate heavier rains which brought down silt and sand from the hills. The gypsum probably originated from the action of sulphuric acid or sulphates upon limestone, lime-bearing rocks, or lime compounds in solution, and as iron sulphide is widely distributed, the sulphuric acid or sulphates may have been mainly derived from the decomposition of this mineral. However, "to every thing there is a season" and these interesting speculations can not be further discussed here. Suffice it to say that enormous quantities of gypsum daily reach the ocean in the drainage waters from the land.

DEVELOPMENT.

The openings in the gypsum are superficial with the exception of a shaft and numerous drill holes put down by the U. S. Gypsum Co. The drills were worked with spring-poles and the holes are all vertical. The shaft, which is in the eastern part of the district and near the northern limit of the gypsum belt, is also vertical, being 70 ft. deep, with a crosscut at the bottom to the south 50 ft. long. At the face, this crosscut passes out of the gypsum and into the limestone wall. From the bottom of the shaft a vertical hole was drilled to a depth of 260 ft., the writer being unable to say whether this hole finally went through the gypsum bed into one of the walls. At the surface the bed is almost vertical with a slight inclination to the north, but the crosscut proves that the dip is southerly lower down. The dump looks like a snowdrift, as the gypsum is white and mostly in small fragments, having evidently been crushed here by movements. As a rule, however, the gypsum of the district appears to be compact, below the surface alteration, and many pieces on some of the dumps have two parallel sides, which may be bedding-planes or cleavages later developed.

TONNAGE.

Obviously, in estimating the possibili-

ties of any deposit the probability of its persistence must be considered, and the fact that the gypsum occurs as beds, and in no sense as veins, proves that it is just as much part and parcel of the formation as are the associated rocks. A vein is, of course, younger than the wall rocks, while a bed is younger than the rock upon which it was laid down, but older than the material deposited upon it. The outcrops of gypsum, although not everywhere actually exposed, extend almost from end to end of the district, and gypsum again appears about 5 miles to the east and some 15 to the west, in the Palen mountains. In a part of the Maria region, moreover, rounded hills of gypsum may be seen where the deposits have been cut by gulches.

Now a flat bed of compact gypsum, 15 ft. thick, means over 46,000 short tons to the acre, and a decidedly conservative estimate of the gypsum under a certain tract of 400 acres in the district, amounted to 18,000,000 tons; or enough to last a plaster mill for 600 years, using 30,000 tons of gypsum annually. Where the beds dip, the amount of gypsum, per acre of surface, increases with the angle of dip, but on the other hand, the cost of mining also increases with depth. Doubtless the beds of gypsum vary in thickness underground as well as at the outcrops, a condition to be expected, particularly when deposits of a relatively soft material like gypsum have been tilted and bent. More faults may also be met with in working the deposits than a hasty inspection of the surface would indicate. In brief, there are millions of tons of gypsum in the region, much of which appears to be of excellent quality, and in deposits of this size, a few million tons, one way or the other, make little practical difference.

WATER.

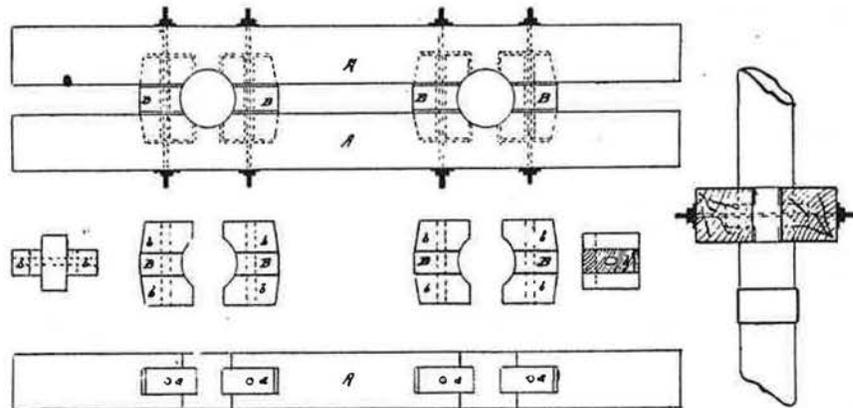
Chandler's well is some 2½ miles northwesterly from the west end of the district and in January, 1911, the water stood about 18 ft. from the surface. The water seemed good, as far as could be learned by drinking it, which, after all, is a fairly practical test. There are also natural "tanks," 3 miles or so from the gypsum area, such tanks being depressions, often more or less filled with loose gravel, in which rain water accumulates. Water is reported to have been found in a drill hole on the property of the U. S. Gypsum Co., but no particulars are at hand. It should be borne in mind that, in making gypsum into plaster of paris, water is driven off from the material instead of being added to it.

THE COUNTRY IN GENERAL.

The Maria mountains are a desert range and the harder rocks are coated in many places with dark "desert varnish." No trees, suitable for timber, grow in the gypsum region, although some of the washes are marked by growths of palo verde and ironwood, the latter furnishing excellent firewood. There are cottonwood trees along the Colorado river, and some cottonwood timber is used in the Palo Verde valley, where fence posts of mesquite are com-

mon. It is interesting to note that the creosote bush (*Larrea mexicana*), thrives as well actually on the gypsum outcrops as elsewhere, while a plant with light-gray foliage, abundant in the region, usually avoids the gypsum beds. The Palo Verde valley and parts of the adjacent country have great agricultural possibilities, and not only is a portion of the valley irrigated with water from the Colorado river, but the Chucawalla Development Co. has a concession to dam the river 20 miles above Parker, Ariz., and proposes to irrigate from 200,000 to 300,000 acres of the higher lands. The plan is to develop electric power and pump the water to a high-level canal, and also to furnish power for commercial purposes throughout the region. The bill authorizing the construction and maintenance of this dam was signed by President Taft on Feb. 17.

As a striking example of the dryness of the climate, the telephone line, some 40 miles in length from Blythe Junction to Blythe, may be mentioned, for only



Clamping Device in Shaft Piping.

recently has the line been strung on poles. Previous to this the bare wire either lay on the ground or hung on bushes here and there, without insulators of any kind, yet conversation was carried on with little difficulty between the two places, save during occasional wet weather. The climate, while delightful in winter, is hot enough to suit a salamander in summer.

With the advent of a railroad, the great petroleum fields of southern California would be convenient sources of fuel for plaster mills.

CONCLUSION.

Seeing that but a few days were spent in the gypsum region it is hoped that due allowances will be made for the many imperfections of the foregoing. Future and thorough investigation may show errors in what has been said, but it was deemed better to give a few particulars of a district not hitherto described, rather than to wait indefinitely for an exhaustive examination. Hence the above can be by no means styled a report, but must be looked upon as a reconnaissance.

Imports of Russian iron into Germany in 1910 totaled 779,402 tons.

Simple Shaft-Piping Clamps.

By VERNER A. ROBINSON.

The supporting in position of large steam, air and water pipes in vertical and inclined shafts is one of the more common problems confronting the engineer, and is solved more or less satisfactorily in various ways.

The sketch here presented shows a simple clamping device used by the writer on several occasions, which has given entire satisfaction.

The construction is simple, and can be made by any competent timber framer. The clamp as here shown is made to accommodate two 8-in. pipes, and consists of 12 parts, *i. e.*, two 8 by 8 timbers, *A A*, of proper length, to be supported by the shaft timbers; four short pieces 8 by 8, *B B B B*, framed in the manner shown, and four 1-in. bolts with nuts and washers on both ends.

The timbers *A A*, one of which may be one of the plates of the shaft sets, are

mortised as shown at *a a a a*. These mortises have a batter on the outer ends of each pair, and the tenets *b* of the parts *B* are likewise battered, so that when the bolts are tightly drawn, the parts *B* are forced inwardly upon two sides of the pipe covering one-sixth of the circumference of the pipe on either side. Also the timbers *A* are at the same time drawn tightly against the pipe coming into contact with the balance of the pipe's circumference.

The mortises *a* are made larger in the two directions, and the bolt holes through the pieces *B* are made larger the one way, in order to allow for the movement.

It will be noted that in this clamp the entire circumference of the pipe is positively gripped in all directions.

Any number of pipes may be held in the same side pieces, and of varying sizes, if need be, and valuable space saved.

Clamps should be placed at proper intervals to take the weight and prevent lateral sway. In case of expansion from any cause, the clamp may be bolted to mine timbers with rubber cushions between.

The coal output of France in 1910 totaled 37,862,020 tons, as compared with 37,115,891 tons in 1909.

duced. The rate on low-grade ores is now \$2 instead of \$2.50, and on high-grade, \$3.50 instead of \$5. The new rate became effective Oct. 26.

Though only a small force is employed at the camp of the Vulture Peak Copper Co., in the Vulture district, a good showing is being made, and the shaft is now down about 15 ft. on one claim and the vein, which is 3 ft. wide, gives returns of 17 to 20% copper.

Report is current that the Vulture Canyon Co. is soon to start operations on its property in the Vulture district. A party is expected from the east soon to look over the mine. An assay made last week from the Copper Giant claim gave returns of 51.8% copper, \$2 gold and 8.5 ozs. silver.

Kingman.

The zinc-gold-silver ores of the Idaho mine, near Cerbat, will soon be treated in the Vanderbilt mill, where a big roaster is in place to handle the zinc ores before they pass over the magnetic separators. The mine has several large bodies of high-grade ore.

Reports from the oil fields in the northern part of the county say that within a short time the rush into that section will almost equal the Bakersfield rush a few years ago.

The Golden Gem Mining Co. contemplates sinking its shaft several hundred feet this winter. At present the mine is producing a good grade of milling ore.

At the Cyclopic mine, in Gold Basin, Robert Jacobson is running a small mill and getting good results. A company has been organized to take over this property, and when this is done a larger force will be employed and a modern mill erected.

A rich outcrop of ore in the White Hills section of the Weaver mining district was recently made by S. C. Bagg. A party of mining men went up into that section last week to look at the strike.

It is understood that work will be resumed on the old Jenny mine which is now owned by Messrs. Bagg, Alexander and others. At one time this mine was a producer of rich silver-gold ore.

A company was recently organized to take over the Temple Bar placer mines and placer machinery is soon to be installed. A German engineer examined the ground about two months ago and his report is very flattering.

The wagon road from Yuca to the McCracken mine has been improved and made passable for heavy machinery that is to be installed at the property. Two automobiles now run from Yuca to the mine. When the installation of the machinery is completed the company will employ almost double the present force.

During the past month many prospectors have gone into the country north of Bill William's Fork and have found a number of veins of gold-bearing ore, while other prospectors on the Yuma side of the river have been doing the same thing. Some of this country has never been prospected, but that it is rich in gold is almost a certainty. This winter will doubtless see many good strikes made in the Bill Williams section.

A \$25,000 bar of bullion was brought in

from the Gold Road mine last Tuesday and with it the report that the mill is running steadily and that a new hoist was put to work that morning. It is probable that the mill will be kept running until the new machinery arrives.

An examination has just been made on the Prosperity group of mines in Todd basin, with a view to again working this old property, which at one time was a big producer of silver and is now in a fair state of development. There is an adit drift on the property 900 ft. in length, connected with the surface with shafts and winzes several hundred feet in depth. In one of these shafts several years ago a body of ore 9 ft. wide was discovered that ran over 200 ozs. silver to the ton. In the drift the ore is a sulphide and carries good values.

Salome.

A party of miners was recently out in the hills shooting rabbits and the next day the little town of Salome was deserted because these rabbit hunters had come into the desert village with pieces of quartz that contained nuggets of gold. One of the hunters picked up a piece of quartz float rich in gold. The party searched further and found a large piece of iron stained quartz, one nugget in the quartz being worth several dollars. A number of claims were located on a large quartz ledge near the place where the float was found and now locations are being made and work is starting on all sides. The strike is in a schist belt several miles wide, lying on the southwesterly slope of the largest mountain in the west end of the Harcuvars, known locally as Granite mountain. Numerous diabase and diorite dikes cut the schist in all directions, and iron stained quartz blowouts, stringers and ledges are numerous. About seven years ago a piece of quartz float was picked up in that same vicinity. It was horned down and yielded \$27 in gold.

The Griffin, four miles west of here, is one of the best looking copper prospects opened in that section. On the property there is nothing but 10-ft. holes and open cuts, but almost every pound of ore taken from these shafts and cuts is the pay kind and a good amount of it runs high enough in silver and copper to pay handsomely if shipped. The strike on the Griffin is about three-quarters of a mile north of the Finnegan camp in the schist belt west of Salome, and is just south of the scene of the new gold excitement. Many of the surrounding claims have fine copper and silver showings. The formation is principally schist, dipping to the southwest and varying from a yellowish-white, iron-stained sericite schist to darker varieties, some almost black and verging close onto slate.

CALIFORNIA.

Yreka

Considerable interest is now being centered in the Salmon River section of Siskiyou county and there is every indication that a number of old-time producers will again be placed in the shipping class. At the Mountain Laurel mine preparations are being made to resume operations on a large scale. With devel-

opment the vein shows up much stronger and better. Work at present is being done at the 100 level. The company is installing a large power plant at Sawyer's Bar, which will furnish ample electric power. There is a 20-stamp mill on the property, fully equipped for successfully treating the ores from the company's various properties.

To the east of the Mountain Laurel mine are the Cleaver, Esmeralda, Lanky Bob, Jumbo and several other mines. At the Esmeralda the ledge has again been found, but the strike has not been fully explored as yet, but as it is known to be a continuation of the other ledge there is no question as to its richness.

The Lanky Bob is being worked on a small scale at present, owing to a scarcity of water for running the mill. The upper level is being driven ahead and is showing up a fine body of ore, while at a lower level a tunnel is being run to cut the vein as it pitches into the hill. A 2-stamp mill is in operation. George Skillen is the owner.

A short distance north of the Lanky Bob is the Jumbo mine, the property of the Holman-Foskett syndicate, of which Jas. P. Holman is manager. Preparations are being made to operate this property on an extensive scale. The property is equipped with a 10-stamp mill. The Fisher claim is another of the holdings of this company.

On Tanner's Peak is the well-known Malloy group, which is now in litigation. This property has, with little development, proved itself a splendid proposition. The ore is free-milling and carries good average values.

To the west is the White Swan owned by Vincent & Dunphy, who are at present running a crosscut tunnel from the surface and expect soon to reach the ledge.

Further west on Jackass gulch several promising prospects have been found which give good indications of becoming mines of merit.

Kennett.

It is expected that the Guggenheims will have commenced this week, the shipment of copper ore from Kennett. Several thousand tons are in the lot and it will be five or six weeks before the shipment is completed. The ore will come from the Golinsky group of mines which the Guggenheims have had under bond for over a year, and on which they have done a good deal of development work. Their bond will expire in December. The ore will be transported from the mine to Holt & Gregg's electric road over a tram line a mile long and operated by mule power. Holt & Gregg's electric road, two miles in length from their quarry to Kennett, will dump the ore into standard-gauge cars of the Southern Pacific. A night crew will be put on the electric road, ore being transported at night.

MISCELLANEOUS CAMPS.

The Atolia Mining Co. of San Francisco, operating the Randsburg tungsten mines, which have in the past been large producers, have closed down the mines indefinitely.

Del Norte County.—W. Monte Ferry, Isaac Sparey, W. H. Turner, and other

Utah men have lately taken over two promising propositions known as the Union and Alta-California groups, located about eight miles from Smith river, a logging camp connected with Crescent City by rail. The Union group is being operated under direction of Wm. Ochs and on the property over 1,000 ft. of work has been done in tunnels, crosscuts, drifts, and a winze in one of the three tunnels. The ledges are in porphyry and the one upon which most of the work has been done shows from 3 to 12 ft. of ore. Conservative samples indicate average values of better than 15% copper with some silver and gold. The cost of mining and transportation to market will not exceed \$7 a ton, thus giving fair profit with copper at 10 to 12 cents a pound.

The Alta-California group adjoining the Union group is a very old property and ore was shipped from it to Wales in the sixties at a cost of \$60 a ton transportation. It required ore of not less than 25% copper to meet the costs of mining, transportation and treatment. The Alta claim, when patented in the early days, covered a stretch of ground 3,600 by 1,200 ft., the equivalent of nearly five claims of present time. Cornish miners were employed in those days and measurement was by fathoms instead of feet. A new hoisting plant and dumping machinery has been purchased and will shortly be installed and active workings in vogue. The whole section of country is covered with forests of heavy redwood timber.

COLORADO.

Denver.

The situation in the money market has not directly affected mining in Colorado. Some of the development enterprises, like the Central Power Co., have curtailed on work planned for the winter, and the promotion companies depending upon the sale of stock for funds for development are finding it necessary to go slow; otherwise the condition is fairly normal as in other years at this season.

There is a promise of considerable activity in the Montezuma district, in Summit county, this winter. This camp has lain dormant since '93, and the old properties which were worked at that time now offer promising opportunities for development with machinery. The prospect of an extension of the Colorado & Southern road from Keystone to the district and the certainty of electric power being provided at an early date give additional impetus to the situation. A number of strong operators are in the district and some very extensive plans for development are under way. One company has a project for a line of aerial trams to bring the ore to the proposed mill at the Montezuma townsite both from its own lines and from some other lines. The company is also planning to establish a system of air pipes to carry compressed air from a central station to the various mines in the surrounding steep mountains. It is likely that there will be considerable activity in the camp all winter in the way of development and exploration.

The Commodore tunnel on Red Ele-

phant mountain, at Lawson, Clear Creek county, has been taken over by a syndicate of which C. C. Pence and I. W. Duncan, of Braddock, Pa., are the representatives. The tunnel cuts a part of Clear Creek which has been very active in the past, represented by the Boulder, Nest, White, Free America, Tabor, and other mines of Red Elephant mountain, which have a record of over \$4,000,000 production in silver. The Commodore tunnel was driven in by A. E. Reynolds, but no attempt was made to explore or develop the veins which were cut. The tunnel is now in 3,600 ft., and at a point 3,200 ft. from the portal an exploration drift has been run 1,000 ft. west and 400 ft. east. The plant is equipped with a compressor and all machinery necessary for the operation of the tunnel. W. L. Shaffer of Idaho Springs will be manager.

Well informed miners conversant with the condition of the tungsten market predict that better prices for the black metal will come in the near future. With the opening of the Stevens mill the amount of ore required to keep it running will draw heavily upon the present output handled in the local market and the law of supply and demand will advance the price to the old figures, \$10 to \$11 a unit.

The Wano mill, at Jamestown, is cleaning up an average of \$10,000 per month. The gold bricks are sent to the Denver mint. The fluorspar mines in the Jamestown section are producing and shipping to the Pueblo Steel works about 50 tons weekly.

At Idaho Springs the Silver Ring property in Eclipse gulch has been started up by a Missouri company represented by John Larson of Idaho Springs. The property is secured under lease and bond and will be opened up by a crosscut tunnel.

The Pennsylvania Mining Co., which recently purchased the Nemah group on Bobtail hill in the Central City section, is cleaning out the old shaft and planning to install an air compressor.

The Jefferson-Calhoun Co. in the Central City district, has installed a 3 by 8 Jeansville sinking pump, and will operate with electricity supplied from the Georgetown plant.

The Ohio Gulch mines at Idaho Springs have resumed operations, after being idle for 10 years. There is a mill on the property. A plant of machinery will be installed on the Dorit tunnel on Chicago creek. The tunnel is now in 1,000 ft., and it is expected to continue it 3,000 ft. more.

There is considerable activity in the district above Empire, known as the Atlantic district resulting from satisfactory developments in that section this summer. This was formerly known as Camp Shaffer. A. A. Ireland is manager of one of the strong companies operating there.

At Georgetown the Prudential Mining Co. has let a contract for advancing the tunnel. W. C. Wood is manager.

The Cripple Creek district for the last month produced in excess of a million dollars in gold. The October output amounted to 7,158 tons, with a total val-

uation of \$1,033,066. The October increase is due to the reduced charges for ore treatment made by the mill syndicate, and the promise is that the output will be still further increased the rest of the year. The figures of the output are as follows:

Property	Tons	Av. Val.	Total value.
U. S. R. & R.	15,000	\$23.00	\$ 345,000
Smelters	5,125	54.00	276,750
Portland	11,000	25.00	275,000
Golden Cycle	24,800	2.50	62,000
Small Plants	3,000	8.00	24,000
Isabella	3,100	6.00	18,600
Phoenix	4,650	3.00	13,950
Vindicator	600	20.00	12,000
Ironclad	2,883	2.00	5,766
	70,158		\$1,033,066

The Blue Bird group of mines at Eldora is being extensively developed. The ore is silver-lead. The Golden Fleece mine in the same district has resumed work.

Drilling has been resumed in the downtown district of Leadville, at the Thirtieth street drill hole. A diamond drill will be used instead of the churn drill and the hole will be carried down to prove the formation at this point. The present depth is 575 ft. and the hole is entering porphyry.

Electrical power will be soon supplied in the Alma district from the Summit county power plant at Dillon. The approach of winter has closed the placer operations which have been generally successful.

The Vulcan Good Hope property at Vulcan near Gunnison is being pumped out with a view of extensive operations this winter. The mine water impregnated with copper will be treated with scrap iron to save the metals contained.

The Highland Chief property at Lake City has been examined by H. Blueher and E. B. Quickel of Albuquerque, owners of the property. A new tramway was completed on this plant this summer.

The Herman group of claims on Houghton and Wood mountain, near Animas Forks, has been sold by W. A. Triplett and Philip Newman to H. M. Corwin and associates, of Denver, for \$8,000. The new owners are planning to install machinery and continue operations during the winter.

The Smuggler-Union Mining Co. at Telluride has completed the power system which has been under development for some time. The water is derived from Blue lake and conducted two miles. The water after passing the power plant generates 700 h-p at the Pandora mill, making a total of 1,150 h-p generated, most of which will be used for the purposes of the company. The power installation was carried on under the management of Bulkeley Wells, general manager.

The Lewis mine, near the Bridal Veil basin, Telluride, has been leased to Bulkeley Wells and Thomas L. Livermore. The property will be unwatered and operated.

The J. C. Kernohan Co., of Cleveland, Ohio, is figuring on erecting a pyrite smelter, the McDonald process, at Denver. Messrs. Kernohan and C. E. Colber

and is hard to liberate for that reason. The company is laying a pipe line from Quartzite to the hills in which the mines lie, a distance of seven miles, for the purpose of furnishing a reliable water supply.

Texas people have become interested in the Sycamore mine near Jerome, only four miles from the big United Verde camp, but by the road around the mountains it is 12 miles. The owners are now installing powerful machinery. They are down 280 ft. on a 2-compartment shaft, 4½ by 9 feet.

A Yavapai county proposition gaining headway is the Golden Jewel, in the Bradshaw mountains, which has a pay streak 30 ft. in width, averaging \$25 a ton gold.

Announcement is made that the Mocia mines will have a big 10-stamp mill at once. They have opened the mine 1,100 ft. with tunnels and drifts. The mines are 14 miles southeast of Kirkland, in the Weaver Ridge country.

CALIFORNIA

Grass Valley.

One of the most important events in this section for several months is the strike recently made near the 500 level in the Idaho-Maryland mine. The vein is of fair width and was encountered in a drift 1,500 ft. from the shaft. The ore assays well, with samples running high. Bray Wilkins is superintendent.

The Prescott Hill shaft at the Sultana mines is down 1,140 ft., and is being rapidly driven to the 1,500 point. The company has been greatly handicapped by the frequent breakdown of the electric power line, and is considering the installation of an auxiliary plant at an early date. The big pumps, which were recently installed, are working well, and are expected to keep the mine clear of water. Good ore is being developed at several levels, and the 20-stamp mill is running on good milling ore.

The Central shaft has passed the 5,000 point, and is still going down. Splendid values have been encountered in the bottom of the shaft, and a large area of rich territory is being developed. In the upper levels the ledge is showing up well, and the mill is operating on fair grade ore. A. D. Foote is general manager.

One of the finest hydraulic restraining dams in California has just been completed across Greenhorn creek, about a mile above the Narrow Gauge railroad. The dam is of the cribbed type, and is 30 ft. wide at the base, 25 ft. high and 106 ft. long. The dam will be used to impound the tailings from the Nevada hydraulic mine, and will back up the river for half a mile. The height of the dam can be increased to 75 ft. by laying logs along the top, which will divert the stream into an adjoining canyon. Pipe lines have been laid, and everything is in readiness for the winter rains. The Nevada is owned by J. S. Goodwin of You Bet and the Nichols family of Dutch Flat.

For the first time since the early '60s, white men are working with rockers along the banks of the South and Middle Yuba rivers, above Nevada City. Excel-

lent results have been obtained, and the scene calls to mind the pioneer days of '49 when every stream was searched for the golden treasures. Indians and Chinese have worked along the rivers for several years, but always claimed that they were meeting with indifferent success.

A rich body of gravel has been struck in the Mt. Pleasant mine, and several nuggets have been taken out. The gravel apparently exists in large quantities and the strike is considered of great importance. The Mt. Pleasant adjoins the Orient, which was recently bonded by a strong Oakland company.

The new 10-stamp mill at the Anchu mine has been completed, and is in readiness to commence the treatment of ore. The tunnel at the mine will be driven to intersect a new ledge, while a large crew of men are engaged in extracting ore from the old workings. Several ledges have been found on the property, and Superintendent Overman is highly pleased with the outlook. Eastern people are largely interested in the property.

The Aurora mine has suspended operations pending the readjustment of the financial situation. The shaft is down 41 ft., and discloses a 2-ft. vein of fair grade ore. Several other small properties have been compelled to close on account of the lack of funds. Among them is the Iron Mountain copper mine, which has closed for an indefinite period.

Another rich strike has been made in the south drift of the Tightner mine, and approximately \$15,000 were taken out in the course of a few hours. A small force of men is following the vein, while considerable ore is being extracted. The ledge is of good average value. H. L. Johnson is general manager.

A rich shoot of ore has been struck in the Wyoming-Lackawanna mine, near Allegheny. The strike is the result of consistent developments on the part of the company, and promises to make the mine one of the leading ones in the district. The vein is well defined and gives every evidence of being a permanent vein. Scranton and Wilkesburg (Pa.) people are principally interested in the property.

A 5-ft. ledge of rich ore has been struck in the Deep Blue gravel mine, at Smith's Flat. The ore is quartz with gold bearing arsenopyrite scattered through it, together with flakes of free gold. The ore assays around \$200 per ton with samples running much higher.

Rich ore has been struck in the Antelope mine, near Clio, and three veins, the Antelope, New Ledge and Hawkeye, are being developed. The mine is being developed by two shafts and two adits, the longest being 260 feet. The Antelope vein is the most important, while considerable development on the Hawkeye has disclosed much rich ore. The New Ledge vein has not been developed to any extent. Main operations will be carried on through the main adit.

Chrysopolis.

Thirty years ago Chrysopolis was in the heyday of its fame. It was then from all accounts and appearances a rich and prosperous camp, and thousands of dol-

lars worth of oriferous ores were taken out of some of the old workings. The condition of the mines to-day, and the character of the dumps bear conclusive testimony regarding this. The ores sought after in those days were free milling, and some of it must have been exceedingly rich, for there exists in the veins and stringers of the old workings, pieces of quartz freely and beautifully speckled with gold. Some of the old shafts and drifts and tunnels are 200 and 300 ft. in extent. The gulches were fairly alive with quartz and placer miners, and horse and water-power aastras were numerous, while here and there along the banks of the Owens river, a short distance away, were mills ranging from 5 to 20 stamps. Chrysopolis in those days was without doubt a flourishing camp.

The country rock is a metamorphosed granite intersected every 100 ft. or so by immense dikes of quartzose schist. These dikes range from 10 to 50 and 100 ft. wide. Paralleling and alternating with them are numerous veins of quartz. These veins and dikes outcrop prominently on the surface and run generally in a northerly and southerly direction. They are heavily capped and strongly impregnated with iron here and there, and carry more or less gold and copper values. Crossing these formations again, and cutting them at frequent intervals at angles of from 30 to 45 degs. are massive porphyry and greenstone dikes. The quartz ledges run from 10 or 12 ins. to 5 and 10 ft. in width. Pannings of gold can be made from almost any of them, and assays run from \$5 up and from 5 to 20% copper.

COLORADO.

Denver.

The United States Reduction & Refining Co., J. D. Hawkins, general manager, has issued a letter which indicates that this company is prepared to meet the competition of the Golden Cycle Mining & Milling Co. in connection with the treatment of Cripple Creek ores. The former company is supposed to be operating in close connection with the American Smelting & Refining Co., and the announcement of the management would indicate that there is a possibility of decided competition in the milling situation in the Cripple Creek district.

The new Golden Cycle mill at Colorado City recently completed at a cost of \$1,250,000, has had the effect of generally reviving the confidence in the Cripple Creek situation. The old mill belonging to this company was burned some months ago, and a record has been made in replacing it with a modern mill. The new mill covers nine acres of ground, and is modern and automatic throughout.

The Golden Cycle Mining Co., which owns the mill and mine in Cripple Creek, will open a large coal mine northeast of Colorado Springs. It is expected the output will be about 1,000 tons a day, which will supply the company's mine and mill and also supply local demands. The company some months ago purchased about 2,000 acres of land.

Work on the Cripple Creek drainage tunnel was suspended last Saturday un-

Recent Developments at Furnace Creek Copper Mines.

BY FRANCIS C. NICHOLAS.

Economic Geologist and Mining Engineer.

During the active trading in mining stocks a few months ago, probably no



FRANCIS C. NICHOLAS.

greater interest was developed in any proposition than that which the public accorded to Furnace Creek copper. Now that the boom has collapsed, the extreme feeling is shown, with the result that the stock has gone down to 25c a share bid, whereas it was eagerly purchased at \$4 to \$5 a share a short time ago. The low bid for the stock is being made, not because the great surface exposures are less extensive, nor the

at places very rich, and below a completely leached zone. This seems a natural sequence, for how could water dissolve mineral out of a lower zone and not attack the upper portions of an ore deposit? Is it an anomaly, or is it the manifestation of a peculiar condition incident to this formation? Two explanations are possible; one is very unfavorable to the future of mining at Furnace Creek, and the other gives hope that the property will be as great as anticipated.

These questions have been suggested: (1) Has Furnace Creek an example of a vein formed and then locally enriched at the surface by lateral secretions? (2) Is there a vein which has been influenced by mineral bearing solutions from depth and afterwards leached of its mineral in levels below the surface by some process or physical action which attacked the

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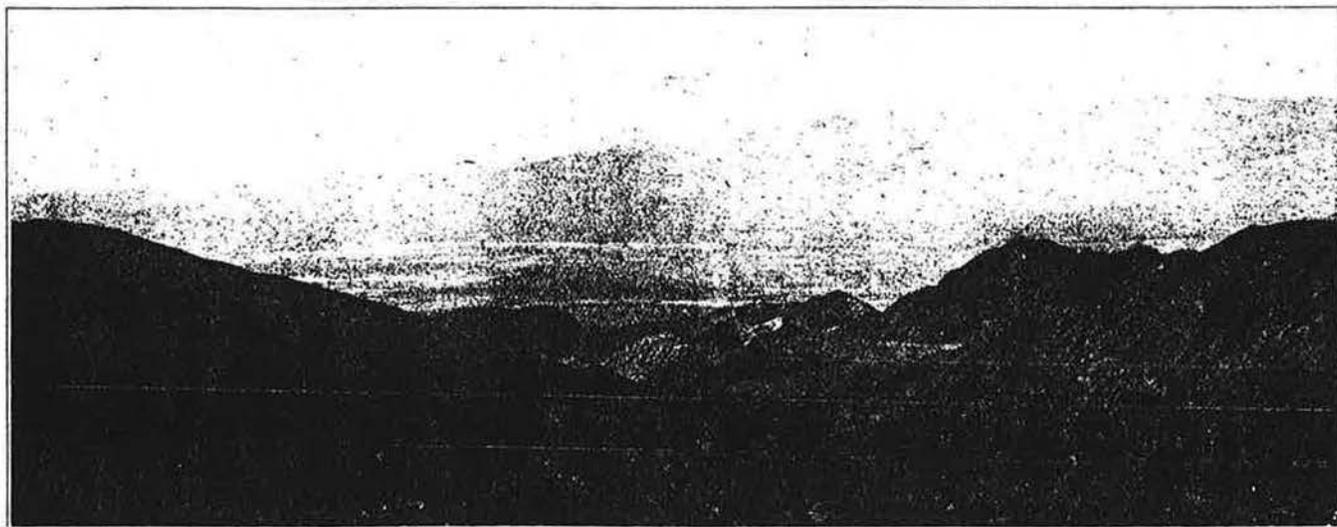
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The ore bodies are not so found, for they are located in veins of porphyry with andesite dikes appearing as later eruptives and rhyolite flows on the surface, which apparently originated from the eastward, at places entirely covering the andesite dikes, granite and porphyry.

Had these flows developed the influences leading to surface mineralization the ore bodies would not be found confined to iron stained porphyry of older formation, but would be found among the limestone and along the drainage zones of easy access, and to some extent at least, as contacts between these later developments and the older rocks. But the ore is not so found; it is in the porphyry dikes, and would seem to have originated with them or during subsequent developments while the heated activities were subsiding and before the later outbreaks which caused the rhyolite flows.

Surface lavas and recent eruptions are not greatly productive of mineralizing influences, and it would seem that indications pointing to surface influences for local lateral enrichments are not pronounced in the Greenwater district. The



Panoramic View of Death Valley.

management less efficient, but because the zone of permanent sulphides is found not so near the surface as the engineers had thought. But at the 500-ft. level the ore deposits occur exactly as early indications had promised. The walls are strong, and although the characteristics of the vein material have not changed it is found to be leached of all values, due to the subsiding waters.

The scientific interest in the developments at Furnace Creek is mainly in the traces of atmospheric influences and the action of subterranean waters through various stages of subsidence in the almost rainless region in the Funeral mountains and Death Valley.

For atmospheric influences to leave a record behind such as is seen on the properties of the Furnace Creek Copper Co. suggests circumstances and incidents of formation which must have been favorable to an unusual degree; otherwise there would not be a great upper oxidized zone, which is mineral bearing and

formation below while leaving the surface exposures free from its influences? The second problem seems impossible.

The Greenwater district in which the Furnace Creek mines are situated consists of intrusive formations which disturb granite and limestone, and at places rhyolite covers the intrusive rocks and portions of the granite exposures. If these intrusions have exerted the influences for mineralization, the ore bodies will be deep and not superficial, because intrusive rocks come up from the depths. If the ore bodies are to be considered superficial, however, we must look to the rhyolite flows and exposures for the source of the ore formations. Mineralization could hardly have come from the limestone, for it would have exerted a precipitating influence, and ore bodies if they originated from solutions formed by waters percolating among lava flows or among rocks containing copper would have developed ore bodies as replacements precipitated among the limestone.

indications suggest deeper mineralizing causes, but it must be explained how the lower levels of a formation could be leached of ore while the upper exposures are still mineral bearing.

Were surface waters and accumulations from rains the only waters which drained through the earth this condition—the greatest leaching at the surface—would invariably be the case. But exceptions are possible, and subterranean waters may have caused the leaching. It would seem that where the formation of an ore deposit is indicated to be of deep origin and uprising solutions, as are indicated at Furnace Creek, influences other than surface drainage might reasonably be considered as having caused the leaching some distance below the surface. Before accepting such a conclusion, however, we must consider what evidences there are to suggest mineralization by uprising solutions, rather than by local and lateral enrichments. For these evidences we must look beyond the limits of one mine

and examine the development of the ore deposits in general in this district.

The whole country is mineralized. The veins occur in porphyry dikes, together with quartz and barite with values in gold and copper—a typical vein formation due to uprising solutions. It is distinctly different from the surrounding rocks and has characteristics of its own. If this vein material, or the mineral

followed a period of seismic disturbances which shattered and fissured the rocks and formed the ore bodies. At a later period came the activities which may not have brought mineral, but which have exerted a segregating influence within the great mineral deposits, developing the veins within veins which have attracted attention.

Apparently the mineralization will ex-

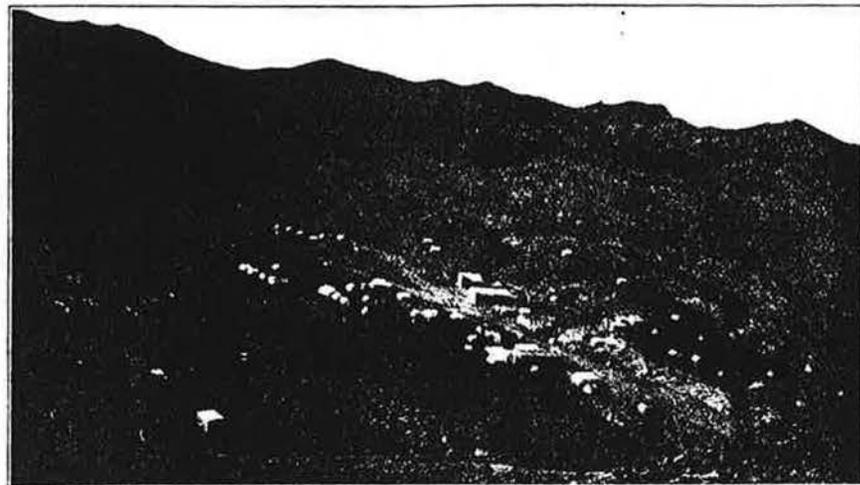
first the leaching process took place and had gotten only as far as the point of oxidation; then came the drying up of the rains spreading little by little to the surrounding country, till a great, almost rainless region was formed. The rains dried up, and the water levels retired much more slowly. Naturally, the springs continued for a considerable time and left water in the cracks and fissures of the rocks.

The portions of the ore bodies which were influenced by atmospheric waters rapidly became dry, but the subterranean waters subsided much more slowly.

Even at this late period water comes to the surface at isolated springs in the Greenwater district, but at widely distant places. In the course of time these springs will dry up with the sinking of the water levels of adjacent regions.

When this development began the water at and near the surface simply dried up, but the subsidence of the subterranean waters was slow and as it sank lower in the ore bodies at Furnace Creek, setting up a leaching process during the passing ages and carrying the mineral down with it, the water sometimes rising, sometimes disappearing as atmospheric moisture, affected with varying degree the surrounding country. Slowly with the lapse of centuries the welling up and subsiding of the waters within the earth, and in seeking with almost imperceptible progress lower and lower levels, these subterranean waters leached out the mineral and carried it down with them. The drier portions of the veins nearer the surface were not reached by this influence, hence we have the peculiarity at Furnace Creek of ore on the surface with leached measures underneath it.

As a natural inference we may believe

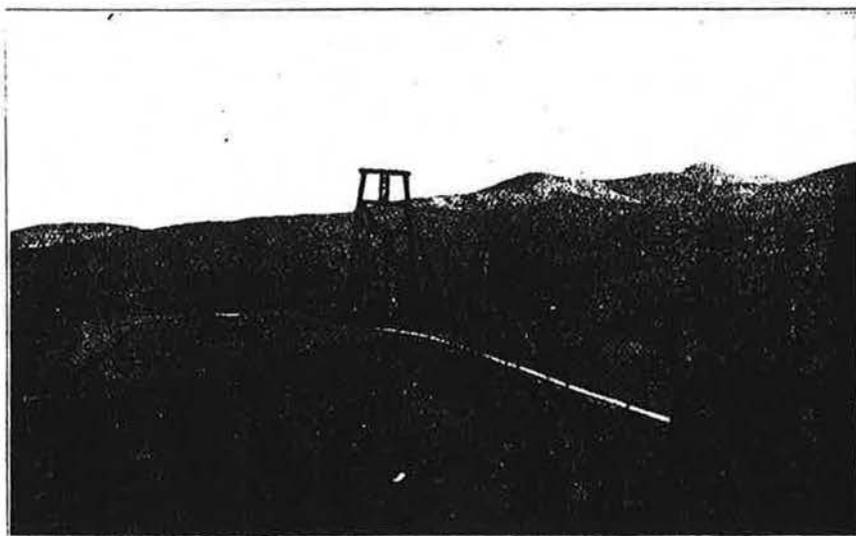


View of Greenwater District, California.

found in it, were derived from lateral secretions, reaching as far only as the surface rhyolite flows penetrated, its composition would be largely of materials which would have been derived from rhyolite. Rhyolite is a highly silicious and acidic rock, solution from which will not deposit barite, though it would have attacked the alkaline limestone formations, resulting in the development of replacement deposits among the limestone. Instead, the veins and ledges are distinct, characteristic and having in general a resemblance one to another, which indicates a much deeper mineralizing cause than simply the heated influences from surface flows of rhyolite. Other mineralizing causes must be looked for, which are probably indicated by the intrusive dikes themselves. These dikes became mineral bearing during their intrusion through and accumulation in the fissures, and the more recent activities have not brought mineral into them, but have probably readjusted the mineralization so that it is not now found distributed equally through the dikes. Rather is the mineralization as segregates within the dikes themselves developing a series of veins, and mineral deposits within veins; a fact that has caused confusion of opinion, some reports being that there are several veins in a great intrusive dike, and others that the whole is one vein. Both opinions are correct, because later activities of heated influences have caused the development of segregates within the formation, so that we have veins indicated within veins.

The country we are considering is primarily of granite and limestone with diabase in great intrusive masses, which probably disturbed and caused uplifts among the other rock formations. With the cooling of these intrusions naturally

tend below the level in which mining can follow it. But how comes it that at the upper exposures mineral is found and that at some distance below there is a development of leached ore bodies? If the mineralization took place with the formation of the dikes, or by reason of the subsidence of igneous activities subsequent to their intrusion, the ore must have been on the surface as well as at depth. The surface, however, is not



Property of Furnace Creek Copper Co.

leached; it is simply oxidized, so if a deeper portion of the ore body is leached, why not the surface?

This can be answered only by inference, based on the evidence that in a region like Death Valley and the Funeral mountains the subsidence of the water levels after the drying up of atmospheric moisture is gradual. In this section at

that this gradual leaching has created a zone of great enrichment near the present water level, but where it can be a speculative theory.

Germany imported 3,070 metric tons of aluminum and exported 1,658 tons in the nine months ending with September, 1907.

tion, are making ready to build a branch line from Topock to Oatman. Topock is located southeast of Needles on the main line of the Santa Fe and is almost due south of Oatman. The branch line will be established just east of the National Old Trails highway and will be about 35 miles long. It will afford interurban transit facilities to the Pioneer, Black Range and Kraus Canon sections, will connect Old Trails townsite with Oatman and ultimately will link all sections of the district. The Santa Fe will begin construction work soon.

Under the efficient management of S. S. Jones the Tom Reed mine was developed into a bonanza and eventually became the most valuable gold mine in Arizona. It has paid dividends in excess of \$2.70 per share within the past 5 years, and is today the premier gold producer of the southwest. Ore has been opened along the main Tom Reed contact, within the boundaries of the company's estate, for a length of more than a mile and is being mined to a depth of 1075 ft. The gold bullion output of the mine has an average value of \$100,000 per month. Recently a new and valuable ore body was opened 1000 ft. east of the main shaft in a section of the mine hitherto little prospected.

Somewhat less than a year ago Long & McIver obtained a bond from Joe Pariso and associates on a considerable acreage adjoining the Tom Reed property on the north and west, incorporated it under the name of the United Eastern Mining Co. They struck ore at a depth of 200 ft. and encountered pay values at 300. At the outset of the venture the people of the camp, as a whole, were inclined to view with skepticism the efforts of Long & McIver to open a mine beyond the boundaries of the Tom Reed. Today, less than a year from the time they began work, Long & McIver opened pay ore in the United Eastern mine from a depth of 300 ft. to a depth of 565. On the 460 and 565-ft. levels the average grade of the ore is \$40 across a breadth of 35 ft. Prominent engineers have estimated the value of the ore in sight in the United Eastern workings at \$10,000,000 and have pronounced it to be one of the most remarkable mines they have ever examined. United Eastern shares, placed originally at 25 cts. per share, are now in demand at upward of \$4.

Mining operations are now being aggressively prosecuted throughout a 7 by 10-mile area, and on at least 60 different mining properties, whereas a few months ago they were confined to the Tom Reed and Gold Road mines and a scant half-dozen less well-known properties. From a quiet and more or less moribund hamlet of 300 inhabitants Oatman has grown into a bustling, hustling mining camp of approximately 1200 people and is increasing daily in population.

Kelvin.

The Kelvin-Sultana Copper Co., known at one time as the Riverside group, and for many years a shipper of high-grade carbonate ores near surface, is now, after nearly 5 years of steady development work, crosscutting its six principal veins on the 540-level, and has already accomplished 700 ft. of this crosscut work, which will be about 1900 ft. altogether. They have already crosscut the No. 2 vein, which is high grade in copper, and expect to reach the next vein within 2 weeks. As soon as three or four of these veins have been cut the necessary drifts and stopes will be carried out. The concentrator has been completed and already tried out with success on the upper level ores. The mill, which now has a capacity of 150 tons per day, can later be increased to 300 tons by the addition of extra Wilfley and slime tables, as the primary parts of the mill were built for 300 tons per day. This mill and the Westfall 3-compartment shaft, which it adjoins, are both furnished electric power from the company's oil burning power plant on the railway across the river on its own property adjoining the railway. In the past year a bridge has been erected by the company and another larger bridge is being built. The company has also been working with great success its tram, which carries the concentrates across the river and dumps them directly into cars, whence they are taken to Hayden to the smelter of the American Smelting & Refining Co. The company is apparently entering its production period on a permanent basis.

Jerome.

The Hayden Development Co.'s new 200-ton plant at the Copper Chief camp will be in operation early in November.

Conservative estimates of the ore supply ready for blocking give 500,000 tons as ready for treatment, resulting from over 10 years of steady development.

Warren.

The Tucson, Cornelia & Gila Bend railroad, owned jointly by Calumet & Arizona and Phelps, Dodge & Co., has let a contract for the construction of the 45-mile section from the property to Gila Bend, where it will connect with the Southern Pacific. Work will be started immediately and as soon as the road is completed mill construction will be undertaken.

CALIFORNIA.

Atolia.

The Atolia Mining Co. is completing a pipe line to this place from Randsburg to provide an adequate water supply. The water is obtained from the Consolidated group of mines, where a good flow has been developed. Hitherto, all water used in Atolia has been brought in tank cars over the Santa Fe. The company has largely increased its working force and is maintaining a heavy output of high-grade tungsten, which occurs in the form of scheelite.

Discoveries of high-grade scheelite have been made on the Osdick, Scheelite and other properties in the past month. Near the Baltic mine lessees are opening good ore and saving concentrates with old-style dry-washing machines. One lease on the Osdick group has uncovered an 8-ft. vein of good ore 30 ft. above bedrock. Since the sharp advance in price of tungsten the population of this camp has increased from about 60 to over 300.

Randsburg.

Operations at the Yellow Aster are proceeding, with much new ground recently brought within the productive zone; 300 tons are milled daily, with the greater portion of the 130-stamp plant in operation. New equipment has been installed, designed to facilitate development of new territory. About 200 men are employed. Gross earnings in the 8 months ending Aug. 30 were \$305,584, netting \$106,516. Dividends absorbed \$11,000.

Redding.

M. E. Dittmar and Albert Hanford have completed a deal for the Green Horn mine, at Tower House, for \$100,000, the full price to be paid on or before May 1, 1917. The property lies in the East Side section of the Shasta copper field, and shipments of high-grade ore are being made to the Mammoth smelter at Kennett. The new lower tunnel has intersected a wide vein of ore averaging over 8% copper.

It is rumored a merger of the Balaklala, Trinity and other copper properties is being considered by Thomas W. Lawson of Boston and associates. It is said the deal may involve the Bully Hill, Sugar Loaf and other well-known mines. The Balaklala and Trinity adjoin and both have been extensively developed by tunnels and drifts. The Bully Hill group lies about 25 miles from the Balaklala smelter and has been opened to an approximate depth of 1000 ft. by shafts. No work has been done at the Bully Hill or Trinity mines for several years.

Jackson.

The Kennedy Mining Co. has started sinking a new shaft at the Zeila mine to open the ore bodies tapped by long drifts from the old workings. The Zeila was recently bought after a thorough examination and sampling. Large quantities of low-grade ore exposed in the old workings and it is understood an attempt will be made to treat this material with flotation. The Kennedy mine continues to maintain its usual heavy yield, with 100 stamps falling.

Callahan.

A compressor and power drills have been installed at the Trail Creek mine and driving of a lower tunnel commenced. In the upper workings good ore has been developed, and the new work is designed to open the vein over 300 ft. below present levels. Eastern capital is interested. George A. Foster is superintendent.

A 6-ft. vein of good ore has been encountered in the Sugar Hill mine, on Fox creek. Accompanying the milling

quartz is a shoot of high grade. Late work has also tapped the ancient river channel and preparations are being made for extensive gravel mining with the arrival of the rainy season.

Sierra City.

The Keystone mine has been taken under lease by George M. Biglow and Clarence J. Simmons, and sampling of the ore bodies commenced. As soon as this work is completed mining will begin. Fair-grade ore is exposed at several points, but the lessees are principally interested in developing high-grade quartz, of which numerous shoots have been worked in the past history of the property.

The shaft at the Bald Mountain Extension gravel mine has gained a depth of 140 ft. and is advancing through a bed of lava sand believed to overlie the gravel. Progress has been slow before entering the sand, as the shaft was sent down through hard lava mingled with boulders. The dry weather is aiding work and the management hopes to be able to start production before snow flies.

Downieville.

Slow but sure development is being accomplished at the Alhambra quartz mine in Jim Crow canyon by Richardson, Rixey & Spordli. A drift of 80 ft. on the pay shoot is keeping the Sears mill supplied day and night to full capacity, with no indication of diminishing.

All outside work has been completed by Deal & Dills at their Rattlesnake gravel property, and breasting is in progress, with returns of \$4 gold, per carload. The main drift has been run to a length to allow of breasting for some months to come.

Nichols & Sherke are working the Lonesome Pine quartz claim under bond, and have found good prospects in free gold in a 25-ft. shaft and in the crosscut. This claim was formerly known as the Dolly Varden, from which rich pockets were taken out some years ago.

At the Mount Alta gravel mine, near Sleightville house, the main tunnel is being kept 300 ft. ahead of breasts, and gravel is paying well. The present crew of 10 will be enlarged when water supply increases for washing. E. Sutro of San Francisco is interested with Supt. Chatfield in the operation of the property.

Parker.

There is much mining activity in the vicinity of Parker at this time, the activities extending to both the Arizona and California sides of the Colorado river. On the California side, in Riverside county, the most notable development is on the Bendigo Mines Co. property, formerly known as the Morgan & Bradley group. The Bendigo Co. purchased the property in January, 1915, and during the summer kept a small force of men busy on development work. Several cars of copper-gold ore were shipped to the Hayden smelter, giving returns of about \$50 per ton. Manager J. E. Meyer has gone to the property and is making preparations to start an active campaign during the winter, both developing and shipping ore. It is his intention to ship 2 carloads per month as soon as he puts a full crew to work, aside from development work. The property is operated through an incline shaft 150 ft. in depth, equipped with gasoline hoist. A vertical winze from the foot of the shaft is down 60 ft. and has opened 3 ft. of ore breaking about \$100 per ton. An upraise will be made from the top of this winze to the surface, making a vertical working shaft, and as lateral work is conducted from the station cut at the foot of the winze, the shaft will be sent deeper. More than \$75,000 has been taken from a small block of ground about 150 ft. vertical depth and with no lateral extending more than 50 ft. from the shaft. Part of the property contains a deposit of gypsum which is 90% pure and is estimated at 1,600,000 tons, and negotiations are now in progress for the shipment of 250,000 tons of this material within the next 2 years on contract. This will necessitate the construction of a spur from the Santa Fe railroad from Vidal to the mine, a distance of 7 miles. This will decrease the present expense of handling ore from the mine by about \$4 per ton, beside affording an outlet for the huge gypsum tonnage.

Brumbaugh and Wilson are constructing a small custom mill on the Colorado river, 7 miles from Vidal. A 5-ft. Huntington mill is being erected to crush ores, and amalgamation

and concentration processes will be used in recovery of values. A small cyanide plant may be erected later. The mill will be ready for operation by Nov. 15. Brumbaugh and Wilson are developing some good gold ore on their property, nearby, and the mill will prove a boon to other miners in that district who are developing prospects.

Among others on the California side of the river, near Parker, are Joseph Hull, Burke Bros. and B. L. Vaughan, who are developing likely prospects, and all of whom have sent small shipments of ore to smelter. Development is also in progress on the Texas, Buckeye and Neptune properties, all of which are showing some shipping ore as well as mill-grade in comparatively shallow development work.

COLORADO.

Cripple Creek.

The Gold Bond Mining & Development Co., whose shareholders have taken over the Hummer bond and lease, and are reported to hold a controlling interest in the Gold Bond Con. Mines Co., will shortly commence construction work on a large concentrating plant, to be erected on the Gold Bond estate on the southwestern slope of Gold hill.

Leasers on Gold Dollar made a shipment of 30 tons last week, receiving \$44.20 per ton.

A new vein for the complicated Revenue vein system of the Golden Cycle mine has been cut on the 800-ft. level of the main shaft on the Barnard lease, and the core of the vein 20 ins. wide, rich with rusty gold, carried high values. The vein proper, measuring from 6 to 7 ft. between walls, with the core eliminated, will, it is estimated, ship from \$25 to \$30 to the ton.

The Moose mine on the southwestern slope of Raven hill, adjoining the Cresson property, is undergoing examination by Thomas Kavanaugh, the well-known hill operator, who has under consideration the active operation of the mine under lease with bond to purchase.

At a special meeting of the stockholders of the Gold Sovereign Mining & Tunneling Co., held the first of the week at the offices of the company in the Burns building at Colorado Springs, to consider and vote upon the extension of the charter, that would have expired by limitation this month, 1,250,000 shares of the total issue of 1,800,000 shares, were represented. The vote was unanimous in favor of the extension and the charter will accordingly be renewed by the secretary of state. The property of the company on Bull hill is active under lease to the Union Leasing Co., and a rich strike was recently made at the 1300-ft., or deepest level of the mine.

The Cripple Creek Deep Leasing Co., operating the Jerry Johnson Mining Co.'s Ironclad hill, has made its initial shipment from the 850-ft. level of the Jerry Johnson main shaft, and has another shipment almost ready.

The C. K. & N. mine on Beacon hill, owned by the C. K. & N. Mining Co., with two sets of lessees active in the 3d and 5th levels, is making steady production of milling grade ore, while the development gives promise of opening up another of the rich shoots that made the property famous as a producer of high-grade ore. Last week 5 cars of ore containing about 135 tons of ore, were consigned to the valley for treatment and 2 cars left the mine during the week. At this rate the October production will approximate 550 tons. The C. K. & N. Co. exacts a straight royalty from its lessees, and operates the mine plant while prosecuting development work in the levels and on blocks reserved for operation on company account. K. Macdermid, general manager of the company, is now in the district and will spend the week at the property. The C. K. & N. mine to date has produced in excess of \$1,350,000, although containing but 5.27 acres.

Rico.

Hay and Herron, lessees on the Hiawatha vein in Group tunnel, are producing some very rich silver ore.

The Resolute Mining Co. has placed a large amount of

"Unit" and "Content" Prices of Tungsten and Other Rare Minerals.

By W. M. FOOTE.*

The spectacular war-time advances in tungsten, antimony and others of the unusual or rare ores, along with zinc and many commoner ones, are familiar to all. Not merely new capital has been attracted, but novices in prospecting and production are numerous, so that miners, investors and some intending buyers frequently puzzle over the simple terminology of values employed in settlements. Briefly there are the two following systems, or rather two ways of stating the same operation. The prices here used are in no sense market quotations.

The Unit System.

The well-known tungsten prices will serve as an example. A common form of unit price (A) is: "\$40 per unit WO_3 per net ton of ore guaranteed to contain 50% or better WO_3 (meaning tungstic oxide, tungstic trioxide or tungstic acid) with bonus or penalty of 20 cts. per unit for each unit over or under 50%." This is sometimes cabled briefly, "\$40 unit 50% ore bonus or penalty 20 cts. unit." The word unit as used in this case is synonymous with percent.

Suppose (1) 5700 lbs. ore delivered contains just 50% (50 units) WO_3 . Then \$40 multiplied by 50 (units) equals \$2000 for one net ton (2000 lbs.); or 1 lb. costs \$1, making 5700 lbs. cost \$5700. Suppose (2) under the same offer ore is delivered containing 65.5% WO_3 . Here the bonus applies on 15.5%, excess above the standard 50%. Thus 20 cts. multiplied by 15.5 (units) equals \$3.10 bonus to be added to the standard unit price of \$40, making a total unit price of \$43.10. Then \$43.10 multiplied by 65.5 (units) equals \$2823.05 for 2000 lbs. or 1 lb. costs \$1.411525, making 5700 lbs. cost \$8045.69.

A rarer though more precise form of stating the (A) quotation prevails in some fields, thus (B) \$40 per unit of 20 lbs. of WO_3 per net ton of ore, etc. Here the unit is doubly explained, because 1% (one unit) of 2000 lbs. is 20 lbs. The bonus and penalty is fairly common, though far from universal. While more equitable, it has the disadvantage of complicating the contract.

The Content System.

This is a simpler way of quoting. Thus (C). For molybdenite: 75 cts. per pound of MoS_2 contained in concentrates 90% or better MoS_2 (molybdenum sulphide). Suppose (3) 10 net tons of 93% concentrates are delivered; 93% of 20,000 lbs. is 18,600 lbs. MoS_2 . Then 75 cts. (per lb.) multiplied by 18,600 (lbs.) equals \$13,950 for the 20,000 lbs. concentrates.

Some offers prefix the MoS_2 with 100% or pure. Or it may be cabled simply, "75 cts. lb. molybdenum sulphide."

Frequently the price is stated in terms of the element or the metal contained, rather than the oxide, sulphide or other valuable compound. Thus an antimony quotation might read "20 cts. per pound of metallic antimony contained."

The Flat Price.

This simplest of all quotations in most cases involves a minimum and sometimes a maximum per-

*Of the Foote Mineral Co., Philadelphia.

centage guarantee. Thus: "Manganese oxide guaranteed over 70% MnO_2 and under 5% Fe_2O_3 at \$40 per net ton."

Assaying Costs.

The assayers' certificate of weighing, sampling and analysis usually costs but a fraction of 1% of the transaction. There is no legal or trade rule as to the buyer or seller bearing the cost; generally they share it by mutual agreement.

Tungsten Industry and Production in 1915.

The production of tungsten ores in the United States during 1915 broke the record and was apparently equivalent to about 2165 short tons of concentrates, carrying 60% of tungsten trioxide (WO_3), and was valued at more than \$2,000,000. These figures are based on preliminary returns to the U. S. Geological Survey. The largest previous output of tungsten ore was in 1910, when 1821 tons was produced.

Conditions and prices in the tungsten market were unsettled and somewhat anomalous. Although the price in the latter part of 1914 was \$9 or more a unit, 60% ore was sold in the early part of 1915 as low as \$5.80 a unit, so that tungsten mining did not start very briskly. Early in the summer, however, floods of orders for munitions of war caused a great demand for high-speed steels, to be used in cutting shells, rifle barrels, etc.; an embargo was declared by the British government on the export of tungsten ores from any part of the British possessions, and there was soon a country-wide scramble for tungsten ores. Probably no one foresaw the height to which the price of tungsten would rise, and some operators contracted for ores at prices which in ordinary years would be high, but which were soon exceeded by several hundred percent. Tungsten metal was also contracted for at prices much below those afterward reached. In the fall the prices of tungsten reached unheard-of heights; \$48 per unit was paid for numerous lots, \$50 for some, and even higher prices were reported. The prices moved upward so rapidly and unexpectedly that strenuous tungsten prospecting did not follow at once, but early in the fall a large number of men were in the field looking for deposits.

The output of the Boulder (Colorado) field was for various reasons not increased as had been hoped. Many properties had been worked by leasing, so that there was no development of ore bodies, for the ore had been removed as fast as it was exposed, and it is reported that in the Conger mine, whose shaft was sunk below the 800-ft. level, ore development was disappointing. The output of the district was estimated by the Boulder County Metal Miners' Association as equivalent to 960 tons of 60% concentrates.

In the Atolia (California) field there were great developments. The Atolia Mining Co. is reported to have employed more than 300 men, and many men worked the desert sands in the vicinity for float scheelite. P. J. Osdick discovered rich ore east of the Atolia Mining Co.'s property and made large profits. On and near the Baltic claim a number of men worked the gravel of a shallow gulch for scheelite and the sands on the Sunshine and other claims are also reported to have been worked at a profit. Several gold mines also produced some scheelite. The Consolidated Gold Mines, in Randsburg, had found water at a depth of about 500 ft. and this has been piped to the Atolia Mining Co.'s mill, about 5 miles distant. Formerly water was hauled on the railroad for a distance of

(missing)

for treatment of the complex ores. The Globe Con., at Dedrick, produced heavily, and was examined toward the end of the year by the Crown Reserve Co. of Cobalt, Canada, with a view to its acquisition. The Bullychoop mine, near Bullychoop, was reopened by San Francisco capitalists. The Trinity Asbestos Co. erected a crushing plant at its mines near Cinnabar, and partly completed a highway from the property to Castello. Developments in the mine were stated to be satisfactory and a few small shipments were made. The Marysville Dredging Co. bonded large areas of placer ground in the vicinity of Junction City, and prospected the ground to determine its value for dredge mining. The Trinity Gold Dredging Co. kept its Lewiston dredge in steady service and prospected extensive areas along Coffee creek and Trinity river. The Alta Bert dredge, at Trinity Center, continued to work profitable territory. The Trinity Development Co. drilled extensive territory along the Trinity in expectation of erecting dredges.

SISKIYOU COUNTY.

The Big Cliff mine, near Etna Mills, was purchased by the Big Cliff Mining Co., of Seattle, for \$85,000, and much important work begun. A large sawmill was erected and orders placed for a reduction plant. A good tonnage of profitable ore was exposed. The McKeen mine, at Callahan, was taken over by Los Angeles people and a mill installed. The Victory group, near Etna Mills, was equipped with milling facilities. Rich discoveries were reported from the Gold Run, Oom Paul, Thanksgiving and numerous small properties. The Siskiyou syndicate started building of a mill to treat ores from the Blue Jeans and Cub Bear. In the Yreka district good ore came from the Homestake, Black Bear, Highland, and several others. The Klamath River Dredging Co. secured the Barton-Quigley placers at Oak Bar and built a dredge specially designed to work difficult ground. The Siskiyou Dredging Co. operated steadily at Fort Jones, and a remodeled Oroville dredge was installed on Greenhorn creek, near Yreka, by the El Oro Dredging Co. A rich placer strike was reported near Happy Camp, and considerable activity followed. Copper mining was generally quiet, but near Happy Camp good ore was developed. The Elk Copper mine, in the Etna field, was bonded to New York people and arrangements made for extensive work. Discoveries of manganese were reported from several points, but these strikes were generally made late in the year, and winter prevented developments.

KERN COUNTY.

Kern remained at the head of the southern counties of California in production of gold, and ranked first in petroleum. Its enormous petroleum yield places it at the head of all California counties in value of mineral output. Despite the heavy decline in output of petroleum, due largely to restricted markets during the year, its mineral output for 1915 approximated \$24,000,000. A few gushers were brought in, but none compared with the tremendous wells developed in the early days of the Midway field. Drilling was largely curtailed, but the closing weeks of the year brought about a change for the better, and unless Federal legislation interferes, the coming year is expected to prove a highly satisfactory period.

The Randsburg district continues the main source of the gold output. Several improvements were made to the equipment of the Yellow Aster, the leading producer, and a heavy output continued, the daily tonnage milled averaging 300 tons; 200 men were employed regularly. Good ore was shipped from the Sunshine and other small producers. Rich strikes were reported from the Johnnie, Sunshine, Crazy Horse and other mines in the district. The Amalie district was quite active, with several small properties dividing attention. The Woody copper mine, at Woody, was worked and preparations made for installation of equipment to treat the ores.

INYO COUNTY.

Bishop-Keeler Districts.

The Bishop Creek Gold Co. operated its mill part time and treated 50 tons of ore per day. Several improvements were made, and plans considered for installation of flota-

tion machines to increase the gold extraction. The Keeler Wonder was taken over by the Frances-Mohawk Mining & Leasing Co., of Goldfield, Nev., and the mill placed in commission. The mill at the Skidoo Con. was improved and a heating plant provided to keep the works in good winter condition. The Cerro Gordo Co. completed a tramway from the property to Keeler capable of handling 15 tons per hour. Arrangements were also made for the building of a transmission line to the mine for delivery of electric power. Mine developments were highly satisfactory, the property making a record shipment of high-grade zinc ores, and also shipping large quantities of silver-lead ore. The company took over the mine, which has been operated by a leasing company for some years, and prosecuted work with increased energy. Considerable equipment was installed at the mine, and operating costs materially lowered. The Cerro Gordo is credited with being the leading silver-lead producer, and second in output of zinc in the state. Some gold was also produced.

Other Districts.

The Lietow Con. Mines Co. started active work on its property near Crucero and developed good ore. A mill site was laid out and preparations made for a plant. Work was carried on at several properties in the Ubehebe field, and small shipments made to Bonnie Clare by means of motor trucks. The ores contain silver, lead and copper.

PLACER COUNTY.

Developments in the Colfax and Forest Hill sections were attended with good results. The Excelsior Mining Co., composed of eastern investors, installed a 9-stamp mill at the Excelsior mine, near Forest Hill, and operated along profitable lines. Good grade gravel was also mined. The Big Oak and Rising Star mines passed into new hands and received much attention. At Westville, the Barton mine was operated on a broad scale by the Hermine Operating Co., of Pittsburg, Pa. Good ore was opened in the lower workings and the 30-stamp mill placed in action. Numerous small producers were worked in the Auburn, Ophir, Iowa Hill and other districts.

The Pacific Gold Dredging Co. operated steadily near Auburn and took under option new areas. The El Dorado Placer interests worked the rich bars in the vicinity of Auburn. Engineers said to represent Natomas Con. and the Guggenheims examined several promising placer areas and the outlook is considered favorable for extension of the dredging field.

EL DORADO COUNTY.

Reopening of old mines was a feature of the year. The Georgia Slide, at Georgetown, passed into the hands of San Francisco people, and development of new ground was energetically conducted. New equipment was installed and preparations made for extensive work in the ensuing year. The Stillwagon, Mt. Pleasant, Burton, Grizzly Flat, and numerous other mines changed hands. With the exception of Tuolumne, El Dorado probably exceeded all other California counties in the number of mining deals for the year. The Rising Hope gravel mine began a heavy output after 5 years of development. The Guilford maintained a good output of excellent quartz. The Webber Creek Mining Co. acquired extensive areas of placer ground near Cold Springs and installed considerable equipment.

OTHER COUNTIES.

Mariposa, Imperial and a few other counties made a fair gold output, but the yield was divided among a large number of small properties. It was stated in the closing months of the year a deal was being negotiated for sale of the Mariposa group, near Mariposa, to eastern people. The property is considered of exceptional merit and formerly produced well and paid large dividends. In Modoc county the High Grade district continued to claim interest. The Modoc Mines Co., of Chicago, sunk a new shaft, opened good ore on the 200-level, and announced plans for a custom mill. The company also constructed an excellent highway facilitating communications with the outside world practically throughout the year. Good ore was mined in the Sunshine

During the last quarter of the year work was pushed to open out the south drift on the 1400 and to sink and drift on the 1500, which workings are now far advanced and breaking into excellent ore, which is proving the theory of the management, the real ore bodies of the Coalition will eventually be found to the south in the deeper levels. New equipment now working gives every facility for extensive development work, at the same time affording more economical means of extracting the ore. Everything points to great prosperity for Coalition during 1916.

The Nevada Packard Mines Co., in the Rochester district and two miles south of Rochester Mines, has also during the past year been developed into a large low-grade gold-silver proposition. Following its lead the North Packard Extension Co. and the Packard Extension Co. have laid out plans for extensive development work, these concerns constituting a very busy family on the southern end of the Rochester zone.

During 1915 Packard Mines built a \$65,000 cyanide mill and carried on hundreds of feet of underground development. The ore from the mine is handled through the lower D tunnel direct to the crushing mill, which is connected with the reduction plant by automatic belt conveyors. The mill, which began operations Dec. 1, had an estimated capacity of 100 tons, but this has been increased 10%. The company claims enough ore in sight to keep the mill running 3 years.

Another large property that is being developed rapidly

and at the same time is making monthly bullion shipments is the Lincoln Hill Milling & Mining Co. on Lincoln hill in the Rochester district. It is a free-milling gold proposition and the bullion shipments average about \$5000 a month.

In the Seven Troughs district, in addition to the Coalition, the Delaware Mining Co. of Vernon is putting ore through the old Darby mill and shipping between \$5000 and \$6000 in bullion every month. The Hahn & Snyder lease on the Signal Peak property at Seven Troughs is running a small stamp mill with a production ranging from \$1500 to \$2000 a month, while a number of leasers are shipping ore from the Fairview property of the Seven Troughs Mining Co.

On account of high war prices the search for antimony has redoubled throughout northern Nevada, and a number of important deposits have been discovered. During the past few months the shipments from Humboldt county alone have jumped from nothing to more than \$50,000.

A 50-ton tungsten plant erected at Toy, 18 miles southwest of Lovelock by the Atkins-Kroll combination of California, began operations late in the fall, and is now sending out concentrates. The mill is on the edge of the Humboldt sink, 2½ miles from the mine, and the water is secured by pumping. The mine is declared to contain big tungsten deposits.

A recent discovery of copper in the Muttelberry range, 12 miles east of Lovelock, is announced, which, from preliminary survey, promises to add another great low-grade copper mine to the wealth of Nevada. A company is now being organized to open up this property.

Washington

By L. K. ARMSTRONG

The total production in Washington of the five principal minerals, i. e., copper, gold, lead, silver and zinc, was less than for the previous year, and yet, there were indisputable signs of not only recovery but a general better tone than has ever prevailed in the metal mining districts of the state. The counties of Okanogan, Ferry and Stevens especially reflected this condition.

The completion and operation of the Okanogan branch of the Great Northern railway from Wenatchee, on the main line, to Oroville, at the extreme north end of the county, and on the Spokane & Northern division of the Great Northern system, has given the miners of Okanogan county an opportunity to ship their ores, either to Tacoma or to any one of the three smelters in southern British Columbia, stimulation extending to properties producing gold by local treatment. The Arlington mine in old Ruby camp was an example, fairly constant shipments having been made of a high-grade mixed sulphide ore carrying in addition to lead and copper, gold and silver values. More energetic development and sinking to deeper levels promise to make this a constant shipper some time to come.

As a result of this operation and the high-grade tenure of the ore, other properties in the same camp are resuming operations, with a view to early shipments. In this class is the Rock Con. group of some 20 claims.

Around Palmer mountain small operators were fairly busy the close of the year, the Ivanhoe mine being one of the best. With its small stamp mill operated on a fairly high-grade ore, Oroville section made no notable gains or discoveries, but satisfactory progress was noted at the year end. In gold mining operations continued with a view to production.

Some of the Ferry county mines have been taken over by the smelters and several of the Republic properties so controlled have been constant shippers for some months. From this camp weekly shipments up to 1350 tons have been made, and the average was probably between 600 and 800 tons per week. Local milling operations practically ceased for the time being, but there is no doubt but what cheap power and better methods will result in considerable activity in the future. A moderately large plant, with up-to-date machinery and energetic, efficient management, will cause a permanent revival when installed.

Leases were able to make money by extracting and shipping the Republic ores to the smelters, but probably at

the expense of development, and by shipping only the higher grades of ore.

Notice that the Spokane & British Columbia railway will be extended from Republic to Spokane, when the Colville reservation is opened, has stimulated development in southern Ferry county, around Keller especially, where there are deposits of lead, silver, gold and copper ores, and one especially attractive nickel deposit. Near the end of the year parties controlling the Malm patents for ore reduction and metals recovery obtained possession of the machinery and other assets of the Keller smelter, which will be overhauled and changed to meet the requirements incident to the operation of the process.

In Stevens county there were three principal centers of activity. At Chewelah the United Copper continued production under somewhat unfavorable conditions. Adding to the milling capacity of the mine until a total of 74 stamps were in operation, installing a flotation plant to handle the slimes and fine product were completed in the face of a power shortage. At the end of the year an Oliver filter was ordered, so that within a few weeks at most a dewatered product will be going out. As it was, the grade of all products shipped was raised, and with higher prices for copper and silver, the mine has shown an increasing net profit, insuring early dividends. The mine is said to be in condition to make a long sustained production from reserves already created, and the word has gone out that sinking will soon be continued to the 2000-ft. level.

Other properties developing in the camp should be noted, especially the Security and Hecla, both of which have been in steady development for more than a year. Security is on the same mineral zone and about 2 miles southerly from the United, has a system of six veins traversing the property, five of which are of unusual width where crosscut at or below the surface. All show the usual surface alteration common to the best developed mines of the camp, being thoroughly oxidized and leached at surface, leaving a very siliceous limonite, without other values. Leaching having extended to the 150-ft. level on No. 4 vein, sinking is being continued to deeper levels, the main shaft now being down 170 ft. At 350 ft. a crosscut will be run to the vein and drifting will be extended both to the north and south. At the 500-level it is intended to crosscut all the other veins but No. 1. Ore has been found in the veins of this type at from 150 to 200 ft. in Chewelah camp. A Foos distillate

three veins about 3 ft. wide, which sample about \$10 in gold. Nearer the surface the shaft cut a 6-ft. vein of \$12 ore. A winze is being sunk in the upper tunnel to connect with an up-raise from the lower tunnel. It is in pay ore to a depth of 85 ft.

Endlining the Fairview and Nelson properties on the east is the Lincoln group, a veteran of early territorial days. The Lincoln ledge is a continuation of the Tiger Gold ledge and is being developed under mineral conditions which indicate a long and remunerative period of productivity. The Lincoln has outputted about \$600,000 worth of gold ore. In former years the ore mined had an average value of \$35. It was treated in the 10-stamp mill on the property.

Development of the Fairview group has been centered on the Fairview claim, although sufficient work has been done on others to demonstrate the continuity to the north of the vein and its values. Three distinct veins are exposed in the Fairview ledge—one along the hanging wall, another through the center and a third along the footwall of the deposit. A tunnel has been driven along the center vein for a distance of 225 ft. At the portal the pay streak is 15 ins. wide. In the breast it is 4 ft. wide. A 50-ton shipment sent to the Humboldt smelter gave the following returns: Gold, 1.16 ozs.; silver, 7.4 ozs.; copper, a trace; iron, 24.8%. Picked samples gave returns of \$70 per ton, principally in gold. The bands along the hanging and foot walls of the ledge have an average width of 3 ft. and a gold value of from \$4 to \$20.

Oatman.

"Inability to reach an agreement as to the financial basis on which the merger should be effected," is the official reason given by officers of both the Tom Reed and United Eastern mines why the plans for a consolidation of the two properties, begun some weeks ago, have been abandoned. Both companies are proceeding with development work along original plans, and the Eastern is beginning foundation work for its proposed 200-ton mill.

Operations at the Big Jim, where a 46-ft. ledge running \$7.44 was encountered on the 400-level, are being hampered this week at the 450-level because of a heavy inflow of water. Shaft sinking has been temporarily halted, pending the installation of pumps and the bringing in of electric power. Work of sinking to the 600-level is to be resumed soon as possible.

Great activity was displayed this week by the stock of the Ivanhoe Con., owned by the same interests controlling the Big Jim. An average of 35,000 shares a day changing hands on the coast exchanges at prices ranging from 17 up to 23 cts., following the encountering of high-grade ore at grassroots on the Nancy Lee vein, and the excellent prospects found in the bottom of the main shaft, now down to the 400-level, where stringers have been cut running high in gold values.

At the Casey Jones, foundations have been completed for the boiler and compressor expected to arrive within the next fortnight. Spar and quartz in the bottom of the shaft, now down 40 ft., run \$2.86 per ton. At the Jerome-Oatman, a depth of 5 ft. a day is being made in sinking the main shaft, now down 270 ft. The Fessenden has just installed a 3-drill compressor. Black Range has conquered the heavy inflow of water with pumps and is proceeding with the crosscut.

Kingman.

The old Hackberry mine, now known as the Sunshine, which is credited with a production in its infancy of \$2,000,000 worth of high grade silver ore, is soon again to enter the list of active properties in the Peacock district 26 miles northwest of Kingman. It has been taken over on a lease and bond by Philip Wiseman and L. W. Wickes, of Los Angeles, from W. B. Ridenour, who located it Oct. 10, 1874. In the early days an incline shaft was sunk on the vein 500 ft., giving a vertical depth of 364 ft., at which depth such a heavy flow of water was struck that it was impossible to continue work. Prior to the suspension of the early day operations in the mine practically all ore above the water level, to almost the surface, was stoped out, averaging in width about 2½ ft., and in value around 200 ozs. in silver in addition to lead and zinc in small proportions. A mill was erected, but it was destroyed by fire many years ago. In recent years a vertical shaft was sunk to the water level, at which point work was suspended after only a small amount of new exploratory work had been

performed. The mine has since filled with water up to a point 110 ft. below the collar of the new shaft, which is equipped with a 22-hp. gasoline hoist. With a force of miners working three shifts, the present operators will pump out the water and make a thorough examination, after which they will decide upon their plan of future development. In addition to the Hackberry, Wiseman and Wickes have obtained a lease and bond from W. K. Ridenour, on the South Hackberry property, adjoining on the south. The two properties will be operated as one, since they are traversed by the same vein.

CALIFORNIA.

Mokelumne Hill.

J. J. McSorley and associates of this place have taken under bond the Alma quartz mine near Jackson. The property has been idle many years; it contains good ore and is considered valuable. It is planned to form a new company and start work in the early spring.

Gravel mining in this section is quite active. The Stockton Ridge Co. is making a good output and opening excellent ground. The Rough Diamond, Safe Deposit, Emerson, Curnow and other claims are producing. At Chili Gulch work is proceeding on the What Cheer and Brewster claims. Late rains have provided abundant water and the outlook is bright for a prosperous season.

Angels Camp.

Milling has been resumed at the South Carolina on Carson hill. The mine has been idle since last August, but all difficulties have been overcome and sufficient ore is blocked out to insure a long mill run.

Sutter Creek.

Eastern capitalists have made an offer to local stockholders for control of the Wildman-Mahoney-Lincoln group, and indications are considered favorable for resumption of mining in the spring. The Wildman has been developed by two shafts, an incline of 1400 ft. and a vertical 600 ft. deep. The Mahoney shaft is 1200 ft. deep, and the Lincoln has been opened to a depth of 2000 ft. A promising ore body was encountered in the lower workings of the Wildman a short time before the operating company lost the mine because of financial troubles. Mills containing 80 stamps are on the Wildman-Mahoney ground. Much equipment will be required to place the group in shape for mining. The group is credited with a total gold output of \$5,000,000.

An examination of the upper workings of the Eureka mine has been concluded by T. Walker Beam and J. D. Gilchrist of Denver, representing the eastern interests recently acquiring the property. It is understood plans have been perfected for initial work, and that unwatering of the lower levels will commence shortly.

Yreka.

A movement has been launched to construct a railroad from Boise, Idaho, to Eureka, which would facilitate operation of the Blue Ledge copper group, in the extreme northern section of Siskiyou county, and numerous gold and copper properties along the route. Representatives of Humboldt and Siskiyou counties, this state, and Jackson county, Oregon, are to meet in Yreka Feb. 18 to form an organization to assist in construction of the proposed line. As soon as construction of the road is assured Blue Ledge Copper Co. will resume operations, according to reliable advices. The group has been comprehensively developed and contains an immense tonnage of copper ore, with the gold and silver content approximating \$2 per ton. It is owned by New York people.

Atolia.

Production of tungsten in this district has been temporarily stopped by the burning of the new concentrating plant, which was turning out about 100 tons of tungsten concentrates daily. About 400 men are idle as a result, and it will require 40 days to reconstruct the plant. The fire is said to have been caused by back-firing of the gasoline engine in the hoisting room. Late developments in the Atolia group have been exceedingly satisfactory. In the Churchill mine high-grade product has been opened and a heavy output was going to the concentrator from this property prior to the fire.

Several leasing companies are working good ground adjoining the Atolia holdings.

Three miles west of the Rand mountains, toward Kane Springs, a new and apparently rich tungsten deposit has been discovered. It strikes east and west and consists of scheelite. A stampede is on, and claims are being located for miles in all directions from the original holdings. Buyers of high-grade tungsten are numerous in the Atolia district and \$1 to \$4 per pound is being paid for ore. High-grading is prevalent, and the companies are experiencing much trouble in preventing theft of the richer ores. New camps are springing up and the ore-bearing area promises to encompass 130 to 160 sq. miles of San Bernardino and Kern counties. Atolia now contains over 600 people.

Randsburg.

At the late meeting of the directors of the Yellow Aster Mining Co. Albert Anchor was elected president; E. D. Mooeres, vice-president; R. L. Burcham, secretary; Carl H. Fry, superintendent. W. J. Cotton continues as managing director. Mine conditions continue highly satisfactory, with a large tonnage of profitable ore available. Monthly dividends continue to be disbursed.

Redding.

El Oro Dredging Co. has taken under bond 400 acres of placer ground along the Sacramento river, east of Redding, and has started testing the deposit with a Keystone drill. Preliminary prospecting proved encouraging. The company is operating at Yreka and Jenny Lind with good results. On Greenhorn creek, near Yreka, the company is working difficult ground containing numerous boulders. At some points the bedrock is so close to surface it is necessary to cut it away to enable the dredge to float. The dredge has been in commission 16 months and has turned over 994,742 cu. yds. of gravel. Sufficient ground is available to insure operation for 4 years. L. M. Parke is general manager.

Coffee.

The Golden Jubilee Mining Co. has started driving of a long tunnel to explore the ore bodies at an approximate depth of 900 ft. below present workings. This is the deepest work ever undertaken in the district and is expected to determine whether or not the ore bodies persist to depth. Equipment for the new mill has been ordered and its installation will start as soon as the roads are in good shape.

Grass Valley.

The Brunswick Con. is again producing at full capacity after an idleness of several weeks, the result of shutting off of the water by fierce storms, and damage to the motor operating the main pump. Mine developments continue highly satisfactory, and it is understood the late trouble will not interfere with dividend disbursements.

Unwatering of the Union mine, on Banner mountain, has been resumed. The property is under option to D. W. Shanks and associates, and will be worked if the ore in the lower levels fulfill expectations. It was formerly a yielder of much rich free-milling quartz.

Spenceville.

The Mineral Hill mining district is experiencing a substantial revival as the result of work done during the past 2 years by the Queen Regent Merger Mines Co. of San Francisco. The company will have a smelting plant in operation this month to treat its ore at the mine. A percentage of the profits applies on the purchase price until the plant is paid for in full, whereupon it will be taken over and operated by the company. The engineer of the parties interested in the deal reported sufficient high-grade ore already developed to pay for the plant in 90 days' operations, as the ore approximately averages in copper, gold and silver \$50 per ton. The active operations of these mines has aroused much interest in the district and properties have changed hands on which active development will be started at once.

COLORADO.

Cripple Creek.

A flotation mill of not less than 1000 tons daily capacity for this district is proposed by the Vindicator Con. Gold Min-

ing Co., as outlined by Vice-President and General Manager Irving T. Snyder, in the annual report mailed stockholders with the January dividend checks. Consulting engineers of the company have recommended the remodeling of the Golden Cycle concentrating plant, now obsolete, into a flotation unit of 300 tons daily capacity. This unit will be sufficient to treat all reject material from the mine and at the same time permit of experimental tests on all grades of ore from both the Vindicator and Golden Cycle shafts. "The cost," as embodied in the report of the general manager, "will not be great," as the old building and part of the machinery can be utilized. With the plant remodeled, the company will first determine the best and most economic process to use on its ores, and will then proceed with the plans for "a large and thoroughly modern flotation mill of not less than 1000 tons daily capacity." The cost of such a plant, it is explained, will not exceed \$200,000, while a cyanide mill of similar capacity would cost more than \$750,000. The extraction from low-grade ores, it is claimed, will be 90% of the value, at a cost of less than \$1 a ton.

The rich ore body in the Isabella has now been drifted on for a distance of 12 ft. and the vein matter, as exposed, is both wider and richer. The vein as measured from wall to wall, is now 3½ ft. strong, while samples taken by Supt. Clarke B. Mitchell on the lower one-half of the rich ore, a streak 6 ins. wide, a sample, and not a selected specimen, showed when assayed a gold content of 800 ozs. gold. The mine sample apart from this sample gave values of 71 ozs. gold and 91 ozs. silver, a gross value of \$1572 a ton. Every round drilled to date has shown enhanced values.

The Blue Bell mine and Blue Bell mill site claim adjoining, owned by the Blue Bell Mining, Milling & Prospecting Co., located west of the town of Anaconda, have been secured under a 5-year lease by Walter R. Vidler of Cripple Creek representing Illinois and Canon City investors, who will operate under the corporate name of the Blue Bell Operating & Leasing Co. P. M. Collins has been engaged as superintendent and arrangements for active work have already been made.

With the drainage tunnel at its present objective point near to the Elkton shaft, a crosscut will be extended out to a point directly under the tunnel and connection made by a raise of approximately 175 ft. from the tunnel level. The breast of the tunnel is now about 75 ft. from this point.

Georgetown.

The Georgetown tunnel is drawing near a network of veins on Columbian mountain which produced heavy yields of high-grade ore from surface or shaft workings. There seems to be little question regarding the continuity of the ore shoots of the mountains being explored and in due time the tunnel should become the source of much earning power.

The Capital mine on Griffith mountain is showing more activity than at any time in a year past. While little work is being performed on company account, outside of driving the Kane adit, the various lessees are maintaining a steady production and a good earning is resulting in a majority of instances.

The LeMaster lease on the west drift of the Aetna vein has proved a large revenue earner for the last year and a heavier earning than heretofore is now resulting.

The Harper lease is again producing a good grade of ore, values running around \$60 a ton being received in settlement upon the first-class product.

Excellent headway is being made in the advance of the Kane adit and the heading is now nearing that point where sinking will be started to connect with the raise that is to be run from the Capital tunnel level.

It is generally known that a number of mill operators are seriously considering the installation of flotation machinery and in all probability the improvements will be in order early in the coming spring.

Idaho Springs.

The Argo mill, the biggest institution of its kind in Clear Creek county, was brought into commission a few days ago after a temporary close-down of a week to permit of the installation of the flotation process of ore treatment. Provision has been made for the treating of 200 tons of ore

gold. This is the first instance where ore of this character has been found in this county.

The Distoff mine, a high-grade silver property near the Tennessee, has been recently taken over under a lease and bond and will be worked.

The recent heavy storms have materially hampered shipping from this section, but at present extra heavy shipments of ore are being sent from the Tennessee mine, an effort being made to clean up the bins and stopes. Development work in the main shaft and lower levels is proceeding rapidly, every effort being made to take advantage of the present high price of the different metals.

Maynard.

The Arizona Tellurium Mines Co. has elected officers as follows: Thos. H. Condon, president; W. L. MacKay, vice-president and manager; Geo. A. Shay, secretary-treasurer. Work on the No. 1 shaft, suspended because of an inrush of water, has been resumed, the water having been drained through a crosscut tunnel. It will be sent to the 300-level before crosscutting begins.

Union Pass.

The Tyro Gold Mines Co. this week began shaft sinking following the installation of hoist and air compressor. The Thumb Buttes Co. is sinking a 2-compartment vertical shaft to the 500-level. The bottom of the shaft, down 75 ft., is said to be in \$12-ore. The Arabian mine is crosscutting on the 100-level of its 300-ft. shaft. From the surface to the 225-level an ore shoot having a width of 15 ft. has been opened on the hanging-wall side of the vein. On the Dublin property, adjoining the Arabian, a crosscut tunnel has been started to determine the width of the vein. The bore is in 30 ft.

CALIFORNIA.

Bishop.

The Miller-Wichman-Hilton group of placer mines in the Mono Lake district has been taken under bond and option by a company represented by Nott Leete of Reno. Work will commence about May 1, and the first payment is due July 1. The holdings comprise about 1000 acres. The same company has also taken over the Conway group of about 1000 acres. Rich gravel has been worked at several points and water is abundant.

The Daisy group of 21 claims in Opal canyon, 24 miles from Big Pine, is being worked by F. M. Bedell and associates. The group contains several veins of lead-silver-copper-gold ore, lead predominating. Sinking of an 800-ft. shaft has begun, and at a depth of 40 ft. a 16-in. shoot is stated to assay 70% lead and \$7 gold. The Daisy is controlled by the Haverhill Mining Co. of the Coeur d'Alenes district, Idaho.

Quartz.

Installation of new machinery is proceeding rapidly at the Dutch-App mill. Tube mills, concentrators, and other equipment are in position, and the enlarged plant will be ready for action within a few days. Underground work is proceeding steadily. From the Dutch shaft levels are being extended into the App and Sweeney mines, and a large amount of new work is also going on in Dutch territory. Crosscuts and drifts to a total length of 5000 ft. will be extended from three main levels of the Dutch shaft. Sufficient ore is blocked out to keep the enlarged mill running steadily for a long time. W. J. Loring is general manager.

Dedrick.

Extensive work is going on in the Globe Con. mine and the mill is treating 125 tons of \$9 ore daily. Late work in the lower level has been encouraging, and deep explorations have uncovered a large tonnage of fair-grade ore. The mine is now operated by the Globe Con. Lease, Incorporated, a company controlled by the Crown Reserve Co. of Cobalt, Ontario.

Mokelumne Hill.

Easy Bird mine is undergoing extensive development by the International Investment Syndicate of Los Angeles, which holds an option on the property. An electric

power transmission line has been completed to the property and an electric hoist and compressor will be installed within 3 months. New mill equipment is on the ground. Late developments have been satisfactory and a good tonnage of profitable ore is in sight. Herman J. Wendler is superintendent.

Rumsey.

San Francisco people, represented locally by J. T. Lowrey, are preparing to operate the Reed quicksilver mine, and other quicksilver properties, near this place. Work will commence as soon as equipment can be assembled. The Reed formerly produced well, but has been idle several years. The high price of quicksilver has stimulated reopening of numerous old producers in this section of the state.

Trinity Center.

The Trinity Development Co. has made a 5% payment on the purchase price of extensive dredging areas along the Trinity river, and secured a further extension of its options. The payment amounted to about \$50,000. The company holds options on 12 miles of ground along Trinity river and Coffee creek, and has arranged to erect a large dredge. The company is said to have expended \$150,000 in prospecting its holdings.

Jacksonville.

Negotiations are said to be pending for the purchase of the Clio mine from the Ora Mining Co. by a company of eastern people. The Clio lies near the Republican and has been opened by an 800-ft. tunnel and 400-ft. shaft. Equipment includes a 10-stamp mill.

The Republican mill has been thoroughly overhauled and is ready to go into commission. Good ore continues to be opened in the main workings, and preparations are under way for extensive operations on the McDougal claim. The mill and mine equipment will be operated by electricity.

Tuttletown.

The Atlas mine has been provided with transformers and other equipment, and everything is in shape for resumption of milling. The property recently passed into the hands of a strong company, and has been placed in shape for a steady yield. J. Whitney is manager.

Nevada City.

The Blue Tent, Sailor Flat and Bell-McLeon gravel mines have been taken over by J. C. Work and associates of New York and operations will commence about March 15. The mines have been operated extensively in past years and large quantities of gravel extracted. The Blue Tent has been a particularly rich yielder. Drift mining is the method employed.

Grass Valley.

The head offices of the Brunswick Con. Mines Co. have been moved from San Francisco to this city. J. C. Nilon is secretary-treasurer and C. H. Mallen, superintendent. The mill is again operating at full capacity and a heavy tonnage of profitable ore is coming from below the 1200-level.

Greenville.

The Southern Eureka Mining Co. has been organized by Spokane, Wash., people, with a capitalization of \$2,000,000, to operate the Southern Eureka, Hibernia, McClellan and Wardlow mines. The group contains approximately 450 acres of mineral ground, and is traversed by several veins, including the noted Crescent-Indian Valley ledge. Extensive work will start in the spring. Directors of the corporation are George D. Needy, E. F. Yeager, M. A. De Huff, Hal J. Cole and H. R. Van Dreathen, all residents of Spokane.

Sierra City.

Preparations are being made to deepen the shaft of the Monarch Con. to 400 ft. and to later drive a main working tunnel. On the 200-level the ore body is averaging 7 ft. wide and has been opened by the west drift for over 300 ft.; 20 stamps are dropping steadily, and the tailings are being stored for future treatment. A rock crusher and other equipment have been added to the mill. The property is owned by R. G. Gillespie and associates of Pittsburgh, Pa. The same company is developing the Cleveland mine and has sunk the shaft past the 350-ft. point. An Ingersoll-Rand compressor has been installed and sinking is proceeding more rapidly; 40 men

are employed at the Monarch Con. and 25 at the Cleveland. Dan McGonigal is manager of both mines.

Tuolumne.

A 3-ft. vein of rich ore has been encountered in the Star King. The best ore assays \$1500 in gold, and the entire face is of good grade. It was encountered 80 ft. below the 400-ft. level, between walls of limestone and slate. It has widened slightly with further work and is being followed by a winze. Some good ore has been mined in the upper workings, but the late strike is the most important made in the property for many years.

Downieville.

The 180-ft. shaft of the North Fork mine at Forest will be sunk 200 ft. deeper. Some rich ore and arsenical sulphurets have been taken out at various times. Geo. F. Stone is manager and he thinks that by sinking through the shattered veins and rock that the vein will be found in place and confined between the regular walls—porphyry and serpentine.

Sutter Creek.

Unwatering of the lower levels of the Oneida mine is progressing steadily, and opening of the ore bodies at depth from the South Eureka workings will begin in the near future. Work in the South Eureka continues to be attended with good results, and the 80-stamp mill is running at full capacity. As soon as the Oneida ores are available for extraction shipments will be made to the South Eureka mill, the South Eureka Co. owning both mines.

COLORADO.

Cripple Creek.

At the Jerry Johnson main shaft, the Cripple Creek Deep Leasing Co., operating at the 850-ft. level, has ore exposed at three points on 2 veins under development at that level, and the 2 last cars shipped recently are estimated to have carried values of 2 ozs. gold. Four cars of ore loaded out from this lease during January gave returns of about 1 1/4 ozs. gold. In addition to this the Caley lease, from 650-level of main shaft to surface, there have been good finds made. To the east of this Supt. Johnson is prospecting toward the W. P. H. mine. The Cripple Creek Deep Leasing Co. is operating below the 650-level with machine drills and has encountered some \$84 ore and made a few shipments.

Vindicator Con. Gold Mining Co. produced a train load of ore a day, or a total of 440 broad-gauge cars during January. The total tonnage from these mines go to the Golden Cycle mill

Water has been encountered again in the Deep Drainage Tunnel. Supt. Fuller reported water spurting from the drill holes 30 to 40 ft. back in the tunnel, and the water line had risen 4 ins. during the night. The water is now 1/2 in. higher than any previous high water mark and the weir at the portal shows a flow of 15,000 gpm. The flow is coming from the main Elkton basalt dike. A full round could not be drilled because of the water, but one side of the dike was cut about 3 ft. The eastern wall has not been reached and it will take another round of holes before the dike is cut through. Considering their encounters, 284 ft. was good progress to make during January.

Harry Douchev and W. Jones have leased the Hoosier mine of the Grafton Gold Mining Co. It has formerly produced in excess of \$375,000. Work has been commenced underground and two shafts have been sunk, the incline one about 350 ft. and the vertical or main shaft 870 ft. The main shaft has a hoisting plant and compressor. An air line is laid to connect with the power line of the former Western Investment Co.'s line system, now controlled by the Teller County Air Co., and this offers a most satisfactory means of power.

The largest rolls ever brought into Colorado have been ordered for June 1 by the Portland Gold Mining Co. Each set weighs 205,000 lbs., or a total weight of 205 tons for the complete set. The rolls, as specified, will be 70 ins. in diameter and 20 ins. in width. The smallest piece in the mechanism weighs 750 lbs. A 30-ton crane will be necessary to remove

the rolls from the cars to the concrete bases. Grading is well under way at the sampler. The plant will be located near the Independence mine and construction work will soon be started.

Boulder.

On the Buster-Sessell lease there is \$75,000 worth of ore blocked out and the property is in good shipping condition, with a fair output. It has been equipped with electric hoist. A winze has been sunk below the tunnel level, where the body of high-grade ore was opened. Levels have been run a distance of 85 ft. from the winze and a fine block of ground made ready for mining. Manufacturers are buying tungsten at present from independent producers and a sale price of \$45 per unit has been maintained.

At the tungsten property of N. M. Nelson and D. Davidson on Bummer gulch work is progressing on the three claims owned by them. They are again putting on men and it has been said their previous developments have paid at the rate of \$10 per day man.

Telluride.

The Santa Cruz mine, leased to J. Myers and C. Wichmann, has produced a carload of ore for the Durango smelter. There is a continuous small force working and fair lead-copper-silver ore has been produced. A shut down was made during the first part of the month because of some accidents to the electric power lines from San Juan, caused by storms.

The Rio Grande Southern railroad has been blocked between Telluride and Durango since Jan. 27, so that the product of this camp has not been moving rapidly. Some ore has been sent to the smelters to the east and north, the mills are filled to running over and much is stored in cars on the sidings. During January shipments were as follows in the district: Tomboy, 45 cars; Smuggler, 21; Black Bear, 10; Liberty Bell, 11.

Anderson & Lacey Leasing Co. are progressing with preliminary work on the Ballard property. They have run 250 ft. on the Butterfly vein and are driving for a more extensive body further into the hill. There is a raise between No. 1 and No. 2 levels and they can drop their ore and waste down through the raise and handle the dirt cheaper than by tramming.

IDAHO.

Wallace.

The installation of a flotation plant in the Hunter mill is resulting in giving many thousands of dollars to the company which were either lost or remained in the mine because there was no known method of recovering the values. Parallel with the big lead vein there is what is commonly referred to as the spar vein, being a continuous shoot of gray copper ore 600 ft. in length and averaging 2 1/2 or 3 ft. in width, and extending from the upper workings to the lower levels, representing a depth of 1000 ft. or more. It is not uncommon for this ore to carry 1000 ozs. of silver, and the heavy gangue renders it impossible to recover the values by the ordinary methods of concentration. With the first introduction of flotation into the district the management immediately took steps to experiment with the ore. An experimental flotation plant was immediately constructed and the result of the first test produced indisputable evidence that the vexed problem had been solved. A permanent flotation plant was added to the equipment of the Hunter mill and of sufficient capacity to meet all requirements. Now the obstinate ore is yielding its riches and a large asset has been added to the Hunter mine. An idea of what flotation is doing is conveyed by the fact that the product of the flotation plant assays 500 ozs. in silver and 40% lead.

Gilmore.

On the 2nd, Dan Mullen, a leaser in the Silver Dollar claim of the Pittsburgh-Idaho Co., made a strike of very rich gold ore while prospecting a ledge for lead-silver. The ledge is in limestone, 3 to 5 ft. wide, and the ore, decomposed material mainly iron and manganese oxides. Free gold is conspicuous throughout the mass and samples run very high in gold with but an ounce of silver and a trace

1000% Raise in Tungsten Prices in Less than 12 Months.

The Vasco Mining Co., one of the principal ore buying agencies of the Boulder, Colo., tungsten fields, announces an increase of 20 and 20% above the \$45 schedule which has ruled in tungsten settlements for several weeks, according to the *Miner*. This movement was at once met by the Colorado Tungsten Co., with a still larger advance to \$57 the unit for 60% ore, or \$3420 per ton for such ore. The Boulder Tungsten Production Co. through Manager J. G. Clark has a schedule that equals the best prices paid for the higher grade ores and is especially advantageous in the lower-grade milling material which the company is prepared to handle profitably through its modern mill, just put in commission last month.

The Vasco Co. schedule makes a flat premium of 20% on all ores from 10 to 50% tungstic acid content, and 25% upon the higher grades. Ores below 10% are not advanced in this schedule. The Vasco is the buying agency for the Vanadium Steel Co., and it is understood that the parent company has ordered that the local buyers disregard local schedules and buy a quantity of the mineral needed for immediate use in the steel works. Manager McKenna is anxious to establish a standard of prices whereby the big consumers may be able to place their orders with assurance of their fulfillment, and the matter is not so much a question of the advance or depression of price as it is of a fixed market. However the steel works, almost without exception, are unsupplied even for present requirements, and there is no reserve held in any place in the country. This condition naturally makes the market nervous and frequently inducive of such a flurry as that which made the big advance at this time. The fact seems probable that prices must advance to a higher figure before any such desirable stability of market shall prevail. Certain it is that the big agencies have no longer the ability to control the market quotations for the double reason that the buying agencies and milling facilities now are so numerous and the steel and other manufacturers are evidencing an inclination to buy of the independents.

The Primos, as the biggest producer and the agency with the widest scope, has acted as a steadying influence throughout the development of the boom in tungsten. It has led in advancing prices paid to the independent mines and its basis of leasing contracts on its own extensive territory have been liberal and definitely defined in contracts which have enabled it to avoid all friction with its lease operators. One of the most unsatisfactory conditions in the tungsten district has been the discontent which arose from more or less arbitrary policies asserted by the Wolf Tongue Co., in dealing with lessees for ore mined on company property. This matter, it is said, will be adjudicated by the courts and it is hoped that a more definite system of leasing contracts will be a resultant of such action.

The Boulder tungsten boom is the most sound and the biggest thing that has come to Colorado in years and it must be fostered to its fullest fruition.

The prices now quoted are almost 10 times the rates paid one year ago, nearly 1000% gain in a year. The impetus that this has given to mining cannot be appreciated by those who have not visited the district. It is taking proportions as great and as stirring as the great Leadville strikes of years ago or the more recent Cripple Creek boom. The coming summer will undoubtedly witness the re-enactment of the exciting occurrences of the boom days of those two great camps, with however this difference, that there will be more of material substance and less of speculative agitation in this 1916 boom.

The Utilization of Lean Ores.

"In the early history of mining in this country the loss to the world through the waste of ore underground and of half-treated products was enormous," declared Dr. L. D. Ricketts, in a paper on "Improved Mining and Metallurgical Methods as an Aid to Conservation," read before the recent Pan-American Scientific Congress, Washington. "In the conservation of mineral resources it must be remembered that organized investigation and study of mining and metallurgical processes play a tremendously important part, for, if leaner and leaner ores can be brought to the point of commercial use, the life of our mineral industries will be almost indefinitely extended. Also, the so-called waste products, such as slags, tailings, etc., containing some values, now unprofitable, may in turn become exceedingly profitable. They should, therefore, be stored and held for future use.

"Wonderful progress has been made in decreasing unit costs and in improvements in process and recoveries. In mining, the square-set system was originated in America and followed for a generation or more. Later, caving systems were introduced, and these methods have been followed by so-called shrinkage and other efficient systems. Through these efforts the cost of mining has been tremendously decreased and much low-grade material has been made available.

"In connection with beneficiation, it has also been necessary to greatly cheapen the unit costs and at the same time to largely increase the metallurgical recovery. Flotation has proved to have a tremendously important bearing on the increased recovery of copper from sulphide ores. Improvements in the design of smelter furnaces, the use of fuel oil or powered coal in reverberatory practice, the introduction of static-electric methods for avoiding dust losses, etc., together with the improved mining methods mentioned, have caused much 'worthless rock' of 10 years ago to be commercially valuable ore today."

Ammonia is produced cheaply as a by-product from the manufacture of coke in by-product ovens. It is recovered in the form of sulphate.

the 20-stamp mill located near the entrance of No. 5 tunnel. From the north drift in No. 5 an upraise in ore has been made to No. 4 tunnel. The south drift from No. 5 has a length of 200 ft.—in ore—and is likewise connected by an upraise with No. 4 tunnel. The depth between the two tunnels is 225 ft. In the upper tunnel Supt. Spaulding has located and is developing the tellurium vein from which the rich float, gathered and shipped by the locators of the property, was eroded. While narrow, the streak carries a high gold content. The mine is equipped with a compressor and the other necessary machinery.

On the opposite side of the Hassayampa river, adjoining the Climax holdings, are located the Billy Boy and Christmas groups, owned by Ed Block of Prescott. The groups sideline and carry paralleling ledges, the distance between the latter being 500 ft. By driving a crosscut tunnel from the breast of the Empire tunnel on the Billy Boy group of four patented claims, the vein on the Christmas Gift claim of the Christmas group would be intersected at a depth of 300 ft. A drive north on the ledge from the point of intersection would gain depth rapidly. By this mode of development the ores in both properties could be brought to surface through a main tunnel having its portal convenient to a mill on the bank of the Hassayampa. The tunnel, as proposed, would enable mining cheaply and profitably a very low-grade ore.

A disseminated porphyry, surrounded on three sides by granite, and on the side next to the Hassayampa river by diorite, characterizes the McNulty and McBride group of 50 copper claims, adjoining the Christmas group. The porphyritic belt is about 2 by 2½ miles in extent, with connecting necks of porphyry running through to Copper Basin, where there is another area of the same character—monzonite and rhyolite. In the latter area are located the Sink-to-Rise and Copper groups, and the properties of the Commercial and Loma Prieta companies. The Commercial is shipping 100 tons of high-grade copper ore daily. The Loma Prieta people have opened a body of chalcopryrite carrying high values and will soon begin marketing their ore. Owing to the similarity of the ore it appears probable a commercial grade of copper ore will ultimately be mined throughout the intervening territory. The McNulty and McBride holdings offer exceptional possibilities. Ore is opened to a depth of 200 ft., and, in the aggregate, through the medium of shafts, winzes, openings and tunnels, for a length of 4000 ft.

The Joe group of five claims, owned by McNulty and adjoining the McNulty-McBride copper group, a deposit of copper-lead-zinc ore is being developed. The ore occurs in a spur vein of the main porphyry belt. A tunnel has been driven on this spur vein for a length of 600 ft. In the process it has a depth of 135 ft. Ore is being sacked for shipment, which has a value of \$46 per ton in gold and silver, and of its copper, lead and zinc by-product.

All of the properties mentioned are located within 12 miles of Prescott, and for the greater portion of the year are accessible via good roads. Railroad facilities are available in the Cedar Valley, about 18 miles distant.

Chloride.

Mr. Holmes of Salt Lake and associates are employing 15 men, divided into two shifts, in the operation of the Mendenhall property near here, in the Wallapai district, which they recently took over from Kean and John St. Charles of Kingman. They are at present extending a west crosscut on the top or bottom level to a ledge on the 100-ft. level that carries well in zinc, gold and copper. As soon as the ore has been proven the shaft will be continued to a depth of 300 ft. Following a recent visit to the property, Mr. Holmes announced that as soon as work at present outlined is completed he will install an entire new equipment of machinery and erect a large concentrating mill on the ground.

Secret Pass.

Samuel King of Spokane and associates recently concluded negotiations whereby they have taken over the Orphan property of "Shorty" Werner in the Secret Pass section of the San Francisco district and the lease of O. T. James and associates on the property. Operating a 2-stamp mill, the former has received bullion to the value of approximately \$100,000 during the 6 months' period that they prosecuted the development of the property. The new owners have again

placed the mill in commission and are treating ore, averaging about \$50 per ton, being extracted from a surface "glory hole" 10 ft. wide, 20 ft. long and 15 ft. deep. An 80-ft. crosscut extended from the bottom of a 40-ft. prospect shaft has exposed 20 ft. of \$12 ore. It is the intention of the new owners to materially increase operations at the property in the near future.

Cedar Valley.

After several weeks of preparatory work in repairing roads damaged by recent heavy storm and unwatering and retimbering, where necessary, its 350-ft. vertical shaft, the Arizona Venture Corporation will soon resume sinking operations on its Waldron property in the Cedar Valley district, 56 miles southeast of Kingman. It is the intention to continue the shaft down to the 500-ft. point, and prosecute the lateral development of the ore bodies upon an extensive scale. Among the minerals found in the property is lenzite, more commonly known as wireless telegraph crystals. The mining of these crystals has attracted the notice of Director George Otis Smith of the U. S. Geological Survey and he has asked General Manager W. D. Grannis for full data and specimens of the mineral. The Marconi Wireless Telegraph Co. has opened negotiations with eastern representatives of the company looking to the acquisition of the full output of the crystals from the property.

CALIFORNIA.

Marigold.

The Marysville Dredging Co. has launched dredge No. 5 and expects to have it in operation within 60 days. It is equipped with 16-cu. ft. buckets and will operate to a depth of 70 ft. below the water line. The bucket line carries 85 steel buckets, and the hull is of steel throughout. In general design the boat is similar to the No. 14 dredge of the Yuba Con. Gold Fields, operating at Hammonton.

Hodson.

The Royal Gold Mines Co., operating the Royal Con. mine, is preparing extensive alterations to the milling plant; 20 of the 50 stamps in action will be discarded in favor of regrinding equipment, and oil flotation machines will replace the concentrators and vanners, marking the first use of the flotation process in California gold mining. A plant will probably be erected to treat concentrates, using either chlorination or cyanidation. Underground developments continue highly satisfactory, and an immense reserve of fair-grade ore is blocked out. The mill is crushing 140 tons daily; 100 men are employed. The company is controlled by Boston capital. F. N. Page is managing director.

Sutter Creek.

General Manager T. Walter Beam has arrived at the Eureka mine to start rehabilitation and equipment of the property. The syndicate of eastern capitalists purchasing the mine from Mrs. Hetty Green acquired formal possession Feb. 7, and has arranged for extensive operations. A large electrically operated hoist will be soon installed, and plans are being made for a large mill, tramway and other equipment. It is understood the mill will be similar to the plant so successfully operated at the Plymouth Con. mine, near Plymouth. The price paid for the Eureka exceeded \$500,000.

Kennett.

Shipments of blister copper for 1915 from the Mammoth smelter totaled 230 carloads. About 170 carloads of selected zinc ore were also shipped, the product being separated from lower grade material by hand. The Mammoth Copper, Balaklala and Mountain Copper companies have increased wages of employes 25 cts. per day, the scale to continue in force while copper remains above 20 cts. About 1350 men are affected.

Atolia.

Pending rebuilding of the 100-ton reduction plant, recently destroyed by fire, the Atolia Mining Co. has placed the old Huntington mill in commission and is again producing tungsten concentrates. Mine operations are proceeding. New tungsten discoveries are reported from the west slope of the Rand mountains, and between Atolia and Randsburg hun-

dreds of placer miners are at work, recovering tungsten, gold and black sand concentrates. Ore buyers are paying \$2 to \$2.50 per pound for crude ore containing 2% WO₃ and up.

Brownsville.

Eastern people have taken under bond the Manzanita mine a mile west of here, and are unwatering the 300-ft. shaft. It is a gold proposition and has produced good ore, but has lain idle 10 years. The mill was destroyed several years ago by fire.

Woodland.

The Reed and Soda Springs quicksilver mines have been acquired by Breed & Bancroft of Oakland and arrangements are being made to reopen and operate the properties along broad lines. Reopening of the old tunnels will be rushed and considerable equipment installed. The Knoxville quicksilver mine, 3 miles southeast of the Reed, is producing on a small scale. It is owned by F. E. Johnson of Napa.

Washington.

Warm weather is rapidly melting the deep snow, and operations have been resumed at most of the mines. Underground work is again proceeding in the Columbia Con., and milling will be resumed at an early date. E. C. Klinker is superintendent. The Ocean Star group, under the superintendency of Clarence Woods, will be worked within a few weeks. At the Yuba mine preparations are being made to carry the shaft to the 1000-ft. level, from which point extensive development of the Yuba vein-system will be carried forward. Several other ledges will later receive attention.

Copperopolis.

The Calaveras Copper Co. is completing a 350-ton oil flotation plant and expects to have it in operation early in March. For a year the company has operated a 25-ton plant with satisfactory results. If the enlarged plant proves as efficient as anticipated its capacity will be doubled. Above the No. 6 level approximately 149,000 tons of ore averaging 3% copper are exposed, together with about 151,000 tons of lower grade. On No. 10 level some good ore has been exposed and a 3-compartment shaft is being sunk to open the lower deposits.

Downieville.

Mining is exceedingly active in this field despite recent heavy snow. At the Gold Bluff-Oxford group about 35 men are employed and extensive developments are going forward. Development of new ore in the Oxford is receiving attention and the property is being placed in shape for a heavy output with the coming of good weather. It is controlled by Salt Lake people, headed by Grant Snyder.

The Yorke mine, formerly a good producer, is being placed in shape for a substantial yield. A pipeline is being laid to bring water power to the plant and a pump has been installed. Erection of a hoist and mine buildings will begin soon. It is stated late underground work has been encouraging. George Morris is manager.

Heroult.

President H. H. Noble of the Noble Electric Steel Co. has announced the capacity of the electric smelter at this place will be increased in the early spring, and a heavy output of ferromanganese and ferrochrome maintained. Dependable deposits of manganese and chrome are now controlled by the company, and construction of additional furnaces will be carried forward. It is unlikely that any pig iron will be produced here for some time, as the other products are far more valuable and command a ready and profitable market. Rich chrome deposits and some promising veins of manganese are under development in territory tributary to the plant.

COLORADO.

Cripple Creek.

A good grade of ore has been encountered by the Excelsior Mining, Milling & Electric Co. on the Bull Hill group of the Stratton estate. They are operating through the Longfellow 300-ft. shaft. It is said the vein will be developed from the deeper levels of the Vindicator workings and it is probable the vein is one from the Vindicator or Golden

Cycle systems. On this account shipments from the property are expected soon.

Work is progressing at the Laura Lee Gold Mining & Development Co. mine and it is proposed to continue the 160-ft. shaft to 550 ft., and the shaft has been retimbered. The Arkansas Valley Railway, Light & Power Co. is extending the power line to the mine. A. Pearce is superintendent and will soon install a 5-drill electric compressor and electric hoist. The company has only recently been organized and incorporated.

There are four machine drills at development work on the Hondo Gold Mining & Milling Co. property. An ore shoot has been entered at the 400-ft. level. The vein is believed to be the Harrison of the Golden Cycle. Samples showed from \$9 to \$43. The values come from the foot wall of the vein.

Idaho Springs.

The Wyoming Valley tunnel, which will make a somewhat shorter haulage than the present Argo tunnel, is being pushed. A contract for 100 ft. of driving has been let. During the last 200 ft. a vein was followed showing mineral. The present contractor will drive through the Ardell vein, which is supposed to be an extension of the Seaton, one of the former producers.

A shipment to the Georgetown sampler recently from the J. R. Campbell lease on the 300-level of the Santiago mine returned \$104.70 per ton. The vein is 3 ft. wide and besides the values in silver and lead carries a fair percentage of copper. Ore from the 450-level is also ready for shipment. The lease is held by the Hanson Leasing Co. and the ore is said to be worth about \$100.

Leadville.

The Garbutt mine is now producing 150 tons a day. The reduction in production was made since it is being planned to build a mill this spring. Low-grade ores are found in the shoot that was opened last year, and these will go to the new mill. The ore now being shipped is gold-silver-copper-sulphide, and is mined in the lower workings. The mill will be completed in the fall, after which the production will be raised to 350 tons per day.

The new tram from the Gordon-Tiger mine to the mill has been completed, as also have alterations on the mill and cyanide plant. The latter now has a 100-ton capacity and will be worked to this continuously.

Sulphide ores, with gold, silver and copper values, are being shipped to the Ohio-Colorado Smelting Co. at Salida. It is mined at Yak tunnel level, or 1000-ft. level. Zinc carbonate ores have been opened. Trial shipments have been made and if terms can be secured from the smelters the ore will be mined. Some of the ore is suitable for the Western Zinc Oxide Co. process of smelting and much of the carbonate is now going to that smelter at Iola, Kan.

Salida.

The Madonna mine's new shaft is down a depth of 70 ft. They are working in three shifts with 20 men. At the present rate of progress the shaft will be down 350 ft. in 2½ months, and shortly thereafter shipments will commence.

Walter Higham, who has two manganese claims near Salida, has sent samples of ore to a New York company. He has shipped three car lots, each of a different grade, for trial runs. They brought from \$10 to \$15 in Salida. If any of the grades prove satisfactory it is probable a new industry will sprout in this district.

Nederland.

O. Barrow Willmarth, Idaho Springs, is planning on a tungsten sampling plant for this district. The cost of the plant for the treatment of tungsten ore is estimated at \$10,000. It will be at Rollinsville, because this site is on the Moffat road and makes a desirable center.

A vein of ore from 1½ to 6 ins. wide and running close to 60% has been uncovered on the Barker tract No. 1 at Stevens camp. During development a 1500-lb. shipment was made.

Georgetown.

At the Onondaga foundations are being placed for an Imperial Rand compressor, with a capacity of 540 cu. ft. and an electric motor and transformer for changing the current

probably because of the colloidal state of the precipitated sulphides rather than the result of any deleterious action on the oils used of the sodium sulphide, or the sodium sulphate formed.

The cause of the breaking of the froth was not clear. It may have been due to the sodium sulphate formed, or, what seems more probable, to some impurities in the sodium sulphide, the latter being only about 50% pure. This effect was very general, the froth on the second machine breaking up, although no sodium sulphide was added to it, except through a return middling elevator which was common to both machines. Fig. 8 shows the flow sheet of the slime-flotation plant at Anaconda.

Description of Flotation Concentrate Dewatering Plant.

The dewatering of the flotation concentrate is done in six 50 by 12-ft. Dorr thickeners. Five tanks of the same size have been provided for the slime plant. The pulp is delivered to a baffle box about 5 ft. sq. in the center of the tank, and extending down to within a few inches of the rake arms. Surrounding this is another baffle about 15 ft. sq. and extending about 18 ins. below the surface of the water (Fig. 9). These baffles catch a large portion of the froth which is there broken up by means of a water spray. The capacity of these tanks when treating flotation concentrate is from 200,000 to 250,000 gals. of pulp per 24 hours, although they will probably not be required to handle more than 200,000 gals. Operating even at this capacity, there is a small amount of finely divided material that will not settle. Therefore, the overflow from these tanks is run to a slime pond and the solids collected for future treatment. The capacity of these same tanks when treating round-table concentrate is about 1,000,000 gals. of pulp per 24 hours.

Some experiments were made to increase the capacity of the tanks by the use of glue. Indications from tests in a beaker seemed to indicate that glue would greatly aid the settling, but this did not prove to be the case. The glue caused the colloidal material to coagulate, but it did not actually increase the capacity of the settling tanks to any great extent.

The density of the pulp delivered to the tanks averages from 18 to 20% solids, and the spigot averages about 60% solids. The spigot product is further dewatered in Oliver filters 11½-ft. diameter by 12-ft. face. There will be 11 of these, each capable of handling 150 tons per 24 hours and making a cake containing about 15% moisture. The cake from the filters is delivered to a belt conveyor and is carried with the fine mill concentrate to the new roaster plant. The new roaster plant consists of twenty-eight 25-ft. Wedge furnaces. This will about double the roaster capacity of the plant. In this way a fairly good mixing of the concentrates will be obtained.

The Rhodesian gold output in January totaled 76,000 fine ounces.

Tungsten Deposits in Burma to be Worked

Some 5 years ago the first serious attempt was made to develop the wolfram deposits of the Indian Empire, and Lower Burma. The first record of the occurrence of wolfram in Burma was in 1841, but prospecting was not taken up by the general public till the present century. During the 1909-13 Lower Burma produced over 5000 tons of concentrates with a value of nearly £400,000, and the present rate of production is about 2000 tons.

The ore, which always consists of wolframite, occurs primarily in veins composed chiefly of quartz, but carrying also columbite, tourmaline, molybdenite, and, very occasionally, cassiterite. These veins traverse granite and a series of metamorphosed sediments composed of slate, schist, and quartzite, and known as the Mergui series. Occasionally both tin and wolfram are found in the same lode, but this association appears to be exceptional.

The wolfram tin-bearing belt of granite and metamorphic rocks runs on northwards from Mergui and Tavoy into the Southern Shan States, and is being exploited in Bawlake state; it is also said to occur further north in the neighborhood of Kalaw. In India wolfram has been found in various localities, but only in comparatively small quantities.

Although the development of the industry in Burma has been extremely rapid and the profits very great, the methods have for the most part been of the most primitive description. In addition to the quartz-wolframite lodes, float deposits provide a certain amount of ore, but the greater part is obtained from the lodes, which are usually worked by quarries and open-cut workings sometimes of a highly dangerous nature. The laborers are to a large extent Chinese and Telegus, with a sparse scattering of Burmese, who do not as a race take kindly to hard work of the kind involved in mining. The ore, when won, is as a rule crushed by hand and panned or sluiced. Concentrating machinery is almost unknown, but it will no doubt soon be introduced more generally, for the methods at present in vogue are wasteful and must result in permanent loss, since much of the ore now left in dumps and tailings will for economic reasons be ultimately irrecoverable.

It is now announced that the Government of India is taking energetic steps to stimulate the output of wolfram. Arrangements for this purpose are much on the lines of munitions legislation, and the ordinance will be of a far-reaching character.

Efficiency is not a comparison of costs, one mine with another, but a comparison of the mine costs as they are, and as they might be if the little details that are causing waste of time or power was properly attended to. It may seem like a reflection upon the management of a mine to put in efficiency men to look over the plant, but in almost every mine a good, live practical efficiency man will many times save his salary

reach the property and be installed within the next 30 days. The shaft is going down on a vein which on the surface has a width of 60 ft. and gives assays of from 80 cts. to \$2. It is announced that a second shaft will be started on the Buster fraction in about 30 days.

Kingman.

After a brief shutdown, the Arizona Tellurium Mines Co. has resumed operations in the Maynard district, 15 miles east of here. It is announced that the road to the main shaft from the bottom of the mountain on which the property is located will be completed immediately, incident to the early installation of a gasoline hoist, following which the bore will be continued down from the 72 to the 300-ft. point for the thorough exploration of the Ohio and Gaddis veins, which have yielded splendid returns in the development work thus far. George A. Shea, secretary-treasurer and a director, announced a few days ago, upon his return from a visit to Chicago, where he conferred with his associates, that the company has been completely financed. On account of continued illness W. L. MacKay has resigned as general manager and director of the company.

The unwatering of the old Hackberry mine in the Peacock district, one of the old producers of the southwest in the days of "Dollar silver," is in full operation, three shifts of workmen being employed by L. W. Kickes, who in association with Frank A. Keith, Seeley W. Mudd, R. I. Rogers and Philip Wiseman, all of Los Angeles, who recently took over the property from W. B. Ridenour, who located it in 1874. Manager Wickes has installed a pump of 150 gals. per minute capacity, which, together with a baling bucket, he is using in raising the water from the old workings, which have a depth on the vein of 500 ft. It is estimated that it will take 2 months to unwater the mine, after which a thorough examination will be made and the future development work outlined.

Unusual interest attached at present to the operations of the Union Basin Mining Co. at its Golconda mine in the Wallapai district, in consequence of the fact that its recently completed 200-ton oil flotation plant has been placed in commission. Although exhaustive tests previously made have proven the ores of the mine amenable to the process, mining men are keenly interested in the performance of the new plant and an announcement by the management as to the results obtained in its operation is being eagerly awaited. The plant represents an expenditure of approximately \$100,000. It is electrically operated, a high-power line having been extended to the property from the plant of the Desert Power & Water Co. in Kingman. The double-compartment incline shaft on the main Golconda vein is being continued down from the 800 to the 1000-ft. point. Three shifts are employed. On the 800-level northwest and southeast drifts have been extended approximately 350 and 500 ft., respectively, on the main vein of 4 ft. of excellent ore. Stopping operations above each of the drifts are yielding a large tonnage of high-grade ore. On the same level, at a point 500 ft. south of the shaft, a crosscut is being extended to the Tubb vein, which parallels the Golconda ledge 120 ft. to the westward. The crosscut is nearing the objective point and the exploration of the Tubb vein on this level will soon begin. On the 700-level drifting and stopping is in progress on the main vein northwest and southeast of the shaft. The stopes are being extended in the hanging wall portion of the vein on 12 ft. of excellent milling ore. There is at present approximately 80,000 tons of milling grade ore on the shaft dumps awaiting treatment.

The Middle Golconda Mines Co., recently organized, has inaugurated development work on its Big Bethel and Silver claims, which adjoins on the east, west and south and possess the northern extension of the veins of the Golconda mine. From the face of an 80-ft. south drift tunnel in the foot wall section of the Golconda vein, Manager C. B. Bell of the new company has started a crosscut to the hanging wall. This crosscut will pass 15 ft. below the bottom of a 100-ft. vertical 4 by 8-ft. shaft, sunk several years ago. After a raise from the crosscut connects with it, this shaft will be enlarged to 4 by 10-ft. in size and continued to great depth. From the crosscut a south drift will be extended along the hanging wall of the vein. This work will give a depth of more than 400 ft. on the vein. The new company is an Arizona corporation, capitalized for \$1,000,000. The personnel is as follows:

President, John Mulligan of Kingman; vice-president, J. E. Suits of Yuma; secretary-treasurer, J. B. Speed of Douglas; general manager, C. B. Bell of Kingman; directors include above, with Joe Winchester of Kingman.

CALIFORNIA.

Jackson.

The Argonaut Mining Co. is installing a hoist on the 4600-ft. level capable of operating to a depth of about 1400 ft. below present workings. This will give a total incline depth of 6000 ft. Construction of a large restraining dam has begun, and the tailings will be treated at some future date to recover the gold content; 40 stamps are dropping steadily and a larger mill is contemplated. In addition to the Argonaut, the company controls the Kennedy Extension property.

Sutter Creek.

Unwatering of the Eureka shaft has commenced. The old property was idle for 35 years. Arrangements have been made for immediate installation of hoisting and pumping equipment, and as soon as the underground workings are in satisfactory condition arrangements for a large reduction plant will be made. The property is owned by the Con. Amador Mining Co., with T. Walter Beam president and general manager.

The raise from the 3200-ft. level of the Central Eureka has intersected the ledge opened on the 3100-level and shows the same good character of ore. On the 700-level ore indications are improving; 30 stamps are dropping on quartz from the 2800, 3000, 3100 and 3200 levels.

Porterville.

The Blue Mountain gold mine, at White River, has been taken under lease by Wallace Brothers, formerly operating in Arizona, and new equipment has been installed. The mine formerly produced well, but water broke into the lower workings, forcing closing of the property. Good ore is said to be exposed at several points. The group is owned by Mississippi people headed by W. T. Young. It is reported an option has been taken by San Francisco capitalists.

The extensive magnesite deposits in this district are claiming much attention. Value of the ore shipped daily approximates \$3000, and within a few weeks is expected to reach \$10,000 daily, as several plants are nearing completion. The Southwest Chemical Co., of Los Angeles, is erecting a calcining plant to treat ores from its own property and the mines controlled by the Magnesite Mining Co. and S. D. Coughlan. The Corbin Co. is shipping to eastern points and the Porterville Magnesite and Tulare Mining companies are also shipping steadily. About 400 men are at present employed in the magnesite mines tributary to Porterville, and within 60 days it is believed 800 to 1000 will be at work. The main deposits thus far developed are at Magnesite and Magnesite Hill.

W. D. Corbin, of the Southwest Chemical Co., has purchased from J. A. Wilcox 160 acres of magnesite land 6 miles east of here. The price approximated \$18,000. A large deposit of excellent-grade ore has been demonstrated, and extensive developments will start at once.

Nevada City.

Negotiations are pending for the sale of the Oustomah mine to a syndicate of Utah people represented by Charles T. Law. The property has been examined by F. Wichman, superintendent of the Utah Metals and Bingham-New Haven companies. The purchase price is about \$60,000, but the mine will be worked under bond and lease until its merit has been proven to satisfaction of purchasers. The Oustomah has produced much good ore and is well equipped.

Grass Valley.

The rich shoot in the Golden Center, which has been opened at several points in the upper levels, has been encountered at a depth of 850 ft. It is very strong at this depth, with streaks of high-grade showing. Preparations are under way for additions to the 10-stamp mill. Development of the Peabody mine is about to start along broad lines. The

COPY

company is considering the acquisition of two Mother Lode properties. C. A. Brockington is manager.

Portola.

A deposit of precious stones has been found near here, and specimens shown by S. J. Johnson are of considerable value. The gems are largely opals, sapphires, turquoise and zircons, of which some are of excellent quality. Plans are being made for development work as soon as warm weather sets in.

Copperopolis.

Late developments in the mines of the Calaveras Copper Co. have been decidedly satisfactory. On No. 4 level the workings have exposed commercial ore for a distance of 1500 ft. On No. 10 level the ore body is strong and of the same character as in the older workings, consisting largely of chalcopryite. This is the lowest working level and is 800 vertical feet from surface. Conditions are considered favorable for development of commercial ore below this point. The company is producing 200 to 250 tons of ore daily and is about to place a 250-ton flotation unit in commission.

Grass Valley.

Operations have been resumed at the Orleans mine, with Albert Crase in charge. The mine forms one of the Sultana group and formerly produced much rich ore. It adjoins the Empire group and is believed to contain the extension of the Empire vein-system. Retimbering of the shaft has started and sinking will be carried to a depth of 1000 ft. The property is drained by the deep Empire workings, relieving the Orleans Co. from the necessity of operating pumps.

Alleghany.

The Mugwamp Mining Co. has been formed by Grass Valley and Nevada City people to operate the Gold Star and Young America quartz and gravel mines lying between Alleghany and Forest. A. D. Foote, manager of the North Star Mines Co., at Grass Valley, is president and managing director. The Gold Star and Young America have both produced well and contain promising lode veins together with extensive areas of placer territory. Operations will start at once.

Rich ore has been opened in the Ireland mine at a point 860 ft. in from the tunnel portal. A survey of this section of the mine has been made and plans drawn for extensive work. Rich quartz has also been encountered in the Sixteen-to-One mine, and preparations are being made for more extensive work in this famous old producer.

San Bernardino.

A rich tungsten discovery has been made 6 miles southwest of Ferris by Charles Ellis. The ledge is 6 ft. wide and consists of scheelite said to average 40 to 40% tungsten. The better grade ranges from 80 to 90%. The ore closely resembles that found at Atolia. The strike has caused much excitement and numerous claims have been staked out. A small mill and concentrator are being erected.

Yankee Hill.

Erection of a 5-stamp mill is proceeding at the Sunbeam mine, where a vein of gold-bearing ore 3½ ft. wide was recently intersected. The property is owned by Ray Dwelver, J. L. Charles, L. H. Fields, William Dwelver and Gus Fort-hous.

Chrome.

This camp, located near Willows, is quite active as a result of discoveries of chrome and manganese. J. J. Hull and associates have located promising manganese claims and are preparing for extensive work. San Francisco people have taken over chrome properties and have started developments. It is reported arrangements have been made for steady shipments of manganese to the Heroult electric smelter in the early spring, provided the ore proves sufficiently rich.

Plymouth.

The Plymouth Con. Co., operating the Plymouth Con. mine, has taken under option the Creek Ledge property, north of Plymouth. Some good ore has been produced. Work will begin in the early spring.

Sierra City.

The Sierra Buttes Mining Co. is preparing to install equipment to replace the machinery destroyed by a late

snowslide. The transformer-house and a portion of were demolished, and the flume line badly damaged. Present good weather continues the roads will soon shape for transportation of heavy equipment.

COLORADO.

Cripple Creek.

Foundations have been completed and the new compressor and hoisting machinery for the main shaft of the Laura Lee is being installed. The installations consist of a hoist 8 by 19 ft. and a 6-drill Chicago Pneumatic Tool Co. compressor, with motor and full equipment of air lines, receiver, etc. Tracks and ore cars have also been purchased and the property will be started in the first part of March. A. S. Pierce is in charge and will sink the shaft to 300 ft. before drifting. The Arkansas Valley Railway, Light & Power Co. will extend its power line from the Ella W. mine on Tenderfoot Hill to the Laura Lee.

Good ore has been opened on the 850-ft. level of the Jerry Johnson mine. It is under lease to the Cripple Creek Deep Leasing Co. The vein is vertical and grab samples show from \$50 to \$135. A special sample on 3 ins. of quartz ran \$1748. One 30-ton shipment had \$60.20 a ton and brought about \$1800. In the district it is said this is one of the best strikes since 1904.

Deeper development work in Cripple Creek seems to show that there is ore below the barren zone. A winze is being sunk on the East Victor vein of the Isabella mine, from the 15th, or bottom level. It is down 12 ft. and showing ore. Samples across a 5-ft. vein there returned 3.80 ozs. gold and 8 ozs. silver, equal to \$76 and \$120 to the ton. The vein is widening with depth. The Buena Vista vein on this level has been proven for 45 ft. Stopping on it will shortly be commenced. The Cheyenne vein has also been reached by cross cutting. Gold values on it ranged from \$20 to \$30 per ton. A streak of tetrahedrite (copper) 18 ins. wide, with silver 50 ozs. per ton, has also been encountered.

Leadville.

Work is being prosecuted by U. S. Smelting, Refining Exploration Co., to unwater the Fryer Hill basin, which is thought to be rich in minerals. The Harvard shaft will be the Leadville unit for bringing water to surface. Pumping machinery is on the ground and ready to be installed. They are now employing 31 men. Three shifts are used to cut pump station at 250 ft., just above water level. Drilling is being done by hand, but Jackhamer drills, operated by steam, will soon be at work. Concrete foundations for a new hoist has been started. The transformers for the electric power line are on hand and the power company is bringing its lines to the property, besides wiring the mine buildings. When drainage operations are under way the force will be cut 50% until preparations can be made for mining. Many other mines in the basin will benefit from the proposed unwatering. They are the Matchless, Little Pittsburg, Little Chief, Chrysolite, Progressive, North Star, Amie, Duncan, Climax, James, Seven Thirty, New Discovery, Robert E. Lee and Hibernia. The tract to be unwatered includes many of the older Leadville producers.

Georgetown.

The Malm mill, which was practically completed 3 years ago and then dismantled and shipped to Kellogg, Idaho, where it was installed at the Bunker-Sullivan mines is going to be taken up again. Mrs. A. G. Brownlee has succeeded in raising the required \$50,000 for construction and repair. Their method is essentially electrolytic and dry chlorination, though other less important methods are used in combination therewith. The gold, silver, lead, zinc and copper will be in bullion form. Its initial capacity will be 50 tons, but space for additional machinery has been provided which will allow 200 tons' capacity per day. They expect to be operating in the first part of May.

From the Santiago mine a car of lead ore was shipped from No. 2 level in the weeks ending Feb. 20 and 27. A shipment from No. 4 level gave mill concentrates running 1.2 ozs. gold, 27.4 ozs. silver and 8.66% copper. The shaft

down 75 ft. from the 6th level and work has been commenced on a new level. It is the intention of the management to extend the 7th level 800 ft. south, and open up stoping ground as the level advances. The 6th level is in ore most of the way and the presumption is that the same ore will be found on the 7th.

Boulder.

The Gilpin & Boulder Tungsten Mining Co. has recently been incorporated. Charles A. Woodward of Idaho Springs, with C. Hesselbine, W. R. Benzie, F. A. Clarkson and M. E. Southworth, will be directors. It is capitalized at \$100,000.

In the Magnolia district Fairhurst Bros. have sold their tungsten property. They are now engaged in development of other tungsten mines. With the sale money, \$5000, they will equip and operate the Graphic tungsten mines, also in the Magnolia district.

Two feet of solid sulphide ore has been cut in a drift of the Sullivan No. 5 mine. The association is headed by Mr. Wolf and associates of Boulder. They are preparing to unwater properties adjacent to the New Market mine. Huberite, one of the most valuable tungsten ores, was left when the mine was operated as a gold property, and is the principal mineral to be looked for.

IDAHO.

Wallace.

Approximately \$60,000 will be added to the February payroll of the mines directly tributary to Wallace. The high price of lead already gives assurance that the March payroll will be increased by \$75,000, in round numbers. The wage paid to all mine and mill employes is now based on the price of lead. A sliding scale has been agreed upon. The minimum is still \$3.50 per day. The payroll has been about \$500,000 monthly for the past 6 months. The sliding scale means that the additional pay will be distributed among a little over 3000 workmen, giving each one from \$15 to \$22.50 a month more than heretofore. In the Kellogg district the Bunker Hill & Sullivan Co. has also adopted a sliding scale. Although only 12 miles from Wallace, the scale at the Bunker Hill has always been \$3 a shift and the extra pay allowed for the higher price of lead gives no employe a chance to increase his income by more than 50 cts. a shift. Muckers, therefore, will receive \$3.50 per day while lead is up. Every property in the near d'Alene mining district is now working full time. Mills and mills are all busy. Some of the properties that are out in the making were shut down for a few weeks on account of cold and snow, but operations have been resumed everywhere and the spring and summer will likely bring in a few more producers. Optimism prevails in every part of the district. Likely looking prospects are being extensively explored by both local and outside capital. More money is being received from ore shipments than ever before and all mines are paying big dividends. In every way the outlook for 1916 is the most promising since mining was first started in the placer diggings of Murray in the early eighties.

A strike of real importance has been made in the shaft at the mouth of the main tunnel of the Constitution mine on Pine creek, and at least 8 ft. of ore that will average better than 40% in zinc has been uncovered. The shaft had been in mixed ore all the way down, but at 82 ft. from the bottom it broke into high-grade. The showing was 3 ft. wide at first. In the bottom of the shaft at a depth of 90 ft. it is 8 ft. wide, with only one wall in sight.

Kellogg.

The output for December was 895,120 lbs. of lead, 72,337 lbs. of copper and 112,414 ozs. of silver. The advances in price over the December settlement are: Lead, 85 cts. a hundred pounds; copper, 5 cts. a pound, and silver, 2 cts. an ounce. At these prices the lead would have brought \$7608 more, the copper \$3816 and the silver \$2248.

January shipments totaled 893.58 tons of concentrates and 57 tons of crude ore, of an aggregate value of \$149,000. The concentrates averaging \$100 a ton and the crude ore \$100 a ton. The cost of mining 3599 tons of ore is stated at \$359,900, yielding 3036 tons at \$2119; loading on cars 1427 tons

at \$295; freight, treatment and smelter deductions, \$38,496; total expense, \$49,056. The following details of the January production also are given: Pounds of lead marketed, 885,740 at 6.07 cts., \$53,771.99; ounces of silver, 133,347 at 56.9 cts., \$75,936.22; pounds of copper, 79,402 at 24.7 cts., \$19,606.

The January net earnings of the Caledonia Mining Co. were \$100,264, according to the monthly report of Charles McKinnis, general manager. This establishes a new high record of profits for the company, despite the fact the mine was closed down several days because of water shortage at the mill, caused by the cold weather. This earning is at the rate of 3 7/10 cts. a share, or 7/10 ct. in excess of dividend requirements, and enables the company to transfer \$22,114 to the surplus account for the period. The average payroll during the month was but 35 men, working 6 days a week. It is evident the February profits will be much greater, as the smelter returns for the first 10 days amounted to \$45,487.

Bonnors Ferry.

According to A. Klockman, manager of the Idaho Continental, near here, the company is shipping only such ore as is taken out in the course of development, which was rich enough to stand hand sorting, and is making more than operating expenses despite the fact that its payroll includes more than 100 men, most of whom are engaged in construction. He says: "We are shipping 2 carloads a week of galena that averages 58% in lead and 25 ozs. of silver. It is hand-sorted from the ore extracted in development on our No. 6 tunnel level. We now have in the mine workings approximately 30,000 tons of second-class ore, or enough to run our new mill, which will be in operation by May 1, for more than 3 months. Our first mill, which was destroyed by fire July 31, had a capacity of 250 tons a day and ran less than 2 months. As a result of its operations we shipped 2000 tons of clean ore and concentrates, the latter averaging 68% lead and 40 ozs. of silver. The new mill will have a capacity of 300 tons daily. The building is completed and most of the machinery already is installed. Since last October we have installed a 12-drill compressor and an 1800-ft. aerial tramway from the mine to the mill. Both now are in operation."

LAKE SUPERIOR.

COPPER.

Houghton.

All the mines here are running with the normal rate of rock tonnage, with the exception of an occasional delay arising from a shortage of cars, and every mill in the district ran last Sunday. The greatest railroad tonnage of the refined metal known in the history of the Copper Country is now leaving daily. This applies equally to all of the producers.

New Baltic met with the No. 8 conglomerate in the vertical, the second hole, at a shallower distance than was expected, and is now going to drill a third 800 ft. north at an angle of about 80°. If another core, even if it should be considerably less in mineral values than that encountered in the hole last drilled, should be disclosed, it will confirm the belief in the great extent of mineralization of the New Arcadian lode, as that will have been demonstrated for over 4800 ft. on its strike.

New Arcadian is getting good grades in the lode found 16 ft. from the shaft on the 1250-level, as the drifts are being opened, the same abundance of the smaller shot copper almost constantly appearing. The New Arcadian lode will be entered by the crosscut on this same level in about 2 weeks, as all the formations passed through seem to be in the same order and of the same thickness as they were on the levels above.

Calumet & Hecla's very slight falling off from the best average of daily tonnage in its history during the great storm is attributed almost wholly to the presence of la grippe, which was the most prevalent at that time, as its railroad was only affected to a very slight degree by the great snowfall. The engine formerly at Calumet No. 5 has been moved to No. 14 on the Osceola amygdaloid, replacing a hoist that had reached the limit of its capacity, permitting the hoisting of two skips carrying 7½ tons, where only one of 5 tons was in operation.

Blue Bell people, to the contrary, were able to continue operations, and to good purposes, for the mine is producing high-grade copper ore to a depth of 800 ft. and has for a long time been a steady and consistent shipper.

D. H. Bradley, Jr., a former operator of mines in Mexico, has taken over the Lincoln mine under bond and lease. Philadelphia capital is interested in the project with him. A force of 20 men is repairing the roads leading to the mine, cleaning out the old drifts and stopes. A new working shaft is to be sunk at a central point in the large ore shoot exposed in the old workings.

Douglas.

Calumet & Arizona, whose principal office is at Calumet, Mich., at the meeting of the board of directors held at Chicago, recently, decided to install a plant for the manufacture of 60% sulphuric acid at the smelter at Douglas, 25 miles from the mine, and the contracts have been already made, and it will be ready for operation this year. This step will do away with the nuisance of the sulphur fumes descending over the country for some miles around, and will furnish the new leaching plant at the New Cornelia with its largest chemical requirement. The capacity will be 100 tons of acid daily. An additional reverberatory furnace is to be built at the smelter to treat the low grades which have not been treated before, and of which there has been left quite a large quantity in the mine. The grades smelted here will run as low as 3%, and the capacity of the new furnace will be about the same as that of the others—300 tons a day. A new electric pump, which will get its power from the smelter, will be put in at the Junction shaft and its capacity will be about 1000 gals. a minute. These improvements will require the expenditure of considerable money, but in time will be very profitable to the company. As the money is to be spent quite soon it is unlikely that there will be much, if any, increase in the dividend to be declared 3 months from now.

Oatman.

Notwithstanding the fact that it is not known when delivery of the necessary machinery will be made, General Manager George W. Long recently put a force to work grading the site for the proposed mill of the United Eastern Mining Co. The plant will have an initial capacity of 200 tons. The millsite is on the side of a hill immediately below the new or No. 2 3-compartment shaft, which is located about 500-ft. north of the old or No. 1 shaft, through which all underground operations are prosecuted at present. The collar of the new shaft is 125 ft. above that of the old one. The mechanical equipment for the new shaft, including a 150-hp. double-drum electric hoist, 800 cu. ft. compressor and 150-hp. motor to propel the compressor, has been completely installed and sinking operations at the 60-ft. point will be resumed within the next 10 days with a depth of 800 ft. as the objective point. Three shifts of machine drills will be used in the work, and upon the completion of the shaft to the depth proposed, it will be used exclusively for the hoisting of ore for the mill. There have been no new underground developments at the mine. Drifting northwest and southeast on the new 665-ft. level, and exploratory work from the northwest drift on the 465-ft. level, continue to make a good headway.

The controlling interest of the Oatman Pioneer Gold Mines have been sold by Allen L. Burris and Charles Walden to Keith and Keith, shoe manufacturers of Boston. E. H. Dawson, who represented the buyers in the transaction, has been made general manager of the company and will direct the future development of the property. It is announced that drifts will be run north and south on the 400-ft. level, and as soon as ore bodies are reached winzes will be sunk to the 660-ft. point. Two feet of ore, assaying as high as \$66, was recently exposed in a winze below the 100-level.

The Adams Mining Co. is one of the latest corporations; it is capitalized for \$100,000, divided into 1,000,000 shares. The officers are: President, E. H. Newland; secretary-treasurer and general manager, N. A. D'Arcy; directors, the above named with C. H. Palmer, Jr., and M. Lines. Palmer was one of the first mining engineers to make a report on the camp at Oatman. The company has acquired 9 claims, including the Adams group of 3 claims, which adjoins the Nellie on the south. Former owners drove a 48-ft. south

crosscut tunnel, which penetrated the main vein a distance of 12 ft. and disclosed quartz assaying \$2 per ton, without exposing the foot wall. A 54-ft. shaft was also sunk and a crosscut from the bottom was extended 15 ft. from the foot wall of the same vein, as disclosed by the tunnel without revealing the hanging wall. Samples taken across the width named returned values ranging from \$2.24 to \$26 per ton. General Manager D'Arcy announces that he will immediately resume the extension of the tunnel and crosscut at the bottom of the shaft to determine width of the vein, and to aid him in deciding upon the location of the main vertical shaft, which will be sent to a depth of at least 400 ft. before any lateral work is attempted.

CALIFORNIA.

Taylorville.

The Engels Copper Mining Co. announces operations in 1915 yielded a net profit of \$115,501. This allows for depreciations during the year. A large amount of new work was done, including enlargement of the flotation plant, and building of an electric power line. Mine developments were highly satisfactory. It is understood more equipment will be installed in the summer, as the available reserves of profitable ore have been recently augmented.

Harrison Gulch.

A shoot of ore assaying \$100 per ton in gold has been intersected on the second level of the Midas mine, operated by the Victor Power & Development Co. It was opened in the footwall of the Middle vein and opens to development a large area of new territory. It is over 8 ft. wide and has been opened for approximately 100 ft. Developments in the main levels of the Midas and Gold Hill mines are proceeding, and the working force has been increased. Early additions to the milling plant are contemplated. President J. H. Sharpe has decided to immediately take personal charge of operations.

Clipper Mills.

Opening of deposits of manganese at the Bear Canyon mine is proceeding with a small crew. A large tonnage of good ore is in sight, and the old workings contain much material of profitable character. The Bear Canyon was formerly worked in a small way, but has been idle for years. It is owned by G. W. Woolley, but is being operated in the interest of the Noble Electric Steel Co., which operates an electric smelter at Heroult. Several other manganese mines in this field are receiving attention.

Alleghany.

The long crosscut from the lower adit of the Tightner has intersected the Osceola vein, disclosing medium-grade quartz. Crosscutting continues to reach the Red Star ledge, which yielded bonanza in the upper workings. Much promising territory in this section of the group is receiving attention. The 10-stamp mill is running steadily.

Operations have been resumed at the Gold King by W. H. Weldon, and it is planned to install a compressor and machine drills with the arrival of good weather. The Gold King is situated on Kanaka creek, and below the snow line. A compressor and drills will be shipped to the Eastern Star group in the spring. The property is operated under bond by C. A. Jackson, representing middle west investors. Extensive work is going forward at the Twenty-One, Morning Glory, Mariposa, Sixteen-to-One, and other properties. Rich discoveries have been recently made in the Twenty-One, Ireland and Sixteen-to-One.

Angels Camp.

Extensive lateral work is proceeding from the 100 and 200-levels of the Columbia mine, where the main shaft has been carried to a depth of 250 ft. Fair-grade ore is showing at several points. Equipment includes a 5-stamp mill, gasoline hoist, compressor, and pump, electrically driven. J. R. Rear, Vancouver, is president.

Atolia.

Trouble has broken out in this field between the Adams Mining Co. and independent miners who are working claims adjoining the Atolia holdings. A temporary truce prevails.

with a possibility that the Atolia may purchase the properties of its rivals. Small companies are extracting rich tungsten float from placers on land claimed by the company, while the outside workers claim the company is seeking to hold placer deposits located as lode claims. Most of the independents are Americans, while the employees of the Atolia Co. are largely Italians. The small companies are selling their product to agents of eastern consumers and thereby offering formidable competition to the Atolia people. The Atolia Co. claims about 2000 acres, but in this territory are many claims worked by American miners who express themselves determined to guard their interests at any cost.

Oroville.

Development of the Banner group, recently acquired by New York people, is advancing under the management of Richard Phillips. The Amoskey and South Banner claims are receiving principal attention at present. The shaft on the Amoskey has been sunk to an incline depth of 600 ft. with the ore showing encouraging on the lower levels. A hoist, 75-hp. engine, and other equipment, are on the ground. A 10-stamp mill will be erected in the early summer and additional units provided as rapidly as ore conditions justify.

Sacramento.

The total gold recovery by the dredges of the Natomas Con. in 1915 was \$2,416,960. Net profits amounted to \$1,313,780. The company is operating in the Folsom and Oroville fields and tributary districts, and is the second largest producer of gold in California, being surpassed only by the Yuba Con. Gold Fields.

Georgetown.

The old Georgia Slide mine is being rapidly placed in shape for production. Two shifts are driving drifts on the vein, and a third shift will be engaged as soon as the air pipes are in position. Construction of a 10-stamp mill is progressing, and a pipe line, about 1 mile long, is being completed to bring water to the mill. The property is being rehabilitated by a strong company of eastern investors.

Ormonde.

The Washington mine at this place, which is near Washington, has been bonded by San Francisco people and preparations are being made for early work. The Washington is an old producer and has yielded about \$1,500,000 in gold. It lies near the Columbia Con. group and is worked by tunnels. Equipment includes a 20-stamp mill in good condition and considerable mine machinery.

Yreka.

The St. Albans Mining & Milling Co. has been incorporated to operate the St. Albans copper mine, in the Blue Ledge district. The directors are W. A. Callahan, A. L. Hill, L. B. Cameron, Henry Callahan and W. L. McGraw, all of Medford, Ore. The principal place of business will be Cop-per, Siskiyou county, California.

COLORADO.

Cripple Creek.

Lessees have recently opened good ground on properties of the United Gold Mines Co. At the Trail mine, on block No. 2, J. Jones and J. Eastman of Victor have been working on the Trail tunnel. They have carried a drift south on the main Trail vein and in a short distance broke beyond the barren point. Their samples are assaying from \$25 to \$38 to the ton in gold.

J. L. Jones on the Big Banta property has exposed a good vein at shallow depth. Grab samples taken across 2 ft. assayed 8.75 ozs. and 9 ozs. gold. He has given up the "prospector's permit" and took the option of the 18 months' lease. He is now operating on the tunnel at the Old Ironside claim, next to the Big Banta, and expects to cut the vein discovered at surface at a depth of 100 ft. by a crosscut of about 30 ft. If his theories prove out he will have a very good body blocked out.

On Tenderfoot hill the Hoosier mine is again active and has commenced production. The mine, originally owned by the Grafton Gold Mining Co., a close corporation, was in-

corporated in January, 1896. It is now controlled by David Rubridge of Denver, vice-president and treasurer of the company since its beginning. Two shafts have been sunk, one incline, from which most of the production was made, and the main vertical shaft is 870 ft. deep. The property is now under lease and being operated through the vertical shaft.

A crosscut from the main Roosevelt drainage tunnel has been made towards the Elkton Co.'s shaft, a distance of 66 ft. It has undoubtedly struck the main Elkton vein, for the water is coming from a drill hole and shooting a distance of fully 25 ft. back. This will give an idea of the great pressure and amount of water to be encountered later. At present there is 13,000-gpm. flowing. The water level in the tunnel has dropped 4 ins. since Feb. 1. When the expected encounter of water comes from the crosscut the present level and amount will be greatly increased. Work is progressing at the tunnel head, but not as fast as would be were it not for the crosscut.

Leadville.

Diamond drilling to a depth of 200 ft. in the Luema tunnel, 1500 ft. from the portal, gave good results though cores were not obtained owing to the soft ground. An interior shaft on the course of the drill holes has been started. This development will be complete in about 2 months. The tunnel is equipped with electric power and a new electric hoist has been installed for the winze being sunk. Prospect mountain, lying on the northern edge of the district, offers great opportunities, since it has been prospected but little.

A 50-hp. electric hoist has been installed at the Ponsardin mine. Other improvements are being made. About 50 tons of high-grade zinc sulphide daily are now being shipped. The ore is coming from stopes that were opened last summer.

Boulder.

The Boulder Tungsten Production Co. are at present paying considerable attention to their Forest Home mine, from which a recent single wagon load brought \$9200. Their production is going to the new reduction plant and is coming from operations rather than the reserve dumps. The mill was completed about a month ago and is running smoothly. The tunnel is advancing 6 ft. a day. The tunnel has cut many veins and lateral development on one of them is disclosing good ground. Three of the lodes cut are of sufficient quality to warrant exploration. This will be done as soon as the heading is far enough advanced. The tunnel will make their main haulage way and later may prove of the same advantage for other properties.

Idaho Springs.

A mile of 4-in. pipe is to be used at the Onondaga mine. A building 24 by 36 ft. will serve as compressor, dry and blacksmith shop building. Foundations for the machinery are ready, and the plant will be running in the last part of March. Then two shifts will be put on. There are now 275 tons, with a concentrate ratio 6 to 1. They will run this through the Hudson mill. The ore was obtained on the 80-ft. level, where a 10-in. vein of solid smelting ore is in the 40-in. width mined. A stope has been started here. No. 3 raise shows 8 ins. of ore which returns 1.80 ozs. gold and 11 ozs. of silver. The company plans to produce 450 tons per month, block out ore and when conditions warrant it in the near future construct a new mill.

The Big Five Co. will extend its tram dump from the present terminus to connect with the Colorado & Southern railroad in the west part of town. No restrictions will be dictated to lessees as to what mills and smelters they shall send their ores.

IDAHO.

Wallace.

Harry L. Day has tendered his resignation as president and general manager of the Federal Mining & Smelting Co., one of the largest operating corporations in the Coeur d'Alenes, and F. H. Brownell of Seattle, former president and now chairman of the board of directors, has been chosen to succeed him as executive, while H. A. Guess, for several

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CHICAGO

March 18, 1916.

New Handling Plant of the Temescal Rock Co., Corona, Cal.

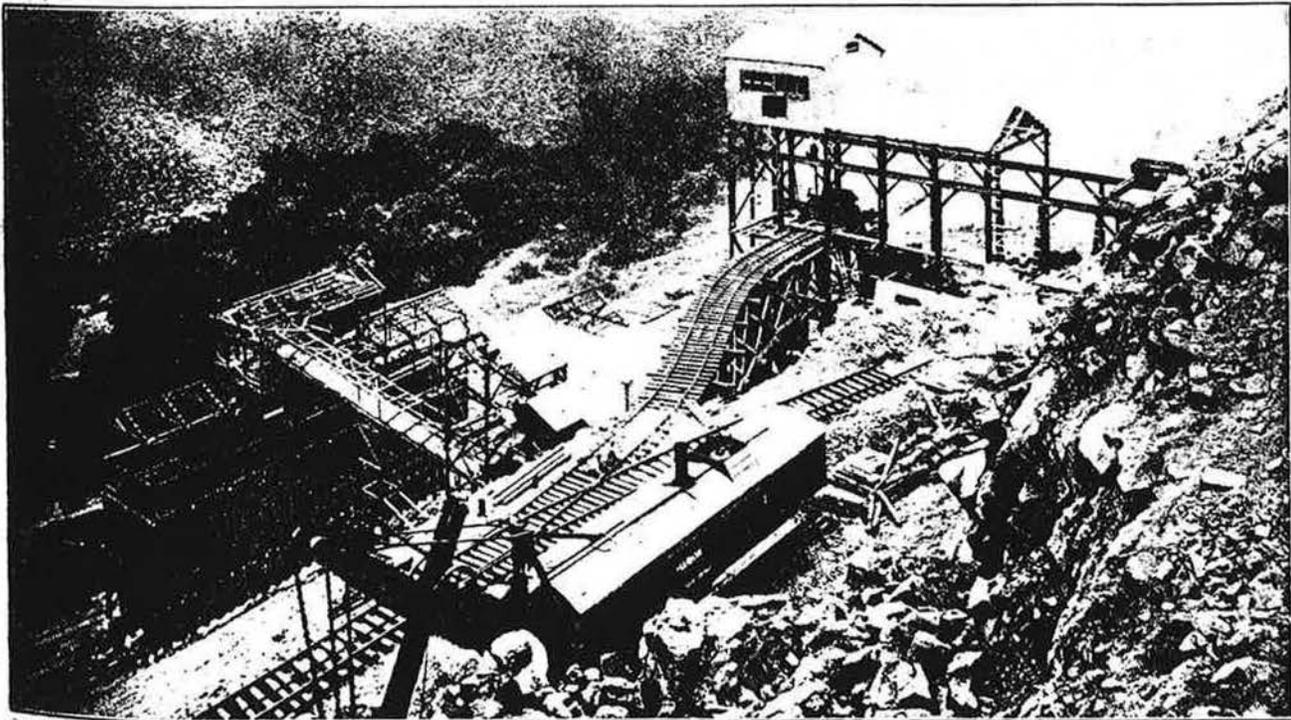
p. 557

By CHAS. A. BAECHTOLD.

The operations of the Temescal Rock Co. are located near Corona, Cal., in the Temescal canyon, the formation of the mountain on which the quarry is located being of altered rhyolite porphyry. At a half-mile back from the bottom of the canyon the top of the mountain is 1000 ft. higher, and its slope offers exceptional conditions for installing a rock-crushing

ing the first unit of that plant, which will have an initial capacity of from 1500 to 2000 tons of crushed rock products a day. This capacity may be doubled and trebled if the market justifies, with very little interference in the operation of the first unit.

The company is also perfecting plans for installing cableways to load large rock up to 12 tons in weight



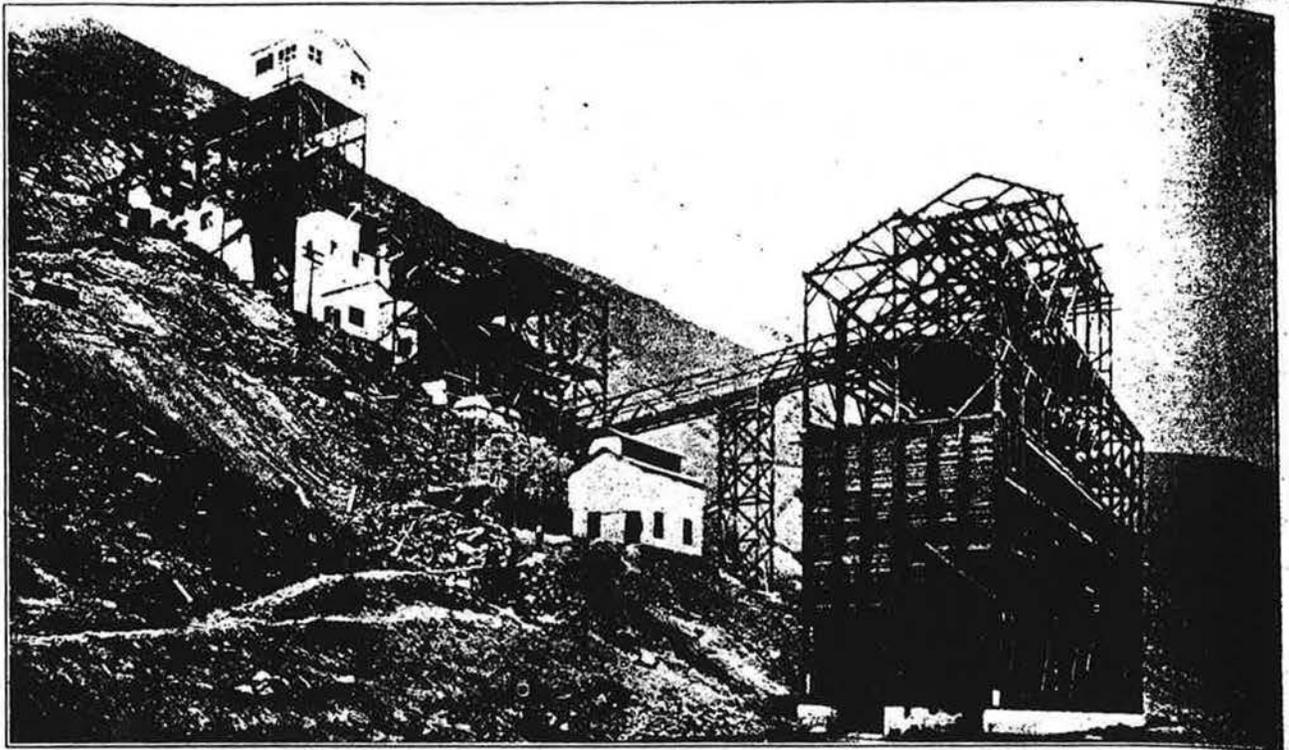
DIGGING AND LOADING ROCK WITH MARION STEAM SHOVEL AT TEMESCAL QUARRY.

plant to handle its products by gravity. The floor of the canyon rises only 40 ft. to the mile, making easy grades for a railroad track to reach the plant from the main lines of the Santa Fe and Pacific Electric railroads.

The company has designed a modern quarrying, crushing and storage plant, to utilize these favorable conditions. It has built nearly 4 miles of railroad tracks, has bought machinery for and is now install-

for rip-rap and sea wall construction. This installation will also be in units, each with the capacity to load 1000 tons of rock a day on railroad cars, and it has room for five units of this plant.

There are many interesting features in the operation of this quarry and crushing plant. The quarry faces extend along the mountain side, both north and south of the head of the crushing plant. While one end of the quarry is being drilled and blasted, the



CRUSHING PLANT, STORAGE AND LOADING BINS OF TEMESCAL ROCK CO.

broken rock on the other end is being loaded into cars and hauled to the crusher. A powerful Marion steam shovel loads the broken rock into all-steel, dump, quarry cars. These cars are operated by electric motors, receiving current from a third rail. By a system of levers in a tower over the crusher, operated by one man, an empty car is sent to the steam shovel, and when loaded brought back and spotted at the chute to the initial crusher, into which the load is dumped by pulling another lever. Thus, one man takes the place of six men necessary to operate two trains of cars hauled by donkey engine locomotives, and four cars operated singly take the place of the two trains. Then, if the power goes off, as it sometimes will, there is a minimum of quarry rock in the chute.

The initial crusher of the Blake jaw type will receive a 10-ton piece of rock and break it down to a maximum of 10-in. pieces in less than 2 minutes, which is its justification, because it eliminates all sledging and nearly all reblasting in the quarry. The capacity of this machine is rated at 600 tons per hour, so without duplicating it the capacity of the plant may be trebled.

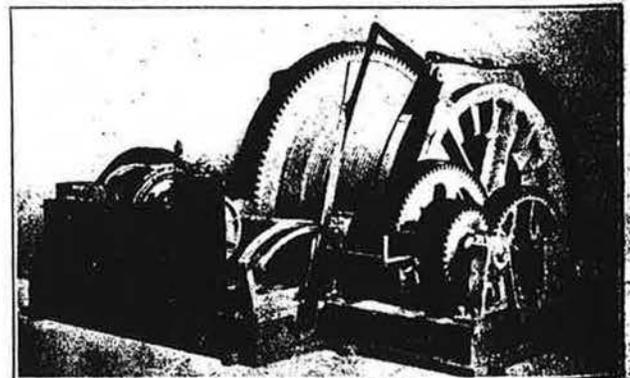
The product of the big jaw crusher slides down into a No. 9 gyratory crusher, which further reduces it to 3½-in. maximum pieces. The product from this machine is carried by a belt conveyor to revolving screens, which take out all that is broken to 2 ins. or less, and the portion over 2 ins. in size is fed down to large disc crushers, from which it does not escape until it is finished by being broken to 2 ins. or less in size.

The finished product is carried on a belt conveyor from the scalping screens and disc crushers, to the

sizing screen over the storage bins, where it is separated into the various commercial sizes. Those sizes of smallest volume are conveyed by chutes direct into the bins nearest the screen, and those of larger volume are carried by shuttle belt conveyors to bins farther away.

The storage bins are in two adjoining rows located over two railroad tracks. Each bin is 5 yds. sq. and 10 yds. deep, and in the bottom is a gate 18 by 24 ins. in size, which when opened full will load a 50-ton railroad car passing under it in 2 minutes. Ample railroad tracks to hold empty cars, to pass those cars under the bins to load them, and to store loaded cars, have been provided to accommodate a large volume of business.

As the quarry floor is located on the side of the mountain, and all of the heavy crushing machinery is located just below the quarry floor, it has been necessary to install a special incline arrangement for handling this crushing machinery. The incline is



LIDGERWOOD HOIST RAISING ROCK TO CRUSHERS

about 48½% and 550 ft. long. The design of same was such that the loaded cars which were received from the railroads were hauled directly to the quarry floor and unloaded there by means of a large traveling crane. It was therefore unnecessary to unload the material at the bottom of the incline, and the expense of rehandling was thus not incurred.

Owing to the unusual loads and the steep grades, it was necessary to design a special arrangement, which is rather unique, in that a sheave car precedes the railroad car, and is attached by means of two 1¼-in. plow steel ropes to a barney car located behind the railroad car. The sheave car provides for three parts of rope in order to take care of the unusual stresses developed, and to keep the size of the hoist equipment to a minimum.

The barney car is of the Lidgerwood Mfg. Co.'s standard design, built throughout of structural steel, and operates on a standard-gauge track instead of a narrow-gauge track, as is the common practice. Switching arrangements are provided at the bottom for getting the barney car out of the way while the railroad car is being located at the foot of the incline.

The sheave car is built of structural steel, has a large steel sheave arranged horizontally, 1¼-in. hauling rope being used. This leads from the hoist, which is located on the quarry floor through suitable deflecting sheaves to the sheave car, in such a manner as to give a three-part arrangement. The operation of this sheave car is shown in the accompanying diagram.

The hoist, which is a Lidgerwood, is shown in the accompanying photograph. It is a large single-drum, 2-speed outfit, drum being 66-in. diameter, 44-in. face, equipped with a very powerful post brake. It is geared by means of steel gearing to a General Electric slip-ring type 75-hp. motor, the latter being equipped with solenoid brake sufficiently powerful to bring the entire system to rest in case of failure of the current supply. The design is such that loads may be either hoisted or lowered electrically; that is, when a loaded car is being lowered the motor will act as a generator, and will return the current to the power circuit. The 2-speed arrangement is such that lighter loads may be hoisted more rapidly. While the hoist was designed for a normal duty at the drum of 19,500 lbs. at 60 fpm. on the slow speed, or 7300 lbs. at 160 fpm. for the higher speed, the actual duties have exceeded these amounts considerably. Loads of 131,000 lbs. have been hoisted to the quarry floor without any difficulty whatever.

At the conclusion of the construction period, the three-part arrangement with the sheave car and the barney car will be dispensed with, and the hoist will operate with a single line to a supply car for hauling the usual quarry supplies to the quarry floor.

Power is very often lost through improperly insulated trolley wires, the current leaking through wet surfaces, etc.

Steel Corporation to Build New Big Plant.

Announcement is made by the United States Steel Corporation of its intention to build one of the largest plants which it has erected in years. The new works will be a tube plant to cost about \$25,000,000.

The construction is in line with the corporation's extensive program of development mapped out several months ago to meet not only the enormous demand on the concern through the business now being brought to these shores by the European war, but also the immense trade which the directors see opening to the corporation in the reconstruction period to follow the war. Already the corporation has received huge orders for manufactures to be turned over to consumers in Europe when the hostilities are ended, and has begun a big campaign of salesmanship in South America to capture trade with that continent which formerly went to European manufacturers.

Elbert H. Gary, chairman of the corporation, in making the announcement of the new works, said:

"We have decided to build and will promptly commence the construction of a first-class tube plant at Gary, Ind. It is estimated the improvements, including ore docks, ore yards, blast furnaces, converting mills, blooming mills, powder stations, water works, sheared plate mill, universal plate mills, butt departments, will cost \$25,000,000. It is probable the plant will be built in two units, the first of which it is hoped will be completed in about fourteen months."

The appropriation for the tube plant, together with others for extension work, brings the total sum set aside by the corporation during the last 6 months for new plants up to about \$53,000,000. A large part of the expenditures is for new coke works. The amount is exclusive of the \$3,000,000 to be expended in the construction of the big zinc works at Donora, Pa.

The following table shows the cash expenditures of the Steel Corporation for new construction since organization:

1916.....	*\$55,000,000	1908.....	\$49,422,697
1915.....	*17,500,000	1907.....	66,981,252
1914.....	23,171,013	1906.....	32,155,146
1913.....	41,999,098	1905.....	24,395,408
1912.....	13,780,362	1904.....	17,957,946
1911.....	49,430,861	1903.....	31,042,135
1910.....	53,101,221	1902.....	16,586,531
1909.....	37,916,250	1901.....	16,956,868
Total			\$547,396,788

*Estimated.

How the corporation has maintained its plants at an exceptionally high degree of efficiency is reflected in allowances for depreciation, sinking funds and ordinary repairs. To the close of 1915 allowances for the purposes mentioned totaled approximately \$880,000,000 and by the close of this year they will have reached, perhaps, \$950,000,000.

The asphalt deposits found at Trinidad and the Red Sea are practically pure bitumen.

making about 4 ft. per day in sinking operations. The shaft will be sent down 750 ft., and possibly 800 ft., before lateral work is resumed. On the 505-ft. level quite a large amount of commercial ore has been opened.

The Gold Dust Co. has taken over about 40 acres of the old O'Ryan property adjoining the Boundary Cone and started development. There are three shafts on this property ranging from 300 to 500 ft. in depth, with more than 3000 ft. of lateral workings. Some years ago the operators of this property constructed a mill, but it was not able to recover the values, and the company was forced out of existence. The Gold Dust Co. takes over the old main workings of the O'Ryan and all of the equipment excepting the mill. There is quite a tonnage of commercial ore still exposed in some of the old workings. The new operators intend to go to greater depth, and at the same time to do development work at and above the 500-level in order to solve the fault zone which was encountered by the former operators, and which they made practically no attempt to solve.

Splendid progress is being made in sinking the shaft of the Oatman Gold Mining & Milling Co. from the 315 to the 500-ft. point. The bore is now down 475 ft. and has cut a number of stringers and spurs showing mineralization with very flattering values in gold. When the 500-ft. point is reached, extensive exploratory work will be done at that level, and it is the belief of Engineer Edward W. Brooks that important ore bodies should be found on this level.

The Oatman United Co. is building a road to its property, and is making preparations to conduct a very extensive development campaign. A plant is being ordered, and this will be of sufficient capacity to work to a depth of 1000 ft. This property lies alongside the Tom Reed, United Eastern and Big Jim mines.

The Arizona Tom Reed, which encountered a small ore shoot containing values a week or 10 days ago, is still drifting in a very promising looking vein, the characteristics of which are such as to lead the operators to believe that an important ore shoot is not far away.

Black Range, which encountered a body of commercial ore containing good values, has not been able to further develop its find during the last few days. When the vein was opened the flow of water coming into the mine almost doubled and the pumping plant was drowned out. It will be a week or more perhaps before this property is in a position to resume development of its new find.

The shaft of the Big Jim is now down approximately 300 ft., and it is expected that crosscutting will begin on the 400-level on or about March 20. Work of sinking the shaft to the 600-ft. point will be continued at the same time, and when the 600-ft. station is cut another crosscut will be driven towards the ore shoot on that level, at the same time development work is being done on the 500. Some drifting has recently been done on the 400-ft. level of the Big Jim. Drifts were carried out about 25 ft. in each direction from the point where the crosscut tapped its ore shoot. The values disclosed were much higher than those where the crosscut penetrated the ore. Average samples of the entire breast of one drift by three different people is reported to have resulted in uniform average values of about \$70. Average sampling done on the breast and roof of the other drift showed slightly lower values in the breast and higher values in the roof. It is thought possible by mining men that the crosscut penetrated the vein at the point of widening and consequently lessening of average values, and as drifting is done on the vein in each direction it will narrow down to the usual 20 to 30 ft. found along that system, and the average grade of ore will be much higher than that shown in the crosscut.

A station is now being cut on the 500-ft. level in the Ivanhoe property, and crosscutting is expected to be under way soon. It is estimated that the crosscut will have to be driven a distance of about 200 ft. before the vein is reached, which was developed to some extent on the 200.

A force of men is at work on the property of the United Eastern grading a site for the projected new mill. The plant will have a capacity of 200 tons daily, but will be constructed on the unit system, so that additional units can be easily added as they are required. The mechanical equipment for the new shaft, including a 150-hp. double-drum electric hoist

and an electric-driven, 800-ft. compressor, has been installed. Sinking operations on the shaft will be resumed within a few days. The new shaft is now down 60 ft. In the old workings development continues on the 665-ft. level with splendid results, while work is continuing with the object of exploring the ground at a depth of 765 ft.

The Oatman Amalgamated Co.—one of the Long and McIver companies—is preparing to start an extensive development campaign. This company has over 400 acres on the northerly extension of the Gold Road vein system, and is very favorably regarded. Etienne A. Ritter has just completed an exhaustive report on this property, and has been retained as consulting engineer. A great deal of preliminary exploration work has been done on this property and splendid machinery equipment is now being ordered and will probably be installed within the next 20 days.

The Gilt Edge Co. is making rapid progress, its shaft now being down about 135 ft. A station has been cut at the 100-ft. level, and a crosscut is being driven to the north to explore No. 1 vein, which shows a width of 20 ft. and gives good values in gold at surface. It is the intention of the company to do its principal development work at 500 ft. depth, but stations will be cut every 100 ft. and crosscuts driven to the vein, which is but a short distance away, in order to keep in close touch with the geological conditions in the property.

The shaft of the Gold Range Co. is now down 125 ft., the material all being highly mineralized and showing good pan values. A compressor has just been ordered, and three shifts of men will be put to work. Although occupying ground of tremendous promise, it had not been well financed, and work on it had been slow. It is now splendidly financed and mining men in the district believe that its development will bring another mine into being in the district.

CALIFORNIA.

Grass Valley.

The litigation between the North Star and Empire companies over the vein discovered last spring in the lower workings of both properties has been definitely settled. The North Star is permitted to stope the vein for 750 ft. above the 6300-level, 1000 ft. north of the main shaft, several thousand feet to the south, and for an indefinite distance on the southerly dip. To the Empire is reserved the right to mine the entire northerly dip of the ore body. The division gives to each company practically an equal share of highly promising territory. The vein has been developed to a vertical depth of 2500 ft. in the North Star and 2000 ft. in the Empire. The value of ore developed is estimated at fully \$2,000,000. By means of the new hoist installed at the Central shaft the North Star Co. will be able to work the ore body to an approximate depth of 7500 ft., should it persist to this depth.

The Brunswick Con. Co. is contemplating the addition of more concentrators to the milling plant, which contains 40 stamps. It is likely a cyanide plant will be provided in the summer. Mine conditions continue highly satisfactory and a large tonnage of profitable ore is blocked out.

Nevada City.

The Providence shaft of the Champion group has passed the 2000-ft. point and is being continued to an approximate depth of 2500 ft. It is 3-compartment and will form the main working shaft of the property, displacing the Champion shaft now in use. Where connections have been made with drain tunnel the shaft is timbered with steel. As soon as sinking is completed extensive lateral work will commence.

The Massachusetts quartz property, lying between the Pittsburg and Phoenix mines, has been taken under bond and option by H. O. Secrist of Nevada City. It is intended to form a company and start work soon. Good ore has been taken from the upper workings, and the ledge is stated to average around \$50 per ton.

Sacramento.

The Elizabeth Mines Co. has been formed with a capitalization of \$500,000 to operate on 960 acres of the Fremont grant, near Mariposa. The holdings have been taken under

bond and option from the Mariposa Mines Co. and it is planned to start extensive operations within a few weeks. The directors of the new corporation are Edward M. Herberger of Sutter Creek, Edward R. Solinsky of San Francisco, C. M. Coffing, Edward F. Dalton and R. Miller of Sacramento.

Dutch Flat.

Quartz of excellent grade has been uncovered in the Blue Lead mine, formerly a noted gravel producer, and preparations have been made for extensive work. A small mill has been ordered and developments are proceeding with a force of 20 men. S. C. Jordan is manager.

Preparations are being made for reopening of the Rough & Ready mine. New capital has been interested and a large working force will be employed soon. Underground indications are pronounced highly encouraging. William Watson is superintendent.

San Andreas.

Representing eastern capitalists, Gus Allgewahr has taken under bond the Big Four, Bachman and other properties in this district and has arranged to start early work. The group lies near the Thorpe mine, which is developing well. At the Pioneer Chief good ore continues to be developed, and the outlook is favorable for a prosperous year. J. E. King is superintendent. The Emery property, at Mountain ranch, has been taken under bond by Los Angeles people. It has yielded well in the past.

Tecopa.

The Ibez mine, 14 miles from Zabriskie, has been acquired by Frank A. Keith and J. F. Kent of the Yellow Pine Co., Goodsprings, Nev., and extensive work started with a force of 15 men. The ore contains silver, lead and zinc. An aerial tram, about 2800 ft. long, is to be erected to handle ore from the mine to the bins on the wagon road.

The Graves Lead Syndicate of Philadelphia is aggressively developing several lead-silver properties in this district and shipping 1500 to 2000 tons of ore per month. To facilitate working of the lower-grade deposits arrangements have been made to erect a 50-ton concentrator. Several rich discoveries have been made recently 5 miles east of the Tecopa group.

Harrison Gulch.

The new vein recently uncovered on the second level of the Midas mine has been intersected on the 5th level, giving approximately 600 ft. of backs. Arrangements are being made to seek the ledge on the 14th and intermediate levels. On the 5th level it shows the same strength and rich character of ore as on the second. The company has increased the working force and has the Midas and Victor mills running on mine ore, with the Lane mills treating the product from the old dumps. Drifting is proceeding to open the main Midas vein in the lower workings. The company has also established title to 26 outside claims. Operations are now in charge of President J. H. Sharpe.

Los Angeles.

The Corona Mining & Milling Co. has been organized to take over and operate the Confidence mine in Death valley, and it is planned to construct a 100-ton daily capacity stamp mill on the property this summer, according to Charles E. Merwin of Spokane, Wash., fiscal agent for the corporation. "The property has been variously known for a long period as the Mormon Gold mine, the Lost Mormon mine and the Sterling, and it is said that much of the gold that embellishes the Mormon temple at Salt Lake, Utah, was taken from it in an early day," said Merwin. "It is believed to be the property that was 'high-graded' by 'Death Valley Scotty,' and the workings, although they were in bad shape when we acquired the holdings, have every appearance of having been ruthlessly looted."

COLORADO.

Cripple Creek.

The Worcester mill is nearly completed, and on this account the Rubie Mining & Milling Co. has started operations again, with S. A. Worcester of Victor as general man-

ager. The mill is expected to be in operation by the 15th. The shaft at the mine has been sunk 985 ft. Drifts extend on the main vein both north and south. South of the shaft a winze has been sunk 535 ft. and its deepest workings from the bottom of this winze are therefore 1520 ft. deep. Some of the ground will be leased and some worked on company account. The mill has 50 tons capacity in its crushing department and 30 tons in the leaching department. It is constructed on the new plan, with a view to increasing the capacity in the future. The cyanide process will be adopted and sodium cyanide will be used, since it is now cheaper than the potassium salt, for the sodium compound is now made in this country. A new system of circulating the cyanide solution will be tried. Conveyor belts, etc., will make shoveling operations between the mine and mill unnecessary.

The Buckeye Mines & Milling Co. has been incorporated by E. S. Johnson, W. J. Chinn and Robert C. Argo of Colorado Springs. The capitalization will be \$50,000, and will operate in the Cripple Creek district. They intend to construct their own mill. Though nothing definite is at hand regarding the property they will operate, it is known that Johnson is president of the Blue Bird Gold Mining & Milling Co.

Edwin Gaylord, with W. A. Reed, will soon commence a new 100-ton cyanide plant. They will use the site of the former Gaylord mill, which was burned down a year ago, and are now clearing off this land for foundations. Reed has a lease on the Gold Sovereign dump which was being treated satisfactorily by the old Gaylord plant. Machinery has not yet been contracted for and they intend completing the mill in June.

The Consolidated Mines & Reduction Co., holding a lease on the Mary A. mines, has taken the Ella W. under lease and now has an assembled group of 25 claims on Tenderfoot hill. For developing they will extend the Tenderfoot Hill tunnel 700 ft. from the portal. From this bore they will prospect a radius of 1800 ft. from the tunnel line. The depth at the present breast of the tunnel is 258 ft. from surface, and the extension will attain its deepest point 658 ft. from surface. Already exposed in the Tenderfoot tunnel are veins from 1 to 22 ft. wide. Samples of these show values of \$3.20 to as high as \$78. The Lawrence Worden vein, to be cut by a short crosscut from the tunnel, is 22 ft. wide and is expected to average \$6 to \$8 in milling ore. The company has leased ground for a mill site on Carbonate Hill. Water will be supplied by the Cripple Creek Water Co. Plans for a mill of 250 tons daily capacity will be prepared when results from a 60 to 100-ton shipment of ore for test by cyanide and oil flotation processes have been received. The type of mill to be built will depend on these findings. Work will continue at the Ella W. and a third shift will soon be added. The property has a 6-drill electrically driven compressor. When the third shift is added the production will be increased and it is their intention to enlarge the ore bins to accommodate the ore.

Leadville.

Seventy-five tons of low-grade ore are being mined per day at the Mt. Champion mine, where they are concentrating 7.5 to 1. The concentrates will net between \$100 and \$150 a ton. A 10-ton shipment is made daily. Manager Lucien Smith of the property is planning extensive improvements for the coming summer. A 500-ton milling plant will be erected if the ore bodies prove continuous. He estimates the ore blocked out to be sufficient to continue shipments at the present rate for at least 10 years. No work has been done on the vein below the tunnel level with the exception of a drill hole put down several years ago. The hole showed ore to a depth of over 1000 ft. and development is planned to prove up the lower formations. A handicap in the success of this property is its distance from the railroad.

The Black Bear mine has added an Ingersoll air drill to the equipment. It will be used for driving tunnel No. 1, which is nearest the top of the hill. No 1 has not been worked for some time. It hauled its ore through Nos. 2 and 3 tunnels. There is good ore in all four of the tunnels, which total about 3000 ft. of development. Level No. 1 is now in 700 ft., and will be extended on the ore body until the desired depth is gained. Then a raise will be started from No. 4 which will serve for the double purpose of dropping



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Producers of the "War Metals" Possess the Proverbial Gold Mine.

Had there been an individual a year ago who possessed sufficient optimism to predict the present position of the metal market, he would have been adjudged a "pipe dreamer" obsessed with all the hallucinations and vagaries that are supposed to be the allotment of such an individual. But the most roseate dreams of yesterday are as nothing to the realities of today and copper, lead, zinc, tungsten and other properties are proving the proverbial gold mines of the early days.

The American metal industry at no time in its history has enjoyed so great a demand for the metals, now known as "war metals," as it is doing today. These include principally copper, spelter and lead, for which today there are unprecedented demands that give no indication of lessening for a long period of time, with little thought being given by the buyer to the price asked—prompt delivery being the important consideration.

That there is to be an even greater demand for these metals from foreign countries is the general belief, as a result of the enormous quantities of munitions used up in the big battles now going on in France. Other factors that will have a bearing on this increased demand is the heavy buying that has been started for domestic consumption and which gives every indication of continuing increasing for some time to come.

Copper, which has been enjoying a period of unprecedented prosperity with the metal now selling at close to 28 cts., has a long period of prosperity ahead of it, judging from the unity of opinion expressed that even if the war were to end before the year is over, it would be followed by such a world-wide resumption of industrial activity as was never before witnessed, particularly in the war-ridden countries.

That the copper supplies abroad are rapidly being depleted is evidenced by the decrease in stocks of 1823 tons and a drop of 2123 tons in visible supply in England, France and afloat thereto. The Mexican situation will also have its effects on the copper industry for large quantities of blister copper and concentrates are very likely to be shut off, thereby curtailing the American output to some extent.

Domestic buying, added to the war's demands, during the past 2 weeks has permitted spelter to regain some of its price losses and it is again selling around 19 cts. per pound. Exporters are said to be on a "still hunt" for supplies covering nearby shipments, and seem willing to pay considerably above the present quotations.

There has been a great deal of activity in the lead market the last two weeks, in fact more than for several months past, owing to a big export demand. Foreign manufacturers of war munitions are making heavy drafts upon this country for pig lead. Since the

first of March sales aggregating between 6000 and 7000 tons have been made by New York dealers and operators, largely for export, the heaviest buying being for shipment to Japan. Domestic consumers are also beginning to awaken to the fact that they have seen the last of low prices for some time to come and are now seeking supplies at much higher prices than prevailed a few weeks ago.

No other metal necessary in the manufacture of war implements has reaped so large a benefit as has tungsten, having advanced from under \$600 a ton to nearly \$8000 per ton. To make high-speed tools, necessary in manufacturing shells, rifles and big guns, as well as other war implements, only one kind of steel can be employed, that alloyed with tungsten, which will retain a cutting edge at over 1200° Fahr., or while red hot. The average tungsten content of this steel is 18%. And there is only a limited supply of tungsten commercially available in the world. So heavy is the demand for tungsten that some manufacturers are refusing to consider any foreign orders for the metal. Their supplies are not sufficient to meet the demand from machine tool makers at home, and that is given as the prime reason for the great rise in price.

Plans for Alaska Surveys and Investigations During 1916.

The investigation of the mineral resources of Alaska by the Geological Survey will be continued this year by 12 parties. Congress has recognized the necessity of preparing in advance for the survey of this difficult field by including the appropriation for its continuation in the urgent deficiency act, which was approved on Feb. 28. This prompt action makes it possible to plan the work in advance of the opening of the field season and to carry out the plans efficiently and economically.

The work to be done this year includes a detailed survey of the region tributary to Juneau, which is the most important quartz camp in Alaska. A continuation of the study of the mineral resources of the Ketchikan district, where there are important gold and copper mines, is also planned. The investigation of the water powers of southeastern Alaska will also be continued. Only one party will be employed in the Copper river region. Two parties will work in Prince William sound.

Four parties will make surveys in the region directly or indirectly tributary to the government railroad under construction. One of them will study the new Tolovana placer district and also make some supplementary investigation of the Fairbanks lode district. The geologist of this party will later visit the Nome district. A detailed geologic survey will be made of the western part of the Nenana coal field, which is adjacent to the route of the government railroad. Two other parties will be employed in carrying recon-

naissance surveys westward from the railroad route to the Kantishna placer and lode district. It is also proposed to make surveys of the lower Yukon, including the Marshall placer district.

The recent cement show held in Chicago revealed in an astonishing degree the large and varied use of steel and iron which the industry has occasioned. Machinery for the manufacture of the cement; mixing, conveying and handling equipment for the contractor; steel bars and wire in many forms for reinforcing; steel forms for monolithic construction, and cast-iron molding machinery for concrete blocks, all these, together with the power machinery for driving this equipment, represent a consumption of ferrous metal which has grown at a rate commensurate with the exceptional growth of the Portland cement business. What the promotion of the use of concrete is doing, as visualized at the show, in adding to the market for pig iron, steel and iron bars, sheets, plates, structural shapes, wire, bolts, rivets and chain, may well dispel the fears that have been entertained regarding the inroads that reinforced concrete construction is likely to make on the consumption of steel.

The pay rolls of Butte mines for February were the largest for any month in the history of the Butte camp. The Anaconda Co. pay roll exceeds \$1,200,000, Butte & Superior is approximately \$235,000, North Butte \$120,000, and the Elm Orlu and other Clark companies paid about \$75,000. East Butte Co. rolls are close to \$50,000, while Davis-Daly and other companies that employ smaller number of men are estimated to have pay rolls totaling \$50,000 to \$75,000. The total amount paid out by the mining companies alone in Butte amounts to about \$1,800,000, which does not include any other lines nor does it take into account railroads and transportation lines connected with the mining industries.

As a result of experiments carried on at the Garfield smelting plant, Garfield, Utah, plans were recently completed for the construction of a plant for the treatment of zinc ores by the electrolytic process. The experimental plant is identical with that in use at the Anaconda plant and the new plant is to cost above \$1,000,000.

All American employes of the American Smelting & Refining Co. have been withdrawn from Mexico and are now in the United States. The plants of the company in operation in Mexico, apart from a number of mines, were the smelters at Monterrey and Matchuala. These had been put in operation 6 or 8 weeks ago.

The demand for steel from domestic consumers is increasing instead of falling off and Europe is in the market for almost unheard of tonnages for shell purposes and for railway steel. There is no doubt in the minds of manufacturers that prices will go higher than ever seen before.

latter came here for the purpose of checking the reports. Upon his return to Chicago the financial end of the enterprise was definitely arranged. Before leaving Prescott, Dr. Wheeler outlined his plans and stated they would be in operation by early summer. In speaking of the tunnel project Dr. Wheeler expressed himself as being thoroughly satisfied with the ore-yielding possibilities of that section, and voiced the opinion that at greater depth, larger and more generally mineralized ore bodies than those at present under development, would be encountered.

As outlined, the tunnel will penetrate the Bradshaws for an approximate length of 12,000 ft. and to a maximum depth of 1800 ft. Its course will be from east to west, starting at a site about a mile below the camp of Crown King and terminating on the Wild Flower group of claims on the opposite slope. It is the purpose to utilize the bore for transportation, for exploration and for drainage.

CALIFORNIA.

Quartz.

Streaks of rich ore have been encountered in the lower workings of the App mine, and arrangements are being made to prospect large areas of promising territory in the vicinity of late discoveries. Developments in the Dutch mine continue to expose wide faces of mill ore, and drifts are being extended from the shaft to develop the App and Sweeney to better advantage. The Dutch mill is running steadily on good ore. The group was acquired recently by a strong company of eastern people. W. J. Loring is superintendent.

San Andreas.

The south drift on the 350 level of the Pioneer Chief mine has intersected an ore shoot 9 ft. wide assaying \$5 to \$40. Average value of ore is \$15 in gold. The north drift on the same level shows 6 ft. of \$15 ore. Both drifts are advancing, and stoping has commenced. Late developments have opened productive ground at several points beyond the old workings. An excellent mine plant has been provided and the management plans the installation of a 10-stamp mill in the early summer. J. E. King is superintendent.

The Summerville mine, at Fourth Crossing, is developing well. On the 215 level the 70-ft. crosscut has intersected a 5-ft. vein of good ore. Considerable sulphurets shows. A new shoot has been cut below the 215-level and is to be prospected. Preparations are being made to construct an aerial tramway from the mine to the 30-stamp mill. An electric hoist will also be provided. This mine was formerly known as the Thorpe and produced much good ore. A. H. Summerville is superintendent.

Stent.

The Jumper mine, years ago a remarkable producer, is again working well under the leasing system. In 1915 the output approximated \$100,000, and late developments have been exceedingly good. Several lessees are operating, the company receiving a 25% royalty.

Happy Camp.

Work has been resumed at the Dakin copper property. The mine has been developed by about 4000 ft. of underground workings, and approximately 700,000 tons of good-grade ore has been blocked out. In addition to its copper content, the ore carries good gold values. F. H. Dakin, Jr., is manager.

Yreka.

Engineers are examining the Blue Ledge copper mines, in the northern part of Siskiyou county, and it is reported plans are being consummated for operation of the group. The Blue Ledge is controlled by New York capitalists and has been extensively developed. An immense tonnage of good-grade ore is exposed, but distance from transportation and smelting facilities have militated against production.

Columbia.

At the recent meeting of the Springfield Tunnel & Development Co. the following officers were re-elected: W. M. Hall, president; C. A. Belli, vice-president; A. L. Horner, secretary and general manager; Joseph Cademartori, super-

intendent. The long tunnel is advancing toward the main channel, and good gravel is coming from the Buchanan channel. The property is well equipped.

The main tunnel of the Experimental has advanced to a point 2650 ft. in from the portal and is expected to intersect the main vein within 150 ft. This ledge yielded rich ore at shallow depth several years ago. A second vein was encountered several months ago in the tunnel and is being stoped; 5 stamps are dropping and the water ditch, recently damaged by snow, has been repaired.

Millsaps.

The California Chrome Mining Co. is completing arrangements for extensive operations at its chrome mine near this place. Extraction of ore will commence early in April, and shipments will begin about May 1; 50 tons of ore will be sent daily to Fruto, the nearest railroad point, 14 miles distant. Over 5000 tons of shipping ore have been blocked out.

Kennett.

Driving of the new No. 6 tunnel at the Mammoth mine is progressing with the arrival of good weather. It is planned to tap the ore bodies about 400 ft. below the present workings, besides prospecting a wide belt of virgin territory. A large amount of new work is going forward at the Friday-Lowden, Stowell, Spread Eagle and other outside properties owned by the company. At the smelter three furnaces are operating at top capacity. Ore deliveries from the Balaklala mine continues to average 300 tons daily.

Pilot Hill.

Preparations are being made by J. D. Voss to start shipments of copper-gold ore from his Camelback mine. It is estimated ore to the value of \$350,000 is exposed, much of it being high-grade. Several gold properties in this section are receiving attention and the outlook is favorable for a busy year.

Westville.

A rich strike has been made in the Herman mine, according to advices from the property. It was made near the shaft and is said to consist of a strong shoot assaying \$100 gold. The main tunnel is in 2000 ft. and opening highly promising territory. The shaft is down over 400 ft. Pittsburgh people are chiefly interested.

Sutter Creek.

Unwatering the lower levels of the Oneida is proceeding rapidly and repairs to the shaft will soon start. In the old workings a considerable tonnage of \$10 ore has been encountered, and prospecting has been started to more fully explore this section of the mine. As soon as the lower levels are in working shape ore will be sent to the 80-stamp mill of the South Eureka. This company owns the Oneida, which adjoins the noted South Eureka mine.

Portola.

It is reported the Walker Copper Co. has bonded its property in the Grizzly mountains to a syndicate of eastern capitalists. The mine has been extensively developed and large bodies of excellent-grade ore are exposed. A 100-ton concentrator and aerial tramway were recently installed, and it is said the new operators plan large-scale operations. Developments have been by means of tunnels, drifts and raises.

Grass Valley.

People claiming to represent the Tonopah Belmont Co. of Tonopah, have taken options on large areas of mineral ground north and east of town. The holdings embrace quartz and placer deposits, but most of the ground has never been worked to any extent.

Goffs.

A promising tungsten belt has been discovered a little over 6 miles north of Goffs. It has been traced for 8 miles and ranges from 3000 ft. to 2 miles in width. The ore is largely hubnerite, but some scheelite occurs. Float and higher-grade ore averages 7 to 30% tungsten. Much low-grade ore shows, and it is intended to install a concentrator, if developments continue satisfactory.

Plymouth.

Installation of electrical equipment at the Amador Star mine has been completed, and mining will begin in a few days. An excellent mine plant has been provided, and a large tonnage of profitable ore is stated to be exposed. The mine was

formerly known as the Bay State and has produced much good ore. J. Campini is superintendent.

Seneca.

The mill on the Seneca Con. mine is crushing 30 to 45 tons of ore daily and it is planned to increase the output in the summer. Good ore has been recently opened in new territory, and the main levels continue to yield well; 30 men are employed and more will be put to work soon. County Surveyor Barbee is superintendent.

Alleghany.

With the exception of the Plumbago, all mines in the Alleghany-Forest field have been idle nearly 2 weeks following the burning of a transformer on the electric transmission line of the Middle Yuba Hydro-Electric Co. The Plumbago is provided with its own power facilities.

The Mugwamp Mines Co. is preparing for extensive work at its recently-acquired properties between Alleghany and Forest. Mine equipment has been ordered and development of the main gravel channel will be pressed at once. Later on the quartz deposits will receive attention.

tunnel. The tunnel will be advanced to intersect the Ruler and other veins controlled, and upon which work is now being prosecuted through the Capital tunnel. The installation of the new compressor plant back of the Capital power plant is being rushed. This and other machinery will be ready for operation in a few days.

Leadville.

The La Plata property on Rock hill will resume operations immediately under W. E. Bowden. The property has been an extensive producer of iron-manganese and carbonate of zinc. A new surface plant will be put up and machinery installed.

Bowden is also developing the American on Fryer hill, the water from which place is now being drained off, thus permitting many closed properties to resume. A new plant of machinery has been installed and the shaft retimbered where necessary. Shipping has been under way for several weeks. Several bodies of iron carbonate carrying values in silver have been opened.

COLORADO.

Cripple Creek.

Good ore is now being taken out at the junction of the Shurtloff and Eagle veins. It was encountered by a 100-ft. winze from the 1200-level. They will shortly drift over to the shaft, a short distance from the winze and raise through to connect. The shaft is 1250 ft. deep and with the addition will be 1350 ft. deep. The vein cuts through the shaft on its present course so that ore will be mined right up to the station. Langdon and Reiton lessees operating at the 1000-ft. level, on what is considered a split off from the Shurtloff vein, are shipping ore estimated from \$30 to \$35 a ton. Other lessees are active on the South Burns and producing between 50 and 75 tons a week. Rapp and Cobb, leasing the Shurtloff shaft, have been doing development and have produced very little.

The Vindicator Con. Gold Mining Co. in its annual report announced the intention of the management to proceed with the construction of a mill for the treatment of low-grade ores by the oil flotation process. It is understood the La Bella building, conveniently situated under the dump at the Golden Cycle mine, will be utilized. It is a brick structure, formerly in use for the La Bella electric lighting plant, owned by the Arkansas Valley Railway, Light & Power Co.

Colorado Springs.

At the Golden Cycle mine, owned by the Vindicator Co., the Ready Money vein has been opened 2025 ft. The vein is said to be as wide as 200 ft. above, and the values are satisfactory. Developments are proceeding and the ore body will soon be proved. The shaft is now down 2210 ft. and the company will soon be ready to crosscut to the vein at a depth about 200 ft. lower than the crosscut at the 2025-ft. level, thus making stoping ground of more than 575 ft. below the lowest workings of the Vindicator property. There is little doubt that the ore body will be encountered at this depth just as it was at the 2025-ft. level. The Vindicator shaft is down to a depth of 1787 ft., which is on a level with the 1650-ft. level in the Golden Cycle shaft, since the collar of the Vindicator shaft is 137 ft. higher than that of the Cycle. This proves nearly 400 ft. of ore below the lowest level now at the Vindicator. Though the shaft at the Golden Cycle was not operated for 10 days they produced 4495 tons of ore during February.

Idaho Springs.

The Onondago Mines Co. has taken over the Central Aliunde group on Leavenworth mountain. It is understood that the Hall tunnel will be advanced for 1200 ft. This would take the heading directly to the 1000-ft. level of the shaft workings, completely draining the 30 miles of underground workings. Some years ago a winze was sunk from the 1000-ft. level to a depth of 65 ft. For the entire distance a body of good ore was followed that brought a mill settlement of \$77,000. Development will be instituted through the Doric

IDAHO.

Murray.

The Black Horse mine and mill are to be operated again, according to C. E. Mallette of Spokane, who acquired the property from August Brincken of Latah, Wash., about a year ago. Mallette has organized the Murray Hill Mining Co., a close corporation, to take over and operate the holdings. A satisfactory contract has been made with the U. S. Smelting & Refining Co. for the zinc concentrates, and shipments will begin as soon as possible. Last summer 4 cars of concentrates averaging 50 to 54% zinc were shipped to the Graeselli Chemical Co. at Cleveland, O., the consignments netting about \$16,000 above freight and treatment charges. "The concentrates contained neither lead, iron nor silver, and they are regarded as very desirable smelting material because of this," said Mallette. "The settlement is based on 45% zinc at 5-ct. spelter, and the price is \$23 a ton fob. cars. For each additional cent a pound up to 8 cts. we are allowed \$4 a ton, and for each additional cent from 8 to 16 cts., \$3. For each unit of zinc in excess of 45%, \$1.50 per unit. This means that for 50% zinc concentrates, with spelter at 16 cts. or better, we will receive \$66.50 a ton. As I expect the concentrates to go as formerly, above 50%, I figure to receive, approximately \$70 a ton under the new contract."

Wallace.

The same interests that financed development of the Interstate properties in the Nine-Mile district, now part of the Consolidated Interstate-Callahan holdings, are said to be behind the development of an extensive group of lead-silver claims, adjoining the old California-Black Cloud mine, on the west side of Nine-Mile. No company has been organized yet, the concern being known simply as the Duluth-Minneapolis syndicate, of which Oscar Wallace is manager. He is the original promoter of the enterprise, and those reported to be associated with him are John A. Percival and M. G. Rodearmel, president and first vice-president, respectively, of the Interstate-Callahan Co.; George W. McClelland and E. T. Stacey, Minneapolis, and W. T. Smith and Dr. H. T. Ecklund, Duluth, all of whom were interested in the Interstate at the time of consolidation with the Callahan corporation. The claims have been under development for several months, and already an 1100-ft. drift tunnel has been run, following a vein 10 to 12 ft. wide. The ledge, according to recent reports, is well mineralized, carrying both lead and zinc, with about a half an ounce of silver to each unit of lead. The property is equipped with adequate mining machinery, and comfortable quarters for the employes, together with storage buildings, have been erected at the camp.

The Success Mining Co. on March 23 paid the regular monthly dividends of 3 cts. a share, or \$45,000, to stockholders of record March 15. This will make the disbursements for the current year \$135,000, and will increase the grand total to \$1,730,000, of which \$900,000 is credited to the old Granite Mining Co., which owned and operated the property

driving the exploration crosscut towards one of the main veins which outcrops not far distant from the shaft.

Operators of the United Northern report that the formation being cut in shaft sinking operations at 160 ft. depth is very encouraging, and that stringers are showing high-grade values. A new machinery equipment has just been installed on this property.

The Sunnyside Mining Co. has just installed its new machinery equipment, and its working shaft is now being rushed downward from the 120 ft. point. August McDonald of the Independence mine at Cripple Creek has now become associated with the Sunnyside Company and is in Oatman paying personal attention to its development.

The shaft on the Argo property is down 250 ft. and will be continued to 500 ft. depth. It has a very fine machinery plant now in full operation, and work will be rapid hereafter.

The Esperanza Mining Co., in which J. P. Loftus and George W. Long of the United Eastern in Oatman are officials, has just ordered a complete new equipment consisting of hoist, compressor, power drills and so on, and will soon be pursuing an energetic campaign of development.

The Black Range Co. has been unable to do any development for more than 2 weeks owing to a heavy flow of water. The pumping and bailing equipment which is now in operation is making headway, and the superintendent believes that he will be able to resume mining operations within a week.

The Oatman Gold Mining & Milling Co. is now crosscutting at 500 ft. depth to get the downward continuation of a very promising vein which was explored at 300 ft. depth, and which showed considerable low grade ore, although the vein was considerable broken up.

The Gold Range Co. has been reorganized with H. J. Sayers, of Los Angeles, as its president. A compressor plant is now being installed on the property, and two shifts of miners will henceforth be employed.

Rapid development of the Oatman North Star property, which adjoins the Tom Reed on the northwest and throughout its entire length, has the great dike that indicates the extension of the Tom Reed vein. Upon the advice of engineers who made examination of the property, the shaft was started upon the vein, and had attained a depth of 80 ft. before there was installed a 40 hp. hoist, a 60 hp. compressor and other machinery. A. C. Parsons is president of the company and the other directors include R. E. Gilman, formerly associated with the Guggenheims as an engineer; R. R. Moore, who was an engineer with the Selby Smelting Co. before he took charge of the Oatman North Star, and Lloyd Tevis, a San Francisco capitalist.

CALIFORNIA.

Gold Reef.

This new camp, located 6 miles north of Danby, a station on the Santa Fe railroad, is attracting much attention. The Gold Reef Mining Co., composed of Los Angeles capitalists, has acquired control of the central portion of the district and is preparing for extensive work. Operations will be largely restricted to the leasing system for the present, the company in the meanwhile prospecting the gold-bearing reef to a depth of 1000 ft. with drills. A townsite has been laid out, and lots will be sold only as circumstances justify. B. G. Doak, of the Pacific Steel Co., and other Los Angeles men have taken over claims and are arranging for comprehensive developments.

The district is traversed by a series of mineralized reefs, with the principal lode showing numerous quartz outcrops. The ore is found in andesite. In places the quartz shows a width of 20 to 50 ft., with a length of 1000 to 1400 ft. Outcroppings frequently attain a height of 100 ft. The exposed ore is of fair milling grade, with streaks of rich quartz showing at some points.

Barstow.

A camp of Goldstine, 25 miles north of Barstow, is showing a rich discovery. On the Goldstine group bonanza showing and a shipment of 1000 lbs. of high-grade

ore was made last week to Barstow. A. A. Turner is manager. Several other claims in the district are being vigorously developed. The camp was discovered a year ago.

Oroville.

A rich strike is reported from the South Banner mine, the discovery being made on the 350-ft. level. The vein is stated to be the full width of the shaft with portions running into fancy values. All the ore is free-milling. The capacity of the 2-stamp mill is to be increased. The South Banner is one of the properties comprising the Banner group, recently acquired by New York capitalists. Richard Phillips is superintendent.

Amador City.

Sinking of the Fremont Con. shaft to a depth of 2750 ft. is proceeding. The shaft at present is 2350 ft. deep. From the new levels extensive lateral developments will be prosecuted. About 175 men are on the payroll and the mill is running steadily. W. L. Palmer is superintendent.

Junction City.

The Valdor Dredging Co. has closed a contract for immediate delivery of equipment for a bucket-elevator dredge to the Heurtevant ranch, 4 miles below Junction City, on the Trinity river. It is planned to have the dredge in commission in the early summer.

Carrville.

The Trinity Development Co. is busily preparing for the building of its \$350,000 dredger on Coffee creek, near this place. Machinery is en route to the placers and it is expected the dredge will be ready for service before the end of summer. The company is still prospecting large areas of promising ground adjoining its main holdings.

Operations have been resumed at the Golden Jubilee mine, near Coffee, and within 30 days 50 to 75 men will be employed. Construction of a new reduction plant will start shortly. The mine has been extensively developed and large reserves of gold-bearing ore have been blocked out. H. C. Lyon is manager.

Jackson.

Representatives of the U. S. Steel Corporation have examined and sampled the Johnson copper-iron mine, 4 miles west of Jackson, and the acquisition of the property is under consideration. Deposits of good-grade copper ore were encountered several years ago, and, recently, high-grade iron was found. The mine lies 8 miles north of the Campo Seco copper properties.

New York people are reported to have taken over the Hardenburg gold mine, 4 miles south of Jackson. The property was formerly worked along broad lines and is equipped with an excellent mill and mine plant.

Soulsbyville.

The Cherokee Gravel Co. is preparing to extend the main tunnel several hundred feet to reach an ancient channel which prospects well where exposed. From the tunnel raises will be extended to open the deposit advantageously. James Harry and J. H. West of Soulsbyville are heavily interested.

Tuolumne.

Developments are proceeding steadily at the Star King mine, east of town, with good ore showing. On the 625-ft. level a station has been cut and opening of new ground is going forward. A mill-test of the ore is being made, and on the result will depend future activities.

Grass Valley.

Preparations are being made to sink the 1100-ft. vertical shaft of the Brunswick Con. Co. 200 ft. deeper. Late work in the 1100 workings has been satisfactory and indicates a large tonnage of good ore may be looked for at further depth. The mill is treating about 3300 tons of ore per month, averaging around \$10 per ton. The management reports 16,000 tons of profitable ore blocked out, and a good tonnage of low-grade material is also exposed. Sorting will be tried in an endeavor to turn part of the low-grade product to profitable account. C. H. Mallen is superintendent.

The Union Hill Co. has arranged to sink the 800-ft. shaft to a depth of 1000 ft. From this point drifts will be extended to pick up the extension of the rich shoot which yielded bonanza on the 800 workings. Unwatering of the

shaft has been nearly finished. Additional funds are being raised to complete a payment of \$25,000 on the property.

On May 1 the Empire Mines Co. will pay the final installment of the purchase price on the Pennsylvania mine, amounting to \$50,000. The total price of the mine was about \$500,000. Soon after this payment has been distributed to stockholders the Pennsylvania Con. Mines Co. will be dissolved.

Montague.

The Shasta Development Co., composed principally of Indianapolis, Ind., people, has acquired a large area of supposedly oil-bearing land 6 miles south of Montague, and has shipped two strings of tools to the scene. Henry Rominger is president; Charles E. Nördyke, treasurer; J. B. Wood, local manager. Indications are thought favorable for striking an oil pool at an approximate depth of 2700 ft. It is planned to start the first well in April.

COLORADO.

Cripple Creek.

A good strike was made in the latter part of March on the Yellow Bird Co.'s property. While drifting southeast to the Midget-Bonanza King vein they struck a cross stringer 12 ins. wide. It contained galena, sphalerite and tetrahedrite. Samples assayed gave gold, \$3.60; silver, 26 ozs.; zinc, 33%, and copper, 3%. This gives the total value at \$72. They are continuing to drift south and are confident that the junction of the two veins will expose an ore shoot. At the Red Bird workings two drills are in operation. A drift in a north-westerly direction on the Yellow Bird vein, which extends into the Red Bird on the west, mine samples have ranged from \$6.20 to \$14.40 per ton. Until recently considerable trouble and delay was encountered from mine gases. A large electrical ventilating fan has been installed and has remedied the trouble.

At a recent meeting of the El Paso Con. Co. the building of a flotation plant was decided upon as soon as satisfactory results are obtained from experimental work now under way by this and the Portland Gold Mining companies. Officers elected were as follows: H. McGarry, Colorado Springs, president; F. W. Bailey, Denver, vice-president; G. M. Miller, New York, secretary-treasurer. They intend to develop the Beacon Hill property. An effort is being made to introduce the split check leasing system, but this will be optional with the lessee. A contract committee to handle contracts for the sale of ores and supervise this business is as follows: F. W. Bailey, R. M. Rankin, Daniel Thatcher, J. K. Corbiere and G. W. Gano, and Daniel Thatcher, F. W. Bailey and H. McGarry will make up the executive committee.

J. B. Neville and W. Brown have leased the Pueblo mine from the Free Coinage Co. The property is located on Bull Cliffs. At a depth of 85 ft. in the incline shaft they have opened an ore shoot. It is an oxidized brecciated quartz, carrying gold. Assays show about \$30 per ton in gold. A shoot on this vein, operated by a former lessee, produced over \$60,000.

The Elkton Con. Co. has again started to hoist in the Thompson shaft, which has been closed since Jan. 2. This shaft and ground worked through it have been leased to the Oston Leasing Co. I. J. Russell is superintendent. Three drills were kept on development while hoisting was discontinued. There is now in the stopes about 7000 tons of ore that will bring from \$8 to \$10 a ton. It will be shipped to the Golden Cycle mill, Colorado City. The lowering of freight and treatment changes has been under long consideration as regards the low-grade ores. If the rates being considered are brought into effect ores valued as low as \$4 can be profitably worked.

Leadville.

Near Wortman in the Alicante district ground formerly operated by the Burma Co. has been leased by the Denver Mining & Milling Co. E. E. Miller, Denver, and O. H. Cold will be active superintendents. They will work through the Alicante property. They are transporting machinery to the mine and preparing to start immediate development. The

mill erected by the Burma Co. will be remodeled and reformed into a flotation plant. All ore mined will be concentrated before shipping. A railroad siding is being built in from Wortman. The Alicante has a 150-ft. shaft and a tunnel 500 ft. on the vein. The ore is low-grade lead-zinc and was probably found unprofitable before because of the methods and equipment used.

Salida.

From recent reports it seems that Boulder county is now not the only county in Colorado having tungsten. The first discovery was made on the manganese property owned by W. H. Boyer and Ray Hanks, near Wellsville, south of here. The ore was considered only as manganese bearing, but tungsten was found by an accidental qualitative analysis. Samples of the ore assayed 3.1% tungsten. The mineral is in a contact vein between jasper and limestone formation. A second strike was reported at Hecla Junction. A formation running for about 9 miles from the location of the first to that of the second find is the one which carries the mineralized veins.

Georgetown.

It has been announced by Mrs. A. H. Brownlee that the Malm mill will be ready for operation in not over 3 months. Inventor of the process, J. L. Malm, will be in charge of the plant. It is under control of the Colorado Metal Milling & Reduction Co., with a capitalization of \$1,000,000. Shares have a par value of \$1. Officers are as follows: President, F. W. Traphagen, Golden, Colo.; vice-president, Forbes Rickard, Denver, also consulting engineer of the company; secretary-treasurer, J. B. Foley, Georgetown. These officers, with Buell S. Rogers, Chicago, and Calvin Tompkins, New York, will be the board of directors. The plant will treat 100 tons per day at \$2 or less per ton, and save all metals which are gold, silver, copper, lead, zinc and iron. The ore is first ground to 20 mesh and then goes to tube mills. Chlorination and electrolysis are then used, which make the final separation.

IDAHO.

Wallace.

The Anaconda Copper Co. has started work on the Douglas mine, on Pine Creek, which it has taken under lease and bond, secured in the first instance by J. O. Elton of Butte. W. J. Kelly, who is in charge, says his instructions are simply to develop it. He will put 16 men to work extending both tunnels and cleaning out the incline which connects them with the surface. The No. 2 tunnel is in 400 ft. and the No. 3 between 700 and 800. The lower tunnel shows a continuous ore shoot for 700 ft., much of it being a solid sulphide, containing high values in both zinc and lead. The intimacy with which these metals are mixed heretofore has made it impossible to separate them by any known milling process. The ore will be treated at the Anaconda company's electrolytic zinc reduction works, or by a similar plant constructed on the ground. The purchase price of the Douglas is \$256,000, in payments strung out over more than 2 years.

Oro Grand.

Assay returns from two samples of ore from the Una mine, sent east for testing, show that the product carries from \$90 to \$387 in gold and from \$1.14 to \$22 in silver, according to reports received by J. M. Hinton, superintendent of the property. The samples were taken from a new exposure, made during the winter, where the main vein was opened by a shallow shaft 300 ft. west of the principal workings. "Our main tunnel, now in 900 ft., will reach a point directly under our No. 1 shaft in about 100 ft. at a vertical depth of more than 200 ft.," states Hinton. "This will bring us beneath where the vein shows on the surface for 150 ft. in width, with frequent pay streaks that are from a few inches to 5 ft. wide. The shaft, now down 30 ft., is sunk on the ore, and a crosscut from the bottom has penetrated the vein for 40 ft., without exposing the opposite wall. Samples from this deposit average about \$7 in gold, with small silver values. We had to suspend work a few weeks ago because of the cold weather, but operations will be resumed."

Owl Head Manganese Deposit, San Bernardino County, California

M+GW 4-15-16 (v. 441)

By R. L. MANN.*

In these days of great demand and resulting high prices for minerals and metals occurring west of the Rocky mountains, which until lately were considered almost worthless, manganese occupies a prominent place. Ferro-manganese, an alloy of manganese and iron produced in the furnace containing 80% MN., is quoted at present around \$400 per ton and the price is still soaring.

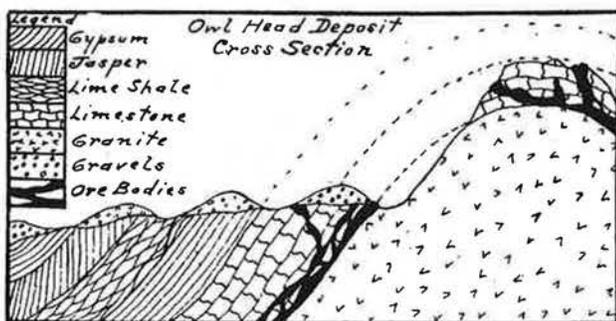
The value of ores containing manganese depends on their mineralogical nature as well as their purity. The prices paid at present for ore of medium grade, for which the demand is greatest, are rising steadily, while the values of high-grade ores, which are consumed in smaller quantities, has practically doubled within the month. The elimination of the Russian and Indian sources of manganese ores, the one due to the closing of the Dardanelles, the other to shortage of bottoms to move it, will not only keep up the high prices for this metal during the present war, but can be expected to keep that level for some time to come after peace is declared, since undoubtedly the belligerents will need a large supply from those sources for the building up of their industries. The deposits of Russia, India and Brazil yield, by sorting only, material rich enough to be smelted or even adapted for special uses, but although manganese occurs in many places in this country, only in certain instances is the ore of such grade as to comply with the above requirements, and the deposit sufficiently large to assure a steady tonnage. The description of an ore occurrence which meets those conditions and which to my knowledge has had no prior mention in technical literature or survey bulletins, might be of special interest at this time.

The Owl Head deposit is situated in the northern part of San Bernardino county, California, about 30 miles west from the Tonopah & Tidewater railroad, with which it is connected by a truck road in fair condition. The distance from the nearest postoffice, which is Silver Lake, to the mine, is 40 miles. A 30-hp. Caterpillar tractor, capable of hauling 20 tons, is taking the ore to the railroad, making the round trip in about 30 hours. The ore, which is being shipped at present at the rate of 200 tons per month to eastern points for chemical and battery purposes, shows the following analysis in carload lots: MnO_2 , 76.86%; MnO , 6.56%; BaO , 3.93%; phosphorus, .022%; SiO_2 , 3.58%; Fe_2O_3 , 1.12%; Al_2O_3 , 1.03%; CaO , 2.85%; MgO , 1.45%; moisture and CO_2 , 2.60%.

There is an immense tonnage of ore containing from 40 to 45% MN (metallic manganese), with an

iron content of less than 3%, silicon not to exceed 5%, and phosphorus less than 0.20%, which is not mined at present, but which should find a ready market with steel manufacturers.

The mine, consisting of 21 claims located at an elevation of 2000 ft. above sea level, was discovered during 1911 by the present owner. The geological horizon in the vicinity of the mine is simple. The rocks on the hanging-wall side of the deposit consist of sedimentaries constituting at one time, probably Jurassic, the bed of a lake. This series embraces limestones, jasper, shales, gypsum, conglomerate and gravels. These beds, which attain a thickness of about 1000 ft., are tilted by the intrusion of a mass of porphyritic granite, and as usual in such cases the dip of the sediments nearest the intrusive is steepest, 60°



CROSS-SECTION OWL HEAD DEPOSIT.

in this instance, flattening out as the distance away from the point of uplift increases. This intrusive rock is composed of a coarsely crystalline mass, consisting of orthoclase and oligoclase feldspars, the former in large well-defined crystals; biotite, a little hornblende, and is heavily stained with iron and manganese oxides. Indications seem to suggest that the granite did not break through the lime strata at the time of intrusion, but lifted it in the form of a dome. This shattered and broken area was later removed by erosion, leaving the limestones along the northern and southern flanks of the granite dipping in opposite directions. (See crosssection.) At the contact of these rocks intense mineralization took place resulting in large deposits of high-grade manganese ores. These deposits, classified as replacements, crop out in limestone at and in the vicinity of the contact for over 2 miles along a NW-SE course, and although covered up in places by shallow gravels and later debris, the line of outcrop is so strong and persistent as to lead to the reasonable assumption that the occurrence of ore for that distance is practically continuous.

Those portions of the ore body inspected at the

* Consulting Engineer, Silver Lake, Calif.

time of my visit will be classified as "Ore occurrences" and these again will be subdivided under the heading of "Deposit." Ore occurrence No. 1, Deposit A: A body of solid manganese 15 ft. thick exposed in a glory hole for a distance of 50 ft. Deposit B: Two parallel veins 40 ft. apart opened by 30-ft. shaft, with a 70-ft. drift in bottom, a 50-ft. adit and a number of open cuts; length of ore exposed 120 ft., thickness, 3 to 4 ft., high-grade. Deposit C: Ore crops strongly 500 ft. from shaft for a distance of several hundred feet; thickness of ore, 4 ft., high-grade. Ore occurrence No. 2, Deposit A: Ore 4 ft. thick by 300 ft. long, high-grade. Deposit B: Irregular replacement in limestone near contact 100 ft. wide, high-grade. Deposit C: A body of solid manganiferous iron 30 ft. thick of unknown length. Deposit D: Irregular replacement in limestone, some veins from 1 to 6 ft. thick appear to be solid pyrolusite. Total length of ore shoot in ore occurrence No. 2 appears to be about 2000 ft. long showing high-grade ore wherever exposed by open cuts. Ore occurrence No. 3, Deposit A: An area of high-grade pyrolusite crops out in limestone 200 ft. long by 12 ft. thick. Ore occurrence No. 4, Deposit A: Open cut showing 4 ft. of pyrolusite, which is packed on burros for a distance of half a mile to the road. Deposit B: A large body of manganiferous iron cropping 400 ft. long by 100 ft. wide.

It will be seen by the foregoing that the mine is capable of producing an enormous tonnage of high-grade manganese and manganiferous iron, and should be classed as an important asset to the mineral resources of the state.

The Nickel Mines of Ontario.

The nickel mines of the province of Ontario are described by Thomas W. Gibson, Deputy Minister of Mines for Ontario, in a recent issue of the *Financial Times*, London. The mines are located in the Sudbury district and are of great extent and value. The ore is a pyrrhotite, carrying the nickel mineral pentlandite and also chalcopryrite. In contents it varies from 1.5 to 5% in both nickel and copper, but the latter metal is usually somewhat lower in proportion than the former. A fair average of the ores as raised would be, say, 3.5% nickel and 2% copper. The deposits occur in lenticular masses on the outer edges of a huge laccolithic sheet of eruptive rock, which surrounds an elliptical area about 35 miles long and 17 miles wide. The first discoveries were made during the construction of the Canadian Pacific railway, in 1883. The finders shipped a quantity of the copper ore to a refining plant in the United States. Unexpected difficulties were met in its treatment, which on investigation proved to be due to the presence of nickel. Mines were opened by the Canadian Copper Co., employing American capital, and also by the Vivians of Swansea, who, however, retired from the field a number of years ago. The Canadian Copper Co. and the Mond

Nickel Co.—the latter an English concern—are the two chief producers, the works of the former being at Copper Cliff and the latter at Coniston.

A small proportion of nickel—say, 2½ or 3%—when alloyed with steel imparts to the latter many advantages. It greatly adds to its strength and toughness, and, in addition, imparts a high degree of non-corrosibility. Early advantage was taken of this property of nickel by manufacturers of armor-plate for battleships. These, when cemented and face-hardened, presented a great resistance to the penetration of projectiles, and the impact of the latter failed to crack them. For heavy ordnance nickel steel is invaluable, and is also used in the manufacture of cartridges and other articles of military equipment. In fact, wherever strength combined with lightness is desired, nickel-steel is in demand. For coinage purposes, electroplating of metallic objects, the manufacture of Britannia ware and for many other purposes nickel is also employed.

The development of the nickel-copper industry in the Sudbury district is going on rapidly, and the great demand for nickel owing to the present war is obliging the companies to push production to the limits of their capacity. In 1910 the quantity of nickel turned out was 18,636 tons and of copper 9630 tons. The outbreak of the war last year disturbed conditions for a short time, but the mines were ere long again at work, and the production of 1914 amounted to 22,750 tons of nickel and 14,448 tons of copper. The production for 1915 was about 32,000 tons of nickel and 18,750 tons of copper, the united value of which at the prices of the refined metals would be not less than \$30,000,000.

The ore after being raised to the surface is crushed to hand size and sorted, then roasted in huge heaps in the open air. The roasted ore is smelted to a low-grade matte, which is converted by the Bessemer process into a matte containing 75 or 80% of the metals combined. The Canadian Copper Co.'s matte carries, say, 50% of nickel and 25% of copper, and the Mond Co.'s matte about 40% of each. The Bessemer matte is exported by the Canadian Copper Co. to Constable Hook, N. J., and by the Mond Co. to Clydach, Wales, for final separation of the metals. In addition to copper and nickel the mattes yield gold, silver, platinum and palladium. At the Mond Nickel Co.'s works the copper is recovered as copper sulphate, which is in demand in the vine-growing countries of Europe as an antidote to the phylloxera.

Early in the history of nickel mining the Government of Ontario offered to the Imperial authorities of the day a substantial—possibly a controlling—interest in the nickel deposits of the Province, asking the British Government in return to establish refining works and a plant for the manufacture of nickel steel. The proposition did not commend itself to the Home Government, which believed it could depend upon the ordinary channels of trade for the supply of its wants.

40-hp. Fairbanks-Morse hoist, a 450-ft. compressor driven by a 60-hp. gas engine, and a 10-hp. gas engine to run pump to supply water to the mine, and a dynamo which will supply the mine buildings and workings with electric light. This is one of the most complete plants yet contemplated in the Oatman district.

In the Boundary Cone property the work of crosscutting to the vein on the 750-ft. level is now under way. The operators expect to reach the downward continuation of the vein in which has been developed a large tonnage of commercial ore on the 550-level within 20 days.

Lateral work in the property of the Oatman Gold Mining & Milling Co. continues, and indications are such that there is quite a general belief among the Oatman operators that this may be the next property in the camp to come into ore.

The Times Co. is now well launched on its development campaign, having completed the installation of its plant, the enlargement and retimbering of its shaft, and other such improvements. Its 3-compartment shaft will be carried to 500-ft. depth before extensive lateral work is attempted. This property already has a good tonnage of high mill-grade ore in sight.

On the Gilt Edge property the shaft is down about 200 ft., with indications that vein No. 2 may have pitched to the north and may be cut by the shaft within a short distance.

The new compressor on the Gold Range is now in operation, and three shifts are employed. The shaft has attained a depth of 165 ft., and encouraging gold values are showing in all the country rock.

In the United Northern property the shaft is down to a depth of 175 ft. and has encountered a change of formation, the vein matter containing much more calcite and showing strong seams of iron hematite accompanied by gold values up to \$5 and \$6.

The United Eastern Co. continues a steady development campaign, which is constantly adding to the ore reserves of the property. At the same time its new 3-compartment shaft, 700 ft. from the old shaft, is being sent downward, and preparations for the construction of its new 200-ton mill are being rushed.

The Tom Reed Co. continues a steady production of over \$50,000 per month, and arrangements are being made for quite extensive development of heretofore unexplored territory. A new shaft is being sunk midway between its Ben Harrison and Black Eagle shafts, some 150 ft. to the south of the Big Jim side lines.

The Gold Road Co.'s production is not given out, but it is estimated to be at the rate of something over \$100,000 gold bullion per month.

M. J. Monnette, vice-president of the Citizens National Bank of Los Angeles, together with John A. Hassell, a consulting engineer who was prominent in the early days of Goldfield, and George W. Long of the United Eastern Co., have organized the Mohawk Central Mining Co., and have ordered machinery equipment. This property is surrounded by the United Eastern, Tom Reed and Oatman United properties.

Bisbee.

The 40-ton testing plant of New Cornelia has been closed down permanently and construction of the big plant that is to handle the 40,000,000 tons' deposit of 2% copper ore, already proved by diamond drilling operations, is well under way. The steel framework for the machine shops is in place and a cement foundation for the power house is being laid. At present all the power used is generated at the big wells, 7 miles northeast of the mines, and transmitted over a pole line. When the big plant is completed the line will be used for the transmission of power in the other direction and the small plant at the wells will be discontinued. A railroad 5500 ft. in length extends clear around the vast ore body. The ore is to be steam shoveled and conveyed in 60-ft. flat cars to the first crusher. This crusher will handle 1000 tons a day and break the ore into lumps not greater than 6 ins. diameter. It will then go to a battery of small crushers which will reduce it to 2½-in. lumps. Conveyors will then carry it to bins above disk crushers, which will reduce the ore

to sand. Belt conveyers will then carry the sand to 11 lead-lined leaching tanks, each having a capacity of 5000 tons a day. The leached copper will then pass through the electrolytic process in 150 tanks 30 by 4 by 5 ft. These tanks will be able to treat 100,000 lbs. of copper a day. Sulphuric acid for the electrolytic process will be made from the fumes of the Calumet & Arizona smelter at Douglas.

As is the case in mine output, the Copper Queen and Calumet & Arizona smelters in Douglas are working to capacity. The copper production of Calumet & Arizona for March exceeded all records for any one month since the plant was put in operation. The amount of copper produced reached 8,400,000 lbs. The plant is working to the limit of capacity now, but plans have been announced which will greatly increase the present capacity by the addition of new furnaces, roasters and other equipment. The production of Calumet & Arizona for March last year only amounted to about 3,000,000 lbs.

Parker.

While little or no publicity is being given to the unusual mining activity prevailing throughout northern Yuma county, it is nevertheless a fact that there is more actual development now going on in this section than at any other period in its history. Numerous properties in this end of the county are preparing for development on a large scale, and nearly every day the work which is now under way is resulting in opening up new and greater ore bodies. The strikes being made are of convincing proof that this mineralized zone will some day rank with anything yet discovered in the state.

In the immediate vicinity of Parker several properties are getting under good headway. The Empire Arizona is making shipments via auto truck to Parker daily, and the developments at the mine the past week have resulted in the opening up of new and richer ore bodies. This company will soon be shipping 2 or 3 carloads daily. A new auto road is projected to Parker, which cuts the distance from the mine to the railroad from 12.7 miles to about 9. A force of 20 men is employed and this is soon to be increased. The company received a carload of lumber this week, and two hoists are to be installed as soon as possible.

The Billy Mack mine is producing steadily and encountering new and richer ore bodies. It is rumored that strong financial interests are about to take over this property and open up this old-time producer on a larger scale.

The Zealite-Mammon, which was recently purchased by Nevada interests, is preparing to ship. W. B. Andrews, manager, is now on the ground and proposes to start extensive development. About 20 to 30 tons per day can be shipped from this property with present equipment. The ore platform in local Santa Fe yards is overloaded with ore from the various properties now shipping from this vicinity, and efforts are being made for the railroad to extend the platform and install adequate ore bins for the more economical handling of ore.

The Swansea-Planet districts are humming with activity and prosperity. The Swansea lease, on the Clara Con. mine, which is held by the Thomas estate, cleaned up a profit of \$22,000 last month, and it is said that this month the profits will exceed this amount. Three carloads per day are now going out of Swansea and the ore is averaging a little better than 4% copper. A new body measuring 35 ft. in width has just been opened up and averages over 5% in copper.

The Planet is shipping 40 tons per day to Midway, a station on the Swansea railroad. The ore is running about 18% copper. Motor trucks are employed for transportation of the ore.

CALIFORNIA.

Nevada City.

Representing Nevada and Utah people, William H. Tuttle of Reno has taken under bond the Texas, Guild and Niagara mines, a mile east of Nevada City. The Texas is the principal property and has been developed to a vertical depth of 600 ft., exposing four veins. The mine has pro-

duced much rich ore, but has lain idle since 1900. Equipments consist of a 10-stamp mill and good hoist. Good quartz has been extracted from the Guild and Niagara, but neither mine has been extensively developed. A crosscut will be extended from the 600-level of the Texas to develop the ground to best advantage. The Texas is owned by Frederick Ayer of Beverly, Mass.

The Columbia Con. Mines Co. has purchased the Columbia mine, near Washington, for a reputed price of \$25,000, and has also taken over the German and Ocean Star properties. The three properties will be worked from the Columbia. The Columbia Con. has been working the Columbia mine under bond for 3 years, in which time large bodies of milling ore have been blocked out and a mill erected. E. C. Klinker is superintendent.

Jackson.

Ten mining companies in Amador county have increased the wages of underground men from \$2.50 to \$2.75 per day. The mines affected are the Kennedy, Kennedy Extension, Argonaut, South Eureka, Central Eureka, Bunker Hill, Fremont Con., Keystone, Little Amador and Plymouth Con.

The syndicate of eastern capitalists recently acquiring the Eureka mine at Sutter Creek has incorporated under the laws of Delaware with the name of the Old Eureka Mining Co. The capitalization is \$3,000,000, par value of stock, \$10. Only 100,000 shares will be issued at this time, as this will provide enough capital to unwater the shaft and finance explorative work. The company is building an excellent wagon road to the property and getting things in shape for installation of pumping and hoisting equipment. T. Walter Beam is manager.

Bishop.

The Noble, Cooper & Powning group of eight tungsten claims, 8 miles west of Bishop, has been purchased by A. J. Clark of Los Angeles. Options have been taken on the adjacent Everett and Vonderheide groups, embracing all known tungsten ground in this vicinity. The purchaser states \$40,000 will be expended on immediate developments.

Atolia.

Placer scheelite continues to claim much attention in this district and several small leasing companies are earning large profits. Ore buyers are very active. The new mill of the Atolia Mining Co. is rapidly nearing completion and will turn out about 7 tons of tungsten concentrates daily. It is conservatively estimated that 200,000 tons of profitable ore are available for immediate extraction. Arrangements have been made to install an electric hoist in No. 1 mine on the 900-level. From this point the prospect winze will be sent to considerable depth. The property is to be lighted by electricity.

Masonic.

The mill, tailings and all personal property of the Pittsburgh Liberty Mining Co. have been sold to the Stahl Bros. for \$20,000. The sale includes practically all the assets of the bankrupt estate, excepting the patented claims; \$750 was paid at the time the contract was signed and equal amounts are called for on the first day of every month to and including Dec. 1, 1916. On Jan. 1, 1917, \$5000 is to be paid, and \$7500 on July 1, 1917.

Colfax.

A 1-stamp Williams mill, said to have a capacity equivalent to that of five ordinary stamps, has been installed at the Live Oak mine, 4 miles from Colfax. The property is operated under lease by D. J. Williams of Weiman. Another Williams stamp will be placed in position shortly. A compressor has been added to the mine plant. The shaft is down 175 ft. and will be deepened 100 ft. A good tonnage of \$15 ore is exposed.

Mining is more active in this district at present than at any time in the past 20 years. The Black Oak, Red Bird and Big John mines are being worked, and a small mill is in operation on the latter. Preparations are being made for resumption of developments on the Annie Laurie.

Hayfork.

Representing New York and San Francisco interests, E. A. Wiltsee has taken bonds on 2000 acres of dredging territory adjoining Hayfork; 2000 additional acres are under

consideration. A Keystone drilling outfit has been secured and comprehensive prospecting started. The gravel ranges from 12 to 18 ft. in depth and averages 6 to 7 cts. per cu. yd. If the ground proves as attractive as anticipated, a \$300,000 dredge will be erected in the fall. J. A. Scott is in charge of the explorative work.

Kennett.

The Mammoth Copper Co. is about to start driving of a long tunnel to develop the Suro mine to an approximate depth of 1000 ft. The tunnel will be 5000 ft. in length and will cost approximately \$100,000. It will explore a large area of new ground besides facilitating economical development of known ore bodies. No. 6 tunnel, on which work commenced last December, is in 1100 ft. and advancing at the rate of 15 ft. per day. It will be 5000 ft. long and is designed to tap the main Mammoth ore body about 1000 ft. below present workings. When completed it will form the main working thoroughfare. An aerial tramline, about 1 mile long, is to be constructed from the Stowell mine to connect with the tramline from the Balaklala property; 2500 tons of selected zinc ore were shipped from the Mammoth mine in March.

Gottville.

H. S. Vaughn of Denver is arranging to extensively work a group of quartz claims on Dutch creek, near Gottville. A strong shoot of free-gold ore has been opened and considerable development work accomplished. It is planned to start production within 90 days.

Copperopolis.

The new flotation mill of the Calaveras Copper Co. is treating 200 tons of ore daily and producing 16 to 19% copper concentrates. Capacity of the plant will be increased 50% in the near future. A new coarse-crushing plant, costing about \$15,000, will be erected at once. Mine conditions continue satisfactory, particularly in the lower levels, where a large tonnage of commercial ore is being opened. Streaks of high-grade ore accompanies the usual grade of material.

COLORADO.

Cripple Creek.

At the War Eagle mine where lessees lost the Carper vein some time ago after it had produced nearly \$300,000 in ore, a search for the vein has been successful. The vein was faulted by a porphyry dike. The extension has been located about 20 ft. from the point where the dike intruded and cut off values. The former lessee had quit work at this point. As now exposed for 30 ft. in length, it is 20 ins. to 2 ft. wide, and is making ore of a milling grade at \$20 to \$30 in gold values. Two machine drills are further developing the vein. In addition the company is engaged in sinking a 3-compartment shaft on the eastern side of the Happy Year claim, near to the side line of the Mountain Tiger and Unexpected claims on Raven and Bull Hills. It is to be the main operating shaft of the War Eagle Con. Co. It will be sunk to a depth of 1000 ft. The timbers have been ordered and are being delivered subject to demand. The Happy Year has a gross production of about \$650,000. The new shaft is above the old discovery shaft, which is down 392 ft. and from survey estimates they should encounter the old vein at a depth of about 100 ft.

The American Eagles, Orpha May, Lucky Gus and Specimen of the Stratton Cripple Creek Mining Co. are producing under lessees. At the Colorado King in Poverty gulch the lessees have sorted the dump and made a shipment, and are now getting their ore from the mine. Keener, Portis & Co. operating the Lady Smith on Globe Hill, have been shipping from the Keener tunnel on Globe Hill and the ore is returning values of \$14 and \$20. Hahnwald Leasing Co., at the Abe Lincoln, and sub-lessees working under their lease, are producing. They have been handicapped by mine gases. New ore bodies have been opened and conditions are good. The 1915 statement is as follows: The Acacia Con. Co., receipts, \$744.65; disbursements, \$517.80; balance on hand Jan. 1, 1916, \$226.78. The Granite Hill Co., total receipts, \$1056.80; \$1086.13; disbursements, \$988.45; balance on hand, \$98.22.

to some delays in getting its machinery plant installed. Mining operations were resumed in this property on the 15th. The general impression around the camp is that United Western is on the verge of an important discovery of ore.

The shaft on the Tom Reed, Jr., property is at a depth of 245 ft., and is all in low-grade ore. It begins to appear that the vein near where the shaft is being sunk has changed its dip and has turned toward the shaft, which now appears to be entering it.

The Fessenden shaft is now down 500 ft., and a station is being cut. It is estimated that crosscutting for the vein system in which it is expected to find commercial ore will be started this month.

The Hi Henry Mining Co., located to the south of the Lexington, has just completed the installation of hoist and compressor, and has now started an active development campaign. Its shaft is down 150 ft., and will be rushed to a depth of 500 ft. before lateral work is started.

The Gold Range shaft has attained a depth of 175 ft., with three shifts working with power steel. The bore continues to cut stringers of ore averaging \$3 to \$6, and all of the rock shows high mineralization.

Lateral work on the 500-level of the Big Jim is now well under way, and the operators expect to reach the downward continuation of the big ore shoot opened on the 400-level soon.

The Iowa Mining Co. has just started its development campaign, and its stock has been listed on the Los Angeles Exchange, and has been given the first call.

Douglas.

Wolverine & Arizona has just been visited by President John Daniel of Laurium and Secretary Chas. Chynoweth of Houghton, and they have decided to explore the northern portion of the property, where it is mountainous and difficult to carry on mining operations, by means of a tunnel on the eastern end from the Calumet & Arizona workings, and another towards the western end from the Shattuck, permission and also the use of air and water having been granted by these companies. There are good indications in this new territory.

CALIFORNIA.

Grass Valley.

High-grade antimony ore has been discovered on the Robert Johnson ranch, a few miles from Grass Valley. The vein is 30 ins. wide and has been opened for 20 ft. The ore is said to assay 72% antimony. Drifting is proceeding to determine the extent of the ore body. Antimony float has been found in the vicinity several times in the past 10 years.

The Golden Center has perfected plans for an enlarged mill and a cyanide plant. The Whiskey vein is showing rich quartz on the 800 level, and driving to reach the Peabody ore bodies will commence soon. Net profits of \$49,842 were earned in 1915, after the expenditure of large sums for equipment and other properties. The cyanide plant is expected to effect a saving of \$2500 per year.

Atolia.

C. F. Smith and Gregory Palmer of Redlands have taken under lease 160 acres in the heart of the tungsten-bearing area of this district and have placed orders for machinery. Good ore has been exposed. The Morgan group, near Randsburg, is also being worked. A shaft is going down to intersect a promising tungsten deposit at fair depth. F. A. Morgan of Redlands is owner.

Jerseydale.

Operations have been resumed at the Early gold property by Mrs. N. C. McIntyre. From the old main level a 100-ft. shaft has been sunk and drifting both ways is proceeding. It is expected extensions of good veins formerly mined near surface will be intersected.

Berdan.

The Royal Drift Mining Co. has intersected rich gravel Robinson mine and is preparing to start production. Men are employed, under the management of J. Allan. At the Royal Drift work is progressing steadily.

The company has taken options on the Big Butte, Boston Hill, Best, Double Eagle and Straugham claims. Eastern capital is largely concerned.

Dedrick.

The 20-stamp mill at the Globe Con. is treating 150 tons of ore daily, the product averaging around \$9. The vein averages 6 ft. wide. Considerable deep tunnel work is proceeding and the ore body is showing excellent strength as greater depth is attained. The property is controlled by the Crown Reserve Mining Co., of Cobalt, Canada.

Angels Camp.

Electrical equipment has been installed on the Tulloch mine, and many improvements made to the surface buildings. It is planned to erect a stamp mill in the near future. Twenty men are employed and late ore developments have been decidedly satisfactory. The property is being operated under bond and option by Thomas Lane.

Mokelumne Hill.

It is rumored a syndicate of eastern capitalists is considering reopening the Gwin mine, idle many years. The Gwin was formerly a prominent gold producer and was worked to a depth of 3200 ft. Distance of the vein from the shaft resulted in high operating costs, and rather than sink a new shaft the owners ceased work. Good ore was exposed at the time.

Marysville.

The Pacific Gold Dredging Co. is busily preparing for active work in the Yuba River field. The Southern Pacific Co. is building a spur track from the Marysville-Oroville line to the Sunset claims, on the Yuba river, and electric transmission lines have been erected. Equipment for the first of the new fleet of dredges is expected to be on the ground within a few weeks. This dredge will start operations near the holdings of the Yuba Gold Fields Con.

Forest.

Unwatering of the 200-ft. shaft of the North Fork mine has been completed and sinking to a depth of 400 ft. is proceeding. From the 400 level extensive lateral developments will be conducted. In the present workings the vein is badly faulted, but appears to grow more compact with depth. Three pumps are now in operation in the shaft and are expected to easily handle the water, which has seriously hampered work in the past few months. The ledge lies between walls of diorite and schist.

Georgetown.

The 10-stamp mill at the Georgia Slide mine has been finished and is running on ore from the old dumps. A large amount of new ground is being developed and good-grade quartz is showing at several points. The dumps contain sufficient ore of profitable grade to keep the mill running several months. Water is delivered to the mill through a pipeline a mile long. Fifty men are employed.

Campo Seco.

Following a strike of 24 hours, the wages of employes of the Penn Chemical Co. were increased 25 cts. per day, April 12. The management insisted that the men curtail their drinking of liquors, stating this practice was making mining unnecessarily dangerous, and the employes agreed to be more temperate.

Nevada City.

The Richardson Diggings property at Grizzly Hill has been taken under bond by Thomas N. Coan, of Nevada City, and Edgar B. Powers of You Bet. It is planned to drive a tunnel to intersect the Blue Lead channel, which traverses the holdings. The property was formerly a famous hydraulic producer but has been idle since the anti-hydraulic regulations went into effect.

Vallejo.

The St. John's Mines Co.'s plant was originally equipped with two coarse ore furnaces of the cupelo type. These furnaces were very unsatisfactory for the reason that a certain amount of fines were carried into them, due to improper classification. A new Scott type fine ore furnace has been erected to treat the fines and new ore bins, sorting and classifying arrangements. The ore is delivered to receiving bin from the mine; flows to sorting and sizing platform where waste is picked and all ore put through grizzly, with 6-in.

openings; drops on to shaking screen; oversize to belt conveyor, thence to coarse ore bin; undersize to elevator, thence to fine ore bin. The coarse ore bin is the main storage. Ore can be drawn from this bin to rock crusher, to elevator to fine ore bins as well as direct to coarse ore furnaces. The fine ore flows from fine ore bin direct to dryer, thence to fine ore furnace.

Placerville.

Operations have been started at the Union gold mine, near El Dorado, and it is expected production will commence soon. The mine was recently acquired by eastern people. It produced well years ago, and considerable ore of milling grade is stated to be exposed. The Noonday copper mine, near the Union, is being worked for the first time in many years.

Ingot.

The new owners of the Afterthought copper mine have acquired numerous outside claims and are busily preparing for extensive operations. Principal attention is being devoted to remodeling of the plant, as an abundance of commercial ore is blocked out in the mine. It is reported flotation will be used in the new plant and both zinc and copper concentrates produced. Extension of the Bella Vista railroad to Ingot will be rushed, enabling the company to ship in machinery and supplies at greatly lowered costs.

COLORADO.

Cripple Creek.

In the 1915 report on the El Paso Co. President H. McGarry says: "But very little ore was in sight and most of it low grade. During the years 1913 and 1914 the company had made no profits and had exhausted its treasury surplus, was about \$70,000 in debt and doing business largely upon credit. The leasing system to a general depth of 700 ft., heretofore existing was carried on and there are now 16 leases in operation under Superintendent J. J. Darnell. The company produced and sold 28,448 tons, the lessees produced and sold 9994 tons, making a total of 38,442 tons. From these ore sales the company realized, including royalties from lessees, \$129,546.41. Profit on storehouse sales to lessees, \$3081.77. Received from sale of junk, \$1384.57; making total receipts of the company \$134,012.75. The superintendent has kept from three to six drills on dead work searching for ore and has performed 4230 ft. of crosscutting, drifting, raising and winzing. Profits to the company on the ore mined and sold by it, together with the royalties from lessees, have been for April, \$2084.56; May, \$1184.28; June, \$1743.68; July, \$1249.08; August, \$4611.74; September, \$3864.81; October, \$2907.91; November, \$3991.69; December, \$5362.90; January, \$4639.44, and February, \$5533.30, making a total of \$37,433.30 from April last year to March 1 this year. These profits were applied on the indebtedness of the company, which has been reduced. We now have (April 1) \$4972 in the treasury. We have broken and in the stopes about 7000 tons of ore ready for shipment, and have in sight for breaking probably about 12,000 tons. The lower levels of the mine, including the tunnel level on the C. K. & N. vein, which has been the heaviest and best producer, appears to be low grade so far as exposed. However, there are possibilities of high-grade ore being opened in the upper levels of the mine yet to be discovered by exploration. We have been offered a royalty-lease for the working of our low-grade and dump ores by the flotation on a 15-ct. royalty basis. Nothing will be decided, however, until more is learned regarding the results of flotation experiments at the Vindicator and Portland mines."

Leadville.

The Derry Ranch Gold Dredging Co., which started operations in 1915, has been plowing its way through 5 ft. of ice on Derry lake and has succeeded in commencing operations for this season. The work of repairing and overhauling the dredge was commenced by Manager R. F. Lafferty about the middle of February with a force of 15 men.

A thorough exploration of the Prospect mountain section is being made through the Valley tunnel, where development work is steadily progressing under Manager W. F.

Page. He states that the interior shaft that is being down to fully prospect the drill holes which showed the presence of ore in the property at a distance of from 150 to 200 ft. is now over 100 ft. deep. This work is expected to be complete within the next 60 days.

A statement has been made by A. Hoffman, president of the Western Zinc Oxide Co., that they intend to enlarge the plant west of here. This progress is partly due to the purchase of about one-fourth of the stock by the Midland Chemical Co., Chicago, who use the Western Zinc product for a white paint pigment. The first step to be taken by the company in the enlargement of the plant will be the erection of another block of furnaces similar to those now installed. The addition will double the capacity of the plant, which now treats 50 tons of carbonate daily. Construction will be undertaken as soon as experienced men can be secured for the work. Following the completion of the new block of furnaces a 50-ton roasting plant will be added to the plant for the purpose of handling sulphide ores. Under the new program, provision has been made for securing 1500 tons of carbonates a month for a period of 3 years from the Gallagher property on East Carbonate hill, which is now under lease to George W. Casey, W. M. Harvey and associates. Development has been under way in the property for some time and the largest body of low-grade carbonate of this kind now known to exist in the district has been uncovered. The ore contains from 12 to 18% zinc and is an ideal product for the process of treatment used by the Western Oxide Co. The contract calls for a car a day up to 5000 tons and automatically increases to 10,000 tons if the smelting company requires the shipment of 50 tons daily. The ore from the Gallagher is now being hauled by team to the nearest siding, but the Denver & Rio Grande has men at work now installing a switch to the property. This is expected to be complete within the next 2 weeks. A force of 12 men is now employed at the property.

Victor.

The Granite Gold Mining Co. has recently installed a Wellman-Seaver-Morgan hoisting unit. This is a double-drum electric hoist with single reduction Wuest herringbone gears encased in oil-tight gear housing, having drums 34-in. diameter by 42-in. face, of steel plate construction, with band friction clutches and post brakes, hand operated. The hoist is driven by 165-hp. Westinghouse motor, 3-phase, 30-cycle, 440-volt, 580 rpm., with magnetic control. This hoist is intended to handle a double-deck cage with 2 cars of ore, or a total unbalanced load of 10,000 lbs., including rope, from a maximum depth of 2000 ft. While the hoist will usually operate in balance, it has sufficient power to handle the usual unbalanced load when desired.

IDAHO.

Bealer.

An effort is being made to pool the issued stock of the Carbonate Mining & Milling Co., with properties near here, that a syndicate now being formed can be in better position to market the treasury stock, according to a letter recently sent to stockholders by Secretary C. W. Simmons. Herman J. Rossi of Wallace is representing the proposed syndicate.

Wallace.

The Federal Mining Co. has discovered that it has a concentrating plant, the existence of which was unsuspected. The separating system in point comprises a mile-and-a-half section of its flume supplying power for the Grouse creek compressor, which has its intake just below the big mill that treats the output of the Morning mine at Mullan. The conduit is 4 ft. wide and 4 ft. deep, and during the winter when the water was low, the slimes from the mill tailings collected nearly 2 ft. deep in the places where the current was sluggish. When the freshets came this spring an overflow resulted, and the railway tracks lower down the mountain side were badly damaged. An investigation followed, and it was discovered that the sediment in the flume carried from 20 to 30 feet to the smelter. All of the deposit is not of commercial value.

caused suspension of operations is now being prosecuted. Some very good looking ore was crosscut in this vein, and the operators believe that they are on the verge of an important discovery of ore.

On the 750 level in the Boundary Cone, crosscutting operations have reached one of the veins, and a drift has now been started to get underneath the ore shoot in which good mill grade ore was developed on the 550 level.

The Esperanza Exploration Co., in which J. P. Loftus, former president of the Round Mountain mine in Nevada, and George Long, of the United Eastern, are interested, has its machinery equipment now on the ground and has started an extensive development campaign. This property has one of the most spectacular surfaces showings in the Oatman district.

The machinery of the Oatman United Co. is being placed on the ground, and the 3-compartment shaft is being sunk pending the completion of the machinery installation.

Charles S. Sprague is president of the Oatman United Co., and J. K. Turner is consulting engineer for the company.

Angus McDonald, formerly superintendent of the Independence mine at Cripple Creek, is now actively in charge of the development of the Sunnyside property. The machinery equipment is now completely installed, and sinking operations are in progress. The shaft is down about 130 ft.

The Gold Ore Co., operating ground about a mile to the northeast of the Gold Road mine, is steadily shipping ore to the Gold Road mill. This ore is being developed on the 530 ft. level, and is said to be giving mill returns of about \$15. Some very high-grade ore has been encountered which is full of free gold. This high-grade streak is being developed, but not being milled at this time.

On the property of the Oatman Gold Mining & Milling Co. important developments are looked for any time. The crosscut is nearing the big Kokomo vein at a depth in which Consulting Engineer Edward W. Brooks expects to find important bodies of commercial ore.

The shaft on the Telluride property at a depth of 310 ft. recently encountered the top of an ore shoot, and has since penetrated the ore for a depth of 30 ft. This ore is similar in appearance to the Tom Reed and United Eastern. The Telluride lies between the Lucky Boy and the extreme southeastern end of the Tom Reed property. The vein in which ore is being developed is what is known as the Lucky Boy vein.

In the United Eastern property lateral development on the 665 ft. level is disclosing some very rich ore. The north drift is now out something over 200 ft., and the last 75 ft. have been in rich ore for the entire width of the drift; neither wall is in sight. At a distance of 160 ft., from the point where the drift was started an explanatory crosscut was driven which showed the ore body to be 40 ft. in width with an average value of \$21 in gold. In size this is commensurate with the ore shoot on the upper levels, while the values are some higher. It is estimated that the mill of the United Eastern will be ready for operations by Oct. 1.

The shaft of the Tom Reed Junior Co. is now down 285 ft. with its bottom all in ore. A sample across the bottom of the shaft shows an average value of about \$6.

G. H. Hadley of Butte, Mont., and E. J. Scott, have just purchased 9 claims in the Cerbat mountains near Chlois, and are preparing to start development on a large scale.

William Sheets of New York, A. B. Bradick, of Spokane, Louis Lusk, Spokane, and S. M. Odell, Los Angeles, have for some time been developing a property about 7 miles from Kingman, and reports from the property are to the effect that some very large bodies of copper gold ore are being opened. Their organization is known as the Arizona Eastern Mining Co., and as they have been working very quietly the result of their development work is occasioning considerable excitement in the Kingman district now that it is becoming known.

Chloride.

The Schuylkill mine, which possesses the extension of the Messee veins, has started dewatering operations. This

company shipped high-grade silver lead ore to the Benson smelter in the early 80's, and large bodies of commercial ore were exposed by lateral work on the 500 level. Operation of the property was suspended after the death of the principal owner.

Prescott.

In the Superior copper belt, the Henrietta mine, a copper proposition in the Big Bug district, is nearing the stage of regular production. The Henrietta is owned by the Big Ledge Co., and has a good production record. Adverse conditions, with which the present company was not concerned, ultimately resulted in the suspension of operations at a time when production was increasing. The present operators are developing the old workings with a view to ore shipments at an early date. Dwight Woodbridge recently made an examination of the property for the company.

Ed. Block has closed a deal with A. E. Moynahan of Denver for the purchase of the White Spar group, situated near the Hassayampa river, near the Climax mines, and close to the southeast end lines of Copper Basing district. The White Spar in its early days of activity, dating back to over 30 years ago, has a record among other old silver producers, in being a shipper when packing and freighting was required to Seligman, the nearest railroad point, over 100 miles distant. Its antimony product was known then but was valueless. The zones carrying this mineral were abandoned, accordingly, necessitating new exploration at heavy expense. Silver slumping led to its abandonment, except at intervals in recent years, when an occasional leaser operated to disadvantage under heavy transportation charges in marketing the silver product at a low valuation. A combination of antimony and silver are in heavy demand as is tungsten. The property will be actively worked.

CALIFORNIA.

San Francisco.

Chapman Smelter Co., 409 Battery St., San Francisco, buyers of antimony ores, and refiners, has equipment for producing antimony oxide and the metallic antimony; and a reverberatory furnace is being installed for reducing oxide ores. The company obtains stibnite ores from its own mines at Austin and Bernice, Nevada, and some from Alaska.

Tuolumne.

Columbus mine, at Tuolumne, which has been closed down 18 months, is to be extensively developed under the management of Alexander Hamilton, consulting engineer, Rialto building, San Francisco. The old 200-ft., 2-compartment shaft, has been dewatered, and the plan is to sink to 1000 ft. and drive from all stations. The old 10-stamp mill may be operated some, but plans contemplate building a new mill of 200 tons capacity, to recover gold and silver by amalgamation and concentration.

Plymouth.

An erroneous statement appeared under this heading in March 25th issue, in regard to the Amador Star Mining Co., Baylies C. Clark is the manager and not J. Campini, as stated. Mr. Campini is an electrician with the Western States Gas & Electric Co. The property was formerly known as the Rhetta mine.

Auburn.

The Bunker Hill copper mine, near the old camp of Penobscot, has been reopened by eastern people, with D. L. Shepherd in charge. The mine was last worked in 1864, when shipments of high-grade ore were made to Swansea, Wales. As soon as sufficient ore is exposed an auto truck will be purchased to transport the product to Auburn, the nearest railroad point.

Sonora.

The Tarantula group of gold properties near Shawmut has been purchased by ex-Governor Henry T. Gage, of Los Angeles and arrangements have been completed for comprehensive operations. The Tarantula tunnel will be extended 140 ft. to connect with the adjoining Jones mine, and ore from both properties will be crushed at the 20-stamp Taran-

tula mill. The ore bodies are large and of medium grade, with occasional shoots of rich quartz showing.

The Pittsburg-Silver Peak Co. has installed a Cameron pump on the 500 level of the Rawhide mine. The pump has a capacity of 400 gpm. Developments are proceeding on the 300 level, where good ore was recently intersected, and explorations are advancing on the 400 and 500 levels. The company is also preparing to unwater and explore the nearby Patterson mine.

Seneca.

Eastern capitalists have consolidated the White Lily, Del Monte, and other gold properties in this district and are preparing for production along broadened lines. It is reported plans include the early building of a 75-ton mill and cyanide plant. J. J. Reilly is manager.

Portola.

Litigation among the leading owners has checked operations at the Walker copper mine, 20 miles east of Portola. Late work in the property has been highly pleasing, including the opening of good ore by diamond drills below the 125 level. A Leschen aerial tram, 4200 ft. long, is nearly completed, and equipment provided for a 100-ton flotation unit. The plant is figured to make an extraction of 93% copper. Amount of profitable ore disclosed is estimated at 50,000 tons.

Quincy.

Andrew Murdock and G. Sanonica are preparing to resume work on the Murdock copper mine. This property produced shipping ore last season and is considered a highly-promising mine. It is stated molybdenum has been found to accompany the Murdock copper deposits.

The Mohawk Mining Co. of, Reno, Nev., has started work on the Mohawk mine, near Chilcote, with a crew of 14 men. Considerable ore was shipped to smelters last year from this property, and a good tonnage of profitable ore is stated to be in sight.

Nevada City.

The Murchie mine, a mile east of here, has been taken under bond by New Yorkers headed by Henry W. Miller, who will direct operations. It is planned to start active work in the early summer. Equipment includes a hoist, compressor, pumps and 10-stamp mill. The mine has yielded rich ore.

Mojave.

It is reported outside capitalists are contemplating the rejuvenation of the Mojave Con. gold property, recently sold to satisfy a claim of wages due A. A. Morris. The mine is considered a good one.

Jackson.

Excavating for the tailings dam at the Afterthought mine has commenced, a steam shovel being employed. The dam will be 416 ft. long by 44 high, and will impound tailings from the 40-stamp mill. Later on the material is to be treated by cyanide. Sinking from the 3900 level is proceeding. The electric hoist here is capable of operating to a depth of 4000 ft. The company is also developing the Kennedy Extension section of its holding.

Downieville.

The Kirkpatrick Mining Co. is extending the north drift to intersect the Magnolia channel in expectation of striking the south section of the deposit early in June. The channel is stated to course through the Kirkpatrick ground for about 1700 ft. John Donnelly is principal owner.

Grass Valley.

An option has been taken on the Union Hill mine by Errol MacBoyle, and if the deal is consummated the 800-ft. shaft will be carried to a depth of 1200 ft. A strong shoot of gold quartz was found on the 800 level before water drove out the miners, and this is to be explored. Numerous small deposits of tungsten have been found of late, and indications are said to be favorable for an important yield of this metal.

The Empire Mines Co. has recently acquired several holdings adjoining its property, including the Town Talk placer mine and the Bogue, Manion and Body properties. The company is developing the rich vein which caused the friction with the North Star Mines Co. last summer. The

final payment on the Pennsylvania mine has been made. George W. Starr is manager.

Delivery of abundant water to this camp, and the introduction of cheap electric power, has stimulated tungsten production, and a heavy output is being made by independent operators. The new mill of the Atolia Mining Co. is rapidly nearing completion, and will soon be turning out high-grade concentrates. Italian miners recently uncovered a scheelite nugget weighing 142 lbs. about 2½ miles from the Atolia mill. Ore buyers offered \$570 for the specimen. High grading is still active, despite numerous arrests. The camp is now supplied with telegraph and telephone service, and numerous automobiles are operating between Atolia and Randsburg, Mojave, Kramer and Johannesburg.

San Andreas.

The Pioneer Chief Mining Co. has purchased the Kane ranch of 203 acres and will explore it thoroughly. It adjoins the Pioneer Chief mine which is developing well. Sinking of the shaft to 500 ft. is progressing. At 390 the vein is 6 ft. wide and averages \$8 in gold. Good ore is opened at several other points and a small experimental mill may be erected this summer. In the lower workings the formation is very hard, and little timbering will be required, according to the present outlook. N. J. Martin, of San Francisco, is consulting engineer. J. E. King is superintendent.

COLORADO.

Idaho Springs.

A strike was recently made with the intersecting of the Martin vein by the Pioneer crosscut tunnel at a distance of 560 ft. from the portal on property of the Pioneer Mining, Milling, Power & Tunnel Co. in Gilpin county. The vein varies from 2 to 8 ins. wide and has been exposed on the hanging wall for 50 ft. Assays show 10 to 40% tungstic acid, and about 20% is said to be the average. The company is on an active campaign of development, and the new milling plant will shortly be completed. Bodies of milling ore having a value of \$15 to \$18 a ton are exposed underground. There is also in evidence smelting ore that is worth about \$40.

A vein 10 ins. wide and showing assay values of 350 ozs. gold and 277 ozs. silver has been opened at the French Flag mine, and is thought to be a continuation of the Silver Age vein. The ore was encountered on the 235-level south of the vein. The new shoot was first found in stope No. 1, then in No. 3, following which it was discovered in Nos. 2 and 4. Work of extending the 315-ft. level to cut the Silver Age vein is in order. From the workings of Silver Age, ore has been mined that ran from \$150 to \$500. This vein has been found persistent to the bottom of the French Flag shaft. Shipments are at present being made from the 135-level. They are constructing a new mill with a capacity of about 140 tons: the jigs to be used will operate the reverse of the usual type. Each section of the mill, including crusher, jigs and Wilfley table, will be driven by separate gas engines. The fines after passing through a 1-in. screen of the jigs go to the Wilfley table, where the lead, zinc and iron are separated. The ore is reduced 14 to 1 and a saving of 60 to 75% maintained. Captain Ripley estimates that there are 18,000 tons of ore in the stopes and dumps that have an average value of \$7.

Cripple Creek.

An extension of the Bonanza King vein has been opened on property of the Yellow Bird Gold Mining Co. The vein was reached by crosscut, from the 300-level of the Red Bird shaft, but on Yellow Bird at a point under the Midland Terminal tracks, and in a southeast direction from the shaft. To the northeast the pay streak, at first measuring but a few inches, has widened out to 2 ft., while values have increased from \$16.80 to \$17.80 and \$25.60 in the last 12 ft. The ore, a brecciated quartz, contains pyrite and is colored with fluorite. Lumber is on the ground and work commenced to reconstruct the old ore house. A second shift will be put to work at the 400-level of the Red Bird shaft, to crosscut to the Bonanza King vein, a distance of 80 ft. This will give an

the big vein systems which traverse this property continues to show mineralization and quartz stringers containing high gold values.

On the Tom Reed Junior property the working shaft has passed the 300-point and is reported by the operators to be all in ore. A Cameron sinking pump has been installed to handle the water which is beginning to come into the shaft. Indications are that the vein has changed its dip, and that the shaft will cut through the main vein which traverses the property between the 300 and the 400-levels.

A new 350-ft. compressor plant has just been put in operation on the Sunnyside, and shaft sinking is now under way, the bore being down 130 ft. Angus McDonald, formerly of Cripple Creek, is in charge of the development of this property.

In the Black Range, crosscutting operations continue on the 300-level in a drive for the main vein. The spur vein, which showed very gratifying gold values, is not being developed at this time, but it is the intention of the operators to drift on it after the main vein has been reached.

The United Western has at last been unwatered, and with its new machinery plant in full operation, drifting operations are now being conducted in the 6-ft. vein, which was just being cut when operations were suspended. This vein was brecciated quartz and showed average values of \$5. The drift is being driven north into territory which is less broken than that in which operations have heretofore been conducted.

The Adams Mining Co., operating in the southern part of the district, is now installing its equipment, and will soon be driving its working shaft downward with power steel. A supply of water has been developed on another part of this property.

Prescott.

Mining engineers and prospective investors in mining property are inspecting Yavapai county mines and prospects in increasing numbers, and in most instances their investigations are followed by favorable reports and the investment of capital.

Homer Wood and partners shipped 3090 lbs. of 70% tungsten ore to Pittsburgh late last week. The consignment went forward from their property in the Eureka district, and has a value in excess of \$10,000. The initial shipment from the property, made in March, consisted of 3600 lbs. of 65% tungsten.

Five cars, loaded with concentrates from the property of the Major Mining Co. at Walker went forward a few days ago to the Humboldt smelter. The consignment represented a short run at the Poland mill, made for the purpose of testing values and ascertaining the process best adapted for the reduction of the ores, and those of the Eureka in general. It has been decided to install a flotation plant at the mine, having a capacity of 100 tons daily. Representatives of the company are en route here from the east.

A transmission line is being run from Walker to the mine and mill of the Big Pine Mining Co. and will be in operation within 30 days. The distance between the two points is about 4 miles, the intervening country being dotted with mines which are likewise to be supplied with electric power. The contract with the Big Pine management calls for 150-hp. daily. The Big Pine property is being operated by Minnesota mining men. A mill is being installed and the mine placed in condition for immediate production.

William Forbach and partners of Bisbee are operating the First Home property. Several shipments of silver-lead ore have been made and another shipment will go to the Humboldt smelter within a few days. The main working shaft, 300 ft. deep, is now being unwatered preparatory to operations on a more extended scale. The First Home is located in the Upper Big Bug district.

CALIFORNIA.

Redding.

Afterthought Copper Co., whose mine is 25 miles north of Redding, is being financed by the American Metal

Co., Ltd., New York. A force of 15 to 20 men is now employed cleaning out the old workings and the mine is being thoroughly sampled. If results of sampling justify the heavy expenditure required for proper equipment and development, the plan of financing the company will be fully carried out. The mine has been idle since January, 1908. It is probable that much equipment will be required, and the scheme of ore treatment may be a combination of leaching and smelting.

Georgetown.

The Georgia Slide mine is being sampled and tested by R. E. Cranston, San Francisco. To accomplish this thoroughly a 10-stamp mill was built. Free gold occurs in seams and lenses of broken quartz, and the schist material between lenses carries some gold. The old workings were near the surface, the new work cuts the ore at considerable depth.

Goffs.

H. J. Reynolds is building a custom concentrating mill for treating tungsten ores being mined near Goffs. The ore occurs as hubnerite.

Bishop.

Development of rich tungsten ore is proceeding on the Aeroplane group, under the direction of Supt. Porter; 4 tons ranging up to 25% tungsten were extracted last week. The strike was made a short distance in from the tunnel portal; 35 men are at work and building of a 75-ton mill has commenced at Laws. Surveys have been made for an electric power line from the Nevada-California transmission line, about 3 miles distant from the mill.

The Tungsten Mines Co. is preparing to erect a mill near this place. Machinery has been purchased and construction of buildings will soon start. A good tonnage of profitable ore has been exposed. L. E. Stevens is superintendent.

An 8-ft. vein of tungsten ore has been opened 4 miles from Bishop by John L. MacIver and W. P. Yaney. Portions of the vein are stated to assay 10% tungsten. The vein was cut several months ago 100 ft. further down the hill, and another crosscut is being driven to strike it 60 ft. further up. In the older workings considerable gold, silver and copper accompanies low-grade tungsten-bearing material.

Masonic.

Stall brothers have arranged for the building of an electric-power plant on the Walker river, from which point power will be transmitted to the Serita mine and Pittsburg-Liberty mill. The capacity of mill is also to be increased. At present 60 tons are crushed daily, the ore averaging around \$20; 60 men are employed.

Big Pine.

Discoveries of rich tungsten deposits in the Sierra and White mountains are reported from several points. At Cowhorn Flat, 20 miles east of Big Pine, ore assaying 20 to 40% tungsten has been discovered. High-grade material has also been found east of Big Pine by Ed Ober and S. Drouillard. Hundreds of prospectors are actively exploring the territory in all directions from here. Several ore buyers are on the ground seeking high-grade ore. While many companies are offering to buy ore, few are showing any desire to purchase ground. Like conditions prevail at several other new camps.

Auburn.

Ore carrying gold and platinum has been discovered on the Shirland tract by Gardner Wood. Preparations are being made to develop the deposit along broad lines. Some free gold shows, and platinum values are stated to be exceedingly good.

Marysville.

The Red Ravine Mining Co. has elected H. A. Bell of Indian ranch, president, and H. A. Geach of Marysville, secretary. An assessment amounting to \$20,000 has been levied to finance extensive operations at the property, which is located at Dobbins. Outside interests have leased the Red Ravine and Elk claims, both showing good ore.

Columbia.

A rich gravel strike has been made in the adit of the Springfield Tunnel & Development Co., about 414 ft. in from the old workings. The deposit is 4 ft. deep and work is advancing to determine its width and extent. It was found below the Buchanan channel, which has yielded much gold.

The new deposit is stated to contain much coarse gold and numerous small nuggets, and preparations are being made to mine it extensively. Meanwhile the tunnel is being driven ahead to tap other channels exposed in the upper workings. The present company has been engaged 12 years in developing the property, in which time approximately \$500,000 was expended without returns. Equipment includes an excellent washing plant.

Kennett.

The Mammoth Copper Co. has installed a new zinc furnace for the production of zinc oxide, which is used in neutralizing furnace fumes previous to their admission to the baghouse. The company is operating three blast furnaces at full capacity and giving its own ore the preference, excepting the 300 tons treated daily for the Balaklala Copper Co. Driving of the Friday-Lowden tunnel has advanced to a point 1500 ft. from the portal. The new Sutro tunnel is in over 500 ft.

Heroult.

The Noble electric smelter is turning out ferro-manganese at the rate of 12 tons per day. A second furnace will be placed in commission within 3 weeks, and a third unit will probably be operated before the end of summer. The company is receiving manganese ore from several points, including newly-opened mines in Butte and Shasta counties. Production of ferro-chrome will probably begin in the near future; 125 men are employed.

Placerville.

Ore averaging \$60 gold is coming from the Red Wing mine, where the ledge has been opened for 100 ft. The shoot is narrow, but free milling. The 2-stamp mill is running steadily and its capacity will probably be increased soon. Joe Lawyer is managing owner.

The Rising Hope gravel property is running full-handed and yielding rich returns. The channel has been opened sufficiently to insure a long output, with much of the gravel carrying excellent gold values. The company is working channels of the ancient Neocene river. New York people are the owners.

Nevada City.

After considerable trouble unwatering of the Union mine, on Banner mountain, has been accomplished and an examination of the old workings is being made by J. Nelson Nevins of Los Angeles. If conditions prove satisfactory the property will be extensively operated by a company of Los Angeles capitalists. It was formerly a good producer.

Deadwood.

A strong vein of fine-milling ore has been opened in the Lappin mine and arrangements are being made for extensive operations this summer. J. B. F. Bacon of Detroit, Mich., is the principal owner and is personally examining the new ore body.

Sutter Creek.

At the recent annual meeting of the stockholders of the Central Eureka Mining Co. V. S. Walsh was chosen president and William A. N. Van Bokkelen re-elected secretary-treasurer. The new directorate has outlined more comprehensive work at depth in hopes of again placing the old producer on a profit-earning basis. Late work in the lower levels has been encouraging, and 20 stamps have been kept in commission.

San Francisco.

A record for achievement has been set for owners of low-grade mining properties in California along the Mother Lode and in other districts of the state by the Mountain King Co. The property, consisting of 350 acres in Mariposa county, was taken over a couple of years ago by a syndicate in which several prominent officials of the Standard Oil Co. of California are interested. Within the year it was found necessary to levy an assessment of about \$60,000 on the capital stock outstanding, amounting to slightly less than 600,000 shares. On May 15, according to the annual report, the company will pay an initial dividend of 3 cts. per share. From the financial statement, however, it appears that during the year the earnings enabled the company to cancel an indebtedness amounting to about \$73,700, build a hydro-electric plant and improve its milling capacity and meet the expenses of other important improvements. Over and above this there was left in bank on March 31, 1916, a balance of \$36,229.

Gross ore handled during the year amounted to 28,140 tons and the gross extraction averaged 93.16%. Net earnings of the company for the year were \$87,303. The most encouraging feature, from the standpoint of the owners of California mines of this description, were the reductions made in mining and milling costs. The average value of the ore crushed was \$6.86 per ton and the total yield per ton was \$6.39. The company is now operating 20 stamps, with ore in sufficient quantity blocked out to keep these busy during a couple of years, and available 30 stamps. Development work during the past year amounted to 3765 ft.

COLORADO.

Cripple Creek.

The Consolidated Mines & Reduction Co., operating the Ella W. mine, has encountered high-grade in a winze from the tunnel level which is thought to be the Queen Bess vein from an adjacent property, which is being worked at the 750-ft. level. Two samples taken across 2 ft. to 30 ins. of vein matter, gave 4.60 ozs. and 5 ozs. gold, respectively, or \$92 and \$100. The rock is a close-grained porphyry and is heavy. The lease has produced steadily this week, teams having been engaged 5 of the 6 days of the present week, loading out ore at the C. O. D. loading station. The ore shipped has averaged close to 1 oz. gold to the ton. For handling this high-grade the usual method will not be used and a number of new ore sacks have been purchased for sacking it.

A report from the Vindicator Con. Gold Mining Co. announces "the retirement of all the notes issued a little over a year ago, in concluding the purchase of the Golden Cycle mine and the liquidation of the indebtedness of \$1,260,000 incurred at that time has been accomplished. Development work during the quarter has resulted in further additions to ore reserves, particularly in the middle vein system of the Vindicator mine. On the 19th level of the Golden Cycle mine the drifts on the first vein intersected by the main cross-cut are running in medium grade ore, and an improvement in values is anticipated with extension. The new centrifugal pumps have been installed on the 20th level, and development of this level, already begun, will follow about 3 months behind that of the 19th level. Experiments with a 10-ton unit of the flotation process for the handling of the extremely low-grade ores of the property have closely checked the results obtained in the laboratory tests, and the conversion of the concentration plant at the Golden Cycle ore house to a 300-ton plant employing flotation is already under way. If the recovery made in the operation of this plant backs our previous results, the erection of a large mill of at least 1000 tons capacity will be undertaken, as outlined in the annual report."

Idaho Springs.

It is now the intention of the Little Giant Gold Mining & Milling Co. to construct a modern mill with an initial capacity of 50 tons. Plans have already been prepared as outlined from tests made of late. The estate is owned outright; there is no indebtedness and there is money in the treasury to carry on development as outlined. The larger mines in the group, namely, the Free America, Boulder Nest, Little Giant, White and Young America, contain about 75,000 tons of ore that has a value of from \$20 to \$30 a ton in gold, silver and lead, and the old stopes also contain considerable ore. The new mill will embody the older methods of concentration as well as flotation units. A big campaign of development is to be undertaken. Operations are at present being centered through the Commodore and Tabor tunnels. There is one machine drill in each tunnel.

Silverton.

A new body has recently been encountered on the Emerald claim of the Crown Jewel group. A tunnel driven on the Diamond about 500 ft. entered Emerald ground and had only a few feet to go to reach the intersection of the two veins. The present lessees started at 25 ft. in on the Emerald vein and in less than 12 ft. the first streak of ore, running better than \$30, was encountered. Six feet further the main vein showing 3 ft. of solid gray copper and chalcopyrite carrying

Boulder County Tungsten District as it is Today

By J. GILLINGHAM HIBBS.

E. M. W. 5-20-16 (V. 44)
p. 953

It is doubtful, if, in the history of localized mining in this country, there has ever been a situation more unique, heterogeneous and cosmopolitan than that to be found today in the Nederland tungsten district of Boulder county, Colorado.

The conditions involve many new sides to the old factors so prevalent in the past in mining booms, particularly relating to capital and labor, means and methods employed for production and speculative features.

Investigation into the first of these factors discloses an unusual condition of contentment on the part of those two, ordinarily warring factions. That capital held the whip hand when prices rose was an evident fact, as practically all of the known deposits were owned or controlled by the moneyed interests, and labor, from an independent operating standpoint, was in the helpless position it usually finds itself.

Whatever the attitude taken by capital towards labor was superinduced by an apparently wholesome desire on the part of capital to co-operate with the men and share the profits to be acquired, or whether capital sensed out such procedure as a keen business stroke will not be here hazarded, as we are dealing with results, not motives; but of the outcome there can be no doubt.

Instead of widening its field of operation to meet the ever increasing demand for ore, thereby holding labor to a fixed wage scale and incurring discontent in the face of the known increased profits by ore scales, capital adopted a liberal policy and informed the men in its employ that they might select certain sections of capital-owned, tungsten-bearing ground and take out leases for their own benefit, with the one restriction, that such employes must hold their position of employment with the capital interests in order to retain lease.

These men were permitted to employ whomsoever they chose as workmen from the horde of men who were pouring into this district and operate such leased ground under their own superintendence.

This policy has engendered not only an entente cordiale between the owners and the miners but when capital again, by the ever increasing price of ore, reaping the benefit of such prices, it refrained from holding the "leaser" to the strict terms of his contract, as to the prices capital would pay for lessee's product, and agreed to pay such lessees a price commensurate with the current market.

By this plan capital has retained its best men in its employ, and the men have had no occasion to find fault with their old enemy.

Leases are let on every manner of operation, from the raw prospect to abandoned drifts and stopes of

the more extensive operations, as well as old dumps and creek beds.

Not only are the owners so supplied with capacity ore, but the profits accruing to the lessees are very great, ranging from a few hundred to as much as \$10,000 per month. With this newly supplied wealth spread so widely among the working class, fine clothes, diamonds and automobiles are finding their way to many a home of the wage earner, who, as before, holds down his old job for capital.

That the present wave of prosperity is augmented by the rigidly enforced prohibition law is a self evident fact, and again we are astounded at the absence of the gaming house, saloon and the generally disorderly characteristics of our former boom camps.

Accommodations for the constantly increasing population are totally inadequate to meet necessities. The town of Nederland, which for years eked out a mere existence for its 300 citizens, now boasts of some 3000 to 4000 inhabitants, with banking, commercial and shipping facilities hitherto unknown. Every mode of habitation is encountered, shacks, cabins, tents and even the fast disappearing "sheep camp" may be found in all sections. Probably no district which is devoted entirely to mining is supplied with conveying facilities such as this, into which over 300 men, living in and about the city of Boulder, are transported by automobile, stage and jitney service daily to and from their places of employment.

The other factor in this widespread prosperity that has been common to former booms is the rise in the cost of living, as the prices of all commodities for all purposes has risen from 25 to 100%, and wages have advanced for the miner from 20 to 40%.

From the second angle there is much more to appeal to the interests of the mining man or "layman."

The Lakewood field—about 1½ miles from Nederland—affords a glaring tribute to the ingenuity and energy of the American working man. From almost any place of elevation one may see in all directions a bee hive of operations, "gopher holes," trenches, open cuts, "glory holes" and shafts until one begins to think that some military defense is being installed. Huge leaps of newly turned rocks and earth stand like bastions on a battlefield; men are pouring in, out and over this sea of activity. Within earshot of the modern mill, equipped with the latest devices for electric-driven, crushing and concentration mill practice, one can see the lessee hoisting his rock and water with a hand windlass, or grading his ore by means of small jigs, or the old dumps of former operations being culled and assorted by hand. Again, along the creeks one may see the "gum shoe" miner shoveling into flume and sluice box, or pumping away at the antiquated "Missouri jig." The arrastra seems to be the

only method of ore preparation absent in this cauldron of activity.

Electrically-driven trains and automobile trucks vie with the horse and the homely "jack" of mining tradition.

When a keener insight is gained as to just what these men are earning, it will be seen that the independent operator in the "50's" of California history, did no better than these boys are now doing, and who today are not forced to live like pagans with life in constant danger from man and beast.

Crude as some of these appliances may appear to be, the "saving" is high, and the grade of ore as cut out bears an abnormal profit for its owner.

In reworking dumps 6 men can shovel from 20 to 25 tons per day, and the saving ranges from 15 to 200 lbs. of high-grade ore per day.

Based on the present scale of prices—\$75 schedule—this ore ranges from 48 to 53% tungstic acid content. When it is considered that 50% ore contains 1000 lbs. of tungstic acid to the ton an average saving of 50 lbs. per day accrues to the lessee, about \$75 per day gross, from which he has to deduct his maintenance cost of not more than \$25 per day for such an ore handling.

While such profits would appear as "easy money," it has its hardships, as the men have to work in splashing water with the thermometer anywhere from zero up, repetition day in and day out of such conditions, pulls hard at the endurance of the average man, and merely shows what the American can and will do where there is a financial incentive.

While new operators are constantly finding a place among the old, the field is broad enough to give employment to all who are willing to work, and with the ever increasing tonnage so produced, there runs hand and hand new mills to absorb the increase and new markets to use the concentrates.

Prior to the boom Boulder county produced about 1200 tons in concentrates per annum, representing about two-thirds of the United States production, while from January to April of this year the production had approximately increased to about 200 tons per month, or 2400 tons per year, and since April 1 the increase has practically met 250 tons per month, representing a cash value ranging from \$750,000 to \$1,000,000 per month, and the market today may be considered fully 50% short of the demand.

A third odd factor in this "tempest in a tea pot" lies in the fact that in spite of such possibilities in earnings "wild catting" is conspicuous by its absence, and local money has financed the mining operations of practically all the new works. Since the boom began much eastern capital has flowed into Boulder county, but rather for the purchase of concentrates than for mining operations. The local money as has been invested has been put in entirely from an investment standpoint, and the "natives" are reaping a harvest for their confidence in the mineral resources of their own county.

Other fields in western Colorado, southern California and the Black Hills of South Dakota have operated extensively and benefited greatly by the demand for the black metal, but Boulder county is the only locality from which the mineral "ferberite" is mined, and for the popular uses of this metal today this mineral possesses better characteristics than the hubnerite, wolframite and scheelite from these other districts and for it a greater price is paid.

All forms of general business have been favorably affected by the tungsten situation; and it may be truly said that Boulder county has been redrafted on the mining map of this country.

(To Be Continued.)

New York Interests Invest in British Columbia Mines.

The acquisition of control of the Hudson Bay Mines Co., with holdings in the Sheep Creek district of British Columbia, by the Hayden-Stone-Jackling syndicate of New York for approximately \$1,150,000, of which it is said \$1,000,000 already have been paid, is inducing remarkable activity in the region.

The Hudson Bay group promises to become one of the largest producers of the province. Bodies of clean shipping zinc ore more than 30 ft. wide are being opened in the lower workings. The extent of these deposits has not been determined, but exploration is being rushed as rapidly as possible.

Although a caterpillar engine, drawing three ore trucks, and three 6-horse and two 4-horse teams are transporting an average of 60 tons of ore daily to the railway at Salmo, they are not able to keep up with the production from development work alone. The company now is installing an aerial tram from the mine workings to the foot of the hill, where the mill is to be built this summer and the terminal of the railway to Salmo established. When the concentrator, railway and tram are in operation production will be increased to between 150 and 200 tons daily.

The railway will serve all the properties of the Sheep Creek district, and will be the means of assuring development of a number of promising properties that otherwise would have laid dormant for years. Many of the companies with holdings there will follow the example of the Hudson Bay Co. and connect their properties with the railway by aerial trams, and those that can not will be benefited greatly, as it will shorten the wagon haul on their output materially.

The Sheep Creek hills are full of prospectors and everything that was located years ago and allowed to lapse has been restaked. Numerous new discoveries are reported and attention is being specially devoted to outcrops of similar character to those of the Hudson Bay group."

Copper exports from Atlantic ports for the week ended April 11 totaled 6079 tons.

the days when the Tip Top was a silver bonanza. The tungsten values are equalled, if not exceeded, by what was once the low-grade, but is now high-grade silver ore.

The new company is capitalized for \$375,000, 1,500,000 shares at a par value of 25 cts. each.

C. W. Davis is president and treasurer. F. L. Haworth is secretary and business manager, and the company's operations are being taken care of by A. F. Muter, E. M., and W. W. Elliott.

Bisbee.

Jointly the Calumet & Arizona and Copper Queen smelters at Douglas produced 22,000,000 lbs. of copper in April, including custom ores and the concentrates from the Montezuma Copper Co.'s mill at Nacozari, Sonora. Eliminating the custom ores and concentrates, the production was less than that of the International and Old Dominion smelters in the Globe-Miami district. The Copper Queen reports that offers of custom ores are beyond the capacity of the plant and much must be refused. A number of small producers have contracts with the Copper Queen and also C. & A. The work of enlarging the Calumet & Arizona is now well under way and material is arriving. There are to be two additional reverberatory furnaces, a number of roasters, enlargements of the power house, etc. It is known that the Copper Queen is also starting some enlargement work which will include two new converters and additional roasters. The production is divided as 7,000,000 lbs. for C. & A. and 15,000,000 for Copper Queen.

Chloride.

W. M. Wautlaud of Ocean Park recently acquired the Blackwell extension of the Pay Roll mine and will at once develop it on rather an extensive scale. Also he has undertaken the exploration of the Goldback lode, situated 2 miles southeast of Chloride.

The Schuylkill mine is now being operated under bond and lease and is sending to the smelter regular shipments of lead ores.

What has been known as the Morgan claims, just south of Chloride, were taken over last week by a group of capitalists. A cash consideration figured in the deal and time payments will complete the sale. This group, consisting of 8 claims, is well known, and lately a fair grade ore body was encountered in the crosscut from the Grand Boy gulch.

The Bay State and adjoining claims are now being worked. A prospect shaft is being sunk by three shifts. Drifts on the vein will be run from the 100-ft. level.

The Tennessee mine is now sending out daily ore shipments averaging from 200 to 300 tons. The 1400-level is now the shaft, enabling the surface hoisting engines to make greater speed. The 1250-level is still proving a greater and being run by four 6-hour shifts of miners being employed for that purpose. A counter balance will at once be arranged in more valuable ore body than heretofore encountered on the levels above.

A contract for sinking the Distaff shaft an additional 100 ft. has recently been let to Jas. Wiggins and work is going ahead rapidly.

The Pay Roll shaft is rapidly nearing the 400-level, from which point the vein will be thoroughly explored. The 200-level shows an ore body 29 ft. thick and running nearly \$50 per ton in gold.

CALIFORNIA.

Bishop.

An option has been taken on the Williams-Johnson anti-mony property by R. W. Moore and H. R. Russell of Bishop. The claims were located recently by Ralph Williams and George Johnson, and are southeast of Darwin, in the Argus mountains. On surface ore shoots have been proven to be 18 ins. wide, with ore of good grade showing.

The new tungsten camp east of Bishop has been named Tungsten City. Numerous tents and portable houses have been erected and surveying of a townsite is soon to start. At the Jackrabbit group, recently purchased by L. E. Stevens

and associates, developments are proceeding energetically and machinery for a 300-ton plant has been purchased. The management expects to have the mill in operation within 60 days. Cooper Shapley is superintendent.

Porterville.

The calcining plant of the California Magnesite Co. has been completed and a 60-ton furnace is about to be blown in. More furnaces will be operated in the near future. The company has developed extensive reserves of high-grade magnesite, and practically all the calcined product will be marketed in New York. It is officially stated the entire output of the plant has been contracted for over a period of several months. Eastern people are interested.

The magnesite output of this district has increased to 12 tons per day, netting producers about \$6000. The Success district is developing splendidly, and the lines of the Porterville Northeastern railroad have been extended to the mines. This section of the field is yielding 4 to 6 carloads of ore daily.

G. F. Myers and associates have taken a lease on Lindsay Peak, where high-grade manganese has been discovered. Work has started with a small force and arrangements made to ship ore. S. A. Crookshanks has located a promising manganese deposit on his ranch, east of town, and about 300 tons of ore have been blocked out.

Goffs.

The Signal district, 8 miles north of Goffs, is very active following tungsten discoveries. The old Louisiana-California mine, formerly a large silver producer, will be equipped with a new mill, and it is reported the tungsten deposits will also be given attention. Some good silver ore is stated to be exposed in old workings. The Lombard property has been provided with a tungsten mill and will commence production within a few days. Most of the tungsten occurs in the form of wolframite, the formation consisting of decomposed granite. A number of shallow shafts have been sunk and some rich discoveries reported.

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A rich strike has been made in the Ireland mine. The ore contains arsenical sulphurets and considerable free gold. Much of the exposed quartz is high-grade and developments are being pressed to determine the extent of the ore shoot. W. T. Waldron is superintendent.

Chrome.

This place, near the town of Willows, is the center of important chrome mining. Carter & Quigg of Wilmington, Del., are working 16 men on 3 claims and preparing for early shipments. The ore will be hauled to Fruto and from this point shipped east by rail.

Scott Bar.

The Milne hydraulic properties, near this place, have been sold to Boston capitalists for \$60,000, according to reports from the mines. The holdings comprise 153 acres of placer ground, and the property for years has been one of the leading hydraulic producers of California. George Milne was former owner.

Redding.

Reorganization of the Yankee John Mining Co. has been completed under the title of the Yankee John Development Co. Pittsburgh capital controls the group, which embraces the Yankee John, Hustle, Hedge, Preston and Wedge properties. It is reported arrangements have been made for aggressive work. The property lies 3 miles west of town and has been a good producer.

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Sinking of a new shaft at the Faxon has been started by F. A. Burgson and F. R. Restano. An electric hoist is to be installed to expedite the work. When a depth of 180 ft. is gained a crosscut will be driven to tap the old workings.

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The Radhide mine has been unwatered to the 200-level

by the Pittsburg-Silver Peak Co. and sampling of the large ore bodies in old workings is proceeding steadily. It is understood assays of much of the old ore are satisfactory. Unwatering of the shaft continues and as soon as the 1800-level is gained sinking will be resumed.

The Dutch-Sweeney Mines Co. has increased wages of miners 25 cts. per day. A like increase has been granted most surface workers. Developments in the mines continue satisfactory, particularly in the Dutch and App. From the deep Dutch shaft opening of productive ground is proceeding at several points. W. J. Loring is general manager.

Silver Lake.

The Mollett Development Co. of Massillon, O., is actively operating the Owl Head manganese mine near this place; 35 men are employed and about 970 tons are produced per month. Two Holt 75-hp. caterpillar tractors have been purchased. Surveys for a railroad are being made. R. L. Mann is consulting engineer.

Denny.

Cinnabar ore is showing in the Overland mine, which is being operated by L. Yocom and associates of Arcata. The 50-ft. crosscut has exposed a 12-in. shoot of good ore, and the main ore body appears to be 50 ft. wide. A 2-compartment shaft is being sunk and has opened a 4-ft. shoot of promising ore.

Grass Valley.

The annual meeting of stockholders of the Maryland Gold Quartz Mining Co. was held in this city last week. S. P. Dorsey was re-elected president and T. C. Dorsey, secretary. No attempt will be made to resume operations for the present.

The North Star mine is taking steps to change its milling process from cyanidation to concentration by flotation, but will cyanide the 80-mesh concentrates produced by flotation.

San Francisco capitalists, headed by E. L. Oliver and F. W. McNear, have acquired control of the Union Hill mine. Errol MacBoyle has been chosen superintendent. The mine is well equipped and an attempt will be made to develop at further depth the rich shoot opened last fall on the 800-level.

Brownsville.

Gold mining is showing renewed activity in this district, and prospecting is quite active. The Manzanita has been acquired by a strong company and preparations are being made for early work. The Campbell is about to start production. Much work was completed during the winter and a ledge of good-grade quartz is exposed.

A cyanide plant capable of treating 150 tons per day is being installed at the A. B. C. mine. The 5-stamp mill is running on good ore, and it is reported additional crushing machinery may be installed soon. Late work underground has been encouraging.

Hoisting and pumping equipment have been placed on the shaft of the Manzanita mine, and sinking of the shaft resumed. It is down about 300 ft. with some good ore showing. The property is controlled by Boston people. F. Young is superintendent.

Crucero.

The Lietzow Con. Co. is preparing to purchase a new plant, following rich gold discoveries in the mine. Equipment will probably include mining and milling machinery. Three strong veins have been opened, ranging from 6 to 12 ft. wide. The ore occurs in limestone, near a porphyry contact. This camp lies near Barstow and Goldstone.

Sutter Creek.

The Old Eureka Mines Co., controlled by New York capitalists, is installing 3 pumps in the shaft of the Eureka mine. Construction of a steel headframe will commence soon. The transformer house has been completed and installation of electrical machinery is about to start. Large quantities of supplies are arriving and the management expects to be in a position to start sampling of the upper workings within a few weeks.

Randsburg.

The Yellow Aster 100-stamp mill is crushing 500 tons of ore per day, the recovery of gold by plate amalgamation running between \$35,000 and \$40,000 per month. The gold is

mostly in the fine material, and the Yellow Aster Co. contemplates installing a dry screening plant by which much of the coarse waste may be eliminated before the material reaches the stamps. The screening plant is to handle about 3500 tons a day.

Smartsville.

The Pacific Dredging Co., a subsidiary of the Guggenheim interests, is preparing to start dredge mining along the Yuba river in this vicinity. A 2-mile electric transmission line is under construction from the Smartsville station of the Pacific Gas & Electric Co. The holdings have been extensively prospected and adjoin the properties of the Yuba Con Gold Fields.

Plymouth.

New surface buildings are nearing completion at the Amador Star and transformers are in place. Good ore has been opened recently.

COLORADO.

Boulder.

Machinery has been ordered and construction started on the remodeled tungsten mill of the Vasco Mining Co. This plant was formerly known as the Boyd. The bins are full and no more ore will be purchased for more than a month. Monell slimers are being installed. Previously the capacity was about 25 tons per day.

The Colburn tungsten mill is being reconstructed to handle 100 tons per day and it is expected that it will be in operation by June 10. Hereafter the mill will be known as the Degge Clark. It assimilates the Clark mill in design and will get its ores principally from Magnolia, Bummer Gulch and the camps above Boulder falls. From all the districts in question there is an easy downhill grade. Another large source from which they will obtain ore is the Boulder Production Co., operating at Barker's Meadow.

A. H. Carlisle, New York, has bought the Criss Bracken mines for \$100,000 and is negotiating for the Catastrophe mines at \$60,000. The purchase embraces 20 acres of tungsten-bearing land, the April Fool No. 1 and No. 2, the Good Friday and Red Bird Slipper. They have been developed by a number of shafts and a crosscut tunnel advanced only a short distance. It is the intention to lower the main shaft, while exploration will be continued in a number of other places, as well as in the extension of the crosscut tunnel. N. H. Brown, Denver, has been appointed superintendent and has ordered two electric compressors and an electric hoist for immediate delivery.

Leadville.

A Layne turbine, deep-well pump is being installed in the Wolfstone shaft. The pump will have a 180-ft. head, operated by electricity and installed on the 800-level. It will be connected with the steam plant now operating in the station. The water column will be lowered into the shaft from the pump and will reach to the 980-level, the entire length of the pipe being in water. This type of pump eliminates all danger of burning out the motors and has been found successful where the suction does not become clogged with dirt where the intake pipe is near the bottom of the shaft. It is thought that little or no debris is in the shaft here and for that reason the pump should work well.

Cripple Creek.

The Granite Gold Mining Co. has finished the work of lining the Dillon shaft. The counter balance guides have been set for 1000 ft., and operations were resumed at both the Gold Coin and Dillon shafts this week. A new blacksmith shop is under construction at the Dillon shaft. The two forges have been set in concrete base and the sharpening machine is also on a concrete foundation. When their alterations are all completed a full underground force will be employed and work pushed to the limit.

In crosscutting from the Red Bird shaft on the Yellow Bird Gold Mining Co.'s property a new vein was found 185 ft. west of the shaft and a short distance north of the main Yellow Bird vein. The new vein is from 6 to 7 ft. wide, and carries another vein from 6 to 8 ins. wide, of fluorite quartz

Notes on the Tungsten Ores of the Southwest

By H. H. TAFT.* E. M. EW 6-3-16 (v. 44) 1047

There is probably no mineral, commercially valuable, that takes so many forms differing so radically in appearance as the ores of tungsten. To the ordinary observer there is no connection except the unusual weight between the black ferberite and the light colored, sometimes white, scheelite. Every miner when shown the ore exclaims: I have seen that before, somewhere; then rakes over his memory for the place, and when he goes to it finds that it is something else, or that someone else is there. In visiting various tungsten mining districts one is impressed with two things: That there is very little mineral coming from places that have not been known to someone for a long time. A claim carrying hubnerite was patented in Colorado in 1877, and the specimens were discussed in scientific papers in the early eighties, yet is still unknown commercially; and the ease with which the various minerals may be overlooked, scheelite particularly, would not be recognized in the course of an ordinary mine examination, unless made specifically for that mineral.

New mining regions pass through a cycle of development; experienced mine operators are a conservative lot, and are generally the last to take hold. One first sees those who stake everything in sight, and the consequent troubles that result from the skimping and avoidance of the legal assessment work; then the raw-hide period sets in, and it does one good to see the honest effort on the part of those whose means are very limited, but whose knowledge of ore dressing is good. In the Dragoon mountains in Arizona one can now see the almost forgotten rocker and pan and hand jigs augmented by gasoline driven crushers. The next stage is an old battery from some abandoned silver or, worse, gold mill, and a table. The loss in slimes in these mills is very great.

The prospector generally asks where to look for the ore, and is generally told to look for quartz veins in granite or pegmatite dikes. At White Oaks, New Mexico, the ore is in a crushed zone in rhyolite; at Hatchita the ore is in limestone. In the Dragoons the veins are quartz with a little fluor spar in granite, but the larger production is from placers, and they would suggest a country rock rather than vein mineralization, for the quartz veins are thin and the placer area is considerable. In the Wheatstone mountains near Benson, the ore is altered granite. The feldspar is not apparent to the eye, and the mica is light colored, instead of the not unfrequent magnetic iron; it carries ferberite. Near Nogales, where both wolframite and scheelite are found, the country rock is granite, or some of its modifications. In Sonora scheelite is occasionally seen in the concentrating copper ores at Nacozari, and farther south a green-colored scheelite

comes from a copper mine. Again in Sonora ore identical with that of the Gigas is found; this same ore can hardly be distinguished from that from Bi:ma.

What is likely to prove an important tungsten area is the Gigas (quartz) mountains, near Arivaca, about 70 miles south of Tucson, Ariz., and 20 miles from the Southern Pacific railroad at Amada station. This is a range of hills rather than mountains, about 8 miles long and 2 or 3 miles wide; not over 800 ft. higher than the surrounding country, and having its greater elongation northwest and southeast. To the south flows Arivaca creek, that has surface water for 3 or 4 miles all of the year through. The stream on the northerly side only flows after a heavy rain, but has a considerable drainage in the gravel that can be reached by shallow wells.

The northwest end of the Gigas is granite, but the middle and southeasterly portion is of more recent eruptives, commonly known as porphyry, but not yet named. Through the range are a number of dikes of a dark green rock, perhaps diorite. The veins are of white quartz and are very prominent, dipping nearly vertically and strike with the mountain range. A secondary smaller series crosses the mountain. These veins are from thin seams to 5 or 6 ft. in thickness. Often there is a foot or two of quartz, a foot or two of country rock, a smaller seam of quartz, more country rock; another seam of quartz, etc. In all making a vein 10 ft. or more thick. The quartz is a typical gold quartz, carrying a small amount of the usual pyrites, chalcopyrites, galena, etc. Sometimes the country rock in the vein is mineralized better than the quartz itself.

The quartz veins at the northwest extremity of the range and for 3 or 4 miles east and south, are remarkable for the crystals of hubnerite; sometimes pin-head specks, and again beautiful crystals several inches long radiating like the fingers of an open hand, reminding one first of stibnite. These crystals are frozen to the quartz, making hand dressing impossible, unless roasting is resorted to. The present practice is to break (spall) the ore and pick out the best for shipment. There is a stamp mill equipped with tables at the lower end of the mountain.

At Campo Bonito, near Oracle, about 40 miles north of Tucson, is another tungsten area. The mineral is a salmon-colored scheelite. The principal vein is that of the Cody-Dyer Gold Mining Co., and is a fracture zone in the sedimentaries, limestone, shales, etc. The underlying rock is granite, and in the neighborhood the same mineral occurs in quartz veins in granite and in granite diorite contacts.

Rigid laws do not apply to nature very well. While most of the tungsten is found in granite and with quartz, it is found associated with many other rocks.

*Denver, Colo.

Ferberite seems to favor small seams, and to make breccia fillings as in Boulder county, Colorado; hubnerite or wolframite, as crystals in quartz, neither mineral shows any regularity; a stope looks good today, tomorrow it may show no ore at all. Scheelite is the easiest mineral to pass over, and is the most irregular in its occurrence; it is never low grade in the sense of being intimately mixed with other minerals, but occurs pure in irregular masses or small fragments. Two or three hundred pounds have been found about 10 miles northeast of Nogales. The pits from which it was taken are the ordinary assessment holes dug in searching for gold-copper-bearing quartz. The mineral was in sharp-angled fragments of practically pure scheelite, imbedded in the soft granite of the veins. Even now one can pan the dumps and obtain particles of the mineral about the size of a grain of wheat. These particles, while the mineral is markedly crystalline, rarely show crystal faces, and are not rounded at all. In some instances they are probably pseudomorphs; more likely they are simply fillings of small rough vuggs.

It might almost be given as a rule that all unprofitable gold mines should be looked over for tungsten minerals. All valuable high-grade ore has a habit of being very irregular in its occurrence. One sees a great many unfortunate investments in the way of gold mines, that have been induced by occasional bunches or pockets of rich ore in fine-looking quartz veins, that do not yield enough low-grade material between the rich pockets to sustain the expense of operating, or a sufficient number of pockets to make selective mining profitable. It must be an agreeable surprise to some of the owners to find that they have a profitable tungsten mine.

All the tungsten ores are very brittle; crush the ore to $\frac{1}{4}$ -in. and then jig or screen through a 20 or 30-mesh screen, and nearly all the mineral will be obtained, this fact and its high specific gravity, makes it possible to obtain a marketable product with hand appliances. It slimes badly. The writer has seen it floating like mosquito larvae on the water of a pool below a rocker where placer ground was being washed. The addition of a concentrating table to an old stamp mill is an economic plant in the matter of initial cost. If a stamp mill is to be used, slime equipment will be required. It is much better to reduce the proportion of slimes by using slow moving rolls. Eventually, when the price of tungsten declines, it will be found necessary to devise some plan to save the gold, thereby gaining an income from both metals. It appears sometimes that there is an inverse ratio between the gold and tungsten, when the tungsten content of the vein becomes low, the gold is likely to increase.

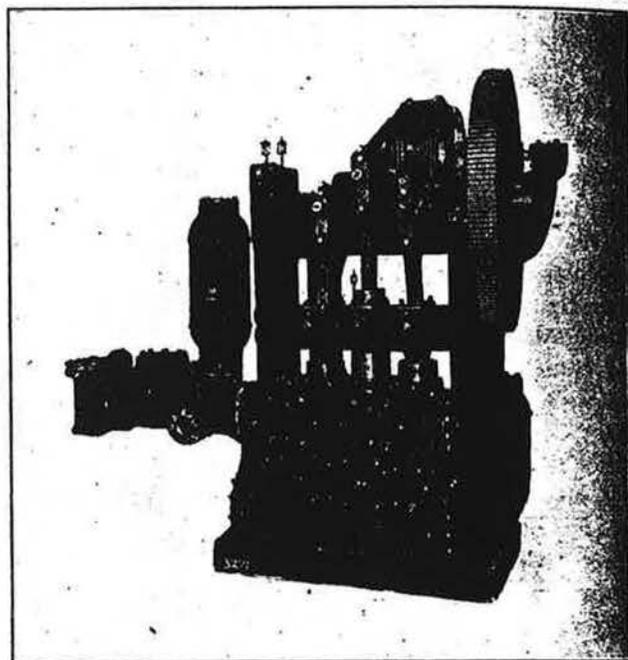
Sylvanite, sometimes called graphic tellurium, is a telluride of gold and silver. It sometimes contains lead and antimony.

An advertised brand is of itself a guarantee.

Modern High Economy Pumps for the Zinc Districts.

Companies in the lead-zinc mining districts, whose equipment in former years was notoriously crude and inefficient, are now installing pumps of the most modern type. The one shown in the cut, which has a maximum capacity of 1000 gals. per minute and was built for the Monmouth Zinc Mining Co., Hazel Green, Wis., offers an excellent illustration of this tendency.

It consists of a 11 by 12-in. Aldrich vertical triplex, outside-packed plunger electric pump of the divided water end type, single reduction, direct geared. Provision is made for mounting the motor on the top, as shown. The pump has also been furnished with two



ALDRICH ELECTRICALLY OPERATED PUMP.

pinions, one for giving a capacity of 850 gals. per minute at 58 rpm., and the other to deliver 1000 gals. per minute at 68 rpm., against a total working head of 240 ft. It is fitted with split hub and rim-cast steel, spur-cut gear, forged-steel motor pinion, cotboard bearing for extended motor shaft, check and by-pass valves, 12-in. suction and 8-in. discharge openings, bronze-lined throats, babbitt metallic packing; and a cast-iron pump base.

The pump is operated by a 75-hp., 3-phase, 60-cycle, 220-volt, General Electric squirrel cage induction motor. It has an extended motor shaft and is without bed plate or pulley, but complete with hand starting box. The synchronous speed is 600 rpm.; approximate full load speed, 570 rpm.

This installation is being watched with interest by the managers of other properties in the district and will undoubtedly be followed by others.

Pure metals are usually more malleable than their alloys.

Late News From the World's Mining Camp

Editorial and Special Correspondence.

ALASKA.

Valdez.

From April 1 to 23 the Alaska Gold Mines Co. milled 126,000 tons assaying 79.3 cts. General Manager Thane says: "Condition of stopes east of the shaft shows great improvement and I shall be able to resume delivery of ore from No. 2 east of No. 5 level and from new stopes opened east on No. 6 and No. 7 levels. Grade of ore should improve during the entire month of May and show marked improvement during the entire month of June. Tonnage maintained, I expect will be about 6000 tons per day until about the middle of June, when new stopes east of the shaft should be in good condition to deliver their proper percentage of ore, so that tonnage can be thereafter increased." In the first 10 days of May the company treated 6000 tons of ore per day, running \$1.60 per ton. The average assays for the month of March and February were \$1.02 and \$1.03 a ton. In January ore averaged only 94 cts., but this was raised to \$1.02 and \$1.03 in February and March. During the last week of April workings in the schist formation east of the shaft began to produce and the average of the combined ore, amounting to 40,000 tons, was \$1.40 on this account.

It is rumored that M. F. Hendrickson, now in New York, has raised money with which to reopen the Three-in-One mine. To sustain this it is known that Superintendent F. J. Devinney has put 3 men to work getting the mine into condition again.

In the Stewart river district, pay dirt has been located on Nelson creek and a rush to the location has been in progress for some weeks. The creek is said to be 20 miles long, and 45 to 50 claims have been staked. More are still on their way there to plant their posts. The creek on discovery was 6 ft. to bedrock, and a summer proposition. The discoverers got 20 cts. in gold to 16 pans. The best pan went 1.6 cts. It is rumored that the country is well wooded and offers plenty of construction timber.

ARIZONA.

Ray.

Excitement is growing over the progress in this district. The Ray Con. Co. is maintaining a steady production of 9500 tons. The ore is shipped in 60-ton steel cars to the company's concentrator at Hayden, which reduces 16 or 18 to 1 and shoots the product over to the smelter, 100 yards to the east. The ore averages 1.75% copper and approximately 70% is saved. The Pinal Development Co. is developing the Renfro group at Troy. A 100-ton concentrator is to be placed on the Sullivan mine, which has a big known deposit of vanadium ore. Arrangements are being made to sink a 500-ft. shaft at the Ray Lode. Four churn drills are being operated 24 hours on the Ray Hercules, and a shaft is being put down. Just what has been discovered is being held secret by the management, but it is generally believed that the determinations have been satisfactory. There is a report that rich ore was encountered in the shaft at a depth of 120 ft. Until the burning of the sampling mill forced a curtailment of operations at the Hayden smelter the Ray Hercules was shipping some ore to that plant. For some time Ray Hercules has owned an excellent concentrator site at Kelvin, 6 miles below Ray on the Phoenix and Eastern railroad. There is some reason for believing the road will soon be built and that the company will complete the magnificent concrete hotel

it started to build in the northeast part of Ray. The hotel is about half finished.

Prescott.

Yavapai county's silver mining industry—quiescent and more or less moribund since the repeal of the silver purchasing act in the early nineties—has been quickened by the recent advance in the price of that metal, and is now assuming active proportions. There has been no period since the demonetization of silver when the financial wellbeing of that branch of the county's mining industry was so thoroughly assured as now.

The Randolph-Gemmill Development Co.'s mill, the Saratoga Mining Co.'s mill and the mills of the Tiger Silver and Tiger Gold Mining companies, are operating day and night on silver and gold ores of the Bradshaw mountains. Two additional mills are to be erected as well as a custom plant in the vicinity of the camp of Crown King for the treatment of custom ores of that locality in general.

The Crown King, Wildflower and Tiger mines, owned by the Yavapai Con. Gold-Silver-Copper Co., have been taken over by the Bradshaw Reduction Co.—holding company for the Randolph-Gemmill Development Co. The first mentioned corporation has also acquired control of the War Eagle-Gladiator group under a lease and bond. It is the purpose to aggressively develop all four of the properties and to treat the ores in the Randolph-Gemmill mill. The latter is to be enlarged to meet the additional ore reduction demand. The ores carry commercially valuable copper, lead and zinc, in addition to pay values in gold and silver. These determinations have been satisfactorily demonstrated at the Randolph-Gemmill plant.

A copper property in Yavapai county that is being financed with pronounced success is that owned by the Loma Prieta Mines Co. in the Copper Basin district. The stock of this company, placed originally at 25 cts. per share, is now selling at \$1. Reorganization of the company was recently perfected and the treasury holdings increased to 600,000 shares. John Livezey, formerly of Leadville, is general manager of the Loma Prieta. The company's property adjoins the Commercial mine, which is outputting an average of 85 tons of copper ore daily, and carries the main sulphide ore channel of the Copper Basin district. The Loma Prieta shaft is being deepened to the 200-ft. point, and is in high-grade chalcopyrite ore from the 85-ft. point to its present depth of 125 ft.

Plans are completed for listing the shares of the Tusconia Mining & Milling Co. of Arizona on the San Francisco stock exchange. The company was incorporated in March, 1916, for 1,000,000 \$1 par shares. The corporation is headed by local mining and business men. The property has a production record of \$1,000,000 in high-grade silver ore that was mined from near-surface workings. The ore is identical in appearance and value to the rich silver ores of the Tonopah district, and, like those of Tonopah, occurs in the lode porphyry. Development work is in charge of James H. Sullivan.

CALIFORNIA.

Grass Valley.

An electric power line is under construction to the Allison Ranch mine and arrangements have been made to install pumping equipment. Orders will also be placed shortly for a compressor and drills. Charles A. Brockington is superintendent.

The Cassidy Mines Co. has been incorporated, with a capital stock of \$200,000, to reopen and operate the Cassidy

property in this district. Sinking will commence early in the hopes of intersecting the Cassidy and Linden veins. The Cassidy lies between the Empire and Pennsylvania mines and produced rich ore in the upper workings.

The Pittsburg mine, in the Gold Flat district, has been acquired by Bert Schlessinger and associates of San Francisco, and developments are being pressed. A crosscut is being driven toward the vein and is expected to enter pay within a few weeks. The Pittsburg is an old property and has been worked intermittently for 50 years. Herbert Bates of Nevada City is superintendent.

Redding.

The Shasta National Copper Co. has been formed by local capitalists to develop 1000 acres of copper-bearing land adjoining the holdings of the Mammoth Copper Co. The company is incorporated with 5,000,000 shares, par value \$1. Directors are C. F. Brouillard, William H. McEwen, S. S. Norcross, M. F. Fries of Redding and A. J. Shields of Anderson. The company also intends to operate mining properties in other sections of the county.

J. W. Killinger has taken under bond from Frank Panter the Garfield gold mine in the Old Diggings district. The old 150-ft. tunnel will be extended and a new crosscut driven 600 ft. The Garfield produced rich ore 20 years ago, but the loss of the ore shoot caused its closing after a few shipments of rich quartz had been made. Developments will be commenced immediately.

Hayfork.

Rich ore has been encountered in the Black Bess mine, owned by Benjamin Murphy and Alonzo Layman; 10 tons of ore yielded \$800. The shoot is reported to be showing length with development.

Tungsten City.

This new camp, near Bishop, is the center of a live mining section. Several tungsten companies are operating and preparing to start production of concentrates in a few weeks. Water has been brought to the camp from nearby springs and a business center established. High-grade zinc ore was mined last week about 3 miles from here and several prospectors are exploring the deposits. Eleven claims have been staked and more are being staked out.

Lewiston.

Claims along the Trinity river from Lewiston to Poker aggregating 1500 acres, have been taken under bond by a syndicate of Los Angeles and San Francisco capitalists. The purchase price averages \$200 per acre, said to be the highest rate commanded by placer territory north of Oroville. It is intended to operate three gold dredges on the territory, and orders have been already placed for No. 1 boat. The company has been prospecting the ground for several months with drills, and has proven the deposit to range from 10 to 30 ft. in depth. The syndicate is represented by W. B. Weston of San Francisco and C. A. March of Los Angeles.

Atolia.

Local tungsten producers are curtailing their output, following the appearance of scores of new producers in California, Nevada and other states. The Atolia Mining Co. has closed its Parr mine. Other companies state buyers are showing little interest in offers and that too much ore is being produced.

Mountain Ranch.

A ledge of rich ore has been encountered in the property of the Calaveras Development Co. The general average assays approximate \$100. Drifting is proceeding to determine the width and extent of the vein. The company is also working 200 acres of placer ground.

Columbia.

The Springfield Tunnel & Development Co. has discovered a deposit of rich gravel in the Ranch claim, located several hundred feet from the recent bonanza strike in the Channan channel. The new discovery was made while running a drift from an old shaft to connect with workings from the main tunnel, and shows a large deposit containing considerable coarse gold. The deposit encountered in the Channan channel is being opened by raises and drifts. It is 4 ft. thick at the rim and is deepening as the center is reached. As the tunnel advances shafts will be sunk to work the channels and pockets as they are freed of water. The

tunnel is now in about 2850 ft. Joseph Cademartori has been appointed general superintendent, recently made vacant by the death of A. L. Horner.

Folsom.

Deposits of chrome in this section are being vigorously worked and a number of important deals have been announced. The Manganese Co. of San Francisco has purchased a large deposit on the Steele ranch, near Pilot Hill, from G. W. Neilsen, J. J. Smith and P. F. Donnelly of Folsom. Extensive developments will start at once. D. E. Wiley of Folsom and M. Armstrong and J. J. Beyne of El Dorado have sold their chrome holdings to San Francisco people. S. W. Hill and associates are ready to start shipments of chrome to eastern mills.

Magalia.

The Willard placer mine has been acquired by W. E. Young and S. D. Mesmith of San Diego and operations started. Driving of a tunnel is proceeding to open a quartz ledge recently found on the hillside, and construction of a boarding and bunkhouse is under way. The mine comprises 5 claims and produced fabulously in early days. The largest of numerous nuggets found was extracted in 1856. It weighed 54 lbs. and brought \$10,476.

Last Chance.

With abundant water available mining is quite active here; 20 men are working the Home Ticket, with D. M. Day in charge. The long-sought channel has been encountered in the Glen property. Ten men are working under the management of F. A. Moss. The working force at the Pacific has been increased to 25 men and production is proceeding along greatly broadened lines. Several other properties are active, and the outlook is favorable for a prosperous year.

COLORADO.

Telluride.

A good strike has been made at the Imes mine and confirmed by its principal bondholder, E. E. Wheeler, Ouray. He has had this mine and the Fourth of July mine under lease and bond for some time. Mr. Pomeroy of Sawpit, who is in charge of operations, encountered the vein while drifting. The vein averages 2 ft. wide and assay results show about \$6 in gold, 6.7 ozs. silver; 10% lead and 21% zinc.

Under Manager Mullen of the Standard Chemical Co., at the Ford camp, diamond drilling is proceeding. The holdings are of carnotite ore and when this is again in demand it is the intention to have the veins well drilled so that a large tonnage can be produced on short notice and kept up.

The Favorite Mines & Reduction Co., with a capital of \$25,000, 250,000 shares at 10 cts., paid up and non-assessable, has recently filed articles of incorporation. The incorporators are P. L. Foster, W. D. Thornton and D. A. Herron, who are also the directors. The office will be here. Herron will act as manager. This company has taken over the Favorite mine at Ophir, and have 10 men at present working the property.

Idaho Springs.

A lease has been granted by President Wimbush to Charles Orpin and associates of Denver on the Uncle Sam vein workings through the Big Five tunnel. It runs for 2 years and the lessee is now arranging for the immediate starting of operations. His plan is to put men to work in both headings of the east-west drift. The Uncle Sam lies between the Bellman and Lake properties, both of which have produced heavily through the Big Five tunnel. Lake last year produced about \$250,000 under lease.

One lease on this mine recently was sold for \$30,000. They have drifted on Uncle Sam about 200 ft., proving a practically continuous streak of ore for the entire distance. Assays show \$156 in gold, silver and copper. Small trial shipments have been made. It is thought that they will open into a good shoot of ore similar to the occurrences on the Lake and Bellman.

The American Metals Producing Co., E. S. Moulton, president, and G. W. Adams, secretary, has started the Black Hawk No. 1 plant. It is handling zinc-lead concentrates and

600-kws. each; these are to be steam-driven from the old Babcock & Wilcox boilers originally installed for the smelting plant. The electric power to be generated will be used for operating hoists and pumps. A 1500-cu. ft. Nordberg air compressor, to be steam-driven, is to be put in. The company's two mines, the Eureka and Copper Hill, are 1¼ miles apart, on the same ore belt. The Copper Hill electric hoist is being operated from the Old Dominion power line, but the company will soon have its own electric power connected. Other new equipment being put in consists of two Scranton quintuplex plunger pumps, 500 gals. capacity each, on the 1400 level of Copper Hill shaft. This will supplement the work of an Aldrich pump on same level, which handles 550 gals. per minute. Ore shipments, amounting to 5000 tons per month, from the Copper Hill mine to the Old Dominion smelter, consist of sulphides taken from the 1200, 1300 and 1400 levels. Work in Eureka mine consists of exploration and development, with some ore production incidental thereto. The shaft is 1200 ft. deep, but most of the work is on and above the 800 level. The Commercial operations are under the superintendency of R. R. Boyd.

Superior.

John A. Sandal, having 24 claims 4 miles south of Superior, has two veins of copper, gold and silver ore, opened by a crosscut tunnel. He ships 3 carloads of ore per month to A. S. & R. Co. smelter. Selected ore ran 18% copper. He will put in a gas engine and a 3-drill air compressor and drive a deeper tunnel.

Ray.

The 3-compartment shaft being sunk by the Arizona-Hercules Copper Co. is to have a depth of 1000 ft. and in which 10-ton skips will be operated. Two gas engines, 60 and 25-hp., are used at shaft for hoisting and air compression. Four Star drills are kept in operation in prospecting work, there being now 46 drill holes on the company's property, of varying depth. Shipments of carbonate ore from surface workings, and down to 100 ft., are being made, of grades ranging from 5 to 12½ and 13% copper. Sulphide ores, consisting of chalcocite and chalcopyrite, are opened by drill holes at various depths. The concentration mill, to be built near Kelvin, for which plans are being made by Bradley, Bruff & Le Barthe, will be operated by electric power, to be generated by Deisel engines in the company's own power plant. C. E. Addams, general manager for the company, came recently from the Beers Con. mines, Kimberly, South Africa, where he was manager; he was also connected with Voorspoed diamond mines, in the same country.

Pinal Development Co., which took over the old Renfro group of mining claims, has purchased a gasoline hoist and air compressor, and has begun sinking a shaft which is to be 300 ft. deep. The location is on the copper belt that runs through Superior, Ray, Troy and Christmas, and is in the vicinity of the London-Arizona group, 4 miles from the railroad. It is developed by a 1175-ft. tunnel, designed to cut the ore zone at 500 ft. depth. The shaft location is near the base of the mountain slope, below the tunnel entrance. Surface ores are of good grade and oxidized, and by sinking it is believed the primary ore zone will be reached at 100 ft. On this slope the secondary ore deposit has been exposed by erosion. It is thought these ores will not require concentrating, but the tentative plan contemplates the construction of an aerial tramway from mine to railroad. J. C. Devine, Ray, who for a number of years was assistant superintendent of mines for the Ray Con. Copper Co., lately resigned his position to become president and manager of the Pinal Development. Among other stockholders are T. M. Blake of Gila Bank & Trust Co.; John H. Robinson, Prescott; Dr. F. C. Norman, Jerome; R. H. Boxall and Chas. Hollister, Ray. Aggressive work is intended.

Hayden.

The Hayden smelting plant of A. S. & R. Co. will be increased in capacity 50% by the operation of new equipment being installed, giving the works a capacity of 1300 tons per day. The two reverberatory furnaces now in use have a capacity of 400 tons each, and the new reverberatory being built will be of 500 tons capacity. There are now eight McDougal roasters in operation, and four more are being installed. Other improvements consist of new sampling

works in a steel building, having capacity to crush 7½ tons per hour to ½-in. size. It is being equipped with all modern facilities. The plant has three converters, a Morgan 60-ton crane, and a machine for casting blister copper, this being operated on a Walker wheel by electric power. The plant is operating at full capacity, handling 500 to 600 tons of concentrates per day from the Ray Con. mill. In addition to this shipments of silicious custom ore are received from other parts of the state, including Yavapai and Yuma counties. A new Allis-Chalmers compound, reciprocating blowing engine, lately put in operation, delivers 26,000 cu. ft. of air per minute, under 14-lb. pressure. At these works R. B. Green is superintendent and H. T. Murray, assistant, with S. H. Levison as chief chemist and assayer.

Ray Con. Copper Co. is building at Hayden a new filter plant for filtering the flotation concentrates. The equipment includes Dorr thickeners, and Portland filters, built by Colorado Iron Works.

Christmas.

The Christmas mine, under the superintendency of S. H. Sherman, is mining 7500 tons of self-fluxing low-grade copper ore per month, usually handled at Hayden smelter, but which lately has been sent to Sasco smelter. The ore is transported from the mine to the railroad on the Gila over an aerial tramway a mile in length. This mine belongs to the A. S. & R. Co.

CALIFORNIA.

Bishop.

The tunnel on the Aeroplane claim of the Standard group has cut the ledge of tungsten-bearing ore at an approximate depth of 70 ft. An upper tunnel shows over 20 ft. of ore and a shaft is being sunk from the outcrop to reach the ledge. Frame work and ore bins of the 75-ton mill are in place and installation of machinery is about to begin. A tram is to be built from mine to mill. L. E. Porter is superintendent.

The Tungsten Mines Co. has begun construction of the building for its 200-ton mill; 20 men are at work. An upper tunnel has tapped the ore body on the Little Sister claim at a depth of 75 ft., and the lower tunnel is expected to reach the ore within 200 ft. from the present face. It is now in 130 ft. The company is erecting cottages for the men and several buildings for company use; 100 men are on the payroll. L. L. Stevens is general manager and Cooper Shapley, superintendent.

Atolia.

It is reported the Atolia Mining Co. is preparing to return to the leasing system. Late operations have not been satisfactory: high-grading has seriously cut down profits. While this company has greatly curtailed production, several other concerns are active, and the output of the district has increased to more than 100 tons per day. The population of Atolia is now fully 1200, and the tungsten-bearing area has been extended 10 to 12 miles to the east and west and 5 miles north and south.

Randsburg.

The Yellow Aster Mining Co. is planning improvements to its mill designed to effect a closer gold saving. The 100-stamp mill is crushing 500 tons per day yielding approximately \$40,000 per month by amalgamation. The mine is reported in excellent condition, with ore reserves sufficient to insure a long run of the mill. It is likely additional mine machinery will be installed this year.

Heroult.

A shortage of manganese ore has forced the management of the Heroult electric smelter to commence production of pig iron, but it is expected to resume the making of ferro-manganese in a short time. A promising deposit is being opened near Clipper Mills and shipments from this point will soon begin.

Kennett.

The Mammoth Copper Co. has completed purchase of the Stowell mine for \$65,000 and payment of delinquent taxes amounting to \$13,000. The company has been develop-

ing the Stowell under bond and option for about 3 years, and has demonstrated the existence of large reserves of profitable ore. An excellent camp has been erected at the mine preliminary to more comprehensive work. Extensive developments are proceeding at the Friday-Lowden, Spread Eagle and main Mammoth holdings; 1200 men are on the payroll.

The Mammoth, Balaklala and Mountain Copper companies have granted their employes another wage advance of 25 cts. a day. Approximately 2000 men are affected. The Mammoth is also paying an additional bonus for work above a specified standard in the driving of the two large tunnels being extended to open the main deposits to further depth.

Nevada City.

The vein recently intersected in the Providence mine of the Champion group is reported to be developing well. The quartz carries tellurides and shipments are being made direct to smelters. Much of this ore is said to be of bonanza character. The strike was made in the long east drift from the 1800 level, in a virgin section of the property, and drifting is proceeding to determine the extent of the ore body. The property is owned and operated by the North Star Mines Co., operating the North Star group at Grass Valley.

Sutter Creek.

The South Eureka Co. has placed 10 stamps of the Oneida mill in action on ore from the lower levels of the Oneida mine. It is planned to increase the mill capacity to take care of ore developed east of the main South Eureka workings. The 80-stamp South Eureka mill is running steadily on ore from the South Eureka. Connections between the South Eureka shaft and Oneida mine have been established and good ore opened in old workings of the Oneida, thought by the old operators to have been worked out.

The Sutter Creek Mining Co. is rapidly unwatering the Poundstone mine and expects to start work in the upper levels at an early date. Reopening of the old shaft, north of the main workings, is proceeding with a small crew. The property is equipped with a 10-stamp mill and good mine plant.

Jackson.

The Argonaut Mining Co. has placed orders with a local foundry for the building of a 40-stamp mill, which will displace the plant now in use. It will be erected west of the present mill, where facilities for storing the tailings are good. A natural basin exists at this point and a restraining dam, 400 ft. long and 40 ft. high, is being built to prevent escape of the tailings.

Sierra City.

The Young America quartz mine has been sold to A. C. Aiken for delinquent taxes, and plans are being formed for resumption of work. The old dumps at tunnels 2, 3 and 4 will be first sent through the mill, and underground work then prosecuted.

Poker Flat.

Preparations are being completed for extensive sluicing at the Bunker Hill-Herkiner placer mine, 4 miles east of here. A large body of pay gravel was intersected last January, but deep snow prevented production. The Bunker Hill was worked over 40 years ago and is credited with a yield of \$3,000,000.

Redding.

The El Oro Dredging Co. has sunk 25 holes on the Arnold ranch with Keystone drill and has found good gravel at several points. The company is planning the building of a dredge near this point if the gravel prospects favorably, and has recently taken under option the Diestelhorst ranch of 150 acres, just across the Sacramento river from Redding. Most of the gravel recently prospected averages about 17 ft. in depth.

COLORADO.

Boulder.

Operators in the district hold that manipulation is the cause of lower tungsten prices. With this in view, all pro-

ducers are stocking their product to keep it off the market. In exceptions which are unavoidable ore will be sold at \$25 per unit to those who will keep it out of the open market. The producers are holding for \$50 per unit.

Among the exceptions to the above, W. W. Dedge is buying ore at \$25 with which to supply his mill. He expects to have it in operation about the first week in July. The mill is at Bummer gulch and the 400-ton bins have been completed. These will be filled as soon as the road now being graded and cut is completed. The mill will have 75 tons capacity and is being built by the Colorado Iron Works, Denver, under the personal supervision of W. A. Kunkel.

Low-grade, left during the bonanza days of the Livingston mine, is now being mined by the United States Gold Corporation. The mill was started the first of 1916. The ores average from \$10 to \$30, and in the east part of the 400 level the vein has been found beyond the fault and will be in the formerly rich No. 1 ore body by July 1. A strike was made of ore carrying from 200 to 400 ozs. gold, worth \$4000 to \$8000 per ton. In the breast of the 400 level west of the Nyanza vein, the Potato patch ore shoot was encountered and in it was silvanite ore. It carries the same gold values that the body had in the surface workings 400 ft. above. The rich ore shoot had never been found below the 120-ft. level until the workings of the 400 level were reached. The streak of high grade is 3 to 4 ins. wide and with it is a vein of excellent milling ore. The Nyanza ore body, 10 ft. wide, is turning out a tremendous amount of ore for the mill and thus the lowest level of the mine becomes the center of activity, though the reserves of the older levels are drawn on to supplement the demands of the mill, which is gradually being brought up to 75 tons capacity.

Rico.

According to J. C. Jensen, manager of the Rico Argentine mines, the new tunnel has run on the fissure a distance of 28 ft. and 2 ft. of this shows some lead, silver and 23% zinc. Two feet on each side of this drift is well mineralized and the formation is improving. The tunnel is being sent under the old workings, which showed an immense tonnage of copper ore. They cut a station and are making a raise to connect with the first of the old workings. This will give better ventilation and a line on the ore occurrences. This raise is up 25 ft. and has 15 ft. more to reach the contact. The tunnel is being sent ahead while the raise is made and is now some distance beyond the station. When the contact is reached the management will drift on it to the southeast and in this work some good development is looked for. The last 52 ft. in the tunnel drift is much improved and the last 10 ft. indicates that the first large copper deposit may come in earlier than indicated by the survey. The engineer's report shows that the copper deposit is 100 ft. ahead of the present face of the tunnel.

Georgetown.

Lessees are active at the Capital mines. Hamilton & Culberson received \$2500 for 30 tons of ore, besides which the concentrates and bullion from their mill dirt netted \$900. They now have 25 tons of ore ready to ship. DeMasters had 125 tons run through the mill. Holcombe & Co. run 100 tons of mill dirt. Their ore is widening out in each three raises. Pearson & Johnson have 125 tons going through the mill. Prouse & Co. have made a shipment of 20 tons of smelting ore. Hanson & Walthers are still drifting on 2 ft. of ore, which is becoming more solid. Dick Kane, leasing on the Kane adit, has 3 mill holes started. The ore is improving and he will soon be ready to start his stope. After this is accomplished more leases will be let in the adit, as ore is showing all along the course. The shaft to be sunk a distance of 250 ft. from the Kane adit to connect with the raise from the Capital tunnel may be commenced in the near future. The sooner this can be done the greater will be the output of the mine and less the cost of operation, as the circulation of air which will be created all through the mine will allow the working of more men.

Cripple Creek.

Two good showings have been made by lessees at the Prince Albert on the south slope of Beacon hill. Henry von Phul, who has the lease on blocks 10 and 12, has been prospecting at surface west of the open cut. In a shallow pros-

What Mines and Mills Buy in Equipment and Supplies.

Some idea of the immensity of the amount of supplies purchased by American mines and works may be had from the report of the Transvaal mines for 1915, which gives an itemized statement of the supplies used and the cost of same. As this amount was consumed almost entirely by the gold mines of that country, and as this production is only approximately 12% greater than the total gold and silver production of the United States, it can readily be seen that the purchase of supplies by other American mines other than gold and silver will bring the total to a sum reaching into the hundred millions.

Here is the list of the Transvaal gold mine requirements:

	Amount.	Value.
Bags	3,614	£ 3,614
Belting	125,790	125,790
Bolts, nuts, washers and rivets (lbs.)	3,106,664	42,872
Brattice cloth	1,121	1,121
Bricks	13,575	13,575
Brushware	11,154	11,154
Candles (lbs.)	10,710,411	218,867
Carbide (lbs.)	5,705,296	65,168
Castings—(a) Brass	32,581	32,581
(b) Iron	75,161	75,161
Cement—(a) Casks	1,312	2,057
(b) Bags	97,686	32,662
Charcoal	4,262	4,262
Chemicals and assay requisites	167,015	167,015
Coal—(a) Smithy (tons)	20,666	27,587
(b) Steam (tons)	1,825,345	947,113
(c) Other (tons)	23,512	20,369
Coke—(a) Imported (tons)	284	2,532
(b) Local (tons)	1,229	5,238
Compressed air (purchased)	319,127	319,127
Cyanide (lbs.)	10,312,309	538,366
Disinfectants	16,219	16,219
Electrical machinery	208,304	208,304
Electric machinery spares	50,780	50,780
Electric power and light (purchased)	1,077,886	1,077,886
Explosives—		
(a) Blasting gelatine (cases)	284,872	655,518
(b) Gellignite and gelatine dynamite (cases)	393,617	707,979
(c) Dynamite, No. 1 (cases)	116	199
(d) Dynamite No. 2 and Ligdyn (cases)	2,017	2,857
(e) Other explosives (cases)	365	759
(f) Detonators	49,244	49,244
(g) Electric detonators (or electric fuses)		265
(h) Safety fuse	148,754	148,754
(i) Lighting torches (Tyisa sticks)	14,865	14,865
Fencing and wire netting	2,220	2,220
Fodder for stables—Bran, chaff, mealies, forage, etc.	26,949	26,949
Foods, etc. (for colored laborers)—		
(a) Beans (lbs.)	5,642,292	31,216
(b) Rice (lbs.)	2,063,253	17,537
(c) Meal (mealie, Kafir corn, etc. bags)	585,758	311,662
(d) Malt and cereals for beer	20,420	20,420
(e) Meat (lbs.)	31,108,055	404,348
(f) Fish (lbs.)	376,323	5,169
(g) Salt (bags)	7,185	2,132
(h) Groceries, coffee, sugar, oil, ghee, molasses, etc.		37,307
(i) Sundry food including bread	208,720	208,720
(j) Vegetables	51,882	51,882
(k) Medicines, etc.	26,467	26,467
(l) Clothing	12,161	12,161
Hosing (steam, suction and rock-drill)	69,077	69,077
Hand tools (picks, shovels, hammers, etc.)	86,142	86,142
Iron—(a) Bar and angle (lbs.)	6,627,972	53,962
(b) Galvanized	11,149	11,149
(c) Sheet (lbs.)	126,807	1,567
(d) Pig (lbs.)	348,725	1,804
Lamps and spares	14,257	14,257
Lead—(a) Pig (lbs.)	219,422	1,861
(b) Sheet (lbs.)	28,863	532
Lime—(a) White (bags)	534,368	122,761
(b) Blue (bags)	11,777	2,099
Lubricants—(a) Oils	58,400	67,806
(b) Grease and tallows	67,806	67,806
Machinery and machine tools	280,484	280,484
Machinery spares, other than specified	237,333	237,333
Mercury (bottles)	3,017	34,435
Metals (anti-friction)	19,598	19,598
Mill screenings	20,780	20,780
Motor cars and accessories	12,355	12,355
Oils, other than lubricating—		
(a) Transformer	2,567	2,567
(b) Other	1,294	1,294

Oilskin suits	8,560
Paint, tar, driers, etc.	18,157
Paraffin (cases)	19,509
Petrol (cases)	13,974
Pipes and pipe fittings	327,247
Rails, crossings, sleepers, etc.	195,540
Rock-drills	1,742
Rock-drill spares	200,544
Ropes—(a) Wire	114,489
(b) Cotton and manilla	10,444
Screenings, other than mill	5,078
Screws, nails, etc.	22,308
Shoes and dies (lbs.)	15,246,268
Skips and spares	14,530
Stationery	51,644
Steel—(a) Bar, tool, cast, etc. (lbs.)	1,563,081
(b) Sheet (lbs.)	11,974,523
(c) Hand-drill (lbs.)	4,727,171
(d) Rock-drill (lbs.)	5,718,442
(e) Other (lbs.)	384,445
Timber—	
(a) Building material (ceilings, floorings, doors, etc.)	22,350
(b) Oregon pitch pine, etc. (cu. ft.)	1,008,314
(c) Mining poles and round lagging	361,997
(d) Deals (lin. ft.)	2,745,929
(e) Fuel	757
Tube mill requisites—	
(a) Pebbles and flints	1,099
(b) Liners	49,112
(c) Other requisites	16,150
Trucks and spares	94,431
Waste	11,028
Water (purchased)	144,325
Zinc and zinc discs (lbs.)	234,330
Sundry articles not specified above	223,085
Total value	£10,889,115

Tungsten from the Argentine.

The Hansa Mines, Ltd., in Argentine, can produce about 50 tons per month of tungsten ore, according to U. S. Consul General W. H. Robertson, of Buenos Aires, and until the outbreak of the war the entire output was shipped to Germany. The mine has been largely controlled by German owners reported to be affiliated with the Krupp interests. The total Argentina exports of tungsten ore from 1909 to 1913, inclusive, amounted to 3319 metric tons, of which 3309 tons went to Germany and 10 tons to Great Britain, in 1909 and 1910. Germany in 1912 took 637 tons, with 536 tons in 1913 and 394 tons in 1914. In 1915 the United States became an importer, taking 135 out of a total of 158 exported. To April 1, 1916, the United States took 146 tons. When the war broke out, cutting off the German market, part of the mine's plant closed down reducing production to a limited figure. Now, however, the Hansa Mines are working at full capacity with the announcement that the entire output for 1916 has been contracted for in the United States.

Ferrovanadium Exports Increasing.

Ferrovanadium exports were the largest in March on record, having been 138,718 lbs. or nearly double the monthly export rate for 1915, the record year. Government data show the following as recent ferrovanadium exports in pounds:

	Per month.
January, 1916	44,782
February, 1916	63,065
March, 1916	138,718
1915	84,265
1914	770,079
1913	604,287
	82,188
	70,022
	64,173
	50,351

The rate to April 1, 1916, of 82,188 lbs. per month is at the rate of 986,256 lbs. per year—a large increase over that for 1915, the record year.

keted in the east. The manganese mill tailings are shipped to the Copper Queen smelter, where they are used as a flux. A small tonnage of crude ore, running 43% manganese, is shipped without concentrating to steel works in the east. Most of the ore cyanided, as heretofore mentioned, is made up of oxides and carbonates. There are some sulphide ores, however, and these are milled separately, the slime therefrom being concentrated over a Senn pan-motion vanner, which makes a good saving and has large capacity. The different phases of mill work herein indicated are in the nature of experiments, evidently designed to make determinations on which to base future operations on a larger scale. E. Grebe is manager; J. Davis, mining engineer, W. F. Tindall, metallurgist and mill superintendent.

Oatman.

The Oatman mining district continues to be the center of attraction. During the past week the Black Range Co. opened a considerable body of commercial ore on the 300 level. Drifting operations through the week are reported to have been in ore varying from \$18 to \$30 average values, these values secured from sampling across the entire face of the drift. Drifting continues in ore, and it is said that the values are slowly increasing.

Big Jim has enlarged its working crew. Drifts are being run on both the 400 and 485 levels. On the new 485 level the drift to the east is said to be in solid ore. This drift has nearly entered the rich ore shoot opened on the 400 level. Such a rapid increase in values on the 485 level prevail that the operators believe that higher values will be found on this level than on the 400 level to date.

The Pioneer reports notable developments on its 400 level. This property is controlled by Keith & Keith of Boston, and an energetic development campaign is under way. It is reported that in the south drift a body of ore averaging about \$20 has been opened for a length of 35 ft., and is 8 ft. in width. After extensive sampling of the ore bodies in the old workings of the Pioneer, the officials of the company claim that much more than 500,000 tons of mill-grade ore is now blocked out, and that more ore is rapidly being placed in sight. A mill is now in contemplation for this property.

In the United Eastern, work of blocking out ore continues, and the concrete foundation work for the 200-ton mill will soon be completed.

Persistent rumor continues that a find of ore has been made on the new 1400 level of the Tom Reed. Ellis Mallory has started on the work of preparing a complete geological map of the holdings. The annual report of the Tom Reed Co. for the year ending March 31 shows that 5718 ft. of work was done and that 29,916 tons of ore was milled, the average value of this ore being \$22.12, the extraction being 98.6%. The total was \$661,870.68, against an average of \$739,690.21 for the preceding 7 years. The total production to date has been \$5,833,702.17. Dividends paid during the year amounted to \$163,719.90, or 18% on the par value of the outstanding stock. It was estimated that 11,000 tons of ore were blocked out in stopes at the end of the year. Net earnings for the year, \$170,577.98, as compared with \$548,846.15 for the previous year. Income from other sources than mining totaled \$32,580.76, making total earnings slightly above \$200,000, or about 28% on issued capitalization. Mining and milling costs averaged \$11.21, a higher rate than ever before. This is accounted for by increased cost of labor and materials, and a more extensive development campaign.

The crosscut on the 500 level of the Ivanhoe appears to have penetrated the quartz porphyry dike which was entered some 10 days ago, the character of the rock now being extremely good, the gold values carried by much of it seeming to indicate that the vein has been entered on the foot-wall side. The operators estimate the vein to be 30 to 40 ft. in thickness, and have also expressed the belief that the highest values would be found on the hanging-wall side.

The Boundary Cone is drifting in low-grade ore to the north and to the south on the 750 level, and as the downward extensions of the ore shoot opened on the 550 level are neared slowly increasing values are reported.

Work is now being rapidly prosecuted on the Adams property, and the shaft is down about 90 ft. The success of the Black Range has greatly stimulated work on the Adams,

Nellie, Oatman Syndicate, Murdock, Green Quartz and other properties in the Black Range section.

The shaft on the Argo has now attained a depth of 640 ft., and the operators will probably carry it to the 700 point before doing further lateral work.

James C. Ray has just completed a geological survey of the Esperanza Mining Co. ground. This is the most complete geological survey which has ever been made of any property in the district, and is an exhaustive study of the geology, petrology and mineralogy of the southern section of the field.

Etienne A. Ritter has made an extensive study of the Oatman district, and in commenting upon the conditions prevailing there said, in part: "It is my belief that the Oatman district is destined to become one of the greatest gold producing districts in the United States. I believe that time will prove that the Oatman district, like Cripple Creek district, will develop a large number of heavy producers covering a very wide area of territory, rather than being a camp of two or three mines lying along one ledge. Oatman is a deep-mining district, shafts must average from 400 to 600 ft. before lateral work is started. When laterals are started they must, as a rule, be driven some considerable distance to pick up the mineral-bearing veins, and then, as a rule, considerable lateral work must be done in the vein before ore is discovered. Mineral-bearing veins of great lateral extent do not contain rich ore deposits throughout their entire length. Much vertical and lateral development must be done before pay ore in large quantities is found. Every foot of additional development work in the Oatman district brings success nearer. Therefore, in my opinion, the public should continue to have faith in the Oatman district, and those who are interested in the development of various well-located properties there should continue to manifest their faith if only by refusing to part with Oatman securities they hold prior to the time when extensive work should have proved whether or not the various properties are of genuine merit. It is my belief that those people who have faith in the Oatman district, and who are content to await and give the district time will eventually enjoy very large rewards for their confidence."

The officials of the Iowa Mining Co. have recently made an extensive investigation of their property, accompanied by their engineer, Carl O. Lindberg. The retimbering of the old 300-ft. shaft has been completed, and an active development campaign has now been started along the lines proposed. This property has quite a tonnage of ore of low-mill grade blocked out in old workings, but a depth of 500 to 600 ft. will be attained before further lateral work is done.

With its machinery equipment all in operation, shaft sinking on the property of the Oatman United Co. is being rushed night and day. The company has its own electric light plant, and is endeavoring to set a record driving its shaft to the 500 point. Charles S. Sprague, president of the Jumbo Extension Co., is president of the Oatman United, and he has retained J. K. Turner as consulting engineer.

The station on the 350 level of the Lucky Boy is completed and the operators are just starting to crosscut to their vein. Intense silification of the country rock and high gold values found in many stringers cause the operators to feel highly optimistic regarding the outcome of their development work.

CALIFORNIA.

Goldstone.

This new camp, 33 miles northeast of Barstow, is attracting great interest, following several rich strikes of free-milling gold quartz. High-grade ore is being taken from the Goldstone, Red Bridge and Lucky Find properties. None of the claims has been opened to a greater depth than 50 ft. On the Red Bridge a strong shoot of free-milling ore has been opened on surface for a length of 250 ft. As far as work has advanced the ore is free milling and of excellent character. The formation consists of shale, schist and

quartzite, with the dikes and flows composed of igneous rocks. The richest ore is found in the contact, particularly in the schist. Scores of claims have been located and are undergoing development.

Atolia.

Independent producers continue to receive \$45 to \$50 per unit for their tungsten ore, and buyers are again showing interest. The Atolia Co., said to be controlled by the Schwab interests, is still restricting production, but it is generally believed large blocks of the company's ground will be opened to lessees before the end of July. Many of the business houses here are accepting high-grade ore as a medium of exchange.

Sutter Creek.

The Old Eureka Mining Co. has purchased the Wildman-Mahoney-Lincoln group of gold mines for \$205,000. The first payment of \$41,000 has been made and preliminary work started. The property adjoins the Old Eureka mine and it is reported the two may be consolidated and worked from a central shaft.

Unwatering of the Old Eureka shaft has begun with three electric pumps. A 6-in. stream of water is thrown from the shaft and at the present rate of progress the upper workings will soon be open to prospecting. Construction of a steel headframe will soon start, a wooden temporary hoist being now employed.

Jamestown.

The Bacigalupi group of claims has been taken under bond by the Pittsburg-Silver Peak Co. from H. C. Garner and James Diamond. Sinking of a 300-ft. shaft has commenced and from the lower level crosscuts are to be driven to reach the ore body which yielded good ore in old workings. Some good ore is already showing and a pump has been installed. The company is prosecuting extensive work at the Rawhide mine and is constantly adding new equipment to the mine plant.

Tungsten City.

The concentrating mill of the Standard Co. was placed in operation last week and is turning out 72 units of tungsten concentrates daily, valued at \$33 per unit. Developments in the Aeroplane claim continues to uncover good ore and the management is planning the early construction of a tramway from the claim to the mill, at an estimated cost of \$25,000.

Yreka.

Several chrome prospects are being worked in this vicinity. Ore assaying 40 to 45% chrome is exposed at some points, and plans are being made for early shipments. In an old shaft on the Farrish mine, operated by William A. Farrish, Jr., a strong ore body averaging 42% chrome has been exposed and a small force is at work blocking out shipping material.

Redding.

At the annual meeting of the Delta Con. Mines Co. Dr. Sherman T. White was re-elected president and S. D. Furber, secretary and manager. The installation of a 50-ton mill was authorized, including cyanide equipment. The mine lies in the Dog Creek district, near Delta, and is owned by middle west people. Sufficient ore is stated to be exposed to keep the mill running for many months.

The Mammoth Copper Co. is shipping 3 carloads of zinc ore per day to Kansas smelters from its Kennett properties. Much of the ore is high grade. The Kennett smelter is turning out approximately 1,750,000 lbs. of blister copper per month. About 1200 men are on the payroll and an immense amount of new work is going on at the Mammoth, Friday-Lowden, Stowell and Spread Eagle mines.

Rich gravel is being worked on Clear creek, 3 miles southwest of Redding, by the Gardella Dredging Co. Three cleanups have been made in the past 4 weeks and the gravel is averaging 25 to 30 cts. per cubic yard.

Graniteville.

A large compressor has been installed at the Anchu mine and developments with machine drills are progressing on ore of good grade. Considerable new ground has been recently added to the productive area and the management states the property is in the best condition since its discovery. Eastern people are interested. George Mainhart is superintendent.

COLORADO.

Cripple Creek.

A good find was made by the Colonial Mines & Investment Co., now leasing on ground of Stratton's Cripple Creek Co. at Womack hill. A tunnel was being driven towards the El Paso Gold Ring property when a 4½-ft. vein was encountered. Grab samples from the face assayed \$8. This cross-cut tunnel is making for the Reno vein and until it is reached the new find will remain untouched. It is thought to be an extension of one of the C. O. D. leads. The deepest workings from the former Reno shaft were 150 ft. down and the present tunnel will attain a depth of 225 ft. The tunnel is known as the Reno. It starts from the west slope of Poverty gulch and is in 500 ft. Track has been laid to the breast of the tunnel. An air line has been carried over Womack hill, from the compressor plant at the Abe Lincoln mine in Poverty gulch, and is now furnishing air for the machine drills. An electrically driven fan has been installed to ventilate the tunnel workings. No mine buildings have been erected to date, and none are necessary at this time, but an ore house has been planned and will be constructed at the portal of the tunnel, in Poverty gulch, a short haul to the Abe Lincoln loading station of the Midland Terminal and Short Line railroad.

On the Shoo Fly property, also on Womack hill and adjoining the above mentioned Stratton ground, H. M. Gilbert has made a find. He started a crosscut west from the bottom of the 110-ft. shaft. His idea was to open up the source of surface ores, underground. Driving west 30 ft., the formation changed to a sulphide, and values commenced to come in. Gilbert then started a raise into the oxidized zone still heading westward, and at a point 10 ft. farther west and 20 ft. above the level, the vein was entered. Grab samples ran \$28.60 and \$52.60 to the ton, and the ore was hoisted to surface and into the bins. Recent mine samples taken after shooting would indicate that the shoot has only been entered on its edge, for the string of colors in the pan was a good one with the gold, both rusty and bright yellow, showing up coarse. Some colors as large as a big pinhead were noted.

The Laura Lee Mining & Leasing Co. has equipped the main shaft, now 164 ft. deep, with a mine plant, including an electric hoist and compressor. General Manager Al Pierce is now engaged in sinking the main shaft an additional 136 ft., to a total depth of 300 ft. A station will be cut when this depth is attained and laterals carried to exploit the property. It is confidently expected an ore body will be entered. On the Mishey lease from the 120 level to surface sampling old workings in the main vein has revealed \$20 ore.

Work of sinking a 1200-ft. shaft on the Happy Year group has been commenced by the War Eagle Con. Co. The property is on the west slope of Bull and Raven hills. In preparation for this work a 6-drill compressor specially constructed by the Chicago Pneumatic Tool Co. has been installed at the War Eagle shaft house. An air line 1200 ft. in length has been carried over to the Happy Year. By preliminary work with hand steel the new shaft has been sunk 22 ft. The shaft, with three compartments for the manway, skipway and counterbalance, is to be sunk 8 by 8 ft. in the clear and will be square set with Oregon fir. Stations are to be cut 150 ft. apart, so that 8 levels will be turned in the 1200-ft. No lateral work will be attempted from the new shaft until a depth of at least 500 ft. is attained, and then sinking operations will be continuous. The old shaft on the Happy Year mine, abandoned by reason of its caved condition, is accredited with a production of \$40,000 from between the 200 and 400 levels. Development work is also under way at the War Eagle shaft, where thorough exploitation of this territory is in progress.

Leadville.

The Down Town Mines Co. has completed its drainage work through the Penrose shaft by reaching the 874-ft. mark. Dewatering the Down Town basin was the first of this class of work undertaken with electric power. Following the installing of the station pumping plant, mining will be taken

Chemistry and Metallurgy of Tungsten

By M. L. HARTMAN.* *E. M. + G. W.* 7-8-16 (45) p. 55

The directions for making the qualitative reduction test are as follows: Boil at least 0.2 gram of finely divided material in a small test tube with concentrated hydrochloric acid until about one-half of the acid is evaporated. Dilute with an equal volume of water, add a piece of metallic tin, and heat if necessary. A fine blue color in the solution, or a blue residue, indicates the presence of tungsten. If this test gives negative results, about 0.5 gram of the material should be fused in at least four grams of sodium carbonate. (This may be done with an ordinary Bunsen burner in a metal crucible or before the blast in a porcelain crucible.) Dissolve the fused mass by boiling water in the crucible. Acidify the aqueous solution with an equal volume of concentrated hydrochloric acid, add a piece of metallic tin, and warm if necessary. The volume of the solution should not be more than 10-20 cc. A fine blue color in the solution or a blue residue indicates the presence of tungsten. In either case, if reduction is continued long enough, a brown color is obtained.

These tests if properly used will show the presence of tungsten in materials as low as 2%, and by using special precautions will detect tungsten in even lower grade materials.

Columbium (niobium) is the only element at all likely to give a blue color under the conditions of this test. This blue can be distinguished from the blue of tungsten oxides by the fact that it disappears when the blue solution is diluted with water. Vanadium also gives a blue color when solutions of its salts are reduced, but tartaric acid will cause this reduction, whereas it will not reduce tungstic oxide. Molybdenum on reduction goes through a series of color changes from violet to blue to black. Titanium gives a violet color. No other elements will ordinarily interfere with the test for tungsten.

The following three methods are the ones in most common use for the quantitative determination of tungsten in ores. The first two are quoted from A. H. Low's "Technical Methods of Ore Analysis." The third is a method preferred by some analysts.

Hydrofluoric Acid Method.—Treat 0.5 gram of very finely powdered ore in a small platinum dish with equal parts of strong HCl and HF acids. Digest on a water bath until solution is complete, adding more of each acid from time to time if necessary. It may require from one to several hours to effect complete decomposition of the ore. Usually a perfect solution may be obtained. Any tin oxide present will be unaffected. Finally, evaporate to about 15 cc. with an excess of HCl. A yellow precipitate of H_2WO_4 may separate during the final evaporation, owing to the

expulsion of the hydrofluoric acid that holds it in solution. This will do no harm, provided it can be removed from the dish. Transfer the solution and any precipitate to a 6-oz. flask, add 20 cc. HCl acid and 8 cc. strong nitric acid. Boil down to about 10 cc. This will expel any remaining HF and precipitate the tungsten as tungstic acid. Dilute with 50 cc. hot water and allow to simmer at a gentle heat for about half an hour or until the tungstic acid has settled clear. Filter, wash with hot water, slightly acidulated with HCl, and then dissolve the tungstic acid on the filter by pouring warm dilute ammonia over it, using as little as possible, and washing the filter with the same solution. Receive the filtrate in a weighed platinum dish. Evaporate the solution on a water bath to dryness, and then ignite the residue at a red heat, cool and weigh as WO_3 . The cold residue should be a bright yellow color. Multiply the weight of the WO_3 by 0.793 to obtain the weight of tungsten, from which the percentage in the ore may be calculated.

Fusion Method for Tungsten Ores.—Fuse 0.5 gram of the very finely ground ore with 2 to 3 grams of sodium-potassium carbonate in a platinum crucible for from one-half to three-quarters of an hour. Dissolve the fused mass in boiling water. The tungsten goes into solution as sodium or potassium tungstate, together with alkali silicate, and also stannate, if tin is present. The residue contains the iron, manganese, calcium and magnesium. Filter and wash with hot water. Rinse the residue into a beaker, and warm with dilute HCl. If gritty particles remain undissolved, filter them off through the filter last used and wash with hot water. Dry and ignite the residue, and again fuse it with the mixed carbonates. Dissolve the fused mass as before, filter and unite the filtrate with the first filtrate.

Having thus obtained an aqueous solution of alkali tungstate, add to it an excess of nitric acid, and evaporate to dryness on a water bath. Again add a little nitric acid and evaporate to dryness a second and third time. Finally heat the residue in a drying oven at $120^\circ C.$ for some time and then moisten with strong nitric acid and allow to stand for 15 or 20 minutes. Now add a hot 5% solution of ammonium nitrate and filter the mixture, washing well with ammonium nitrate solution slightly acid with nitric acid to remove all the sodium and potassium salts. Finally wash once or twice more with a hot, very dilute ammonium nitrate solution and then dry the filter and contents and transfer the latter as completely as possible to a weighed platinum crucible. Moisten the paper with a strong solution of ammonium nitrate, dry it and incinerate over the crucible in a coil of platinum wire. Ignite the whole, now, with free access of air. If the tungstic acid is not pure yellow when cool, moisten

*Professor of Chemistry, South Dakota School of Mines, in *Engineering Quarterly*.

with a few drops of nitric acid and repeat the ignition.

The ignited tungstic acid may contain silica and stannic oxide. The former may be removed by warming with a few cc. HF, evaporating to dryness and igniting. The residue consists of pure tungstic acid or tungstic acid and stannic oxide. The amount of the latter is usually so small as to be negligible. If desired, the tin may be volatilized as stannic chloride by ignition with ammonium chloride. The stannic chloride is decomposed by the moisture of the air and stannic oxide may be deposited on the outside of the crucible. To prevent this, place the crucible in a larger one, and keep the outer crucible covered until the ammonium chloride is completely expelled. Now heat the inner crucible with free access of air until its contents become of a pure yellow color. Cool and weigh. Repeat the ignition with six or eight times as much ammonium chloride as there is precipitate, until the weight of the residue WO_3 becomes constant. The tungstic oxide becomes dark on igniting in the absence of air and only assumes its true color and weight on igniting with free access of air.

The weight of the WO_3 multiplied by 0.793 gives that of the tungsten.

Aqua Regia Method.—One gram of the finely ground ore is treated with about 50 cc. aqua regia in a 4-oz. flask. The solution should be heated but not boiled, and the flask should be frequently shaken. When the solution is evaporated to 10 or 15 cc. it is diluted with 50 cc. hot water and allowed to stand for a half hour. The solution is then decanted through a filter paper, and the residue washed several times by decantation, using about 50 cc. hot water each time. The wash water should be slightly acidulated with hydrochloric acid. Add about 20 cc. ammonium hydroxide solution to the residue in the beaker and when the yellow tungsten acid is dissolved, decant through the filter paper. The ammonium hydroxide solution is best made by adding 200 cc. strong ammonium hydroxide with 1000 cc. water and adding a little hydrochloric acid (about 10 cc.) to form some ammonium chloride. The residue is transferred to the paper by means of this solution, and washed thoroughly. The silica should be white. If it showed signs of incomplete decomposition before transferring to the paper, it should be heated with aqua regia again and treated as before. The ammoniacal solution is evaporated to dryness in a weighed platinum dish, ignited gently to drive off the ammonium salts, and finally heated strongly in the burner flame. Cool, moisten with hydrofluoric acid, and again evaporate to dryness, ignite, and weigh as tungstic oxide.

Accurate methods of analyses and their careful use avail nothing if corresponding care and accuracy is not taken in sampling the material assayed. Errors introduced through careless sampling are in most cases far greater than creep in from the use of inaccurate methods.

Second National Exposition of Chemical Industries.

That the chemical industries are alive to the situation they now occupy in the sum of affairs is evident by the great numbers of firms that have engaged space at the Second National Exposition of Chemical Industries to be held at the Grand Central Palace, New York, during the week of Sept. 25-30, 1916.

The advisory committee of the exposition has been increased and is composed as follows: Chas. H. Herty, chairman, Raymond F. Bacon, L. H. Baekeland, Henry B. Faber, Francis A. J. Fitzgerald, Bernhard C. Hesse, A. D. Little, R. P. Perry, Wm. Cooper Procter, E. F. Roeber, George D. Rosengarten, T. B. Wagner, Utley Wedge, M. C. Whitaker, and Charles F. Roth and Adriaan Nagelvoort, managers.

The managers anticipate an even greater number of visitors to attend this second exposition. The numerous chemical and engineering societies that last year had their attention divided with the attractions of the exposition and the engineering congresses on the Pacific coast, and the first exposition of chemical industries in the east, have this year united and arranged to hold their annual meetings in New York during and in conjunction with the exposition.

The American Chemical Society will hold its annual meeting during the whole week—the program for the meeting is now being arranged and the committees appointed.

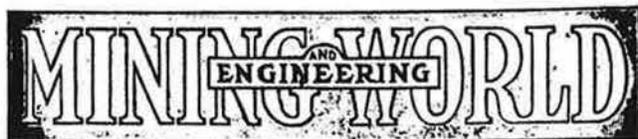
The American Electrochemical Society have arranged to hold their meetings the latter part of the week, Sept. 28, 29 and 30, being the dates chosen, and at least one of these days will be devoted to papers that will add greatly to and form a memorable session.

The Technical Association of the American Pulp and Paper Industry is arranging the meeting for this week. This is a young and unusually active institution within the American Paper and Pulp Association and composed of the technical men engaged in the manufacture of paper and its by-products—they consist of chemists, engineers, chemical engineers, plant superintendents and foremen—those who are actually doing the things.

The Bureau of Commercial Economics at Washington is again co-operating with the exposition by arranging a most elaborate program of motion pictures covering subjects dealing with the industries depending on chemistry. Many of these films will have their premier showing at the exposition.

There will be other things innumerable that will prove attractive, entertaining and educational and with all these things and the great interest already aroused for the exposition, it should be a very much greater success than the one last year.

We sometimes learn by telling others what we know. It keeps our minds active and suggests things we would like to find out from others.



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*Illustrated.

Anaconda Copper Co.'s Wonderful Earning Powers.

A prediction a few years ago that a mining company would show net profits in a single year of \$45,000,000 would have been laughed to scorn. Yet today this is possible for the Anaconda Copper Co. Figuring on the basis of present production of approximately 30,000,000 lbs. of copper a month; produced at a cost of 10 cts. a pound and sold at an average of 24 cts. per pound, there results a total net profit of close to the amount mentioned above.

In addition to the above Anaconda derives substantial profits from spelter and the income from smelting and refining Inspiration and Miami concentrates.

The company's 25-ton electrolytic zinc plant is running at capacity; in fact, it is now producing at the rate of 24½ tons per day. This plant when completed will cost a tidy sum, but its product has been sold well into 1917 at a profit of \$4,000,000.

Anaconda's big construction campaign, with the exception of the work necessary to increase the zinc plant to 100 tons daily capacity, is now 100% complete. The company is prepared to make the record of a life-time—low costs, high recoveries and an output 40,000,000 lbs. per annum larger by reason of flotation—without any increase in the tonnage of ore treated.

Mining Towns Better as a Result of Prohibition.

At the recent national conference on charities and correction at Indianapolis many practical points were presented covering the results of extended studies as to the attitude of mining companies, railroads, public service corporations, etc. From returns received from employers of 750,000 people alcohol is forbidden in their plants and in many instances its use is considered in the promotion and retention of employees.

This attitude on the part of employers brings before every man the necessity of total abstinence.

Reports received by Mining & Engineering World from many mining towns where alcoholic liquors are not for sale indicate that total abstinence on the part of mine workers has resulted in their becoming better workmen, better husbands and fathers, and ready for work on Monday mornings following pay days.

Other results mentioned are to the effect that many miners who were always behind at the company stores, when the bar rooms drew a large part of their wages, now have balances due them each month, many having savings accounts. Furthermore, their wives and children are comfortably clothed, which was too often not the case when they were spending their earnings for drink.

Altogether, labor conditions have been greatly improved in those mining towns and there has been no falling off in the number of laborers by reason of prohibition.

paid in by the syndicate, gives the company a treasury fund of \$558,000. The treasury fund is intact, save for the amount drawn bi-monthly to pay mining expenses, and is drawing interest at the rate of \$1000 per month. In addition, the company has in treasury 300,000 shares. No effort will be made to sell this stock until such time as the property has been developed to a stage where it is necessary to erect a reduction plant.

Vidal.

On the California side of the Colorado river the section around Vidal is the scene of constantly growing activity. The Bendigo Mines Co. of Los Angeles, which has shipped 450 tons of gold-copper-silver ore netting \$45 per ton during the last few months, is preparing another shipment, and several individual operators operating properties nearby are also preparing shipments of ore which as a rule go to the Hayden smelter. One notable find of silver-lead ore of high grade has been made in the district during the week, while on another property an 8-ft. vein of copper-silver-gold ore has been opened which yielded shipping ore at surface in several places.

On the Parker side of the Colorado river mining activity is constantly increasing, and such a large aggregate tonnage of ore is being shipped that several interests are figuring on building a custom smelter on the Colorado river, near Parker, where it may be reached by mine operators on both sides of the river. Mining men who have studied this district state that the formation and mineralization is similar to that of the Copper Queen, Old Dominion and Arizona Copper mines. The ore is found in fissure veins of great lateral extent, the veins capped by an iron gossan, followed by the leached zone containing copper carbonates and oxides and some sulphides, and all containing gold and silver. The gangue matter is principally quartz, but much calcite and baryte is found with lenses of manganese and iron oxides.

Mayer.

Operations have been resumed at the Holmes mine in Black canon. The property was recently taken over by Willard Bonderant and associates of Los Angeles, who purpose to develop it at depth. The history of the Holmes mine dates back to the early sixties, and its record as a producer of high-grade, gold-bearing ore runs concurrently therewith. Early development was prosecuted by means of a tunnel and disclosed free milling ore. The general average grade of the ore at that time mined is said to have been \$60. It was reduced in a small mill erected on the property at a fair profit. A wagon road has been built connecting the property with the camp of Mayer, and the old workings are now being rehabilitated as a preliminary to extensive mining research.

Walker.

An oil-flotation plant of 100 tons capacity is to be built at the property of the Major Mining Co., near Walker. The decision to erect this plant is the outcome of the returns received on 5 carloads of concentrates shipped to the Humboldt smelter.

CALIFORNIA.

Mokelumne Hill.

The Sullivan and Paul Con. gravel mines have been taken under bond by J. J. Foltz and operations will begin within 30 days. Both mines formerly produced heavily but have been idle several years. It is planned to work the holdings from a central level. Considerable rich gravel is stated to be still in sight in the old workings.

The McKnight Mining Co. has installed a 20-stamp mill and complete mine plant at the Hamby mine. The hoist is operated by steam, generated with fuel oil, but will be later driven by motors. A large tonnage of good-grade quartz has been blocked out. Luther Everitt is superintendent.

The Mokelumne Mines Co. has arranged to sink a 3-compartment shaft at the Easy Bird property and intends to soon install a 75-ton reduction plant, including amalgamating, concentrating and classifying equipment. A cyanide unit may be added later. A 650-cu. ft. Sullivan compressor has been

placed in position, and much new work is advancing from the main tunnel. Above this level a large tonnage of ore averaging around \$8.50 has been developed. An electric hoist is contemplated. H. J. Wendler is manager and A. M. Howat superintendent.

Jamestown.

Bonanza ore has been encountered below the 800 level of the Jumper mine in the Stephen Rowe lease. The rich shoot is believed to be the extension of the ledge which yielded much specimen ore above the 700. Three sets of lessees are working the property with good results.

Sutter Creek.

Unwatering of the Old Eureka mine has progressed to a depth of 170 ft. and three shifts have been put at work in the shaft. Timbers are found in excellent state of preservation, although under water 30 years. At present rate of progress the management expects to be in a position to start important developments before the summer ends.

At the Central Eureka 20 of the 40 stamps are dropping on quartz from the 2800, 3000, and 3100 levels. Preliminary work has started on a winze from the 3200 level, and drifting from the 700 is planned in expectation of intersecting a new ledge. Seventy men are employed.

Jackson.

Preparations are being completed for the sinking of the Kennedy shaft to a depth of 3900 ft. The ore opened on the deeper levels is the best in the mine, with the big vein showing excellent strength. The 100-stamp mill is turning out approximately \$90,000 in gold per month.

Lewiston.

The Trinity Star Dredging Co. is building a dredge on the Paulsen ranch, costing approximately \$300,000. It will be equipped with buckets of 5-cu. ft. capacity and will go into commission early in 1917. The property embraces 700 acres of proven placer ground. Fred Paulsen is manager.

Pine Grove.

The Pitts quartz mine has been taken under bond by M. Robinson, who has purchased the old Climax 10-stamp mill and is moving it to the Pitts. A fair tonnage of excellent mill ore has been opened, some of the quartz containing specimen values.

Washington.

The Columbia Con. Mines Co. has acquired 160 acres of patented ground at Ormonde, above Washington, and is preparing to work the area. The Columbia mine is yielding ore of profitable grade and the mill is running steadily. The company also holds bonds and options on the German and Ocean Star mines, both of which are showing well. E. C. Klinker is manager.

Keeler.

A new lead-zinc ore body has been encountered in the Buena Vista tunnel of the Cerro Gordo, at an approximate depth of 115 ft. It is 30 ft. wide, of good grade throughout, with streaks of high-grade showing. The management is contemplating the building of a reduction plant to cost about \$250,000. It is designed to separate the zinc and lead ores before shipments to smelters. L. D. Gordon is general manager.

Forest.

Under the management of W. F. Copeland three shifts are driving a short tunnel to intersect the old Bald Mountain adit back of the caved section. The new tunnel will be 300 ft. long and as soon as completed will be used to prospect a promising quartz vein in the Bald Mountain mine. It is likely attention may be devoted to the gravel channel later.

The North Fork Mining Co. has purchased from the Wisconsin Co. a piece of disputed ground for \$5200, and will proceed to extensively prospect its quartz deposits through a new incline. The Wisconsin Co. is driving a new tunnel to open its gravel channel to best advantage. G. F. Stone is superintendent of the North Fork, and D. E. Hayden of the Wisconsin.

Clipper Mills.

Prospecting of manganese deposits is active at this point. A. A. Davis and T. F. Hornung are sinking on a promising ledge and running crosscuts. Indications are favorable for development of a large body of commercial ore. Binet

brothers of Oroville are working claims adjoining the Woolley group, the vein apparently being an extension of the high-grade ore body exposed in the Woolley holdings. Operations at the latter have been temporarily suspended as a result of friction between the owner, G. Woolley, and the Noble Electric Steel Co., which has been working the property under bond. The ore is high grade and is desired for the electric smelter at Heroult.

New Idria.

The New Idria Co. has installed a 250-ton concentrating plant at its mines and is also operating the old 300-ton furnaces. Most of the ore is being drawn from the San Carlos mine, where the deposits are broader than in the Idria, and an 8000-ft. aerial tramway is being built from the property to the new plant.

Grass Valley.

After an idleness of 2 years the Sultana mine is again being worked. Fifteen men were put at work last week, and prospecting of the lower workings is going on. The Sultana adjoins the Empire group and formerly produced much profitable quartz, but the principal vein was lost in the deep levels. It is thought extensions of the Empire ledge traverse the mine. A. W. Crase is superintendent.

Hawkins Bar.

The placer mine of the Corona Mining Co. is producing gold and platinum and sufficient water is available for another month of activity. Three bars worth \$1000 each have been shipped since the season commenced, and the final cleanup will take place in July. About 1 oz. of platinum is recovered for each 50 ozs. gold.

Downieville.

Representing Arizona capitalists, Thomas Wilson has taken a bond on the Shady Flat gravel mine, owned by John Mason. The property lies between Downieville and Sierra City and produced well in pioneer days. Orders have been placed for a pumping and hoisting plant and exploration of the old channel will be pushed.

Bishop.

Lessees are opening rich ore on the Santa Rosa mine, controlled by the West End Co., of Tonopah, Nev. The vein averages 4 ft. wide and was encountered at a depth of a few feet. Assays range from \$35 to \$70 in gold per ton. The owning interests are arranging for work on company account.

Sonora.

Rich ore has been opened in the deep levels of the Dutch mine, operated by the Dutch-Swenney Co., controlled by New York people. Splendid ore is also showing in the App workings with a tonnage of large proportions exposed. The mill is treating 250 to 260 tons per day and making a high recovery. Much new machinery has been installed in the past few weeks and since Nov. 1, 1915, upward of 3000 ft. of development work has been accomplished. It is probable the purchase of the group will be consummated in August, as the operators are reported well satisfied with conditions.

COLORADO.

Boulder.

The Tungsten Metals Corporation has completed its mine boarding and bunk house, offices, compressor house, machine shop and store house in Boulder canyon. Its Red Sign mill, being built by the Colorado Iron Co., will be completed by Aug. 1. The capacity of the mill will be 25 tons. The building is placed on a concrete foundation a foot thick, all the footings are of concrete and the timbers used are of large size. Some of the timbers are 12 by 12 and 20 ft. long. The elevator pit, which is now complete, is concrete. All flooring on the ground floor is to be cement. The roof and sides are covered with lightning-proof Galvanite roofing, which is a heavy, gummy paper covered with flake mica.

East of Nederland the McKenzie mill, formerly treating gold ore, has been reopened as a tungsten concentrating plant. New machinery has been installed, consisting of a table and 5 new stamps. These with other machinery in the mill gives it a capacity of 10 tons. Besides custom ores the

mill will be supplied with ore from the McKenzie mines, and a considerable amount of material from old stopes will be run.

The Primos Mining Co. announces that leases upon its tungsten property were renewed at expiration, July 1, upon the same terms as in the past at the schedule of from \$12 to \$20 now in force. This is indicative of the confidence of the company that the lowest prices have been reached and a steady market is in view. There are 500 men employed in Primos ground by lease operators aside from the force on company account in the Conger and other mines. During the past 2 months Primos lessees have sold their ore without delay at contract rates.

Cripple Creek.

The shaft at the C. O. D. mine is being sunk further, work having commenced on July 5. While this work is in progress lease operations, excepting by such lessees as are mining and shipping ore, will be temporarily suspended as the hoist will be running to capacity hoisting such ore and the waste from the shaft. Supt. Williams will give personal supervision to the work of sinking and will maintain his office at the mine.

A vein has been opened on Newton hill by the Cripple Creek General Mining & Exploration Co. It is 4 ft. wide and averaging \$4 for its full width. The vein is cut at a depth of 300 ft. by the New York tunnel penetrating Newton hill from its west slope. It is proposed to survey the course of the new vein and crosscut for it from the tunnel level. The tunnel has caved badly in places through disuse, and it will be necessary to retimber the caved ground. A basalt vein carrying low values is exposed in the New York tunnel and will be explored later. The basalt dike lies on the Katie Hollis. Frank Vetter is in charge, with power to issue prospecting permits with lease option, on advantageous terms. Maps of the property may be seen and examined on request.

One car of mixed ore, a cleanup of the bins and mine, preparatory to hoisting ore from the more recent discovery, brought settlement at the rate of \$19 a ton for lessees on the Shoo-Fly. The second car, containing coarse ore from the new strike, was settled for at a rate of 2.70 ozs. gold. They have been breaking ore at the junction of two distinct veins—a vein having come in from the southeast—6½ ft. wide. The shoot under development lies at a point 40 ft. north of the shaft, and as the incline drift is carried northwards, the values are improving and the present prospects for one of the richest ore shoots opened in the western section of the district are considered excellent. Ore is being hoisted after every round of shots and lessees will ship again in a few days.

During June there were 76 cars, about 2000 tons, shipped from the El Paso Con. Co.'s property. Returns have not all been received, but an estimate of better than 1 oz. of gold per ton is given. The company mined 19 cars, 500 tons, from No. 1 shaft, on the south end of the property, and 10 cars, about 265 tons, from the No. 2 shaft, on the north end of the property. The company ore, it is estimated, will average \$15 to \$20. The lessees working under a graded scale of royalties or under the split-check system, were accredited with 47 cars, about 1245 tons. The lessees' ore at the 1st level south of the No. 1 shaft, was of a higher average value than the company ore and is estimated at \$30. There are at this time 17 sets active. Twelve sets of lessees are working under the graded royalty, and five on the split-check.

GEORGIA.

Dahlonega.

The Etowah Milling & Power Co. has been formed and begun preliminary work on the Etowah river, about 5 miles from here. Associated in the company are: D. S. Walraven, C. H. Butts, W. L. Tumlin, T. H. McGahee, J. T. Ritigan, H. E. Cabiness, H. H. Turner, S. A. Osborn, J. H. Simms and Dr. Hulaney. The method to be used is suction dredge on a large scale. It is well known that there are deposits of gold in the Etowah bed. Work of installation has begun

Present Situation in Tungsten Industry. What the Future Has in Store for Silver.

Better tungsten prices are inevitable. This was the opinion expressed yesterday by Lewis A. Jeffs, mining engineer, prominent in the tungsten properties of Idaho and Nevada. Mr. Jeffs is of the opinion that the buyers of tungsten ores have reached an agreement which has resulted in driving down the price of the concentrates and that by so doing they have put themselves in a very unfavorable position. In discussing the tungsten market Jeffs said:

"I firmly believe that better tungsten prices than those prevailing at present are inevitable and for the following reasons: To begin with there is apparently a combination among the buyers with the avowed intention of hammering down the price to be paid the producers. They have hammered down the price to such a point that at least three-fourths of the operators that have been shipping tungsten concentrates have stopped producing. I have been in touch with numerous operators recently both in Idaho and in Nevada and they are considering the advisability of suspending operations entirely.

"One of the arguments that the buyers have been making recently and which with the uninitiated has had considerable weight is the impurity argument. Tungsten concentrates contain a number of impurities. First among these is phosphorus. Just why this should be singled out and so much stress laid upon it is hard to understand for it can be removed by smelting with lime as in the basic Bessemer process. Another impurity is copper and still another is arsenic. Tin, sulphur and bismuth are also objected to.

"Producers should not forget, however, that not all of the buyers object to the impurities and when the demand for the new tungsten was heavy no objections were raised.

"Now the peculiar feature of the present situation is that with three-fourths of the producers in Nevada and Idaho and other western states closed down and with numerous operators about to close down a very small tonnage is being produced. In answer to the law of supply and demand a decrease in the supply in the face of a constantly increasing demand means higher prices.

"I am told on good authority that one of the largest companies in Nevada, the Atkins-Kroll Co., has discontinued operations at Osceola, Nevada. This is but one of the many straws that point to what may be expected in the near future in the producing field. A number of new mills that have been completed recently in Nevada have not turned a wheel and have been practically abandoned."

In 1915, according to a Survey report, there were 166,336 short tons of talc produced and marketed in the United States, valued at \$1,401,197. This exceeded the 1914 output by 15,248 tons and \$60,323 in value. The average price of the domestic talc marketed in 1915 was \$8.42 a short ton.

In a letter to a friend in Gilpin county, Colorado, U. S. Senator Charles S. Thomas discusses the future of silver. He ventured the prediction, at the time of the breaking out of the European war, that one of its ultimate and necessary results would be the re-establishment of silver as a money metal upon some general and fixed ratio with gold.

"I did this because I believed and still believe, first, that the effect of the war upon exchange in gold using nations would be magnified by a corresponding but more desirable fluctuation between gold and silver than it ever had. Second, because gold would disappear from the currents of trade in all the warring countries, and silver would very naturally fall into the vacuum thus created, being preferable to and perhaps an equally good basis for paper currency. Third and lastly, because the enormous cost of the war represented by debt of striking proportions would necessitate resort to silver as the only means of broadening the metallic basis for money and credit. If I am correct in this forecast, the intrigues of the money interests can only retard their operation; the movement cannot be avoided.

"I do not think the moneyed interests have had anything to do with the recent rise in silver or its more recent fall to 62½ cts. This is one of the spasmodic fluctuations in the value of the commodity, which are caused by sudden and temporary demand. I think these are liable to occur from time to time, resulting in a permanent rise of the level of market quotations. It is too early to predict a close of the war, and until that arrives, little if anything will be done for silver.

"When the war ends the total public debt of the belligerent and neutral European nations (who have been obliged to be at all times on a military basis at great expense), will be far in excess of a hundred billions of dollars. The annual interest upon this sum at 5% represents \$5,000,000,000, which, added to the cost of government operations, will mean an annual tax upon their producing masses of not less than \$7,500,000,000. This is much more than the total productive wealth of the countries concerned, and means repudiation, unless silver comes to the rescue of gold. Even then, the nations will have to stagger along under an awful load for many years, if they are ever to get out from under it. Between repudiation and payment in silver, the holders of these national securities will prefer the latter. I therefore conclude that the interests heretofore responsible for silver's demonetization will be found among the champions of that metal through the stimulus of self interest."

By the systematic recovery of scrap tool steel, and following a plan of utilizing the material for smaller sizes and shapes for which it is perfectly applicable, there is an opportunity in a mine repair and maintenance shop to save a great deal of tool steel.

Poppet Valve Engines.

Bulletin No. 28, recently published by the Nordberg Mfg. Co., covers a line of poppet valve engines which includes three types, namely, full poppet, poppet-uniflow and poppet-coriass. It is pointed out that the engine best suited for the purpose is recommended in each case. For ordinary non-condensing service, the high-speed full poppet valve engine shows the highest efficiency. For condensing service two types of engines are offered—Nordberg poppet-uniflow and Nordberg poppet-coriass, the former being an engine with uniflow cylinder design, that is, exhaust ports in the cylinder barrel and poppet steam valves, and the latter a compound engine with a full poppet high pressure cylinder and a coriass valve low-pressure cylinder. The poppet-uniflow engine is particularly adapted to widely fluctuating loads on account of its flat steam consumption characteristic. Recently two of the largest uniflow engines so far constructed in this country have been shipped to the Youngstown Sheet & Tube Co., for steel mill drive. The poppet-coriass engine is adapted to constant load or constant m.e.p. work, under which conditions it shows very high steam economy. A compound engine of this type, fitted to an ammonia compressor showed by test a steam consumption of less than 10 lbs. per indicated horsepower hour.

The bulletin is well illustrated, showing many installations of engines, and also pictures of details of construction of the valves, valve operating gear, removable cages, cylinders and head. Particular attention is drawn to the construction of the latter, which contains all cored passages and ports, the cylinder proper being a simple cylindrical casting which is free to expand and contract with temperature changes.

Following the discussion of the different types of engines and their construction, a number of pages are devoted to test results. This is followed by a short discussion of the application of poppet valve engines to compressors, pumps and ice machines. The remaining part of the bulletin is devoted to the illustration and description of the frame, bearings, rods, cranks and receiver. Copies of this bulletin are being distributed on request.

Hauling Borax in Death Valley, California.

The 20-mule teams, with their picturesque drivers and long, snake-like 50-ft. cracker whips, that have made Death Valley and the mines of the Pacific Coast Borax Co. in California famous for more than a quarter of a century, and around which romance and tragedy has been weaved by the versatile publicity agent, are giving away to the more prosaic haulage system of modernity.

Within the past year chugging gasoline industrial locomotives, with their trains of from 10 to 15 loaded cars, wind their way up and around Black mountains and over Death Valley and the dry bed of Salt lake and the famous mule teams are passing into history. This change has been brought about by the cost data expert, who with his charts and figures and the experiences of others behind him, decreed that while the 20 mules were picturesque and afforded the publicity agent good material for literary essays, they proved too expensive in the production of borax.

The gasoline industrial locomotive, he said, would not only cut down the haulage costs about one-half, but speed up the mines and cut down manufacturing and mining costs. His promise has proven true since the installation of the first two Plymouth gasoline locomotives more than a year ago, according to Supt. K. W. Sheean of the Pacific Coast Borax Co., and the change was more than warranted by the results achieved.

The full story of this interesting experience, as well as that of other mine owners in different fields, is contained in a 96-page book, "Cutting Haulage Costs in Half," issued by the J. D. Fate Co., 211 Riggs avenue, Plymouth, O., and which was printed for free distribution. Copies of this book may be had by addressing this concern, and should prove

profitable to any mine operator, because of the compilation of cost data and other information.

TRADE PUBLICATIONS.

Products de la Ingersoll-Rand. Ingersoll-Rand Co., New York. Catalog; Form No. 92075; pp. 123; illustrated.

This is an edition in Spanish in which the products of the Ingersoll-Rand Co. are summarized. Different types of pumps, rock drills, air compressors and allied equipment are covered. In as many cases as possible a small illustration is given with a brief description and specific data in tabulated form for most of the equipment.

Roller Bearings. George Automatic Roller Bearing Co., Cincinnati, Ohio. Booklet; illustrated.

Besides illustrating and describing the construction of the bearing, views are given showing the method of taking the bearing apart for cleaning and inspection. Different types of mountings are reviewed and illustrated. It is stated that one of the special features of this bearing is the use of a tapered bearing with balls at either end, thus automatically adjusting variations in the actual diameter of the rollers.

Oil Engines and Pumps. National Transit Pump & Machine Co., Oil City, Pa. Three folders; illustrated.

The first folder is relative to a line of pumps which the company now has in stock. The different types are listed and under each tabulation details are given of the sizes, etc., of pumps of different capacities. Engines for use with the same are also listed therewith. The other two folders illustrate and describe a line of engines using oil or gas for fuel. The operation of all are described in general and briefs are given on the practical use of each separately. Brief statements are also given regarding the cost of operation of the same.

Dry Concentrators. Sutton, Steele & Steele Mfg., Mining & Milling Co., Denver, Colo. Catalog; pp. 16; illustrated.

Concentrating tables, screenless sizers, deduster and dielectric separator are the equipment described. This class of machinery is of most importance, it is stated, where the water supply is costly. In the operation of this class of equipment air under a low pressure is used in place of water, the design of the equipment, of course, being in general like that of the water concentrating tables and classifiers. The machines and superior points of dry concentration are described and compared with water concentration plants. Some specific data is given and a flow sheet of a Sutton, Steele & Steele dry concentrating plant is shown on the last page.

INDUSTRIAL AND TRADE NOTES.

An interesting evidence of Detroit's increased importance as a center of steel consumption comes the announcement that Joseph T. Ryerson & Son have prepared the way for Detroit warehouse development by purchase of a suitable industrial site. The property consists of about 3 acres in the Milwaukee junction district and is one of the few remaining vacant sites having the double facilities of both Grand Trunk and Michigan Central direct trackage.

Taylor Foundry & Engineering Co., Grass Valley, Cal., recently built a 75-hp. Taylor electric hoist for the Sixteen-to-One mine, at Alleghany, Cal. It is equipped with heringbone gears, and will be operated by direct connection to a motor by flexible coupling. This company also sold one of its 22-hp. hoists to the Orleans mine, Grass Valley; and a 300-gal. triplex electric pump to the Enterprise Mines Co. for its Pennsylvania mine; also, a similar pump for Polar Star mine in Grass Valley district.

said that the east drift on the 750 level is also getting into ore. On the 550 level fine milling ore was opened in drifts both to east and west, and then the shaft was carried to 750-ft. depth before lateral work was resumed. Conditions now existing are very satisfactory.

On the 500 level of the Fessenden drifting has been started on a 3-ft. feeder vein which was penetrated by the south crosscut. The vein is quartz, showing high mineralization and fair pan values in gold. The operators expect to drift on it to its junction with the main vein.

The Sun Dial is steadily sinking, with its shaft now down about 150 ft.

Oatman United is steadily sinking, and Engineer J. K. Turner reports satisfactory progress and encouraging formation.

The shaft of the United Northern is now down 370 ft., and will be continued to 500 before lateral work is started.

North Star has started crosscutting on the 400 level and is reported to have cut several quartz stringers showing high values.

Gold Road Bonanza has its shaft down 300 ft. and will sink to the 500 ft. Arrangements are being made with the Gold Road Co., adjoining, whereby the Bonanza will be given permission to drive a crosscut into its ground from one of the deeper workings of the Gold Road mine, for exploration purposes.

Prescott.

During the last few days, several important deals and much unusual development has taken place in the mines of Yavapai county. Probably the most important deal, to Prescott was the transfer of 50 claims on Copper creek, owned by C. J. McNulty and Mike McBride, to the Daly-Crawford-Lewisohn syndicate. The 50 claims are believed by mining men to be in a region which is a continuation of the rich Copper Basin field. Approximately \$300,000 is involved in the deal, to be made in payments as development progresses.

D. R. Finlayson, former superintendent of the Copper Chief mill, has taken charge of the Green Monster property, and is pushing development. While commercial ore has not as yet been struck, officials of the company say the development has been all that could be expected and that they look for important determinations to be made in the near future. A. P. Thompson, geologist, is assembling geological data on the various outcrops and contacts. Road building will be commenced at once. By the time the machinery, which has been ordered, arrives, the foundations and buildings will be ready for installation. The site for the camp on the property is ideal, both from a standpoint of sanitation and comfort. The buildings will all be permanent and completely protected; will be completed and ready for occupancy as soon as the machinery arrives.

The old Sunnyside group of gold mines, 11 miles southeast of Prescott, has been taken over under option by H. A. Groom, of Phoenix, who plans to begin operating soon. This group was discovered in the early 80's by Enoch Williams and a considerable amount of ore taken out and treated by an arastra. Williams also did placer work in the gulches leading to the vein of the group. A tunnel, 383 ft. long, is already on the property, extending about 40 ft. below the surface at a depth where the sulphide zone begins. The Sunnyside vein is traceable on the surface for about a mile, and Groom is confident that it extends to great depth.

Announcement has been made by Supt. William Ellingford, of the Gold Blossom Mining Co., of the striking of a high-grade lead-silver ore body at a depth of 185 ft. Sinking will be continued until the 200 level is reached, when drifting will begin. The property is situated 6 miles south of Prescott and was originally patented for farming purposes.

One of the biggest strikes in the history of the Walker district was made this week on the old Homestead mine, recently acquired by J. J. Shoskley and associates, of New York. A 3 ft. gold ore body was encountered, carrying a good milling grade in the loose formation. The strike was made at a depth of 75 ft. in the main shaft. The Homestead lies in the center of the Walker and was first operated in the 60's by J. J. Milliken, when its free product was treated by an arastra. The old mine was abandoned when base ores

came in and until its recent re-opening, the property had lain idle for almost a third of a century. The strike in the Homestead has encouraged many other operators in the Walker and adjacent districts.

Extensive exploration and development is being planned on the New State property in the Hassayampa district, following a strike made several weeks ago. The Elk holdings are to be worked at once. A force of men is now employed in cleaning out and retimbering the old 525-ft. tunnel.

Jerome.

The Jerome-Victor Extension shaft at Jerome is to be sunk about 500 ft. below the present level, 1200 ft., work to start within a few weeks. The 700 station has been reached in unwatering the property, formerly known as the Haynes property, and as there is no lateral work below this level, the unwatering will from now on proceed rapidly. After sinking is started, it is expected that the shaft will be put down at the rate of 100 ft. per month. Only 120 ft. of cross-cutting and drifting was done on the 1200 level and it is believed that prospecting of the lower levels on the mine will disclose new leads that will change the plan of operation.

The main shaft of the Pittsburg-Jerome mine has been sunk 195 ft. below the 500 level, and considerable copper is showing on the face of the ledge, with a soft formation in the bottom of the shaft. Indications of water encountered on drifting in the south crosscut have led to the construction of a dam across a drift run from the 500 level at a point 160 ft. north of the shaft. The road to the property is being built by a force of 75 men. An extra crew has been put at work at the mine. The new road, although longer than the old one, will have a much less grade and will make the hauling of ore and supplies an easy task.

CALIFORNIA.

Grass Valley.

Close to 400 tons of ore per day is hoisted from the central shaft of the North Star mines. The ore, after being dumped, passes over grizzlies, the undersize, amounting to over 200 tons, passes direct into the mill bins; the oversize, amounting to 170 tons per day, passes through mechanical feeders to two sorting tables, where 6 men and a foreman, working one 8-hour shift, pick out 70 tons of waste, consisting of diabase and granodiorite. The picking tables are given a longitudinal shaking motion, by which the ore is moved forward and fed to a jaw crusher by which it is reduced to a size required for the stamp mill. By this arrangement the sorters handle an average of 11½ tons of waste per man in 8 hours.

Weimar.

New York capitalists have taken under bond and option the Big John gold mine, 8 miles east of Weimar, and also bonded the holdings of J. D. Nelson and Joe Snyder. It is stated work will commence within 30 days. The Big John has produced some rich ore and is stated to contain much profitable quartz.

Alleghany.

The Morning Glory Gold Mines Co., whose affairs are managed by A. A. Codd, is building a 5-stamp mill. Amalgamating plates and a table will serve to recover the gold.

A 75-h.p. electric hoist has been purchased by the Sixteen-to-One Mining Co. and it is probable a stamp-mill will be acquired within the next few months. An excellent tonnage of milling ore has been exposed in the lower workings, with occasional seams of specimen quartz found.

The Croesus Mining Co., of Chicago, is adding 5 stamps to its 15-stamp mill at the Plumbago mine, increasing its capacity to 70 tons daily. The main ore body has been opened at widely divergent points and shows quartz of uniformly good grade. W. E. Pearson is manager.

Recent work in the Twenty-One, adjoining the Tightner has been of such a satisfactory character that the management is arranging to install a 50-ton Hendy mill, which will operate in conjunction with the Lane mill now in commission. The Morning Glory is to be equipped with a compr-

boist and 5-stamp mill. Much good ore has been recently opened in virgin territory.

Arrangements have been made for installation of a compressor at the Louise Con., and an Allis-Chalmers ball mill is being placed in position at the Irelan. Other companies are planning improvements to their plants. Completion of the new mills will increase the output of this district to from 350 to 400 tons per day.

Jackson.

The Argonaut Co. has completed its impounding dam for restraint of mill tailings and will divert them into the basin in the early fall. The dam is approximately 500 ft. long and 40 ft. high. Construction of the new 40-stamp mill is making good progress. The rock crusher is in place and considerable machinery for the main plant has been installed. Ore of splendid grade is coming from below the 3800 level for reduction in the old 40-stamp plant.

The Kennedy Mining Co. has arranged to increase the height of its restraining dam from the present 40 ft. to 60 ft. Shaft sinking is proceeding rapidly and ore of excellent grade is being drawn from the 3700-ft. workings. As soon as the 3900-ft. point has been gained extensive lateral workings will be driven from this level. The company is paying good quarterly dividends.

Nevada City.

The Delhi mine, in the Columbia Hill section, has been taken under bond by Colorado capitalists. Unwatering has commenced and it is expected to start mine examination within a few weeks. The Delhi has been idle about 10 years, but formerly produced well. W. D. Griffiths is in charge of operations.

The Columbia Con. Mining Co., with headquarters at Nevada City, has arranged for the building of a 20-stamp mill at its Ocean Star mine in the Ormonde district. A 200-h.p. electric generator has been installed and will deliver power to the Ocean Star and Columbia properties. A ball mill and mine machinery are also to be installed at the Ocean Star. At the Columbia 10 stamps are falling on good ore. The company has augmented its holdings by the purchase of upward of 100 acres of patented ground. E. C. Klinker is manager.

Amador City.

The new mill at the Treasure mine is making a high-gold extraction, according to late advices from the property. Hardinge ball mills are employed in place of stamps, with the resultant product treated on Wilfley concentrators, Deister-Overstrom tables and Frue vanners. The ore shoot in the new shaft has widened into a strong vein.

Independence.

The Reward group of gold mines, including the noted old Eclipse, has been acquired by English capitalists for a reputed cash price of \$50,000. The property is a large, low-grade, gold proposition and was operated over 60 years ago. The Eclipse is credited with an output in excess of \$3,000,000 and was equipped in 1853 with a stamp mill, shipped from England. It is stated the new owners will install a large flotation plant. The main ore body assays around \$8. The syndicate is represented locally by A. Burnett and J. A. Summers.

The Keane Wonder mine in Death Valley is to be extensively operated, according to present plans. The company will be reorganized and endeavors made to open a large tonnage of ore below the present workings. The cyanide plant is operating at present on tailings. The Keane Wonder is owned by the Frances McHawk Co. of Goldfield. F. N. Fletcher, of Reno, Nev., is manager.

Slatington.

The Sierra Slate Corporation of New York has acquired the Eureka slate quarry and has started work. It is stated 50 men will be employed within a few weeks and from 1000 to 3000 squares of slate will be sent to eastern points. The slate is of splendid quality, particularly for roofing purposes.

Nashville.

Developments on the 500 and 600 levels of the Montezuma mine are disclosing wide bodies of milling ore, in places over 40 ft. wide. Assays range from \$5 to \$30. Sinking of the shaft to the 1000-ft. point has been completed and

drifts and crosscuts have been started to pick up and develop the main ledge. The Montezuma is being worked under bond and option by the Wingfield interests of Nevada and eastern people headed by W. J. Loring. The same people hold a bond on the Havilla, an adjoining property, and will probably work it through the Montezuma shaft.

Portola.

The 100-ton flotation unit at the Walker copper mine is operating on excellent ore and shipment of concentrates will start within 20 days; 150 men are on the payroll and a large amount of new underground work is proceeding. Motor trucks are operated between the mine and Portola delivering supplies, etc.

COLORADO.

Cripple Creek.

The Rex Mining & Milling Co. has put the Ironclad mill again in commission, Thomas Kavanaugh, manager of the plant, having set the machinery in motion on July 18. The plant has a capacity of 100 tons daily. This tonnage will be mined from the open cut on the Magna Charta property adjacent to the mill. Kavanaugh has miners prospecting by adit tunnel driven into the Newton Hill spur of Ironclad, on the Annex lode. The dirt from this tunnel pans freely.

Margie M. Gold Mining Co., an eastern corporation, will reopen the Little Daisy mine. F. F. Eddy of Boston is in the district purchasing mining supplies and arranging for the starting. The property is located near the Midland Terminal tracks, a short distance from the shaft house of the School Section Leasing Co., on Block 8 of School Section 16, on the west side of the railroad.

Below the 650 level of the Jerry Johnson main shaft the Cripple Creek Deep Leasing Co. has loaded out 2 cars of ore, mined from the vein under development at the 850 level, making 5 cars shipped since operations were resumed on June 25. The ore is averaging \$20 a ton. The Deep Leasing Co. is driving a crosscut to the contact east of the shaft, from the 750 level. It has been carried 100 ft. and is nearing the contact when it is expected ore will be encountered, as the ore at the deeper level is found in the granite-schist contact.

The Isabella Mines Co. made about \$12,000 net profit during June from a production valued at \$37,000. This included lessees and company account operations. This profit is good, considering that the company shipments totaled but 15 cars mined from the rich shoot on the Buena Vista vein, under development at the bottom level of the Lee shaft, at a depth of 1275 ft. This ore is high-grade, 2 cars shipped during the month having netted \$1749. Lessees who were accredited with the shipment of between 50 and 60 cars shipped considerable low-grade ore, lowering the general average value of the June production, which, however, will not fall below \$20 a ton.

Leadville.

S. Marshall Carlton states that he believes the Pendery fault, which was first encountered in the Judge Pendery property on Carbonate hill in the early days and later traced north into the Augusta and Clipper claims where it was found through the workings of the Northern shaft, has again been cut in the Alright property on Poverty Flats. The lessees on the Alright recently encountered granite in their drifts at 260 ft. and 40 ft. east of the shaft. Here the face of the granite is exposed for several feet, both above and below the level of the drift and undoubtedly is the east side or upper bench of the Pendery fault. Should this prove to be the case, one of the important faults in the Leadville district has been traced between 2500 and 3000 ft. further north than it has been known to exist. Such properties as the Alright, Jason, Northern and Coronado, which are on the west side of the fault, will have to be greatly increased in depth before reaching the ore zone, which was encountered at a depth of 260 to 300 ft. in the Hibsche and M. E. C. properties on the east side of the fault. The theory is that before the faulting, the Fryer hill basin continued west as far

Six Months' Tungsten Production

M. G. W. 8-5-16
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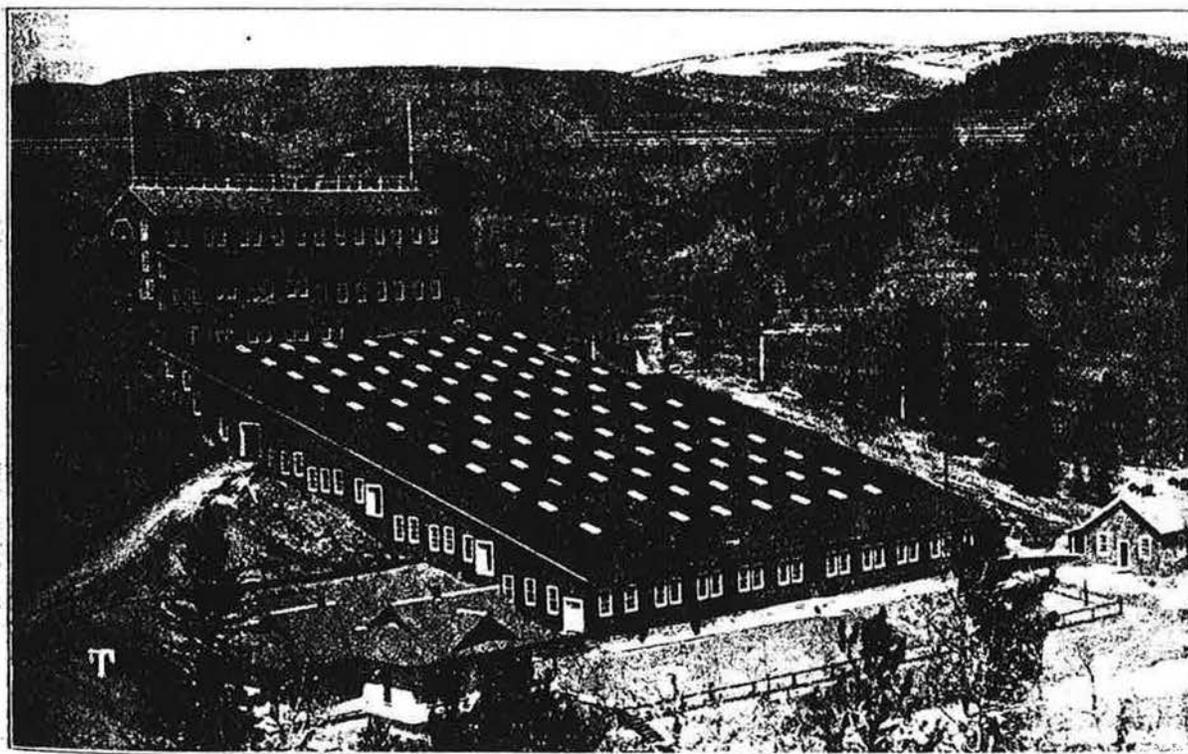
The tungsten production of the United States during the first 6 months of 1916 exceeded the production of this or any other country in any previous 12 months. Prices were even more phenomenal than production and reached more than 10 times their ordinary level. The output was equivalent to about 3290 short tons of concentrates carrying 60% WO_3 , valued at \$9,113,000, according to an estimate made by Frank L. Hess. Statistics are valuable only so far as their accuracy is known, and this estimate is believed to be correct within 10% and to be under rather than over the true figures.

These figures are no less noteworthy when it is known that in 1915 much the larger part of the production was in the second half of the year, so that the

production. The quantities and values were approximately as follows: Ferberite, 1495 tons, \$3,590,000; scheelite, 1404 tons, \$4,322,000; wolframite, 201 tons, \$613,000; and hubnerite, 185 tons, \$587,000.

In most countries the prevailing mineral is wolframite, and no other country approaches the United States in the quantity of ferberite or scheelite produced. The scheelite comes mostly from Atolia, Cal., but significant quantities are mined in Nevada, Arizona, Idaho and Connecticut.

The tremendous increase of prices caused by the need for "high speed" tools to cut war steel ordered by the governments of Europe of course caused the great increase in production. Prices at the beginning of the year were irregular and depended on the buy-



PRIMOS MILL, COLORADO.

total domestic output for the 12 months ending June 30, 1916, probably amounted to about 5000 tons.

Colorado has regained its lead in the production of tungsten ores and, between Jan. 1 and June 30, marketed 1505 tons, valued at \$3,638,000, of which the Boulder field furnished 1494 tons. California sold 94 tons, valued at \$3,005,000. The reason for the higher value of the California ore was that it was nearly all sold as high-grade concentrates, but a large part of the Colorado ore sold was of low percentage and had to be milled and concentrated, with consequent expense and loss.

From Nevada, 461 tons, valued at \$1,432,000, and from Arizona 175 tons, worth \$565,000, are estimated to have been shipped. Smaller quantities were mined in Alaska, Connecticut, Idaho, Missouri, New Mexico, South Dakota, Utah and Washington.

Not only were the output and prices unique, but the ratio of the several tungsten minerals produced was different from that of other countries of large

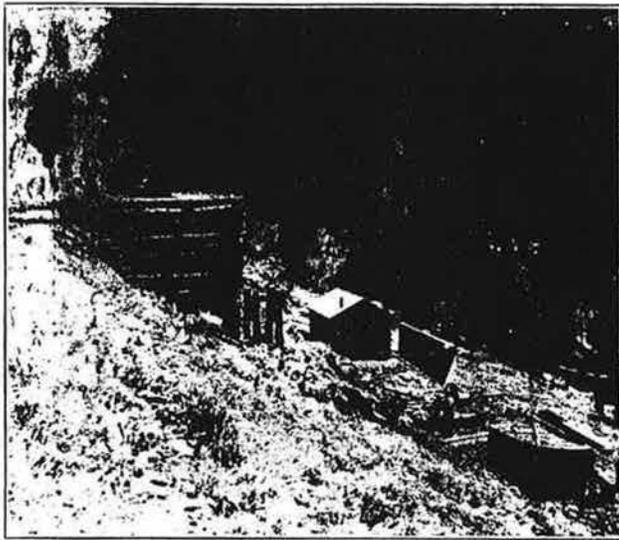
er's need of the ore and probably on his fear of the possibility of not being able to get it when he might need it even more. Ores carrying 60% tungsten trioxide brought at that time as much as \$66 a unit, but by the last of March some ferberite sold for \$93.50 a unit at the mills, and even higher prices were quoted in the newspapers, though they could not be confirmed. The prices of the same ore in the New York market would naturally be somewhat higher. Under the stimulus of these high prices production, not only in this country but in the world at large, has been at the highest point ever known. At first the sudden demand created by the orders for war steel were far ahead of the instant productive power of the country. The rapid increase in prices, starting last fall at a time when tungsten mining was at a low ebb and culminating in the undreamed maximum mentioned, caused prospecting and consequent discoveries of new deposits, increase of development of known deposits, the operating at high tension of old mills, and the hasty build-

ing of new mills. As a result, the production increased faster than the consumption and soon overran the demand that would absorb the output at the extremely high prices prevailing, so that a drop in prices was inevitable. June closed with the price around \$25 a unit, which was still much higher than any price known before this year. The highest price previously reported was \$15 a unit, paid in 1907. The normal price has been \$6 to \$7.

During the 6 months under consideration 40 mills of various types and sizes were in operation part or all of the time on tungsten ores, and at the end of June, 14 were under construction.

In the tungsten mining camps the excitement that followed the increase of prices was similar to that caused by important gold discoveries. Nederland, Colo., a little village of two or three dozen homes, suddenly became a town of 3000 or more inhabitants. East of Nederland two settlements, each containing several hundred people, sprang into existence. Atolia, Cal., a camp of 60 or 80 people, grew to more than a thousand.

In the Boulder region, Colo., 10 mills, 6 of which



CONSOLIDATED TUNGSTEN CO.'S MILL, NEVADA.

were new, were in operation. Besides these, at the end of June five old mills were being overhauled to work on tungsten ores and three new ones were under construction. One was in course of erection on the Copeland property, on South Boulder creek, to work ores that have heretofore given much trouble owing to the fineness of the particles of ferberite, which are spread through "horn rock." Fifteen jigs are reported to have been operating on old tailings piles and on placers. From those workings on tailings, the concentrates were sent to Wilfley tables. All mills and jigs were operated by electric power, and so great was the demand for motors that the stocks in Denver were exhausted.

In Arizona four mills were erected at Dragoon, three at Arivaca and one at Yucca. In California two mills were reported under construction near Goffs and one near Nipton. At Atolia the mill of the Atolia Mining Co. was burned but was rebuilt and enlarged. A smaller mill was operated at Johannesburg, and many kinds of machines were used to extract scheelite from the desert debris between Randsbury and Atolia.

In Nevada a mill was constructed and operated near Toy, Humboldt county, and four or more mills

were constructed in the Snake range, in which tungsten deposits were found through a length of 50 or more miles. The United States Tungsten Corporation operated the mill built a number of years ago by former owners of the property at Tungsten, 12 miles south of Osceola, and a small mill was operated on the east side of the range. Most of the deposits of the Snake range are said to be of low grade. A mill was also operated at Round Mountain.

Tungsten mining was started as a new industry at Silvermine, Madison county, Mo., and a small quantity of scheelite was mined at Long Hill, 8 miles north of Trumbull, Conn. The mill on the Long Hill property was burned and operations ceased for a time. In Washington a mill was under construction on Tungsten mountain, 35 miles northwest of Oroville.

One of the most interesting developments of the year was the beginning of production of scheelite from contact-metamorphic deposits. Two deposits of this sort near Toy (Browns), Nev., were exploited, and near Bishop, Cal., mills of 80 and 100 tons were erected on similar deposits. Other contact deposits were located a few miles south of Bishop. It is thought by the Bishop mill owners that their claims can be worked profitably under such prices as were paid before the war. Tungsten minerals added largely to the receipts of gold mines at Lead, S. Dak., and White Oaks, New Mexico.

The consumption of tungsten in the United States was even greater than was indicated by the ores produced, for all parts of the world free from the control of the warring European nations were drawn on for supplies, and during the first 5 months of the year 1520 tons of tungsten ore, valued at \$3,449,311, were imported. The June imports were probably equal to the average of the five preceding months, making the total for the half year 1824 tons, valued at \$4,139,000. Some of the ore imported is known to have been of low grade, but a considerable quantity carried more than 60% tungsten trioxide, and probably the average was not far from 60% WO_3 . Most of the ore came from South America—Peru, Bolivia, Argentina and a little from Brazil—but some ore came from Japan and Mexico. Some of that imported, like a little of the American ore, contained phosphorus, arsenic, copper and other harmful impurities, but during the height of the demand even this ore was readily bought. By June buyers became more careful and it was not so easy to sell bad ore.

Ten tons of tungsten metal and ferrotungsten, valued at \$36,885, were recorded as imported. The exports for the first 5 months of the year amounted to 4906 lbs., valued at \$10,571.

If the American production and imports are added the consumption seems to have amounted, roughly, to 5100 tons of 60% concentrates, valued at \$13,278,000. On the supposition that 20% of the metal was lost in various operations, it seems probable that between 11,000 and 12,000 tons of new high-speed steels were made during the period, in addition to the steel made from tungsten saved from scrap and scale.

Larger Imports of Manganese Ore.—Imports of manganese ore into the United States in April were 48,413 gross tons, the largest this year. This brings the average to May 1, 1916, up to 24,989 tons per month, which compares with 26,731 tons per month in 1915 and 28,757 tons per month in 1913. For the 10 months to May 1, 1916, the total imports have been 355,795 tons, against 159,203 tons and 242,748 tons for the same periods in 1915 and 1914, respectively.

purchasers. Both the Gopher and Hackberry properties are attractively rated in gold and copper.

Sinking of the shaft on the Loma Prieta property in Copper Basin is going ahead steadily. A continuous ore body has been determined for more than 55 ft., and with every foot of increased depth the showing improves. A carload of high-grade chalcopryrite ore has been shipped as a test from the Loma Prieta. All work at the mine is now under direction of John Livezey, who has taken up his residence at the camp.

Recent exploration in the old Senator mine has resulted in new and valuable ore being proven. In the zone where the Treadwell vein was penetrated a large tonnage was opened up, giving values of \$50 in gold and copper. The strike occurred at a point 2500 ft. in on the old tunnel. The Senator, one of the units of the Commercial Mining Co., was believed to have been worked out years ago. Another claim of the group, the Snoozer, is shipping daily to Douglas a large tonnage of high-grade copper.

Initial exploration movements on the McNulty-McBride properties, recently taken over under option by the Daly-Crawford-Levisohn syndicate, are under way. A. L. Johns of Globe has taken charge of the work, established a camp and is ready to go ahead with churn drilling as soon as one of the three drills to be used arrives. Three hundred acres of ground has been set aside for early exploration.

Throughout Yavapai many mines with which the public is not so familiar as with the larger producers, are doing good and making many improvements on their properties. Contracts have been let for the construction of six new buildings to accommodate a force of 50 miners at the camp of the Beehive Co., adjoining the Octave mine on the east. The Octave has made good during the last year and both mines will be operated during the coming year.

Operations on the Dolphin mines, on Turkey Creek, will be resumed in the near future, the owners having decided on a plan of rapid development after a recent inspection of underground conditions on the property.

A high-grade copper sulphide, carrying gold values, has been encountered in the old Bullwhacker mine. The property is now being developed to great depth, after having lain idle for many years.

Active work is under way on the project of the Arizona Deep Mining & Tunnelling Co. in the Bradshaws. The company plans to run a tunnel, approximately 17,000 ft. to explore six fissures in the mineral belt north of Crown King, in which are included the Lincoln, Nelson, Fairview, War Eagle, Gladiator, Crown King, Del Pasco and Wildflower groups. At certain points a depth of more than 1500 ft. will be given, and the exploration is declared to be the most extensive ever conducted in the southwest. The tunnel has been driven more than 50 ft. from the initial point selected by the engineers.

The first discovery of sheelite in this field was made several days ago in mines in the Hassayampa district owned by Louis Bernard, Valentine Allbarade and John Barnard. A 3-in. streak of sheelite was cut on a 40-ft. crescent from the main tunnel and, when analyzed, was pronounced as of exceptionally high grade. The property is under development for its silver values.

Oatman.

During the past week two events have occurred, one of them being the peaceable solution of the labor difficulties which had occasioned the Gold Road mine of the U. S. Smelting & Refining Co. to close down temporarily, and another one a financial deal of magnitude whereby the control of the Carter Mining Co. passes to Keith & Keith of Boston within thirty days if the option taken by them and upon which a large cash payment was made, is exercised.

It is also reported that a deal involving a large sum of money is under way for the Oatman Queen property, and that either Keith & Keith or the United Eastern interests are the possible purchasers. It is known that extensive sampling of this property by engineers close to these two interests has been under way for some days. The Oatman Queen has opened a very fine and somewhat extensive showing of pay ore on one level, and on account of surface con-

ditions is regarded as a highly promising property. It lies in the same zone of ore channels as the Pioneer, Carter and Lucky Boy.

Officials of the Lucky Boy state that they expect to resume operations by Aug. 15, and the Oatman Queen expects to resume on or before that time.

The Big Jim is steadily blocking out ore in east and west drifts on the 400 and 485 levels, and it is officially stated that the average gold value for more than 300 ft. of ore exposure maintains a level well above \$20. The ore body is 30 or more feet in thickness.

At a depth of 200 ft. the Arizona Central, which lies between the United Eastern and the United Western, has cut 12 ft. of vein which gave average values of \$5.58. The quartz is similar in appearance to that in the pay shoots in the Tom Reed, United Eastern and Big Jim. The shaft will be continued to 500-ft. depth, and then the vein will be explored at that depth.

On the 400 level of the Pioneer 1500 ft. of lateral work has been done during the past 90 days, and has opened 600 ft. of new ore shoots, averaging \$15. The ore body is known to average better than 8 ft. in width where opened.

The Jerome Oatman shaft, at a depth of 360 ft., is running into a change of vein matter which is said by the operators to show good pan values, which seems to indicate the proximity of an ore body. Operations were temporarily checked by the burning of the compressor house 2 weeks ago, but work is now well under way again.

The new headframe of the United Eastern is now completed, and the hoist will soon be working on the new main shaft, which is down 375 ft. The headframe is 75 ft. in height. Foundations for the new mill are completed, and machinery equipment is arriving daily. Underground development continues to add largely to known ore reserves.

The plant of the Wrigley Exploration Co. has arrived and is being installed. It consists of a 75-hp. oil-burning engine and a 14x12 Ingersoll-Rand compressor and drill. The company is engaged in driving a tunnel from a low level into one of the main elevations of the Black Range mountains, to cut at depths ranging from 500 to 1200 ft. the series of veins which outcrop at surface. Not only will the property of the company be explored by this crosscut tunnel, but it may be used as a means through which adjacent properties will be developed at depth, and at the same time mines lying above will be afforded drainage. The project is an ambitious one, as it is planned to drive the bore at least 2000 ft.

Two 100-hp. marine-type, oil burning boilers, have just arrived in Oatman and are now being installed, one of them on the Lazy Boy and the other on the Esperanza. They will generate power to drive hoist, compressor and pumps. Work will soon be resumed on these two properties.

Supt. Keating, who has so successfully handled the development of the Big Jim, has also been given complete charge of the development of the Ivanhoe. Preparations are now being made to start drifting on a 6-ft. vein of highly-mineralized quartz which was cut on the 500 level, and which showed high-pan values, said to average around \$5. This vein is in the immense quartz-porphry dike which cuts through the andesites and the underlying sedimentaries, as is shown on the 500 level. The operators anticipate important developments soon.

CALIFORNIA.

Grass Valley.

The Brunswick Con. hoist has been provided with a new drum and is operating at full capacity. The new vertical shaft has been carried to a depth of 1200 ft. and some excellent ore is being mined. Forty stamps are dropping. The old shaft will be kept in repair for use in emergencies.

Buildings for the hoist and other machinery have been completed at the Allison Ranch mine, and installation of equipment will start early in September. By means of an ejector the water in shaft will be lowered 200 ft. before the

pumps are in position. Sampling of the huge dump is proceeding with good results, and it is believed a large tonnage of this material can be profitably milled.

Dedrick.

Control of the Globe gold mine has passed from the Globe Con. Mines Co. to H. M. Hall, the original owner, and steps have been taken to resume operations. Although the mine is stated to contain considerable ore of good character and is splendidly equipped, it failed to satisfy the operators. Under the management of the owner deep work will be pressed and a portion of the 20-stamp mill operated.

Columbia.

The Springfield Tunnel & Development Co. has acquired the Elliott property and will start developments shortly. A shaft is being sunk from the end of the 1200-ft. drift in the Ranch mine, where a large deposit of rich gravel was recently uncovered. It is planned to work this gravel while driving of the main tunnel is proceeding. The tunnel is now in 2800 ft. and will be driven about 2 miles further. As soon as it is completed a series of raises will be driven to facilitate mining of the various channels to advantage.

Redding.

The First National Copper Co., operating the Balaklala mine at Coram, has distributed a 25 ct. dividend, the first in its history. Shipments are going forward to the Mammoth smelter at the rate of 300 tons daily. A large amount of new development work has been recently performed with good results. The management has granted the employes the same wage scale that prevails at the Mammoth, Mountain Copper and other Shasta Belt mines.

The Gardella Dredging Co. has announced that its dredge at Lincoln will be moved to a point near Redding within a year. Two more dredges will be built in the near future. The original dredge has been operating several months, on land lying along Clear Creek and has won profits considerably in excess of values indicated by the drills. The success of this company has stimulated interest of other corporations in the local dredging field, and much explorative work is going on.

A strong company, represented locally by M. E. Dittmar, has taken a bond and lease on the Michigan group of copper claims on Bully Hill, and is preparing for extensive developments. The North Star, the principal claim, lies 600 ft. west of the Bully Hill mine, and is believed to contain the extension of the Rising Star ore body.

Sutter Creek.

Unwatering of the Old Eureka mine has attained a point 450 ft. deep. Three sinking pumps are in commission, and a fourth will be installed on the 600 level as soon as it is reached. Concrete foundations are being erected for the new electric hoist and steel headframe.

Sinking from the 3200 level of the Central Eureka has begun, and from the 3300 level drifts will be extended to intersect the vein which is yielding good ore at the 3200 point. Twenty stamps are dropping on quartz from the 2800, 3100, and 3200 levels, and 10 more will go into commission in a few days.

Amador City.

Cutting of a station on the 1800 level of the Keystone is going on, and from this point an east crosscut will be driven to the main ore body. Ore bodies of good width and fair values have been opened on the 1000, 1200, and 1400 levels, and 40 stamps are dropping constantly. In the first 6 months of 1916, 41,084 tons of ore were crushed, of a gross value of \$81,365. Total expenses approximated \$78,000.

Sierra City.

The Butte Saddle and Sacred Mound mines are being reopened by a strong company, with F. E. Barnett manager. Both mines have produced rich ore in the past and it is planned to press work on a broad scale. At the Cleveland 25 men are working and some good ore is exposed. The mine is controlled by the Gillespie interests of Pittsburgh, Pa.

Groveland.

A Tonopah syndicate, including Arthur Brown, Gurley Jones and J. H. Skelton, has taken over the Cosmopolite gold mine, about a half-mile from Groveland. The property

embraces 7 claims and millsite, and is equipped with a stamp mill, compressor and other machinery. A large tonnage of fair-grade ore is blocked out above the main tunnel and it is proposed to install a ball mill and other equipment, designed to increase the capacity of the mill to 50 tons per day.

Ophir.

The Mowitza, Enterprise, Good Friday, Green, Cornucopia and West Friday claims have been taken under lease and option by the Globe Con. Leasing Co., understood to be a subsidiary of the Crown Reserve Co., of Cobalt. Under direction of Supt. Burnett a Cameron pump, compressor, electric hoist and other machinery have been installed, and sinking is proceeding rapidly. At a depth of 300 ft. drifts will be sent out to intersect the Friday vein. The claims contain several veins carrying copper and gold, with copper predominating.

COLORADO.

Cripple Creek.

The ore shoot as exposed at the 1400-ft. level of Dillon shaft is now 550 ft. in. The 1600-ft. level, where the deep continuation of the shoot shows, has recently been enlarged. The June production from this estate, comprising the Upper Granite, Monument, Dillon, Dead Pine and Coin mines was about 4000 tons. The company shipments from the Dillon mine are now holding at better than 2 cars daily. Bach & Co. on the Lower Dead Pine are mining a good average grade of ore, and a second set of lessees operating through the Dead Pine shaft are also producing. Carruff & Duncan operating through the Coin shaft continue to make steady production from the Dead Pine. Williams Brothers lessees on the Monument are shipping, and four sets of lessees on the Upper Granite mine are producing.

The Vindicator Con. in a letter to stockholders by President A. J. Zang says: "The operations of the second quarter of the year were characterized by extensive development, largely in preparing the Middle vein system of the Vindicator mine for stoping. This ore body has now been opened from the 18th level up to the 12th level, disclosing an immense volume of ore of better than average grade. Only a small portion of the work necessary to open the 19th and 20th levels of the Golden Cycle mine has been accomplished. The outline of the work planned extends well into 1917. Our engineering staff report that the flotation plant being erected below the Golden Cycle ore house will be completed about Sept. 1, and the results there obtained will govern the future policy of the company with respect to the handling of low-grade ores used in filling the stopes from the beginning of the development of the property. A lessened production during the second quarter over that of the first quarter was made necessary by the development referred to above. The tonnage shipped on company account was 14,877 tons, and that of the lessees was 16,276 tons. The net earnings for the quarter amounted to \$185,000, making the total for the half year \$410,000."

Leadville.

Reports of the district for the first half of 1916 apparently show favorably as regards operations in the district. To the end of June 402,250 tons of ore have been extracted from the mines in Lake county. Of this output, June showed the largest tonnage, with 82,250 tons, an average daily production of 2742 tons. May gave 73,000 tons, April 66,000, March 63,000, February 57,000 and January 61,000. The average daily output during the period was 2210 tons. It is conservatively estimated that the average gross value of the ore produced in the district is \$25 a ton. At this figure the district has produced \$10,056,250 for 6 months. In 1915 the total output for the year was 532,217 tons, with a value of \$15,895,229.99. Comparing these figures, which were considered a high mark last year, with the record made during the past 6 months gives an idea of what the totals are to be when added up for Jan. 1, 1917. During the past 6 months 29 old properties have resumed activity. Among these are several large mines that have been taken

which lies more directly south of the United Eastern, and in which a considerable tonnage of milling ore has been exposed. Sunnyside, also, has some remarkable surface showings, while the Telluride and the Lucky Boy, in this same vicinity, are regarded as coming mines when they shall have been properly developed.

Development on the 400 and 485 levels of the Big Jim property continues to add large quantities of ore to the known reserves, and it is officially stated that the average value of all ore being exposed is above \$20. Foot for foot of work done to date, the Big Jim is fully equal to the Tom Reed at similar levels, according to assay maps of both properties.

The Tom Reed continues to develop large bodies of ore in its Ben Harrison (its main mine) and its Black Eagle workings. Arrangements are being made to do extensive development work on other parts of its large estate, which extends for some 6 miles across the Oatman district. Indications favor the belief that several large mines will be developed in the Tom Reed holdings. Its mill is now dropping its entire 20 stamps on company ore.

The Gold Road mill is steadily operating on its own ore and on 30 tons per day from the Gold Ore Co.

The Ivanhoe is drifting on its vein on the 500 level, as is the Fessenden.

Work in other properties, such as Carter, Boundary Cone, Arizona, Tom Reed, Aotman Pioneer, North Star, United Northern, Times, Gold Dust, Gold Key, Gold Road Bonanza, Black Range, Jerome Oatman, Lexington, Adams, Nellie, United Western and others is steadily progressing.

Oatman United, delayed for a long time by inability to secure delivery of its 60-hp. engine to drive its compressor, has at last received its engine, and this is now being placed. The big 3-compartment shaft is now down 175 ft., and will be driven to the 500 point with all possible speed as soon as its power drills can be used.

Oatman Queen and Lucky Boy will soon resume operations, and Lazy Boy and Esperanza will follow shortly with resumption of operations.

Eastern capital is now coming into the Oatman district and several deals of magnitude are said to be pending. Large blocks of stocks of a number of Oatman companies have recently been placed in New York, Philadelphia and Boston. A number of these were companies which were none too well-financed at the start, but which managed to get along very well during the first flush of excitement when Oatman development stocks were selling briskly. Now that eastern capital is becoming interested and is being made available for the development of the properties in the district, mining operations are gradually increasing. Nothing has as yet developed in the camp to prove that the opinions of the eminent engineers who reported favorably upon the district were incorrect, but, on the contrary, developments in those properties which are well advanced in their exploration work are exactly in line with the predictions made last fall and winter by such engineers as J. Parke Channing, Etienne A. Ritter, H. C. James, J. K. Turner, C. D. Jackling, Frank A. Keith, Seeley W. Mudd and others. Ore deposits in the district are so deep lying that considerable time—an average of much more than one year—must be devoted to development and exploration work before important ore bodies are to be expected. A number of companies are now approaching the stage where pay ore may be found at any time, and a still greater number are steadily and quietly developing, with the expectation of going several months before developing anything of general public interest. The spirit of optimism manifested among the operators in the district is in striking contrast to the market for mining securities.

Miami.

N. W. Tanner and his assistant W. L. Card, have just returned to Miami, after having spent 3 weeks in the district southeast of Miami, known as Mineral Creek section, examining the property of the Greater Miami Copper Co. The property consists of 20 claims, located, approximately, 15 miles southeast of Miami. A good deal of development work has been done; besides numerous minor shafts and tunnels, a tunnel is in 110 ft., and a contract to push it in 100 ft.

further will be let at once; also two more crosscut tunnels will be started at once. The property has the advantage of plenty of water, sufficient to run a small electric plant the year round. It is the intention of the company to enlarge the present camp and increase the number of men employed. Work on the road is under way, 35 men being employed on a road leading through Russell Gulch and across the company's property. There is also a crew of railroad engineers making a survey along, approximately, the same route as this road.

CALIFORNIA.

Darwin.

The Darwin Development Co. has completed a flotation plant at the Lane mine and will have it in operation by the end of August. The management reports a large tonnage of good-grade ore available, and if the process proves as satisfactory as anticipated production will be maintained on a large scale.

Two shoots of excellent ore have been opened in the Custer mine, managed by John H. Thornkike. Portions of the vein contain some of the richest ore ever found in the property. Important discoveries have been reported from the Lucky Jim and Christmas Gift properties. The latter is operated by Skinner Bros.

The 300-ton mill of the Tungsten Mines Co., at Tungsten City, has been completed and will go into operation within 10 days. Mule teams are hauling ore to the bins, and the motor trucks will be placed in service before the end of the week. The tunnels and shaft at the mine continue in ore of good grade.

The deposit of zinc carbonate recently uncovered in the Cerro Gordo mine, at Keeler, is proving the most extensive ore body of its kind ever found in the old producer. It was intersected 500 ft. southeast of the shaft, on the 200 level, and is 25 ft. wide. The new winze has gone down on the ore 40 ft. with the vein increasing. The ore is stated to average 25% zinc and occurs as a replacement in limestone. The company is shipping 700 tons of ore and 1500 tons of material from the old slag piles every month.

Downieville.

Henderson & Hodgkinson are driving a new tunnel to intersect the vein in the City of Six mine at a point 60 ft. below the bottom of the 40-ft. shaft. It is expected the objective will be gained within 125 ft. Following this the main lower tunnel, now in 1300 ft., will be continued to the ore body. Some good ore has been exposed in the shaft workings.

Dolan & Bell have erected a small quartz mill at their Rock Creek property and are ready to start crushing. A shoot of rich mill ore has been opened for 100 ft. and 35 tons of selected quartz are ready for the stamps. Arrangements have been made to prosecute work at further depth.

Engineers said to represent the Jackling Exploration Co. have taken options on several groups of low-grade gold properties near Downieville and are sampling the quartz. It is reported an experimental mill is to be constructed to facilitate thorough testing, and that satisfactory results will be followed by the construction of a large plant.

Alleghany.

The Twenty-One mine is idle as a result of an injunction filed against it on behalf of the Sixteen-to-One Co. The latter charges the Twenty-One owners with extracting ore from plaintiff's property, and has entered suit for \$100,000. The Twenty-One people maintain that the other party has invaded Twenty-One territory and are arranging for an injunction against the Sixteen-to-One. Considerable rich ore has recently been opened in disputed territory.

Auburn.

Control of the Borealis Con. group, in the Ophir district, has passed to a syndicate of New York people headed by J. C. Winters. A 100-ton flotation unit is to be installed and the old mine plant replaced with modern equipment.

The group comprises the Eureka, Kirkland and Hataway mines, and contains extensive reserves of good ore. E. P. Stephenson, of Auburn, is manager.

Forks of Salmon.

The Gold run mine, 9 miles from this point, has been purchased by New York capitalists from W. L. Beall, and preparations are being made for operation on a more extensive scale. The mine is equipped with a 10-stamp mill and mine equipment, and contains much ore of good grade. It was recently reopened after lying idle several years.

Ione.

The shaft at the Allen copper mine is down 500 ft. and stoping has commenced on a large block of good ore. The vein averages 5 ft. wide and carries copper and gold. Large reserves are exposed and shipments will start in the near future. C. N. Johnson, of Cutter Creek, is manager.

Washington.

The stamp mill formerly operated at the Grover-Murphy mine, near Nevada City, is being assembled at the Ocean Star, recently acquired by the Columbia Co. Mines Co. A large amount of new work is proceeding in the mine with encouraging results. Good ore is going to the Columbia Con. mill from the Columbia property. Much new work is in progress at the German claim.

Shipments of chrome ore are going to eastern steel mills from the Red Ledge mine, and the vein shows strength as developments advance. The gold bearing ore bodies continue to develop well and a good tonnage is going to the mill.

Nevada City.

The mill at the Texas mine, in Willow Valley, is crushing good-grade ore and the company operating the property under bond has arranged for greater operations. Arrangements are also being made to work several adjoining claims by way of the Texas shaft. W. H. Tuttle is manager.

Roy Tremereux, assistant superintendent of the Champion mine, has been selected to manage the Delhi mine at Columbia Hill, which is being reopened by local capitalists. Unwatering of the lower levels is proceeding and as soon as this has been accomplished a larger pump will be installed and sinking resumed. The mine is equipped with a 20-stamp mill and excellent mine plant.

Atolia

Heavy shipments of high-grade tungsten ore continue to be made by the independent companies, and new work is constantly extending the productive zone. A large acreage of new ground is being worked between Atolia and Bandsburg and leasing companies are particularly active.

Chico.

G. L. Crowder and W. H. Whitten of Chico have bonded their Mugford gold mine to a Nevada company. The property has produced well in the past and the new operators have started work. The Mugford lies 16 miles east of Chico.

Lotus.

The new shaft at the Wagner mine has intersected at a depth of 60 ft. a 4-ft. vein of ore averaging \$35 to \$40 in gold. A 4-stamp mill, compressor, 22-h.p. gasoline engine and other equipment have been recently installed, and plans have been made to send the shaft deeper. The Wagner was extensively worked 20 years ago but has long lain idle.

Tungsten City.

The Standard Tungsten Co. is erecting a 1600-ft. gravity tramway, a new mill with a capacity of 10 tons, and other equipment. This will increase the output of tungsten concentrates fully 80%. Developments continue to uncover good bodies of tungsten-bearing ore.

Yreka.

W. R. Beall of Yreka has made the first payment of \$10,000 on the \$20,000 purchase price of the Gold Run mine, near Forks of Salmon; 20 men are at work and 10 stamps are dropping steadily. Beall reopened the Gold Run several months ago after the property had lain idle 5 years. Large deposits of copper ore have been found in the Forks of Salmon district and it seems likely the region will attract attention in a mining way in the coming year. Numer-

ous gold ledges are being prospected with encouraging results. The district lies near the new government road from Forks of Salmon to Somes bar and is readily accessible for the first time.

Oroville.

A deposit of rich gravel has been encountered in the Butterfly mine, in Morris ravine, 4 miles from Oroville. It was tapped at the end of a 500-ft. tunnel and appears to be 4 ft. thick. Crosscutting is proceeding to determine its width. Among the principal owners are C. F. Belding, R. S. Kitrick, W. T. Baldwin, C. L. Bills and Herman Legrunde.

The Big Blue Lead gravel mine, near Bangor, has been acquired by F. F. Ford and C. G. Fowler, and arrangements have been made to work it along broad lines; \$20,000 will be expended on development work, and the 2500-ft. tunnel will probably be extended to intersect a series of rich channels believed to course through the property. The property lies about 10 miles from Oroville and is in one of the richest placer sections of California.

COLORADO.

Cripple Creek.

Under Supt. Kissel shaft work is progressing at the War Eagle Con. A new electric fan for use in sinking the Happy Year shaft has been installed. This 3-compartment shaft has obtained a depth of 125 ft., and is gaining at the rate of 3 to 4 ft. daily. The shaft is timbered with Oregon pine. A station has been cut out at 125 ft. and a crosscut is being carried east in close proximity to the main Happy Year vein, lying an estimated distance of 40 to 50 ft. east of the new shaft, and between it and the old Josephine shaft. This old shaft, although but 70 ft. deep, is accredited with a total production of close to \$70,000, when litigation stopped further operations. The lateral from the Happy Year shaft, lower down the hill, will cut under the old workings on the Josephine at an approximate depth of 150 ft., or 75 ft. deeper than the level from which the output was made. It is expected that with the vein tapped paying values will be obtained. The 200 level of the Happy Year shaft is planned to connect with the Happy Year tunnel workings. In driving this tunnel a basalt dike was followed and numerous cross veins intersected. The low values obtained in these veins was too low to permit of development, but such grade may now be mined at profit. Connection with the tunnel will also ensure perfect ventilation, and until this work is completed, the electric fan will be kept in operation. The old Happy Year shaft is between 400 and 500 ft. deep and was sunk in granite. Samples, it is said, range from \$14 to \$40.

A vertical vein at the Ella W. is now being prospected by a winze from the 100-tunnel level. It is showing up good and assays are as follows: Coarse quartz 3.33 oz. gold \$66.60 and screenings 4.32 oz. gold \$86.40. These samples were taken from the 4 ft. of vein matter as broken with machine drills. The first shipment of the higher grade quartz, a carload to be loaded out by teams of the Colorado Trading & Transfer Co., will, it is estimated by the mine superintendent, bring settlement at a rate of between \$35 and \$40 to the ton. A carload of the richer screenings will have accumulated by the end of the week and will then be shipped from the lease by the Consolidated Mines & Reduction Co.

The Jerry Johnson produced \$25,632.50 in ore during the first 6 months of 1916. During this time 33 lots of ore were consigned to mill or smelter and values as shown in the report of Supt. D. C. Smith, of the Cripple Creek Deep Leasing, Milltown Extension combination, ranged from 0.5 oz. gold \$10 to as high as 3.01 ozs. gold \$60.20. The company's lease extends from the 650 level of the main Jerry Johnson shaft downwards. The Deep Leasing Co. is mining and shipping a good grade of ore from the bottom or 850 level. A crosscut at the 750 level now being carried to the breccia-schist contact should reach the objective point by Aug. 14, when it is expected that another ore shoot will be entered. During July the production made by the Deep

cold feet. Quitters nearly always lose—there is no chance to win success when you quit and run away. The stickers, who finish their development, are the winners in the end.

Everybody belongs to one of the two classes—they are either "stickers" or "quitters." It makes no difference whether a quitter quits in the first hour or in the eleventh hour, just when victory is in his grasp, the result is the same.

If you are not enthusiastic about your business you can't expect others to be. If you have no enthusiasm, and no ambition to make your business a success, don't go into it in the first place. If you start, stick. Make it a success by your own efforts.

If your mine needs funds for further development, for building ore bins and so forth, it naturally falls on you as a stockholder, or partner, in the mine to furnish your share of that expense, before the returns can be taken from the ground. If you can't furnish \$1000, or \$500, or \$100, right now, you can at least furnish \$10 or \$20 or perhaps \$50 a month, for a few months, which will accomplish the same result. It is strictly up to you how fast the progress is. Spread your enthusiasm and stick-to-it-ive-ness to your neighbors and friends, and interest them. If you were a partner in a grocery store you'd rustle your friends for patronage, and boost your business, until you became established.

Use of Slags for Fertilizing.

Utilization of iron and steel works slags was discussed by E. C. Brown, chief civil engineer, Carnegie Steel Co., Pittsburgh, in a paper read before the Engineers' Society of Western Pennsylvania and printed in the January issue of the Proceedings of the Society. Little commercial or industrial use, he said, has been made of either open-hearth or converter slags, as compared with blast-furnace slag. When slag is high in lime it may be returned to the blast furnace as a flux. Open-hearth slag has been ground and used in agriculture as a soil corrective, giving higher and quicker results than lime applied in the usual form. At Birmingham, Ala., slags from high phosphorus local ores are being built up by recharging until they contain as high as from 12 to 18% of phosphorus, thereby being about in the same class of fertilizer as imported "Thomas meal" or phosphate slag.

A dry granulation process, he mentioned also, has been developed in Germany for preparing slag for cement. The essential feature of the process is a rotating cylinder into which the slag stream is directed with a blast of air and a small amount of high-pressure steam. The product is dense and contains but little moisture.

Britania metal is an alloy of 10% antimony and 90% tin.



THE CREW OF THE DEUTSCHLAND.

The American people are naturally divided in their sympathies as regards the warring nations of Europe. But they are noted for their fairness as well, and a feeling of admiration arose when through ingenuity and daring a seemingly impossible feat was accomplished. In the above, for which we are indebted to the *Marine Review*, is shown the crew of the German submarine *Deutschland* which recently completed its record voyage to the United States and back to Germany. Of interest to the mining fraternity is the knowledge that part of the cargo of this vessel was nickel bars.

tom. In other words, the shaft is in ore for a depth of 90 ft. A considerable tonnage mined in sinking has commercial value, and there are several tons of sorted ore on the dump that carries 15% copper. A few days ago a level was established at 140 ft. and crosscuts started east and west in the ore. The face of the east drive is completely filled with chalcopryite. This condition has prevailed from the shaft to the present point of development and presents indications of continuing several hundred feet further to the east. The west crosscut carries bands of ore impregnated with chalcopryite which seem to be converging into a solid body as the cut is advanced. Water trouble is hampering operations considerably, due to the inadequacy of the small hoisting plant.

Another property in the Copper Basin country that is attracting a good bit of attention in mining circles is the McNulty & McBride, where a churn-drill plant recently began operations. Two shifts of nine men each are at work and three holes are being drilled. As yet no determinations have been made public. The holdings show very favorable copper indications at surface and nominal depth, however, and the opinion is general that the churn drills will disclose commercial values at depth. The venture is backed by the Crawford Syndicate.

Stringers of ore showing native copper have been encountered in the limestone-capping at a depth of 400 ft. in the Dundee-Arizona shaft. The property is located in the Jerome field and is viewed with favor by the mining men of that section. Considerable water is seeping into the shaft, but is not hampering operations as the plant of machinery recently installed is amply capable of handling both water and waste.

Satisfactory progress is being made in unwatering and retimbering the Jerome Victor Extension shaft and in installing the big pump on the 700 level. To date most of the unwatering has been accomplished by bailing and to good purpose taking into consideration the fact there were approximately 3000 ft. of lateral openings to be drained on the 700 level. For a while delays were enforced by the necessity of repairing certain parts of the hoist, by the jamming of the bucket in the shaft timbers just above the 700 level and by the non-arrival of timbers, coal and other mine essentials. Now, however, an adequate amount of timber, fuel, drill-steel, etc., is on hand and the work is progressing to better advantage than formerly.

Prescott.

F. A. Johnson has been appointed superintendent of the property of the Gold Blossom Mining Co., located about 6 miles south of here. Johnson has put three shifts on and will sink the main shaft to a depth of 500 ft. The present depth of the shaft is 200 ft. and on that level an ore body 3 ft. wide is being developed. Gold values are reported to run close to \$100 per ton. This ore body is to again be opened by crosscuts and drifts run out at the 400 and 500 levels. A hoisting plant, air compressor and other mine equipment is in transit to the property.

The Midnight Test group of gold-bearing claims in the Groom Creek country have been sold to R. M. Merrill of San Francisco. The property is one of a number of former producers in Yavapai county that has passed to outsiders of late. The retiring owner, Colonel Chase, of Faribault, Minn., opened the property to a depth of 400 ft. and mined a large tonnage of free-milling ore which was treated in the Nissen mill erected by him. The new owners have taken possession of the mine and are preparing to open it at greater depth.

Development of the recent strike in the Lady Alldy mine indicates it to be one of the most important made in the Chaparral section in a number of years. The ore body has a breadth of 3 ft., where opened on the 200 level, and is said to assay close to \$100 gold per ton. Ben Rybon and Dr. R. N. Looney, of Prescott, are the owners. The mine is being worked by the Smith brothers under a \$20,000 option to purchase.

Mayer.

Officials of the Big Ledge Development Co. announce the purchase of the old Treadwell smelter at Mayer and that it is at once to be overhauled and placed in commission. They likewise announce the purchase of the Hackberry and Gopher properties and the intention to thoroughly de-

velop them. The company has for some time operated the Henrietta and Butternut mines in the Big Bug country. The intention is to reduce the ores mined on all four of the properties mentioned at the smelter recently bought.

Humboldt.

A 50-ton reduction plant and a new equipment of mining machinery, all to be operated by a Semi-Diesel engine, are to be installed at once by the Arizona Mine Supply Co., of Prescott, at the Arizona mine. The property is being operated by Anderson & Birch and has of late been a frequent shipper of high grade silver-lead ore. When the new machinery is in commission the mine is to be opened at greater depth.

Manager W. S. Vilhelm of the New State mine, recently the scene of a strike of high grade gold ore, will at once equip the property with additional machinery, including a large air compressor and drills. The fissure from which the high grade is being mined continues on into the Elk and Perry properties, also controlled by the New State people. Hoisting and compressor plants are to be installed on these groups. All three of the properties are to be developed at depth as soon as the machinery is in operation. In furtherance of the plan accommodations for additional miners are being established and other surface improvements made.

CALIFORNIA.

Nevada City.

The Delhi Mines Con. has been formed, with a capital stock of \$1,000,000, to operate the Delhi mines, at Columbia Hill. The directors are C. R. Clinch, Frank Vestal, L. P. Larue and Roy Tremereaux of Grass Valley, and Carrol Searls of Nevada City. The mine produced good ore years ago and is considered a property of promise.

Crosscutting from the main shaft of the Pittsburg mine to penetrate the Gold Flat vein is progressing, but hard rock is retarding work. The crosscut is out 500 ft. and is expected to tap the ore body within 600 ft. The mine is well equipped.

Arrangements have been made to work the Massachusetts quartz property in the Gold Flat district, about 2 miles below Nevada City. The 2-stamp mill of the Norton mine in Willow Valley, has been moved to the Massachusetts and will start crushing within 10 days. Some good ore has been opened. The property is operated by C. H. and E. C. Dougherty of Nevada City.

A new hoist has been installed at the Texas mine and sinking on the New York vein has started with 10 men. This ledge formerly produced some rich quartz and is expected to persist to considerable depth. The mill is running on ore from the main workings.

Placerville.

A large compressor and machine drills have been installed at the Rising Hope gravel mine on Webber creek, 3 miles east of Placerville, and a new bedrock tunnel will be driven beneath the lava cap to open the channels to advantage. About 2 miles of development work have been already accomplished and large bodies of excellent gravel blocked out. The property is equipped with a good gravel mill and washing plant. The mine is owned by Schuyler N. Warren and associates of New York.

Portola.

The Walker copper mine has been acquired by the International Smelting & Refining Co. and will be operated on a larger scale than originally planned. A flotation plant of 100 tons daily capacity was recently completed and everything is in readiness for a heavy output. The new lower tunnel and shaft are both in ore averaging better than 6% copper, and considerable gold and silver is also present. The new owners will expend at least \$25,000 on further developments.

Smartsville.

An option has been taken on the Campbell gravel mine by eastern people, and an effort will be made to work it by the drift process. A shaft will be sunk to bedrock and the channel thoroughly developed. The Campbell, also known

the Blue Point, formerly ranked among the greatest hydraulic producers of California, but was closed following enactment of anti-hydraulic legislation. Several unsuccessful attempts have been made to work the mine, including the spectacular failure of the Tarr Mining Co. about 8 years ago, when efforts were made to mine the gravel by a combination dredger-hydraulic elevator system.

Laws.

The Tip Top gold mine has been acquired by the Louisiana Con. Mining Co. and is to be actively worked. A large tonnage of good-grade ore is stated to be exposed, and deeper work will be prosecuted. On adjoining property the company has taken an option for \$35,000. The group is equipped with a 10-stamp mill and it is likely capacity of the plant will be increased.

Grass Valley.

An eastern syndicate, headed by King G. Gillette, has acquired the California mine in the Deadman Flat section for approximately \$75,000. One-fifth of this is to be paid down and the remainder in four equal yearly payments. It is reported the shaft will be deepened, equipment provided and operations conducted along broad lines.

The final payment on the purchase price of the Union Hill will be made in a few weeks, and following this developments will be pressed with renewed vigor. Considerable tungsten has been produced in the past 6 months, and profits from this source have materially aided in development of the gold-bearing ledges. Augustus Cox is superintendent.

The California copper mine at Spencerville has been taken under bond by H. W. Morris and Thomas Benney of Grass Valley. Some high-grade ore has been found, with gold and silver occurring in fair percentages.

Carrville.

Operations have been resumed at the Strode mine after an idleness of 5 years. The ledge has been recovered and has widened to 5 ft., with the ore of excellent character. Seams of the quartz are stated to run into fancy figures. Twelve men are employed under supervision of H. L. Stewart.

Considerable prospecting is reported in the district, and several encouraging gold discoveries are reported. The vein recently uncovered in the Golden Jubilee continues to average around 2 ft. wide, with good ore in evidence. A number of small companies are working quartz deposits in the vicinity of Carrville, Coffee and Trinity Center.

Marysville.

The Yukon Gold Co. has filed suits against several prospectors in the vicinity of Smartsville to prevent further mining on placer ground claimed by the company. A temporary injunction has been granted and defendants have been cited to show cause why injunction should not be permanent. The Yukon Gold Co. is building a powerful dredger in the field and plans to erect two more in the spring. The territory lies in the Yuba River field, adjoining holdings of Yuba Gold Fields Con.

Howland Flat.

Construction of the mammoth restraining dam across Slate creek is progressing, with 25 men at work. The dam will be 50 ft. high, of reinforced concrete, and is expected to impound 4,000,000 cu. yds. of debris the first year. Its height will be increased as conditions justify. It will facilitate operation of numerous hydraulic mines in the Howland Flat, Fort Wine, Scales, and other districts. Los Angeles people have secured control of the company and acquired water rights. It is planned to sell water to owners of hydraulic mines for operating purposes.

Angels.

Rich gravel has been encountered in the Rough Diamond mine, 5 miles from Angels. The deposit was intersected at a depth of 62 ft. and is stated to average \$30 to \$40 per ton. The channel is the Central lead, which has produced splendidly. It is planned to install machinery soon and to press work more vigorously. L. J. Hutchinson and David Oard are the owners.

Yreka.

The Spring Gulch quartz mine has been taken under bond by Seattle people and extensive prospecting is proceeding. Ten short tunnels have been extended and all are ore of low grade. Altogether, about 3000 ft. of development work has been performed.

COLORADO.

Cripple Creek.

The Cripple Creek Deep Leasing Co. loaded out a 35-ton shipment from its lease on the deep levels of the Jerry Johnson mine on Ironclad Hill. The company is mining ore at both the 850 and 750 levels that is averaging close to 2 ozs. gold from the breccia-schist contact lying east of the shaft.

Charles Hill at a depth of not to exceed 30 ft. on his lease in the Ajax Co.'s mine has opened up a huge ore body. Except for dumping the rock over a screen, the ore is shipped as broken, and is returning values in carload lots of between \$15 and \$20. The full width of the ore body has not yet been determined and until a depth of at least 50 ft. is attained sinking will be continued. A drift may be run out from the 50-ft. point, when the dimensions of the ore body can be determined.

A new ore house is being constructed at the Dillon mine. Superintendent McCarthy expects to be using the structure by Aug. 28. The Dillon mine continues to keep two teams busy loading out ore and the daily shipments aggregate 70 tons. With the new ore house completed the tonnage will be raised to 100 tons.

A thorough and successful test is in progress at the Rex Gold Mining & Milling Co.'s Ironclad hill plant, on the low grade ores from the company's properties, on which the mill is located. It has been treating between 60 and 75 tons daily for about 3 weeks, and these tests have proven that the oxidized product taken out from the open cut, some of a value not to exceed \$1.25 a ton, can be treated with a slight margin of profit. Ore above this grade, and the general average to date has been close to \$4 a ton, costs no more to mine or treat, and handled at the full capacity of the mill, 100 tons daily, would be profitable.

Development is progressing at the Shoo Fly mine. A depth of 150 ft. has been attained in the shaft now being sunk on Womack hill, and with 35 ft. additional depth, at 185 ft. it is proposed to cut a station and drift through the Iowana claim adjoining the Shoo Fly on the west. Connection is also projected with the Iowana tunnel, thereby affording exit from and ventilation for the workings of both properties. This tunnel, long neglected, has been found upon examination to be free from caves and in good working condition. All that remains to bring the tunnel into use is to re-lay track. While development work is in progress, shipments will be limited. Manager Gilbert is carrying a filled stope and will ship heavily when the dead work is completed. The values are holding up in the ore broken and the next shipment to be loaded out will, it is expected, average better than 2 ozs. gold.

A good strike has been made in the Little Florence mine, owned by the Argon Gold Mining & Milling Co. and being operated under lease by M. Johnson. The vein as now exposed in the heading of the adit is from 2 to 3 ft. wide, and practically vertical, precluding present determination of the hanging or foot walls of the vein. The depth attained to date will not exceed 12 ft. and the gold is there from the subsoil down. The lode strikes northwest and as the adit is extended into the hill depth will be gained rapidly. Everything taken out to date, excepting some 3 or 4 tons of dump rock, has been shipped. Sampling the supposed waste rock it was a surprise to find a value of \$31 a ton. The "dump" will be loaded out with the next shipment.

Leadville.

The Prince of Wales Leasing Co., operating the Bartlett property on Sugar Loaf, which temporarily stopped developments several weeks ago for the installation of a power line to the property, has now resumed activities. The power line has been completed and all connections made. The lessees plan to sink the winze near the breast of the tunnel several hundred feet. A heavy flow of water was encountered in the winze while the work was being carried on last spring and pumping was necessary before sinking could continue. Electric pumps have been installed in the tunnel and everything is in readiness for extensive development. Rich bodies of high grade silver were found in the Bartlett during the early

days. The last large vein was lost in an expansive cave which partly closed the tunnel years ago. Conditions at the time made it inadvisable to reopen the tunnel in search of the buried ore shoot and it stood idle.

The Colorado Power Co. is constructing two lines. One is to the Mikado property, where G. O. Argall is planning a draining and development enterprise. One line will be brought to the Mikado from the Iron Silver line running to the Tucson on the top of Iron Hill while the other will be extended from the Yak-Waterloo line, which runs through Stray Horse gulch and Graham park. The construction work is progressing, and, according to Manager Morarity of the power company, the lines will be complete before they are required at the Mikado. The transformer will stand in Stray Horse gulch, just below the property.

Boulder.

The Degge-Clark Co., concentrating tungsten ores, formerly purchased outright all satisfactory ores offered. The new plan is to make a straight custom concentrator of the plant, receiving and running a shipper's product and turning over to him the concentrates. Lots of 5 tons and more will be treated separately and the concentrates delivered to the owner or stored for him. A regular schedule of charges for concentrating has been issued. The shipper may pay this charge in cash and remove his ore or Degge-Clark will hold the charge against the concentrates while in storage and will act as agents for the sale of the lot, subject to the approval of the owner. This plan will permit the miners to have their product reduced to commercial material and held in shape for immediate delivery on demand.

IDAHO.

Kellogg.

The July net earnings of the Caledonia Mining Co., which owns and is operating the Caledonia mine, were \$90,000, according to Stanly A. Easton, president and general manager, who states that production is being maintained at the normal rate. He says also that development on the Keating tunnel level so far has failed to locate the ore body, which faulted several months ago, but that the work is being continued. The company on Aug. 24 declared the regular monthly dividend of 3 cts., or \$78,150, payable Sept. 5 to stockholders of record Aug. 25. This will make the payments for the current year \$677,300 and will increase the grand total to \$1,560,031, or approximately 60 cts. per share on the entire capitalization of 2,605,000 shares at \$1 each.

Burke.

The terms of the 10-year lease recently acquired by the Consolidated Marsh Mines Co. on the Mono, O'Neil and Russell claims of the Federal Mining Co.'s Tiger-Poorman group, adjoining the Marsh holdings here, were made public Aug. 24, when the contract was filed with the recorder of Shoshone county. The agreement states that the Marsh Co. is to expend not less than \$40,000 developing the Marsh group and the leased holdings, such expenditures to be made under the control of the Federal Co., but the work to be supervised by the Marsh management. Operations are to begin immediately, and not less than \$2500 are to be expended each calendar month. If the Marsh Co. fails to comply with the provisions of the contract, the Federal Co. retains the right to institute action for alleged trespass of the former corporation on the grounds of the leased claims, and the Marsh officials agree to waive statute of limitations. Under the lease the Marsh shall account to the Federal Co. for milling ore on the following basis: When the milling ore contains 9% lead or less the royalty shall be 35 cts. per ton milled, and for each unit of lead above 9% the royalty shall be increased at the rate of 25 cts. per ton for each unit in excess. This rate is to apply when lead is $5\frac{1}{2}$ cts. per pound New York, and when higher than $5\frac{1}{2}$ cts. the royalty shall be increased at the rate of 30 cts. per ton for each cent above 5 cts. per pound, fractions proportionately. The royalty on crude ore is 15% of the net smelter returns when lead is $5\frac{1}{2}$ cts. in New York, 20% when the price is $5\frac{1}{2}$ to 7 cts. and 25% when the price is 7 to 8 cts. The Marsh Co.

also agrees to pay all taxes and hold the Federal Co. free from loss or damage by reason of personal injuries, liens or other encumbrances. The expenditure of the \$40,000 on development is mandatory, in order to secure the validity of the lease. The Marsh Co. also agrees and has signed an ore contract to sell all the ores to the A. S. & R. Co. Any reorganization of the Marsh Co. is bound by the agreement and lease.

Wallace.

Speculation is rife regarding the plans of the Tamarack & Custer Mining Co. relative to providing facilities for treating its output, but the management seems unwilling to give out any information, and stockholders as well as investors are in the dark as to the corporation's future policy. Since operations were begun nearly 2 years ago, following consolidation of the Tamarack & Chesapeake and the Custer companies, the output has been treated in the old Rex mill, now owned by the Rex Con. Co., but the latter has resumed possession of the plant, and production at the Tamarack & Custer has been suspended. The tramway that connected the Rex mine and mill was removed to provide transportation for the Tamarack ore when the lease was secured, but the carrier now is being restored to its former location, in compliance with the terms of the contract, and it is believed that the Tamarack properties will be idle for an indefinite period. It is rumored that the Tamarack Co. is endeavoring to purchase the Frisco mill from the Federal Mining Co., but that the latter refuses to transfer possession of the plant unless the Frisco mine is included in the sale. It is said also that negotiations are pending for purchase of the National Copper Mining Co.'s 500-ton daily capacity plant at Mullan, Idaho, recently closed down because the National Copper ore could not be treated at a profit. Other rumors are to the effect that the Tamarack Co. is seeking to secure an agreement with the Federal Co. for a permanent easement through the No. 6 tunnel of the Greenhill-Cleveland property. Not to exceed 2000 ft. of work would connect the Tamarack undergrounds with this artery, giving an outlet on both the Northern Pacific and O. W. R. & N. tracks, and eliminating the necessity for tramping the ore. The real reason for suspending operations generally is believed to be that the Northport smelter, constructed to treat the product of the Hercules and Tamarack & Custer properties, is buried with shipments, and that the congestion will not be relieved until the third furnace, now being installed, is in commission. In this connection it is said that the Northport plant's output will not be increased, as the A. S. & R. Co. is exerting its influence in the lead market to prevent the Northport Co. from marketing its product to advantage.

LAKE SUPERIOR.

COPPER.

Houghton.

Michigan is now about 46 ft. beyond the Omigah lode, or 234 ft. from the Butler lode, with its shaft and is meeting with a little copper every few feet. A fault is being encountered on one side of the drift and is consequently at right angles to the formations, which makes it easy for the men to cut out the rock. The western drift is in better rock than for the 10 days previous. The eastern drift is cutting up a stope now 30 ft. high at the top of lode, but will immediately continue the drift. The copper there is both mass and stamp. The mine is yielding a lot of the heavy mass. One piece 3000 lbs. in weight and another of about half that weight were taken out on the 22nd. This territory abounds in copper and it seems that wherever there is a crack or fissure the metal is found. From the present showing it appears quite strongly that a mine will be found here.

North Lake should at any moment enter a lode disclosed in No. 13 drill hole 47 ft. wide, with some copper and with a little in seams above and below the lode at a depth of 392 ft. This lode is the same that was found by the No. 10 hole at the depth of 1137 ft., with good copper values. The hole at the depth of 1137 ft., with good copper values, 10 ft. There was also found in No. 13 hole when 124 ft. down an amygdaloid 11 ft. thick, with copper over its top.

are under way, and the officials state that they hope to resume work in the near future. It is intimated that money for a broad development campaign has already been pledged. This is one of the most attractive looking properties in the central part of the district and resumption of work on it will stimulate development in adjoining properties.

United Northern is crosscutting on the 400 level, and because of the stringers of highly oxidized hematites and quartz showing, Engineer Goldsworthy believes that the cut is very close to the vein and that good values will be found when it is penetrated.

Officials of the Tom Reed Mining Co. state that bullion valued at \$65,000 has just been shipped to the mint as the result of 2 weeks' clean-up. The mill is steadily running at full capacity, and insiders are predicting a resumption of dividends in the near future.

Esperanza and Lazy Boy are now working three shifts, sinking, after having been inoperative for some time.

Adams, Nellie, Murdock, Arizona Central, Hi Henry, Jerome Oatman, North Star, United Western, Midway, Oatman United, Sun Dial, Oatman Amalgamated, Oatman Syndicate, Arizona-Tom Reed, Pioneer, Arizona Rex, Blue Bird, Boundary Cone, Chicago Syndicate, Ivanhoe, Iowa, Oatman Combination, Oatman Crescent, Telluride, Tipperary, and Wrigley Exploration are steadily operating.

Gold Reed is drifting and crosscutting on the 500 level and is reported to be opening satisfactory bodies of \$10 to \$18 ore. Mill tests of some of this ore are now being made.

Gold Ore is steadily developing, although milling operations have been checked by labor troubles at the Gold Road plant, which has been treating the ore from this property.

Gold Dust is steadily blocking out ore on two levels, while Gold Key, adjoining, is also reported to be placing a considerable tonnage of pay ore in sight.

Although it is reported that the Times Co. is well financed, operations have been discontinued. It is intimated that some change in the personnel of the company officials is pending, and that by the first of October operations will be resumed.

By the middle of September the hot weather will have been broken, and mining operations throughout the Oatman district will be materially increased. Already many operators who left on account of the hot weather are returning and preparing to resume work.

Jerome.

Sampler and smelter returns show 3,500,000 lbs. of copper from United Verde Extension (Little Daisy) during August. These figures correspond closely with the copper matte figures for July. The ore tonnage shipped during August was considerably less than July, showing that the average copper content of the ore was higher. The winze being sunk on the 1400 level is down better than 80 ft. in ore which carries from 20 to 50% copper. Native copper is a feature in the winze and the level above.

With the pump on the 700 level of the Jerome Victor Extension shaft, it is only a question of days now until the workings are completely drained and the work of sinking is started on the 1200 level. The officials of the company authorize the statement that there is no truth in the rumor to the effect that legal action has been taken in the matter of the purchase of the property by the Monarch Co. and its subsequent transfer by the latter to the Jerome Victor Extension Co. So far as can be learned, no legal step affecting title to the ground is contemplated as there is nothing upon which such an action could be based. With the unwatering of the shaft, therefore, it is probable the troubles of the management will be of the past.

Control of the Venture Apex property adjoining the Venture Hill Co. in the Jerome copper belt, will within a few days be vested in H. E. Schumate and other mining men of Prescott and Jerome. The first payment was made about 10 days ago and will be followed shortly by payment in full and a change in control as stated. The deal covers 85 acres. Development work in a tunnel 600 ft. long has exposed copper ore of commercial value and apparently in place. On the dump there are about 150 tons of ore that samples well.

Another tunnel has a length of 300 ft., but is not yet in the ore. A number of shafts from 25 to 50 ft. deep have also been sunk at various points.

The shaft on the property of the Jerome-Portland Co. is down better than 75 ft. in a schist formation that shows strong copper indications. A compressor and other mine machinery have been installed, and the necessary camp buildings are being erected. The working force numbers 15 men.

Montana capital, represented by George D. Case, formerly of the Anaconda Copper Co.'s smelter, is back of a plan to finance and develop a group of claims south of Jerome. Several prominent mining men of the Jerome field are likewise interested in the project, among them being C. V. Hopkins, chief engineer of the United Verde Copper Co., and George Mitchell, former superintendent of the United Verde Copper Co.'s smelter.

Miami.

Inspiration Needles Copper Co., owning 35 claims, 500 acres is acquiring Miami Needles group of 11 adjoining claims. This will give Inspiration Needles 720 acres, a compact tract lying one-half mile west of Inspiration Con. Nearly 500 acres of the Pinal schist ore-bearing porphyry formation of the Miami Copper belt underlie the Inspiration Needles tract. This is traversed throughout its extent by the contact between the Pinal schist and the overlying Schultze intrusive granite. This contact zone produces the ore bodies in the Miami district. John S. Cook, Globe, is financing the development by churn drilling. Two drills are down about 400 ft., showing patches of oxidized copper. Two more drills are contracted for and should arrive the last week in August. Ultimately 7 drills will be in operation. Sulphide ore is expected at about 600 ft., judging from its occurrence in the tunnel on the Standard No. 5 claim.

Wenden.

The mines near Wenden are attracting capital and many new companies have been formed and are now doing development work. The "Critic" mine is shipping one car per week of copper-gold ore that yields \$3000 per car net. The Desert mine is now equipped with gasoline hoist and air and Black Reef mine is installing a plant of a like nature. Both of these properties will be producers as soon as the necessary improvements can be made.

Crown King.

Eastern capital has taken over the leasehold on the Tiger Gold property in the Crown King country, hitherto held by C. C. Cowan and R. W. Runnels. The latter returned here a few days ago from the East where negotiations for the transfer were consummated and plans for the future development of the property were made. Under the new regime the main-working shaft is immediately to be unwatered and development of the ore bodies taken up. In former years the Tiger Gold produced a large tonnage of high grade gold ore. As the shaft was deepened values fell off somewhat and base minerals made their appearance. The milling appliances then in use proved inadequate to handle the base ore and the mine was closed down. Modern methods of mining and milling make possible the profitable reclamation of the mineral contents of the refractory ore. A considerable tonnage of the latter is exposed on the various levels of the mine.

CALIFORNIA.

Copperopolis.

At a depth of 15 ft. an 8-ft. ledge of gold-copper ore has been encountered in the Napoleon mine. A new shaft is going down in ore and the vein is steadily widening. The old mill is being overhauled and will be placed in commission soon. It is likely a small flotation plant may be installed.

Wood.

The Weringer Mines Co. is constructing a flotation plant of 100 tons capacity at its copper mine here. It is planned to start production within 90 days. Developments have been in progress about 5 years and it is stated sufficient

to keep the plant in steady operation for 2 years. High-grade chalcocite has been exposed in the crosscut from the 200 level and the winze is going down on a strong body of material. Shipments of rich sulphides are being made at the rate of a car load weekly.

Auburn.

The Pacific Dredging Co., a subsidiary of the Yukon Gold Co., has contracted for the thorough prospecting of gravel deposits along the north fork of the American river from Auburn to Colfax. Prospecting of the Grottlan ranch is proceeding with a large drilling outfit. Codfish canyon and Manhattan bars, both famous producers, will be given principal attention. Satisfactory results will be followed by the building of one or more dredges.

Oroville.

Natomas Con. has started re-dredging of the first land successfully worked by the dredging practice in California. On the tracts formerly worked by dredges, Couch No. 1, 2 and 3, the company has installed Feather River dredge No. 1, provided with the latest gold-saving appliances. The boat is expected to not only profitably work the old tailings, but to restore much of the land to a state of fertility. Successful culmination of the experiment will be followed by the placing of several boats in operation.

Daggett.

Arrangements have been made to convert the 200-ton mill of the Daggett Reduction Co. into a custom plant for treatment of ores from the Goldstone district. The mill will operate in the interests of lessees and is expected to stimulate developments in the new gold camp. Shipments of rich ore continue to be made from the leading mines and deeper work indicates some of the ore bodies will probably persist to considerable depth. A considerable percentage of the ore is free milling.

Jackson.

A general strike of miners along the Mother lode is threatened by labor leaders unless a further advance in the wage scale is granted. The operating companies state it will be impossible to meet the demands, as many are operating on small margins of profit, and another advance would mean actual losses. The scale ranges from \$2.75 to \$3.35, depending on the property and the class of labor. A few of the leading concerns recently adopted a scale of \$3 to \$3.25, and it is thought will not be affected by the trouble.

Construction of the new mill of the Argonaut Co. is nearing completion and the stamps will start crushing soon. The plant contains 60 heavy stamps and numerous departments calculated to lower costs and increase the gold recovery. The old mill has 40 stamps. From the final set of tables tailings will flow into an impounding pond, served by a dam 400 ft. long and 40 ft. high at the lowest point.

Additional rolls and concentrators are being added to the mill of the Bunker Hill Con., near Amador City. Recent developments have materially augmented supplies of visible ore, and the plant is operating at capacity. Dividends continue to be disbursed at the rate of \$5,000 per month.

Carrville.

The Pacific Dredging Co. has completed the hull of its massive dredge in Morrison gulch, and is installing the machinery. Within 60 days the dredge is scheduled to go into operation. A large acreage of excellent ground has been proven and the company is still prospecting broad areas along the Trinity river and its tributaries with Keystone drills.

Nevada City.

The bed and banks of the South Yuba river for a distance of 2000 ft. below the junction of Humbug creek and the river have been taken under bond by W. W. Kirkham, R. L. Plummer, and L. R. Kirkham of Nevada City, and leased to E. W. Kay and associates of San Francisco. It is planned to divert the river from its course and to shovel the gravel and sand into sluices for extraction of the gold.

Darwin.

The Darwin Development Co. is operating the Columbia Lane, Jim and Promotory mines with good results. On the 600 level of the Jim a 2-ft. ledge of \$125 ore has been cut. Rich ore has also been opened in the Promotory. From latter a tramline is being constructed to the mill. The

mill practice is unique. After being finely crushed the ore is mixed with small quantities of oil and magnetite and rotated with a number of small steel balls. The minerals concentrate on the balls from which they are removed by friction on a screen. Tests show a recovery of 85 to 87%.

Big Pine.

The Bunker Hill mine, east of Big Pine, has been acquired by J. F. Fitting, the Nevada operator, and arrangements made for extensive work. Some good ore is blocked out and further satisfactory work will be followed by the building of a mill.

Sonora.

Unwatering of the Omega mine has progressed to a point beyond the 300 level and mining has been resumed at the 200 and 300-ft. points. As soon as the 600 level is cleared of water extensive drifting will start to seek the big ore body which formerly yielded well; 20 men are employed.

A bond has been taken by Boston capitalists on the Bell mine, near Tuttletown, and unwatering of the shaft will start as soon as equipment can be assembled. The mine has produced well and contains wide ledges of good-grade quartz. It is a typical Mother lode property. Operations will be in charge of Paul S. Bernard.

Mokelumne Hill.

Rich gravel has been uncovered in the lower channel of the Stockton Ridge mine and the gravel mill is running at capacity with good results. The mine has been developed by a 3000-ft. tunnel and comprehensive lateral workings, and is well equipped. George Chapman is superintendent.

Ubehebe.

The Lost Burro gold mine, 4 miles from Ubehebe, has been taken under option by the Montana-Tonopah Co. and is being examined by company engineers. The principal vein has an average width of 4 ft. and assays \$19 to \$21 in gold. Tests indicate 85% of the metal can be recovered by amalgamation. A good flow of water has been developed within 2 miles of the mine.

Folsom.

A new jig has been invented by Emory Oliver, L. D. Hopfield, F. W. Griffen and Edward Strous of the Natomas Con. Co., that has proven its ability to recover 90 to 97% of the fine gold formerly lost in gold dredging. All the Natomas boats will be equipped with the new device, which is expected to save the company thousands of dollars daily.

COLORADO.

Cripple Creek.

Supt. McDonald has temporarily suspended sinking at the main shaft of the Strong mine in Victor, where a depth of approximately 1500 ft. has been attained. He is now engaged in cutting out the station for 1400 level. The elevation at the collar of the Strong shaft is 9756 ft. so that the station will be located at an elevation of approximately 8256 ft. As compared with the Portland No. 2 shaft, the Strong mine is now the deeper. The Portland No. 2, is 10,244 ft. above sea level at the collar of the shaft, and 1900 ft. deep, so that the bottom level station is located at an elevation of about 8344 ft. as compared to 8256 ft. for the Strong. If the depths are correct the Strong is 88 ft. deeper, but it is possible the laterals from the Strong may be carried out at the same approximate elevation for possible connection at a future date.

W. F. Kendrick, Denver, president and director of the Anona Mining Co., owning in all about 26 acres adjoining the Isabella Mining Co., and old Victor Co., on the eastern slope of Bull Cliff, has visited the property and arrangements are being completed for the resumption of work.

Progress is being made with the drive from the 1000 level of the Vindicator Con. Co.'s main shaft to a point directly under the main shaft of the Hondo Co. south from the Vindicator. This lateral will be approximately 900 ft. in length, when the objective point is attained. Of this distance about 450 ft. has been covered. The lateral is now well within the boundary lines of the Hondo Co.'s estate, and important developments are anticipated. The lateral has crosscut several

& Arizona Copper Co. to the Goodrich-Lockhart people of New York, and that the latter have taken possession of the mine holdings and books. The deal, as ratified, provides for the payment to the Goodrich-Lockhart people of 2,000,000 shares of Arkansas & Arizona for the properties of the Mowles Copper Co. and a year's option on 1,500,000 additional shares at 25 cts. per share. Reports from Jerome are to the effect that development work is immediately to be resumed.

Important Tungsten Deposits of Inyo County, Cal.

The demand for tungsten has recently led to an extremely energetic development of the tungsten deposits 8 miles west of Bishop, Inyo county, Cal. The deposits were discovered in 1913 but remained practically unknown until the spring of 1916. On April 7 the Standard Tungsten Co. began work. Trails and roads were built, ore bodies were opened up, a mill was erected and electric power was brought in. On June 7 the mill began to crush ore. The Tungsten Mines Co. started work on May 1 and by the later part of July had completed a mill of 300 tons daily capacity and was rapidly opening its main ore body, disclosing a lode as much as 60 ft. wide. This activity has greatly stimulated prospecting, and tungsten has been found in a belt 15 miles long.

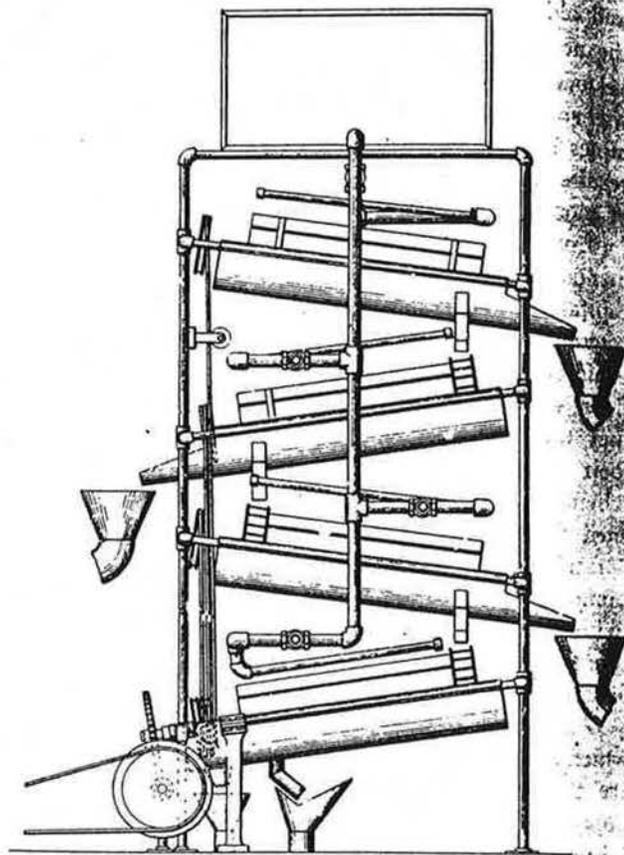
The ore bodies, which have been visited by Adolph Knopf of the Survey, are remarkable and in fact are of a kind not mentioned by the recognized authorities on ore deposits as a commercial source of tungsten. The ore consists of scheelite associated mainly with garnet, epidote and quartz. The general country rock is granite, but in it are scattered masses of limestone which became mineralized at the time when the granite cooled from a molten condition. The limestones were altered to masses of garnet carrying subordinate scheelite by the metallic vapors then given off, and these are the ore bodies now worked. They average about 2% tungsten trioxide (WO_3). The deposits, like those recently discovered near Lovelock, Nev., belong to the so-called contact-metamorphic class, a well known source of copper but not heretofore recognized as a source of tungsten.

The fact that the tungsten-bearing mineral—scheelite—is associated with garnet is a great help to the prospector, and all bodies of garnet rock scattered through the great granite masses of the eastern Sierra slope bordering Owens valley are being carefully examined and panned for scheelite.

Ferrous oxide (FeO) is a transitional product in the reduction of higher oxides and the oxidation of metallic iron. It is not known in the isolated state, owing to the readiness with which it combines to form higher oxides and salts. It is basic in character, forming easily fusible compounds with silica.

New Ore-Classifying Machine

Selden I. Clawson, Salt Lake, Utah, describes in a recent patent an apparatus for classifying ore, in which the screens are cleansed with water, which is at the same time mixed with the material to assist in the process. The illustration shows a side elevation, the inclined screens being either rocked or revolved, according to type, by power supplied as shown. A system of piping carries water from the storage tank above to nozzles located above each screen. From



AN ORE CLASSIFYING MACHINE.

these nozzles the water is forced in jets onto the screens. In this patent are described a number of screens to cover all operating conditions. In one type, which rocks, partitions are arranged to retard the material in its passage. In another there is a screw which revolves and forces the material slowly along the length of the cylindrical screen. Underneath the screens are inclined troughs. Each trough collects material of a certain fineness and delivers it to a conveyor tube.

Fluxes are divided into three classes—acid, basic and neutral. Silica is the common acid flux. The basic fluxes are lime, magnesia, ferrous oxide, manganese oxide and alumina, which is feebly basic. Fluorspar is a neutral flux.

Anode mud obtained in the electrolytic refining of copper is treated for the recovery of silver and gold.

view of proving the width of the new ore body. As soon as the new road to the Pittsburgh-Jerome property, now under construction, is completed, the new compressor, hoist, and other equipment will be rushed to the mine for installation and development, which should soon bring it into the producing class.

Prescott.

Considerable excitement in the Crown King district has followed the strike made recently in the Fairview mine. A sulphide ore body for the full width of the shaft has been uncovered. A vein 18 ins. wide is located near the mouth of the tunnel and work of sinking has been under way but a short time. Until the time of the recent strike the principal work on the Fairview has been the extending of the tunnel, a 3-ft. body of oxidized ore, giving about \$30 in gold, having been developed.

Perfection of plans for developing the Black Chief mines, near Dewey, has been completed and development started. The main shaft being sunk from the 100 level is progressing rapidly and a depth of about 50 ft. has been reached, with ore conditions satisfactory. Sinking will continue, with other exploration, until the 300 level is reached.

Pumps of sufficient capacity to handle any flow of water that may develop in the shaft, and a new hoist, compressor and other equipment are on the way to the Dundee-Arizona property. The Dundee shaft is now making 600 gals. of water an hour, and it is reported that the new pumps are to have a capacity of 2000 gals. Although no work has been done in the shaft since water was struck last week, the superintendent has been busy since then completing the raise from the tunnel level to the crosscut that was run westward from the 65 point in the shaft.

CALIFORNIA.

Jackson.

With the exception of the Old Eureka mine at Sutter Creek, and the Keystone and Little Amador at Amador City, every gold mining property in Amador county is idle and 1850 men are on strike. Mine operators declare the mines have been closed for an indefinite period and that the demands for higher wages will under no consideration be granted. The miners demand \$3.50 per day and \$3 for carmen and muckers. At the Old Eureka, Keystone and Little Amador the advanced scale prevails. Thus far no trouble has developed. The majority of the men are from southern Europe and it is thought probable that clashes will develop, although leaders assert there will be no violence. Operators met the strike with a lockout. Amador county is the leading gold producer of California and the strike is certain to seriously cut down the annual output of the state.

Grass Valley.

All miners in the Grass Valley and Nevada City districts have been granted an advance of 25 cts. per day in wages and there is no fear of the Mother Lode labor troubles invading this field. Mine managers state the raise was made as much to retain efficient men, tempted by the high wages prevailing in the copper regions, as for any reason. No labor trouble is considered, as this field has been remarkably free of such disturbances and the best of feeling prevails.

The Empire Mines Co. has arranged for the building of an electric railway from the Pennsylvania mine to the Empire mill, a distance of a mile. It has been decided to increase the capacity of the mill from its present 60 to 100 stamps, and to crush ore from the combined properties. As soon as it is in commission the 20-stamp Pennsylvania mill will be dismantled. The enlarged Empire plant is intended to treat 600 tons per day, making it the largest quartz mill in California. Late developments in the Empire at a depth of 4000 ft. have been highly encouraging, the new vein at this point proving to be one of the best ever developed in the district.

Another rich discovery has been made in the Golden Center, the strike being made at an approximate depth of 1000 ft. Much specimen ore shows and the vein is stated to be

over 3 ft. in width. Driving of a crosscut to tap the ore in the adjoining Peabody mine will be started shortly from the newly opened 1000 level of the Golden Center shaft. Arrangements have been made to materially augment the capacity of the mill. At its Allison Ranch property the company has unwatered the shaft to a depth of 80 ft. and is retimbering portions. Equipment is arriving for the new mine plant and mill and the management expects to have it installed by the end of November. The pumps and hoist will be installed first and unwatering of the shaft rushed.

Keeler.

A caterpillar train, consisting of an engine and 5 trailers, has been placed in operation between the Santa Rosa mine and Keeler. It has a capacity of 25 tons per trip. Driving of a new lower tunnel has started and is designed to intersect the ore bodies 500 ft. below present workings. Satisfactory developments will be followed by the driving of another lower tunnel. The management states 15 north-south veins outcrop, with more than 10 cross veins in evidence. The ore contains silver, lead and zinc, and much is high-grade. The property is controlled by the West End Co. of Tonopah.

Ore shipments from Keeler are the heaviest in history. Motor trucks and mule-trains are crowding the highways, and the railroad is taxed to capacity to get consignments to the smelters. The Cerro Gordo is maintaining a particularly heavy output, and is also shipping to advantage the slag deposited when the old furnaces were operated. Most of the ore going out from the district contains zinc, or silver-lead.

Campo Seco.

Suits filed 3 months ago by 33 Mariposa county farmers against the Penn Chemical Co. have been dismissed by consent of all parties concerned. The suits were brought to recover damages alleged to be caused by fumes from the smelter near Valley Springs. It is understood the company compensated the farmers for all losses demonstrated.

Placerville.

San Francisco people have purchased the Rocky Bar gravel mine in the Fairplay district for \$50,000. Arrangements are being made for operation of the property along broader lines, and considerable new development work will be done. The mine is excellently equipped and has long been one of the premier placer gold producers of the district.

Work has been started at the Pyramid mine, near Rescue, with a force of 15 men. The 500-ft. 2-compartment shaft has been unwatered and repaired and will be sent 200 ft. deeper. The mine contains considerable ore in old workings and is well equipped. Charles Evans is superintendent.

The Badger Hill gravel mine, near Camino, has been reopened after lying idle 22 years. The old tunnel is being placed in shape for extensive work and driving of a 600-ft. lower tunnel has been decided on.

Mokelumne Hill.

The Eclipse gravel mine in Chili gulch has been taken under bond by W. H. Morrison and J. Miller of Stockton, who are arranging for extensive work. The property is traversed by the Blue Lead channel and considerable black sand, carrying gold and platinum, occurs. New devices are being installed to save these values. The Eclipse is owned by A. H. McCarty of Mokelumne Hill.

Taylorville.

The report of the Engels Copper Co. for the half year ending June 30, 1916, has been issued. It shows gross earnings of \$475,578, and a net income of \$226,224. Large sums were expended on additional equipment and in the extension of new developments. Large deposits of profitable ore were indicated in outside ground by means of diamond drills.

Grass Valley.

The final payment has been made on the purchase price of the Union Hill mine and preparations are being made to send the shaft 400 ft. deeper and crosscut in expectation of intersecting the Union Hill and Georgia ledges. A new electrical plant will also be installed. Some good ore is being worked in the main levels and small shipments of ore are being sent out occasionally. The entire purchase price is said to have been about \$80,000. The present owners

comprised largely of San Francisco, Los Angeles and Pasadena people. The mine is equipped with excellent hoisting and pumping equipment, and a 20-stamp mill.

Hart.

Oro Belle Mines Co. will be taken over by a new company to be organized and in which John Hays Hammond and associates of New York have agreed with President W. B. Andrews and his directors to assume the controlling interest on an optional basis. This gold mine is for the greater part owned in the Copper Country and in Duluth, and it has 1,000,000 shares. It has a shaft 850 ft. deep that was thoroughly repaired about a year ago with considerable other exploratory work. In the two veins that have been opened there are gold values of commercial importance. R. C. Pryor, H. W. Fesing, R. M. Edwards and Prof. A. E. Seaman of the Michigan College of Mines, all of Houghton, are among the large stockholders, and the main office is located there. The details of Hammond's proposition have not yet been given out, but as far as it is known it is favorably regarded by the stockholders, and there will be no doubt of its ratification, when it is submitted at a meeting soon to be called.

COLORADO.

Cripple Creek.

At the 800-ft. or 10th level of the C. O. D. mine a 6 by 8 hoist to be operated by air has been installed and will be used for sinking. The work has been delayed, but Supt. Williams expects to start Oct. 1. The company is mining a good grade of milling ore from the main C. O. D. vein under development at the 6th level. The raise carried by the Sun Tungsten Co., Denver, on the new vein lying east of the main C. O. D. is entering richer ground and values have risen to as high as \$12 and \$15.

Settlement for a 2-car shipment from the Isabella Mines Co. has been made. The ore was mined by the company at the 16th level of the Lee shaft, from the ore shoot on the Buena Vista vein. One car of screenings brought 4.23 ozs. gold, \$84.60 per ton. A car of coarse rock returned higher values, the settlement having been 4.55 ozs., \$91 per ton. The net returns exceeded \$4000. The shoot on the Buena Vista from which this was mined has been stoped to a point above the 15th level within 40 ft. of the 14th level. A lateral is being carried out from the 14th level to tap this shoot. Ore with an average value of \$30 is also being mined by the company at the 15th level on the East Victor vein, and the winze being sunk to prove continuity of values is down 35 ft. with values holding. Work on the ore house for the Lee shaft is progressing. The building is equipped with ore washers and will be heated by steam. By Oct. 2 three of the bins will be ready for use.

The Gillard Tungsten Mining & Leasing Co. has recently shipped out a shipment from the property of the Gold Bond Mining Co., on which the company has secured a bond. The company recently purchased a hoisting plant from the S. H. Machine Co. of this city, and has ordered a 6-hp. compressor from Denver. The company has plans under preparation for a 100-ton mill. Flotation and cyanide processes will be used. It is planned to treat low-grade cus-

Leadville.

According to John Nelson, who has the contract for timbering the Mikado shaft, the work will be completed by Sept. 20. Timbering has been finished from the collar to within 74 ft. of the water level at the 900 level. Foundations for the new hoist are being laid and preparations for the draining and developing enterprise planned for the property are being carried out. New surface buildings are being erected at the shaft preliminary to the installation of the power and machinery plant.

Sinking pumps at the Penrose are being moved to the station, as sinking has been completed. The shaft containing water pipes from the pumps and the shaft being cleared. While sinking was in progress two shafts were devoted to the pumps, both containing a

separate column and power cable. With the lowering of the water to the bottom level and the subsequent installation of the 2000-gal. station pump at the bottom, the service of both sinkers was no longer required. One compartment containing the original column for one of the sinkers and the new column for the station pump was then designated as the pumping compartment was undertaken. The two sinkers were moved from the shaft into the bottom station. One machine is now connected with its relief pump at the 450 level and is operating. The column for the other is being moved. This plan of concentrating the pumping power into the bottom station and gathering the water columns and cables into one compartment is for the purpose of opening two compartments for hoisting. As soon as the machinery is placed it is planned to develop the property on a large scale. Present reports state that the preliminary work at the Penrose will be complete by the end of September. Some development is under way in the upper workings, but this is more of a preparation for the work to come than a new undertaking.

Breckenridge.

Bulkeley Wells, formerly operating the Smuggler-Union mine, and now agent for a mining syndicate, is operating the old Puzzle mine for the Puzzle Leasing Co. He will proceed at once with preparations for sinking a 2-compartment shaft to 150 ft. below the tunnel level. The property is to be equipped with machinery for deep work. Electric drills are to be installed and one is on the ground and in operation. Installation of new machinery, overhauling of the present plant and other preliminary work will delay actual sinking until Oct. 1 or later. At that time it is expected that three shifts will be started. When completed, a depth of approximately 500 ft. will be attained. For the past 2 years, the Puzzle Leasing Co., operating through the Puzzle tunnel, has been developing the Gold Dust property. A shaft has been sunk a distance of 60 ft. from the Puzzle tunnel level and 1000 ft. of drifting has been done. The work has determined so far that lead-zinc ore shoots go down, and that former operators by no means exhausted the ore. On the level below the tunnel a large ore reserve has been blocked. On both the foot and hanging walls are lead-zinc streaks of good width, carrying values in gold and silver. From these streaks the shipping material has been taken. Between them lies a 20-ft. body of lower grade ore, which if determined intact at the depth to which the shaft will go, will furnish a milling proposition.

IDAHO.

Wallace.

The net profits of the Federal Mining Co. for the quarter ended July 31, 1916, were \$268,287, as compared with \$290,891 for the previous 3 months, according to the official report to stockholders, under date of Aug. 27. Shipments during the period were 38,972 tons, as against 31,844 for the first quarter of the current year, and the net earnings for the 6 months were \$624,029. Depreciation charges for the first quarter were \$65,234, and for the second quarter, \$64,006, and dividend payments to Oct. 1 were \$360,000. Shipments in February were 8558 tons; March, 10,627; April, 12,659; May, 13,707; June, 13,375, and in July, 11,890, while the net profits for the same periods, depreciation not deducted, were as follows: February, \$77,663; March, \$131,753; April, \$146,709; May, \$174,934; June, \$99,640, and July, \$57,719.

M. J. Sweeny, president of the Rex Con. Mining Co., which was organized a number of months ago to take over the old Rex mine and mill in the Nine-Mile district, and who also has been general manager since development was resumed at the property, has resigned the latter position, and Raymond Guyer, widely known mining engineer, has been chosen to succeed him. Guyer already has assumed his new duties, and President Sweeny will devote his entire attention to the executive affairs of the corporation. The Rex mill for a number of months was under lease to the Tamarack & Custer Mining Co., which last week bought the Frisco mill at Gem from the Federal Mining & Smelting Co. for \$150,000, and the Rex plant now is being remodeled, preparatory to

gross revenue represented in these items is about \$130,000. The production of zinc and silver continues at the usual rate and management believes that the dividend rate may easily be maintained.

COLORADO.

Georgetown.

At the Capitol mine, which for years has been worked as a producer of silver, leasers have opened a vug of ore estimated to contain \$100,000. Three weeks ago miners working on a raise 290 ft. from the main tunnel level uncovered a streak of ore 2½ ft. wide, all first-class, which ran 1390.41 ozs. gold. Alongside this is another streak 3 to 4 ft. in width which gave 88.50 ozs. gold.

Telluride.

The Wagner Development & Mining Co., operators of the Alta mines and other groups in Gold King basin, has purchased the Junta 65-stamp mill, including the tramways, etc. Next year after the completion of the new wagon road now in course of making the entire purchase will be moved up to include the Alta mines.

The Ophir Gold Mines & Reduction Co. has filed articles with the county clerk. The holdings of the company are those which Jim Belisle and Newton Sankey have been developing. The directors for the first year are C. M. Goddard, Denver; James M. Belisle and Newton Sankey, Norwood. They have a number of gold-bearing claims above Ophir and also have a vein of molybdenite from which some nice specimens have been taken.

The Tomboy, Smuggler and Liberty Bell mills are making more concentrates from the individual properties than for years.

Manager Smith, of the Highland Mary Mining Co. at Ophir, let a contract for 100 ft. of work on its property at Swamp canon to Mose Hill. The drift they will extend is the one in which they made an excellent strike a week or so ago, and they want to determine the extent of the ore body opened.

At the Black Bear mine they are doing considerable building, enlarging the workshop, putting an addition on the converter house, etc. They will shut down for a month while they enlarge the shaft and get ready for installing a skip to take the place of the bucket now used.

The Imes at Sawpit, being operated by Ouray interests, is showing some good ore. The property is the old Fourth of July claim.

Ophir.

The raise at the Silver Bell has reached the highest or sixth level. Its raise is 2-compartment and the distance between the mill crosscut and the higher level connected is 800 ft. It was run on ore all of the way. There is a mill on the property which could be brought into use. The mill equipment is 50 stamps. Frue vanners and bumping tables, and with the flotation and grinders, the mill would be up to date. The mill crosscut is now in 1800 ft. and may be driven in further—for when work on this level was discontinued it was being pushed south towards a considerably stronger mineral zone than that through which they had previously passed. The Kracaw group upon which the company has a lease lies to the south of the Bell. These have splendid surface indications and have also been proven at some depth and are considered good claims.

Ouray.

King Bros. & Lovinggood, lessees of the St. Paul property near Red Mountain, have made another good strike on that property, opening up a new ore shoot 15 by 18 ft. The discovery was made about 25 ft. from the body opened up earlier in the spring, and appears to be even better than the old one, which has netted an average of something over \$800 per ton. Since the first of the year they have shipped about 1000 tons of ore running as above stated. They are now workmen and may increase the force.

The Gold Crown Mining Co. has decided to push its mill completion. The company has acquired some good min-

ing property and it is all situated just below the city, convenient to the railroad and its mill. Completion of the mill is the key to the successful operation of the property.

A recent good find of quartz several inches wide has been made at the Governor. Alongside the quartz are several inches of talc that pans \$5 per lb. The extent of the ore bodies are as yet unknown.

Cripple Creek.

Vindicator's flotation plant it is said will be ready for operation by Oct. 15. It is now under construction at the old La Bella buildings and new ones erected for the purpose below the Golden Cycle mine dump. During the past year the company has made numerous tests with Vindicator and Golden Cycle ores, and these tests have warranted the construction of the new plant. The mill will have an initial capacity of from 350 to 500 tons and it is the plan of the company to increase this capacity from time to time until 1500 tons daily, the ultimate capacity, is reached. In the mines of the company there are reserves of low grade ranging from \$5 to \$8 a ton available, while the ore house dumps are estimated to contain in excess of 3,000,000 tons of waste ranging from \$2 to \$3. This ore will be treated. Ore conditions in the main Vindicator shaft are said to be in better condition than for a long period past, and in places the ore body at the 16th level is reported to be 50 ft. wide and averaging \$30 a ton.

A raise from the 1st level at the War Eagle Con. has disclosed ore and a new rock house is being constructed at the War Eagle shaft. The raise carried up to within 75 ft. from surface has entered a new flat. Supt. Kissel has opened the vein for about 20 ft., and is breaking ore about 3½ ft. thick. The values are 1 oz. gold. The more important development is the cutting of the Josephine vein by a cross-cut carried 85 ft. east of the new 3-compartment shaft on the Happy Year claim, from the first level station at a depth of 125 ft. from surface. The vein as exposed measures 5½ ft. Drifting will now be started, and from past developments along this dike it is practically assured that other ore shoots will be disclosed within the boundaries of the company. Rapid progress is being made in the Happy Year shaft and a depth of 225 ft. has been attained. This shaft, the main working shaft for the War Eagle group, is to be continued down to the 500 level and from the present indications the work will be accomplished before the close of the year.

Breckenridge.

The output of the four gold dredges in Breckenridge district for 1915 was \$700,000, and it is estimated by H. J. Reiling, president of the French Gulch Dredging Co., that the 1916 production will considerably exceed that figure. The French Gulch, which operates a dredge with 6-cu. ft. buckets, is handling 70,000 cu. yds. per month, recovering about 27 cts. per yard. The record of a recent weekly cleanup showed \$5607. The dredge operates to a depth of 43 ft. on French creek, taking up about 1 ft. of the bedrock. The Tonopah Placers Co. operates one dredge on French gulch, down stream from that of French Gulch Co., of about 70,000 yds. capacity; also, a dredge on the Blue river, and one on Swan creek. The last two named have capacities of 150,000 yds. each per month. It is understood the grounds being dredged on the Blue and Swan run about 15 cts. Manager Hopkins is in charge of the Tonopah Placers Co. dredges.

Red Cliff.

Iron Mask mine, at Gilman, near Red Cliff, being operated by Empire Zinc Co., is producing about 150 tons per day of zinc ore. This is treated at the company's mill, close to Red Cliff. The process is one of separating the zinc from the iron by magnetic machines, producing about 50 tons per day of zinc concentrates.

GEORGIA.

Dahlonega.

The Crown Mountain Co. is pushing work rapidly and will soon have 20 stamps running on ore from the Wallace vein, and others that have been opened. They are using jackhammer drills, and two drills break more ground than the

The property end is looking fine and the directors are not inclined to pay any attention to the stock market end.

Phoenix.

A 10-h.p. Western engine hoist, mining cars, buckets and 350 ft. of cable have been unloaded at Wenden and were taken to the property of the Wenden Copper Co. this week. Twenty thousand feet of lumber have been delivered to the mine and work of erecting the head frame will begin soon. The first 50 ft. of the shaft will be completed by hand drilling, it is announced.

Oatman.

At a called meeting this week the stockholders ratified the recent sale of control of the Sunnyside mining property to those who control the United Eastern. By the terms of the deal the treasury is enriched to the extent of \$86,500 in cash and work will proceed on the same plan that made the Eastern mines. The purchasers are Seeley W. Mudd, Colonel D. C. Jackling, F. A. Keith, Philip Wiseman and C. H. Palmer Jr. The former management was composed of S. S. Jones, P. L. Mullen, W. H. Flanigan and L. C. Monks.

CALIFORNIA.

Grass Valley.

Connecticut capitalists, headed by Frank L. Rodgers, are interested in a syndicate which has taken under bond and option the Prudential and Norambagua gold properties. Both properties have produced rich ore and the Prudential has been opened to an approximate depth of 1000 ft. It is planned to extend drifts into the Norambagua from the Prudential shaft and operate the mines from a central point. The Prudential is equipped with a small mill and mine machinery.

Redding.

The Potosi mine at Muletown, 6 miles west of Redding, has been taken under bond by a company and work started, with A. S. Howe, superintendent. The mine has lain idle 45 years, although for a short time it produced some rich gold ore. It belongs to the estate of the late Senator Jones of Nevada.

The Mammoth Copper Co. has completed the tramline from its Stowell mine to the main haulage system, and the ore is going direct to the smelter. Construction of the \$350,000 electrolytic zinc plant near Kennett is proceeding. It is reported the plant will handle custom ore in addition to the product from the bag house and the Mammoth line. A small commercial unit embodying the process has been operated for several months at Winthrop by the Bully Hill Copper Co., and it is reported this corporation is perfecting arrangements for the building of a large plant next summer.

Oroville.

Arrangements have been made to operate the plant at the Banner group with electric power. Late developments in the property have been highly satisfactory, particularly in the South Banner. All the quartz is of good milling grade. Richard Phillips is manager.

Karl Brehme and associates of Los Angeles have applied to the Debris Commission for a permit to work placer ground near St. Louis by the hydraulic method. The new dam across Slate creek is rapidly nearing completion and will cost in the neighborhood of \$40,000. It is 30 ft. high and constructed throughout of reinforced concrete. Several companies in the district have applied for permission to hydraulic their holdings, and an abundance of water has been assured for the numerous projects.

Greenville.

The Southern Eureka Co. has arranged for resumption of work at the Southern Eureka and Wardlow mines. Rich quartz has been opened in both mines and as soon as sufficient profitable quartz is exposed arrangements will be made for installation of reduction facilities.

The Boyden and McMillan copper-gold claims have been acquired by Salt Lake capitalists and arrangements made for extensive work. The Ruby copper-gold mine is being worked

under the management of Lester Williams. Several other properties are receiving attention, due to the building of the Indian Valley railway through the district.

Jackson.

The strike situation continues unchanged. Little violence has developed and the companies continue to keep pumps active and repairs are going forward. The Miners' Union has issued a statement to the effect that recognition of the union will be waived provided the increased wage scale of 25 cts. daily is paid. As the union question was not mentioned in the original demand, operators have ignored the latest attitude of the men.

Placerville.

The Frog Pond quartz mine in the Garden Valley district has been taken over by N. H. Burger and associates of Placerville. The mine has produced much rich ore and is considered one of the best propositions in this section of the Mother Lode territory. The shaft will be deepened and extensive lateral developments prosecuted.

Sutter Creek.

Unwatering of the shaft at the Old Eureka continues to be steadily conducted, despite the strike and bad caves below the 600. The sawmill has been finished and construction of surface buildings is proceeding. The new hoist will soon be in position and the management is hopeful of starting active mine operations early in January.

At the Central Eureka everything is being placed in shape for resumption of shaft sinking as soon as the strike ends. It is planned to sink to a depth of 3400 ft. and crosscut to reach two veins believed to parallel the main ledge. Repairs to the shaft are being made with a small crew.

Porterville.

An improved demand for magnesite ores has stimulated developments in this vicinity and contracts have been signed for the delivery of 100 carloads of crude ore within 30 days. This is in addition to the regular output. The American Magnesite Co. and Tulare Mining Co. are arranging to augment the capacity of their calcining plants. This will increase the local output to 2 cars of calcined ore daily.

Goldstone.

Vigorous developments are proceeding at the Goodrick silver mine. The shaft is down 147 ft. and the ledge is 4 ft. wide with values running into high figures. Silver predominates, but there is a little gold and copper.

The gold mining companies are increasing activities. The United Goldstone Co. has started work on the Shamrock claim, where a good ledge is exposed near surface. Three claims have been leased to Ramsey & Schwartz of Santa Monica. Alexander & Hale have acquired the Goldstone Townsite group and started work. The custom mill is running and is reported to be making a good extraction. Motor trucks are delivering ore from numerous leases.

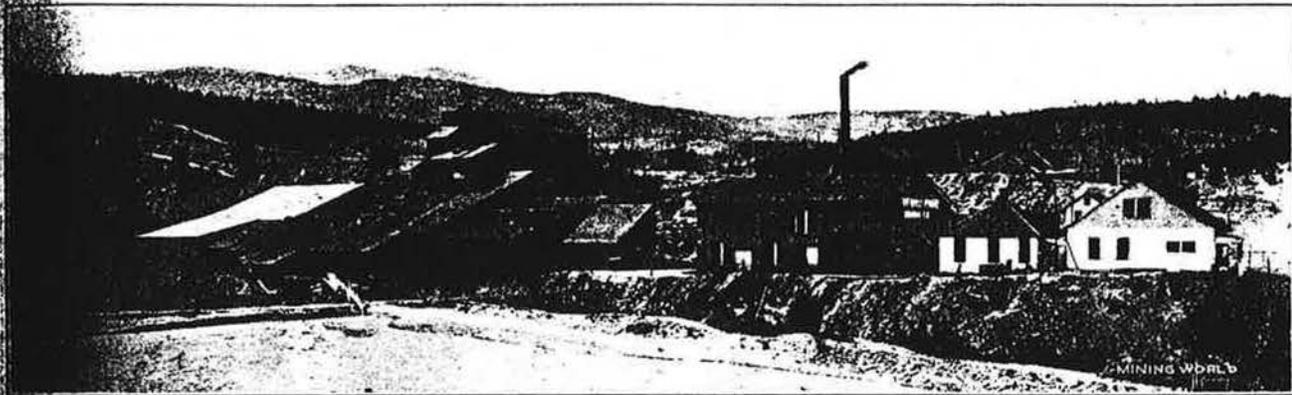
Callahan.

The McKean ledge has been struck in the upper tunnel of the McKean mine and is showing well with development. No. 2 tunnel is advancing rapidly and a raise has been driven to connect with No. 1 tunnel workings. Good ore is coming from both points. Plans have been made to equip the mill with heavier machinery. Twenty men are employed. W. L. Fraser is superintendent.

A deposit of chrome ore has been discovered near this point by H. A. Eaton, W. H. Gassoway, Alex. Parker and M. F. Barnum. The ore is of excellent grade and a road is being constructed to facilitate early shipments. Gold prospecting is very active in this section and some promising discoveries have been reported. Several companies are preparing for placer work.

Campo.

In December, 1914, 31 ranchers in Jackson and Calaveras counties entered suit against Penn Mining Co., a smelter, for damage alleged to have resulted from fumes to vegetation and stock. Ten of the cases were in May, in the U. S. District court at San Francisco was given defendant, at plaintiffs' cost. The remaining cases have been dismissed without trial, and with payment of any damages.



WOLF TONGUE MINING CO.'S MILL, NEDERLAND, COLO.

Concentrating Tungsten Ores, Boulder County, Colorado

W. A. SCOTT.

In passing briefly over the tungsten producing interests of Boulder county, Colorado, no attempt will be made to discuss market conditions, nor make predictions as to future demands and consequent output of that metal. The best informed men of that locality, including producers and buyers, are not making calculations extending far into the future, concerning demands and prices. That many companies and individuals are well prepared to mine ore and turn out profitable concentrates, is everywhere evident. They all seem to concur in the effort that is being made to influence action by Congress to fix an import duty on tungsten ores and tungstic acid, to protect American producers against the products of foreign mines, which are operated at much lower cost, especially as to labor. While some large foreign sources of supply are now cut off from our markets by the exigencies of war, it is realized that, with the probable cessation of hostilities soon, American tungsten production may be further depressed and curtailed by the importation of cheaper foreign ores, by which prices will be governed.

When, in the winter of 1915-16, demands became great and prices advanced, it was demonstrated that tungsten miners of the western states were quick to respond to this demand, their production for the first months of 1916 having amounted to 3290 tons of product, sub-divided as follows: Colorado, 1505

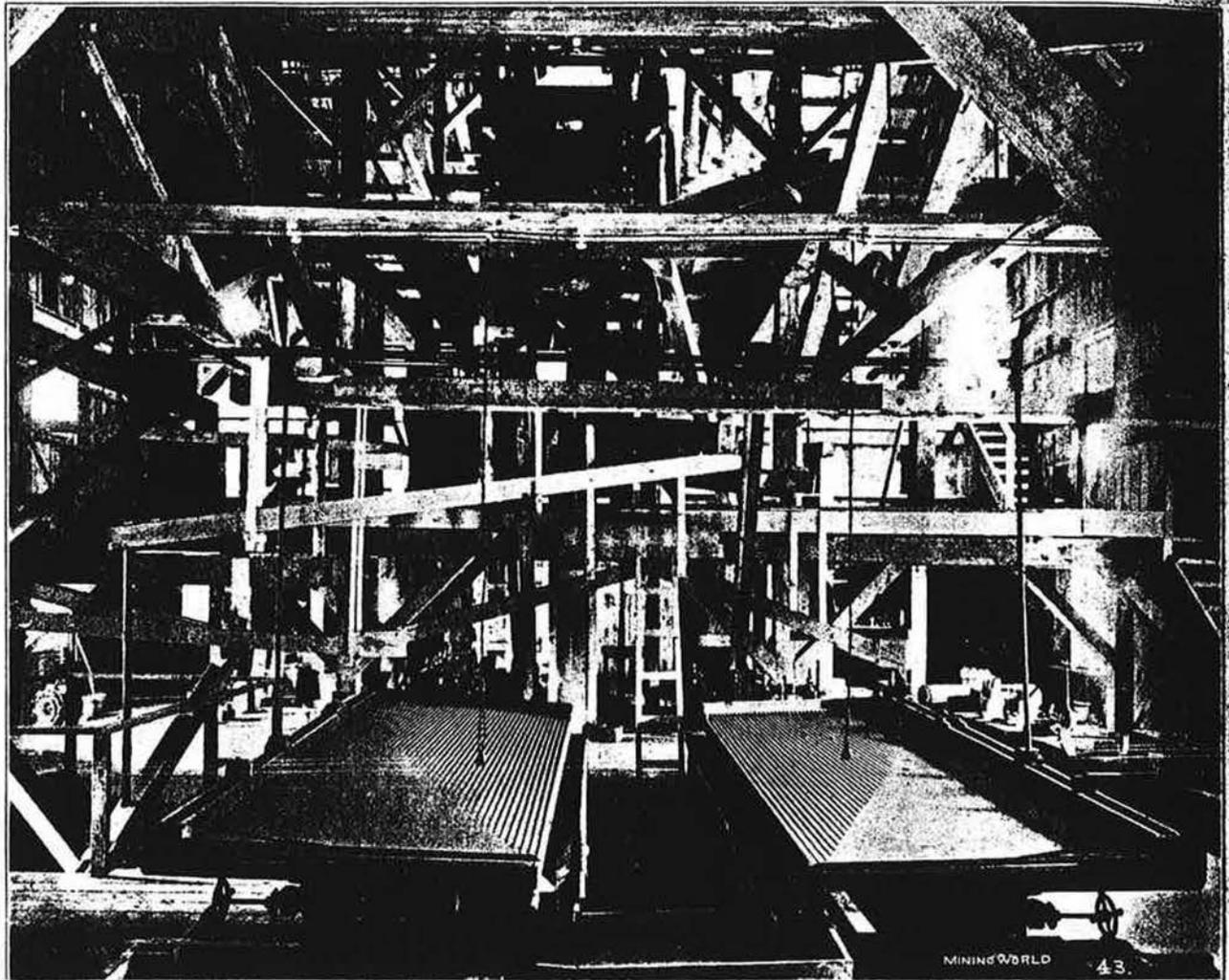
tons; California, 984 tons; Nevada, 461 tons; and 165 tons were produced by Alaska, Idaho, Utah, and other states. The imports for that period amounted to 1824 tons. This leads to the belief that the mines of this country are capable of producing tungsten sufficient to supply any domestic demands that may exist. Evidently, the element of uncertainty as to future prices is the foreign supply. A reasonable import duty probably would tend to steady the market, and keep the mines in this country in operation. It is surely of interest to both consumers and producers to avoid, if possible, radical fluctuations.

The Wolf Tongue Property.

The writer's main purpose is to report as accurately as he can some of the facts pertaining to milling methods and mill equipment observed in several of the tungsten concentrating plants. The first one visited was that of the Wolf Tongue Mining Co., situated at Nederland. This company's mineral holdings comprise 500 acres lying 2 miles north of that town. All of the 50 tons of ore per day being milled is taken from the company's mines, one-half being produced by the company direct, and one-half by lessees. The ore consists of ferberite, averaging about 7% WO_3 , the gangue being mostly silica and talc. The ore is first crushed to $\frac{1}{4}$ -in. size in a Blake jaw-crusher and a set of rolls. This product, after a 10% sample is cut out,

is passed to two Richards pulsator jigs, operating in series, with a dewatering box between the two units. Each unit is provided with separate pulsator valves and automatic gates for discharging coarse concentrates that accumulate above the screen and a hutch gate for discharging the fine concentrates that settle down through the screen. The coarse product ranges from $\frac{1}{2}$ to $\frac{1}{4}$ -in., and 10 mesh; the screen which holds it is 6 mesh, having 0.113-in. openings. The two products made on jig No. 1 consist of coarse concentrates running 63 to 57% WO_3 , and fine hutch concentrates running 60%; the product of jig No. 2, coarse con-

lic classifier; the overflow from the classifier is passed over Card and Wilfley slime tables, on which are made first-grade and second-grade concentrates, running 60 and 20% respectively. A third cut from the tables is returned to the ball mill circulation. The table tailings are retreated over Monell slimers, on which 40% tungsten concentrates are made, all tailings from Monell slimers passing over canvas plates. Now, the underflow, or heavier slimes, from the hydraulic classifier go to a Bunker Hill 30-mesh revolving screen; the plus 30-mesh is retreated over Card tables, the minus 30 goes to a Bunker Hill 50-mesh screen; the plus 50-



INTERIOR OF RARE METAL ORE CO.'S MILL, ROLLINSVILLE, COLO.

centrates, runs 20 to 30%. The Richards pulsator jig, made by Denver Engineering Works, has a pulsion stroke, upward, not accompanied by any counter suction. In this installation the total screen area of both jig units is only 2 sq. ft., and the two jigs in series treat 45 tons in 24 hours. The jig tailings are divided into two streams; one part is recrushed in two 5-stamp batteries, having 20-mesh screens, and the other part is reground in a Marcy ball mill, the latter reducing to 65 mesh. The stamps and ball mill are being run on the same material to ascertain comparative results. The pulp in each case is passed to a Richards hydraul-

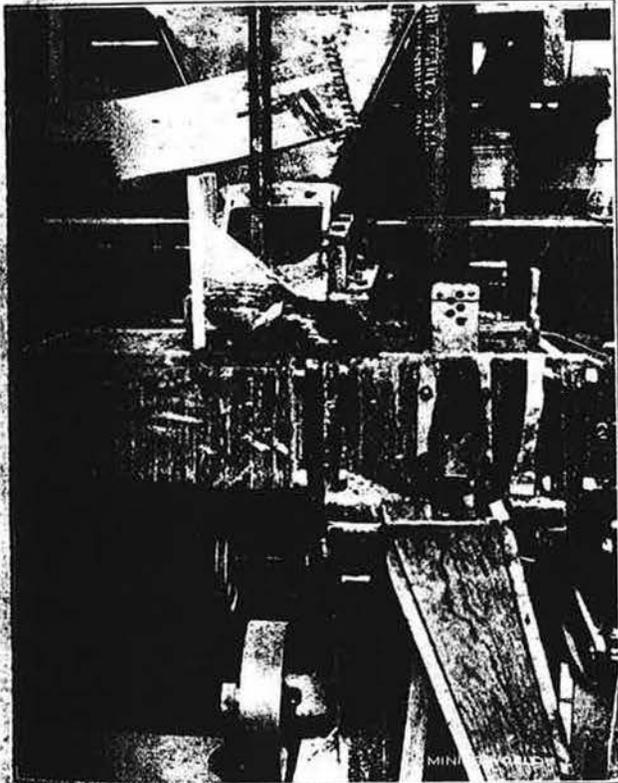
ic classifier, the overflow from the classifier is passed over Card and Wilfley slime tables, and thence over slime tables and canvas plates. All Card tables yield a first-grade running 60% tungsten; a second-grade of 20%, the middlings being reground. The tailings from Card slimers is pumped to the canvas plates. The final tailings that go to the waste dump are from the latter plates. The "rag plant" contains 7600 sq. ft. of canvas plates. These plates are 3-decked, to economize room. The clean concentrates, comprising jig, table, slimer, and canvas products, are stove-dried, sacked and shipped.

The Wolf Tongue property is under the man-

of William Loach, with C. A. De Witt, mill superintendent, and Wm. Todd, mine superintendent. The mines are opened through 10 shafts. The 25 sets of leasers on the property pay a royalty of 25%, the company furnishing all supplies and power for drills and hoists. There are about 150 men employed.

The Vasco Property.

The mill of Vasco Mining Co., situated at Tungsten, or Stevens camp, is being operated on 80 tons of tungsten ore per day. This plant was built and equipped by Hendrie & Balthoff Mfg. & Supply Co., Denver, and is doing efficient work. The Vasco oper-

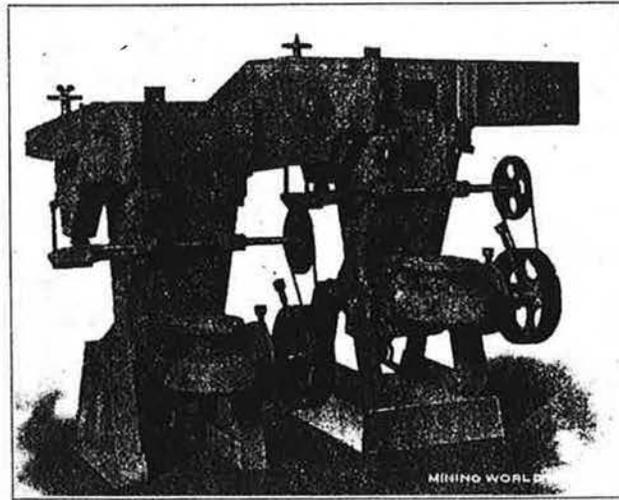


RICHARDS PULSATOR JIG IN DUNCAN MILL.

ations are under the general superintendency of John Connors; Thos. McGrath and W. W. Waldron are mill and mine superintendent, respectively.

The larger tonnage of ore milled is taken from the 450-ft. crosscut, the portal of which is close to the mill. It intersects one principal vein in granite; and mining operations are going on both above and below this crosscut. Ore is dumped from mine cars into mill bins, and is thence elevated to the coarse crushing department, in which there is a Sampson 1½-in. crusher and a Universal ¾-in. The resultant product is reduced to ⅜-in. by McFarlane rolls, and this is elevated to the fine ore bins, and from these it passes through three sets of trommels. The first set oversize, which is plus 3 mesh, is returned to the rolls for regrinding. The undersize of first to second trommel, or 10 mesh and the oversize from same, pass to Hurley department jigs of different screen sizes. The trommel undersize, or 14 mesh, is run through

Bunker Hill screens, by which it is classified for table concentration. About 50% of the entire mill recovery is made on these jigs. The jig tailings are sent to the waste dump, except as to certain grades of ore, wherein they are reground. The jig middlings, after being reground in a ball mill of Denver Engineering Works make, are reconcentrated over Card tables. The oversize from the Bunker Hill classifiers passes to tables, and the finer, or 100-mesh product to Callow tanks. The tank settlings are reconcentrated on Card slime tables, the overflow from tank being passed over canvas plates. When the jig tailings are reground in the ball mill, the pulp is first classified in an Akins machine, and thence to Bunker Hill cone classifier for table and canvas plate finishing. In this mill work, the jig product runs 50% WO₃, the table concentrates running 40 to 45%. The two crushers and one set of rolls operate dry, the wet pulverizing beginning with



RICHARDS PULSATOR JIGS IN TANDEM.

the McFarlane rolls. John McKenna, Boulder, is general manager of the Vasco Mining Co.

Tungsten Production Co.

J. G. Clark is manager of Boulder Tungsten Production Co., the mines and mill being at Stevens camp, on South Boulder creek. Principal mine operations are conducted through a 100-ft. crosscut, intersecting four veins of tungsten ore, in granite, in which there are also dikes of porphyry and veins of quartz. There is about 1000 ft. of lateral development from the crosscut haulage level, tracks from that level leading to the crusher at the head of the mill. The milling plant, built and equipped by Colorado Iron Works, involves standard coarse and fine crushing, and concentration over jigs and tables.

Degge-Clark Operations.

Degge-Clark Tungsten Mining & Milling Co. is mining and milling 25 tons per day of ore running 7% tungstic acid, the mill concentrates carrying 50 to 60%. This company's highest grade ore is received from its Beaver creek properties, 15 miles southwest

from the mill, and is hauled thereto in auto trucks. The Beaver creek group contains a series of about 20 veins in porphyry, the development being through shafts and tunnels. Some of this ore assayed as high as 71%. The mill is a Colorado Iron Works plant, containing crusher, two sets of rolls, ball mill, jigs, tables, and canvas plates.

Duncan Mill.

John T. Duncan owns and operates the Black Prince tungsten mill, situated in Boulder canyon. It was designed by Geo. S. Love, and was constructed by Denver Quartz Mill & Crusher Co. It has a capacity of 25 tons per day, and this is to be increased to 75 tons. The equipment consists of that company's 8 by 12 steel crusher, its No. 2 ore feeder, the Denver Quartz mill pulverizer, with second unit being installed: a Richards' pulsator single jig, Isbell concentrators, and a Colorado Iron Works' diaphragm pump. The crusher oversize is recrushed in a Peter McFarlane set of 12 by 20-in. rolls, the product of which is elevated to the ore bins, and thence through a Denver ore-feeder to the Richards' jig. The jig middlings are reground in a Denver quartz mill to 30 mesh. This pulp is concentrated by an Isbell table, the slime from which is conveyed by the diaphragm pump to Monell slimers, the overflow slimes from the Monell passing to the canvas plates. By all this equipment four classes of product are made: a coarse jig product, a finer jig hutch product, an Isbell table concentrate, and the slime concentrates collected by Monell tables and canvas plates. This mill is said to be making a saving of 84.3% of the assay value of the ore, the heads running 1.30% tungsten, the tails 0.22%. The jig product runs 48.3%, table concentrates 16.75%, slime product 30.2%.

Boyd Mill.

This mill, situated at Boulder, is operated by the Vasco Mining Co. It is in charge of Henry Kautzsch, and is treating a small tonnage of ferberite ore, ranging from 2 to 45%, making products running 55 to 60% WO_3 . The ore is crushed at the sampling plant, and as it comes to the Boyd mill it is passed to jigs in which a coarse product is made. The jig hutch is reconcentrated over tables. The jig tailings are run through batteries of stamps. The middlings from Wilfley and Card tables are reground in a ball mill, then reconcentrated over tables. The Monell slimers handle the fine slimes from the tables, and Monell tailings are retreated on the canvas plates, of which there are 16 in first set and 14 in other.

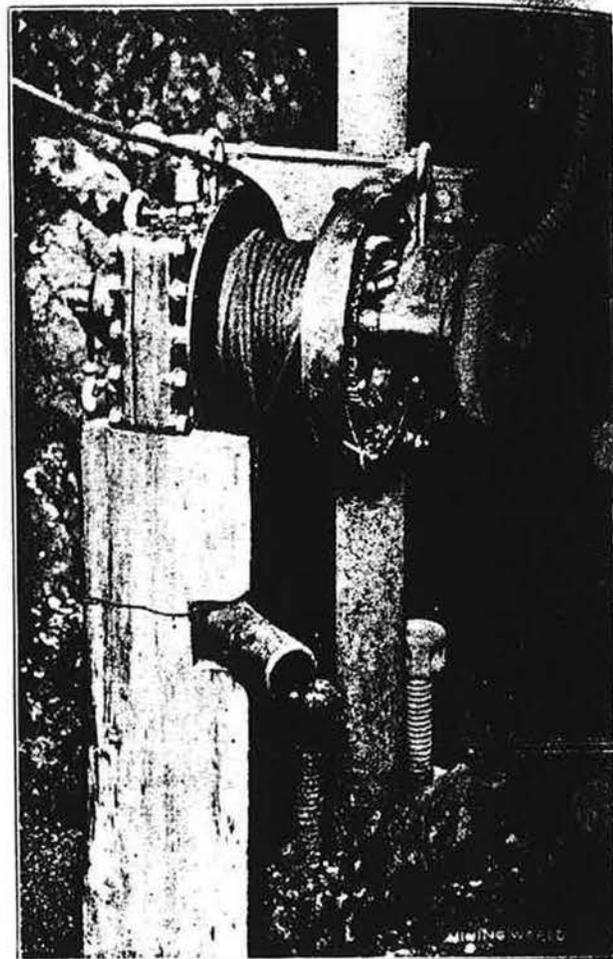
The Luckie Two.

H. B. Holmes is manager of Luckie Two Tungsten Co., which works its mines up Boulder creek, and operates a concentrating mill in Boulder. The ore, like most of the tungsten ores of Boulder county, is a ferberite, or tungstate of iron. The mill is running on 10 tons per day of ore that carries 6 to 7%, and pro-

duces concentrates that run 60% WO_3 . This is reduced to $\frac{1}{4}$ -in. size by a crusher and sent to the mill, and is then pulverized by Denver Quartz mill to the mesh required for Wilfley tables and Monell slimers. A classifier is used between the quartz mills and tables. The slimer tailings pass to the canvas plant, containing 2400 sq. ft. of canvas.

Black Metal.

The Black Metal Reduction Co. has in operation at Boulder a plant for the production of pure tungstic acid from the 60% tungsten concentrates of the district. The product turned out is said to rank high among those who use tungstic acid. W. B. Stoddard



DRILL COLUMN HOIST IN TUNGSTEN MINE.

is manager for the company. Prof. Ira M. DeLong, of the state University, is concerned in the plant, appliances and chemical methods.

Rollinsville Mill.

The Rare Metals Ore Co. is operating a custom sampler and reduction plant at Rollinsville. The mill capacity is 50 tons per day, and is being operated at about that tonnage. Rollinsville is on the Montezuma railroad, and is 4 miles south of Nederland. The company buys ores running 2 to 15% tungsten, and concentrates them to a marketable product. The tungsten which is the most prevalent of the tungsten

this locality, is said to be the most in demand by consumers. A recent shipment from this mill showed the following contents by analysis: Tungsten, 66.85%; iron, 18.48%; sulphur, 0.98%; phosphorus, 0.0063%; silica, 3.95%; tin, a trace; manganese, 0.25%. The mill, which was built by Colorado Iron Works, is equipped for pulverizing by a crusher, rolls and a ball mill; and for concentration by jigs, and Wilfley and Deister tables. Included are classifiers and Callow tanks. Nelson Franklin, formerly identified with ore sampling in Black Hawk and Cripple Creek, is manager. The officers of this company are: Guilford S. Wood, president; Irving T. Snyder, vice-president; A. J. Zang, who was treasurer, recently passed away; Geo. A. Stahl, secretary. This company is closely affiliated with the Vindicator Con. Gold Mining Co., owner of the Vindicator and Golden Cycle mines. Cripple Creek district.

Primos.

The Primos Mining Co., controlled by Primos Chemical Co., is operating a large mill for the concentration of tungsten ores, same being situated at Lakewood, 4 miles north of Nederland.

Important Mining Matters Before American Mining Congress.

Under the present coal production of various Western states has been under a federal leasing system at the low rate of royalty which has ever been considered, the state for instance as Colorado would now be paying upon its present coal production approximately \$125,000 annually to the federal government, and the state would have been deprived of whatever taxes it receives from its coal resources."

This statement is made by J. F. Callbreath, secretary of the American Mining Congress, who has just returned from a trip to the west in the interest of the annual convention to be held at Chicago in November.

Expressing this thought, Mr. Callbreath went on to say that under a federal leasing system, at the low rate of royalty which has ever been considered, the west would be paying upon its present coal production approximately \$125,000 annually; Washington, \$100,000; Utah, \$150,000; Montana, \$155,000, and Mexico, \$50,000 annually.

The convention of the American Mining Congress says Mr. Callbreath, "will afford an ideal opportunity for the west to present its claims to representation from the eastern mining states whose representation acting with western men will prevent unwise legislation and bring about the enactment of laws which will stimulate the development of western resources.

Whether the Ferris land leasing bills shall be amended, whether the amendments made by the senate shall prevail, is of vital importance to the west. Whether the California oil claimants whose

rights are based on a compliance with the U. S. Land Office regulations then in force, shall be robbed of their property without right of appeal to the courts, as the Alaskan coal claimants have been, is of vital importance to every loyal citizen.

"Whether the resources of the west are to pay endless tribute to the government through a federal leasing system, or whether these resources shall be subject to the taxing power of the states, concern directly every taxpayer. Whether a cumbersome agency 2000 miles away, without knowledge of conditions, shall control western development, or whether the basic principle of republican government, home rule, shall prevail, and our development be controlled by those who know, is one of the most important and pressing questions now facing the west.

"The coming session of congress at Washington will probably pass finally upon these questions. The leasing bills have passed the house of representatives and are now before the senate. Western senators are entitled to great credit for the work thus far accomplished.

"The senate is likely to approve the work of its committees; but unless the west shall rally to the support of the senate committee recommendations, there is great danger that the house of representatives may refuse its approval. Legislation along several lines of great importance to the west will be thoroughly discussed by those interested in the development of the western states."

Discussing the various issues now pending before congress, Mr. Callbreath said, "The next session of congress will have under consideration the Foster bill, for revision of mineral land laws of the west."

It will be recalled that a bill to investigate conditions at its public hearing in the western mining centers, making recommendations to congress, was introduced by Senator Smoot, and passed the senate, but failed to receive the approval of the house committee on mines and mining.

"In its stead Dr. Foster, chairman of the committee, introduced a bill intended to meet the requirements without the preliminary work of the commission. This bill was severely criticized by the west. A thorough discussion of the subject will take place at the Chicago convention. Dr. Foster himself will lead the discussion and convey the plan he proposes. The discussion will be lively if the critics of his bill meet him on the floor."

Tin exports from the Federated Malay States in July are returned as 3499 tons, against 3544 tons and 4582 tons for July in 1915 and 1914 respectively. The total to August 1, 1916, is given as 25,224 tons, against 26,862 tons to August 1, 1915, and 29,484 tons to August 1, 1914.

Zinc dust oxidizes rapidly, absorbs hydrogen and is chemically very active, resulting at times in spontaneous combustion or explosion.

wiring more. Camp has doubled in population in past 60 days.

Rich copper ore has been found in the Weaver district of G. W. Lynch. The same deposit has been opened on adjoining claims by Richings and Southworth; ore runs high in copper and carries good gold content.

The Schenectady is installing a compressor. Boston investors are inspecting the property. Good ore is showing in the shaft.

Jerome.

Additional impetus has been given development work on the Venture Hill and Verde Apex properties since the owning companies entered into an expense sharing agreement and placed mining operations in charge of John S. Riley. The joint plans were drawn up with a view to opening at depth the deposit of native-copper-bearing ore that was recently encountered in the Venture Hill tunnel. This deposit is one of the most promising opened of late in the Jerome field. At a recent meeting of the Venture Hill in Prescott, Ed Shumate succeeded Boas Duncan as president of the company, and will in the future act jointly with John H. Robinson, secretary of the Verde Apex Co., in the financial management of both corporations.

Development of the Ewing and Hooker group is being pushed with two shifts. The group consists of six patented claims, has been held by the original locators (Ewing and Hooker), since 1894, and is surrounded by the Green Monster, Copper Chief and Copper Chief Extension companies. The group is crossed by one of the boldest outcrops in the Jerome field—an iron gossan showing copper at surface. It lies in the Upper Verde contact about 2 miles from Jerome. A tunnel has been driven on the Porous Iron claim of the group 285 ft., and will be continued to crosscut a ledge that lies about 20 ft. in advance of the present face and to a shaft that lies about 100 ft. ahead. This shaft shows ore carrying as high as 15% copper at a depth of 98 ft. Above that point sand carbonates were encountered that assayed \$90 gold. Ninety-four feet from the mouth of the tunnel a body of ore showing iron pyrites and chalcopyrite was encountered. This ore dipped out of the tunnel 49 ft. beyond the point where it was first found and for that distance gave a general average of 2% copper and \$4 gold per ton.

Three shifts are pushing the drift on the 1200 level of the Jerome Victor Extension toward the United Verde's line, and are making fast progress now that the company's water problem has been successfully solved. The objective is the extension in the Victor ground of the bodies of high-grade copper ore that have been followed in No. 3 United Verde workings, well toward Victor Extension boundaries. As the drift is advanced, copper indications are becoming more pronounced. The present showing encourages Supt. Salisbury to believe that copper ore in commercial tonnage will in due course be encountered.

Prescott.

Under the direction of M. N. Andrews a camp will be established on the Union group in the Chaparral country. This decision follows the purchase of the property last week from John S. Jones by D. M. Locey. St. Louis and Chicago capitalists are interested with Locey in the venture. The transfer involves approximately \$300,000 on the deferred payment plan. A substantial payment was made at the time of signing the contract and other payments are to be made on Nov. 15, Dec. 15 and Jan. 10. The contract likewise provides for yet other payments as the property is opened and developed. The work will be in charge of Andrews, who interested Locey in the project.

The customary carload shipment of copper ore went out late in September from the Pittsburg mine on Castle creek. It averaged 15% copper as well as zinc and gold contents. The dump holds a large tonnage of second-grade ore that could be profitably worked by establishing a concentrating plant at the mine.

Chloride.

The Keystone Con. Mining Co. is constructing a concentrating mill of the Fields flotation type, with an initial capacity of 100 tons. In mine development this week a rich silver strike was made, sampling 226 ozs. silver and 1.41 gold.

CALIFORNIA.

Jackson.

Efforts to resume operations at the South Eureka mine brought the first clash between the striking miners and authorities last week. About 400 armed strikers surrounded the property, drove back deputies and strike breakers, and stopped pumping operations. Sheriff Lucot has asked for assistance from Governor Johnson, stating the situation is beyond his control. It is probable several companies of California militia will arrive here shortly. Most of the strikers are foreigners.

Large numbers of miners have left Amador districts for other fields, but some have returned with the declaration that companies at Grass Valley, Sonora and other camps refused them employment. Leading operators state that fully 1200 of the 1800 men on strike are prepared to return to work on the old scale of wages, and that fully 400 men have left the county since the trouble begun.

The Plymouth Con. is still operating at full capacity near Plymouth, and unwatering of the Old Eureka, at Sutter Creek, continues steadily. Pumpmen have walked out at the Central Eureka, and other companies are facing water problems. Events of the past week indicate the strike will be bitterly contested by both factions.

Marysville.

Arrangements are being made to start work at the Red Ravine and Elk mines in the Indian Ranch district. A patent will first be secured, and subsequently a large amount will be expended on equipment and developments. The group is largely owned by Otto Kipp of Milwaukee, Wis., and Otto Wulwebber of Sheboygan, Mich.

The Pacific Dredging Co. is rapidly transforming the old settlement of Parks Bar into one of the most animated dredging camps in California. Numerous buildings and residences are going up, and the new dredge will soon be ready for operations. Two more boats will be constructed next summer. The camp lies in the Yuba River field, between Marysville and Smartsville. The company continues to explore adjacent territory with drills and prospect pits. The new dredge will operate on territory adjoining the main holdings of the Yuba Con. Gold Fields. The company is controlled by the Yukon Gold Co.

Oroville.

So satisfactory has preliminary redredging of old tailings in this district been that the Natomas Con. has arranged to place another dredge in operation. The ground being reworked was the first to be successfully dredged in California, and the work proves that the old boats failed to clean the bedrock thoroughly and that considerable gold escaped the buckets. It is likely that other companies will arrange to redredge their holdings, as the profitable character of the work has been established.

Pike City.

The owners of the Alaska quartz mine have completed arrangements for the driving of a main working and drainage tunnel. It will be about 6000 ft. long and is expected to intersect the vein system about 600 ft. below the bottom of the shaft. Water has seriously handicapped operations in the Alaska since the shaft gained fair depth, and the tunnel is expected to facilitate this trouble and facilitate economical operations. Eastern people are largely interested. General W. S. Schuyler is president.

Spenceville.

The Spenceville copper mine has been acquired by the Navajo Copper Co. and preparations have been made for work. A good tonnage of excellent ore is exposed and the small smelter will be enlarged and improved. The ore carries some gold. Sinking of the shaft will be started soon and exploration of new ground prosecuted.

Copper Creek.

It is stated here that Manager Elzie of the Valley View Mining Co. is now in San Francisco on business in connection with the raising of funds to develop this property by driving a tunnel at the foot of the mountain.

Miller and Bowen are developing their claims, especially

the Backbone, late assays of which gave 14% copper and \$8.40 gold. They have just reached the hanging wall in a crosscut and may sink on the ore shoot.

On the Copper Gold group, two new ore shoots have lately been opened on the surface, showing strong veins and ore carrying copper and gold. These veins are the same as Miller and Bowen are now developing to the north of this group.

Railroad surveyors are camped within a mile of here and have run their line on the side of the mountain crossing the Copper Gold group and Miller and Bowen ground, all on the east side of the range.

This road connects with the Southern Pacific and Western Pacific roads near Gerlach, Nev.; runs north through Surprise valley to Cedarville and Lake City; then climbs the range on the east side and by a tunnel $1\frac{1}{4}$ miles reaches the west side under Fandango pass; thence down Fandango valley and into Goose Lake valley, passing the foot of the mountain, where High Grade is situated; thence on to Lakeview, Ore., where it will have connections with the Hill and Harriman lines now under construction. This information is from apparently a very reliable source. This road will assist very materially in opening up this mining section and that of High Grade, which is now much handicapped by the extortionate rates.

Forest.

What is believed to be the north extension of the Bald Mountain channel has been intersected in the Bald Mountain Extension. The discovery was made in the Rock Creek tunnel. W. F. Copeland is manager.

Quincy.

The Buckeye-Belmont Co., of Tonopah, has secured control of the Empire Plumas placer mine and is preparing to work it in conjunction with its Chipps Creek Con. group. The channel is about 400 ft. wide and 20 to 40 ft. thick. The tunnel will be enlarged, additional sluices installed, and operations prosecuted on a broad scale. Abundant water is assured.

C. W. Becker and Walter Robinson of Toll Gate have installed some equipment on their placer claims near Hartman's bar, on the middle fork of Feather river. Prospecting will be carried on by the diving system, and it is possible a suction dredge may be installed.

Grass Valley.

A complete pumping and hoisting plant, together with a compressor and machine drills, have arrived at the California mine, about 4 miles below town. Machinery will be installed at once and unwatering of the shaft rushed. The property lies in the Deadman Flat district, and was recently acquired by eastern capitalists headed by King C. Gillette.

Sawyers Bar.

A strong quartz vein which is believed to be the source of the rich placer deposits of this vicinity has been uncovered in the Burro creek Specimen creek section by Holmes and Puttman. The ore body is said to be large and shows much rich quartz. The discovery has stimulated prospecting at several points.

Sutter Creek.

An examination of the Rose mine has been completed by San Francisco engineers and it is reported a deal for the property is pending. The Rose, often known as the Poundstone, has been developed by two shafts and extensive lateral workings, and has yielded much good ore. It is equipped with a 20-stamp mill and excellent mine plant.

The W. J. Loring Co. is busily engaged in reopening the Hardenberg. A new cable has been placed in the shaft and unwatering and retimbering of the shaft is to be pressed energetically. The property is provided with a 20-stamp mill and modern mine equipment and lies in a noted district.

Big Pine.

The Bunker Hill mine, located across the White mountains from Big Pine, has been sold to a group of Whittier people by Arthur Perry. The ore is chiefly valuable for its silver and lead, but considerable high-grade zinc occurs. A large tonnage is exposed underground and the ore on the dumps is estimated to be worth from \$70,000 to \$100,000. Caterpillar engines will be used to move the ore to the Saline Valley tramway, from which point it will be delivered to the

railroad. The tramline is 1800 ft. long and has a drop of 600 ft. It is planned to start heavy shipments immediately. First payment on the purchase price has been made.

COLORADO.

Colorado Springs.

With a surplus in its treasury of \$60,500, which sum is being increased at the rate of \$10,000 monthly, affairs of the Isabella Mines Co. are in an exceptionally good condition, according to announcements made after a meeting of the board of directors. The company's mill is running smoothly and the first clean-up is expected next week. Within a few days the new ore house will be completed, and it is believed that with the mill running capacity good profits will be realized by the company.

The directors of the Mary McKinney Mining Co. have declared a dividend of 1 cent a share, payable Oct. 30, to stockholders of record the 16th. This is the first dividend to be paid by that company since July 25, 1914.

Returns have been received by Alex. Hickman & Co. on the last 2 carload shipments from the Shoo Fly mine on the southwestern slope of Womack hill. Both carloads were of mixed ores, coarse quartz and screenings and brought settlement at close to the same figure. One car of 25 tons was settled for at \$49.60 a ton, and the second brought \$48.80. The second car contained a little better than 26 tons.

Rico.

In the Smuggler drift at the Syndicate mine, some fine lead-zinc-silver ore is being taken out by the Rico Mining Co. Assays run as high as 400 ozs. of silver. The stuff will average close to \$300 per ton. About 4 tons are already sacked, and the vein is showing up strong.

Idaho Springs.

F. B. Hall of New York has taken over the Silver Horn group of 9 claims, situate up Ute creek, owned by L. McLean. The property has about \$20,000 of development work, a 900-ft. tunnel having been driven through the center so that all the claims could be worked from it, and has produced more than \$10,000 in doing the development. It is the intention of Hall to install a new plant of machinery on the property and inaugurate development and thoroughly prospect the property.

Breckenridge.

The two dredging companies sent in three lots of gold to the Denver mint last week valued at \$25,000.

The Wellington Mines Co. paid this month its 12th dividend. This one was for \$200,000, making a total of \$600,000 paid during 1916. The principal product of the company is zinc blende; both crude ore and concentrates are also produced. The two concentration mills on the property are kept running full time on ore from the mine, which is situated on Mineral hill, about $2\frac{1}{2}$ miles easterly from Breckenridge, more than one hundred 25-ton carloads of ore and concentrates were shipped from the property during September. In addition to the usual mine development, the company has started a prospecting shaft on the "fraction" near the west end line of the property. The shaft is now down about 40 ft. and a hoist is being placed on the new shaft. R. M. Henderson is the general manager of the property and Charles Altland, the superintendent.

Telluride.

The Matternhorn management is working a double shift through the lower level of the Butterfly drifting into their veins which lie to the south of the Butterfly property. As the tunnel is not equipped with power, hand work is being done.

Frank Ensign has this fall opened up a big lead of lead ore on a property that he and others own on Mt. Wilson and which he is working at this time. It is one of the big leads on Wilson. There is said to be about 10 ins. of lead lead.

It is given out that the Standard Chemical Co. will begin active work on its properties in the Paradox district and that the company will concentrate the mine product and haul by wagon to Placerville, thence ship east by freight

failures made in operating this property in the past. It also has historic value, being the oldest property in the district. One of the old shafts was the death trap of three of the early-day miners, who were stoned to death by Indians.

Julius Kruschmitt last week sampled the Golden Hammer, the Brunswick and the Holmes properties at Hackberry. He took his samples to El Paso for assay.

The Tennessee Extension has a force of men employed and a contract has been let for an extension of the tunnel.

The Towne mine has ordered a new compressor, hoist and head frame. When these are installed a new shaft will be commenced, the old shaft being in such bad condition that it cannot be used. This is one of the old properties of Chloride. It was recently unwatered and sampled, with good results.

The new power line will be in operation in Chloride in about 3 weeks. Much electrical machinery will be installed.

Eight hundred and seventy-three cars of ore were shipped from Chloride during 9 months ending June 30, according to the Santa Fe records.

Miami.

Development is to be started at the Miami Mother Lode Co.'s property. The property is traversed by several well-defined ledges on which there has been some development, and ore has been encountered in all of the shallow openings. Preparatory to sinking the Cracker Jim shaft to 500 ft. and drifting on the vein at several levels, the equipment is being overhauled and added to. A compressor, purchased in San Francisco, is expected to arrive, and a storage tank for fuel oil is being constructed. As soon as the compressor is installed, three shifts will be put on in the shaft. Several months ago exploratory work at depth on the vein disclosed high-grade sulphide. This is to be drifted on and the vein crosscut.

Globe.

The Miami Con. has recently been formed and capitalized at \$2,500,000. The company owns 1200 acres and is the consolidation of 19 different groups. The ground owned by the company has been worked for many years and hundreds of tons were shipped before the depression in the price of copper. At points where the ground has been opened the formation is shown to be identical with that at the Live Oak and Keystone mines of the Inspiration Con., which lies directly northwest of Miami Con. There is every indication that the body runs southwest from the Keystone and Live Oak, which the new company adjoins, directly through Miami Con. Further indication of this is seen in the fact that 400-ft. drill holes show the same formation at the same levels that have been encountered on the Live Oak and Keystone. Miami Con. is confident that it will encounter the same body of sulphide that was found by the Inspiration at 700 ft. in the Live Oak property.

CALIFORNIA.

Harrison Gulch.

The Victor Power & Development Co. has ordered a large Diesel engine for the power plant of the Midas mine, and expects to have it in position by Nov. 15. It will consume California crude oil and will displace the wood-burning engine now at the mine. President J. H. Sharpe states a yearly saving of \$15,000 in fuel bills will be effected. Unwatering of the Midas shaft to the 1300 point is to be carried on immediately, and from the bottom levels drifts will be thrown out to seek extensions of the Midas, Gold Hill and other veins.

Crescent City.

Frank Edwards has given a bond and option on his French Hill copper property to a group of California capitalists, according to reports. The mine contains a good tonnage of excellent ore, with the deposits showing a persistent character.

Callahan.

James McKeeney, managing owner of the McKeen mine, has decided to add flotation equipment to the 50-ton mill in the early spring. A large tonnage of good-grade ore has

been blocked out and the mill is effecting a good gold recovery, but the sulphides are causing some trouble. Tests with flotation indicate the sulphides will yield readily to the process. A new tunnel is being driven to open the ledge at further depth.

Goldstone.

Ore assaying \$100 to \$150 in gold per ton was encountered last week on the Gold Ring claim of the United Goldstone group. The strike was made by George Branch and associates and work is proceeding to determine its extent. Lessees are actively prospecting adjoining territory.

The Pacific Mines Corporation is developing good ore on the 300 level of the Bagdad-Chase mine, southeast of Goldstone; 100 tons are shipped daily to the United Verde smelter, at Clarksdale, Ariz., and the management expects to be sending out 150 to 200 tons per day in the near future. The product is reported to net around \$4 per ton.

Sinking of the main shaft of the Goldstone Mining Co. started last week. Ore is being followed and the shaft will be sent to the 700-ft. point. Extensive lateral work is planned and the company expects to start a heavy output early in the spring.

Kennett.

The Friday-Lowden tunnel is in 3400 ft. and is expected to intersect the main Mammoth ore channel within 700 ft. at a point fully 600 ft. below the main workings. The Sutro tunnel is in 700 ft. and will be extended a total length of 3000 ft. Both tunnels are exploring wide areas of virgin and highly-promising territory. Grading for the zinc plant is proceeding rapidly and structural work will soon begin.

Jackson.

The strike situation along the Amador section of the Mother Lode is fairly quiet, but the past week has witnessed several scenes of violence. Attempts to resume at the South Eureka were defeated by 400 armed strikers, and owners of other properties have made no effort to reopen their mines. Several operators state they will resume as soon as a sufficient number of men manifest a disposition to return to work.

John P. McLaughlin, State Labor Commissioner, has reported the situation as serious, and expresses his belief that violence can be averted only by a speedy settlement. The Kennedy Co. is installing two new boilers in the power house and completing the impounding dam. The Argonaut, Bunker Hill and Central Eureka Co. are repairing underground workings and surface plants, preparatory to resumption of activity on brief notice.

Pine Grove.

The Pine Grove Mining Co. has placed its mill in operation and expects to keep the stamps dropping steadily. Good ore is exposed in the upper workings, and work is proceeding to open the ledges at further depth. This is a new producer and has yielded some very rich ore.

In the Reward mine a 28-ft. ore body has been uncovered by R. Robinson. Of this 8 ft. carries ore of excellent grade. Preparations are being made for a steady output.

Rich ore has been opened in the Kerkoff mine, near Defender, and the operators are expectant of opening a good tonnage. The shoot shows some specimen ore, and the entire face carries quartz of milling grade. A promising gold deposit was opened recently on the old Stirnman property.

Forbestown.

A small flotation plant has been erected at the Southern Cross and experiments are being made on ores of various grades. A large tonnage of good ore is blocked out and preliminary tests indicate flotation can be successfully applied. Fully \$50,000 has been expended in developing the property.

It is reported a deal is pending for sale of the Forbestown Con. group. This is a consolidation of several of the largest mines in the field, including the noted Gold Bank. Satisfactory flotation tests have been made on Gold Bank ore, and a plant will probably be installed next summer.

Local people have taken over a group of 12 claims, lying northwest of the Gold Bank, and are planning to drive a long tunnel from the south fork of Feather river. The mine has been purchased by Hall and associates of Los

Angeles, who are pushing extensive work. The United States Exploration Co., of New York, is unwatering the Carlisle property, and otherwise preparing for extensive work. The Salano Wonder is active, and engineers are examining the Denver.

Placerville.

The Badger Hill Mining Co. has been formed to operate the Badger Hill mine in the Camino district. It is composed of John L. Woods, Charles F. Bryant and Otto G. Koch. The mine has yielded much rich ore and is said to contain a good tonnage of profitable material. It is owned by County Assessor George Rieber.

The south drift from the 500 level of the Pyramid has broken into a vein assaying \$50. The shaft is being sunk to a depth of 700 ft. and drifts will be run to open the new vein at further depth; 24 men are employed.

Jamestown.

Extensive work continues to be carried on in the lower levels of the famous Harvard, for years one of the premier gold producers of Tuolumne county. The 60-stamp mill is running at top capacity and the quartz continues to carry profitable values. Much new ground has been added lately to the productive belt.

The Boitano mine at Groveland has been taken under bond by J. L. Whitney, manager of the Atlas property in the Tuttle town district. Extensive developments will be started within a few weeks. The Boitano has produced much good ore and considerable ore remains in the workings.

Oroville.

The United States Exploration Co. is shipping supplies to its Robinson mine at Granite Bas'n, northeast of Oroville, and preparing to continue operations throughout the winter months, despite deep snow. The shaft will be deepened to 400 ft., and if ore conditions continue satisfactory, a hydro-electric plant and 100-ton flotation mill will be installed next summer. The company is controlled by New York capitalists. E. N. Miller is superintendent.

Poker Flat.

A new hoist has been installed in the Carey winze of the Herkimer gravel mine, and production of rich material is going on day and night; 25 men are at work and a large yardage of gravel is washed daily. With the new hoist the management expects to take out 100 to 150 cars of gravel per day. Careful prospecting indicates each car will average close to \$11 in gold. Four drifts have been extended from the Carey winze.

COLORADO.

Good Springs.

The Bullion Co. as yet has not opened its ground extensively, but shipments of concentrates and crude zinc ore are being made. In regard to a recent shipment, Joseph J. Daynes, Jr., president, says that the shipment comprised 18 tons. Assays were 14.6 ozs. silver and 64.5% lead. The settlement represents \$74.68 net per ton and the total approximates \$1200. Good results from development is being obtained. The ore found at the greatest depth is richer than that on the upper levels. There is some first-class ore mixed through the mill product, but at the greatest depth the ore is all of a direct shipping grade. The development to new depths is being hurried along. A lead ore was encountered in the crosscut from the 145 level. This crosscut is developing the Daynes vein and there is a good portion of the ore exposed that is of a direct shipping grade. It is expected that within the next 25 ft. the deposit will prove to be a large one and the ore should be of a shipping grade.

Silverton.

B. B. Allen and Celeste Fattor have secured a lease on the Tom Turner property. This property was worked many years. The lessees are making arrangements for immediate work and have been installing necessary machinery, etc. A few men are now employed.

The North Star mill has been started, treating ore from the North Star mine. The mill has been overhauled. The

mine has undergone considerable development in the past 4 months. The work was carefully planned and before the starting of the mill the mine was given the necessary attention.

Clay Johnson has the contract for sinking the shaft at the Dora mine. During the first part of last week he started his men. Three shifts are employed and he expects to complete his task in a short time.

A strike is reported to have been made in the Mayflower, which is now being worked under bond and lease by Slattery, Mears and associates. The value of the body opened is given at \$25,000. The Mayflower is owned by G. H. Malchus of this city.

Georgetown.

A strike has been made on the Hanson-Walthers lease in the Capitol mine. No. 15 raise and a mill run of 4 tons shows 200 ozs. gold per ton. The streak is looking good and the lessees intend to take out at least 12 tons before making another shipment. With this they will ship the tailings they now have, either to the mill at Victor, where the Cresson ore is treated, or direct to the smelter. The other lessees in the Capital are raising and crosscutting for what is now believed to be the gold zone on the hanging wall above the lateral barren plane in the big, continuous copper and lead ore shoot of the Aetna lode. No. 15 raise was the first to go above this barren plane, and from present indications there is no reason that the gold zone should not extend the full length of the mine, as has the copper and lead ore.

Leadville.

The work of draining the ground of the Down Town Mines Co. has been completed and permanent pumping equipment has been placed. Work is now being directed to opening the ore bodies. The lessees who have been operating at the Wolcott and Hibsche shafts in the Down Town section have experienced some difficulty. The first undertaking to operate through the Wolcott resulted in failure because of the water; which prevented the lessees from getting into the old workings, drainage being blocked in some way that could not be remedied without the installation of pumping machinery in the shaft. The expense of such a plant was considered too great. It was decided to move the surface plant to the Hibsche shaft, which was known to be drained. Following the moving of equipment, everything progressed favorably until work had been continued below the old water level in the shaft. Here a large cave in the shaft barred further progress and considerable time has been spent removing the cave and retimbering the shaft. This work is now nearing completion and development in the territory will be under way during this month.

In the past considerable exploratory work has been done by the Fidelity Gold Mining Co. The ore now uncovered appears in the lower tunnel, which cut the vein after driving 1200 ft. Here 4 ft. of smelting ore averaging \$200 has been opened. The ore is iron sulphide carrying 10 ozs. gold and showing high values in silver and copper. It is stated that 200 sacks of the ore have been extracted and will be shipped as soon as trains can be secured to move the ore. Previous work on the Fidelity uncovered a vein of low-grade ore assaying around \$10 to the ton and reported free milling. This shoot, which is stated to be 25 ft. wide and has been traced through the property for 100 ft. Plans for the erection of a mill are now being completed and construction work will be started in the spring. The site of the mill will probably be in Four-Mile Park, near the foot of Bull hill. The present development will be continued till December, when work will be suspended until spring. Should the discovery prove as large and rich as reported, steps will be taken early next year to equip the property for extensive development.

Telluride.

King & Farrell are operating the Gertrude group with a fair sized force. They have put in air drills, are drifting on the Modena vein and will work all winter.

At the Black Bear mine they have a shaft 450 ft. deep and have taken out enough ore to keep 20 stamps at the Smuggler mill going full capacity. The company desires to increase the output, and have commenced widening the shaft

mine was closed down. The success which attends reduction by the oil-flotation process has again given the Tiger Gold ores a commercial value. Bradshaw, Riggs and associates have been handling these ores at a profit for a number of months in the small mill at the property and will continue to do so until such time as Howard inaugurates his more comprehensive mining and milling plans.

Connection of the two main levels in the Nelson mine affords 500 ft. of backs, or stoping ground, and puts the property in line for immediate production. The ore now being mined carries a gold content in excess of \$25 per ton and is being saved for shipment. The property has been undergoing development for nearly 3 years and is considered one of the most promising in the Crown King section. In the near-surface levels very high-grade gold ore was from time to time discovered. Now that the continuation of these ore bodies at depth has been demonstrated it would appear as though the Nelson was in line for a large and regular production.

Reorganization of the Cash Mines Co. has been perfected through N. H. Getchell and a development fund of \$200,000 subscribed. New York and other eastern capitalists are back of the reorganization plans and will visit the property immediately after the election. The Cash mine is located beyond Senator in the Groom Creek country, and is one of the county's best known gold propositions. Getchell has opened it at depth and has exposed a large tonnage of pay ore. During the past 6 months five mining engineers have examined the property and made favorable reports thereon. In each report the recommendation was made that electrical appliances and an oil-flotation unit be established at the Cash mill. These recommendations are to be acted upon at once and will be followed by the reduction of 100 tons of ore per day. The plans of the company likewise include the sinking of the main shaft to greater depth.

The 50-ton mill recently installed at the Arizona property near Humboldt by the Arizona Mines Supply Co. of this city has been in operation for the past 2 weeks, and is successfully treating the mine product. High-grade concentrates are being recovered and shipped to El Paso. The Arizona is owned by F. M. Anderson and Sidney Birch of Prescott, and has for many months been in the productive class while undergoing development. During that period 21 carloads of silver-gold ore were shipped to El Paso. Hereafter, however, only the concentrates will be shipped. The mill will reduce all ores mined and has been tested sufficiently to insure a high saving of values. A large tonnage is on dump and blocked out in the mine workings, and is said to be a better grade in the lower levels than in the near-surface levels. Until Anderson & Birch took it over the mine had been idle for about 25 years.

A large and modern plant of machinery, including a Diesel engine and 5-drill air compressor, is being set up at the old Octave mine in the Congress country. Additional machinery is en route. It includes an oil-flotation unit and other equipment requisite for reducing the large tonnage of ore that has been opened up during the past 3 years. About 4 years ago a group of Boston mining men acquired title to this old-time producer under bankruptcy proceedings. Since then the main-working shaft has been deepened and levels established to a depth of 1200 ft. Drifts and crosscuts have been run on each level and gold ore has been blocked out. The development work of the past 15 months has been especially prolific in the opening of commercial ore.

Within 30 days a new plant of machinery will be in commission at the Last Chance property in the Walker district and development work again in force. The plan includes a hoist, air compressor, jackhammers, ore cars, track, etc. C. B. Hayes is backing the venture personally. Crosscutting from the main shaft has exposed a large deposit of pay gold ore through which pass bands, or lenses of exceptional value. Hayes had expended a large sum in carrying out his development plans.

John Harlan, superintendent of the Crook mine, reports steady mining and milling operations and the shipment of concentrates to El Paso at frequent intervals. The Crook mine has a length of 1800 ft. at this time and is being driven on three shifts. The face of the tunnel is carrying an

excellent grade of gold ore and values are holding strong as it is advanced. A large tonnage of pay ore is in sight and the general situation at the property very encouraging.

New machinery has been installed at the Beehive property and development at depth is well under way. The property adjoins the Octave mine on the east and is located on the rich Octave fissure. The mineral content is gold and is increasing in value as development progresses.

The usual daily production of 80 tons of copper ore is being maintained at the Commercial mine in Copper Basin and is being regularly forwarded to the Humboldt and Clarkdale smelters. S. L. Landon recently assumed charge of the mine as assistant to Major A. J. Pickrell.

D. A. Burns of Oatman has assumed charge of the Mint group in Copper Basin and is shaping the property for extensive mining operations. The workings are being unwatered and as soon as this work is finished the drift on the 200 level will be extended to pick up an ore shoot that gave high gold returns at surface and nominal depth. Burns recently acquired ownership to the Mint group and has the financial resources necessary to thoroughly develop it.

Chloride.

The power line being constructed by the Desert Power & Water Co. is now within 5 miles of Chloride. The line is being built at a rate of half a mile a day, so that in 10 days it ought to be very close to town.

E. M. Binds, a mining engineer of Los Angeles, is here to direct the commencement of operations on the Emerson, adding still another property to the long list in active operation here.

A road is being constructed from the mouth of Alum Wash to the Black Jack mine and an extension of this road is being surveyed to run from the Black Jack to the Gladstone. The entire road will be about 2½ miles in length, and will serve several other good prospects in the east section of the camp.

The Black Jack ore has commenced to go through town on its way to the smelter. The ore is being packed by burros from the mine to Tramway landing, thence by wagon to the railroad.

The water company plans extensive improvements and extensions to accommodate the fast growing town. A new reservoir is to be built at the head of Tennessee avenue to give the camp better pressure for fire-fighting. More cross-mains are to be laid in the north and south sections. The camp is spreading mostly in a southern direction, along the new boulevard now being built by the county, and this section is compelled to rely upon the water wagon for its water supply.

CALIFORNIA.

Jackson.

Deputy U. S. Marshal Otis Bohn and attorneys representing the mine operators have served injunctions on 100 striking miners, restraining them from interfering with working of the mines. This follows a recent order of the U. S. District Court at San Francisco. An injunction has also been issued against Assistant State Labor Commissioner J. J. Kelley. Attorneys in the employ of the Western Federation of Miners will represent the strikers when the temporary injunction comes up for argument.

Large numbers of strikebreakers are coming into the district, and it is evident the operators will make a determined endeavor to resume operations. All the mines remain idle, with the exception of the Plymouth Con., at Plymouth, and the old Eureka, near Sutter Creek. Several clashes have recently developed, but the strikers have been generally peaceable. Pumps are still idle at the South Eureka, but the miners have agreed the company may keep the mine unwatered.

Grass Valley.

A meeting of stockholders of the Union Hill Mines has been called for the purpose of dissolving the corporation and distributing treasury funds; \$85,000 remains in the treasury,

after meeting all expenses. New interests recently took over the property and are operating it at a profit. Rich tungsten ore continues to be mined, and driving is proceeding with a view to intersecting the Georgia and Union Hill veins. Additional territory has also been acquired.

General Manager C. K. Brockington of the Golden Center and Grass Valley Mines companies has placed orders with local foundries for a 10-stamp addition to the Golden Center 10-stamp mill, and a complete 20-stamp plant for the Allison Ranch mine. The shaft of the Golden Center has been completed to a depth of 1000 ft. and drifts are advancing along shoots of rich ore. Unwatering of the Allison Ranch is proceeding slowly, and the new pumping system is to be in service about Nov. 10. Construction of the mill and mine buildings is making good headway.

Bishop.

Heavy shipments of tungsten concentrates are being made regularly by the Tungsten Mines Co., a shipment last week being valued at \$20,000. Eleven concentrators are running with three shifts employed. At the Little Sister mine surface ore is being quarried, and good ore opened in the tunnel workings. Howard Moore has been appointed superintendent.

Considerable work is going on in the Standard group, where some excellent tungsten ore has been blocked out. The company is erecting new buildings and bringing in winter supplies. It is planned to continue work throughout the winter months.

Sonora.

Rich quartz has been intersected in the drift from No. 1 winze in the Omega. The discovery was made about 25 ft. below No. 1 level and shows a 9-ft. vein containing broad shoots of ore averaging better than \$200 per ton in free gold, with considerable sulphurets also present. The ledge is broadening as drifting advances, and the discovery is considered a most important one. The mine formerly yielded much bonanza and at this time is operated under bond and option by Lange & Hussey, understood to represent New York people. C. W. Ayers is manager.

Additional concrete bases and foundations are being installed at the Dutch mine and mill for support of new equipment. The milling plant is being improved and enlarged. The Dutch, App and Sweeney properties are worked through the Dutch shaft and late important developments have warranted the installation of much new machinery.

The Black Oak Co. has installed a diamond drill on the 900 level and has arranged for extensive explorations below this point. Rich ore is coming from the main levels. The Confidence Gold Mining Co. has been formed to take over and operate the Confidence mine. Satisfactory developments will be followed by installation of new equipment.

The McAlpin Mines Co. is opening excellent ore in its property at McAlpin in the southern end of Tuolumne county. The vein is 4 ft. wide and assays \$90 in gold. The strike was made near the 500-ft. point and about 700 ft. of backs are available along the strike of the new ledge. Frank P. Whitcomb is president.

Heroult.

Three furnaces are running steadily at the Heroult electric smelter, producing ferromanganese, ferrochrome and ferrosilica. The company is devoting particular attention to development of manganese deposits, finding it difficult to supply the demand for ferromanganese. Another furnace will be operated on this product as soon as sufficient crude ore is assured. Most of the manganese is coming from points tributary to Hollister, Ukiah, Castella and Livermore. Ore from the Castella district is especially favored, as it is near the plant and means an important saving in freight costs. Deposits near Callahan are considered promising. No attempt will be made at production of pig-iron while the demand for other products remain satisfactory.

Mokelumne Hill.

A bond has been taken on the Sullivan quartz mine in Chili gulch by H. J. Windler, general manager of the Mokelumne group. The property has been opened by a 450-ft. tunnel, which shows a strong ore body 14 ft. wide. The tunnel is being extended and drifts started. The adjoining

Lancell gravel property has also been reopened under bond. The tunnel strikes the noted Stockton Ridge channel.

Angels.

The Angels Camp Deep Mining Co. has installed a compressor and is sinking the shaft with air drills. At a depth of 140 ft. excellent ore is showing, with the vein improving as depth is attained. It is planned to erect a small mill to take care of ore broken in routine work, and to provide a large plant as soon as ore conditions warrant.

Sutter Creek.

A 9000-gal. tank has been installed on the 500 level of the Old Eureka, to take care of water raised to this point from the deeper workings. A centrifugal pump elevates from tank to surface. Unwatering of the 800 level is making good progress and the workings have been found in better condition than anticipated. The management is confident of starting mining early in 1917.

Dutch Flat.

The Rawhide mine has been reopened by the Canon Mines Co., after lying idle 5 years.

COLORADO.

Cripple Creek.

Thirty tons of ore from the Isabella Mines Co. carried a value of \$197.47 per ton, a gross bullion value of \$5,923.50. The ore was mined on company account from the ore shoot under development at the 15th level of the Lee shaft.

A winze sunk 125 ft. below the bottom level of the Cresson Con.'s main shaft has proven ore values continuous to that depth. Work will shortly commence on a lateral to be extended from Roosevelt tunnel directly under the Cresson shaft. A raise will then be carried to connect. The bottom of the winze is 160 to 175 ft. above the tunnel level. This lateral extending in a general northwesterly direction from the line of the drainage tunnel through Raven hill will be important exploitation work.

The shaft on the Little May claim has been timbered by the Cripple Creek General Mining & Exploration Co., and sinking has been resumed. It is expected that the Josephine vein will be cut on its dip in the next 15 or 20 ft., as values are already carried in feeders cut in the shaft. The Little May shaft is equipped with a windlass only. With a depth of 50 ft. an electric hoist will be substituted and a shaft house constructed.

Rico.

Rico shipped 11 cars of ore during September. The falling off in tonnage is due chiefly to the fact that the Rico-Wellington has nearly discontinued its heavy shipment of low-grade and is directing efforts toward the production of higher grades. A new series of ore beds may be encountered at any time as the extensive development operations there proceed. Lead-silver ores now predominate in the output, as was the case in the best days of the camp. September shipments were: Rico-Wellington, 5 cars lead-silver to Leadville; 2 cars copper-sulphide to Leadville; 2 cars lead-carbonate to Durango. Rico-Con., 1 car copper-sulphide to Leadville. W. P. Muncaster & Co., 1 car lead-copper to Durango.

A night shift has been put on at the Rico-Argentine, and a force of 20 men is now employed. Since the installation of the new power drill equipment good headway is being made.

The Rico-Wellington has a record of 684 ft. of work for the month of September. This is a remarkable showing. The mine is reported as being in splendid shape, with ore prospects excellent.

Leadville.

The water level in the Mikado is now down to the 900 level and the shaft has been retimbered to that point. A new and larger station is being cut in the shaft which when finished will be 15 ft. wide, 18 ft. high and 60 ft. long. It will accommodate the main pumping equipment to be installed on surface. The blacksmith and machine shops have been completed. Foundations are being put in for the new

two reasons, to give first consideration to the percentage of copper sulphide in the concentrates.

With a view to obtaining a clean high-grade concentrate, this company has done some remarkable work during the past year. No acid is used, and they have not yet decided whether the results obtained with a hot pulp are better than those obtained when the pulp is treated without heating. In the oil mixture they have found that they obtain best results when 60% of steam-distilled pine oil is mixed with 40% of a collecting oil mixture, made up of fuel oil and coal tar.

To show what good results they are getting, the ore as it comes to the flotation machines, runs on an average 2.3% copper; the concentrates assay from 17 to 18.5% copper; while the tails run about 0.28 to 0.3% copper. Anyone familiar with the usual practice in flotation will admit, from these figures, that what little work is being done by the flotation process in Alaska, it ranks fairly high in efficiency, when compared with the flotation work in the west generally.

Many men in the other camps in southeastern Alaska have expressed the opinion to me that it will not be very long before we will hear about some more flotation plants being constructed in that territory.

Decreasing Ore Waste in Metal Mining

E. T. LEDNUM.

In the winning of ores from their natural beds by blasting, physically fine flaky material is not desired and is a source of serious loss to mine operators. Nevertheless metal mining companies are generally disposed to use the higher grade explosives, perhaps overlooking the economical requirements of a blasting explosive.

With the exception of iron, manganese and a few other base minerals, ores which are crushed and concentrated for their metallic values should not be pulverized or shattered to flaky or powdery fines.

The speed of detonation (that is, the speed of action) of the explosive in the drill hole is in proportion to the volume of gas and heat developed in a given time. These are established facts.

High-grade, quick-acting explosives break down the mineral into minute particles, especially in the zone adjacent to the explosive charged surfaces in the drilled hole. There is also no doubt a fusing effect exerted on zinc ores and other easily reducible ores from the softer rocks. This action is decided, especially where holes are drilled and charged in the ore bodies proper.

Explosives exert the disruptive, crushing and disintegrating effect throughout the burden in direct ratio to the action of the explosive. Low-grade, slower-acting explosives will not be as severe, or produce proportionately the resultant physically fine ore from the blasted burden, as will the higher grades and quicker acting explosives. It will be necessary to do

more boulder blasting when using low-grade explosives if the explosive charge in the drilled hole is not sufficiently tamped with "stemming." Dynamite in a drilled hole without "stemming," when exploded, will exert a great deal of its force on the material which holds it, but as the effect of the explosive is in line of the least resistance, the natural result is that the charge in an untamped hole will expend a great part of its energy in blowing back out of the hole. Explosive charges should, therefore, be "stemmed." The reason for this is set forth in the formula:

$$P V = R T$$

in which P = Pressure and V = Volume; R a constant for each Gas and T = Absolute Temperature. If Temperature remains the same, no matter how Pressure or Volume vary individually, their product will be equal to the constant R T. If Temperature increases and remains constant, R being already constant, nothing is left but for Pressure to increase in the same ratio as Temperature, and the resultant efficiency of the explosive is increased, as will be shown by the quality of the work done. The quality of mine air will also be much better after the blast.

All boulders should be block holed to reduce vibrations in the mines with consequent bad results. However, there would be much less finely divided material left in the mine, and the ore would go to the mill in better condition to be broken down from hard masses, permitting the mill to perform its proper functions, and less finely divided particles of mineral would be carried off in the sludge water and tailings.

The conservative use of explosives adapted to the winning of ores from their bed will not only prevent losses in transportation—that is, from the ore body to the smelter—but will effect further economies in the installation of elaborate flotation and other concentrating equipments to secure the finely divided mineral particles.

Powdered minerals cannot be satisfactorily separated by gravity and as it is therefore important in designing crushing plants to so construct them to minimize as far as possible the sliming of the minerals, the minerals should not be so produced by blasting in the first winning from their deposits.

Japan as a Source of Tungsten.—Exports of tungsten ore from Japan in 1915 were 85 tons to the United States, 214 tons to France, and 110 tons to the United Kingdom, or 409 tons in all. Estimated shipments to July 20, 1916, are placed at 480 tons, most of it going to the United States. The tungsten output of Japan is reported as 25 to 40 tons of ore per month from the Kiwada mine, 10 to 11 tons per month from the Takitori mine, and 75 tons per month from several small mines. Those in Corea produce between 50 and 60 tons per month. Attempts were made to obtain tungsten from Siam, but the ore contained large percentages of tin, greatly reducing the value.

CALIFORNIA.

Jackson.

The strike situation is gradually improving, and hopes are entertained for capacity operations at most mines before the end of November. Work has been resumed at the Bunker Hill with 60 men, and the management expects to have fully 100 on the payroll soon. At the Kennedy 120 men are employed, and the Argonaut has over 100. The Plymouth Con. is working a large force and maintaining a heavy output. The South Eureka Co. has established a guarded camp at its property, and is quietly arranging to resume work at an early date.

Since the strike began fully 500 miners have left the district, including a large number of the most hostile agitators. Attempts to settle the trouble by arbitration have been defeated by the companies, which contend that there is nothing to arbitrate. To grant the wage increase asked would mean the forced idleness of many properties, and no other provision than the demanded scale would be accepted by the miners.

Several old properties in this district are being examined with a view to resumption of activities. Among these are the Mammoth, Mitchell and St. Julian. It is reported a sale is being negotiated for the St. Julian, the prospective buyers being James S. Rear and T. M. Woode of Vancouver, B. C., owners of the Columbia mine and other important California properties.

The elevated tramway from the ore bins of the Argonaut shaft to the new mill is nearing completion. It will be approximately 800 ft. long and provided with double tracks, the descending car aiding to balance the one ascending. Construction of the mill has been practically completed. In addition to the equipment of the old 40-stamp plant, the new mill will be provided with 20 heavy stamps and special gold-saving devices.

Sutter Creek.

Unwatering of the Old Eureka mine is proceeding rapidly. A powerful double-drum hoist, capable of raising a 15,000-lb. load from a depth of 3000 ft. is being installed and a centrifugal pump has been placed in position to elevate water to surface from the 9000-gal. tank on the 500 level. Unwatering of the 800 level is proceeding steadily. The miners are beginning to find numerous charred timbers, mute evidence of the fire that forced the closing of the mine more than 30 years ago.

Kennett.

Construction of the electrolytic zinc plant is proceeding rapidly, and the management expects to start ore treatment within a few weeks. Frame work is in position and considerable machinery has been installed. The plan represents an expenditure of \$300,000 and will treat custom ore in addition to treating flue dust from the baghouse of the Mammoth smelter, and zinc ores from the Mammoth mine. It will also probably handle a heavy tonnage for the Bully Hill smelting people.

In the Arps group a 6-ft. vein of gold-silver ore assaying around \$70 has been intersected. The vein also carries some copper and is developing well. The owners of the Shasta Belmont are arranging for early operations. The lower tunnel will be extended 160 ft. to intersect the main ore zone, and an engine and blower installed. The camp will also be enlarged and the road repaired preliminary to shipping to custom smelters. In the upper tunnel some good ore has been blocked out. The zinc ores will probably be treated in the new Mammoth plant. W. E. Casson, of Carson City, is manager.

Sonora.

The Confidence mine has been acquired by the Confidence Gold Mines Corporation, capitalized at \$600,000. There are 1000 preferred shares, and 5000 common. The directorate is composed of Warren B. Hunting of New York, and E. S. Bolen and W. A. Stratta of Richmond, Va. Comprehensive operations are to be commenced immediately. The Confidence was long one of the most consistent producers of the Sonora district and has produced upward of \$5,000,000 in gold but idle 10

years. It contains wide bodies of medium-grade quartz in the lower workings and has been opened to a depth of 1100 ft.

Rich ore has been opened in the Gem mine, for the past 4 years worked by J. F. Wulzen. The ledge ranges from 3 to 4 ft. wide and was struck in a winze recently started from the end of an old adit. Considerable free gold shows and the strike is considered one of the most important made on the East Belt in years.

Morris Ravine.

Machinery is being installed at the Bumble Bee quartz property, controlled by Ford brothers. Large quantities of electrical equipment is being installed at the Banner mine, and the management expects to start large-scale operations early in December. Good ore is showing on several levels, particularly in the main workings of the South Banner claim.

Angels Camp.

The Estelle Gold Mining Co. has been formed by Denver capitalists to operate a group of claims in this district. The property lies near the Gold Cliff, Angels, Utica and other large producers, and comprises a merger of numerous holdings of great promise. Machinery has been purchased and it is planned to start active operations within 30 days. Ralph M. Jones is president; Felix B. Tait, vice-president; Estelle Sibbald, secretary-treasurer; Daniel F. Mackay, general manager. All are residents of Denver.

Downieville.

The buildings and headframe of the Finney mine have been enclosed and roofed in preparation for the winter. A new hoist is in position and sinking on a goodlooking ledge is making fair progress. It is intended to continue work all winter and to provide reduction facilities in the spring if ore conditions remain satisfactory. George Morse is superintendent.

It is reported the Rock creek section will be supplied with electric power in the early summer. A preliminary survey for the transmission line has been made from the North Fork mine to the Wisconsin, and it is said branches will be extended to all the principal mines.

Tuolumne.

Unwatering of the Columbus mine has been completed and mining will be resumed with the least possible delay. It is one of the oldest properties in California and in its early years yielded much rich ore. Strongly-financed eastern people recently became interested, and a vigorous campaign of development work has been outlined. The Buckeye mine has passed into the hands of New York people and is to be re-opened within 30 days.

Nipton.

The Copper King group of nine claims, belonging to G. H. Hamstadt of Nipton, has been bonded by W. W. Wishon and H. B. Sharps, representing Philadelphia interests, and their examination in the next 60 days will determine the sale. They have four assistants in making the examination now on the property.

COLORADO.

Silverton.

The Pride of the West Mine has been leased by C. W. Byrd and associates. Production will be kept up during the winter. The ore is now being shipped to the Silver Lake customs mill, but will later be treated at the Old Green Mountain mill, which is now being remodeled, including the addition of flotation machines.

Cripple Creek.

The Albert-Beacon Gold Mining Co. is operating the Beacon mine under lease with the privilege to purchase. An electric hoist has been installed at the old Beacon shaft. Just as soon as the old sump is cleaned out, men will go to work in the old levels. Other miners will start sinking the Beacon shaft from its present depth of 360 ft. an additional 20 ft. Two shifts will probably be put to work.

Associated with J. D. Purcell, president of the Chem. Co., Chicago, Matt. Korf has taken a lease on the Victor mine from the Smith-Moffat Mines Co.

few days. A new hoisting engine was installed on the Copper Age and another engine is on the way for use at another point on the same property.

The tunnel at the Hidden Treasure is within 150 ft. of its goal and is going forward at the rate of better than 4 ft. daily.

A representative of the Callow Engineering Co. of Salt Lake is here, making an examination of Hidden Treasure at the request of the Hidden Treasure Co. The company will submit plans for a 150-ton reduction plant.

Leasers are becoming active and applications for blocks of ground being made. This results from presence on ground of four milling companies who are striving to get custom mills erected. The Silver Hill will begin work on its mill at once. The Steffy mill will also begin work at once. Sufficient ore contracts have been made to provide 250 tons daily. The Copper Age mill will add a custom department. This has encouraged leasers, as it will insure them home treatment of their ores and hence a profit.

Jerome.

Decatur Copper Co. with main office at Decatur, Ill., has just been reorganized with the same number of shares, 2,000,000, which will be exchanged at the rate of two of the old for one of the new, thus disposing of 850,000 shares and leaving in the treasury 1,150,000 shares of which 400,000 shares will be offered for sale and 750,000 in the treasury. The new board of directors are: Philip Carroll, Hancock, Mich.; F. P. Wells, Chicago; C. M. Hearst, W. J. Wayne, W. C. Fields, and S. T. Lowry, Decatur. The property lies, it is thought, in the way of the great vein of the United Verde Extension and next to the Green Monster.

Quartzite.

Lidgerwood Mfg. Co., through the Los Angeles office, has sold a 1½-yd. excavator to the Yuma Con., to handle dry placer material on the latter's gold property near Quartzite. The excavator will be operated by electric power, taking up material from the surface and dumping it into a hopper from which it is loaded into 4-yd. ore cars and hauled by electric locomotives to the mill. The dry milling plant is being equipped with a Quenner chain-hammer pulverizer and Stebbins dry concentrating tables, and a belt conveyor for stocking the tailings. Concentrates made from this dry placer dirt, after taking out the coarse gold, ran \$180 gold, 22 ozs. silver and 40% lead. Excavations made through the false bedrock disclosed a good grade of placer material below it.

Oatman.

The Iowa is now entering the foot wall of its vein at 400-ft. depth, and from the mineralization of the wall rock, and signs of replacement of calcite by quartz, the operators believe that they will encounter a pay shoot not far from where the crosscut taps the vein.

Picture Rock, Arizona Tom Reed, Carter, Boundary Cone, Gold Road Bonanza, San Francisco, Mohawk Central and Crescent are other properties which should soon be due for interesting developments.

In the Tunner level of the Times, which has resumed operations, a full face of ore averaging better than \$20 has been encountered, and a drift is now into this ore about 20 ft.

Taken as a whole, Oatman today looks better than ever. A number of insufficiently financed concerns have suspended, but those now operating are performing their work with an earnestness and determination which promises much for the future of the camp, and several other concerns which have just been re-financed with strong capital back of them are making preparations to resume early.

The Gold Dust is steadily developing ore on two levels, and will soon have the old Orion mill equipped to handle 25 tons of its ore daily. The Zimmer centrifugal amalgamation process will be used. Laboratory tests have shown a high saving on these ores, the gold in which is so fine that it cannot be caught by ordinary amalgamation processes.

The Oatman United, at a depth of about 150 ft., has passed through what it believes to be the first fold of a big vein which its operators believe may be the Big Jim vein,

and now is entering the hanging wall of what seems to be the reverse fold of this same vein. J. K. Turner, of the Goldfield Great Bend and Jumbo Extension, is consulting engineer for the Oatman United.

The Big Jim shows the finest example of a folded vein which it is possible to find. On the 485 and the 400 levels, the strike of the vein is N 60° E, and its upward strike is toward the south, at an angle of about 85°—almost perpendicular. At about 200 to 240 ft. depth, the vein encounters a massive dike, the strike of which is parallel with that of the vein, runs upward along the wall of this dike for some 40 ft., and then turns back to the north at an angle of about 56°. This elbow, at point of present work, is near the southerly sideline of the Big Jim, and indications are that further to the east, this elbow will be thrust out some distance beyond its southern sideline, but that the upward inclination of the vein at that point brings its apex back to fully 120 ft. within the Big Jim lines. It is one of the most interesting and geological studies of vein folding.

CALIFORNIA.

Zabriskie.

Fifty Associates Securities Co., Los Angeles, is developing large bodies of talc in San Bernardino and Inyo counties, near the line of the Tonopah & Tidewater railroad. After stripping off the overburden, the talc deposit is bored into with coal augers and blasted with black powder. An analysis of this material shows the following content: SiO₂, 59.3%; MgO, 27.14%; CaO, 2.52%; Al₂O₃, 0.43%; FeO, none; H₂O, 5.38%. This is deemed exceptionally high grade, and commands a market among manufacturers of paper, surgical and toilet powders, automobile tires, lubricants, cotton bleaching and paints. It is also used in tanneries, in ceramic arts and in rubber factories. F. W. Remy, E. M., is directing this work.

Caliente.

The Big Fifty antimony mine, 15 miles from Caliente, Kern county, has been developed by adit levels, exposing a 50-ft. ore body, carrying 30% stibnite in a porphyretic gauge. The ore occurs within a porphyry dike which extends along a contact of limestone and granite, the vein having a dip of about 80°. Shipments amount to 4 or 5 tons per day of the ore of higher grade. A much larger tonnage of lower grade ore is available, and for this a mill may be built. The property belongs to the Fifty Associates Securities Co., Los Angeles, for which F. W. Remy is mining engineer and geologist.

Goldstone.

An important strike was made on the Gold Ring claim of the United Goldstone group last week. The vein is 4 ft. wide and has been opened for 70 ft. with strength displayed as developments advance. About 22 ins. of the center of the ledge carries high values, with 3 to 4 ins. picture ore. It is stated the ledge averages throughout its total width \$72 per ton.

Preparations are being made for resumption of work on the Big Drum group. Large quantities of medium-grade ore are exposed, and shipments to the custom mill are contemplated. The management contemplates erecting its own mill as soon as a satisfactory reduction process has been perfected. The company is controlled by the Shorey-Brown interests of Boston.

The Daggett custom mill is being improved and will soon be in shape to treat 200 tons daily. Some trouble has been experienced in securing a satisfactory extraction, but no further difficulty is anticipated. Boston capitalists control the plant and are supervising it.

Victorville.

A deposit of high-grade tungsten has been discovered on the property of the United Tungsten Mines Co., in the Morongo district. The ore is high-grade scheelite, occurring in a formation of granite and limestone. Contracts have been awarded for supplies, machinery and building material, and construction of a 50-ton plant will be rushed. William

K. Weaver, Warren Gillelen, J. Wells Smith, H. A. Cole, Frank F. Peard, E. M. Coplen and other New Yorkers are interested. D. G. Kidder is manager.

Mt. Gaines.

A large interest has been acquired in the Mt. Gaines Mining Co. by Pennsylvania people, headed by Joseph Cauffel, ex-Mayor of Johnstown, Pa. George Kislingbury has been chosen general manager and consulting engineer, and arrangements made for extensive operations. The Mt. Gaines mine has produced upward of \$1,500,000 in gold, but has been idle since 1911. It is to be immediately unwatered and vigorous work prosecuted. Considerable California capital is also interested. The Mt. Gaines is said to have been the first gold mine in the State to be operated by electric power.

Keeler.

The deposit of rich silver-lead ore lately opened in the Cerro Gordo continues to develop splendidly. As depth is gained the vein appears to be gaining strength with the values maintaining their original average. In the lower workings high-grade zinc is mined and heavy shipments made. The tramway is taxed to capacity to handle the tonnage.

Jackson.

The strike of the miners in Amador county came to an end last Friday, following instructions from the executive offices of the Western Federation of Miners. In these instructions it was stated the strike was ill-timed, without merit, and had been called without instructions from the head officials. All the mines are resuming with full crews as rapidly as places can be found for the men, and roads and trails are crowded with returning workers. With the exception of a few particularly objectionable leaders, all the men are being employed in their old places.

Nevada City.

The North Star Mines Co. is preparing to construct an aerial tramway from the Champion mill to the Providence shaft, which will shortly become the main outlet of the Champion group. Connections of the Champion and Providence mines at a depth of 1800 ft. are proceeding. On the 2700 workings of the Champion a 4-ft. ledge of milling ore has been encountered and is apparently developing into an orebody of importance. Thirty stamps are dropping at the mill, and ten more will be placed in commission in the near future. One hundred and fifty men are employed.

Unwatering of the Delhi mine, on Columbia hill, has been completed and active exploration is about to start. According to miners ore of excellent grade was exposed in the shaft when water forced closing of the property, and if this is proven by actual work, the mill will be placed in commission at once. Considerable low-grade quartz is exposed in the upper levels.

The Sailor Flat hydraulic mine has been taken over by local people and will be worked by the drift method. New lines of flumes have been laid and a good water supply developed. Large bodies of excellent gravel have been blocked out. The outlook is considered encouraging for a profitable season.

Hammonton.

The Yuba Gold Fields Con. will launch dredge No. 16 on No. 20. It will be of steel throughout, equipped with 16-cu. ft. buckets, and designed to handle over 450,000 cu. yds. of material per month. It will closely resemble No. 15 dredge of the Yuba fleet, but will be equipped with improved gold-saving devices and is expected to be even more efficient in every department.

Placerville.

The Placerville Gold Mining Co. has sold 23 claims to a syndicate of California and Eastern people headed by J. W. Northrop, San Francisco. The deal includes the Pacific mine, which has been opened to a depth of 2000 ft. by shaft and winze and five properties located within the city limits of Placerville. For 40 years the Pacific was a consistent producer, but at the outbreak of the European struggle was closed by its English owners. Under the new ownership the Pacific shaft will be dewatered and drifts thrown out to intercept promising shoots disclosed in adjacent territory. R. Chester Turner, general manager of the Brunswick, Con.,

at Grass Valley, has been chosen consulting engineer and general manager.

The Ohio gravel mine, near Smith's Flat, has been sold to J. A. Forsythe and associates of Alaska by William Richards and W. F. Fairchild. Work is to start immediately and some equipment will probably be installed. The Ohio formerly yielded substantial dividends, but has lain idle several years.

Tuolumne.

A marked mining revival is reported throughout the east section of Tuolumne county, and considerable Eastern capital is being invested. In the Columbus a strong vein of \$10 ore has been encountered in the shaft, which is being deepened to 500 ft. In the nearby Carlotta rich ore is showing and the management is preparing for more comprehensive work. Operations have been resumed at the North Star, formerly a good producer.

The Confidence Mines Co., a strongly-financed, \$1,000,000 corporation, is rapidly completing arrangements for extensive work at this property. Considerable new equipment has been decided on, and some orders placed. The Sonore & Duffield property has been reopened. The United Mines Co. is clearing the legal title to its holdings and expects to start along broad lines in the near future. Options have been taken on the Chapparel and Garfield, and other old time producers are receiving attention.

Grass Valley.

The Indiana Dredging Co. has taken a bond on several miles of land along Greenhorn creek and is exploring the territory with prospect shafts. Because of the heavy water flow encountered at shallow depth steel caissons are sunk and the shafts kept clear with a centrifugal pump. Satisfactory results will be followed by construction of a large dredger. The company is one of the leading dredging enterprises in California.

On nearby ground Louis Girdetz and associates are mining rich gravel with a drag-line scraper. The holdings comprise part of Arkansas canyon, and extend for 3 miles to the You Bet placers. Much gold has been recovered by surface placering, but the bedrock has never been worked.

Howland Flat.

Several mines have been reopened and preparations for resumption of hydraulic operations are proceeding actively. The huge restraining dam across Slate creek is nearing completion and as soon as it is accepted by the California Debris Commission, hydraulic operations will start at Howland Flat, Port Wine, St. Louis, La Porte and other camps. Considerable work is going on at the Miners' Home, Wink-eye, and other mines.

Happy Camp.

At the Gray Eagle mine, recently acquired by the Mason Mines Co., the camp is being enlarged and the mine placed in condition for operations on a large scale. The working force has been increased and development of new ground is proceeding. Facilities are also being provided for storage of ore. It is rumored the company plans the building of a concentrator at the mine in the spring, and that concentrates and the higher-grade ores will be shipped to the smelter at Thompson, Nev.

Hart.

Oro Belle Mines Co., whose main office is at Houghton, Mich., will resume mining under the management of the John Hays Hammond-Royer interests about Dec. 1. The new company was organized Oct. 26 and the old company will hold a meeting of the stockholders Dec. 12 to dissolve and distribute the new company's stock on the basis of one share for two of its own; the books closed the 9th and will be opened Dec. 13. The Woodward vein is believed to have a large quantity of low grade gold ore which will prove to be profitable.

Atolia.

The Atolia Mining Co. has temporarily suspended operations, pending shaft improvements which will consume about 60 days. Lessees left portions of the property in bad condition and repairs were necessary. Most of the miners have gone to other camps, but a small amount of tungsten is still being produced by independent operators.

a spur vein, and the inflow of water appears to have started when the main vein was encountered.

The Adams, with its shaft down 400 ft. is now cutting a station, and next week will be engaged in driving a cross-cut to its vein. This property has a good surface showing, and is well financed.

Prescott.

The Commercial mine in Copper Basin, owned by the Phelps-Dodge interests, is shipping from 80 to 100 tons of copper ore daily to smelter, and could increase the tonnage considerably were it not for the fact that smelting facilities are not keeping pace with the output of Arizona's mines, either in this or other mining counties of the state. Adjoining the Commercial mine is the property of the Loma Prieta Co., where a body of ore having a general average grade of 2½% copper is being developed. A small tonnage of sorted ore on the dump samples about 15% copper. The property is to be equipped with a modern plant of machinery and developed at depth. The present depth of the shaft is 155 ft., and it is in a solid body of chalcopryite ore from the 80-ft. point down.

The property of the Copper Hill Co., a corporation dominated by E. S. Clark and John J. Jackson, of Prescott, is another Copper Basin property for which a future is predicted. Next to the Commercial mine, the Copper Hill has been developed to a greater extent than any mine in the basin. Commercial ore is exposed on three levels and has been stoped to some extent above each. Several shipments have been made at a good profit, and the mine is in general in excellent shape for future production. Other properties in Copper Basin having a copper ore showing above average are the Schuber, Blickenstaff, McBride-McNulty, John H. Robinson and Lucky Five.

Mineral conditions continue to improve as development work progresses on the 8th level of the Harqua Hala Bonanza mine, a Yuma county property in which H. William Stevens and other Prescott mining men are heavily interested. Hitherto worked as a gold proposition solely, it now appears probable the mine will in due course come to the fore as a copper proposition. Sulphide ore carrying 5.8% copper was opened several months ago on the 8th level in connection with a large body of oxidized ore carrying high values in gold.

Jerome.

Early December will record the calling of the shares of the Boston and Jerome Copper Co. on the New York Curb. The Boston and Jerome is one of the early-day mining propositions of the Verde district. It consists of 12 claims, a number of which are patented, and is located in the recognized productive area of the Jerome copper belt. It lies 2 miles south of Jerome and adjoins the Verde Central Copper Co. on the west. Considerable development work was done in past years. A lack of funds, however, at that time forced suspension of operations. From then until recently the property remained dormant. Reorganization of the company and a refinancing of its treasury has been perfected through the efforts of S. F. Balentine, of Jerome, who has interested in the proposition several well known mining men of Arizona and a number of wealthy Eastern parties.

Before the close of the current month the shares of the United Verde Con. Co. will be listed and called on the New York Curb. Representatives of the company are now in New York for that purpose, and it is said the stock will open at \$1 per share.

Diamond drilling operations are being prosecuted on the company's United Verde Junior group about 1½ miles south of Jerome, and are to be supplemented in the near future by operations on the company's Mahurin group in the Copper Canyon country. The former is traversed by a strong vein outcrop and is considered promising, while the latter offers ore yielding possibilities similar to those of the copper-porphry deposits of the Ray country.

At the annual meeting of the Venture Hill Co. held a few days ago in Prescott, W. R. Uber, Ed Kiehl, C. T. Jolly, Phil Pecharich and Ed Shumate were elected directors for the ensuing year. The officers will be: Ed Shumate, of Prescott, president-treasurer; C. T. Jolly, of Clarkdale, vice-president; W. R. Uber, of Los Angeles, secretary, and

Ed Kiehl, of Prescott, assistant secretary. The annual report of the company, soon to be issued, will show 437,000 shares of treasury stock, and a treasury fund of \$14,000. The company's property carries a good copper showing, and is being developed under the supervision of John S. Riley, formerly of the United Verde Extension.

Operations are being prosecuted in conjunction with the Verde Apex Co. on a 50-50 expense sharing basis. A force of 25 men is employed in erecting the camp buildings and grading a site for the joint 3-compartment shaft. As soon as the cook house and sleeping quarters are completed the working force is to be doubled. The Venture Hill tunnel has been driven to the line of the Verde Apex ground and a crosscut is now being driven therefrom to the site of the shaft. The plant of machinery, ordered jointly by the Venture Hill and Verde Apex, is en route, and the cement foundations on which it will set are nearing completion.

CALIFORNIA.

Julien.

Friday Copper Mines Co., controlled by W. E. Sterne and L. A. Ellis, San Diego, is opening important deposits of nickel-iron sulphide ore in what was originally started as a copper mine. The ore was oxidized and leached near the surface, but at 100 to 200 ft. depth it is found to be a sulphide. The ore bodies occur in irregular deposits in igneous rock. Samples considered typical of the ore exposed in the workings contained the following, according to assays made: Pyrrhotite, 43.99%; silica, 3.08%; sulphur, 35.11%; arsenic, 0.15%; nickel, 4.12%; copper, 0.93%. Some assays, in addition to the above metals, showed the presence of cobalt and zinc. Two drifts have been run in ore from a 200-ft. shaft, one drift being 50 ft. below the other. This work showed a 14-ft. width of ore. The company is making an effort to develop the property as extensively as possible and block out the ore before attempting to find a market for it. Julien district is 60 miles east of San Diego.

Encinitas.

Encinitas Copper Co. is operating 8 miles east of Encinitas, W. H. McKinnon being superintendent. The mine is being developed through a 420-ft. shaft and a 200-ft. winze from one of the levels. The vein is in diabase and porphyry. The ore runs about 4.7% copper, 4 to 6 ozs. silver and \$4 gold. New milling equipment is being installed in an old building, which will have capacity to crush and concentrate 60 tons per day. Machinery includes a crusher, ball mill and K. & K. flotation machines, the latter being those designed by Southwestern Engineering Co., Los Angeles.

Amador City.

The surface equipment formerly used at the Amador Queen mine, near Jackson, has been moved to the South Keystone, of the South Keystone Con., a recently-formed \$1,000,000 corporation. Unwatering of the 1000-ft. North Star shaft will be immediately rushed, and a drift extended from the 600 level to open the South Keystone ore body.

Extensive repairs to the shafts and surface plants of the Bunker Hill and Keystone properties are being rushed to completion, and the respective managers expect to resume normal production at an early date. The working force is being gradually increased and everything placed in shape for an active year. Practically all the men recently on strike have signified a readiness to return to work.

Jackson.

Unwatering of the Old Eureka mine at Sutter Creek has advanced to the 850-ft. point and less difficulty is being experienced in clearing the shaft below the 800 level than was anticipated; 25 men are engaged in erection of the steel headframe and electric hoist, with a like number active in the shaft.

Examination of the St. Juneau has been completed and the engineers are calculating costs of required equipment and supplies. It is understood British Columbia people have arranged to reopen the property and develop it. It is located in the slate belt 4 miles south of Jackson, and to the west

of the Mother Lode, and has produced several pockets containing \$10,000 to \$50,000, and is said to have yielded \$75,000. Late prospecting of the slate revealed numerous seams of gold-bearing quartz. Developments consist of a 1000-ft. tunnel and numerous laterals.

Taylorville.

Preparations for building of the railroad from the Engels copper mine to the station of Paxton on the Western Pacific have been made, and construction of the line will soon start. The road will be approximately 22 miles long. The management of the Engels Copper Co. states that within a year the company will be producing 1000 tons of ore daily, placing it at the head of California copper properties in point of tonnage. Numerous additions are being made to the flotation plant, and its capacity has been increased to about 700 tons daily.

Angels.

Unwatering of the Porter copper mine, idle since 1865, is proceeding. Timbers are found in a splendid state of preservation and the workings are generally in good shape, despite the many years under water. When last worked considerable rich ore was extracted.

The Angels Camp Deep Mining Co. has installed a hoist and compressor, and is negotiating for the purchase of the Brown-Smyth-Ryland mine. If the deal materializes the 10-stamp mill on the ground will be overhauled and placed in operation. An electric transmission line is also to be built to the Pioneer shaft of the main group. Good ore is showing in new workings and the outlook is considered highly satisfactory.

Sonora.

The Springfield Development Co. has arranged for extensive prospecting of its gravel channels with a Keystone drill. Explorations by the drift method have been curtailed, but driving of the main tunnel continues. As the channels are definitely located by the drill drifts will be thrown out to open the gravel and production pressed.

Quartz mining is decidedly active in this field. All the old producers are operating full-handed, and several good prospects have been recently opened. Abundant water is now available, and the few mines that closed temporarily for want of water are again in operation.

Crescent Hill.

A quartz mill, capable of reducing 50 to 65 tons of ore per 24 hours, has been installed at the Tefft mine and will be operated by a large gasoline engine. A good tonnage of profitable ore is on the dumps and exposed underground, and it is planned to operate during the winter with a force of 15 men. With the advent of spring the working crew will be at least doubled and operations pressed along greatly broadened lines. J. F. Groover is superintendent. Crescent Hill is 5 miles south of Quincy.

Alleghany.

The Twenty-One Mining Co., with head offices at Phoenix, Ariz., has applied to the California Water Commission for authority to divert water from tributaries of Kanaka creek for mining and milling purposes. A 2200-ft. flume and 140 ft. of ditches will be used. Late work in the Twenty-One mine has been encouraging and with the arrival of spring developments will be pressed and milling facilities augmented.

Downieville.

Los Angeles people are actively developing the Morning Star and London Tunnel properties at Blue Nose and Nelson creek. New equipment is being installed and the camp improved. Clearing out of old workings is proceeding, including a 1000-ft. drift in London Tunnel territory. Work will be pressed all winter with a crew of 20 men.

A new pump is being installed at the El Oro gravel property, near Lake City. Work has been seriously hampered in the past month by an unusually heavy water flow. The pay-streak is thought to be near at hand.

The 3475-ft. tailings flume at the Kirkpatrick has been completed and connected with 200 ft. of ditches. This will facilitate removal of tailings to a desirable point, and more economical operations. During the summer much prospecting

and development work was carried forward and a large yardage of good gravel is available for mining. The water supply has also been improved.

Vidal.

Bendigo Mines Development Co. has a well developed copper and gold mine, 7 miles from Vidal station, and 15 miles northwest of Parker, Ariz. The ore occurs in deposits, lenses and irregular shoots in limestone. The copper consists of oxides and chalcocite, and the gold is mostly in free state. Ore shipments made within the last 2 years sampled 12% copper and \$15 gold. Smelter returns from 450 tons were \$45 per ton. Most of the ore thus far produced was taken from an inclined shaft 160 ft. on the ore body. A tunnel is being driven on the ore from a point in a ravine. The entire group of 8 claims is to be explored with churn drills. Lester Scott, E. M., is in charge of the work. The company's camp is close to Colorado river, and its main office is in Los Angeles.

COLORADO.

Cripple Creek.

Ernest A. Colburn purchased the properties of the Ajax Gold Mining Co. with all plants of machinery and improvements thereon, excepting the Colburn mill, at public auction. The price was \$480,400, including costs.

The Modoc Con. Mines Co., Denver, has taken over the old Modoc Mine. A 1500-ft. shaft is to be sunk. The work of sinking is to be pushed from five different levels in order that the shaft may be completed within a few weeks.

The Laura Lee has been equipped with a new electric plant. It includes hoist compressor and drills. One shift is now employed, but the second shift will soon be put on. The company is now driving a crosscut from the 200 level of the main Laura Lee shaft to cut the main east and west vein. When encountered it is planned to drift west to the junction of this vein with the cross veins, that in the past have produced good ore at shallow depth. Ore returning 2 ozs. gold has been exposed by a winze sunk below the 200 level. It is the opinion that Laura Lee will be on the shipping list by the end of November.

Hahnwald Brothers, J. Cortellini and associates have purchased the lease on the Queen Bess.

Plans for the development of the Queen Bess by the new owners are not known.

Idaho Springs.

The Empress group has been taken over by the Gilpin Tungsten Production Co. A 500-ft. tunnel opens this property at a depth of 300 ft. At 75 ft. from the breast \$150 ore was encountered in what is thought to be the Empress vein.

The Argo Leasing Co., operating 22 claims in the Dailey district, is working a force of 20 men. The machinery for the new concentrating mill being erected by the McFarland Co. is now being hauled up, the building having been finished.

The McCreedy property on which a tunnel has been driven some 200 feet, has 25 feet yet to go to reach their objective. The vein on surface shows good value in silver. It is the intention to erect a boarding house and mine buildings next spring, the lumber now being on the ground.

A small force, which is soon to be augmented, is now working under Supt. Sturdevant on the claims of the Pittsburgh Con. This property has not been worked for some years but will now be reopened on a fairly large scale.

Leadville.

The Mikado is constructing new buildings and installing machinery. A 300-hp. Wellman, Siever, Morgan hoist is being installed. The pumping equipment has not been delivered and nothing of importance is being done underground. The Leadville Unit has begun pumping and only the bottom level is under water. The lift is 50 ft. from the shaft bottom to the connecting drift in the Harvard through which the water is being carried to the pumps in the Har-

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El Dorado Canyon—Mining, Milling and Development

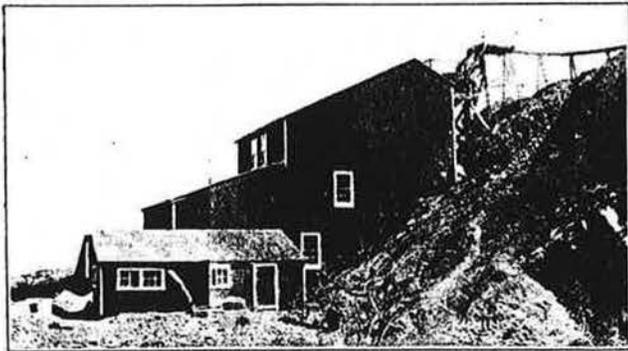
W. A. SCOTT.

El Dorado canyon, in the southeastern part of Clark county, Nevada, has a length of about 11 miles, and drains easterly into the Colorado river. The mining district of that name encompasses the extensive region of igneous formations drained by the main canyon and secondary gulches and washes leading into it. In traversing this canyon from its terminus at the river to its headings near the divide there is an ascent of over 4000 ft. The postoffice and little town of Nelson, situated in the main canyon, 6 miles from its mouth, are 22 miles north of Searchlight, and 45 miles southeast of Las Vegas, both of which are railroad

Geology and Ore Occurrence.

In general features the El Dorado canyon region resembles those of Gold Road, Oatman and Boundary Cone, in Arizona, with respect to the prevalence of igneous and volcanic rocks of several classes. G. A. Duncan, manager of the Colorado-Nevada group of mines in El Dorado canyon, who has spent nine years in the district, has given out a statement relative to the formation and ore occurrence of the district, from which the following is taken:

"The district is near the northeastern edge of an extensive monzonite basin. The canyon is the result



MILL OF RAND MINING CO.

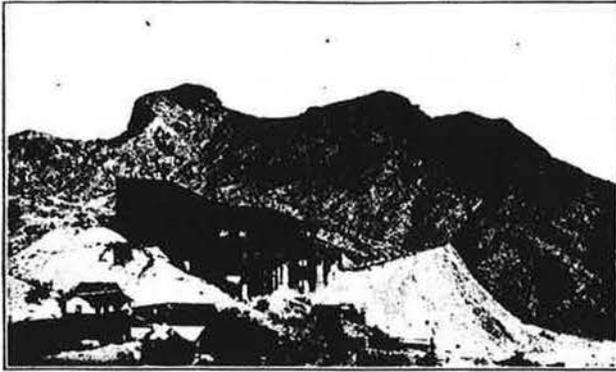


SURFACE WORKINGS ON WALL STREET VEIN.

points. Auto stages make regular trips from both those towns to El Dorado canyon. Nelson is on the route between Las Vegas, Nev., and Kingman, Ariz., and one of the auto stages makes three round trips per week between those towns, a distance of over 100 miles, crossing the Colorado by ferry, at the mouth of El Dorado canyon. Most of the supplies and equipment are hauled into the district from Searchlight. Travelers going into the country over the Los Angeles & Salt Lake railroad usually take an El Dorado canyon stage at Las Vegas, but often go out via Searchlight, which is the terminus of a Santa Fe branch.

of erosion along a profound fracture zone, into which intruded an andesite identical with the Comstock andesite. The dip of the old andesite intrusion is toward the north about 40°; and at various places along its course more recent porphyry dikes mark its hanging and foot wall contacts with the monzonite. Near the middle of this andesite filling of the fracture there intruded a strong porphyry dike, showing the same dip as that of the old andesite which it entered, and is exposed for several miles along the canyon floor. Along this more recent dike the ground movements seem to have taken place, the disturbances inviting erosion, with the obvious result that the canyon and

dike have a common course and position. The ground movements along this dike also caused a brecciated condition to a great depth along its walls, affording a channel for the collecting and passage of mineralized solutions, and making this dike now the one unfailing water course of this section. The ore so far found in this district is in, and along side of the main fracture,

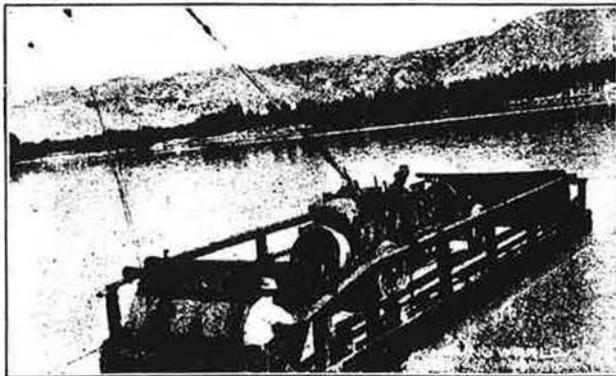


MILL OF COLORADO-NEVADA MINING & MILLING CO.

and in veins departing from it. The outcrop of numerous veins parallel to this dike, and rather close to the old andesite filling of the great fracture, indicate workable ore bodies. Naturally, along so great a shear zone there are departing fractures leading off into adjacent country rock. Mineralizing agencies passed into these fractures, making veins of ore, which, while narrow in comparison to the main fracture vein, have shown some ores of high values."

Colorado-Nevada.

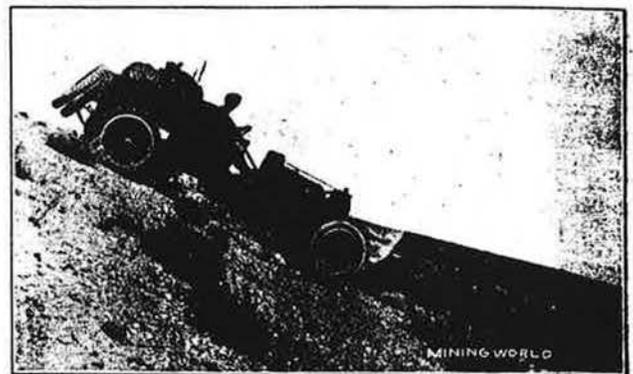
In going over a considerable area of the district, four or five centers of activity were observed along the principal canyon and its tributary gulches. One of the most conspicuous of these is the property of the Colo-



COLORADO RIVER FERRY, OPPOSITE EL DORADO CANYON.

rado-Nevada Mining & Milling Co., located on El Dorado canyon proper, 1½ miles below Nelson. The company's holdings comprise the Flagstaff group, on the main fracture zone, and the White Star group covering one of the deflecting veins referred to in the foregoing statement. The ore bodies on the Flagstaff are within the porphyry dike which strikes easterly and

westerly along the course of the great fracture. This mineralized porphyry dike stands between andesite walls, and has a dip of about 45° toward the north. The porphyritic material, or vein matter, has undergone various degrees of alteration, making a gangue not entirely uniform in character. The ore consists of sulphides of iron, lead, zinc and copper, carrying gold and silver. The gold exists in free state but appears in fine particles. The silver occurs as argentite, as native silver and associated with galena. The vein bearing this class of ore has been mined to a width of 8 to 25 ft. Operations are carried on through an inclined shaft, which sinks 500 ft. on the dip of the vein, and levels on the vein both east and west from regular stations. The ore hoisted from the Flagstaff shaft, amounting to 60 tons per day, is treated in the company's mill by concentration and cyanidation. The ore is first reduced by a jaw crusher, then passed to a battery of ten 1250-lb. stamps, having 20-mesh screens. The pulp from the stamps is concentrated over two tables, a Wilfley and a Butchart, making a lead and iron concentrate carrying gold and silver. The mid-



PROSPECTING IN NEVADA WITH AUTO.

dlings and tailings from the tables are passed to a Dorr classifier and a tube mill, operating in closed circuit, and the cyanide treatment which follows consists of the Dorr system of continuous counter-current and decantation. During the last 4 months the mill operated on ore which assayed an average of \$14.49 per ton and made a recovery by concentration and cyanide treatment of \$13.62 per ton, or 94%. Water for mill work is bailed from the mine, and at times there is hardly a sufficient supply. Power is supplied by gasoline engines, in which California "tops" is used as fuel. The 100-hp. engine, by which the stamps and tube mill are operated, is a De Laverne, the four others, aggregating 150-hp., are the Fairbanks-Morse type. The company's White Star group has been considerably developed, but is not producing. The vein outcropping of the main fissure in the Flagstaff gave very low assays, and this is the case as to the secondary parallel veins. It is by sinking to some depth that the metals are found concentrated in regular ore bodies. In the Flagstaff mine, according to Manager Duncan, the gold and silver in the ore runs in the ratio of 30% gold and 70%

the heavy material passing to a sand table and the lighter to a slimer, making lead and zinc concentrates of different grades. The tailings are being impounded. This camp is 2000 ft. higher than that of the Techatticup and is 800 ft. higher than the Wall Street.

This is one of active centers previously referred to. The Quaker City, on a parallel vein lying north of the Rand, belongs to the Wharton estate, and south of the Rand is the Enterprise group, having a parallel vein formerly opened by an adit level, and on which development is being undertaken by present owners, including E. P. Jeanes, C. E. L. Gresh, H. H. Johnson and Leonard & Co. Existing workings show a fair grade of ore. Other holdings in this locality are on strong veins that will probably justify development. The Occidental-El Dorado, half way between the Rand and Wall Street, is well developed by tunnels and shafts and equipped with hoist, air-compressor and cyanide plant. It has been idle several years, but it is possible that operations may be resumed.

Carnation Lode.

This group of 20 claims, lying north and west of the Wall Street, belongs to W. H. Evans and is under a 5-year lease to A. Welk, C. A. Spencer and W. H. Kirchner. These men, who were formerly in Good Spring district, are exploring and developing, and recently struck a 5-ft. face of ore in a 20-ft. shaft. Other veins on the group have been opened by 60 and 40-ft. shafts, exposing pay ore. Assays of the rich ore in the 20-ft. shaft, according to the assay certificates, showed up as follows: Sample No. 1, 3.85 ozs. gold and 32.56 ozs. silver; No. 2, gold, 127.61 ozs., silver, 1246.9 ozs. No. 3, in three parts, gave gold, 12.08 ozs., 6.8 ozs., 3.8 ozs., respectively, and gave in silver 106.12 ozs., 71.6 ozs. and 28.8 ozs., respectively. All this ore consisted of sulphides, the fold being apparently free. Ore taken from other shallow workings assayed \$8 to \$12 per ton. Specimens taken from a high grade streak in the 20-ft. shaft ran over \$3000 per ton in gold and silver. This leasing firm announces that a small mill of 25 to 50 tons capacity will be erected this fall for amalgamation and concentration.

These rich strikes on ground adjacent to the old Wall Street are making this another active center in the district. The lessees named have let a number of sub-leases, one of these being to Jas. German, M. E. Fisher and Chas. Herman, who have taken over the Lombard Street claim for 5 years. Their development has exposed pay ore 18 ins. wide in a 5-ft. vein.

About 1500 ft. farther down the canyon, apparently on the same mineral belt, is the El Dorado-Empire, in the hands of C. E. L. Gresh and associates. Ore of good grade has been found in a 70-ft. shaft, over which they have a gasoline hoist.

Clark M. Alvord has two groups of claims partly developed. One is the Skylark, located between the Techatticup and the Colorado-Nevada. He has an east-west vein in andesite, on which some ore has been blocked out. The ore is similar to that of the two

mines in that locality. A small shipment of sorted ore sampled \$55 per ton. His other group is the San Juan, extending to both sides of El Dorado canyon, half a mile below Nelson. Development by adit levels exposed sulphide ore, assaying \$4 gold, 7 ozs. silver, 18% zinc and 17% lead. There are four parallel veins. A crosscut is being driven to cut the San Juan vein at a depth of 400 ft.

J. B. Caldwell purchased the Little Eohippus, located one-half mile east of Colorado-Nevada, of J. E. Babcock. Surface work has disclosed some ore on an east-west dike of porphyry. He expects to install a gasoline hoist and air-compressor and develop the property.

Allcock & Wells, Nelson, have some development on the Champion group, located on January wash. This wash enters the main canyon in the vicinity of the Colorado-Nevada. It is claimed there are four veins on the group, opened to some extent by adit levels and winzes. The ore contains gold and silver in sulphides of iron, lead and zinc.

Knob hill, at the head of January wash, is the location of a number of properties, some of which are well developed. Included in these are the El Dorado-Star, Empire, Ben-Ezra and Rich Hill. Among other properties farther east are the Capital, the Wallace and Astor-El Dorado. The Knob hill region was not visited.

New Aluminum Smelting Plant.

The Aluminum Ore Co., a subsidiary of the Aluminum Co. of America, Pittsburgh, has bought a tract of 200 acres or more at Sollers Point, near Sparrows Point, Md., on which it proposes to build a plant for refining bauxite, from which aluminum is extracted. The company has maintained at East St. Louis, Ill., for some years a similar plant, obtaining the bauxite from Arkansas, Georgia and Alabama. The capacity of the new plant at Sollers Point will be much smaller than that of the plant at East St. Louis, but it will be enlarged when the demands of the company make this imperative. The new plant will be built by the engineering organization of the Aluminum Co. of America, which is fully equipped to do the work. C. B. Fox, general superintendent of the East St. Louis plant, will be in regular consultation with the company's engineers in Pittsburgh during the progress of the construction work. The Sollers Point plant is expected to cost somewhat in excess of \$1,000,000 and to be in operation early in 1918. The Aluminum Co. of America is the largest manufacturer of pure aluminum in the world, its principal plants being located at Merryville, Tenn.; Baden, N. C.; New Kensington, Pa.; East St. Louis, Ill.; Niagara Falls and Messina, N. Y., and at Shawinigan Falls, Quebec. The last named plant is operated by the Northern Aluminum Co. of Canada, an identified interest of the Aluminum Co. of America. The company has several smaller plants at other locations.

(v. 45)
silver, in value; but as greater depth is gained the gold increases and is mostly associated with the sulphide of iron.

Techatticup Mine.

The Techatticup belongs to the Wharton estate and is being operated under option to Chas. L. Denison. It is situated on the mountain side, facing Techatticup wash, a branch of the main canyon, and is about a mile north of the Colorado-Nevada. The Techatticup vein runs nearly parallel to the main fracture vein herein described and is considered one of the offshoots therefrom. This is a comparatively narrow vein, in andesite, and has a dip varying from 20 to 80° to the north. The width of ore ranges from a mere seam to 6 ft. The gangue is composed of calcite and quartz, carrying gold and silver in sulphides of iron, lead, zinc and copper, assaying about \$20. Besides the principal vein, striking east-west, there is a branch vein coming into it from the southeast, called the Savage. This branch vein is likewise a fissure in the andesite and other characteristics are the same as those of the Techatticup vein. In the latter vein 90% of the value is in gold, the iron running 5%, zinc 2%, lead 2% and copper 1%. Ore in the Savage vein runs high in silver, much of which occurs as a chloride. In both veins the ore exists in shoots and other bodies, not continuous. Material between such shoots is mineralized but much of it is too low grade to be mined profitably. The 600-ft. inclined shaft was sunk close to the junction of the Techatticup and Savage veins, drifts therefrom extending into both. In general, the inclination of the shaft follows the dip of the vein, but in places where the vein flattens out considerably the shaft is some distance off the vein in the foot wall. There are five working levels, the longest drift east of the shaft being 600 ft. and the farthest west being 400 ft. A crosscut tunnel runs in 300 ft. to the shaft, connecting with it 150 ft. below the collar. This crosscut is on a level with the crusher floor and all ore is hauled out that way. Hoist and compressor are operated by gasoline engines, using "tops," or 40 to 44 gravity gas oil. Other shafts have been sunk on the property for development purposes. A cyanidation plant on the property treats 50 tons of ore per day. The ore is reduced to 4 mesh by a jaw crusher and two sets of rolls. At that size it enters a 5 by 22-ft. tube mill, using flint pebbles, by which it is so pulverized that 80% of it will pass 200 mesh. The cyanide solution is introduced in the tube mill. In passing this pulp to a Dorr classifier, the coarser sand is returned to the tube mill. The slimes pass to Dorr agitators and thickeners, carrying out the system of continuous counter-current and decantation leaching. In this work it is stated that an extraction of 90% is made. R. T. Walker is general superintendent; mine foreman, Frank Hoin; mill men, Roy Leach and G. M. Cotherton.

Wharton Estate.

This property is in control of the Girard Trust Co. as trustee, Philadelphia, represented in this district by

G. S. Borden. It has 22 patented claims in this locality, not including the Techatticup group. They are located in various parts of the district. All are idle excepting in two or three places where ground has been leased. The most noteworthy of all is the Wall Street group, on El Dorado canyon, a mile above Nelson. In earlier years gold and silver ore of the value of over \$1,000,000 was mined and milled. This was taken from a vein 10 to 15 ft. wide, striking east-west, with a dip of 40° south. The ore was mined to a depth of 80 ft. and a length of about 100. Much of the ore is said to have milled \$250, and was hauled to a stamp mill on the river, in which the gold and silver was recovered by amalgamation. Records show that the ore contained 1 oz. gold to 3 ozs. silver. There is now some water in the bottom of the workings. The property was located in 1871 and came into possession of Wharton in 1892. While the Wall Street has been idle during the last 16 years, it has an interesting history and is today a show place in the district. In that locality some of the richest ore thus far found in the district has been uncovered by surface cuts and shallow shafts.

The Rand.

Rand Mining Co. owns 32 claims formerly controlled by the Black Hawk Mining Co. Under the management of Robert Dunbar, Pittsburgh, operations were resumed in February, 1916, with L. C. Campbell as superintendent. The location is on the south side of Copper canyon, on the Searchlight road, about 2 miles west of the Wall Street. The holdings cover 1½ miles on the strike of an east-west fissure vein in monzonite-porphry. The vein has a varying dip to the north. It has been opened by a 500-ft. inclined shaft, following approximately the general dip of the vein. Water came in at 400 ft. and workings below that level are now submerged. A big tonnage of oxidized ore was formerly mined in stopes near the surface. The sulphides were found at and below the 100-ft. level. Ore now being stoped above the 300 level occurs in defined lenses, the gangue being quartz, spar and altered rock. The gold is largely free and amalgamable, the sulphides being those of iron, lead, zinc and antimony. The lead is accompanied by silver. An electric duplex plunger pump, stationed at the 400-ft. level, is used for lifting water to a tank on the surface for mill work. In the shaft house is a gasoline engine for operating a skip in the incline and an air compressor. The Venus shaft, 1200 ft. west of main shaft, contains a supply of water and this is considered in a separate basin. An electric pump is stationed at the 200 level of the Venus whereby water is furnished for domestic and other uses at the camp. Electric power is produced by a Westinghouse generator, driven by a gasoline engine in the mill. This is used for lighting and for pumping operations. The milling plant, consisting of 10 stamps, amalgamating plates and two Deister tables, is operating with one shift, but this is to be increased to two shifts. The pulp from the plates runs into a classifier,

est return at the least expense, and whether this is effected by large, expensive dredges or smaller and less imposing machines, the result is equally satisfactory from the point of view of the shareholder, which is the only point of view that has a right to be considered. One important feature of dredge design is simplicity. An old client of the writer's who was largely interested in New Zealand dredging used to say that he wanted a dredge with one wheel. This, although impossible, is perhaps as good an ideal as any for the dredge designers to aim for. When complications are introduced he must be satisfied that such complications are justified by reduced expense somewhere—that they will reduce labor or facilitate operation in such a way as to effect a sensible saving of time or fuel or effect a better saving of the mineral.

Losses in recovery should be combated strongly. It should not be overlooked that every cubic yard of material that is lifted has cost the company so much actual cash, and to let mineral go overboard again is equivalent to the action of a shopkeeper who, when emptying the till, would throw away the coppers on account of the trouble incurred in counting them. The dredge designer has, therefore, two requirements to study: (1) save every possible cent in working expenses; (2) save every possible grain of mineral that comes on board. There is still room for the engineer to exercise his ability and inventive faculties in bringing these two questions nearer to the irreducible minimum. The second problem is definite, as when all the mineral is recovered no more can be done. The first will always be comparative, as with whatever power is used and whatever machinery employed it will always cost something to run. In practice both questions offer good margins for improved methods.

The future of dredging is largely with the engineers. Every sensible advance made by the engineer in the directions indicated brings fresh territory into the range of paying propositions. The opinion is often expressed that the palmy days of dredging are over. This is no doubt true if what is meant are the days when capital could be secured to dredge any likely looking piece of ground without prospecting it, but in the opinion of those in the best position to be able to judge, real legitimate dredging enterprise is practically only commencing.

Asbestos in Arizona.—Up to the present time Canada was the only locality in America where long-fibered asbestos was obtained. While Wyoming produces asbestos, this material is of the serpentine type and is short-fibered. Lately large deposits of the long-fibered type of asbestos were discovered in Arizona, the largest deposits being in the Sierra Ancha and at Ash creek. The asbestos of Arizona is chrysotile asbestos and is found in lime and diabase. Its nature makes it especially useful for the manufacture of fabrics. The high-grade material is at least 50% of the total material mined and is the only material that is being shipped, due to the high freight.

The Tenth Chicago Cement Show.

The 10th Chicago Cement Show will be held in the Coliseum, Wednesday, Feb. 7, to Thursday, Feb. 15, 1917, inclusive. This is the ninth successive cement show that has been held in Chicago, and will be housed under one roof, making necessary the use of the balcony as well as the main floor and annex of the Coliseum.

The unusual number of manufacturers and producers of building materials and concreting equipment who have already made application for space at the Tenth Chicago Cement Show, makes it highly probable that builders who attend the 1917 show will find an even wider range of products and equipment than was presented at the ninth show. In addition to the standard machines which will be displayed, a number of the better of the new machines and devices which have been developed since the last show will be on exhibition.

Every possible effort is being made by the show management to conserve the available space in order to accommodate as large a number of applicants as possible. Exhibitors have been requested to make application for the minimum amount of space in which their exhibits can be installed and the arrangement which eliminates the drawing for space and permits the management to make direct assignments should do much towards saving space and making the show truly representative of the industry.

The joint exhibit of cement companies at the tenth show will in all probability excell the last exhibit in real educational value. Cement manufacturers have contributed more money for the exhibit and the plans to show concrete products in the making should make this exhibit worthy of careful study.

Production of Scheelite in New Zealand

Scheelite, according to Consul General Alfred A. Winslow, Auckland, is found in several sections of New Zealand in the neighborhood of the gold mines both in the North and South Island, and has of late been quite extensively mined. The output has increased from 58 long tons, valued at \$20,746, in 1909 to 130 tons, valued at \$64,953, in 1912 and to 194 tons, valued at \$135,211, in 1915.

Since September, 1915, the British government has requisitioned all supplies of scheelite and other ore containing tungstic acid, and from that date all exports to other markets have been prohibited. The price fixed by the imperial government was £2 15s (\$13.38) per unit (a unit being 1% of tungstic acid in the sample) delivered at London or Liverpool, the scheelite concentrate to contain not less than 65% (65 units of tungstic acid).

It was reported in the latter part of 1915 that a large body of scheelite was located in the eastern part of the North Island in the Hawke's Bay district.

Electric Smelting at Heroult, Calif.

The Noble Electric Steel Co., San Francisco, has operated continuously its electric smelting plant at Heroult, Calif., since April 15, 1916, turning out a ferromanganese product. Previous to that date the plant had been operated intermittently since 1911. The furnace has undergone several changes, the one now in use having been evolved after special experience with several original types. It is described as the

H. H. Noble, San Francisco, is president of the company; E. E. Mead, secretary. W. W. Clark is metallurgist, at the plant.

Trolley Splicer with Smooth Under-run

This trolley wire splicer is so made that it has a smooth under-run surface, there being no saw cuts or shoulders at the inner ends of the lips which embrace the wires. The grooves which receive the wires are

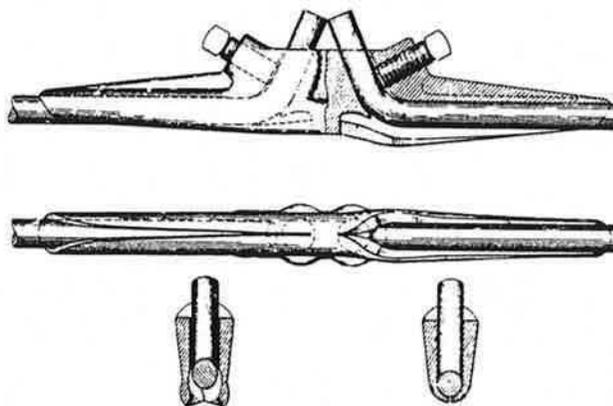


NOBLE ELECTRIC STEEL CO.'S PLANT AT HEROULT, CALIF.

Frickey open delta, split-phase arrangement of electrodes. It is considered a success on ferromanganese ores, the smelting of which was begun in 1914. The closing down at intervals is said to have been due to a shortage of ore of the kind mentioned. The ore smelted varies, but much of it runs 46 to 48% metallic manganese, 14 to 16% silica, and 2 to 3% iron. It is claimed the plant can be successfully operated on ore as low as 40% manganese, and as high as 20% silica. Other elements in the ore are sulphur, 0.01%; phosphorus, 0.1%; carbon, 6.5 to 6.75%. The furnace product contains 80.5 to 81.5% manganese. The plant capacity is 9 tons per day, but this is to be increased. The product is marketed on Pacific coast mostly, though some shipments are made to the eastern states. The ore is mined by the company at several places in California, and a manganese property is being developed in Nevada.

This company, in 1915, began developing and mining chromite ore on a number of properties it had previously acquired in California. Part of the ore tonnage is shipped east, and a part is smelted at the Heroult plant by methods practically similar to those employed in ferromanganese smelting. The analysis of average ore shows 30% chromic oxide, 13% ferrous oxide. The furnace product is a ferrochromium containing 60% chrome oxide and 30 to 32% iron oxide. This class of ore occurs in lenses in serpentine. Heroult camp is on Pitt river, 26 miles from Redding.

inclined upward slightly from the ends of the splicer, forming bendable lips. These lips increase in thickness from the tips of the splicer to the inner ends, where they are of sufficient thickness to withstand the



TROLLEY SPLICER WITH SMOOTH UNDER-RUN.

pounding action of the trolley wheel. When the lips are properly bent around the end of the wire, they form a gradual and smooth approach, so that the wheel will not have a tendency to jump.

According to the Department of Commerce, October imports of copper totaled 34,577,885 lbs., against 36,578,445 lbs. in September. Exports in October totaled 64,713,082 lbs., against 70,905,317 lbs. in previous month.

the vein on the levels above the shaft should cut the hanging wall at about 950. Developed ore between the 300 and 665 levels is estimated at 200,000 tons valued at \$5,000,000. All of this has been opened since March, 1915. The vein is 25 to 50 wide and with the exception of an occasional "horse" of country rock it is solid ore throughout. Some good ore has been encountered in the drifts and crosscuts and the vein on the 400 level averaged \$22.93 across 25 ft. The mill will have a capacity of 200 tons and is expected to make an extraction of 97% at a cost of less than \$2 per ton. Active preparations are being made for the construction of a mill at the Gold Ore mine near the Gold Road. For 3 months the Gold Ore milled its ore at the Gold Road mill. It is said that the average returns of the company were \$30 per ton. The money received from this source will be added to by subscription from several wealthy eastern stockholders and the mill will be built early in 1917.

Development work continues on the easterly end of the Tom Reed properties and a large body of good ore has been opened through the Aztec shaft at a depth of 500. What relation the vein bears to the Big Jim has not been established but in dimensions and structure it bears a strong resemblance, both veins having an average width of 30 ft. The Aztec ore shoot is said to average \$50 per ton for some distance in one of the drifts. E. W. Rabb, superintendent of the Tom Reed mine, is placing orders for a new unit to the mill which will increase the capacity from 175 to 350 tons. He expects to have this unit finished and in operation in 6 months.

The success of the Big Jim, United Eastern, Tom Reed, Gold Ore, and other companies has brought about renewed activity throughout the district and there are now between 40 and 50 properties operating besides those doing assessment work.

Chloride.

The Rattlesnake mine has picked up the ore in a short crosscut run from the bottom of the new shaft. An average of 2 ft. at that point yields returns of \$99.20 per ton. Much copper is showing in the ore.

The Schenectady has broken into very rich silver ore in the North drift, 175-ft. level. Much wire silver and rich specimens are obtainable, exciting great interest, as proving old Chloriders did not go deep enough.

The Hidden Treasure tunnel ought soon to cut vein. Much water is coming in at face and formation changing.

Elkhart expected to start up in a few days. Mill is to be remodelled and active campaign mine development pursued.

Tennessee has completed raise from 1400 to 1170, making good air on lower levels. Men are being put to work as fast as found. The winze was started on 1400 level, 130 ft. from shaft; much copper is coming in.

The Copper Age just broke ground for new mill. The company is well financed and progressive. Mine development has exposed large ore reserves of splendid quality.

Globe.

At Inspiration Con. a pipe line is being constructed on pontoon bridges, across the tailings dam. It will connect the mill with the power house and furnish hot water at the mill during the winter. This is being done because it has been found that the temperature of the mass passing through the flotation machines has considerable influence on the efficiency of the machines. The hot water used will be that coming from the condensers which serve the steam engines. This water when it leaves the condensers ordinarily has a temperature of about 120° F., and under present conditions has to be pumped up to the cooling pond and forced through the spray nozzles for cooling before being returned to the condensers. Under the new arrangement part of the cold water from the Kiser pumping station will be diverted from its passage to the mill for use at the power house, instead of making use of the partially cooled water from the cooling ponds. Thus the scheme is doubly effective, the power plant requiring cold water, and the mill warm water.

At the mill just west of the machine shop, the erection of two steel tanks is progressing. These are to contain fuel

oil which will be used in generating steam in a boiler plant located at the foot of the mill and used for raising the temperature of the concentrate mass fed to the Oliver filters. It has been demonstrated that if this material is allowed to become too cold the filters are not so efficient.

CALIFORNIA.

Atolia.

Atolia Mining Co., San Francisco, is mining and concentrating 60 to 70 tons per day of scheelite ore. The mill product runs about 60% NO₂. This year's shipments of concentrates and high-grade ore will reach about 2500 tons. The mill being operated is a new plant, containing a crusher, a Marcy and four Huntington mills, and Vanners and Deister tables. E. C. Voorheis is president, J. H. Mackenzie, manager.

Grass Valley.

The Grass Valley Boundary Mines Co. has been formed by M. J. Brock and associates to work the Oak Tree, Cabin Flat and New Idea claims, located near the Peabody mine of the Golden Center Co. Arrangements have been made to expend approximately \$10,000 on preliminary development of the Oak Tree ledge, an ore body that has yielded much rich quartz.

The Grass Valley Con. Co., operating the Allison Ranch mine, has acquired for \$50,000 the adjacent territory owned by the Henderson and Lewis interests. The area comprises 53 acres, and is believed to contain the apex of the Caribou vein and other important ledges. Unwatering of the Allison Ranch mine is rapidly nearing completion, and arrangements have been made to resume mining on Dec. 25. All mine equipment is in position, and construction of the mill is proceeding rapidly.

At the Empire, now the leading gold-quartz producer of California, much new work is in progress. Large areas of new productive territory have been opened recently from the 4600 level, and a heavy tonnage is going to the 60-stamp mill from this portion of the property. At the Pennsylvania mine the company is keeping 20 stamps dropping on good ore. It is conservatively estimated the company is producing fully \$125,000 per month.

Jamestown.

The Sierra Nevada Exploration Co. has installed two pumps and a hoist at its Turner Flat placer mine, 3 miles southwest of Jamestown, and is constructing an electric transmission line. Several shafts are being sunk to tap the old river channels under Table mountain, and drifts will be extended into the gravel at a depth of 90 ft.

Amador City.

Foundations for mine and mill machinery have been completed at the South Keystone, and construction of buildings is making good progress. The extensive plant formerly in use at the Amador Queen mine has been moved to the South Keystone, and will be operated near the North Star shaft. Unwatering of the shaft will be rushed and work started from the 600 level with a view to opening several promising veins.

Within 2 weeks the management of the Keystone expects to resume mining on a normal scale. Retimbering of the shaft has advanced to the 400 level, and at all the important stations concrete floors have been put in, and ore-handling facilities greatly improved. C. R. Downs, of Sutter Creek, is manager.

Oroville.

The Oro Electric Corporation has placed orders for the building of a gold dredge of 6 cu. ft. capacity. It will operate on a 100-acre tract at Thermalito, near the valuable producing properties of Natomas Con. It will go into commission in the early spring.

Carrville.

The J. F. Nader property, containing 60 acres of dredging ground on Coffee creek, has been taken under bond by E. A. Wiltsee, understood to represent eastern capital. The same people are reported to be negotiating for the Nash

deep-gravel mine, one of the largest placer properties in Trinity county.

Construction of the massive gold dredge of the Pacific Dredging Co., a subsidiary of the Yukon Gold Co., has been completed, and the dredge will go into commission within a few days. The company is prospecting large areas of promising ground adjoining the developed holdings, and plans the building of a second large gold boat, according to report.

Kennett.

Despite inclement weather the Mammoth Copper Co. is rapidly completing the \$100,000 electrolytic zinc plant at this place, and it is believed everything will be in shape for commencement of production in February. The plant embraces the process developed by the Bully Hill Smelting Co. after over 5 years of experiments, and will operate on ore from the Bully Hill district and the fine dust from the Mammoth baghouse, which contains considerable zinc, together with gold, silver and copper.

Sutter Creek.

An ore body ranging from 5 to 15 ft. in width has been opened on the 2600 level of the Oneida mine, controlled by the South Eureka Co. It has been developed for over 100 ft. and is of good milling character. The Oneida is provided with a 20-stamp mill, hoist and compressor, and is connected with the South Eureka at the 1800-ft level.

Nevada City.

The Mohegan property at Gold Flat has been taken under bond by A. J. Burke, who will operate it in conjunction with J. C. Campbell. The hoisting and pumping plant formerly in service at the Mt. Auburn mine has been moved to the Mohegan and electric power secured by the building of a transmission line from the Pittsburg property. The shaft will be deepened and drifts extended to seek extensions of veins which formerly yielded good ore.

The Champion Mines Co., controlled by the North Star Mines Co., is hoisting a heavy tonnage of good ore through the Providence shaft, which has been converted into the main working outlet. Preparations are being made to place more stamps in commission, and to prosecute extensive work from the deep levels of the Providence shaft. In addition to the ore going to the mill, considerable sulphurets are being shipped to the Selby smelter.

Iowa Hill.

Colfax people are busily completing arrangements for extensive work at the Golden Streak mine, a large gravel property. Considerable equipment has been installed at the property, which will be worked by the drift method. A number of gravel claims are being worked in this vicinity with good results. A company of Chinese capitalists has taken a 3-year lease on the Rose and Schwab canyons, containing tailings from the once-famous Morning Star, Big Dipper and Jupiter mines, and is preparing for extensive work.

COLORADO.

Cripple Creek.

The November production of this district amounted to 75,623 tons, with an average value of \$16.54, according to mill reports. The gross bullion was \$1,251,356, and is divided as follows:

	Tons.	Value ton.	Gross value.
Golden Cycle	38,000	\$19.00	\$ 722,000
Portland	11,333	19.85	233,969
Smelters, Denver and Pueblo..	4,550	55.00	250,250
Portland, Crip. Ck.....	18,700	2.51	45,937
Isabella Mines	2,640	3.00	7,920
Worcester-Rubie	400	3.20	1,280
Total.....	55,623	\$16.54	\$1,251,356

Steamboat Springs.

The Royal Flush mine, owned by the Hahn's Peak Gold M. & M. Co., has made a strike of gold and silver ore in

three levels tributary to the raise which connects the lower and upper tunnels. Ore has been found in the 400, 460 and 476 levels. Three classes of ore are being mined, namely: first class smelter ore, second class smelter ore, and mill ore. The first class will run \$100, the second class \$50, and the mill ore \$18. The smelter ore is being sacked for shipment to the Globe smelter, Denver, while the mill ore is being conserved for treatment in the company concentrator at the mine. From here concentrates will be shipped to the Globe smelter. Connection between the 400 level and the old winze is being made. When this is completed mill ore from the upper levels will be passed through the old winze, trammed through the 400, dropped through the raise to the lower tunnel, and taken to the mill. At present 300 sacks of smelting ore have been mined from rich stopes, and mining and sacking is still in progress.

Leadville.

A contract has been let to Don McKay and work started in the Ontario tunnel in the Tiger and Green Mountain mines. The Ontario has been taken under lease by local men who have advanced the breast of the main tunnel 200 ft. They plan on doing extensive development in the property. The new contract calls for the driving of the tunnel another 275 ft., a distance which is expected to put the breast in ore.

Though extensive development is being carried on in the several mines of the Down Town section, aside from the large body of iron-manganese recently uncovered no important discoveries have been made. At present an output of 40 tons daily is being shipped from the Penrose. The flow of water in the property continues strong and the pumps are forced to operate to capacity. Lessees on the Hibschele are driving prospecting drifts in search of the bodies supposed to exist. Some of the old workings are being cleaned out and retimbered.

Telluride.

In the recent annual report of the Tomboy Gold Mines Co. the accounts show a profit of £76,923 16s 11d, which with the carry forward from the last balance sheet, £20,778 7s 4d, has placed at the company's disposal £97,702 4s 3d. During the year the company treated 150,488 tons of ore, which is the largest ever passed through the mill. The average yield was \$7.14 per ton against \$7.05 last year, but this increase has been offset by an increase in costs of 30 cents per ton. In the Argentine section of the property exploration work will not be continued, at least at present. The lower levels of this section contain a large tonnage of ores carrying lead, zinc and copper. In the Montana section practically the whole work of the year has been carried out. About 5159 ft. of development work was accomplished in drifts, raises and crosscuts.

Kokomo.

Recently the Michigan Mining & Milling Co. has installed a No. 10 Imperial type Ingersoll-Rand compressor and several jack-hammer drills. Its main tunnel is in 750 ft. The company is shipping 50 tons per day to the Globe smelter, Denver and an average of 2 cars of lead ore to the Leadville smelter. The ore shipped to Denver is an iron sulphide carrying gold and silver.

The tunnel on the Tucker mountain property, which has been retimbered and tracks laid, has reached the ore. The body is 6 to 7 ft. wide, carrying gold, silver and copper. Among other current producers here are the Robinson, Champion, Felicia, Grace, Wilfley and Colonel Sellers.

Boulder.

The Nil Desperandum is under the supervision of Mgr. Brandt. In the 2nd level the greater part of the work has been done. There is an ore body there 15 ft. wide and 50 ft. long which is being broken down and shipped with but little sorting. In association with this body a streak of telluride from 2 to 4 ins. wide is carefully mined and conserved. It carries from 15 to 30 ozs. gold. A steady output of ore is to be maintained. The second level is to be made the main working level of the mine by extending the level east a short distance to surface. Mine buildings, shops and ore houses will be erected at that point and the lower levels operated from that station. A force is engaged driving the 3rd level east to undercut the old workings which have been

Activity in Goodsprings District, Nevada

W. A. SCOTT. *1916 M. J. EW 12-27-16 U. S.*

The numerous mines of Goodsprings district, Nevada, are located in Spring Mountain range, 25 to 30 miles in length. Goodsprings, the supply center for that region, is 12 miles westerly from Jean, a station on Los Angeles-Salt Lake railroad. The formation of this range consists of limestone, having numerous intrusions of igneous rock. The ore occurs on the contacts of different kinds of lime—blue, yellow and white. The bedding planes of blue lime dip about 34° west. Ore shoots also occur along breaks in the blue lime and in adjacent bedding. The gangue in shoots and veins consists of chert and altered limestone. The ore comprises zinc carbonate, silicate of zinc and sulphide of zinc, nearly all of which are accompanied by lead. In some veins the zinc and lead are segregated from each other.

The Boss mine has a lode carrying platinum in association with copper carbonate and gold; also in

35 to 40% zinc and 3 to 4% lead. Close to this is the Copper Peak, on the same contact as that of Ninety-Nine. The Copper Peak is owned by P. S. and W. E. McClanahan, H. L. Smith and R. W. Andrus. Shipments this year amounted to about 400 tons, which sampled 17% copper. Workings are by tunnels, and the ore has to be transported 1½ miles by pack animals to the beginning of wagon haulage.

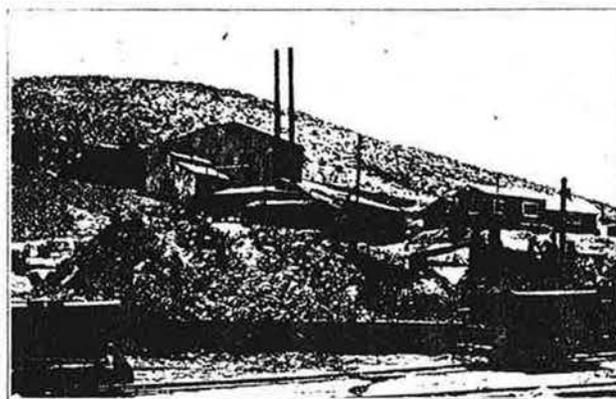
The Christmas, situated at the south end of the range, and controlled by Joseph Doran, Fred Hale, Erick Zenezn, and others, will soon have its mill, with Stebbins dry concentrators, ready for operation. The ore carries zinc and lead and is medium grade.

Monte Cristo, said to have been the earliest zinc producer in the Goodsprings district, is in the hands of lessees who are mining and shipping a car per month of high-grade ore.

Bullion mine, a mile south of Monte Cristo, is



THE TOWN OF GOODSPRINGS.



THE YELLOW PINE MILL.

large seams of plumbo-jarosite, containing palladium and gold.

The mill being erected is to put into effect a modified chlorination process, developed by R. J. Goodwin, metallurgist. The plant contains a crusher and rolls, and a Holt-Dern roaster, and has a daily capacity of 10 tons. Those in control of the property are S. E. Yount, O. J. Fisk, H. White, and others. The presence of platinum in Boss ores was discovered by Harry K. Riddall, assayer and metallurgist, now at Yellow Pine mine and mill. The Boss is about 10 miles from Goodsprings.

Ninety-Nine mine, owned by J. B. Jenson, is a copper producer. During 1916 the ore shipments have averaged 80 tons per month, running 6 to 24% copper. One stope yielded 1200 tons of ore sampling 15%. Most of the ore is oxidized, and is hoisted from a 400-ft. shaft.

The Contact mine, owned by A. L. Chaffin, Goodsprings, produces the zinc ores typical of the district. Ore shipments amount to 100 tons per month, running

owned by J. J. Daynes, C. E. Jenkins, and others, and is under the management of Thos. Varden. A mill of 35 tons capacity, equipped for crushing, pulverizing, and dry concentrating by Stebbins tables, is being operated. October shipments of concentrates consisted of 3 cars running 70% lead, and 3 cars sampling 40% zinc.

In this vicinity is the Anchor mine, operated under direction of Roy Moon. Included in the equipment is a half-mile tramway and a dry concentrating mill. Frank A. Keith, Los Angeles, is one of the owners.

The New Year, 12 miles south of Goodsprings, belongs to the Campbell estate, and has been worked profitably by leasers during last 2 years. One lease to Bert Whitney is producing 200 tons per month of zinc ore of good grade. A second lease to Springer & Frederickson has been producing 75 tons of zinc and 40 tons of lead ore per month.

The Yellow Pine Mining Co. produces about 2700 tons of ore per month, of which 900 tons are shipped

erude and 1800 tons are concentrated before shipping. This is not only a big producer, but a steady dividend payer. The mill is situated at Goodsprings, the mine is 4 miles to the southwest, and the two are connected by a narrow gauge railway for ore haulage. The mine is opened by a 900-ft. inclined shaft in which skips are operated. A Fairbanks-Morse 75-hp. semi-Diesel oil engine operates a generator, the current from which operates the hoist and air compressor. The mill is equipped with a crusher, rolls, jigs and tables. The mill heads run 31 to 33% zinc, and 12 to

ore of profitable grade is exposed all the way down.

The Sultan, 8 miles southwest, owned by Henry Robbins, Goodsprings, is a producer of zinc-lead ore. A mill equipped with Stebbins dry concentrators, having capacity of 30 tons per day, is operated chiefly to separate the lead from the zinc. The Mongolian group, near Sultan, belongs to the A. E. Thomas estate, and is under lease and bond to R. Puelz, who is shipping 20 tons per month of zinc carbonate, running 40% zinc.

The Bill Nye, owned by Wm. Allen, Goodsprings,



THE BULLION MILL.



THE SULTAN MILL.

17% lead. About one-third ounce silver is obtained from each 1% of lead. This ore comprises both sulphide and carbonate. The work here is not only a method of concentration but of separation by gravity. The president of the company is J. F. Kent; secretary Fred A. Hale, Jr.; S. E. Yount and R. B. Chapman are directors and stockholders. J. O. Kemple is mine superintendent, T. J. Renaux being in charge of the mill.

Keystone mine, 7 miles west of Goodsprings, is said to have been located in 1888, and it is claimed it has produced \$500,000 in ore. It is operated under lease by Geo. Rose, who is developing and building a mill for concentrating a lot of ore in an old dump. The shaft has a depth of 700 ft., and it is said oxidized

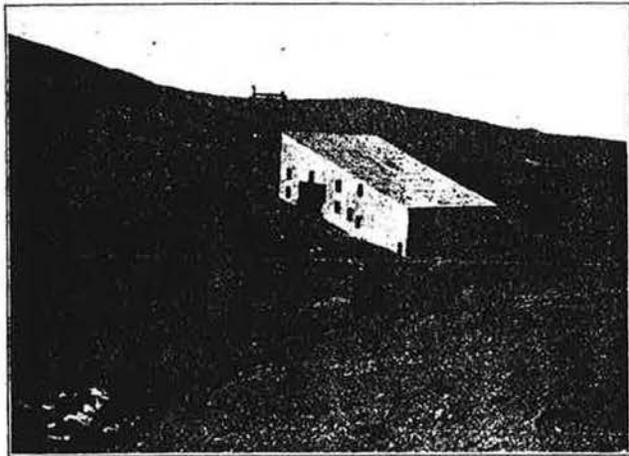
is a small, steady shipper of ore running 40% zinc. The Frederickson, owned by Munzburg & O'Kelly, is mining and dry-concentrating a small tonnage of zinc-lead ore. The Columbia Copper, Jos. Diederich, owner, has a 1200-ft. tramway, ore bins and a gasoline hoist, and is producing a small tonnage.

The Potosi, in northern part of district, was located in 1852, and is now operated by Empire Zinc Co., which produces about 1200 tons of zinc-lead ore per month. The ore is said to run 35 to 45% zinc. The mine is worked through tunnels, and ore is delivered to loading bins by a 2500-ft. tramway. The ore is shipped to Arden station. The Dawn, operated by A. Muncabrock, has shipped some zinc-lead ore, and has shown some molybdenite in the same vein. The Red

Cloud is opened by a 300-ft. shaft and has produced some gold that was extracted by cyanidation. It belongs to J. Armstrong and John Loup, of Long Beach. The Pilgrim is now active. It is owned by Henry Robbins and Harvey Hardy.

Yellow Pine Extension Co. owns the Alice copper and zinc mine, adjoining Yellow Pine mine on the south. It is being further developed from a 700-ft. inclined shaft. The company is controlled by A. J. Robbins, Geo. A. Fayle, Goodsprings, and E. B. Critchlow, Salt Lake, and M. M. Miles and A. J. McDermott, Los Angeles. About 100 tons per month of zinc ore is being shipped. The Prairie Flower, half a mile north of Yellow Pine, is being developed by Fred Hale, who has it under bond. Incidentally it is a small producer of zinc-lead ore. The Oro Amigo, 1½ miles from the Boss mine, is owned and is being developed by S. E. Yount. High grade ore, carrying gold and platinum, has been found.

Other properties being developed comprise the



THE ANCHOR MILL.

Hoodoo, owned by Frank Williams, who has mined and shipped ore running 40% zinc and 60% lead; the Root Zinc Co., operating on Bonanza hill, is mining and shipping about 10 tons per day of zinc-lead ore, and will construct a 1700-ft. aerial tramway to carry the ore to the loading bins; the Singer, in the hands of lessees, is mining and shipping small lots of ore; the Whale has considerable low-grade ore developed, and has put in a gasoline-driven compressor for drill work; the Milford and Addison groups have been producing 4 years; the Ingomar, 30 miles from Goodsprings, and 16 miles from Roach station, is a steady producer of lead and zinc; the Green Monster, belonging to the Hearst estate, is active, under management of C. B. Neel.

The Goodsprings Sampling Co., managed by J. B. Jenson, has about completed a sampling plant of 20 tons capacity at Jean station. This plant has a Wheeling crusher, three sets of Traylor rolls, a 200-ft belt conveyor, a 28-hp. Western gas engine, 100-ton track scales, and a 225-ft. ore platform, as well as ore bins. This plant was expected to be ready for operating be-

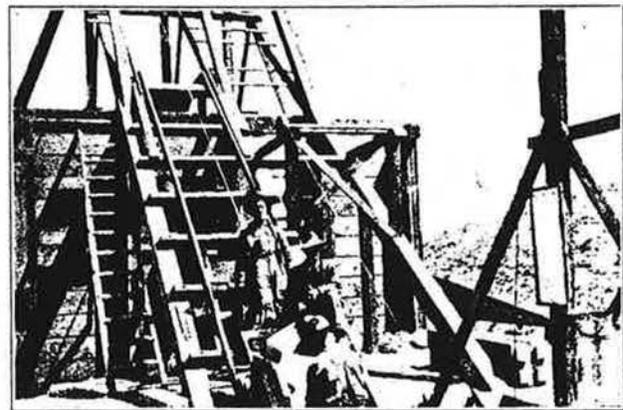
fore Jan. 1. In the meantime, this company has contracted for the delivery of 5000 to 6000 tons of ore per month from the district, which includes both lead and zinc ores. A custom concentrating plant is also to be built at Goodsprings by those who control the sampler. It is to have a capacity of 50 tons per day, and will be equipped for wet concentration. This will facilitate the marketing of ores from Yellow Pine district,



THE COPPER PEAK MINE.

as it is stated on good authority that 70% of the ore available in the mines is of milling grade, and needs concentrating before shipping to market. Part of this is zinc carbonate that has been sorted from the lead ore. The zinc ore produced here is mostly carbonates, silicates and oxides. The lead ores are half carbonate and half sulphide.

During the first 6 months of 1916 the shipments of high-grade ores from the district averaged between



THE YELLOW PINE MINE.

5000 and 6000 tons per month, which did not include Potosi shipments and others from the north end of the district, amounting to 1200 to 1500 tons a month.

The supply of selenium is obtained almost wholly from working the residues of electrolytic copper plants and the flue dust in sulphuric acid chambers.

A special steel of great importance to the electrical industry is silicon steel, used in electrical transformer construction and all alternating-current apparatus.

California Magnesite Industry and Production

W. A. SCOTT.

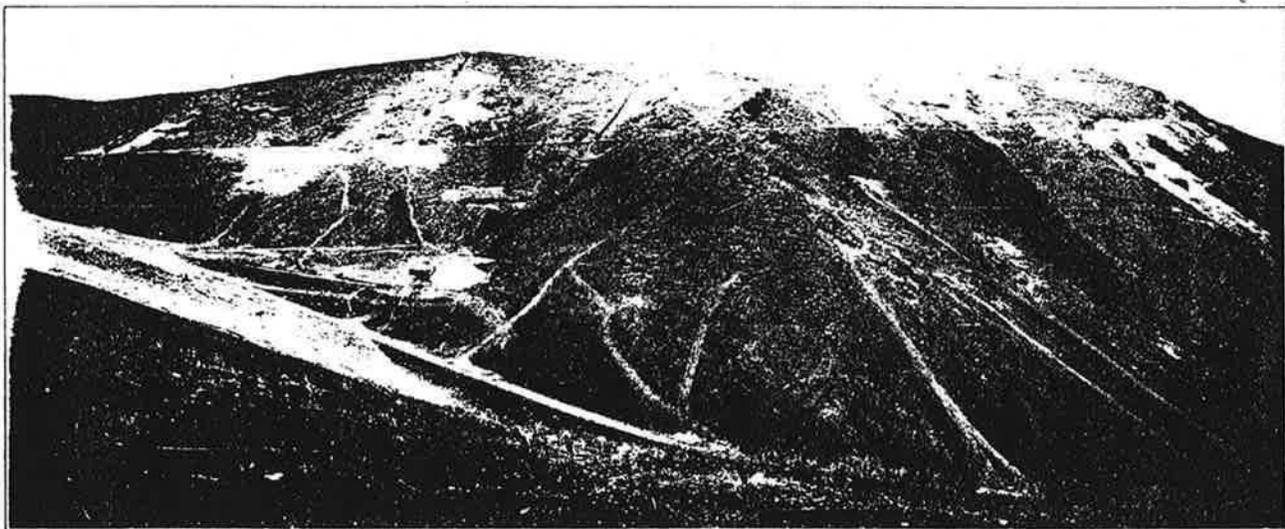
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The 1915 production of magnesite in California was 30,325 tons, according to data prepared by Samuel H. Dolbear, E. M., San Francisco, and published in *Mineral Industry* for that year. Of this output, 19,374 tons were marketed as crude ore, and 10,951 tons were calcined before shipping. The 1915 tonnage was produced principally in four counties as follows: Sonoma, 3729 tons; Tulare, 12,116; Santa Clara, 7270; Napa, 1050; other counties, 6890 tons.

The condition of the industry in this state seems prosperous, and the 1916 production will greatly exceed that of 1915. Several calcining plants have been built and put in operation this year, greatly increasing the tonnage of the calcined product. The calcining process, by means of rotary and vertical kilns in which crude oil is used as fuel, results in driving off the carbon dioxide, which constitutes about one-half

nesium carbonate, and occurs in vertical veins and blanket deposits in serpentine. The mining operations are carried on by driving adit levels on the veins and by open cut work. There being a series of veins on the property, development and mining are in progress at over 30 different openings. The ore is hard, and drills are operated by air from a gasoline-driven compressor at a central point. The mine openings are mostly at high points above the valley, as shown in illustrations. A wooden, steel-lined chute, 400 to 500 ft. long, extends from loading bins and calcining plant up the sidehill, at an angle of 40°, to the main ore center. By this means the ore passes by gravity from the mines to either the loading bin or calcining plant.

Up to November, this year, the company had been mining and shipping about 3500 tons of crude ore per



VIEW OF PORTERVILLE PROPERTY SOUTH SIDE OF CENTER HILL.

of the weight of the ore. The clinker, or kiln product, runs 88 to 95% oxide of magnesia, and this, to be acceptable to consumers, must contain a low per cent of silica.

The users and buyers of magnesite comprise the steel and chemical manufacturers, and refractory companies who prepare magnesite lining for furnaces of various types. The calcining plant at the mine not only makes a product ready for the consumer, but reduces to one-half the weight on which transportation charges are paid.

By calling at the San Francisco offices of several of the magnesite producers the writer was able to obtain some definite information as to 1916 operation and improvements.

Porterville Magnesite Company's holdings of 460 acres are located 3½ miles from Porterville, in Tulare county. The ore on this group runs 94 to 95% mag-

nesium carbonate. In the meantime, a calcining plant was built and set in operation about Nov. 30. It has capacity to treat about 50 tons of ore per day; the calcined product will run about half that tonnage. First, the ore is reduced to ½-in. size, and less, by a crusher, then passed by gravity through a rotary kiln, 5 ft. diameter, and 50 ft. in length; the fuel is supplied by jets of crude oil under pressure. The product is shipped in sacks and barrels. The movement of the ore from mine to plant is entirely by gravity. With the installation of the crusher and rotary kiln, it is likely that about half the output of the mines will be calcined before marketing.

The officers of the company are: President, Walker W. Kamm; vice-president, R. S. Edwards; secretary and treasurer, Philip S. Kamm, all of San Francisco. Mr. Edwards was formerly at Portland,

Ore., and has had wide experience in industrial chemistry and testing of materials. F. F. Parker is superintendent of operations.

The Sonoma Magnesite Co. has a producing mine

in a serpentine country rock. It is said to contain 88 to 93% magnesium carbonate ($MgCO_3$), 1 to 2% iron and aluminum, and 2 to 6% silica. The production for 1916, by the close of the year, will



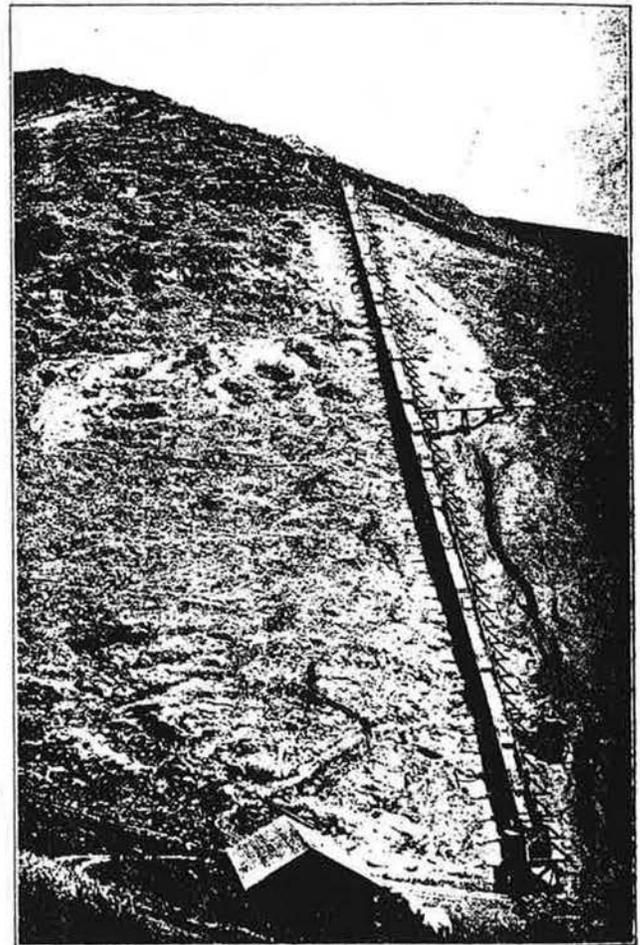
INTERNATIONAL MAGNESITE DEPOSIT.



REFRACTORY MAGNESITE CO.



PORTERVILLE MAGNESITE CO.



ORE CHUTE FROM PORTERVILLE MINE TO BINS.

and calcining plant, 9 miles from Magnesia station, on Northwestern Pacific railroad, in Sonoma county. The company constructed and is operating a narrow-gauge railroad from Magnesia to its camp, where Magnesite post office has been established.

As elsewhere, the ore is found in numerous veins

have averaged 500 to 600 tons per month of calcined magnesite.

The mine work consists of drifting on veins, and quarrying where the ore occurs in the nature of a deposit. Air drills are used. U. S. Webb is president of the company; N. G. Gibson, vice-president;

E. Hirschler, treasurer; Chas. Fletcher, secretary; E. W. Vaughn, superintendent.

Refractory Magnesite Co., San Francisco, is mining and calcining near Preston, in the northern part of Sonoma county. F. R. Turton, president of the company, states that the deposit on this property is the same as the Austrian product.

The ore is given a "dead burn" calcining in a vertical steel kiln of two fireboxes. Oil is used for fuel, low pressure air jets being employed to vaporize the oil. By this process of dead burning the carbon dioxide in the magnesium carbonate is driven off, down to about 0.14%. The average analysis of the calcined product is given as follows: Silica, 1.4%; iron and aluminum, 6%; lime, 0.2%; magnesia, 92.4%.

This company sells no crude ore, but calcines its entire output, and its plant is said to be the only one in the state in which the dead-burned product is turned out. No part of its product is shipped east, but a ready market is found in the coast states, either for the calcined ore or the magnesite brick which the company makes at Livermore. It is purchased for lining open-hearth steel furnaces, copper furnaces and converters. The price of dead burned material is quoted on this coast at \$40 per ton.

Tulare Magnesite Co., which is closely associated with Crown-Willamette Paper Co., is mining magnesite ore near Porterville, and operating two upright kilns, and producing about 40 tons per day of calcined material, containing 8 to 90% magnesia, the carbon dioxide being reduced to 2 to 4%. The Tulare Co. sells its product to paper manufacturers mostly,



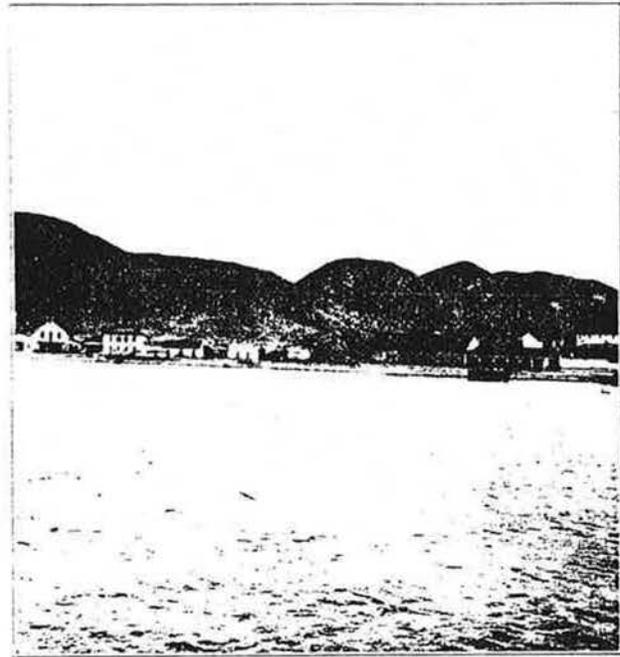
SELECT MAGNESITE DEPOSIT.

for use in sulphide pulp that forms the long fibre in paper. A part, however, is shipped east for refractory and plastic purposes.

Western Magnesite Development Co. has a producing mine and plant in Santa Clara county, from which both crude and calcined ore are shipped. The property is extensive and considerably developed. The output is hauled 35 miles to Livermore.

Other magnesite mines comprise the White Rock, Napa county; Sherlock's, at Madrona; Doyle & Smith's, in Frazier valley; Cook & Langley's, in Deer valley; and the Rex Plaster Co., Los Angeles, is mining a sedimentary ore at Bissell, Kern county, a part of which was calcined in kilns at Los Angeles.

The International Magnesite Co., composed of Pasadena and San Diego men, has a deposit of mag-



PORT OF MAGDALENA, LOWER CALIFORNIA.

nesite on Santa Marguerita island, off Magdalena bay, Lower California. About 35 tons per day are being mined and shipped to the company's rotary calcining plant at Chula Vista, Cal., 10 miles south of San Diego.

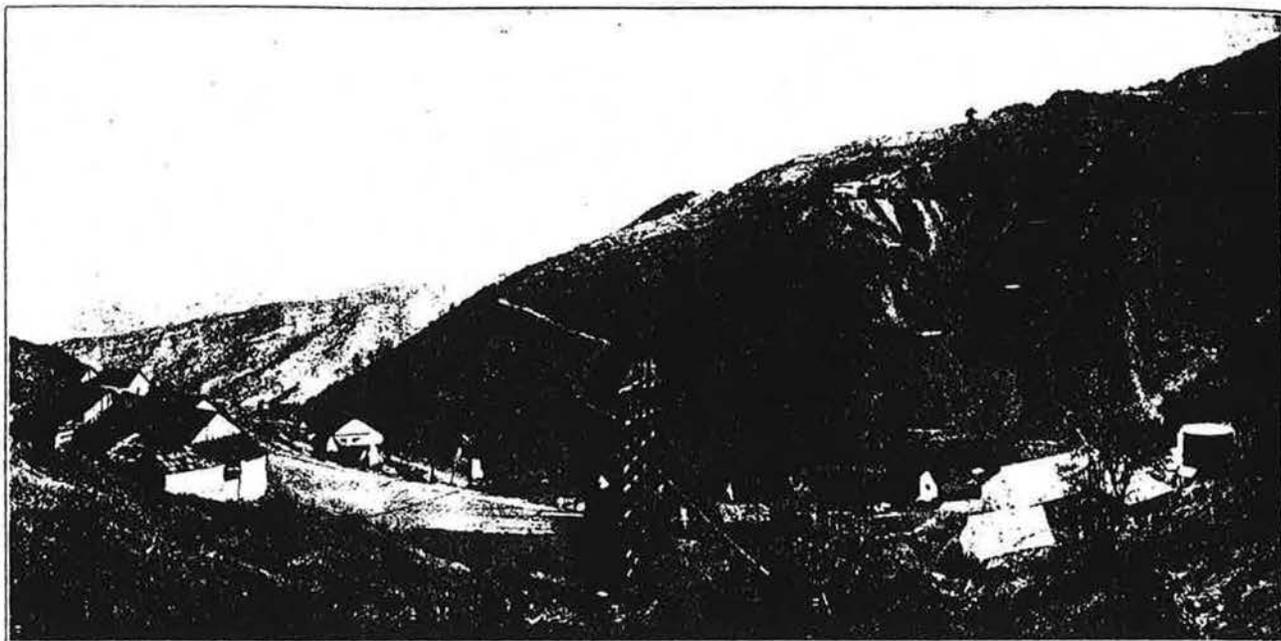
Haiti's Oil Industry to be Developed.

Plans of the Haiti-American Corporation interests call for the development of the oil industry of that country. These plans are being conducted by the Haiti Oil & Refining Co., which has secured absolute control of the industry in Haiti, its claim being secured by government legislation.

Under its concession the company has the sole right to operate refineries in Haiti, and the exclusive right to import crude petroleum free of duty.

The president of the Haiti Oil & Refining Co. will be a man who has been prominent in one of the big Standard Oil companies. In addition the company, it is said, will market its products in Haiti through the West Indies Co., a subsidiary of the Standard Oil Co. of New Jersey.

Copper exports from Atlantic ports for the week ending Dec. 22, were 8,708 tons; since Dec. 1 they were 17,763 tons; same time last year, 26,187 tons.



CAMP NO. 2 OF NEW IDRIA QUICKSILVER CO. AT IDRIA, CALIF.

Quicksilver Mining at Idria, Calif.

New Idria Quicksilver Mining Co., San Francisco, operating at Idria, Cal., is mining and treating 15,000 to 20,000 tons of cinnabar ore per month. Improvements for 1916 consisted of the construction of a mill for mechanical concentration and the building of a 2-mile aerial tramway for transporting ore from mine openings to the mill and furnaces. There are four furnaces of the Scott type. It is estimated that the year's output of ore reaches 160,000 tons. Between 400 and 500 men are employed.

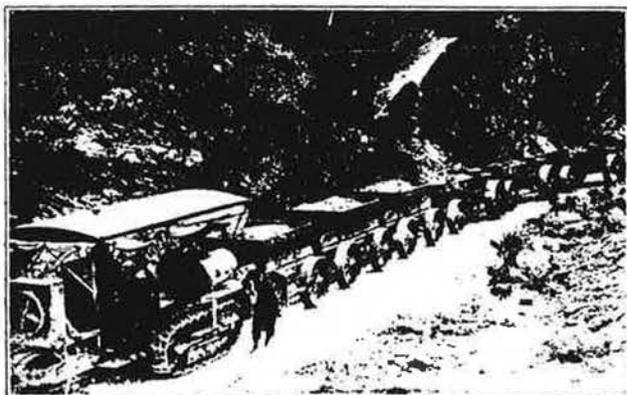
Caterpillar Ore Haulage at Nevada Mines.

Humboldt County Mining & Milling Co., controlled by the H. M. Byllesby Co., Chicago, has completed its concentrating mill at Toulon, near Lovelock, Nev., for treating tungsten ore produced at its Ragged Top

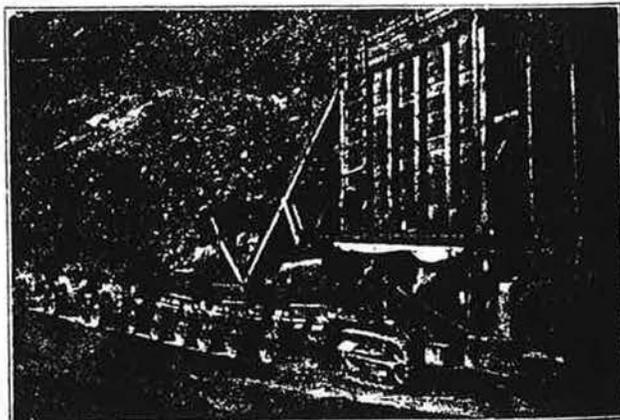
mine, 10 miles southeast of Toulon. The mill is reported in successful operation.

An interesting feature of the work is the haulage of ore from mine to mill in trailers drawn by caterpillar tractors. The outfit consists of three 75-hp. Holt tractors. One of the accompanying illustrations shows the ore wagons being loaded at the mine bins. It will also be seen that one tractor hauls six trailers. It is understood that one caterpillar hauls loaded wagons over a summit close to the mine, and the other two make regular trips to the mill with heavy loads.

Caterpillars are in use in other parts of Nevada for ore haulage. There is one outfit at Sodaville which was kept busy a part of the year hauling tungsten ore, and another is operating at Battle Mountain, on gold and silver ore. They are especially serviceable in those arid regions where steady haulage is required. But the caterpillar, like all other tractors, requires a good road for doing its best. This is being recognized by mine operators, and appropriations for road building are made in cases where auto truck or tractor and trailer haulage is necessary.



HOLT CATERPILLAR TRACTOR HAULING ORE.



AT BINS LOADING ORE.

from \$8.46 to \$42. The discovery was inspected by David Muir, superintendent of the Gold Road mine, and J. A. Burgess and J. L. McIver of the United Eastern, who sampled the ore. They all agree that the showing presents an encouraging prospect. A. M. Walsh, consulting engineer for the Gold Road Bonanza, is very much gratified with the showing, but says it is too early to determine its importance. The strike was unexpected, as the main vein of the Bonanza is some distance from the shaft and the company planned to sink to a depth of 600 ft. and crosscut to the vein. It is now planned to sink to about 525 ft. and cut a station and prospect the new find. The Bonanza ground sidelines the Gold Road mine for 4000 ft., adjoining the Billy Boy and Line Road claims, and the shaft is near the dividing line of two mines. The property is owned by the United Stamping & Smelting Co.

The Nellie Mining Co. has drifted 100 ft. from the shaft on the 350 level, gaining an additional depth of 120 ft., and will crosscut the vein from this point in the expectation of finding an ore shoot on the 500 level of the Ivanhoe. The hanging wall drift is in 7 ft. of mill ore and prospects are considered promising by Superintendent Keating.

At United Eastern final arrangements have been completed and the new mill will be started on Jan. 1.

At Big Jim sinking was resumed Dec. 26 in the shaft at a depth of 485 ft. The shaft will be sunk to a depth of 610 ft., where another crosscut will be run. Nellie is crosscutting the vein 100 ft. east of the original crosscut which will give 140 ft. greater depth below the surface than where the shaft is located.

In the Gold Road Bonanza a stringer has passed through the shaft from one side to the other and the values all the way through were uniform. The stringer widened out to about 4 ft. as it went down. Engineer Walsh intends to sink to about 25 ft. below where the stringer passed through the shaft and then run a drift on to the point where the stringer intersects the main vein.

Adams has started crosscutting from the shaft at a depth of 400 ft. and expects to strike the vein in about 40 or 50 ft. Pumps and other machinery have been installed and the bulkhead built to control the water.

Murdock's—the crosscut on the 350 level has run through about 30 ft. of vein matter containing encouraging values though the main vein has not yet been reached.

CALIFORNIA.

Raymond.

Madera Gold Mining Co., controlled by D. W. Shanks, San Francisco, has reopened the old Gambetta mine, 14 miles from Raymond. This is a gold mine which has been opened to a depth of 800 ft. It has 15,000 tons of \$10 ore blocked out. The mill of 50 tons capacity is equipped for amalgamation and concentration. The mill and hoist are being electrified, and a 6-mile transmission line is being built to connect with one of the main power lines of that section.

Sonora.

The new flotation plant at the Dutch-Sweeney mine has been placed in operation and is proving highly satisfactory. It is of the Minerals Separation type, with a daily capacity of 250 tons, and is the first large flotation unit to be erected by a California gold mining company. The Dutch-Sweeney property is composed of the Dutch, App and Sweeney mines, and is controlled by an eastern corporation, of which W. J. Loring is manager. Late developments in the Dutch and App mines have been highly satisfactory. The winze from the 1800 level has disclosed a wide ledge of excellent ore, and comprehensive developments are proceeding from this point.

Reputed to be representing the Guggenheims, several engineers are examining gold properties in this field, and important deals are reported pending. Some of the mines under consideration formerly produced well and still contain much low-grade ore. Examination of the Harvard is proceeding on behalf of W. J. Loring and associates. The tunnel at

the Ocean Star is being extended 300 ft. in hopes of intersecting the long-lost vein.

Additional pumping equipment is being installed in the shaft of the Rawhide by the Pittsburg-Silver Peak Co. Much machinery has been moved to the property from the Silver Peak mine at Blair, Nev., and some good ore is reported on several of the upper levels. Preparations are being made for systematic exploration of promising ground at depth, and sinking of the shaft will be pressed.

Towle.

Pioneer Gold Mines Co., San Francisco, is taking steps to provide new equipment for its mine and mill. The Pioneer is in Placer county, 9 miles from Towle. It is operated through a crosscut tunnel 3000 ft. in length. Principal workings are on and above that level, there being 1500 ft. of stoping ground above it. Mule power has been employed in hauling ore to the mill through this main tunnel, but an electric locomotive, equipped with storage battery, will soon be in use to haul trains of ten 1-ton ore cars. The 20-stamp mill has been treating about 75 tons per day. About 80% of the gold and silver recovered is saved on amalgamating plates, the balance being collected in concentrates, which are cyanided. By these methods an extraction of 91½% is made. The milling capacity, however, is to be increased to 300 tons per day by the installation of a ball mill of large capacity, and by increasing the concentrating and cyaniding facilities. In the proposed arrangement the stamps will be operated as usual, and other ore will be passed through a crusher, and thence direct to the ball mill, the pulp from which will pass over plates and then to tables. Up to this time mining and milling costs have run about \$3.10 per ton. T. K. Code, manager of the property, estimates that with the increased capacity these costs may be reduced to \$2.60. The mill is now running on ore that assays \$7 to \$10. It is stated that the mine has 40,000 tons of ore blocked out that will average \$4.50. The vein walls are slate, and the gangue is quartz. The Pioneer is in the hands of California stockholders.

Taylorville.

The Engels copper mine is again in operation with a force of 300 men, following a brief shutdown brought about by activities of members of the I. W. W. The agitators induced the men to demand a wage increase of \$1 per day in excess of the \$4 now paid. The management promptly discharged the strikers and closed the mine. A conference was later held with the conservative workers and the way cleared for resumption of activities. The company is driving its new lower tunnel and arranging for addition of more flotation equipment.

Greenville.

Representatives of eastern capitalists have taken under option all the available copper properties in this field, and are preparing for extensive developments. The district forms part of the Plumas copper field, supporting several good producers.

Nashville.

Developments are being prosecuted at the Teddy Bar gold property by Seattle people with good results. A strong shoot assaying \$43 to \$77 has been intersected, and drifting is proceeding on a promising vein. Much good ore has been mined on this property in past years.

Mohawk.

Work has been resumed at the Plumas-Eureka mine by a strongly-financed company, and a plan of developments outlined. Endeavors will be made to recover the rich veins which formerly yielded large amounts of specimen ore, and equipment provided to improve the gold recovery. The property has paid \$2,831,294 in dividends.

At the Jamison, another producer, extensive developments are going on with good results. Sixty men are on the payroll and the mill is running steadily. Prospecting is very active in this section, with indications favorable at several claims.

Graniteville.

William Baker has resumed work at his gold mine in this district, and has a force of men at work laying pipes and otherwise preparing for activities. A strong ledge of good milling ore was recently intersected and is developing so satisfactorily that the building of a 10-stamp mill has been de-

ceded on. The projected plant will probably be erected in the spring. The nearby Republic mine is again operating with a full force. The mill is in commission on ore that is coming from new territory.

Gottville.

Frank Riley and associates have started work on the Swiss Bar placer holdings, formerly among the richest producers of the district. A tunnel will be driven to tap the virgin back channel at the lowest practicable point, and some work also devoted to other gold-bearing deposits in the older workings.

Sutter Creek.

Unwatering and repairing of the shaft of the Old Eureka has progressed to a depth of 1225 ft. and the headframe is rapidly nearing completion. Construction of ore-bins is making good headway, and as soon as the electric motors arrive the big hoist will go into service. The company is using 50,000 to 60,000 ft. of timbers per month and has placed all the cleared workings in splendid shape.

Sinking of the Central Eureka shaft is proceeding rapidly, and the 3300-ft. mark has been passed. As soon as the 3400 point is won a station will be established and drifts run to seek the veins opened in the old workings. Twenty stamps are dropping on ore from the old levels. Waste is used to fill old workings.

Unwatering of the Old Eureka mine has been completed to a point below the 1200 level, and the workings are being found in much better condition than anticipated. Below the 900-ft. point the shaft has been in particularly good shape, facilitating rapid work. Installation of the new hoisting plant is proceeding rapidly, and construction of a change house for the miners begun. The management is rapidly getting things in shape for early work and expects to commence actual mining early in the coming year. As fast as water has been lowered the shaft has been retimbered, and at several points indications are said to be encouraging for development of important ore deposits. Eastern capitalists are rehabilitating the old producer.

Jackson.

A lease on the old tailings of the Argonaut mill has been taken by Simmonds & Latham and construction of a \$15,000 cyanide plant begun. Before going to the tanks the material will be further reduced in an Allis-Chalmers tube mill. It is figured the tailings available amounts to fully 200,000 tons, assaying \$1.75 to \$2.50 per ton. A flotation unit may be installed later. Capacity of the plant will be about 150 tons per day. If the process proves successful other companies in this district will install similar plants.

Within a few days the Miners' Unions of Amador county will take definite action relative to the demand for higher wages. The men will insist that miners be paid \$3.50 per day, and muckers \$3.

Georgetown.

The Beebe mine has been unwatered and carefully sampled, and preparations are being made for comprehensive work. An electric power plant will be erected, and water for generative purposes piped from Hotchkiss hill, 2 miles distant. The Beebe lies within the town limits and formerly produced much rich ore.

Local stockholders have received word that the re-organization of the Mt. Pleasant Mining Co. has been effected, and that operations will begin in the early spring. Considerable ore of good grade has been blocked out, and with ample funds for further development and equipment the property is expected to regain its old time prestige.

Shipments of chrome are being made from several points in Placer and El Dorado counties, with the Manganese Co. of California chiefly interested.

Goldstone.

The United Goldstone Mining Co. is shipping high-grade ore to the custom mill and is sending the shaft to a depth of 100 ft. to open the vein which has been indicated for about 500 ft. On the Gold Ring Extension claim of the company several leasing companies are opening ground of high promise.

The custom mill is operating at full capacity and it is understood plans are being considered to enable the plant

to take care of fully 100 tons more ore per day. The Goldstone Co. has contracted to send 500 tons to the mill, and a large number of small companies and leasing concerns are sending in ore. Operation of the plant has stimulated activity throughout the field. Several companies are reported to be defraying operating costs by sale of ore broken in development, and indications are bright for a lively winter.

Bishop.

The Nobles tungsten property, adjoining the holdings of the Tungsten Mines Co. has been taken under lease and option by a Philadelphia syndicate and operations begun. The syndicate has also arranged to build a large custom mill, which will enable numerous small operators to turn their ore to profitable account. Mining of scheelite is very active in this district at present, and the extent of the productive area is being gradually broadened.

Last Chance.

After 40 years of prospecting by numerous miners the pay channel in the Glenn mine has been intersected, according to F. A. Moss and George Threlkel, who have been working the property for 2 years. Gravel averaging \$5 to \$6 per ton is being extracted and the deposit is said to be widening as work advances. It was struck after running a 900-ft. tunnel.

Alturas.

A new mill has been installed at the Hess mine and is reported to be making a high gold recovery. The main ore body is 18 ft. wide at the 200 level and developments are advancing below this point. The mill product averages around \$10. Judge Jamison of Alturas, and Dr. Patterson of Cedarville, are the principal owners. Irving Clint is superintendent.

COLORADO.

Idaho Springs.

Four good showings have been opened on the property of the Consolidated Gem Mining Co. by four different leasing companies. The Mazda Leasing Co., which has been drifting west from the tunnel on the 1400 level to cut the shoot worked by Shaffer on 1100 and Coe on 1200, has opened up a body 9 ft. wide which has been drifted on 25 ft. and is not through the vein yet. It shows an assay value of \$25. A car from the vein was milled and the returns were better than \$1000 for the car. On the upper level the ore body showed for 65 ft. Osterman & Co., on the 240 level west of the Gem shaft, has cut a good copper-silver vein, as also has the Clear Creek Leasing Co. in its block. G. W. Ford, who has a lease of a block of ground covering 800 ft. running from the Gem shaft west, is working through the old Frater shaft, from a drift run 600 ft. east. He has opened a streak about 14 ins. wide that returns an assay value of better than \$140 and has 400 ft. to surface.

Boulder.

The Tungsten Mountain Mines Co. has recently been formed as a reorganization of an old company in this district. The policy of the management of this company is to carry the development forward on a large plan. Little additional surface exploration will be done. The area will be first undercut by two tunnels, one 1000 ft. above the other. These tunnels will explore the territory, and will give the avenues into the mines for lateral development. At their portals will be erected necessary mills, storehouses, power plants, shops, etc.

Georgetown.

The drift in the ground of the Onondaga Mines Co. west from No. 1 raise on the 450 level in the Capital ground has been advanced 100 ft. The sinking of the shaft from the Kane adit has also been commenced by contractors, who have two shifts at work. A bonus has been hung up for the contractor who first reaches the connecting point of the drift and shaft, there being about 540 ft. of drifting in all from the top of No. 1 raise and about 270 ft. of sinking. A good tonnage of ore is blocked out between the 100 and 180 levels, and also above the 180, where a stope has been started between Nos. 2 and 3 raises. The management has decided not to attempt the mining of this or any other ore until the

UDELL IS SLATED FOR FOURTH PRESIDENTIAL POSITION



A. V. Udell

A. V. Udell, who has gained a reputation of the highest order in the profession of mining engineering during his 28 years of active experience in the industry, is one of the busiest mining men in California today. When not actually in the field visiting his projects in widely scattered regions of the state,

he occupies headquarters in the Crocker Bank Building, San Francisco, and pulls the strings that direct the operations of four distinct mining enterprises of major importance.

Besides carrying the burden of managing two gold mines and a tungsten property, Udell has just undertaken the task of rehabilitating the well-known Big Blue gold mine, near Kernville, California, which produced a fortune for former operators years ago.

A. V. Udell was born in San Francisco in 1884 and his mining career was launched in 1906 with the Mariposa Commercial and Mining Company, of which the late Fred W. Bradley was president. From 1909 to 1914 he served on the engineering staff of the Round Mountain Mining Company and the Goldfield Consolidated Mining Company of Nevada. Then followed two years of exploration work in Central America as manager of the Charles Butters developments.

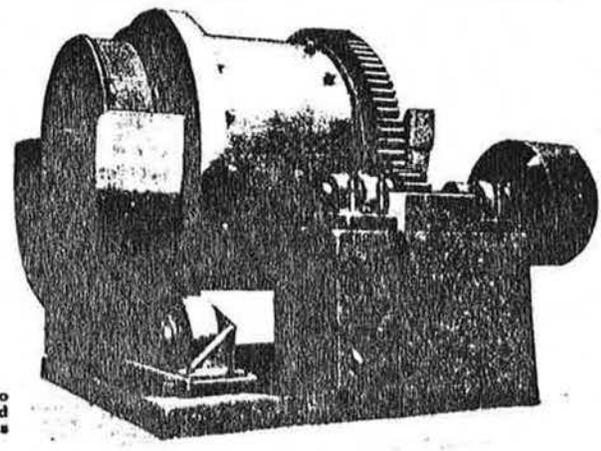
In 1917 he started work on the development of the electrolytic zinc process at Martinez, California. Unusual success marked his labors in this field with the result that he rejoined the Bradley organization in 1920 and superintended the installation of an electrolytic zinc plant for the Bunker Hill Mining and Smelting Company at Kellogg, Idaho.

For the last 14 years he has occupied a high position with the Bradleys and it is interesting coincidence that he is now president and manager of the Pacific Mining Company, a Bradley concern, which operates the Pine Tree mine in Mariposa county, California, where he found his first job in the mining business more than a quarter of a century ago.

Udell, in addition, is the head of two other Bradley projects. For the last 10 years he has been president and manager of the Atolia Mining Company, which produces tungsten ore in San Bernardino county, while in 1932 he became president and manager of the Beebe Gold Mining Company and demonstrated, despite much criticism, the success of the new type Had- nel mill at the Beebe mine near Placerville, California.

He is now slated for his fourth presidential position, that of a new mining corporation which is being formed to represent the various interests affiliated with the Big Blue venture, namely the Kern Development Company, A. V. Udell, Robert Long and the Bullion Gold and Silver Mining Company, Francis Upton of San Francisco, president.

Foundations have been set at the Big Blue property for the erection of a new flotation and cyanide mill which will have a daily capacity of approximately 100 tons and grinding will begin by the first of June at the latest. This plant, which is



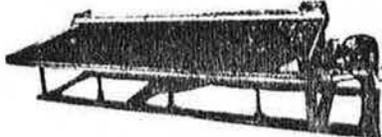
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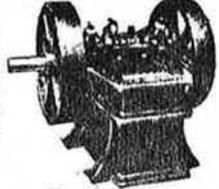
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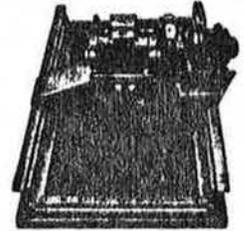
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being built on the bank of the Kern River, will be used as a pilot mill for two years. Then, if more developments warrant, a plant with larger capacity will be erected near the portal of one of the main working tunnels of the mine.

Udell's report on current developments at the Big Blue follows:

"Underground work for the present consists of a shaft raise from the 260-foot level to the surface. The old 180-foot level was broken into by this raise and several spots of good grade ore were found. At one place the ore assayed 10 ounces of gold to the ton but, until further work is done, it is impossible to state the importance of this body.

"As there is about three months' supply of broken ore in the mine and on the surface, no further underground work will be done until about the time the new 100-ton mill is finished. Preparatory mining will then be prosecuted on the hanging wall vein. By the time the present supply of ore is exhausted, this proposed stope should be able to supply the mill for at least two years with ore averaging about \$8 a ton at the present price of gold. Metallurgical tests of the ore indicate no exceptional problems in the recovery of a gold-bearing concentrate."

RECEIVES PLATINUM MEDAL FOR FLIN FLON ACHIEVEMENTS

Robert Early Phelan, of Winnipeg, Manitoba, general manager of the Hudson Bay Mining & Smelting Company, Ltd., was awarded the Inco Platinum Medal of the Canadian Institute of Mining & Metallurgy at the Institute's thirty-fifth annual convention.

The award, which is for distinguished service to Canada's mineral industry, was conferred on Phelan for his leadership in the development of the Flin Flon mine in northern Manitoba. According to the citation, he first visited the property in the summer of 1925 and worked out the problems of creating a successful mine, mill and smelter 90 miles from the nearest railway, of effecting an economical separation of gold, silver, copper and zinc from a complex ore of low grade, and of developing adequate hydro-electric power at a site on the Churchill River some 150 miles from the nearest railway.

The transportation problem alone is said to be unique in the history of industrial engineering; for, without waiting for a spur to be built into the Flin Flon camp from the Hudson Bay Railway, Phelan moved 36,000 tons of mining machinery and of mill, smelter and power plant equipment over winter roads by tractor trains frequently operating in sub-zero weather.

Born in Memphis, Tennessee, on December 11, 1886, Mr. Phelan was graduated in 1910 from the Columbia School of Mines where he was a member of the Sigma Nu fraternity. He gained his early experience in the mines of Utah and Colorado, one of his first jobs being with the Highland Boy Mine at Bingham, Utah. In 1919 he was elected a member of the American Institute of Mining & Metallurgical Engineers, and more recently he was similarly honored by the Canadian Institute.

The Inco Medal was established last year as a feature of the fiftieth anniversary celebration of Canada's nickel industry. Of solid platinum, the disc is three inches in diameter and is struck from models made by Dr. R. Tait McKenzie, internationally known Canadian sculptor. James J. Denny, mill superintendent of

McIntyre Porcupine Mines, Ltd., was awarded the initial medal a year ago for his contribution to the art of milling gold and silver ores.

MIDWEST PLANS FOR EXTENSIVE WORK AT THE MC CRACKEN MINE

Organized as the Midwest Investment Company, a group of eastern investors has acquired on bond and lease the famous old silver producer, the McCracken mine, in Mohave county, Arizona. This property was formerly operated by the Signal Mine Company, and has an important production record.

Rex B. Goodcell, an attorney of Los Angeles, will head the corporation as president, while R. A. Burns of the same city will be secretary. Dr. Walter J. Briggs of Berlin, Germany, will be treasurer; E. Ross Housholder of Kingman, Arizona, will act as consulting engineer, and P. J. Brady, 516 Jewelers Exchange, Minneapolis, Minnesota, as vice-president and general manager. Finances are being furnished through the Thrall-West Company of Minneapolis. Robert Longyear, mining engineer whose offices are in the Foshay Tower in Minneapolis, is to accomplish the sampling of the mine.

After making a thorough geological examination the new operators express the opinion that the property has only been scratched, and that with a modern 200-ton flotation plant, the mine can be made to again show important profits from production.

TREASURY REGULATIONS FOR GOLD AND SILVER PURCHASES

In order to clarify the situation as to the various treasury rulings and regulations for sale of gold and silver, the El Paso Smelting Works of the American Smelting and Refining Company has prepared for shippers a full set of instructions. These cover the methods to be used in pricing domestic gold and silver, and the affidavits which the miner must file to obtain the treasury prices.

In consequence of the Gold Reserve Act of 1934, and regulations issued thereunder, the market price of gold recovered from natural deposits in the United States, or any place subject to the jurisdiction thereof, is in excess of the former mint price of \$20.67 per fine ounce, but may vary in amount from time to time. As long as the gold content of product delivered to the El Paso Smelting Works shall be qualified for sale to the mints, and as long as the mints are regularly purchasing such gold at a net price in excess of \$20.67, payment by the smelter for the gold will be made on the following basis:

Provisional advance payment will be made on the date of agreement upon assays. Final payment for the gold will be made as soon as practicable after the close of the calendar month, in which shipment was received at the smelter, on the basis of the schedule price plus 90 per cent of the amount by which the net realized price shall exceed the mint price of \$20.67, less interest on money advanced in provisional payment at the rate of 6 per cent per annum.

By the net realized price is meant the average price per ounce realized by the smelting company upon all sales of gold originating in mines of the United States, made by it to the United States Mints and Assay Offices, under terms of the Gold Reserve Act of 1934, and regulations issued thereunder.

Under current regulations, approved by

United States Mints are authorized to purchase gold at \$35 per Troy ounce fine gold, less a minting charge of $\frac{1}{4}$ of 1 per cent, or net price of \$34.9125 per ounce. Thus the gold premium or excess payment is \$12.81825 per Troy ounce, arrived at as follows:

Net realized price	\$34.9125
Mint price	20.67

Excess	\$14.2425
90 per cent excess	\$12.81825

Received by shipper	
Provisional advance	\$20.67
Final payment	12.81825

Total.....	\$33.48825
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Silver received in ores and concentrates, delivered to the El Paso Smelting Works, and qualified for delivery to the United States Mints under the terms of the President's Proclamation of December 21, 1933, will be paid for on the basis of 64 $\frac{1}{2}$ cents per ounce, less deductions shown in the regular schedule. The figure of 64 $\frac{1}{2}$ cents is the approximate value per ounce of the standard silver dollars or fractions thereof received by the smelting company for silver delivered by it to the mints for coinage, adjusted to the equivalent value of silver 999 fine and expenses involved.

Provisional payment for silver is to be made promptly on the date of agreement upon assays, on the basis of the foreign quotation.

An "Affidavit of Miner" form is filled out by the smelting company, showing the actual silver content of each shipment. This form is sent to the shipper to be filled out as to name of mine, name of owner, and other information requested by the treasury department. The shipper then signs his name, has the signature sworn to before a notary public, or officer duly authorized to administer oaths. The affidavit is then returned to the smelting company. Upon receipt of the affidavit, properly filled out in the form requested, final payment for silver will be made on the basis of 64 $\frac{1}{2}$ cents per ounce, less deductions quoted in the schedule. The responsibility for the accuracy and honesty of the affidavit rests wholly upon the shipper.

In addition to newly mined silver the smelters have been authorized to accept, under the President's proclamation of December 21, 1933, silver recovered from tailings or old mine dumps, provided:

That said silver comes from natural deposits in the United States, from rock in its natural state and provided that such rock was on or under the ground after December 21, 1933, and that if the silver-bearing material was on the dump or tailing pile on December 22, the silver recovered or extracted therefrom may be accepted, but if the rock was off the ground and was in a mill or smelter on that date, even though processing had not then begun, the silver therefrom may not be accepted.

From the above it is apparent that, upon affidavit from the miner, the government will pay the new price for silver which is recovered from ore or tailing which prior to December 21, 1933, had been piled upon the ground and reduction of the metal temporarily suspended either because of the low value thereof or the lack of necessary mining and reduction equipment.

While the above regulations have been issued especially by the El Paso Smelting Works, all custom plants are following