

The property of the Cornucopia Gold Mines is located on the eastern slope of Granite Mountain in the Wallowa Range, Baker County, Oregon. It is reached by four miles of mountain road which connects with an excellent improved highway at Carson, seventy miles from Baker, the county seat. The closest railroad point is Robinette on the Huntington-Homestead spur line of the Union Pacific Railroad, which is reached from Carson by twenty-five miles of recently built and improved highway.

The topography is rugged and precipitous. The elevation of the town of Cornucopia in Pine Valley, immediately below the mine is approximately 5000 feet, the Union camp is 6000 feet, the Last Chance camp site is 7000 feet, the Baker mill 5250 feet, the outcrop of the Wallingford vein 8000 feet, and that of the Valley View 8500 feet. The climate presents no serious handicaps to mining operations throughout the year. There is ample timber for building and mining operations in the draws and valleys draining into Pine Valley.

The property consists of 58 patented claims, 15 claims held by location, 4 placer claims, and additional lots and acreage in the upper sections of Pine Valley. These holdings are a consolidation of the properties owned by the Cornucopia Mines Co., operators of the Union mine, and the Baker Mines Company, operators of the Last Chance mine; the Stampede Milling and Mining Co., which owned the Mayflower mine. In addition to these productive mines, the property embodies the area to the west on which the Stella, Wallingford, Valley View and other minor veins outcrop.

HISTORY:

The gold-bearing veins of the Cornucopia district, which have had a reported production of several million dollars, were discovered in 1880, were intermittently worked and their ores treated in arrastres until 1895, when a 20-stamp mill with a chlorination plant was erected at the Union mine. This proved unsuccessful and was replaced by a concentrating plant. The concentrates were hauled by wagon to Baker and shipped to various smelters. During the next 15 years a half-dozen other mills of various types were built and operated, but none were markedly successful as the recovery was very low and the process was expensive. In 1910 a cyanide plant was installed to treat the tailings from the Union mill. This method was successful, and in 1912 the Union mill was rebuilt into a cyanide slime plant. In 1915 the present Baker mill and sand-cyanide plant was erected. During the same year two hydro-electric plants were installed.

The camp flourished after 1912, under the management of R. M. Betts, until it was affected by the high costs resulting from war conditions. Due to this high cost, development work in advance of mining was curtailed. In 1924, the Last Chance camp and aerial tram were destroyed by fire. This loss, in addition to the lack of adequate exploration work, the high cost of supplies and labor and transportation difficulties necessitated ceasing operations in 1926 until more favorable economic conditions should exist.

In 1929, after an exhaustive examination, a Canadian company, under the supervision of R. D. McGinnis, reopened the property. Extensive repairs were made with a reported expenditure of \$30,000.00, but this

company was suddenly forced to withdraw, due to financial difficulties.

In 1930, the Comucopia mines were brought to Mr. A. D. Coulter's attention and he, realizing that economic conditions were tending toward pre-war levels, appreciated the merits of the property, and after an examination, formed the Comucopia Gold Mines by consolidation of the various properties in the district. Lowering price levels for commodities and labor, and the recent extensive improvement of the roads serving the mines, were encouraging factors for the prospects of this company. Sampling of the property, in conjunction with mill tests, proved the existence of a large tonnage of low-grade ore that could be profitably handled by flotation in large quantities. Flotation and screen tests proved that a satisfactory recovery producing a shipping concentrate valued at \$200 to \$300 per ton could be obtained without the necessity of fine-grinding, thereby making low treatment costs. Also, the possibilities of reducing mining costs by inaugurating the use of scrapers in the stopes to supplant handmucking were apparent. To provide sufficient ore reserves for a large operation, an extensive geological survey, under the supervision of Prof. G. E. Goodspeed of the University of Washington, was undertaken. This included a complete topographic survey supplemented by a detailed petrographic study of the formations both on the surface and underground. Although this work has not been completed, sufficient data has been obtained to prove the existence of many areas favorable for the occurrence of additional ore bodies not developed or explored in the previous operations.

EQUIPMENT:

Since the property was operated as recently as 1926, much of the equipment is in excellent condition. The surface equipment consists of two camps: one, the Union camp, located on a knoll which is free from snowslides, at the portal of the Clark tunnel, consists of half a dozen dwelling houses, two bunk houses, a cook house, superintendent's residence, and various shops and office buildings. The second camp, in the vicinity of the Baker mill, consists of six dwelling houses, a number of one and two room cabins, and in addition, the usual type of warehouse, office and shop buildings that are associated with mining camps, all of which are in fair condition. Most of these buildings are equipped with inside plumbing and electricity.

The two reduction plants on the property are both equipped with 20-950-lb. stamps and with coarse crushing units. The Union mill, a slime-cyanide plant, has two 5 x 22 tube mills for fine-grinding and the customary cyanide equipment. Except for the crushing units and grinding units, the remaining equipment has deteriorated to the point that it is at present of no service. However, this is of little consequence as flotation will supplant cyanidation in the present operation. In this later method, the crushing and grinding units and compressors will be of use as they are in good condition.

The Baker mill was designed for a sand-cyanide leaching plant, with the usual equipment for that process, all of which is in excellent condition. This plant is operated by water power.

The other equipment throughout the property is powered by electricity, which is supplied from two hydro-electric units, 300 K. W. and 400 K. W. capacity respectively, which are located in the bottom of Pine Creek Valley. This power is transmitted throughout the camp on a trunk line carrying 6600 volts, which is stepped down to 2200, then to 440 at the various plants. In addition to their own power, the company has a standby service over a 4-mile 6600-volt transmission line, which ties in with the Idaho Power Company's trunk line at Carson.

The underground workings of the Union and Last Chance mines are served by the Clark adit tunnel at an elevation of 6000 feet. The Wallingford, Valley View and three other minor veins have been cut at depths varying from 1000 to 2000 feet by the Lawrence adit tunnel driven at an elevation of 7000 feet, the portal of which is located near the outcrop of the Last Chance vein. Supplies and ore are hauled in these tunnels by means of storage battery locomotives of six and two-ton capacity respectively. The rolling stock consists of 12 two-ton roller bearing ore-cars with a number of timber trucks and supply cars.

For mining operations, three Gardner-Denver Model 7 drifters and three light rotating stopers are in use, with customary accessories, tanks, hose and four-ton supply of 1-inch quarter-octagon drill steel. Compressed air is supplied to the mine by a two-stage Sullivan GW-3 Model compressor of 630 cu. ft. capacity, located at the Baker mill. This compressor, although water-driven, has a standby electric motor installation. Another older type of compressor, a two-stage Ingersoll-Sargent of 750 cu. ft. capacity and electrically driven, is located at the portal of the Clark tunnel. The air lines serving the mine have an initial diameter of 4 inches which is reduced to 3 inches, and finally to 2 inches in the various working headings. The rock throughout the mine is handled by gravity, being hand-trammed along the drifts from the stopes and dumped into the main raises which connect with the adit tunnels. For hand-tramming, eight one-ton end-dump drift cars are used. Supplies are handled up these main raises by means of electrically-driven Coeur d'Alene hoists equipped with half-inch cables. The rail installed in the main adit tunnel is 16 and 20 pound weight, that in the drifts and raises is 12-pound wt.

GEOLOGY:

The formations on and in the vicinity of the Cornucopia Mines are of the type that Lindgren and other eminent geologists characterize as very favorable for the deposition of ore bodies. The principal mining areas of the world are located along the border of or adjacent to batholithic intrusions. It is accepted that the maximum deposition of ore occurs near the roof or cupolas of a batholith where the igneous magma has invaded and assimilated the roof rocks resulting in a hybrid igneous rock along the contact which is high in volatile constituents whose presence is necessary for the depositions of ore bodies. The rocks exposed on the surface and in the extensive underground workings prove that the Cornucopia veins occur along the border of a spur offshoot of the Wallewa batholith, which occupies

an area of 250 to 350 square miles. The predominate rock is granodiorite, outcropping as cupolas in schist and greenstone. The veins are undoubtedly associated with the batholithic intrusions but were of a later age as they cut both the granitic and metamorphic formation. After vein deposition, another period of igneous activity accompanied with fissuring occurred as the veins are cut and but slightly displaced by both porphyritic and basaltic dikes. The basalt dikes apparently were the feeders of the recent Columbia River basalt flows.

VEINS:

The veins that outcrop on and traverse the property are: the Whitman, Alta, Van Winkle, Forest Queen, Union-Companion and its extension the Red Jacket, Last Chance and its extension, the Mayflower, Stella Onion Jones, Dawes, Wallingford, Black Eagle and Valley View. The Whitman, Union-Companion, Red Jacket, Last Chance, Mayflower and Wallingford have been the principal producers, but the other veins justify extensive exploration, especially where they pass through granitic and greenstone contacts. The veins are strong and very persistent, have been traced thousands of feet along their outcrop and have been exposed in the underground workings, proving that they continue for great depth. The general strike is north and south, and the dip varies from 35 to 45 degrees westerly. The ore minerals are principally pyrite associated with chalcopyrite, also galena and sphalerite are present. These sulphides occur not disseminated throughout the mass but in distinct bunches, which is an aid to their recovery by flotation. The principal metals recovered are gold and silver in the ratio of one to five by volume. The copper content is erratic, varying from a trace to 0.5%. The gangue minerals are sheared and broken, affording an opportunity to liberate the sulphides by coarse grinding. The vein has a lenticular mode of occurrence, as it varies in thickness from a seam to a width of from ten to fifteen feet. The average mining width in the past has been five feet. The principal ore-shoots that have been developed are known to have occurred in the vicinity of the contact between the granitic and metamorphosed greenstones.

The Union-Companion mine which has produced approximately five million dollars, has been worked to a depth of 1000 feet below the outcrop, at which point excessive water prevented profitable mining. A 6000-foot low-level cross-cut tunnel driven from the valley bottom below the camp would intersect the vein at a horizon which would afford an opportunity to drain and mine by gravity methods, a virgin section of the vein 700 to 900 feet below the mined-out area. This tunnel would also develop at depth the Whitman, Alta, Van Winkle and Forest Queen veins, which from the surface and structural geology have potential merit as they occur in an area where granitic cupolas are known to outcrop in the greenstone.

The Wallingford and Valley View veins, which have exceptionally strong surface showings but are handicapped by transportation difficulties, have excellent possibilities. Both veins have been made accessible through the Lawrence tunnel. A drift on the Wallingford vein where it was cut in the Lawrence tunnel developed an ore-shoot 450 feet long.

with a width varying from 4 to 6 feet, which R. M. Betts reports to have assayed \$14.50 in gold. The burning of the Baker mill aerial tram made it necessary to treat this ore in the Union mill, which proved unsatisfactory, as the lead and zinc content of the ore interfered with the treatment. Due to the low milling recovery, inadequate transportation facilities, and high development cost, this mining proved unprofitable.

Recent tests have shown this ore to be amenable to flotation and the transformation difficulties can be eliminated by driving a raise from the north drift on the 1600-foot level of the Last Chance up to the Lawrence tunnel. Such a raise would be of great importance in the development and the mining of the Last Chance ore to the north of the present Last Chance main raise.

The Last Chance vein has been explored for a depth of 2200 feet along the dip and 2000 feet along the strike, from the surface to the 1600-foot level, where the Clark tunnel cuts it. Of this vein only that part above the 600-foot level has been completely mined out and produced \$3,000,000 in gold and silver. The remaining portion of the vein, which has been partially developed, and on which some stoping has been started, was sampled in 1931, proving the presence of 17,858 tons of assured ore, having an average width of 2.5 feet, which assayed \$9.80 in gold, also a probable tonnage of 30,000 to 40,000 tons and from 80,000 to 100,000 tons of possible ore, which would assay from \$8 to \$10 in gold.

With a daily production of 200 tons, this ore could be mined at a cost of from \$2.00 to \$3.00 per ton.

CONCLUSIONS:

The past operations of the mines in the Cornucopia mining district have been handicapped and retarded - first, by high transportation costs; second, by the necessity of reducing the ore in plants which today are recognized as being obsolete, both from the standpoint of high costs and low recoveries. These two basic items were directly responsible for the necessity of mining high-grade shoots of ore bodies. The total over-all cost of mining and milling in the past operations varied from \$8.00 to \$12.00 per ton; and as there was only a limited amount of ore that would exceed \$10.00 per ton, it was impossible to supply more than 100 tons per day from the underground work, developed during previous operation.

With the recently improved roads which were completed in 1928, transportation costs have been reduced from 50 to 75%. With the advent of flotation for the treatment of gold sulphide ores, which is the mineralogical occurrence of the values in the Cornucopia district, the cost of milling or treatment charges of the ore can be reduced from 35 to 50%. In addition to lower costs, the flotation method will increase the milling and treatment recovery from 10 to 15% greater than by the method previously used. Also from 90% to 95% of the copper,

zinc and lead will be recovered in addition to the gold and silver contents of the ore.

By reducing both transportation and milling costs, a lower grade of ore can be mined at a profit. In all underground mining operations, the costs are directly proportional to the volume of the ore mined. Therefore, with an increased tonnage and improved stoping methods, using scrapers underground, the stoping costs can be reduced from 40 to 50%. From an engineering standpoint there is no question but that the two hundred tons daily production with improved transportation conditions and modern flotation milling methods and improved underground mining methods, the total cost will not exceed \$5.00 per ton.

Respectfully submitted,

Wm. S. Barquist,
Licensed Mining Engineer,
State of Oregon, No. 1522.



Compendia

8) 22
275

4 deep mines

1916	617,425		617,425
1917	421,107		421,107
1918	—		300
1919	367,488		300
1920	—	2 mines 40 stamps	115
1921	—		150
22	did not produce		100
23	full exp 2 mines		2003
24	" " "		1435
25	regular prod, one mine		100
26	1/2 year " "		3838
27	closed		24
28	"		7,800,000
29	old tailing & slupmets		207
30	small		6,883
31	—		617 other mine
			117
			5
			7,000,000
			1670
			8670

3,000,000

32 } U-C mill rebuilt
 33 }
 34 }
 35 } 16,133
 273,647
 393,878
 36 continued
 37 = 95,672
 38 800,000

16,133
 273,647
 393,878
 208,672
 700
 1729,330

Faith in the future of gold and the Oregon holdings of Cornucopoa Gold Mines was indicated by response of stockholders in the corporation to recent offering of 191,500 shares of common capital stock for the purpose of raising funds to do maintenance work preparatory to resuming production. Offered at $27\frac{1}{2}$ cents per share and listed on the New York Curb, the stock was oversubscribed by stockholders by 50,000 shares.

Cornucopia mine, located 35 miles northeast of Baker, Oregon, was shut down in October, 1941 and according to Carl M. Stolle of Spokane, Washington, president of the company, will be reopened when either production costs drop or gold prices rise. Mr. Stolle stated that the property was costing approximately \$26,000 per year for maintenance or workings, buildings, equipment and machinery. The company is said to have produced over \$3,000,000 in gold and silver after deducting costs of smelting, hauling, etc., during the period from 1933 to its closing in 1941. There are seven known veins on the property, of which only three have been explored and mined to appreciable extent.

Cornucopia

This report must be properly executed and filed with the Corporation Commissioner on or before July 1, 1930, in order to entitle a corporation mining for any of the precious metals, coal, or prospecting or operating for oil, or operating an oil well, to pay a license fee of only \$10. If not so filed, such corporation must pay the same license fees as are required to be paid by other corporations for gain.—Section 6890, Oregon Laws.

Annual Report to the Corporation Department

FOR THE YEAR ENDING JUNE 30, 1930 ~~1930~~ 1937

Of CORNUCOPIA MINES COMPANY OF OREGON
(Give legal name in full)

a corporation organized and existing under and pursuant to the laws of the State of Oregon.

The location of its principal office is at No. _____ Street,
in the city of Cornucopia, in the state of Oregon

The names and addresses of principal officers, with the postoffice address of each, are as follows:

NAMES	OFFICE	BUSINESS ADDRESS
Frank Taylor	V. President	Blackbutte, Oregon.
Fred L. Mills	Secretary	do
do	Asst. Treasurer	do

The date of the annual election of officers is 1st Monday in September

The date of the annual election of directors is do

	Common With Par Value	Common No Par Value	Preferred
Amount of authorized capital stock	\$ 1500.00	Shares	\$ 50,000.00
Number of shares of authorized capital stock	150,000		250,000
Par value of each share	\$.01	xxxxxx	\$.20
Amount of capital stock subscribed	\$ 750.01	Shares	\$ 34221.65
Amount of capital stock issued	\$ 750.01	Shares	\$ 34221.65
Amount of capital stock paid up	\$ 750.01	Shares	\$ 34221.65
Price at which no par value stock issued	xxxxxx	\$	xxxxxx

State amount of capital, represented by stock of no par value, with which the corporation began business \$

Total amount of its properties in Oregon (name of claims, lodes, or placers) _____
None, property has been sold to Cornucopia Gold Mines, a Washington corporation

The location of its properties _____
The amount of work done thereon and improvements made thereon since the time of filing last report _____

The amount of output or products of the mines or wells of such corporation from January 1, 1929, to December 31, 1929, inclusive, _____

The value of output or products of the mines or wells of such corporation from January 1, 1929, to December 31, 1929, \$ _____

IN WITNESS WHEREOF, I, Frank T.aylor, vice-president
of said corporation, have signed this report, this

[CORPORATE SEAL]

_____ 28th day of June, A. D. 1937
(signed) Frank Taylor

STATE OF OREGON, }
County of _____ } ss.

State Department of Geology and Mineral Industries

702 Woodlark Building
Portland 5, Oregon

CORNUCOPIA GOLD MINES

Cornucopia District

Baker County

Location: Sections 27, 28, 29, T. 6 S., R. 45 E.W.H. Elevation 4,800 (at town) to 8,400 (top of Cornucopia Lookout).

Area: About 2,000 acres. 975.44 acres of patented claims, and approximately the same of unpatented claims.

History: The property was discovered and the first work done in the late 1870's. No definite record of production is available from that time up to 1907. At that time Robert K. Betts became general manager, occupying that office under numerous changes and reorganizations of ownership until 1927, when the property closed down. During the period between 1927 and 1930 it was examined by a Canadian engineer whose report stated that none of the faces showed ore. However, a new company was formed in 1930 and work started. Since that time the mine has produced around \$3,000,000 of which about \$700,000 has been produced in 1938. The present rate of production is from \$50,000 to \$100,000 per month, gross.

Miscellaneous: The climate is said to consist of "two seasons, July and winter". Snow lies on the ground for an average of 6 months of the year and is from 8 to 15 feet deep in winter. The timber is contracted for, some belonging to the company. Water rights are clear for all plants and for domestic purposes. The new road from the valley is kept open all year. The road up to the upper mine was remodelled in 1938. It takes 1,000 feet in 1 mile, and ore is brought down daily from the upper workings to the mill by the big caterpillar and trailer.

Geology: The outcrop of the Union-Campbell, the first vein, is at an altitude of 6,400 feet, or 1,700 feet above Gaultier tunnel, the latter one and one-half miles down Fall Creek. The outcrop of this vein is traceable according to Bernard Madewald, for 6,800 feet throughout the lengths of the Union, Campbell, Red Jacket, and Robert Emmett claims. Its strike is about N. 20° E. and dip 45° W. into the mountain; its maximum width is 20 feet.

The chief country rock is granodiorite, but the vein is near the extremely irregular borders of the intrusion, so that in the plane of the vein the wall rocks alternate continually between the intrusion and the intruded. The older rock in some places on the walls is greenish schist, originally probably a sandstone; in other parts of the mine the walls were found to be a part of an old intrusion or flow now altered to greenstone.

One characteristic rock specimen shows what appears to be a rather irregular contact with the granodiorite, so vague that one might almost say that the sandstone, or melting of it by the intrusion had been arrested when the work had been but partially completed. On the surface granodiorite is in evidence on the Union and Campbell claims, while on the Red Jacket and Robert Emmett the older rocks ably prevail.

Numerous dikes of granodiorite porphyry are found varying from a few inches to a few feet in width and cutting both the older and the newer rocks. To the east of the dikes are less conspicuous than at points farther west up on the mountain.

Another rock type is the Tertiary Columbia River basalt in the form of dikes. These dikes are shown on the surface with outcrops striking in all directions. These reddish-brown weathered outcrops contrast strongly in color with the whitish granodiorite which they intrude.

Goodspeed (39) discusses and maps the geology and origin of the deposits in detail.

Mineralization: Free gold tellurium ores found at surface. Main oxidation zone about 300 feet in depth. Some oxidation found to depth of 3,000 feet. Primary sulfide zone still showing at depth of 3,000 feet below surface on Union vein, vein being just as strong and containing equal or better average values to that found in the upper workings. Ore composed in main of pyrite, chalcopyrite, tetrahedrite, a little lead and zinc. Higher values usually where shalespyrite is present. Gangue consists of quartz, with intermixed streaks of greenstone and talc. Two stages of quartz, the first being probably contemporaneous with the alteration of the granite and original fracturing. This contains no values. After the original quartz was deposited the vein was sheared and fractured, providing the opening for the second clear quartz to be deposited, which contains all of the ore values. The original white bull quartz had deposited with it quite coarse pyrite. In some sections this pyrite has later been fractured and broken with later mineral values being deposited in the fractures. The later quartz has been microbrecciated, which provides a key for mine development.

Development: There are about 32 miles of workings, varying in elevation from 4,800 to over 8,000 feet. This includes the Lawrence tunnel, 3,700 feet; the Clark tunnel 4,900 feet, the Gaultier tunnel, 6,200 feet. There are drifts on the Union vein on 19 levels; on the Last Chance vein, 19 levels; and all are connected at the present time by a raise from the Gaultier tunnel driven in the summer of 1938 to the old Union workings.

Reserves: Due to the lenticular nature of the ore shoots, which are relatively narrow, it is impossible to block out in the true mining sense, any ore bodies. It is necessary to carry enough working faces in ore, to insure an adequate mill supply. The entire plan of the mine is carried out with this in mind. Sampling is difficult, much sampling of the broken ore being more dependable than regular breast sampling. However, the sulfides contained in the ore at any one point usually are indicative of the tenor of the ore.

The advisability of leasing is due to the fact that there is such a tremendous area of ground opened up, that adequate supervision would be out of the question. Hence the company has adopted a system of leasing certain portions that seem to be more or less worked out, or areas where the veins are too narrow for company operation. The system is as follows: The company provides all necessary mining supplies and equipment. The lessee provides all the labor. From the production, if any, its first deducted the cost of transportation, milling, and supplies furnished. The remaining amount is divided equally between the company and the lessee.

For the first 6 months in 1938, lessees produced 8,788 tons of the total of 26,629 tons of ore mined. The lessee ore averaged .58 ounces per ton, and the company ore averaged .42 ounces per ton, the average mine run thus being .47 ounces per ton.

Mining costs are higher than normal, due to the large amount of development work, which at present is greater than the mining work. A breakdown for the first 7 months in 1938 is as follows:

Labor.	\$2.09
Powder, caps, fuse . . . . .	.23
Timbering . . . . .	.49
General supplies . . . . .	.37
Tramming (high due to great distance). . . . .	.64
Shop charges . . . . .	.06
Assaying and engineering . . . . .	.05
Power and compressed air . . . . .	.15
Maintenance . . . . .	.92
Supervision . . . . .	.39
Transportation on surface . . . . .	.72
Workmen's compensation insurance . . . . .	.32
Social security . . . . .	.15
Total	<u>\$6.58</u>

Milling costs for the first 7 months of 1938 are:

Labor.	\$.33
Supplies . . . . .	.21
Tailings disposal (high) . . . . .	.11
Maintenance and repairs (labor). . . . .	.03
Maintenance and repairs (supplies) . . . . .	.08
Shop charges . . . . .	.07
Assays . . . . .	.04
Power . . . . .	.06
Workmen's compensation insurance . . . . .	.04
Social security . . . . .	.02
Total	<u>\$.99</u>
Labor.	\$.33

References: Lindgren, 01:743-745.
Swartley, 14:36-37.
Parks & Swartley, 16:74.
Lorain, 38:38.

State Department of Geology and Mineral Industries

702 Woodlark Building
Portland, Oregon

QUEEN OF THE WEST MINES CO. (Gold)

Cornucopia District

Baker County

Owners: Cornucopia Gold Mines, Inc.

"Located to the westward on the opposite side of Bonanza basin from the Last Chance in the almost inaccessible cliffs of the mountain is the Queen of the West vein. Picturesque indeed is the position of its mine buildings; its boarding house is on a narrow cliff where material thrown from its windows falls downward for hundreds of feet. A steady nerve and a sure foot are needed on the trail from the mill to the mine and to explore the cliffs above. With snow on the ground it is impossible, and unless they brave the snowslides of the Bonanza basin trail, miners must remain at the mine for some four or five months in winter.

"Nearly all of the country rock is granodiorite, similar to that at the Union-Companion mine. There are a few fragments of schist in the vicinity of the vein which are remnants of the old roof.

"The vein has the usual strike of N. 20 degrees E. and a dip near the surface of about 45 degrees but at depth this decreases to about 30 degrees. The average width of the vein near the surface is between three and four feet, but generally speaking it decreases in width with the decrease in dip.

"The gangue minerals are quartz and calcite containing pyrite, chalcopyrite, galena, and sphalerite in bunches. It is said that the zinc, lead, and copper minerals carry most of the gold values. In many places the vein shows included fragments of altered granodiorite and the granodiorite on each side of the vein for about 2 feet is badly altered and impregnated with pyrite which is said to contain some values in gold and silver. This vein can be traced for a long distance, reported to be as much as 3,000 feet.

"Future development plans are to crosscut from the lower tunnel a few hundred feet beyond the Queen of the West vein, to cut the Red Cross vein whose principal outcrop is some 1,500 feet above the lower tunnel. The Red Cross vein is similar to the other veins, but little is known with reference to ore shoots therein."

There has been some work done on this property since 1916 with some ore discovered. The Red Cross vein is the northern extension of the Valley Vein on Cornucopia Mines ground. Press reports of July, 1938, state that the mill had been crushed by snow and the machinery was being renewed.

Ref. Parks & Swartley, 16:186 (quoted)
Swartley, 14:54
Lindgren, 01:745

Taken from Oregon Metal Mines Handbook, Bull. No. 14-A, by the State Dept. of Geology and Mineral Industries, p. 30.

Cornucopia Gold Mines

Gold

NAME OLD NAMES PRINCIPAL ORE MINOR MINERALS

6 S. 45 E. 28-27-29
T R S

PUBLISHED REFERENCES

Oregon Metal Mines Handbook 14-A page 26
Lindgren 01:743-745
Swartley 14:36-37
Parks & Swartley 16:74
Lorain 38:38

MISCELLANEOUS RECORDS

Baker COUNTY
Cornucopia AREA
4800 to 8000 ELEVATION
..... ROAD OR HIGHWAY
26 mi. to Robinette DISTANCE TO SHIPPING POINT

PRESENT LEGAL OWNER (S) J. M. Baker, Treas.

Address .. 824. Old. National. Bank. Building, .Spokane, .Wa.

OPERATOR

Name of claims Area Pat. Unpat.

Name of claims Area Pat. Unpat.

About 2000 acres $\frac{1}{2}$ pat. $\frac{1}{2}$ unpat.

EQUIPMENT ON PROPERTY

Red Jacket

Sold

NAME	OLD NAMES	PRINCIPAL ORE	MINOR MINERALS
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6 S 45 E 1 mi. N. W. Cornucopia mine
 T R S

PUBLISHED REFERENCES

Dogami 14-A (Page 26 (Cornucopia Mine))

Baker COUNTY
 Cornucopia AREA
 ELEVATION
 ROAD OR HIGHWAY
 DISTANCE TO SHIPPING POINT

MISCELLANEOUS RECORDS

PRESENT LEGAL OWNER (S)

Address

OPERATOR

Name of claims	Area	Pat.	Unpat.

Name of claims	Area	Pat.	Unpat.

EQUIPMENT ON PROPERTY

U. S. DEPARTMENT OF LABOR
WAGE AND HOUR DIVISION
Washington, D. C.

FIRST MINING COMPANY ENJOINED

The Cornucopia Gold Mines, a corporation with principal offices in Seattle, Washington, has been restrained from violations of the Fair Labor Standards Act, according to an announcement of the Wage and Hour Division, U. S. Department of Labor. This is the first Wage and Hour case in which judgement has been entered against a mining company. The corporation, operating a mine and mill near Cornucopia, Oregon, is engaged in the mining and concentrating of ore containing gold and silver.

A judgement entered in the United States District Court for the Western District of Washington, Northern Division, on May 3, provides for the payment of restitution. Approximately \$18,000 in back wages for overtime worked is due some 283 employees.

An important stipulation contained in the judgement is that time spent by employees in traveling from the "portal", or entrance, of the mine to the "face", or place where they work, and from the "face" back to the "portal" is to be deemed time worked. This means that hereafter the miners are assured of wages from the time they enter the mine until they leave it. Heretofore the miners were required to show only six hours of work on their time cards although they were actually in the mine for eight hours. The mining company previously had not paid for the two hours consumed by the men riding into the tunnel in the mine property and going up or down the shafts to their place of work for the day.

Another important stipulation contained in the judgement is that lessees and employees of lessees are all deemed to be employees of the Cornucopia Gold Mines. The company, entering into leasing agreements with individuals to mine a portion of the property owned by the company, furnishes all materials and supplies including air, tools, machinery and equipment. All mining ore is brought to the company's mill which is also a part of the mining property. The lessees each employ one or more persons to assist them in regular mining activities. In other words, the lessees themselves are actually engaged in mining. The lessees receive a share in the net profits resulting from the sale of the ore mined by them and pay their own employees directly.

#

June 4, 1941

Mr. A. B. Quine, General Manager
Cornucopia Gold Mines
Cornucopia, Oregon

Dear Al:

I recall your telling me a couple of months ago that Cornucopia might be interested in looking into a mining property which had profit possibilities. If you are still in the mood, I would like to suggest the Silver Peak property located in the Riddle District, south of Roseburg. I had never given this property serious consideration—never had much information on it in fact—until recently when we started making a survey of zinc possibilities in the State. The reason for this survey is the strong possibility that in the next year or two we may have an electrolytic zinc smelter on the lower Columbia.

Next to the Amalgamated Mine on the North Santiam and the Higgins and Hinsdale developments in the Bohemia District, the Silver Peak property seems to have the best possibilities for zinc. Formerly of course the zinc was either a waste or a detriment when concentrates were shipped to a smelter from the property. From smelter certificates furnished us we can give you the following information:

Tonnage of ore shipped to Tacoma between 1936 and 1937
was 3326 tons in 59 shipments
Average assay content on which smelter rate is based is—
Gold, .08 ounces; silver, 3 ounces; copper 5.43%; zinc, 6.35%

Sampling by Shannon of the U. S. Geological Survey showed around 6% zinc.

Dr. P. T. Meaney, whose address is 912 Selling Bldg., Portland, is trustee for the group and would be pleased to consider any overtures from responsible operating people. Dr. Meaney has no fancy ideas as to terms and would be glad to consider, I believe, a standard mining lease arrangement, perhaps with some payments after examination and exploration to cover some outstanding obligations, such payments to be construed as advance royalty and deductible from subsequent payments.

Our report on the property will soon be available as we are getting out a zinc report shortly. There is some proven ore, a few thousand tons, and a considerable tonnage of "Probable" and "Prospective" ore. The mineralization looks good, and it is just possible that this property is a "sleeper". If interested, drop us a line or communicate directly with Dr. Meaney.

With best wishes to yourself and family, I am,

Sincerely,

EKN:ac cc Dr. Meaney

Director

Cornucopia Milling

Practice at Sixth American Gold Mine

MODERN flotation has solved the recovery problems at Cornucopia Gold Mines.

These problems, which became increasingly serious with depth of operations in the mine, were responsible in part for closing of the property in 1927 after a life of 50 years.

Idle for three years from 1927, Cornucopia has since risen to sixth position among American gold mines. How the problems of geology and mining have been worked out was told in earlier articles.

However, improved metallurgy has had an important part in bringing the property to its present position. Flo-

**T. S. Bailey, mill superintendent,
Cornucopia Gold Mines.**

tation has replaced cyanide and recovery today is excellent.

Leverett Davis, vice president and general manager of Cornucopia Gold Mines, explains it thus:

"In the old days of Cornucopia the ore was treated with cyanide. However, as the mine deepened cyanide



Mill of Cornucopia Gold Mines, situated in the Wallowa Mountains of Oregon at an elevation of 4,800 ft. Snowfall is heavy, running above 10 ft. Capacity is about 180 tons a day. Flotation gives satisfactory recovery where cyanidation failed.



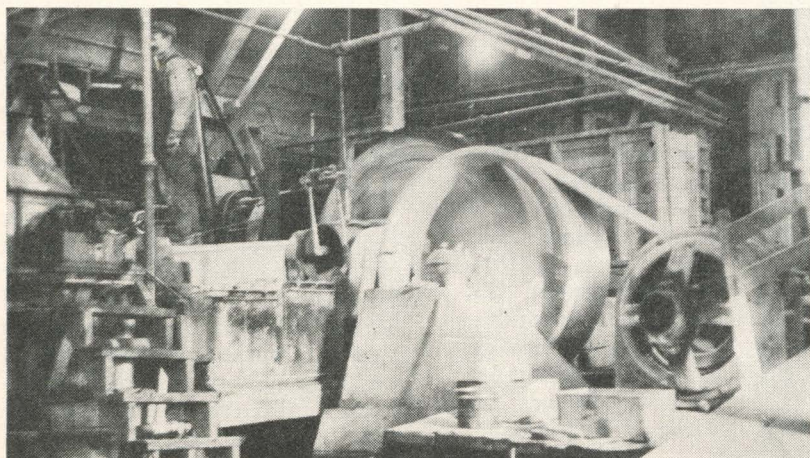
costs became excessive and recovery progressively poorer. The presence in the ore of considerable copper, lead and some zinc complicated the cyanide treatment.

"Today we use flotation, preceded by mineral jigs to remove chalcopyrite, which contains substantial values. We are experimenting with selective flotation and eventually may work out a new flow sheet which will involve flotation of the base metals, followed by cyanidation of the gold and silver."

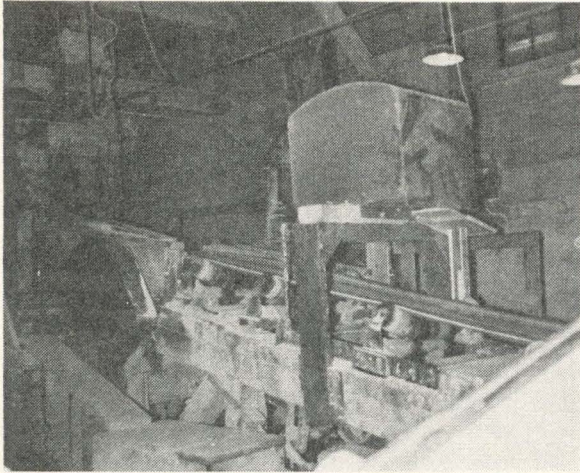
The Cornucopia mill was erected about five years ago at the portal of the new Coulter tunnel. There were two old cyanide mills at other locations on the property, but these have been wrecked.

T. S. Bailey is mill superintendent, and A. W. E. Ginther is master mechanic for the entire Cornucopia operation.

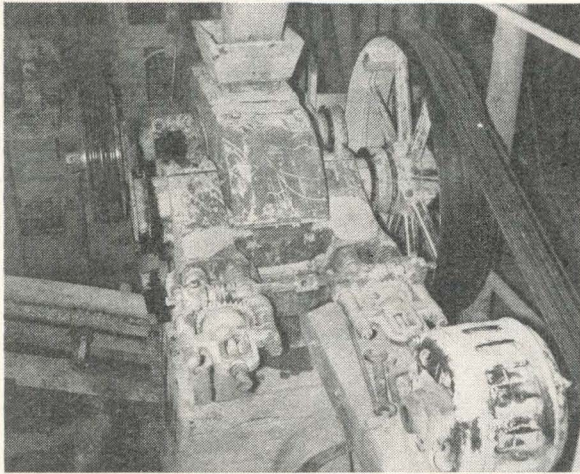
Ore reaches the mill essentially



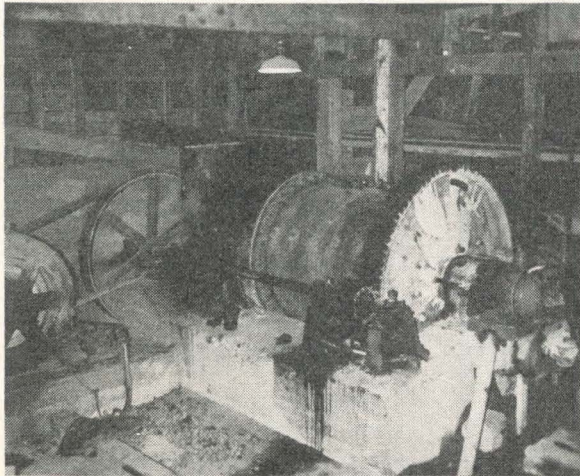
Cornucopia's primary ball mill, a 6 by 4½ Marcy, is seen in the central background. Its product passes over two Denver Equipment Co. mineral jigs in the left central foreground, and their overflow to a Denver unit cell at the extreme left.



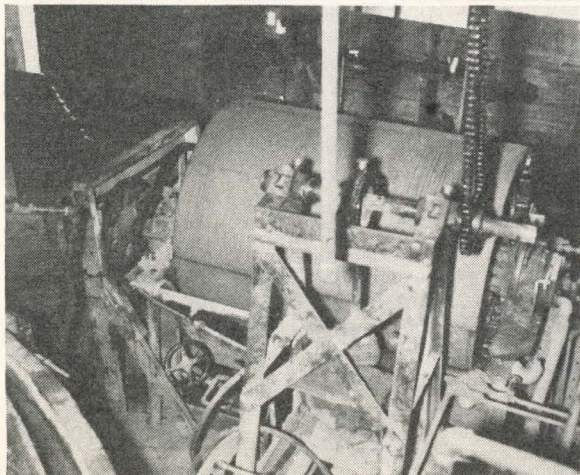
Mill feed is transferred from the Link Belt conveyor crossing lower corner of the picture to the belt going through the Merrick weightometer, and thence to the primary crusher in the left background.



Traylor rolls receive the oversize from the Simplicity vibrating screen, discharging to conveyor in the lower left, which also carries product of primary crusher to the screening circuit.



Secondary ball mill, a 6 by 5 Colorado Iron Works, which receives rake product of the Dorr classifier, discharging to a second Denver Equipment Co. unit cell.



Passing the Dorr thickener, a sector of which is seen in the extreme lower left, concentrates are drawn by a Western Machinery Co. diaphragm pump, right center. From the Denver Equipment Co. continuous rotary filter, dried concentrates go to the bin in the upper left background for loading into trucks.

from two sources. Trains from the Coulter tunnel dump direct into the three 100-ton coarse ore bins. Ore from the higher Clark tunnel, as well as its tributary Red Jacket workings, is brought to the mill by truck, or in winter by a huge buggy towed by an RD8 "Caterpillar" tractor.

Three Link-Belt feeders draw ore from the bins into the mill, depositing it on a rubber conveyor belt running on Link-Belt troughing idlers, which are standard throughout the entire mill. These conveyors are driven by an Allis-Chalmers motor. They carry the ore through a Merrick weightometer, which keeps an accurate account of the tonnage. This is a particularly necessary feature of the Cornucopia operation, due to the large proportion of the mill feed furnished by leasers.

Primary crusher is a Dodge type, from which the ore is elevated by belt in two flights. At the end of the first flight it is possible to divert the flow of material to a hopper outside the mill building. This is provided so that waste may be run through the primary crusher and out to the bin for use on roads.

At the head of the second elevating conveyor is a Dings magnetic pulley to remove all tramp iron. Coarse ore then goes to a Denver-Simplicity screen whose oversize is returned to Traylor crushing rolls, which discharge onto the elevating belt conveyor, all material again passing over the magnetic pulley and screen.

Samples are drawn from the screen undersize as it passes to the fine ore bins from which it flows by gravity to a belt conveyor feeding a Marcy No. 64½, 6 by 4½ ball mill.

Overflow from the ball mill goes direct to a two-cell Denver Equipment Co. jig, whose hutch products, consisting largely of chalcopryrite, go direct to the concentrate bin.

Jig overflow goes to a Denver Equipment Co. Sub-A, Fahrenwald type unit flotation cell. Concentrate from the cell is pumped to a Dorr 14-ft. thickener. Overflow from the unit cell enters a 12-ft. Dorr duplex rake classifier. Oversize from the classifier is divided, ⅓ to the Marcy ball mill and ⅔ to a 6 by 5 Colorado Iron Works ball mill.

Product of the Colorado mill goes to another Denver unit cell, which runs its concentrate to the thickener and its overflow to the classifier.

Overflow from the classifier passes to a 6-cell Denver Sub-A, Fahrenwald type flotation machine. Flotation concentrates from the first two cells go to the thickener. Overflow from the

**CORNUCOPIA
FLOW SHEET**

From the mill, tailings are carried by gravity in a steel pipe on a trestle across Pine Creek, and elevated by Wilfley pump to the tailings bed. Concentrates are trucked 27 miles to Robinette for rail shipment to Tacoma Smelter. The Marcy ball mill should be 6 by 4½ and the diaphragm pump should be a "Wemco."

first two cells goes to the other four. Floated products of the last four cells are re-introduced into the first two. Overflow from the last cell goes to tails.

Flotation concentrates, including those of the two unit cells, as well as those of the first two cells in the large machine, are handled to the thickener by a Denver Equipment Co. vertical pump.

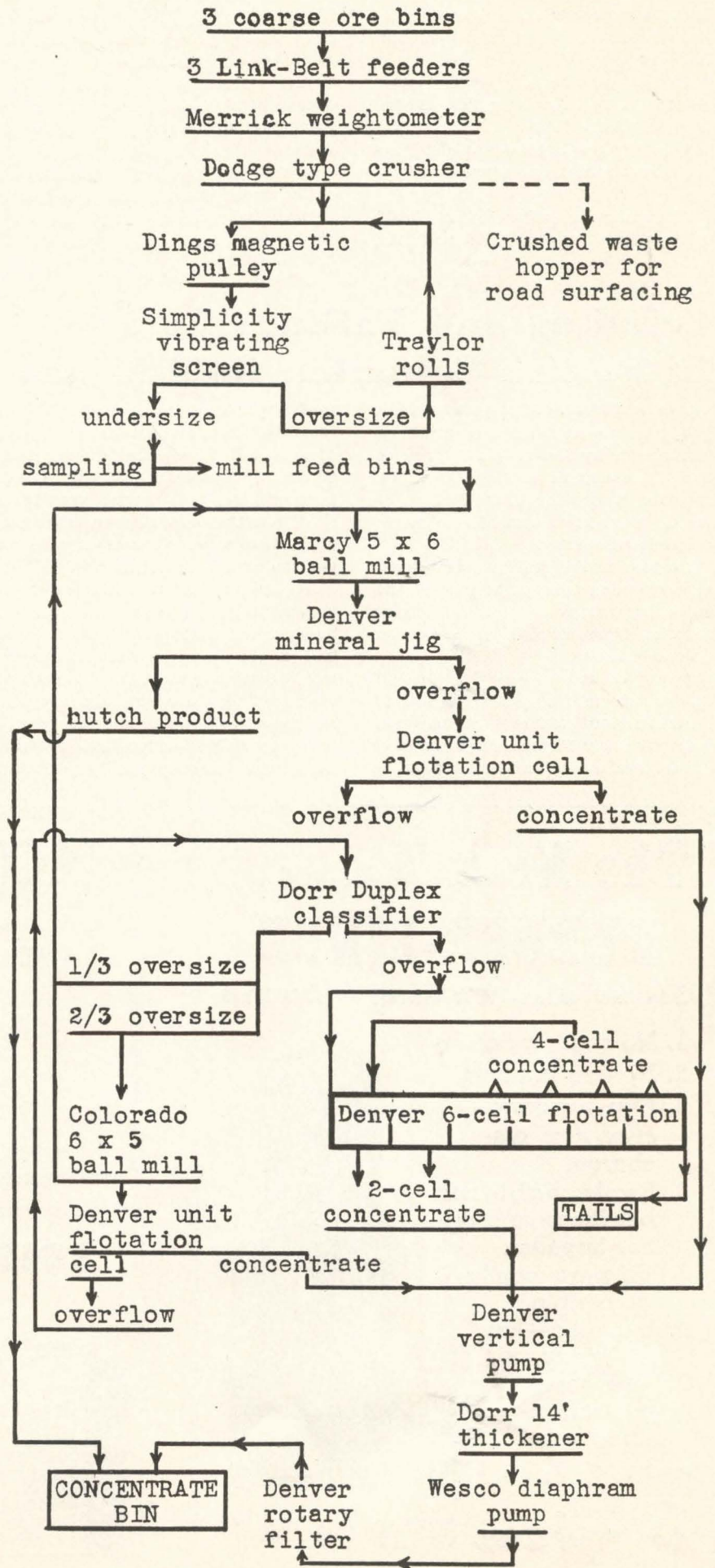
Concentrates from the Dorr thickener are drawn by a Western Machinery Co. diaphragm pump and delivered to a Denver Equipment Co. continuous rotary filter with Ingersoll-Rand pump, where moisture content is reduced about 8 per cent. Dried concentrates are trucked under contract from the mill to Robinette on the Snake River branch of the Union Pacific, a distance of 27 miles. They are loaded in special steel cars and shipped to the Tacoma smelter.

Flotation reagents employed include: soda ash (Trona); cresylic acid, barium sulphide, pine oil, Tarol No. 1, Xanthate Z6 and occasionally fuel oil.

All flotation machines are driven by Allis-Chalmers motors. V-belt drives are Gates or Rockwood. Electric switches and controls are Trumbull Electric Manufacturing Co.

Tails flow by gravity in a spiral-wound steel pipe carried on a trestle across Pine Creek to a pumping station, where they are elevated by a Wilfley sand pump to a flume system by which they are distributed over the tailings beds. Holes bored in the wooden troughs open onto light metal distributing troughs. The flume system is quite comprehensive, permitting even building of the tailing bed.

Power for the mill and the mine as well draws from four sources. There are two hydro-electric plants. One is located a short distance below the mill, served by a pipeline which picks up the east fork of Pine Creek. About 2.5 miles below Cornucopia is a second hydro-electric plant, served by a pipeline picking up the flow of Pine Creek



below the upper tailrace. Normal production of the two plants is around 1,500-hp.

At the same location as the lower plant is a diesel station with a 350-hp. Ingersoll-Rand diesel.

The Cornucopia lines are also connected with the Idaho Power Co. system.

Electricity is generated at 2,300 volts, stepped up to 11,000 volts for

transmission and transformed to desired voltages at point of usage. The compressors underground on the Coulter level are driven by motors operating at 2,300 volts. Most other equipment about the property is 440 volts.

A. W. Fosterling is chief electrician.

The assay office, in charge of Gene Fadden, is equipped with a Denver Fire Clay Co. furnace, an F. W.

Braun crusher, McCool pulverizer made by the Mine & Smelter Supply Co., and a Denver Equipment Co. laboratory flotation machine.

Auxiliaries of the Cornucopia operations include a modern blacksmith shop, a machine shop capable of handling all work for the mill and mine, and a timber framing mill. Lumber is purchased from a nearby sawmill.

Grinding and Tailings Losses In British Columbia Gold Mines

ADVANTAGE of fine-grinding, but the mistake of over-grinding, was shown by Dr. H. V. Warren of the University of British Columbia, speaking before the B. C. Division of the C.I.M.M. at its annual meeting in Vancouver recently.

He told of the results obtained by super-panning tails with some of the university's new equipment, using samples from three notable British Columbia mines.

Assay of tails from the Cariboo Gold Quartz mill, a cyanide operation, showed loss of .022 oz. gold per ton. Approximately 15 per cent of the tails consisted of pyrite, and this accounted

for 75 per cent of the loss. Pyrite from 100 to 150 mesh carried .6 oz. of gold, but represented a small part of the aggregate tails volume. Small particles of pyrite carried very little gold, but the very fine particles ran high. Loss in quartz was only .01 oz. per ton of this material.

Hedley-Mascot, a flotation mill, showed .08 oz. loss in tails plus 100 mesh. Particles from 20 to 40 microns had negligible gold; but the very small, less than 20 microns, showed high loss. Some of the arsenopyrite ran 67 oz. to the ton, but this constituted only .006 oz. per ton of tails, while the arsenopyrite constituted

only one-hundredth of 1 per cent.

In examination of tails from the Privateer mine, it was found that the loss in material plus 100 mesh was .07 oz. per ton. Super-panning showed the one-fourth of 1 per cent arsenopyrite accounted for 4 per cent of the loss. Fifteen per cent of the gold could be traced to pyrite. Loss in free gold and galena was 3 per cent. Coasted gold was cleared of responsibility for any significant loss, but 12 per cent was traced to chalcopyrite.

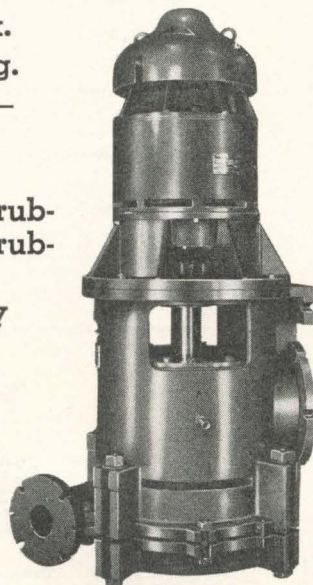
McPherson Is Super

Frank McPherson, formerly of the Basin Montana camp, went north to Alaska in February to become superintendent of the Polaris-Taku mine. He was occupied in Alaska last summer, in charge of drilling near Nome.

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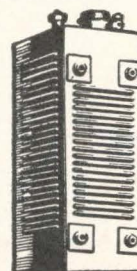
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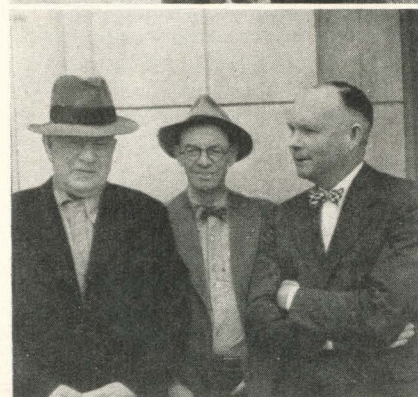
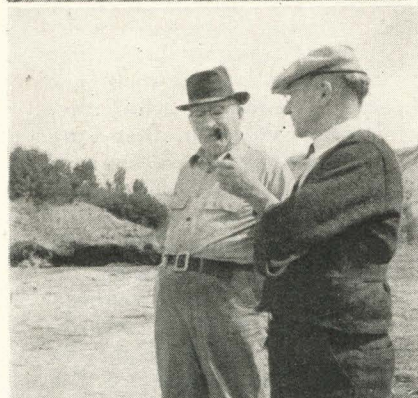
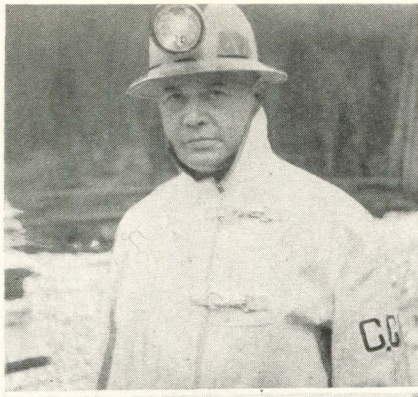
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Oregon Engineers Visit Cornucopia



Mining engineers and operators, members of the A. I. M. E., journeyed to eastern Oregon over the Fourth of July holiday to inspect a number of the operations, and to hold an association meeting at Baker.

Under the leadership of Oregon chapter chairman Earl K. Nixon, a group left Portland in caravan June 30, going through Eugene and on to Prineville. Others joined the party there and drove on the next day to John Day. After lunch, the group visited the dredging plants of the Western Dredging Co., Ferris & Marchbank, etc.

The following day, Sunday, the party saw the placer operations between John Day and Baker, particularly in the Granite and Sumpter Valley region. In the evening a banquet was held at the Baker Hotel, where some 50 persons gathered. Later the A. I. M. E. held its formal meeting, with 20 present. The

At the top, Leverett Davis, vice president and general manager of Cornucopia Gold Mines, ready to go underground.

Next is A. V. Quine, general superintendent of Cornucopia.

Middle picture, a party visiting the Cornucopia mine. Left to right, Roy Edwards, Washington Iron Works; Dr. F. W. Libbey, Oregon Department of Geology; Dr. L. W. Staples, geologist, Horse Heaven Mines, Inc.; F. W. Watson, Portland mining engineer and secretary of the Oregon Mining Association; Mrs. J. E. Brown of Mining World; C. R. Stout, Esterly Mine, O'Brien, Ore.; Leverett Davis, Cornucopia general manager.

Albert Burch of Medford, dean of Oregon mining engineers, left, discusses placer mining with Dr. Warren D. Smith, head of the department of Geology, University of Oregon.

At the bottom, left to right: John Arthur, old-time mining engineer, who has spent 50 years in Baker County, Ore., and is now manager of the Argonaut Mine owned by W. C. "Pop" Wilmott; F. Whalley Watson, Portland engineer and secretary of the Oregon Mining Association; Earl K. Nixon, chairman of the Oregon Chapter of the A.I.M.E. and director of the Oregon State Department of Geology and Mineral Industries.

resignation of Arthur Swartley as secretary was accepted with reluctance, and F. W. Libbey of the State Department of Geology and Mineral Industries was elected to the post.

Mr. Nixon presided as chairman of the meeting. Technical literature available to the men in the industry was discussed by F. Whalley Watson, who, together with Mr. Nixon and Albert Burch, also considered a student loan fund for students of mining engineering. Aerial mapping of mining areas also came in for discussion.

On July 3, a number of the group made the trip to Cornucopia where, as guests of Leverett Davis, vice-president and general manager, and A. V. Quine, general superintendent of the Cornucopia Gold Mines, they made the trip underground and inspected the workings.

Baker's annual Mining Jubilee was held on July 4, and a number of those on the trip remained to see it and to view the single-jack rock drilling contest. Ed Robertson of Bates was first in this event, drilling 10 3/16-in. in 10 minutes. Jack Daugherty of Bates was second with 9 3/4-in. and Mickey Daugherty of Bates was third with 9 11/16-in.

Those making the trip to Cornucopia included J. M. Hague of New York; H. R. Bramel of Hood River, Ore.; H. B. Wood of Portland; S. A. Feitler of Palo Alto, Calif.; C. R. Stout of the Esterly Mine, O'Brien, Or.; J. H. Blackmore of Winston Bros., Helena, Mont.; F. Whalley Watson of Portland; F. W. Libbey of Portland; Roy Edwards of the Washington Iron Works, Seattle; Wallace Todd of Los Angeles and L. W. Staples of the Horse Heaven Mine, Horse Heaven, Ore.

Those who made the mining tour and those who were present at the banquet at Baker were as follows:

John Arthur, Baker; H. E. Handryx, Baker; C. C. Basch, Baker; J. E. Little, Sumpter; Mrs. J. E. Little, Sumpter; F. R. Klein, Greenhorn; Mrs. F. R. Klein, Greenhorn; Stanley Feitler, Palo Alto; F. Whalley Watson, Portland; S. K. Atkinson, Boise, Idaho; A. V. Quine, Cornucopia; E. K. Nixon, Portland; Leverett Davis, Cornucopia; Albert Burch, Medford; J. M. Hague, New

York, N. Y.; Hadley R. Bramel, Hood River; A. E. Murray, Porter & Co.; Clyde Rude, Porter & Co.; J. H. Blackmore; S. K. Atkinson, Jr., Granite; L. W. Thrailkill, Boise.

J. E. Tucker, Granite; Henry Atkinson, Granite; James Bradbury, Baker; Nadie Strayer, Baker; C. R. Stout, O'Brien, Esterly Mine; Geo.

Schlemmer, Baker; Maurice M. Brady, Baker; Leslie L. Motz, Baker, State Dept. of Geology; Warren D. Smith, University of Oregon, Eugene; Mr. and Mrs. K. E. Hamblen, Portland; Lloyd W. Staples, Horse Heaven; Wallace Todd, Los Angeles; Roy M. Evans, Granite; Luther Olson, Baker; John Eliot Allen, Baker; F. W. Libbey, State Dept. of

D. A. Murray, Baker; W. M. Miller, Baker; Klau V. Powell, Baker; T. Ned Thomas, Baker; H. B. Wood, Portland, State Department of Geology; Ray C. Treasher, Portland, Oregon State Department of Mines; Wayne R. Lowell, La Grande, Oregon State Department of Mines; Jos. L. Danziger, Baker;

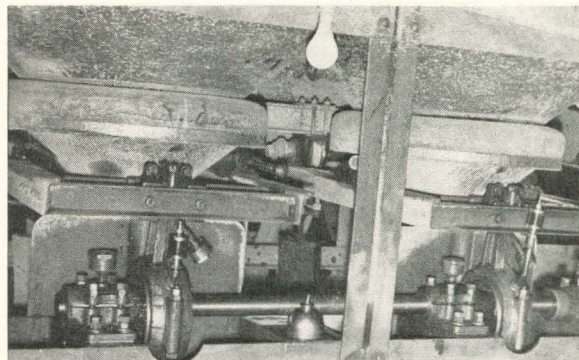
are both passed over large areas of burlap under expanded metal. This not only affords a continuous check on the work of these machines, but also provides a safety device against losses if for any reason any of these jigs should fail to function properly. As long as operation is normal, the recovery from the burlap is very small.

The Kister boat is expected to operate in its present location for about eight years. The dredge uses a total of 600 hp., has 74 buckets on the line, and digs to 55 ft. Bucket line speed is 23 a minute, and capacity of each bucket is 9 cu. ft. The Kister has an operating capacity of between 10,000 and 13,000 cu. yds. per day.

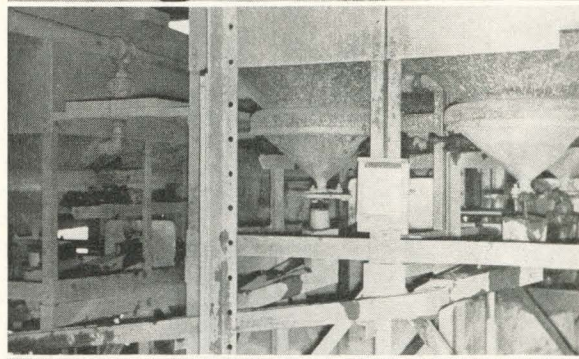
Other equipment of the Kister includes: four Westinghouse 5-hp. motors for driving roughing machines; General Electric motor on Bean intake pump, 40-hp.; Ingersoll-Rand motor pump uses G.-E. 25-hp. unit; Byron-Jackson screen water pump driven by a 16-hp. Westinghouse motor. Bull rig employs a 500-hp. Westinghouse motor.

E. B. DeGolia is the president of the Gold Hill Dredging Co. and J. J. Coney is secretary-treasurer. Walter W. Johnson and Stanley Hiller are vice-presidents. The company is rated as one of the most progressive dredging firms in the country.

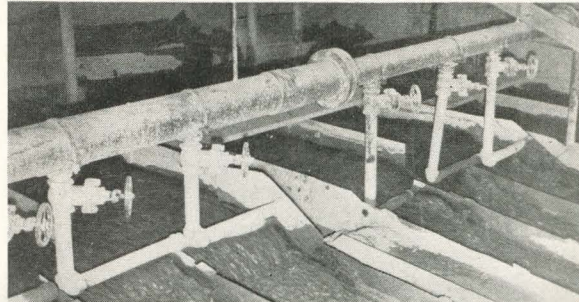
Drive side of the rougher jigs on the Kister dredge, with the shaft through which a Westinghouse motor drives four cells. Note the plate with rounded corners behind the drive on the left, as it bears a relation to the picture below.



Opposite side of the rougher jigs, showing the hutch discharge. The plate mentioned above, separating the drive and the discharge elements of the jig, is seen behind the order board in right center.



Tailings discharge from the rougher jigs.



Mill Machinery Moved To Alaska Mine

Several tons of mining equipment went to Alaska in July aboard the steamer "Mount McKinley" for the McKinley Lake gold claims, 22 miles up the Copper River & Northwestern Railway out of Cordova, and three miles back from steel.

Included in the shipment was a 35-ton Kennedy Van Saun pilot ball mill, two Tuthill mineral jigs, special amalgamating equipment, a complete assay laboratory, four Tuthill D-type gold flotation cells, and an American Sawmill Machinery Co. portable mill with 48-in. saw.

Accompanying the shipment were Walter Gilkey, manager, and L. E. Tuthill, engineer. Mr. Gilkey is one of the sons of William Gilkey, early day Klondiker, who was running mate with "Swiftwater Bill."

The McKinley Lake property, reportedly carrying "good" gold values, is on a shear zone contact of slates and graywackes.

It is planned to install a 150-ton

mill, if values continue, and erect a 300 KVA-low head trunk turbine G. E. power unit.

Copper Canyon Strikes Flush Water Supply

Going after water before sinking for gold, Copper Canyon Mining Co. has struck an abundant supply a little over five miles from its mine in Copper Canyon, 15 miles from Battle Mountain, Nevada. The pipeline will be eight inches in diameter, with a static head of 1093 ft. Test of the 329-ft. well shows production of 652 g.p.m., with drawn-down of 37 ft.

Lenses of gold ore crossing the copper lode formerly worked by the mines are the objective of the new operation which is expected to proceed as result of the new water supply. R. C. McCarthy is general manager of the Copper Canyon operations, with R. R. Raring engineer in charge.

Some mining men brag about the "picture rock" and \$30,000-a-ton ore which they have turned up in their mine, but it isn't often you hear one making the statement that his is the lowest grade ore of them all.

However, in an address at Nevada City, Calif., recently, Robert Hendricks, superintendent of the Zeibright and Murchie mines, said the Zeibright ore was probably the lowest grade being worked in the United States. The gold recovery is approximately 1 to 400,000 parts of ore.

Milling 950 tons of ore per day, the plant recovery system includes amalgamation, cyanidization and floatation. The ball mills are equipped with "electric ears" to maintain the supply of ore at the most efficient milling level.

Cornucopia Acquires Queen of West Group

Addition of the Queen of the West Group of 13 claims to the holding of Cornucopia Gold Mines, Inc., is reported under a royalty arrangement with R. H. Parsons of Medford, Ore. It is understood that development plans call for extension of the Cornucopia Clark tunnel, now 4,900 ft., by approximately 2,000 ft. to open the Queen of the West vein.

This arrangement appears to solve the problems attendant upon operation of the Queen of the West, due to its inaccessability, extreme topography and snow danger.

Mining World Aug. 1939

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Leverett Davis Goes on the Air

Leverett Davis, manager of Cornucopia Gold Mines, Inc., was featured in a July broadcast, "Highlights of Mining in Oregon," from a Portland station. The broadcast began with a dramatization of the discovery of gold in Oregon on Ashland Creek in 1851, and carried the story down by steps to the present day. Mr. Davis was presented to tell something of Cornucopia and Oregon gold mining of today.

Cornucopia

The Horn of Plenty



"Caterpillar" tractor hauling a "buggy" loaded with 15 tons of ore from the Clark tunnel to the Cornucopia mill. The road drops 1,200 ft. in a mile and the winter snow depth ranges from 10 to 25 ft.

CORNUCOPIA is an old camp in the Wallowa Mountains of north-eastern Oregon. First worked in 1878, it produced almost continuously until 1927, when it shut down.

Canadian interests sent engineers and geologists to the property for a thorough examination. The report made in 1930 was that the mines were worked out.

Since that time Cornucopia—"The Horn of Plenty"—has produced nearly \$4,000,000 in gold.

It has risen to the sixth position among American gold mines.

How can you account for this?

Leverett Davis, vice president and general manager of Cornucopia Gold Mines, credits two factors:

1. The faith and determination of the late A. D. Coulter of Seattle, who refused to believe the mine was worked out and who organized the

project which drove a new low-level tunnel 6,000 ft. to the ore 1,200 ft. below any previous workings.

2. The theory evolved by G. E. Goodspeed, professor of geology at the University of Washington, which contends that mineralizing solutions at Cornucopia rose through zones of microbrecciation produced in older masses of brittle quartz by recurrent fracturing and shearing. Microscopic study of thin sections of the vein material thus aids in following the ore shoots through the tangled veins and dikes of Cornucopia Mountain, permitting development to keep on the vein of values by staying with the microbrecciation even where sampling may fail to disclose commercial ore.

There is a third element Mr. Davis did not mention, but the person who spends some time studying the Cornucopia camp cannot escape the im-

pression that a listing of the factors which have brought about the rebirth of Cornucopia should include:

3. The energy, ability and vision of Leverett Davis, vice president and general manager.

Cornucopia Gold Mines' head office is in Seattle, where Dr. Richard E. Fuller is president and A. Scott Hill is secretary-treasurer. Mr. Davis is at Cornucopia, where A. V. Quine is his general superintendent.

The property consists of well over 2,000 acres, of which nearly half are patented. It lies to the west of Pine Creek near its head on the south side of the Wallowa Mountains. The mines are approximately 75 miles northeast from Baker, Ore. Elevation at the mill is 4,800 ft., the property running up to 8,400 ft. at the outcrop of the Valley View vein.

There are 11 veins, of which only two have been worked to any considerable extent, with some development in three others. From east to west, the veins are: Whitman, Alta (which may be a faulted portion of the Whitman), Jonathan Bourne, Forest Queen, Union, Last Chance,

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THE COVER PICTURE

Taken in the underground lunchroom of Cornucopia Gold Mines, the cover illustration shows a part of the crew ready to go off shift. Left to right, the men whose faces appear are: Elton Gillette, Pete Polinick, Ed Widman (scratching his ear), John Willingham, Harry Johnson and Jim Hewitt. The lunch room adjoins the new underground compressor room and is heated by the air pipes from the compressors. Note that the men, as are all of the company's employes, are modernly equipped with M.S.A. Skullguards and electric cap lamps with Edison batteries.

Federal Fractions

HAROLD ICKES discharged Dr. John W. Finch, director of the Bureau of Mines, because some of the civil service employes (whom Ickes couldn't discharge) didn't knuckle-under and support his policies—perhaps it might be better to say his politics.

He is quoted as saying Bureau of Mines officials "tried to sabotage my position;" and that he appointed Dr. Finch because of his ability as a scientist and engineer.

The appointment was sound; the dismissal shameful. It makes plain that Secretary Ickes wants a yes-man, who can force all his subordinates to be yes-men, and not a scientist and engineer as head of the Bureau of Mines.

DEPARTMENT of State announces that no concessions on copper or copper products will be made in the trade agreement being negotiated with Chile.

This is reassuring news to domestic copper producers. Profiting by the experience of the zinc miners, who were sold down the river, copper men have been waging a battle against concessions on their commodity ever since it became known that conversations with Chile were under way.

The announcement shortly preceded the meeting of Congress and undoubtedly forestalled a flood of protest and attack upon the entire reciprocal trade agreement program.

By combining offensive with defensive tactics, the copper producers got results.

AWARD of a strategic minerals contract to Mrs. Dorothea Reddy Moroney of San Francisco to furnish 25,000 tons of chromium ore from property in Alaska may mean a great deal to the territory in rejuvenating its base metal industry.

The amount of the contract is \$825,000 and delivery within a year is specified. The mines are near Selkovia, tributary to Cook Inlet, and their development may prove of immense importance to the future of Alaska and America's supply of chromium.

Stella, Daw, Wallingford, Black Eagle and Valley View.

The Wallingford, Daw and Stella perpetuate in stone the names of characters in the Get-Rich-Quick J. Rufus Wallingford fiction series of some years ago.

The principal veins, Union-Companion, Last Chance, Wallingford and Valley View, strike about 20 degrees east of north and dip uniformly at about 45 degrees to the west.

There are nearly 35 miles of workings. Primary tunnels are: The Lawrence at el. 6,890 ft., running 3,700 ft., 4.5 degrees south of west to the Valley View vein;

The Clark at el. 5,890 ft., running more than 5,000 ft., part way about 18 degrees west of north, then swinging to 40 degrees west of north, cutting the Union-Companion vein and the Last Chance vein, and now being extended to the Wallingford and Valley View.

The Coulter at el. 4,803 ft., running 6,400 ft. at 67 degrees west of north and reaching the Union-Companion vein on the lowest level of the operations.

At present the Lawrence tunnel is not being worked to any significant degree. Workings are being mined extensively from the Clark tunnel, which is also being driven ahead. The Union-Companion vein is being worked from the Coulter tunnel as well.

Raises from the Coulter tunnel, completed last year, connect with all upper workings, which reach surface at a number of points.

Mr. Davis is attacking the Cornucopia problem from a long-range standpoint, as shown by a number of factors.

Earnings have been plowed back into development, above ground as well as below. For example, a whole town has been built for employes, the buildings of the old Cornucopia having largely fallen in. Comfortable staff residences have been built. Arrival of snow this fall saw the completion of a new dry. It is large, comfortable, thoroughly modern and equipped with a solarium where the men can receive hours of sunlight equivalent in a few minutes.

Under construction is a recreation building which will contain a full-sized gymnasium.

The road to the mine from Carson, about 5 miles, has been relocated, regraded and rocked.

Underground, three long-range development projects have been completed and a fourth—the most ambitious—is now under way.

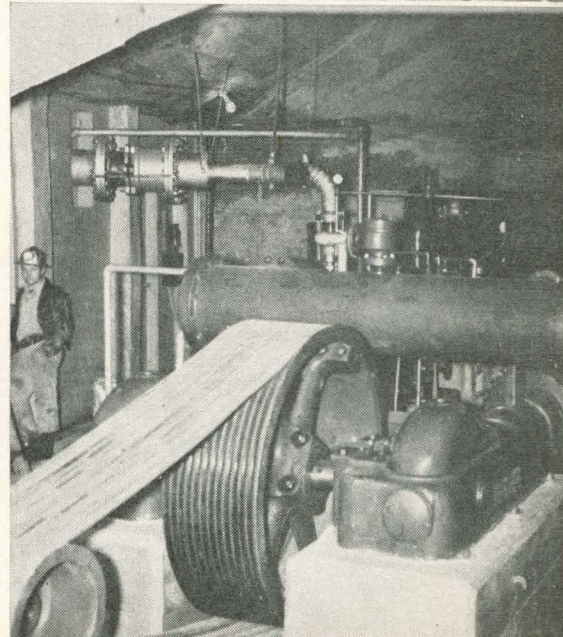
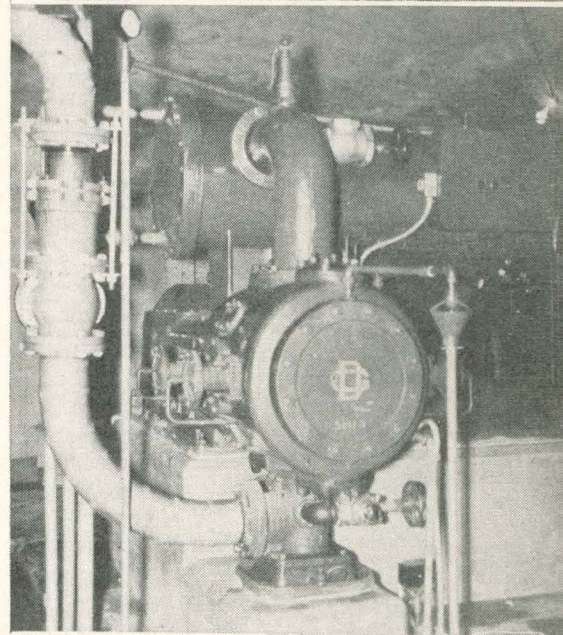
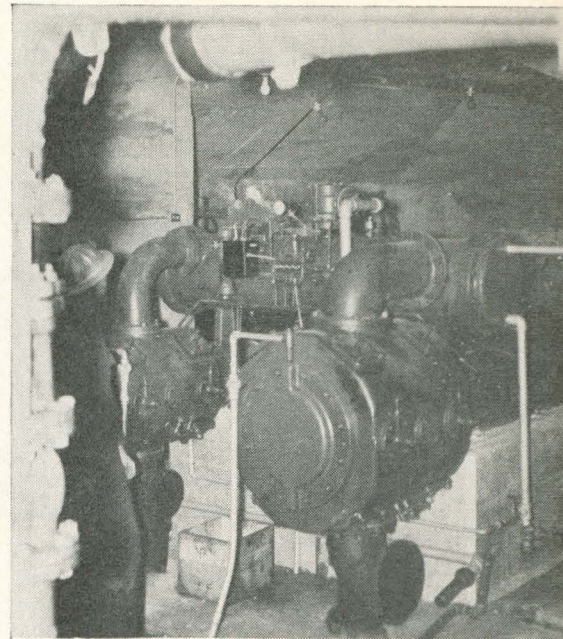
The first of these projects consisted in raising through from the Coulter tunnel on the Union vein to the level of the Clark tunnel. This opened a number of totally unworked levels to mining and gave excellent ventilation in the main workings, as the upper portions of the mine surface at a number of points.

The second consisted in raising the track throughout the Coulter tunnel. It should be explained that the Cornucopia mines are very wet, with the drainage mainly through the low level tunnel. At periods of maximum flow the water over the old track made operations almost impossible. Accordingly, the track was raised on 8 by 8 timbers, and new steel, 40, 60 and 80-lb., was laid throughout.

Third main underground project consisted in the construction of a great compressor room on the Coulter tunnel at the Union vein. This room is 60 ft. long, 16 ft. wide for about half the length and 18 ft. for the balance. The roof is arched, rising from 14 to 20 ft. in height. Off the compressor room in an L is a lunch room for the shift, it being 25 ft. long by 14 wide and 14 ft. high. Air from the compressors is carried through and cooled in this room, so it is heated and comfortable at all times.

Construction of the compressor room was dictated by a number of considerations. First, the level of the track in the Coulter tunnel could not be raised unless the air lines were removed from the tunnel. Second, raising to the Clark tunnel from the Coulter brought much more water into the latter, making elevation of the track essential. Third, leakage in the extended air lines entering the mine was a serious problem, particularly when the lines, if maintained in the tunnel, would be under water and muck virtually all of the time. In the mine electric cable used includes products of General Electric, Kerite Insulated Wire & Cable Co. and Standard Underground Cable Co.

The roof of the compressor room was supported by heavy steel I-beams,



Three views in the underground compressor room 6,000 ft. into Cornucopia Mountain on the Coulter Tunnel level. Top picture shows the big Ingersoll-Rand compressor. Middle view covers part of the 1,200 cu. ft. Gardner-Denver compressor. At the bottom, looking past the two machines. The miner at the left stands at the doorway into the lunch room.



Leverett Davis, vice president and general manager, Cornucopia Gold Mines, on the left, confers in his office with A. V. Quine, his general superintendent.

which in turn carried a close mat of 40-lb. rails and heavy wire netting, the whole serving as reinforcing for the concrete of which the chamber is constructed, the concrete being run in to the rock walls.

Fourth of the major undertakings—and the most extensive and important—is extension of the Clark tunnel a distance of 4,500 to 5,000 ft. to cut the Wallingford and Valley View veins at el. 5,890. This project has two main objects. 1. To open those veins to mining from the Clark to the Lawrence levels. 2. To make practicable the ultimate extension of the Coulter tunnel by another 8,000 ft. or thereabouts, also to cut these veins on a still lower level.

One of the unusual features of the Cornucopia operation is the extent to which ore is produced by leasers. From a third to a half of the mill feed comes from this source. The extensive character of the underground workings, particularly in the upper levels of the mine; the rather tortuous veins and lenses; and the comparative impossibility of maintaining adequate supervision over mining throughout the entire property leads to this unusual leasing policy.

Under the leasing arrangement, the company provides all necessary mining supplies and equipment. The

lessee furnishes the labor. From the smelter returns cost of supplies, milling and transportation is deducted, and the balance is divided equally between the company and the lessee.

There is nearly 19,000 ft. of track in the mine. Trains are hauled by Mancha Titan electric locomotives, three powered with Edison nickel-iron-alkaline storage batteries and two with Exide lead batteries. Another locomotive is on order. Cars number about 50, being in 1½ and 2-ton sizes, side dump type, manufactured by the C. S. Card Iron Works, Denver.

The underground compressor room in the Coulter tunnel contains a Gardner-Denver 1,200 cu. ft. compressor and an Ingersoll-Rand 1,150-ft. compressor. Each is driven by a 150-hp. motor.

The Clark tunnel at present is equipped with one Ingersoll-Rand and

Two elements in the Cornucopia improvement program for the comfort and well-being of the crew. On the left, the new gymnasium and recreation center. At the right, the modern dry, equipped with solarium, showers, lockers and full facilities for the mine crew. In addition, a large number of houses have been built.

one Gardner-Denver compressor, each driven by a General Electric motor. A 900 cu. ft. Sullivan compressor will be installed there shortly.

All company employees are equipped with Edison electric cap lamps, furnished by the Mine Safety Appliances Co., as are most of the hard hats, which are M. S. A. Skullgards from the Sanderson Safety Supply Co., Seattle. Some of the leasers use carbide lamps.

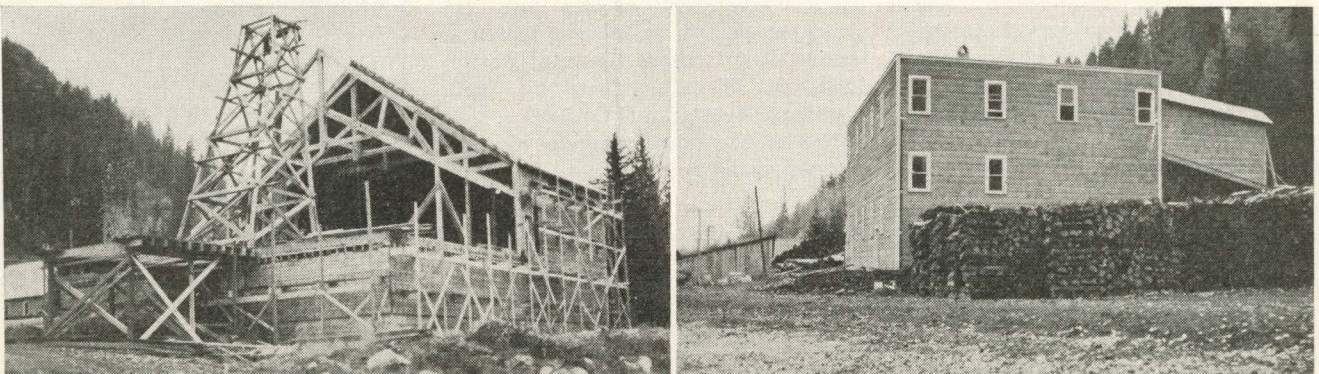
All company drilling is done with Ingersoll-Rand detachable bits. Leasers use conventional steel from the Crucible Steel Co., through Woodbury & Co., Portland.

The bits are hot milled at the Coulter portal on an Ingersoll-Rand JMA Jackmill. They are heated first, and reheated for tempering, in a thermostatically controlled Tate-Jones & Co. furnace and tempered on a jackbit quenching fixture.

Bits received from the mine are first gauged between two converging, calibrated steel rails and then sorted into pigeon holes. The various gauges are milled together, bits being regauged on a similar device after tempering and again sorted into pigeon holes by size.

Although the hot milling equipment was installed only a short time before the plant was visited, Mr. Davis was highly enthusiastic about it. He said early experience had shown that it doubled the number of usages secured per bit, as compared with grinding. Moreover, they were finding that it gave sharply increased footage per use. With the extension of the Cornucopia tunnels, he said, the change to bits from conventional steel had become imperative. Using steel, a train a day was required for transportation of approximately 500 pieces.

In the extension of the Clark tunnel



Upper view shows a truck loaded with ore pulling away from the bins at the Clark tunnel for the Cornucopia road, only a mile away, but 1,200 ft. below. The tractor and buggy pictured on the first page of this article do the hauling in the winter.

Below, where Cornucopia's Ingersoll-Rand detachable bits are reconditioned. The men are sorting dull bits to gauge. To the right of them is the new I-R jackmill, where the bits are hot-milled. They are heated in the Tate-Jones oil-burning furnace at the right. In the lower right corner of the picture is the I-R jackbit quenching fixture where the milled bits are tempered.

a jumbo is being used with two 4-in. drills working in the face. About 25 stopers and as many drifters are employed in the mine, Ingersoll-Rand, Gardner-Denver and Sullivan makes being represented.

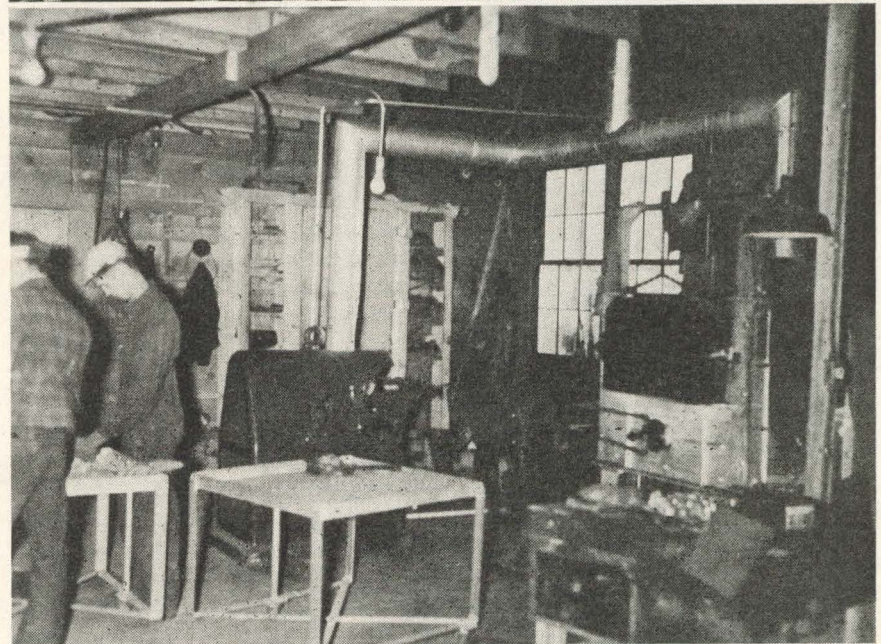
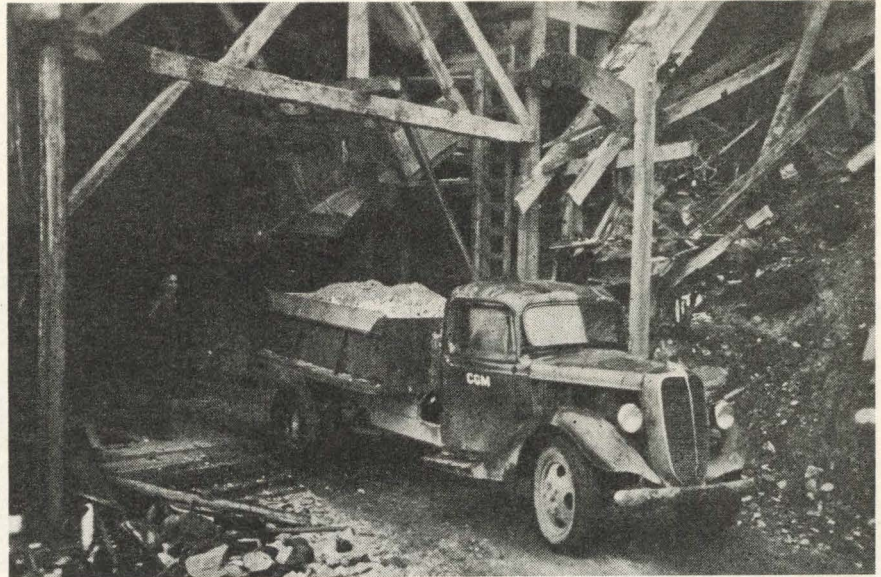
Drifts are usually carried forward in 4.5-ft. lifts, with V-cuts normally employed. All powder is Atlas; VLF special gelatine being the usual type.

A Gardner-Denver mucking machine is employed at the face of the advancing Clark tunnel. A Sullivan slusher finds steady employment in the levels above the Coulter tunnel, particularly in working ore out of large lenses where it is possible to stope down substantial volume.

A winze has been sunk from the Coulter tunnel level 200 ft. on the Union vein, with drifts in either direction. A Bingham pump dewateres the winze, and a second is being installed. A Sullivan hoist is used in the winze with a C. S. Card Iron Works skip. Other hoists in the raises include two Anacondas, a pair of Ingersoll-Rand rotaries, and one 25-hp. electric hoist. In addition, there are a number of Gardner-Denver tuggers.

A Mitchell diamond drill is used in the mine, some bits being Koebellite bits from the Sullivan Machinery Co.

The company buys its mine timbers on contract from local loggers. Red fir and tamarack are preferred. They appear to have virtually unlimited life in the mine, with timbers known to have been in place as much as 30 years still wholly sound. White fir is also available but is not considered suitable save for strictly temporary work, and little is used for that purpose, lest it become mixed with the more permanent species. Mr. Davis does not rate it as good for more than a year at Cornucopia. He has studied the strength and endurance of var-



ious materials and gives tamarack and red fir a rating of 6, as against only 1 for white fir.

One of the interesting features of the Cornucopia operation is winter transport of ore from the Clark tunnel to the mill, which is situated at the Coulter tunnel. The Clark is reached by a road which makes good 1,200 ft. of elevation in a distance of

but little over a mile. Grade runs from 18 to 26 per cent. During the summer months ore is hauled from the Clark in a Ford V-8 dump truck equipped with a Galion body purchased from the Sawtooth Co., Boise.

For about five months of the year, however, snow makes this type of transport impracticable and a "Caterpillar" RD8 tractor takes over the job. The tractor tows a special buggy built by LeTourneau for the purpose. It is a single axle trailer with four wheels using Goodrich tires. A load of ore runs from 14 to 18 tons. Snow at the Clark tunnel reaches a minimum of 10 ft. in midwinter.

The "Caterpillar" is also provided with a LeTourneau bulldozer, which is used for clearing the road to the Clark tunnel, and also for keeping the road open from Cornucopia to Carson. It finds numerous other duties about the property as well.

Little has been said of the geology and mining problem at Cornucopia. It is a complicated subject—complicated geologically and technically.

Nor has the Cornucopia mill and its auxiliaries been touched upon.

Each of these phases of Cornucopia Gold Mines is a story in itself. These articles will appear in early issues.

Consolidated Mining & Smelting Company, Inc.

Stope Filling



The filling material is brought to the collar of the shaft by three RD8 "Caterpillar" tractors, working with LeTourneau bulldozers, roter and a 12-yard carryall. The material is worked to the shaft from the overburden immediately available. The maximum haul is about 1,000 ft. This distance is governed by the necessity of maintaining rational contours and proper surface drainage.

Screen analysis of the filling material gives:

SIZE	Percent
Plus ¼-in. Mesh	50.6
Minus ¼, plus 20 mesh	16.7
Minus 20, plus 100 mesh	16.4
Minus 100, plus 150 mesh	3.0
Minus 15, plus 200 mesh	1.6
Minus 200 mesh	11.5

Few rocks too large to be handled are encountered in the material, but no further effort at segregation of material is made.

Water is added at the collar of the shaft. It has been found that the material will flow readily into a long string of stopes if sufficiently fluid, penetrating to extremities of the stopes virtually level if sufficient water is introduced. In general, however, effort is made to keep the material as dry as possible consistent with complete filling of all voids.

Water drains from the filled material slowly, but there is comparatively little shrinkage. This shrinkage is readily replaced by introduction of a rather fluid topping fill after settlement is complete.

In the initial period of the filling operation, the three "Caterpillars" filled 436,420 cu. yds. of stope in 1,636 shifts. Direct cost of this material, including repairs to equipment, was 9c per yd. Total of the filling pro-

gram to date, including raises and concrete bulkheads underground, is 15c per yd.

Various methods have been employed in mining the pillars, which are large as a result of the room and pillar method of stoping generally employed in Sullivan mining practice. Normal pillar mining involves the running of 70° raises, as in primary stoping, allowing the ground to cave as the ore is withdrawn. In one instance, a pillar has been mined by a spiral raise, leaving a 15-ft. shell, which will later be ring-drilled and blasted.

The drill steel is sharpened underground with electric furnaces. Approximately 1,000 pieces of steel are sharpened daily.

Drifters are used for stoping and raising is done largely with stopers. Blasting is done with Polar Forcite gelatine, 60 per cent, and Polar Driftite 70 per cent, together with Cloverleaf wax fuse and No. 6 detonators. Due to the flatness of the dip, which has a maximum of around 45°, extensive use is made of scrapers in mining.

Electric and air operated double drum hoists are used for this purpose.

Main drifts are 9 by 10 ft. and are broken with a 16 to 20-hole V-cut round and mucking machines are employed to remove the broken ground. The cycle from drilling through blasting and mucking is completed in 16 hours. From 2.5 to 5 ft. is advanced per round, depending on the type of rock encountered.

In smaller drifts a 12-hole V-cut is used, muck being removed with a 36-in. scraper and Sullivan hoist.

In 1938 the average consumption of powder per ton of ore broken was .224 lb. Missed holes averaged only two per 1,000.



The three "Caterpillar" RD8 tractors used by Consolidated Mining & Smelting Co. for delivering material to collars of shafts for stope filling. They work with a LeTourneau ripper and bulldozers.

PRELIMINARY to mining pillars in its Sullivan mine at Kimberley, B. C., Consolidated Mining & Smelting Co. of Canada, Ltd., is engaged in a comprehensive program of filling old stopes.

After a careful consideration of all available filling material and methods, it was decided to use surface gravel and earth from the natural overburden directly above the mine.

Where stopes are to be filled, they are closed off from the other workings with concrete bulkheads and a 75° raise is driven to the surface from a central point on the string of stopes involved. This raise follows standard practice in the mine in all regards, being fully timbered. When it has been carried through to the surface and filling is ready to start all timber is removed.