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John
J.C. Branner



MINING RESOURCES OF CALAVERAS COUNTY

JUBILEE EDITION

1848-98

FOR DISTRIBUTION
ON
CALAVERAS COUNTY
DAY

MINING EST.
FEBRUARY 28TH 1898





plan

J. C. Branner



MINING RESOURCES OF CALAVERAS COUNTY CALIFORNIA

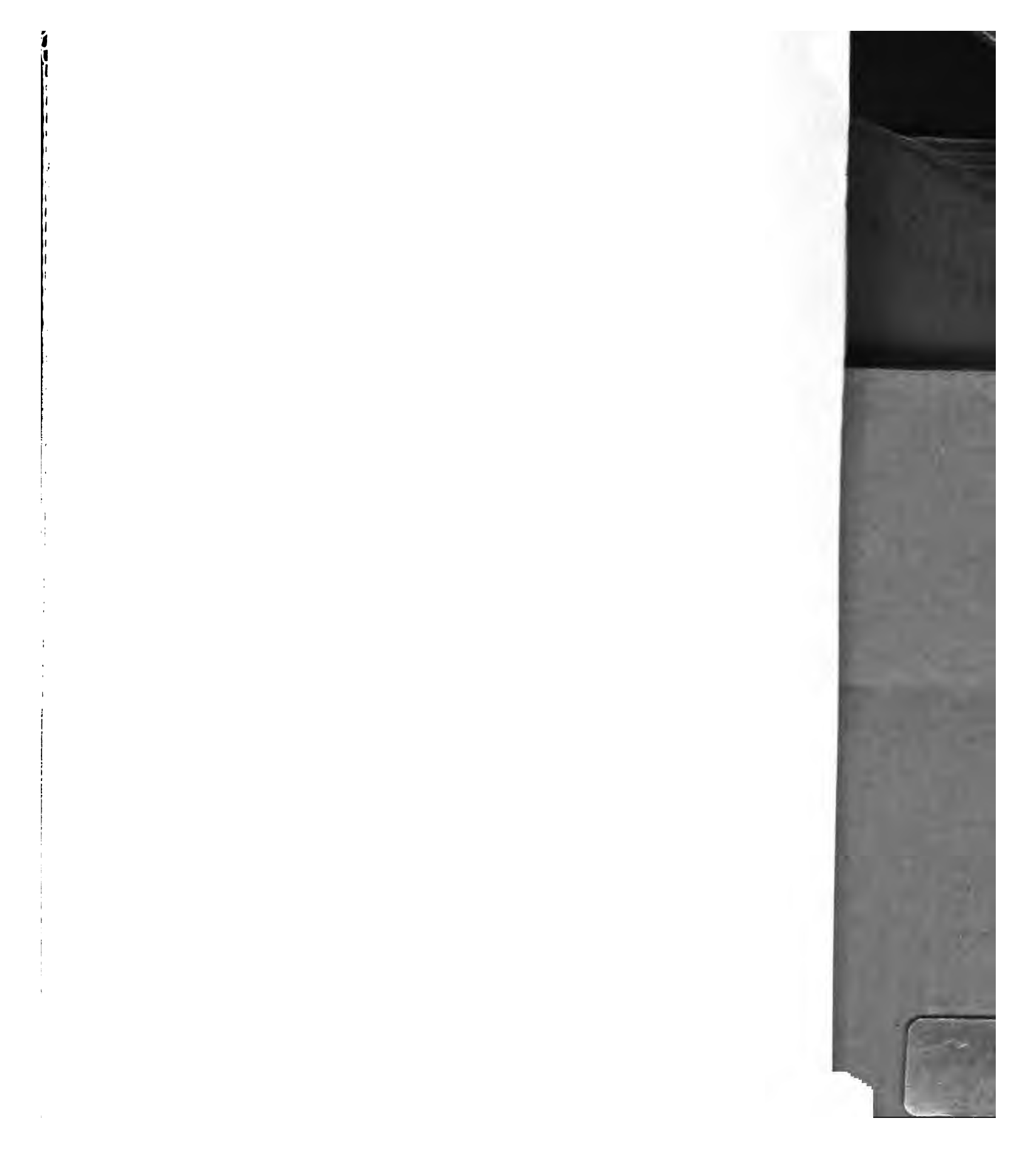
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MINING RESOURCES
OF
CALAVERAS COUNTY
CALIFORNIA

Mar. 11



THE SIERRAS IN CALAVERAS COUNTY.

ILLUSTRATED

. . . FEBRUARY, 1898 . . .

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INTRODUCTION

The stretch of mining country lying between the Mokelumne River and the Gwin Mine on the N.W. and through the Utica on the S. E. has been comparatively neglected in the general resuscitation of mining. The Calaveras County Jubilee Committee have prepared the within pamphlet, merely to call attention to the resources of this stretch of country, which since 1849 has produced over \$50,000,000.00. It is generally conceded that, by proper management, this region can be made to double its present yearly output of a million and a half.

Our statistical friends in neighboring counties have placed their total output away up into the hundreds of millions, but from all available data, we have not been able to account for more than is stated.

Our estimate, we think, is about correct, and if our colleagues should revise their statistics, Calaveras County will probably take second place in California's total gold output.

The county has been divided into five districts, as follows:

1. The foot-wall belt, of which the Gwin Mine is a type. Mr. Mark P. Kerr outlined the work at this point, treating mining as a business.

2. The Central Mother Lode, of which the Ford Mine is a successful type. Mr. H. W. H. Penniman undertook the description of this section.

3. The Mokelumne Hill Mining District, described by Col. W. T. Robinson—The Esperaza being successfully worked here.

4. The various mining sections from Murphys through El Dorado, Railroad Flat and West Point have been grouped as the Eastern belt. M. A. Shepard and H. W. H. Penniman of San Andreas, and E. M. Price, must be thanked for the compilation of this portion of the work.

5. The vicinity of the Utica Mine, through to the Stanislaus River, which belongs properly to the middle group, has been given a special class.

Special attention is called to the article on Compressed Air by Mr. Edward A. Rix, mem. Am. Soc. M. E. & C. E., mem. Am. Soc. C. E., and also on Electricity Applied to Mining by Mr. George P. Low, Electrical Engineer.

The Geological work is extracted from the Report of the U. S. Geological Survey, by Mr. H. W. Turner.

If a longer time had been given us, all the mines could have been mentioned. We have taken only facts and have been governed by them. No one has been intentionally neglected, and we ask the indulgence of our friends in presenting such a compilation on such short notice.

Notwithstanding all the work done in this vicinity, it is very difficult to obtain good maps. It was hoped to have inserted a copy of the claim map now being prepared by Mr. A. B. Searl, under direction of Geographer R. U. Goode, of the United States Geological Survey. The Director of the Survey, however, writes that the work will not be in readiness for some weeks. So the

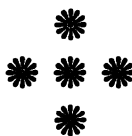
committee has used what material could be compiled without a map.

Attention is also called to the article on the use of Oregon Pine for Mining Purposes, by Mr. G. A. Buell.

We desire also to express our thanks to each and every one sending down ores and specimens, and especial thanks to

Mr. I. S. Foorman, who contributed the article on Water, and to our friends in San Francisco, whose interest and generosity in giving advertisements has rendered it possible to publish this pamphlet.

MARK B. KERR,
Editor.





THE PIONEERS OF ANGELS CAMP.

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CALAVERAS COUNTY EXHIBIT AT THE GOLDEN JUBILEE MINING FAIR, SAN FRANCISCO, 1898.





MINING RESOURCES OF CALAVERAS COUNTY

HISTORY OF SETTLEMENT

Calaveras County, previous to the year 1849, was almost an unknown region, especially that portion lying along the foot hills of the Sierra Nevada. When first defined in 1850, it embraced, besides its present area, the counties of Amador, Mono and Alpine. The county seat was first established at Pleasant Valley, but two months later was transferred to Double Springs, a town then situated near Valley Springs of the present day. Jackson consisted of three log cabins and seven tents, while Mokelumne Hill, settled by soldiers from Stevenson's army, was but a little hamlet. The discovery of gold in 1848 at Coloma was followed immediately by similar discoveries in the hills surrounding the town of Mokelumne Hill. On "Nigger" and "Stockton" hills, both within the present townsite limits, the diggings were found to be so exceedingly rich that only 16 feet square was allowed to any one man. In August, 1848, Jas. H. Carson, a sergeant of Stevenson's Regiment, traveled south on a prospecting tour with a Mr. Angel, which resulted first in the location of Angels Camp, where much gold was found, and a little later in the settlement of Carson's, which included both the present hill and the lower lands along the creek.

The great gold excitement of 1849 has never been equalled in the world's history, and is too well known to warrant detailed description here. Towns sprang up like mushrooms. San An-

dreas, Railroad Flat, West Point, Calaveritas, and Murphys, are a few of the many settlements and camps that nestled in every gulch.

Morgan, situated on the north slope of Carson Hill, rivalled Mokelumne Hill in population and the richness of the gold deposits. Both towns soon had over 5,000 inhabitants. The actual output of precious metal will probably never be known. The placer diggings of Mokelumne Hill were fabulously rich—while at Morgan Hill, the quartz mines in less than two years yielded to their owners \$3,000,000, which, of course, does not include the amount stolen by the Mexican miners. Travel was so great that in six weeks \$10,000 was taken in as ferry tolls at Robinson's Ferry. At Angels in 1852 two brothers by the name of Winter washed out in common sluices \$9,000 from a piece of ground 200 feet square, and upon sinking discovered a ledge yielding \$200 per ton.

At the Morgan, on Carson Hill, much of the ore had to be cut out with cold chisels, being completely bound together by filaments of gold. \$110,000 is said to have been thrown down at a single blast.

A band of ruffians under the leadership of Billy Mulligan, a man of desperate character, took forcible possession of these mines, driving out the lawful owners, who immediately instituted a suit of ejectment that lasted until 1853, when they were finally reinstated. The largest nugget ever found in California was dis-

covered on Carson Hill in November, 1854. It was fifteen inches long by six inches wide and 4 inches thick, weighed 195 lbs. troy and was worth over \$43,000. At Mokelumne Hill, rich discoveries were also made.

Near the top of French Hill, overlooking the town of Mokelumne Hill from the east, the remains of what appears to be the foundation of an old stone wall built along the edge of a lava bluff may be seen, while all around below are piles of rock, tailings, tumble-down banks of lava and gravel, shafts and tunnels, in short, every evidence of an abandoned placer mine. This historical spot, which at one time, was one of the richest placer mines in the State, was the property of a company of Frenchmen, and the wall above referred to is the remains of a fortification built by them for the purpose of defending their property. This mine yielded its golden treasure by the panfull, and the owners of the property made no attempt to conceal the fact, but on the contrary indiscreetly paraded their golden treasure before the eyes of an avaricious public. So rich was the mine, it is said, that the watchman, placed in charge, picked out with his pocket-knife during the first night on duty, several thousand dollars worth of nuggets.

This tract of land is now owned by Mrs. Vandel of Mokelumne Hill.

The following extract from a letter recently written by August Sanno, of Nevada City graphically describes his personal experience, and throws an interesting side light upon the contentions between the French and American mines, as viewed by the French contingent. He writes as follows:

"I am the man who in April, 1851, discovered 'French Hill.' We are the

Frenchmen who were driven out by a mob. As I was well known, I was told to leave as I would be killed first for the money; I left with a part of it; my partner had the balance; he was going to stay behind and see what was going on, and then he was going to follow me; I went ten miles, to the Calaveras river. In my journey I passed by the county seat, (Double Springs). I had the money hid with Mr. King. I coaxed Mr. King to come back and look for my partner. I offered him twenty dollars a day to come back with to try and help me recover my mining ground; he came with me; I was riding a mule; the French were at the county seat—where it is now. Expecting an attack by the French that night, the road was guarded by a sentinel; my mule was shot; I fell in the ravine by the road; I was unconscious for a long while; my shoulder was broken and my knee was dislocated when I came to; King was very near killed; he died in Campo Seco; we were wounded so we could not walk, so we had to crawl as best we could to try and get away from them; the next morning King could see, and we traveled all day and all night, and found a Frenchman who told us where the French were, and that all their camp was going to be burnt that night—that was his report. In the morning we found ourselves in the Stockton road. Afterward my partner came to San Francisco and we divided the gold. I went to Mexico."

In 1852 the county seat was transferred to Mokelumne Hill. In 1854 Amador county was established, with the county seat at Jackson, then a place of 1500 inhabitants. In 1863 an election was held, which resulted in the designation of San Andreas as the county seat

of Calaveras Co. The legality of this election was hotly contested by the residents of Mokelumne Hill and it was not until 1866, after the case had been bitterly fought in the Supreme Court, that the records were finally moved. During this legal contest, in 1864, Mokelumne Hill suffered from a great conflagration, that consumed nearly the entire town and destroyed many valuable county papers. In 1868 San Andreas had a similar experience and Mokelumne Hill was again burned in 1875. Gradually the surface diggings of the county, those that could be worked with small effort, became exhausted. Other gold excitements drew the population elsewhere, and a great depression, the inevitable aftermath of high boom fever, fell upon Calaveras. The people gave more attention to agriculture and stock raising, and large tracts of land were secured to individual owners under agricultural patents along the Western and Mother Lode belts, for at that time few appreciated the prospective value of the great bodies of virgin ore that traversed the county. Milling processes were crude, and quartz that will to-day yield large dividends could not then be profitably worked.

It must not be understood that mining was by any means totally suspended. for Calaveras, even in the times of greatest depression, has always maintained her position among the leading gold pro-

ducers of the State. In the early sixties, the attention of the world was drawn to her copper mines, and until overproduction placed the price of that metal below the cost of extraction, Copperopolis and Campo Seco enjoyed prosperity and world-wide renown. The immense increase during the past few years in the demand for copper, a result of its universal use in electric appliances, is already foreshadowing an early revival of this important branch of the mining industry.

Along the Mother Lode, the climate and general facilities for mining are very favorable.

Some little snow falls in the winter, but not enough to cover the ground for more than a few hours.

In the higher altitudes, the snow piles up in large quantities, which supplies the streams, and in turn the ditches for the mines below, or the power necessary to run large electric plants that are now being constructed upon the Lode.

Indeed, when one thinks of the frozen ice-fields of the North, and the dense tropical growth of the South, it seems as if Nature has been generous in bestowing the foot-hill counties with natural resources very hard to surpass.

Olives, oranges and fruit of all kinds are grown in the foothill valleys of Calaveras County, and as happy and healthful a life can be had here as in any mining region of the world.



GEOLOGICAL HISTORY

The geological history of Calaveras County may be said to date from some time during the Paleozoic era, which includes the Cambrian, Silurian, Devonian and Carboniferous periods. A great ocean then covered this area, with perhaps the exception of the extreme north-eastern portion. The great prehistoric rivers flowing from Nevada for long ages carried to this sea a vast amount of silt, schist, that sinking formed the Paleozoic sediments of the gold belt, afterward metamorphosed to quartzite, mica schist and clay slates with limestone lenses. Rounded crinoid stems, lithostrotion, spirifera, fusulina, and other genera, found chiefly in the limestone, indicate the formation to be principally of the Carboniferous age, but it is probable that many strata are much earlier.

A conglomerate, the evidence of a shore on which were pebbles of quartzite, diabase and hornblende porphyrite, rounded by the action of the waves, is found in the lower portion of the county, interbedded with the slates of this period—presumably of the same age and showing by the presence of igneous pebbles, that volcanic eruption began very early, for the hornblende-porphyrte fragments represent lavas similar to the hornblende-andesites of a later date.

Near the close of the Carboniferous period the land area of Western Nevada subsided, and the shore line of the ocean advanced far east covering Calaveras to a still greater depth. During the Jurassic period there were two great upheavals. The first raising a land mass, stretching the length of the Sierra Nevada, folding and rendering schistose,

the sedimentary strata, and intruding granite and other igneous rocks among them. The land thus raised above the water level was not mountainous, and the present exposed portions were thousands of feet below the surface.

This land area at first partially and then completely separated the Pacific Ocean from the inland sea, a conclusion based upon the fact that fossils of Jurassic age, found in the Mariposa slates, have closer relations with those of Russia than with those of Eastern America. These Mariposa slates consist of an extremely fine sediment deposited in two narrow bands traversing the southeastern portion of Calaveras County in a northwesterly and southeasterly direction, accompanied on the east in both instances by a belt of amphibolite schists.

After the deposit of the Mariposa slates, a second upheaval of much greater magnitude occurred, resulting in the development of a mountain range along the line of the Sierra Nevada, turning the Mariposa strata into a nearly vertical position, injecting granite, vast masses of diabase and other basic igneous rocks. It was during this time of intense eruptive activity that innumerable fissures were formed, to be soon after filled by the auriferous quartz veins that now attract the attention of the world. The famous Mother Lode is supposed to date from this period. The strata of succeeding epochs are wholly sediments and tuff lying nearly horizontal or at low angles, proving this to have been the last great uplifting disturbance, though the Pacific has steadily continued to recede, leaving its deposits far above its present level. The lower por-

tion of Calaveras County was under water with the Great Valley of California during the Cretaceous and Eocene, becoming exposed probably early in the Neocene period. The climate was warm and humid, immense rivers, far greater than those of the present day, flowed to the sea, and before the close of the Neocene period, had lowered the land surface thousands of feet, cutting for them-

the sand stones of Valley Springs, also the coal seams, farther west, were formed.

Toward the end of the Neocene period, an eruption of a volcanic nature took place along or near the summit of the Sierras, accompanied by great floods of so-called lava, consisting of andesite and basalt, that, following the drainage system, completely choked the



MIDDLE BAR OF MOKELUMNE RIVER.

selves great channels through the hills and filling them with vast deposits of gravel from the hard quartz ledges broken down.

The gold released sunk by its great specific gravity to bedrock, the lighter detritus being carried away, and thus the natural process of concentration was for ages carried on. The Pacific shore line was during this period retreating, and

channels in which it flowed, and in some cases, several times made an entire change in the courses of the streams, preserving even until this day an intricate system of ancient river beds, filled with gold-bearing gravel that have as yet received little or no attention except in those portions exposed by the action of the streams of the present. The Pleistocene period was characterized by



THE GWIN MINE HOIST.

a radical change in climatic conditions, the Sierras being capped by glaciers at elevations above 5000 feet, which effectually protected the portions covered, but greatly assisted erosion in the lower altitudes. The change from that time to

the present has been gradual, and without eruptive disturbance, though great erosion has and undoubtedly is still taking place, throwing some light on the past.

THE WORKING OF A GREAT GOLD MINE.

The modern system required in the management of an immense gold mining plant is so different from the idea that the average man has acquired from reading the romantic experiences of the prospector, seeking for the precious metal, that a description of the actual practical business involved, the complicated machinery and engineering skill called into play, in developing and working a modern, up-to-date mine, may prove of interest.

In the eager search for gold, the world over, constant scientific exploration will, in time, open up new fields. The modern prospector, however, does not move from one location to another without giving his claim a thorough trial in depth.

The excitement attending the recent gold discovery in Alaska and the Northwest Territory, bids fair to cause a wild stampede there during the next year, rivaling the exodus to California in the early fifties, or even excelling the mad rush to Australia and South Africa in more recent years. But gold mining is now a legitimate business, and consists in not only digging out gravel and washing the gold contained therein, but the work must be managed with as much precision, care and judgment, as is necessary to insure success in any other great industry.

The modern method of scientific gold mining and milling practice has reached its highest development in California. As a proof of this, the principal point to mention is, that almost all the prominent mine managers of the world, have had some previous practical experience either in the great hydraulic gold gravel deposits, or in the deep level, gold quartz mines of the Golden State.

The application of hydraulic engineering to auriferous deposits, originated in the mines of the Pacific Slope. The method of treating gold sulphurets by chlorination, which is simply the chemical discovery of the affinity of chlorine gas for gold, was first successfully tried at the Gwin mine in Calaveras county, California. This mine, a typical California gold mine, and one of the greatest on the mother lode, is described in this article as an example of what good judgment will do, when combined with experience and skill. The writer, having interests in the vicinity of a similar nature, is very familiar with the history and development of the Gwin property.

In the foothills of California, and following a general trend parallel to the crest of the Sierras, extending in sinuous lines through the counties of Placer, Nevada, El Dorado, Amador, Calaveras and Mariposa, a great open fissure has been discovered, encased between black

slate walls and filled with decomposed slate (gouge) and quartz. The gradual deep-development of several well known mines has proved the existence of gold in the quartz. This fissure or channel is known to mining men as the great Mother Lode of California. In many portions of this lodé, chutes of gold-bearing quartz have had strength enough to come to the surface. These chutes, in depth, spread out longitudinally, rendering it possible to sink shafts and strike the same formation in other points near by, even when very little quartz is shown on the surface. In every case, however, when surface indications are favorable, development in depth on this lode has discovered both high and low grade ore in the lower levels. Exploration seems to prove that the vertical trend of these chutes is pyramidal in structure. On the surface the chute may be only 60 or 100 feet in length, but when greater depths are reached, the chutes are often over 1000 feet long. If a profile should be made upon this plan, the chutes of ore would form hills and valleys.

The hills, or points of pyramids and the lower bases, being the region of the gold bearing veins, and the valleys being barren, except at great depths, when the extension of the base of the ore-pyramid renders it possible to encounter the pay channel. This makes a strong possibility that when a shaft is sunk adjoining a successful dividend-paying mine, the new shaft, at a great depth, will encounter the same pay chute previously discovered. The results obtained at the Argonaut mine in Amador county, can be cited as a proof of this theory. This company sunk a large shaft 1200 feet through the barren zone or country rock, and at this depth encountered the

same theoretical pay zone of the Kennedy mine, which had gradually elongated in length of chute enough to extend beyond the end lines, and into and under the ground controlled by the Argonaut Company. Since the success of the latter, litigation has commenced between the two mines, as to the continuity of the vein between the surface outcroppings and the deep-level workings.

All this recent exploration work upon the Lode, has absolutely proved that these gold-bearing chutes, when explored, go down to great depths, and large bodies of low-grade ore have been discovered and successfully treated in bulk, at depths over 1400 feet.

The present low quotations for mining machinery, supplies and labor, render possible the profitable working of these low-grade ores, when existing in large quantities.

Gradually a system has been inaugurated, where ore yielding over \$2.50 gold per ton at the present time, can be treated at a profit.

These veins dip generally at about 70 degrees east, sometimes flatter, or again nearly vertical. Imagine a curb stone of great length coursing down into the interior of the earth's crust, here, bulging out to a tremendous width, and there, narrowing, or, as the miners say, "pinching out." An idea can then be formed of such a vein, seemingly independent of the surrounding country rock, which may be slate, granite or porphory, although the dip of the walls is generally parallel to the dip of the veins.

In many newly discovered deposits, the first gold washed out from the placers, marks only an epoch in the history of that district, and long before the placers are exhausted, enterprising prospec-



FOUNDATION AND WATER POWER OF GWIN 40-STAMP MILL.

tors explore the hills in search of a source for the gold supply.

Sometimes the placer deposits are covered with loam and detritus. The bed-rock underlies the gravel, wherein the coarsest gold is found. Sometimes, however, in ancient river channels, the gold-gravel is covered by a deposit of lava, and other long tunnels must be driven under this overflow, and the gravel brought out to the surface and washed by streams of water under light pressure. This is drift gravel mining. Or when the surface gravel banks are washed down on a much more extensive scale by streams of water under heavy pressure, and the gold gradually deposited in the bottom of long flumes, the operation is termed hydraulic mining.

The large amount of debris washed down upon the agricultural fields in the lower valleys has injured the farming land to such an extent, that unless large and expensive restraining barriers are constructed, hydraulic mining in the Sacramento valley and its environments has been prohibited by law. For a long time to come, the gold fields of the recently discovered Alaska-Klondike, will be washed by the drift or hydraulic process, before organized companies can seek out the great gold-bearing quartz lodes, prospect them in depth, and make mining a regular business, which it is now in California and South Africa.

The success attending the re-opening of some of the old, abandoned mines in California has changed the apathy of the business men of the State into energetic activity. Experience will prevent repetition of past errors. Over-capitalization, working mines without experienced, practical advice, as well as erecting large mills before developing and blocking out the ore, and such kindred mistakes, have

done more than anything else to occasion the past lack of confidence in mine investments.

Mining on the mother lode necessarily requires large capital, but such good judgment is now being used that the list of dividend-paying mines will be greatly increased in the near future.

The re-opening of these old, abandoned mines by sinking deep shafts, marks another epoch in the history of gold mining development. Most of the great successful working plants of to-day have been placed upon old claims, and are now treating the low-grade ore left in the upper workings of the formerly abandoned properties. Fifteen years ago the heavy operating expense, combined with ignorance of the best method of treatment, made it impossible to obtain a profit on any ore yielding less than \$6 or \$8 per ton in gold. Going back forty years ago, the cost of mining and milling gold quartz ore reached as high an amount as \$25 per ton.

A successful mining plant can now be planned to treat not only all the low grade ore left in the abandoned drifts, but when properly exploited, new chutes or chimneys of ore, of quite as high a grade as were formerly found in the old workings, can be discovered by sinking large, perpendicular shafts to tremendous depths. Then the mining and milling machinery is afterward erected to treat all these ores in an economical manner.

To intelligently describe a great California gold mine of to-day, renders it necessary to give a slight idea of the mines of the different counties upon the gold belt. Beginning at the most northerly county on the lode, Nevada county takes rank as the leading one of the State in the production of gold for the

year 1896. The two mining camps of "Grass Valley" and "Nevada City" are too well known for further comment. The "Empire" and "North Star" mines were once abandoned, and then afterwards re-opened successfully on a large scale. Other mines in this district reached great depths. The width of the pay streak is small, from one to three feet, but the veins are of high grade. Many millions of dollars have been credited to California from the principal mines of this county, and most of them are still good dividend payers.

In El Dorado, good progress and development has been made upon the lode, but as yet the mines have not been explored deep enough to prove their permanent capacity.

The mines of Amador are famous, as well as those of Placer county. The "Kennedy," in Amador county has been such a successful dividend-paying property that two large plants have been built on either side of it, the "Argonaut," on the south, and the "Oneida," on the north. Deep shafts are now being sunk on both these mines at large expense. The "Oneida" has the most complete steam hoisting plant in the State, and the 40-stamp mill of the "Argonaut" is probably the finest on the lode. Sutter creek in Amador county is a typical mining town, and one of the most picturesque upon the mother lode.

The celebrated old Eureka, with a record of having produced a gross yield of \$20,000,000, is situated within one-half a mile of the town, also the old Lincoln, with a \$4,000,000 record, is located within the town limits. Electricity for lighting and motive power has been successfully introduced into Amador county by means of two plants. The Blue Lakes Water Company has erected an exten-

sive power plant on the Mokelumne river, and has placed 1040 feet of 22-inch pipe from a pressure box at end of a long ditch. They obtain an alternating current of from 5,000 to 10,000 volts, and supply portions of Calaveras, as well as Amador with light and power. Another electric power plant has been completed at the town of Sutter Creek.

Since the re-opening of the "Kennedy" mine in 1885, it has paid over \$2,000,000 in dividends and good ore is still obtained from the 2200-foot level.

In Calaveras the most extensive developments are around the "Gwin" mine in north end of the county, and around the "Utica" in the southern portion. The "Utica" is one of the most important mines in California and will be described in another part of the magazine.

The "Gwin" mine will be described in another part of this article, representing a typical working mine of the lode. The ore bodies in Amador and Calaveras counties have immense width and length of chute, and are generally low grade in value.

In Tuolumne county, great activity exists and a railroad has recently been constructed in this county, bringing the mines nearer to the base of supplies. The "Rawhide," "Jumper," and other mines have extensive plants. The mines around Coulterville in Mariposa county are being vigorously exploited. Altogether the outlook for the mines of California is extremely promising, and actual work has proved the existence of deep paying bodies of low-grade ore along this lode, which encourages economical prospecting. The report of the State Minerologist for 1896 gives the yearly production of gold for nine of the principal counties as follows:

1. Nevada County \$2,380,756.13

2. Placer County	1,674,844.30	present conditions existing in the State,
3. Calaveras County	1,546,398.85	and show very clearly the two periods
4. Amador County	1,523,351.28	of development in a large property. A
5. Trinity County	1,296,330.30	full description of these plants will do



OLD CABIN IN GWIN GULCH—"A RELIC OF THE PAST."

6. Siskiyou County	1,091,264.82	more to prove how the business of a
7. Tuolumne County	1,070,141.81	great mining enterprise is conducted
8. El Dorado County	812,289.26	than any other illustration. Mention has
9. Mariposa County	335,637.33	been made of similar plants in other lo-

Trinity and Siskiyou, northern counties of the State, are mentioned in the above list, but do not properly belong to the mother lode.

The "Gwin" mine—and "South Paloma" property adjoining—represent the

more to prove how the business of a great mining enterprise is conducted than any other illustration. Mention has been made of similar plants in other localities, merely to give the yield of the principal counties, and emphasize the fact that the first important problem in mining as a business is to start prospect work upon a sound basis, and in a locality where gold is known to exist. Proper management will again make even

old, abandoned mines pay large profits, especially when experience absolutely proves that ignorance and recklessness have caused the principal failures of the past.

The middle bar of the Mokelumne river was one of the richest "diggings" in the gold excitement of 1849, and the cabins of the miners were built upon the slopes of "rich gulch", or "Gwin gulch," as it is now called. The placers were soon exhausted, and search was made in the adjoining hills for the quartz veins. Shafts were sunk and tunnels driven, wherever favorable indications could be found.

At the "South Paloma" prospect, an old tunnel was driven many years ago into the hillside. Ore was obtained, but not in sufficient quantities, and of too

done except this prospect tunnel. It is fair to state that unless the "Gwin" had successfully re-opened, the shaft would never have been sunk on the South Paloma. With systematic development the company has carried the prospect shaft 700 feet in depth, and are drifting at that level.

The South Paloma prospecting plant is very complete and economical, and consists of a steam 35-horse power hoist, shop and out-buildings, representing the first step toward the making of a great mine.

The shaft is 5x7 in the clear and timbered every 5 feet with 12x12 Oregon pine timbers. The gallows frame is 35 feet high, also of 12x12 timbers. The hoist has a capacity of 1200 feet. About \$26,000 has been expended in equipping



SOUTH PALOMA HOISTING PLANT.

low grade a character to pay at that period.

When the present company took hold of it in 1895, very little work had been

and sinking the mine to the 700-ft. level and drifting at two levels. In this class of work the main expense is in the shaft sinking, but when once the shaft is sunk

and drifts run on the ore, the profits can be calculated with as much regularity as the interest upon 6 per cent bonds. The cost of the shaft sinking depends upon the size of the excavation, nature of the country rock through which the shaft is sunk and the amount of water encountered. The shaft at the South Paloma prospect was sunk at an extremely low figure, all the conditions being favorable. Comparatively small quantities of water were encountered in sinking and the slate was easy to break.

A detailed average cost of sinking per foot is presented as follows, taken from the Superintendent's record:

Labor, per foot.....	\$ 8.00
Lights, per foot.....	.15
Powder, per foot.....	.50
Management, per foot.....	2.00
Top labor, per foot.....	2.35
Timbering, per foot.....	2.00
Total, per sinking foot.....	\$15.00

The South Paloma has been sunk upon the south extension of the famous Gwin mine. The latter was one of the first quartz gold mines to be opened up in California. Some miners in 1850 having found the surface pay croppings of the Gwin mine, were joined by a few others and the shaft was sunk 200 feet on the incline of the vein. The method of reclaiming the gold in the sulphurets, not being known, the values obtained were entirely from the free gold and the sulphuret went to waste. Dr. Gwin, one of California's first Senators, took hold of the mine about that time, and a water power hoist was put in, with a capacity to sink 1000 feet. Messrs. Deetkin and Garland also introduced the Plattner Chlorination process a little later to treat the sulphurets, which enabled them

to work the low grade ores successfully. Even then it was impossible to obtain a profit on any ore not assaying \$6 or \$8 per ton, although the mill capacity had been increased to handle large quantities of quartz.

Very rich ore in streaks was taken out from time to time, but as the mine reached a depth of 1350 feet, the necessity of more effective machinery became apparent. The management, however, went on taking out such ore as could be made to pay. All the high grade ore in sight was mined, and the mine was thus "guttled out." As the shaft reached greater depths, the water increased. The pumps and buckets were of insufficient capacity. The drifts had been run about 1200 feet north and about 100 feet south and the mine was allowed to fill up with water. The drop in value of all California gold properties took place at that time, and the owners could not get the means required to re-open it. A little later forest fires devastated the vicinity, and in 1894, when the present company took hold of it, a deserted log cabin here and there, or a coil of rusty rope, with bundles of old iron and steel, scattered down the gulch, were the only traces of former activity.

Believing in the permanency of the lode in depth, and knowing of the actual existence of large quantities of low grade ore in the upper levels of the mine, Superintendent F. F. Thomas conceived the plan of bonding the land and sinking a vertical shaft 1400 feet through the country slate, and north of the limits of the old workings. The same work had previously been accomplished by Thomas at the Kennedy mine in Amador county. A shaft was sunk there through the comparatively barren belt, and struck a body of good ore below. This

was an especially bold work to undertake at that time, for the depth of the gold bearing veins, as well as their permanency, was uncertain. Reducing the inclined depth of the shaft of the Kennedy to the vertical, the total depth of the mine reaches 2100 feet, the deepest vertical shaft in the State.

The Gwin Company erected a complete water power hoisting plant and the shops, in the summer of 1894. The old, abandoned mountain roads were put in repair, and soon hundreds of teams began hauling the heavy timbers needed for the shaft, and all the thousand and one incidental supplies. This work of sinking was steadily prosecuted for two years, until the 1000 foot level was reached. Drifts were run at the 700 and 1000 foot levels. At the 1000 foot level a well boring machine was used to sink a prospect hole, in advance of the shaft work and down past the old drift. It encountered the north prolongation of the ore body at 1195 feet. This bore hole was sunk to the 1300 foot (vertical) level and happily just escaped the old drifts enough to ensure safety in sinking the shaft down near them. The shaft was then continued to the 1400 foot level and the work of opening up the ore body began on the 1200, 1300 and 1400 foot levels, where the vein in a great many places was over twenty feet in width, of milling rock.

As soon as these lower levels had been opened up and the levels connected, the ore was extracted, sent to surface in large buckets termed "skips," and then run by hand cars into the bin of the 40-stamp mill, which, in the meantime, had been erected. A photograph taken of the mill at this time shows foundation, mortar blocks, water pipe and pressure box. The mill is run by water,

which also supplies both power and electric light.

In the north drift at the 1400 ft. level, in the stopes, a rich vein about 2 ft. wide running through the main fissure was encountered, full of free gold. The writer himself was present when a piece of quartz filled with free gold was taken out. The piece was about the size of an orange and afterward \$2,500 worth of gold was extracted from it. But it is not this rich specimen rock that keeps the mill going steadily, but the large bodies of quartz are yielding \$3.00 and upwards per ton.

The gold sulphurets now are all utilized. The percentage of these sulphurets is between 2 per cent and 3 per cent and average from \$60 to \$100 per ton, when concentrated.

As the South drifts in the 1200 and 1300 levels approached the old workings, it became necessary to open them up and drain out the water. Several schemes were thought over, one to tap the old works by diamond drill holes in the lower levels, but this necessitated compressed air for power. To run such a large hoist under 365 ft. pressure, and the mill under 375 ft. head, required at least 200 miners' inches of water every 24 hours. This was purchased from the Mokelumne Canal Company at 15 cents per inch per day of 24 hours. This water was running to waste, so a plan was devised to put it in a settling tank, and carry it under pressure in a 15 inch sheet iron pipe 4500 feet to the bank of the Mokelumne River, where 380 feet effective pressure head could be obtained. A large Pelton water wheel, 19 feet in diameter, was then put in, and compressed air enough to readily generate 250 horse power was obtained. This compressed air was sent back in a 6 inch

pipe laid alongside the water-pipe, not only to the settling tank, but 1670 feet further to the old original South shaft. An air receiver was put in there giving the power to pump out the water from the old shaft. In fact receivers for the air can be placed at any point where power is needed to perform general hoisting or any other work in the future.

This compressed air plant is one of the most complete ones in California, and in view of the proposed use of three lifts in pumping out the old South shaft to a depth of 1300 feet on its incline, using re-heated air, deserves special mention, as on its success depends the use of similar plants at other mines. Electricity has been so freely used for motive power, that compressed air has been neglected, and it is an open question to-day which one of the two operations in the end will prove most economical.

The new 40 stamp mill has been going steadily since January, 1897, grinding out the ore, and yielding a monthly dividend satisfactory to the shareholders, for it shows what the mine will do when thoroughly opened up. When the old South shaft is pumped out, all the reserves of low grade ore can be obtained and the capacity of the mill, as well as the average of the ore being known, the profits can be calculated to a nicety.

Some idea of the extent and value of these ores can be obtained by taking an average section of any one of the mines along the lode, 100 feet in length by 100 feet in height. A rough estimate of this section, taking average width of vein at 20 feet, would give 10,000 tons. A forty-stamp mill grinds up 3,600 tons of ore a month when running steadily, and this section of loose quartz would be crushed in a little less than three months. Now take a general average of \$5.00 gross yield per ton and place cost of mining

and milling at \$2.50, the profit on this ore would be \$25,000.00 for the above time. This does not take into account any rich ore found from time to time, that is generally utilized in bringing the gross yield up to its usual standard, when for any reason, it may be necessary to shut down the mill. In all of these large mines, when the ore is blocked out, it is simply a question of the capacity of the stamp-mill going at full speed, to realize a steady income. The principal mines of the mother lode, at the deep levels, have chutes of ore over one thousand feet in length, with varying widths, from ten to forty feet, and even more. It needs very little figuring to show that they will last for years, and while one level is being worked, others can be exploited.

With permission of the Superintendent of one of the mines mentioned, a statement is given for an average month of last year. During this month, 116 men were employed, and the average assay value of ore sent to the mill was \$7.50.

MONTHLY STATEMENT OF A MINING AND MILLING COMPANY.

DISBURSEMENTS.		RECEIPTS.	
Mine labor.....	\$ 7,893 45	Mill receipts....	\$26,000 00
Mill labor.....	640 00	Rent, etc.....	300 00
Chlorination labor.....			
Mine supplies..	755 32		
Mill supplies....	315 59		
Chlorinat'n supplies.....	390 35		
Timber and lumber.....	3,422 30		
Assaying supplies.....	41 00		
Water for power	1,551 75		
Wood for power.	115 55		
Salary of superintendent.....	400 00		
Salary of secretary.	100 00		
General expenses.....	87 25		
Express charges (sulphurets) ..	10 50		
Express charges "free gold" bar	64 00		
Total.....	\$15,707 06	Total.....	\$26,300 00

Total profits for month, \$10,592 94.



INTERIOR OF GWIN MILL CONCENTRATING PLANT.

This is only an average report, and when one of these large ore bodies are properly developed, such returns can be regularly obtained steadily for years.

In the wheel-pit of the Gwin mine hoist, a pressure of 365 feet is obtained by a total length of 840 feet of 15-inch sheet-iron pipe.

The three-compartment vertical shaft, 12 feet by 9 feet in the clear, has been sunk to the 1400 foot level at an average cost of \$36.00 per sinking foot.

The hoisting machinery, new forty-stamp mill and all other expenses, except shaft-sinking aggregate \$180,000.00.

The air-compressor plant (when completed) will probably cost \$20,000.00.

The ore is run through a Blake crusher before going to the mill, making the quartz that is to be crushed by the stamps, of uniform size. About 350 feet of railroad track connects the hoist and the mill.

The mine averages 30,000 gallons of water every 24 hours, which is readily handled with large skips, dumping automatically. Below the 1400 foot level there is a forty feet pump and reservoirs, at convenient levels, keep back the water accumulating in the drifts.

The miners work eight hour shifts, and their pay averages \$2.50 per day. Each shift of men generally excavate about fifty tons of rock. The bin in the upper part of the mill has a capacity of 500 tons. The ore is run through the forty stamps each of which, when "shod up", weighs 904 lbs. and have a 6 to 8 inch drop. The stamps run day and night, and each stamp will crush 3 tons of ore in 24 hours.

A 16 mesh screen is placed in front of the stamps and dies, and the pulp is run first on the outside plates, which have a

general grade of $1\frac{1}{4}$ inches to a foot, and are each 4 to 6 feet long.

These outside plates retain most of the free gold upon their silver faces. The residue lodges at the base of the screens, where the inside plates are placed.

The outside plates are cleaned up every day, and the amalgam of gold and quicksilver squeezed into balls of convenient size to handle, through pieces of drilling or cloth. A few drops of cyanide of potassium and also quicksilver, are rubbed on these plates before again replacing them in their proper position. After leaving the plates, the pulp is carried in wooden troughs to large concentrators or vanners, which pan out the sulphurets automatically. After concentration, the sulphurets are shipped to the chlorination plant to be roasted and the gold reclaimed from them. There are two concentrators for each five stamp battery at the Gwin mill.

At the end of each month, there is a general clean up of all the pulp in and around the stamp and dies. This pulp is placed in a barrel with some mercury, and revolved until the mercury has thoroughly penetrated the mass. The amalgam is worked down and afterwards treated by a method similar to that used on the plates, until all the amalgam is collected in convenient shape to be re-orted.

The slimes that leave the mill are assayed from time to time, and if they show value to any extent, are again caught up and run over stationary canvas tables, placed on grades sufficient to allow the slimes to slowly run off. Such treatment is sometimes quite lucrative, and it is not uncommon for some of the mines to sell the privilege of washing these slimes to contractors for over \$1,500 per month.

The retort house is fitted up with a closed and an open furnace. The former is used to heat the amalgam until the quicksilver is condensed. The vapor passes through a cooling tube, until again converted into liquid mercury. In this operation only a very small per centage of the quicksilver is lost.

The rough masses of gold left in the retort are then taken out, and all melted

to build a flume from the South shaft down the gulch, and under the main dump.

This carries the water through the canyon and prevents the dump from caving. This flume is built large enough to carry easily the heavy streams of water rushing down the gulch during the severe winter storms.

The air-compressor line is also flumed



A TRESTLE ON THE COMPRESSOR LINE—GWIN MINE.

together in a crucible in the open coke furnace. After a thorough melting, the gold is moulded into bricks and sent to the mint or smelter. An assay of the gold-brick is made at the mine office as a check upon the refiner. This rough gold varies, but is generally worth from \$16 to \$18 per ounce.

The canyon or gulch in which the Gwin mine is situated is very steep and narrow. Recently it became necessary

where it crosses the gulch. Altogether, the work of the company is done thoroughly and is justified by the present encouraging developments.

The Gwin mine is a close corporation, controlled by a few vigorous mining men, who personally overlook the work. They control the entire stock and none of it is on the market, the few shares offered having been subscribed at the time of organization. It is typical of modern

ingenuity and skill and its history is a history of California since the gold discovery.

In Bayard Taylor's "ElDorado", mention is made of the very place where this mine is situated.

He says: "The rich gulch was filled with miners, most of whom were doing an excellent business. The streak of white quartz crossing the mountains about half way up the gulch had been tried and found to contain rich veins of gold. A company of about twelve had commenced sinking a shaft at right angles. In fact the metal had increased rather than diminished, since my former visit."

If it were possible for the shade of Bayard Taylor to again visit the rich gulch, and see the complete Gwin plant of to-day, grinding out steadily the masses of white quartz from the 1400 foot vertical level, with occasional sacks of ore fully as rich as the mine produced

even in early times, with the addition of all the modern methods of treating these ores, surely he would again explain "that the metal had increased since his last visit." He would also see comparatively little of the rough gambling spirit of the early California fifties, with all the license, frenzy and excitement of that period. This has all been changed and a more conservative and quiet community has settled in the neighborhood. Steady employment is given to over 200 laborers, who with their families have peopled the vicinity, and their homes are again gradually dotting the hill-sides.

Experience and good judgment have made such changes possible and built up industries, absolutely making new money to be added to the gold produce of the world. A quiet reflection of the same bold activity and originality that formerly created and built up the great commonwealth of California.

THE NORTH BRANCH GROUP

Following the Gwin and South Paloma to the south upon the foot-wall we encounter The Hudson, Mester, Gold Run, Horse Shoe, North Branch, Never Sweat and Macchiavello mines, forming a group upon the west belt of the mother lode at North Branch, enclosed in the black Mariposa slate, both walls being of the same formation. The Hudson, Mester, Gold Run and Macchiavello are upon the same fissure, which has a width of from 4 to 15 feet and may be traced for several miles. The development has been wholly by shafts as follows:

The Hudson shaft sunk to a depth of three hundred feet following the foot wall, the Mester shaft eighty feet follow-

ing the vein, which at its depth is well defined and shows about four feet of solid quartz heavily mineralized with six feet of gouge and vein matter, the Gold Run shaft, ninety feet, contains about the same amount of quartz and vein matter as the Mester; the Macchiavello shaft, sixty feet and on the Never Sweat two shafts, one of 50 feet on the middle vein showing a strong vein and well defined ledge, the other 24 feet on the hanging wall vein.

The North Branch shaft 22 feet and also a tunnel started but not run to any great length; by continuing this tunnel 100 feet it will tap the vein at a depth of 150 feet below the surface.

The Horse Shoe mine is practically undeveloped.

Illinois Mine is situated six miles south of San Andreas on the Copperopolis road. The general course of the vein is northwesterly and southeasterly. The out crop is exposed for 90 feet. A vein of stratified quartz on the hanging wall side is four feet thick and carries an abundance of sulphurets, also free gold. On the west or footwall of this vein there is what is known as a boulder ledge of

varying width which is of lower grade.

The foot wall is black slate, the hanging wall classed as diorite. The dip of the vein is to the east at an angle of 55 degrees, and from its position and course is clearly on the foot wall of the mother lode. The developments consist of a shaft 130 feet deep from which a number of drifts have been run, the south drift at the 100 feet level having exposed a fine shoot of pay rock. B. K. Thorn of San Andreas is the owner.

THE FINCK PROPERTY

Under the superintendence of Mr. J. B. Pine, Mr. J. Finck of San Francisco has done considerable development upon a group of mines, with exception of the "Flour Sack", may properly be classed in the middle mother lode belt.

The Flour Sack has taken out a pocket of ore heavily impregnated with arsenical sulphurets, similar in nature to that extracted from the Mammoth in Amador County.

The Justice is the north extension of the Flour Sack, 1500x600 feet.

A little to the east Mr. Finck has located the Occidental Mine, and has also a north extension called the Virginia mine.

These locations are within a mile east of the Gwin in Calaveras and two miles south of the Mammoth or Nevills mine

in Amador, and six or seven miles south of the Zeile and Kennedy mines.

On the road between Jackson and Mokelumne Hill, Mr. Finck also has a location 1500x600 feet and a ranch of 175 acres adjoining.

Further to the south or the middle belt of the northern lode, Mr. Julius Finck has done a great deal of development on the Hamby mine, mostly by tunnels which cut the hill 300 feet from the surface. There appears to be several gravel channels on the place and there was a great deal of prospecting done in early days. There is a good mill site below the Hamby mine of 20.91 acres patented. There are 9.96 acres patented joining the Hamby and on the north 34.52 acres, making 2700 feet in length on the fissure.

CENTRAL MOTHER LODE.

The comparatively unexplored section of the great Mother Lode lying between Mokelumne Hill and Altaville owes its present undeveloped condition to three causes.

First and foremost the lack of capital judiciously expended, a prime requisite to mining on the Mother Lode Belt.

Secondly, the Mokelumne and Stanislaus rivers, having their sources in the

regions of eternal snow, drain the opposite sides of the same water-shed, and then diverging in their downward courses, leave between them an irregular triangle, the drainage system of which extends but a comparatively short distance into the mountain ranges and which is, therefore, during the summer season somewhat depleted. This has, until recently, seriously interfered with the economical development of this section, for while adequate water can be secured for milling purposes, the main source of power has been necessarily steam, expensive in both the installation and operation.

The North Fork of the Calaveras river, Calaveritas, San Antone and San Domingo creeks flowing to the west, divide the section into five corresponding ridges, and are never without water. Many small water rights are located upon these streams by private individuals, while the Mokelumne and Campo Seco Canal Co. are prepared to supply water to all properties north of the North Fork of the Calaveras river from their ditch carrying 1500 inches. The Treat and Wyllie system, cover the country south to San Antone creek, supplemented by the Ide and Terwilliger ditch, and thence south there are many private ditches, and the great Jupiter ditch now building, besides that of the Union Water Company, supplying Angels and vicinity.

The California Exploration Limited, a substantial company backed by both English and American capital, has solved the problem of economical power for this section.

By an arrangement made two years ago with the Blue Lakes Water Company of Amador county, whose immense electric power plant, situated on the

Mokelumne river at Big Bar Bridge, is one of the largest and most complete in the United States, they have control of the electric power in Calaveras county, and already their pole line, with its



QUARTZ CROPPING ON THE GOTTSCHALK MOUNTAIN

various branches, completely covers this portion of the Mother Lode, thus placing at the disposal of mining men the

ideal power of the age at a nominal cost. This company is also engaged in opening up a number of promising properties on its own account, but has sufficient surplus power to supply all comers for many years.

The natural timber of this region is pine and the various oaks, though considerable land is cleared and already the main supply of cord wood and mine timber is derived from the vast forests a few miles to the east. Lumber is read-

being wholly due to the long continued rains of the winter season. About the end of May, the grass dries up from lack of water, and during the summer, affords excellent feed for stock of all kinds.

The heated term so enervating in the counties to the south, is here tempered by the trade winds from the northwest, and a case of sunstroke has never been known; the nights are invariably cool and refreshing.

In addition to the immense deposits



THE FELLOWCRAFT MINE.

ily obtained at from \$18 to \$20 per thousand feet and wood at \$4 to \$6 per cord.

Wages vary from \$2 for surface men to \$2.50 and \$3 for miners, skilled mechanics drawing from \$3 to \$4 per day.

The wagon roads, while not all that could be desired, are always passable, though when possible, heavy teaming is done before the winter rains set in.

Snow is a rare occurrence at this altitude, and never remains upon the ground, the inclemency of the weather

of gold bearing quartz that will ever be the paramount attraction of this region, there are also large and valuable veins of superior building marble, as yet but superficially exploited, and the finest quality of slate, sandstone and soapstone are readily obtained in any quantity.

The deepest mines on this belt are, beginning at the north, as follows: The Quaker City, 600 ft., Golden Hill, 300 ft., Gottschalk, 500 ft., Union, 300 ft., Thorpe, 700 ft., Bund, 400 ft., and the

Ford, 640 ft., each and all of which would be considered on the adjoining section of the Mother Lode as mere surface prospects.

The owners are generally extremely lenient with responsible parties, and under a system of options known at "bonding," the purchaser is allowed to enter and explore the property before reaching a final decision, the purchase price remaining fixed without regard to discoveries that might be made.

The surface diggings of early days were enormously rich, and many pockets

investigation of the manifold advantages offered by the Mother Lode Belt of Calaveras county cannot but prove entertaining, instructive, and, to those who come prepared to explore for mineral treasure, also extremely profitable.

The third and indirect cause, responsible for the present backward condition, lies in the fact that the greater portion of this belt was secured in large tracts under agricultural patents before their value for quartz mining was fully appreciated, and the comparatively small number of owners, the majority of whom are



THE FORD MINE—SAN ANDREAS.

have been and are constantly being found. Taking into careful consideration the character, surroundings, climate and natural advantages of the Mother Lode Belt, it is undoubtedly one of the most promising mining areas of the world.

Free from the extreme heat and drought of the desert and Australia, free from the blighting cold of Alaska and the more northern gold fields, within nine hours journey of San Francisco, where supplies of every description are obtainable at the lowest cost, a personal

engrossed in farming and stock raising, have, to a marked extent, detracted attention from the rich mineral resources of the county.

The geological formation of this section is essentially identical with that of the more fully developed portions of the mother lode lying in Amador county on the north and Tuolumne county on the south, the country formation being the Mariposa and Calaveras slates of Carboniferous and Juratrias eras, accompanied by considerable areas of amphibolite schists of a later date.

MOKELUMNE HILL MINING DISTRICT

Mokelumne Hill Mining District extends from the upper end of Spanish Bar on the Mokelumne River, across the divide to Calaveras River, thence westerly to the town of Paloma; thence northerly along the west rim of Rich Gulch, including the Gwin Mine, to the Mokelumne River, and thence up said river to the place of beginning, being about three by six miles in extent, and embracing within its exterior limits many productive quartz mines, as well as several auriferous gravel channels of great value. A few of the quartz veins have been brought to light by hydraulicizing off the

2000 feet at great expense into Stockton Hill. But, of late years, by means of the hydraulic elevator, now being successfully operated on the river bars of the American River, it has been demonstrated, that there remains millions of gold in beds and bars of our modern rivers throughout California—Spanish Bar, within this district, has been purchased by San Francisco capitalists, who will soon incorporate it into a stock company, and put the necessary plant on it to extract, by means of the hydraulic elevator, the gold not heretofore saved. The average prospector, especially



AN ELECTRIC TRANSMISSION LINE.

gravel, for instance, the Moser and Lamphear Quartz Mines, one mile southeast of the town of Mokelumne Hill, which were at one time covered with lava and gravel. The Hexter Tunnel, one mile west of Mokelumne Hill, has been driven

those having little or no knowledge of the Mother Lode, when in search of gold bearing veins, are apt to be carried away with the idea that the mother lode, as a matter of course, must contain a bold out-crop. Heretofore has been pointed

ont the reasons, that, in many places there are no visible signs of croppings of any kind, and in others only small seams or stringers of quartz. These seams indicate, that at a depth of from 900 to 1200 feet, large bodies of quartz will be encountered. The value of quartz bodies largely depends on the character of quartz contained in the surface seams; so much so that there is yet to be discovered a paying mine anywhere within the mother zone, where rich seams of quartz have not existed at the surface. Hence the prospector must look for seams of quartz within the limitations of the slates, or in the contact between the bull quartz rock and slates.

A peculiarity of the pocket vein of the mother lode is center-veins, which originate in the east wall rock in small blanket veins, lying nearly flat, and are usually quite barren of gold until within a few feet of the slates, when they form into spikes of gold, usually identified with massive bodies of arsenical sulphurets. For instance, the Mammoth Mine at Middle Bar, Amador County.

While the different lode veins nearly all trend parallel to one another, and the quartz and the sulphurets therein contained are characteristic, yet there are some ear marks by which the great hanging wall lode is distinguished from the others, chief of which is the gray gouge matter. The vein slates are more talcous in their nature and less shaley, and the ore bodies are larger, not so high grade, but more reliable for a continuous pay chute. For instance, the Zeile in Amador County, and the Utica in Calaveras County.

But locations on the same lode widely differ, as the local surroundings exercise a vast influence over the ledge matter—hence high or low grade quartz.

If those who judge of a mine are experienced quartz miners, and one who is familiar with the modus operandi of handling the "horn" or "gold pan," and also trained to tell at a glance how much per ton, by the ordinary milling process, the quartz will yield, then in this case it would not be necessary to go to the expense of milling ten or more tons to find its milling value. Otherwise, it is very unnecessary to do so, to give the mine a fair test. Ten tons of average ore should be milled at a neighboring plant to obtain a fair milling test. From the working test of said ten tons, judge the value of the property according to the width and length of the ore chute and the advantage of the conditions for cheap and economical working.

If mine owners would establish a rule not to allow these so-called experts or would-be buyers, to take samples from the mines for assay purposes, but rather compel them to sample by horn or milling test, it would be found far better for both the capitalist and the mine owner. To test a mine by the horn process, one should require from three to seven days on a mine, allowing him to be an adept in the business with the horn or gold pan. It is also necessary to be able to judge from the showing of gold in the horn, within less than one dollar per ton, what the quartz will yield by the ordinary milling process, otherwise the test will avail you nothing. To be perfectly sure of this sampling process, one must be a miner as well as a millman, and one who is fully up to all the details of judging by the horn or pan test, as to what it will likely mill, or, in other words how much per ton of ore can be saved in the mill, and on the upper copper plates.

Therefore, one fit to be sent out to

sample old quartz mines, must be a person that is well up in all the details of mining and milling, and from long experience, able to judge if rock will pay to dump into the mill, simply by the speedy process of panning a few pans of

the rock, dirt or quartz, as the miners say, "break it down."

Men not understanding these matters, cannot do justice to the mine or their employers.

THE ESPERANZA MINE

The property of the Esperanza Gold Mine is situated about two miles north-east of Mokelumne Hill and consists of

the 500 level to the hanging wall. These crosscuts show the vein to be an average of 50 feet in width. The property is



THE ESPERANZA CHLORINATION WORKS.

seven adjacent claims, owned by the Esperanza Quartz Mining Company. The Esperanza claim is the one which has received the greatest amount of development work. On this claim, during the past fifteen months, a three compartment shaft has been sunk to a depth of 800 feet on an incline of about 50 degrees. At the 500 and 700 feet levels, drifts have been run on the foot wall for 200 feet south, all in ore, with two crosscuts on

equipped with a double reel hoist, run by water power under a pressure of 387 feet, with facilities for getting 622 feet when desired; a 30-stamp mill also driven by water power under a pressure of 600 feet; a Chlorination Works, with capacity for treating five tons of sulphurets per day; an electric light plant and all the usual buildings for a mining location. The mines and plant are well located for economic working; the grade of the

canon, admits the handling by gravity of any quantity of ore. About 60 per cent of the value of this ore is in free gold and 40 per cent in sulphurets, the latter treated by chlorination process. The foot wall of the vein is syenite, and the hang-

ing wall micaceous slate. The course of the ledge is north and south, with an easterly dip of about 50 degrees. The development work is still going on and the present shaft will be sunk to a depth of 1100 feet.

THE GREAT UTICA MINE

No description of the gold mines of Calaveras, and indeed of the State of California would be complete without a reference to the Utica Mine owned by the Hobart Estate.

It is another example of an old abandoned mine made to pay well by systematic development and proper management.

Angels Camp was one of the earliest settlements in the County, but the present prosperous condition of the vicinity is entirely owing to the great work of this company, which in all its surroundings employs over 500 men.

There are three claims controlled by the Company—The Utica Stickles, upon which there have been erected 120 stamps—The Madison, upon which are 40 stamp and the Gold Cliff which has 20 stamps. A three compartment shaft has been sunk upon the Stickles to a depth of 1360 feet. It is very difficult to obtain an exact statement of the yield from this mine, but when the plant was running in full blast, before the great fire of last summer, for many months the yield was as high as \$200,000 per month.

Water is used for power and the supply is owned and controlled by the company, the ditch being completed from Alpine County, over 60 miles.

When the business justifies it, an enor-

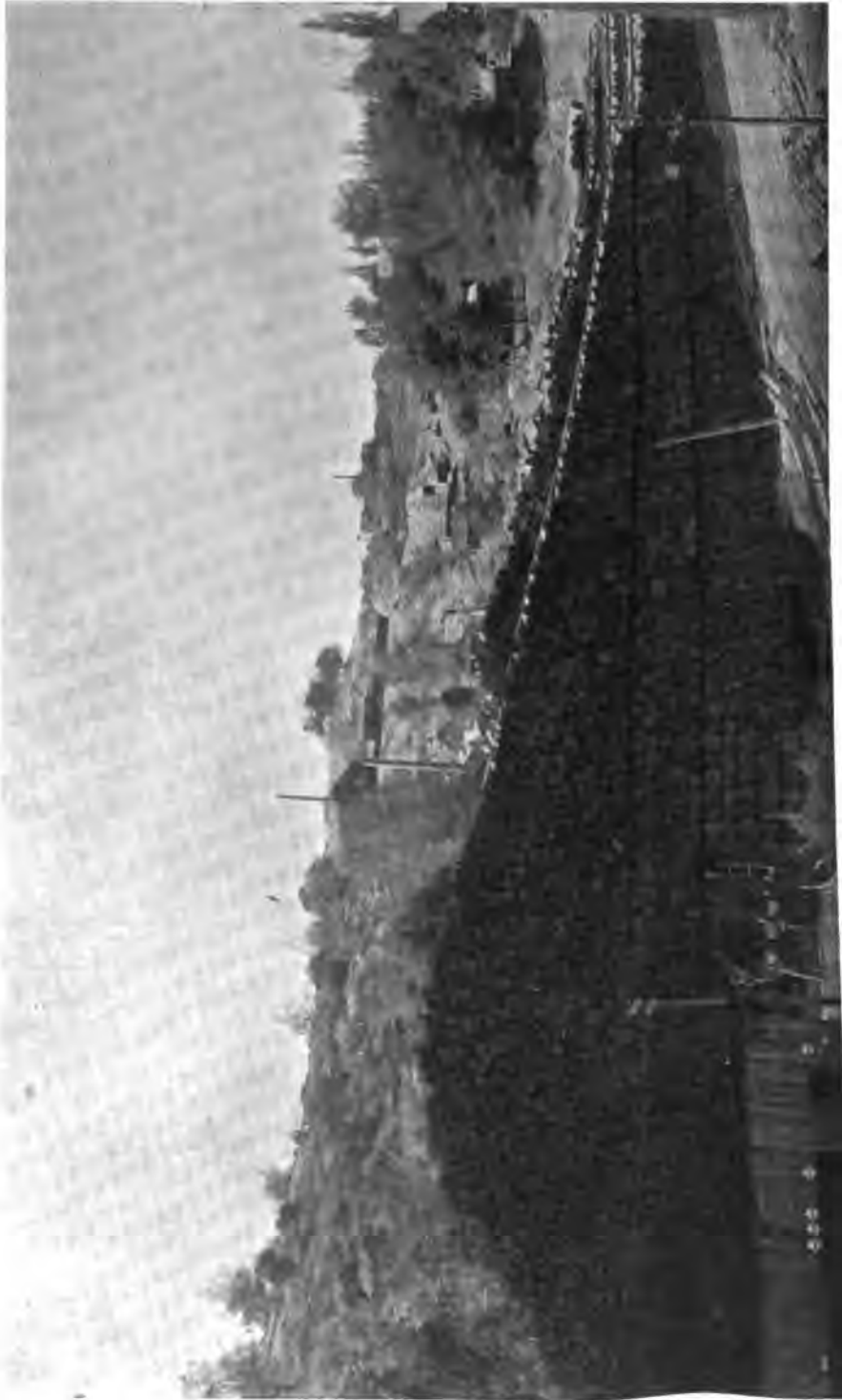
mous electric power can be generated from present water facilities.

The company operates a large chlorination plant for treating sulphurets, also, a cyanide and electrical plant.

In the town of Angels there is a remarkable complexity of veins. The main branch of the mother lode can be traced along the hill west and northwest of the town though it diminishes in size. The serpentine rock of the Madison is replaced northwesterly by an altered diorite.

The shaft of the Utica and Stickles mine starts with vein at the surface, but at a depth of 500 feet the vein takes a somewhat flatter dip, but the shaft continues at the same angle in the foot to the 1360 level.

The stopes of this mineral zone are from 10 to 100 feet wide. The entire gold bearing zone consists of a great mass of altered diabase, which has been rendered slaty and splintery by pressure, and subsequently altered to chloritic or taicose schist. Large masses of crushed diabase are replaced by solid, massive quartz. Power drills are used, and the average weekly progress in sinking the large shaft has been 35 feet. A great forest of round timbers are used up in the shaft and drifts. All the waste is used in filling up the old stopes, and the absence of the large waste dump is a not-



THE UTICA MINE.

iceable and original feature of this mine.

The formation of the Madison is typical of the district, and of the other claims belonging to the Utica Company, and a description of the upper workings will show the general formation.

The foot-wall is black slate, and hanging wall is diorite.

One hundred and fifty feet away in the hanging wall, there is a decomposed serpentine rock. The hanging wall vein, which is more regular, is in some places eight feet thick. No gouge separates it

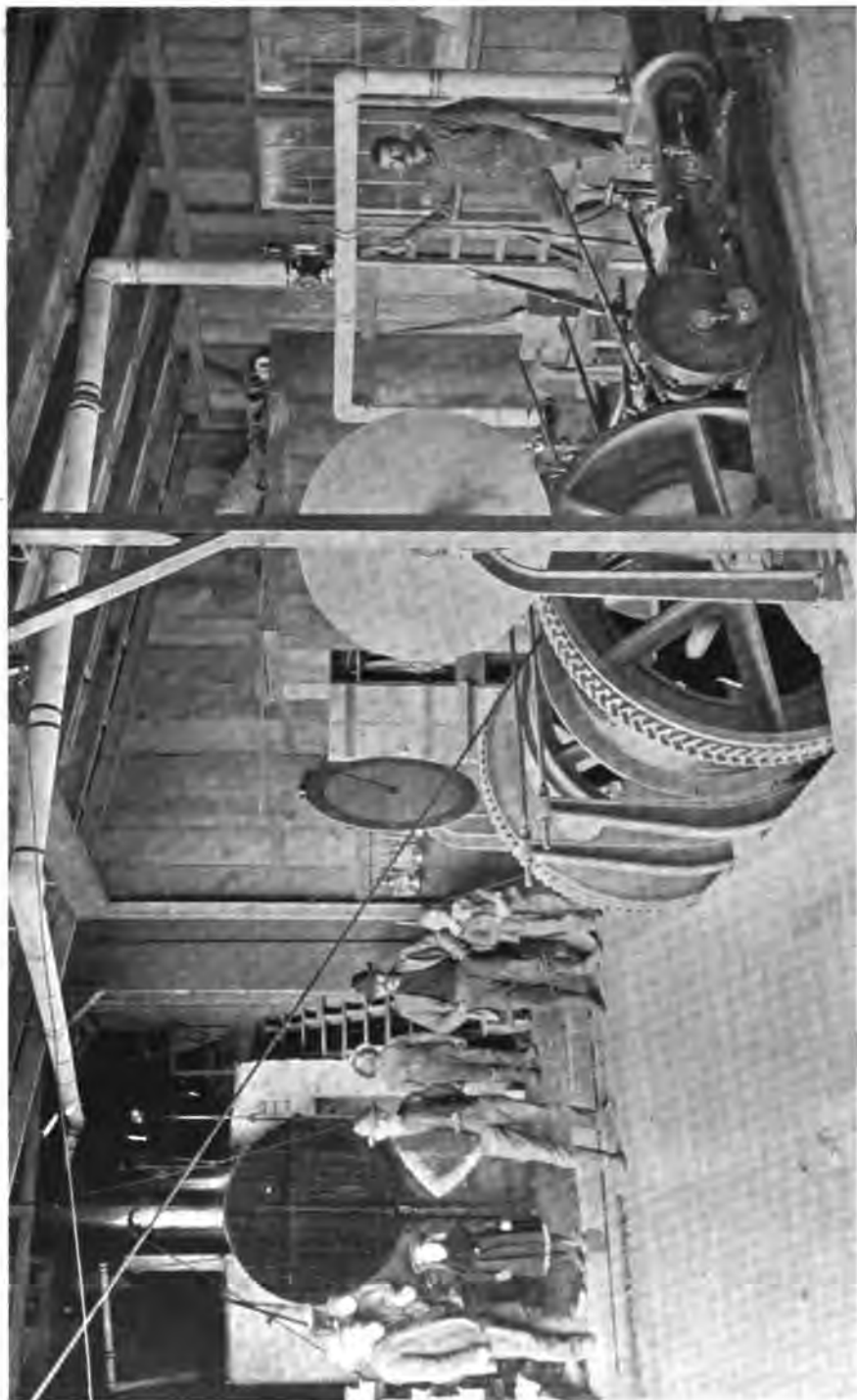
is mostly in the hanging wall vein. The slates on either side of the quartz are impregnated with sulphurets, and are worked for some distance in. These thin bands of quartz, alternating with leaf-like talcose strata, form the body of the ribbon-like rock on either side of the main quartz deposits of this claim, and also of the Gold Cliff mine on the north. Its course is about the same as the Madison. The dip is from 60 to 70 degrees northeast. It varies in width from one to four feet, and is grooved and polished



TIMBER FOR UTICA MINE.

from the slates, which for some distance are intersected by small veins. The main vein averages three feet, with a thin gouge between it and the hanging wall vein. No well-defined foot-wall has been reached. The quartz is bunched and quite flat at times. The average dip is 43 degrees northeast. The massive portion of the quartz contains very few sulphurets—the heavy mineralization being on the foot-wall side. The free gold

on its upper surface. A small vein, having a slight gouge, and a remarkably smooth foot-wall, joins this on the foot-wall side. The rock milled is the small vein, and the slates and ribbon-like quartz between it and the main ledge, which is not worked. East of it is a small pocket vein. This has no defined hanging wall, and the slates are mineralized and intersected with quartz stringers for some distance.



THE TRACY HOIST.

THE TRACY MINE

Things at the Tracy Mine, in the Angels Camp district, have a decidedly business-like appearance. Roads have been built leading to the mine, the

depth of 1,000 feet. The two latter were made in San Francisco expressly for the company. The machinery was put in position under the personal supervision



THE TRACY HOIST.

site for the works graded off, and substantial buildings, covered with corrugated iron, have been erected thereon.

A forty-foot hoist has been put up over the shaft and the power consists of a 60 horse-power engine with eighty horse-power boiler, capable of hoisting from a

of Mr. Drown, and everything was found to work like a charm. All the minor details connected with the plant were constructed with a view to economy and a saving of time and labor.

The original shaft has been enlarged into one of two compartments, timbered

and boarded up in a substantial manner. The partition between the two compartments has been boarded up tightly so as to serve as a ventilator, the cold air in the natural order of things rushing down one compartment, driving the foul air and smoke from blasting up the other. This simple method is a great deal more effective for straight sinking than the use of the artificial air blast for shallow depths.

On New Year's day everything was completed and in the evening the works were formally dedicated with a little ceremony before quite a crowd of interested people. Woodson Garrard, W. W. Emery, and other miners who are authority in such matters, examined every detail of the works and pronounced them first class in every respect. Quite a number of people had gathered to witness the occasion. As the clock struck the hour of midnight, announcing the birth of the New Year, the first bucket was lowered, and, as it descended into the shaft. Mrs. Dr. Lichau, one of the principal stock holders of the company,

broke a bottle of champagne over it, toasting the future success of the mine. A spread was prepared in the open air. More champagne flowed (but not into the shaft) and many good wishes for the success of the property followed.

Immediately after the dedication, about 3 a. m., a shift descended the shaft and at once began sinking. The shaft is now 65 feet deep, and the intention is to go down about 400 feet before doing any cross-cutting. At that depth it is expected to tap the lead which crops out of the hill back of the works. In this vein, rock was found recently that yielded fine returns; besides, there is reason to believe that other leads intersect at that point. Work is under the foremanship of Fred Brandt, a miner of wide experience in quartz mining.

Mostly all the stock of the company is held by German capital, and the corporation is a good substantial one. The promoters are very enthusiastic over the outlook, and believe with reason, that they have one of the best properties on the mother lode.

THE MINERAL RESOURCES OF EASTERN CALAVERAS COUNTY

The section of the county of Calaveras lying east of the Mother Lode is a region that has not received the attention of mining men and capitalists that its merits deserve.

This section comprises an area traversed by rich quartz veins, and channel deposits of auriferous gravel. It also contains marble, limestone, gypsum and iron in abundance, presenting a highly interesting field for investigation.

The formation which contains the numerous gold-bearing veins is generally

a black, foliated and highly mineralized slate, with dikes and reefs of granite and limestone. Porphyritic and other rocks occasionally cut the formation at varying angles.

The veins themselves are generally small as compared with those of the Mother Lode, but are of higher grade, both in free gold and sulphurets. From developments made, ledges varying from a few inches in thickness, to ten, fifteen, and even twenty feet, have demonstrated the fact that in this zone

are to be found a vast number of mines that, given the advantages of skillful treatment, and comparatively small capital, would in a very short time largely increase the number of dividend-paying gold properties, of which Calaveras has furnished her full quota.

At Murphys are a number of properties, both placer and quartz, that are of late receiving much attention at the hands of capitalists.

Those operating them are doing careful and consistent work, and are thus far realizing excellent results for the money expended. These mines lie in mica schists and quartzite phthanite of the Calaveras formation, east and west of the limestone reef that runs through the town of Murphys, and thence to Columbia in Tuolumne county.

In the East Belt near Murphys is the Sperry Iron Mine, containing a large deposit of iron ore, hardly touched. The dike varies from 50 to 100 feet, and can be traced for thousands of feet.

A deposit of Chrome Iron is found in the Page-Cutting property, fully equal in dimensions to the above.

Marble, gypsum and carbonate of lime also occur in large deposits.

In addition to the Buckhorn group, the May Day, the Carley and the McNear mines, and many others may be mentioned in this locality, making a good showing, among which are the "Summit Blue," "Yaller Kid," "Root Hog or Die," "Beatrice," "Total Wreck," "Fair Play," "Shaw," "Dora," and "Gum Boots."

About five miles east of Murphys lie the Collierville mines, which have for years attracted attention by reason of the gold specimens that have been taken out. The various claims are all worthy of consideration and inspection.

On Indian Creek is situated the Old

Calaveras group, comprising the Oro Minto, Enchantress and South Bank.

To the east of the above group are the Hercules, Driver, Homestake, Sonoma, Rose Rock, Big Horn and other mines, each and all estimated by their respective owners to be valuable possessions. Many would undoubtedly prove good mines, if opened and developed on a practical basis.

To the west, on the ridge between Indian and San Antone creeks, is the Golden Bell mine, formerly known as the Washington, when it was for years successfully worked by Samuel Woods of San Antone. The Esmeralda mine, near the town of the same name, has been prospected by two shafts 100 feet and 400 feet respectively in depth, the latter being the deepest shaft sunk on any of the properties thereabouts, as it is essentially a tunnel region.

Three ore shoots have been explored, each of which is between one and two hundred feet in length. The course of the vein is a little north of west and south of east, averaging from three to four feet in width and has a northerly dip of about 68 degrees.

The walls are both of Calaveras slate, and the water flow about 13,000 gallons daily.

North of the Esmeralda, and occupying a corresponding position upon the summit of the ridge between the San Antone and O'Neil creeks, a large group of claims has been located, the Columbus and Rochester, two patented mines owned by D. Fricot, forming the nucleus. These mines were patented a number of years ago, and the development work done at that time opened up a large vein of excellent ribbon quartz with free gold.

A tunnel is now being driven upon

the Albany, the west extension of the Rochester, to tap this vein, the former development having been wholly by shafts.

The Grace Darling, owned by Mr. Ed. Moores, and the Coralie Mine, owned by Mr. H. W. Penniman, of San Andreas, are among the promising properties.

The Bigney, Hobart, Bullion, Golden Star and Morpheus should also be mentioned.

The facilities for economic operation are unequalled, with ample backs for tunneling, and cheap water the year round under four hundred feet pressure. As with those previously mentioned, the course of the vein is nearly east and west.

North of O'Neil's creek, there is a region literally netted with veins, containing many shoots of high grade ore. In common with other portions of the East belt, this section, known as the Washington Ranch Mining District, has been sadly neglected, many of the claims showing better surface indication than did the majority of the great gold producing mines of to-day, when in a like stage of development. Only a few of these properties can here be described. There are many others with prospects as good, both located and awaiting an owner.

The Bigney Quartz Mine is owned by Wm. Casey, Jr., & Co., of San Andreas. The ledge which outcrops plainly the entire length of the claim, is of a ribbon character and averages three feet in width. It runs east and west between a hanging wall of siliceous shist, with a dip to the north. The quartz carries free gold with few sulphurets.

Ninety feet to the south of the main

vein, another ledge, which in its extension, is known as the Howard, can also be traced the length of the claim.

A tunnel of 600 feet would cut both of these ledges, giving between 400 and 500 feet backs.

Treat's ditch, carrying over 500 inches of water crosses through the highest portion of the claim, affording ample water supply, which could be utilized under a high head.

Howard Quartz Mine adjoins the Bigney upon the west and is the property of J. B. Sebrean & Co., of San Andreas. The vein, which is four feet in width, has been developed by a 60-foot tunnel and an open cut of 25 feet. The character of the ore is ribbon quartz, carrying both free gold and sulphurets. The trend of the vein is east and west between walls of slate.

The Washington Quartz Mine is the property of W. F. & E. L. Binum of San Andreas. The vein is three feet in width between a hanging wall of mica shist and foot wall of porphyry. A shaft thirty-five feet in depth has been sunk in the opening. The ore taken out prospected well in free gold, besides a large percentage of sulphurets.

The Bonanza Quartz Mine, the Hobart Mine, the Bullion Mine, the Golden Star, and the Morpheus may be mentioned as mines deserving of work. Wonder Quartz Mine adjoins the Bonanza. The ledge is in highly mineralized black slate, with porphyry foot wall and carries a persistent gouge, also rich in sulphurets and free gold. The development consists of a shaft of 43 feet, with a drift along the vein of 35 feet, also a 150 foot tunnel.

Six miles to the east of the Washington Ranch district, lying on the ridge between San Antone and

O'Neil's creeks, is the famous Sheep Ranch Mine.

This property has been worked to a greater depth than any other mine in this part of the county. It has produced over two million, and has a world-wide reputation. The lowest level is twelve hundred feet from the surface, and though the vein in this mine is small, averaging probably not over eight inches in thickness, it has been so uniformly rich as to utterly disprove the idea that "shoe string" ledges do not make paying mines. It is essentially a "poor man's mine," having paid from the grass roots to its lowest levels, while a twenty-stamp mill in twenty years of constant running did not exhaust the ore reserves. To-day the shoots and levels are many of them full of rich ore, and it will require new machinery and perhaps a modern motive power to again place the mine on a working basis. This property supported a population in the town of Sheep Ranch of about eight hundred people in years past, and it is now currently reported that operations will be resumed the coming spring. The ledge in this mine as in many others in this section lies east and west, though the course of most of the veins is with the trend of the slates. The ore is free milling, having no sulphurets in sufficient quantity to justify the erection of a concentrating plant.

In the vicinity of the town of Sheep Ranch are other claims upon which more or less work has been done, but are now lying idle for want of capital to open them. The Pioche, Chavanne, Smiley, and Lost Boy are all well known prospects, the owners of which are confident of their value. North of O'Neil's creek and in the vicinity of Mountain

Ranch and Cave City, is found a net work of claims mostly in the hands of the original claimants.

But little development has been done here, though the showing in many of the claims is very good. The Golden Eagle, Anderson, Grub Stake, McPherson, El Dorado, Wiley Bros., North Star, Gaston Hill, Alpine, Starlight, Meteor, Rose Hill, Ritter, O'Hara, claims of D. Fillippini and others are all mines showing prospects sufficiently good to warrant the prediction that some day they will become producing properties.

The Little Hero Quartz Mine shows a two-foot vein of ribbon quartz running northeast and southwest in a fissure of the Calaveras slates. A. L. Wyllie, of San Andreas, who owns the property, has developed it by a shaft of sixty feet and eighty feet of tunnel.

The Live Oak Quartz Mine, situated in this district, is supposed by some to be upon the same vein as the above. G. Tiscornia & Co., of San Andreas, are the owners and have developed the claim by 125 feet of tunnel. The vein here shows four feet in width and carries a six inch gouge.

Between the Jesus Maria and Esperanza creeks, is located a series of mines many of them of recent discovery, which are attracting considerable attention. Here development work is being done, ores are being milled, and otherwise tested and indications are favorable for a promising mining district. The same general characteristics as to formation, size of veins, value of ores, etc., apply to this district, as to those farther south in the same belt. The well known Greek mine, lying on the brow of the hills facing Jesus Maria creek is the most extensively developed mine in this group.

A five stamp mill, concentrators, hoisting works, etc., are already in place on the ground, and work is being pushed day and night. This ledge, like the Sheep Ranch, is an east and west one, but unlike that mine, carries a large percentage of high grade sulphurets. There have been found many pockets or bunches of exceedingly rich quartz in this mine, though the average ore is quite uniform, carrying from ten to twenty dollars in gold per ton.

The Poirier and Paul, Belisle, and Roy, Shady Side, Cook and Lamb and Lester mines are new locations showing veins of from one to six feet, though the claims are but little developed.

There are a great many other mines in this vicinity which are in the hands of men of limited means, that will compare favorably with those already mentioned, while lying west at Whisky Slide and Jesus Maria are numerous prospects in both quartz and gravel. North of the Esperanza creek and the town of Railroad Flat is the continuation of the ledges traced from the south to this section. Here are many claims undeveloped, and yet showing fair prospects. The Chapman mine was one of the earliest worked, but no large amount of development has been done on it. The Bismarck, Sanderson, Keystone, Prussian Hill, Kangaroo, Boire, Bald Eagle, and the well known Petticoat Mine are all in the prospect stage of development, except the last named, which is being actively worked, under the superintendency of W. H. Clary, Jr., formerly of the Sheep Ranch mine. This property, after passing through many phases, both good and bad, and lying idle for nearly twenty years, has been reopened, and now, under intelligent management and modern methods,

proved to be one of the best quartz mines in eastern Calaveras.

Situated in the granite belt, northeast of Railroad Flat, is the village of West Point, truly named, the "Poor Man's Camp." There are few mining districts that have yielded such quantities of gold as this, and in so continuous a flow since the early fifties. In the days of placer mining in one of the many gulches known as Sandy Gulch, from fifty to two hundred dollars per day to the man was taken out, and after the pay was supposed to have been exhausted, three men in six weeks at the head of the gulch cleaned up the sum of \$5,000.

But West Point's continuous output of gold has come from innumerable bunches or pockets in quartz, that have been found everywhere throughout the district, and if the amount thus taken out by industrious prospectors could be accurately stated, it would number millions of dollars. On some leads, the miners' monuments or dumps can be counted by hundreds, but the early miners rarely sunk below water level or into hard ground and there are hundreds of rich ore shoots extending deep into the granite that in the near future may become paying mines.

There is ample latent power in the many small, swift rivers that should be conserved to the service of the miner. While this section contains no single large mine, it has had many good paying properties, only a few of which can here be mentioned; they are, however, typical of the remainder. The mines are in a granite belt striking north and south, which is at least six or seven miles wide. Southward the granite is replaced by dioritic and hornblendic rock, while through the granitic area numerous

dikes of fine-grained, dark-green diorite are found, having an east and west trend. Dikes of diorite of light greenish gray color, and coarse texture also occur, striking nearly north and south, and often accompanying important veins of the district.

The Texas Mine was early discovered by people from Texas and was exceedingly rich on the surface. Samples of ore from this mine yielded large returns, but the total output is unknown.

The Lone Star Mine, located four miles west of West Point, is the property of The Hurley Gold Mining Co of Wisconsin, but is at present being operated by the Farrington Co., who employ twenty-five men. The veins, of which there are two important ones, are 50 to 140 feet apart, strike a little east of north and dip generally to the west. The bunches of quartz which constitute the veins occur as replacements in the granite, crushed between a series of fault planes, some of which are nearly perpendicular and parallel, and a second series which pitch to the west at an angle of 15 to 40 degrees. The ore chutes have a pitch to the north at an angle of 30 degrees. The sulphide minerals are iron, zinc and lead. A large percentage of magnetic iron is also present. The development of this property is extensive, aggregating over 7000 linear feet.

The Lockwood Mine is situated about three miles northwest of West Point. The course of the vein is northwest and southeast; the dip is westerly at the surface, but at a very small angle from the perpendicular and at the lowest workings is vertical. The average width of ore throughout is about three feet. The vein is cut by a dike of greenstone from two to six feet thick, nearly at right angles to it, and pitching slightly to the

south. This dike has made no difference apparently in the character of the ore, which is the same on both sides. This mine has been enormously rich in pockets of free gold, while the regular ore averages about six per cent in sulphurets, worth \$50 per ton.



QUARTZ VEIN OF THE FOOTE & THOMPSON MINE—EAST BELT.

The Keltz Mine is situated on the North Fork of the Mokelumne River, about four miles northeast of West Point and still bears the name of the discoverer. Mr. Keltz sold the mine to a San Francisco company, who worked the property for two years, and during

this short period it paid for itself many times over. For some unknown cause the mine was then allowed to remain idle until last summer (1897).

The vein is in a simple fissure, six to eighteen inches wide in granite, and runs north and south. The ore is heavily sulphuretted, and is shipped to the Selby smelter. The mine is worked by a series of tunnels, the lowest, which will have about five hundred feet backs, is now in 235 feet. A winze is being sunk 150 feet from the surface and has ten inches of good ore in the bottom. There are at present twelve men employed. John S. Morgan of San Francisco, owner.

The Paragon group of mines, situated on the Licking Fork, three miles southeast of West Point, comprises the Tip-top, Mountain View, La Palomacita and Paragon locations. It is being worked by a number of tunnels, the lowest of which, when completed, will have upon the La Palomacita about 400 ft. backs. It is now about 300 feet in length on the line of the lode, and has already struck a four foot vein of high grade sulphuretted ore.

The Mountain View and La Palomacita were extensively worked upon the surface in the early days, and yielded many thousands of dollars. The Tip-top is being worked by two tunnels, while a 300 ft. tramway takes the ore to the mill. Five stamps and two concentrators are at present in operation, and five more stamps are being put in. An electric light plant and telephone system have been installed, and twenty men are given employment. S. Bowman, P. L. Shuman and J. L. Haley are the proprietors.

The Woodhouse Mine, situated between the Middle and South Forks of the Mokelumne River, has yielded a

large amount of bullion. It is worked by tunnels from each river, opening a ledge that is in places from six to eight inches wide, carrying \$14 per ton in free gold.

The Mountain Boy Quartz Mine, situated on the North Fork of the Middle Fork of the Mokelumne river, has been opened by two tunnels. The first 100 feet in length, crosscut three veins respectively 12, 22 and 18 inches wide. The second, 142 feet long, has been run to tap a fourth vein at a depth of 90 feet, but has not as yet reached it. All of these veins run northwesterly and southeasterly with prominent outcroppings continuing on the extensions in both directions. The country formation is granite. This claim is owned by W. P. Sargent and Alex Crawford of San Andreas, who, besides owning the extensions, the Chimmie Fadden and Turro-bred, have a number of other properties in this district, namely, the Sparticus Beautycus, His Whiskers, Mamie, Mc-Haley and Hungry Higgins Quartz mines, all of which present encouraging prospects.

Situated on the so-called East belt of Calaveras county and parallel to the Mother Lode at a distance of about five miles, lie the well known group of mines now popularly called the "Esmeralda" Mines, and including the "Esmeralda," "K. J.," "Cuneo," and "Bonehard" Quartz Mines. They are situated in a slate formation that is similar to the famous "Sheep Ranch" Quartz Mine and containing a strong well-defined quartz vein of ribbon rock, averaging in width about six feet, and which has been exposed throughout this entire group.

The "Esmeralda" Mine lies on the extreme east, on what is called Indian Creek, and the "Cuneo" Mine on the

west, on what is called the San Antone Creek, while between the two is the "K. J.," and on the east is the "Bonehard," lying on a high ridge dividing the two creeks. This situation has rendered these mines particularly attractive by reason of the fact that it affords an economical and convenient means of developing them through tunnels run from either creek, which will tap the ore deposits at a depth of about five hundred feet.

The "Esmeralda" Mine, proper, has been extensively developed by Hon. John F. Davis, of Amador County, its present owner, through a shaft sunk over four hundred feet in depth, and numerous drifts which have exposed and opened up large and extensive ore chutes which have already netted Judge Davis and his former partners a large sum of money.

On the "Cuneo" property, a tunnel has been driven in on this same fissure vein, which has demonstrated that the ore chutes and deposits are to be found on the San Antone side of the group, and demonstrate that there must be extensive ore bodies between the "Esmeralda" and "Cuneo" Mines, lying within the limits of the "K. J." and "Bonehard" Mines.

Another interesting feature in connection with these mines is the fact that running parallel to this main fissure vein, which has been commonly termed the "Esmeralda" Lode, are two other strong veins, lying within the limits of the claim and at a distance of about sixty feet apart, which have been sufficiently de-

veloped to show the existence of strong pay chutes. These veins can be readily worked in connection with the main lode so that these mines practically consist of three well-defined veins, at distances of about sixty feet apart, all of which can be economically worked through one shaft or tunnel. The ore contained within these veins is the same as usually found in the East Belt, being a high grade, free milling, and the sulphurets being very rich. In this particular it differs from the so-called Mother Lode veins in the fact that the latter are usually low grade, but contain much more extensive and broader ore deposits.

When it is remembered that the now famous "Sheep Ranch" Quartz Mine, which is situated about three miles from this group, was worked to a depth of twelve hundred feet, and many millions of dollars extracted therefrom, it will not be surprising to the many people familiar with this group to know that at an early date they will rank among the first gold producers of Calaveras county. Judge Davis, the owner, has had very tempting offers submitted to him, but he has thus far refused them all, believing that with a comparatively small outlay he, himself, can place the properties upon a basis that will yield to him large and long continuing profits.

None of the mines have been proved in depth, but no one has the knowledge to determine whether they "go down" or not. The investor must take his chances on that problem.



THE CHANNEL SYSTEM OF THE EASTERN BELT

Skirting along the edge of the great eastern quartz bearing area is the large well defined Fort Mountain Gravel Channel, with its numerous tributaries, a lava capped ancient river bed, having its source high in the Sierra Nevada and coursing thence along the upper foot hills of the main range, across the sev-

Fort Mountain Channel is of a blue, partially cemented character, similar to that of the Forest Hill Divide and the dead rivers of Nevada and Placer counties. The portions of this channel lying remote from the water courses of the present day, have been almost entirely overlooked, while those sections worked



DOWER GRAVEL MINE, OLD GULCH.

eral branches of the Mokelumne river, southerly across the Esperanza and Jesus Maria creeks, down past the towns of Mountain Ranch to Cave City, where it apparently met an obstruction and turned sharply to the west, running through Old Gulch, Washington Ranch and Calaveritas to a junction with the Central Hill channel from Vallecito and continuing to San Andreas, thence west where it joined the large channels coming in from Mokelumne Hill and Chili Gulch, soon to be lost in the great valleys below. The gravel found in the

have in every instance given rise to flourishing mining camps immediately below such crossing. From the South Fork of the Mokelumne River to Cave City, but four openings, in a distance of sixteen miles, have been made, that may be said to have determined the extent and character of the gravel bed lying below the lava cap. At the Martin, or Table Mountain Mine, near Mountain Ranch, a shaft has been sunk to bed rock a distance of about forty-five feet. Considerable drifting and crosscutting has been done, exposing a large and well

defined blue gravel deposit, carrying gold in paying quantities. A five stamp mill and hoisting works are on the ground ready to operate as soon as sufficient water for power can be obtained. The Bessella Mine is equipped for hydraulic work, piping during the water season, the gravel lying along the rims of the channel. Powder is used on this property to blow up the bank, and owing to the cemented character of the ground, there must be a considerable loss of gold in this method. The mine is, however, provided with a ten stamp, water power mill, and the owners intend to drift the property, when the piping shall have been carried into the deeper, lava capped portions of the mines.

The Banner Blue Gravel Mine, a typical property of this class, is situated on the Jesus Maria creek, and comprises a claim of one and one half miles. It has been opened by a double compartment shaft sixty-three feet deep to bed rock. A crosscut one hundred and ten feet in length has been made, and a main gangway or drift run up the channel three hundred and fifty feet. The gravel, of which some three thousand tons have been breasted and worked, is partially cemented and blue. It carries from 25 to 40 per cent of boulders, large quantities of magnetic black sand, and sulphides of iron. A miner can break down in the breasts from three to four tons per shift of ten hours, six to eight feet of gravel in depth being extracted. The gravel pays from \$3 to \$4 per ton and is mined and milled at a cost of \$1 to 1.25 per ton.

The Best Chance, Sugar Loaf, and

Bingham Valley placer mines of 160 acres each, lie north of the Banner and extend along the channel from a point south of Esperanza creek to Calaveras Valley near Railroad Flat. These claims which cover two and a half miles of the Fort Mountain Channel, were located in November, 1897, by J. L. Lester of Railroad Flat, and others. A double compartment working shaft is being sunk through the lava at Esperanza creek, that will reach bed rock at about 100 feet.

The Lava Bed Mine is opened by a shaft to bed rock, eighty-five feet deep. The most extensive work at any point on the channel has been done on this property. The channel has been drifted and breasted for about six hundred feet, exposing an extensive body of slightly cemented blue gravel. In the extraction of the gravel, powder is used only to break an occasional large boulder or to cut down a high point of bed rock. The mine is equipped with a steam power hoist and five stamp mill. The gravel is very high grade in many parts of the mine, yielding as much as \$20 per ton. The property is extensive and promises to be very valuable. At and near the town of Railroad Flat are several mines. Timber is abundant and of good quality.

In the foregoing description of the mineral resources of this portion of Calaveras county, but a few of the entire number of mines have been mentioned. As compared with other mining sections of the State of California, this region is scarcely touched. Here is almost a virgin field that should be peculiarly interesting and worthy the attention of the mine buyer of moderate means

CARSON HILL

Carson Hill, the extreme southerly end of Calaveras county, through which the Mother Lode passes, is an historic locality.

Carson Ravine and Squirrel Gulch, were very rich in placer gold, which was fed from the erosion of the ledges. The Morgan mine, situated on the northerly slope, was fabulously rich, and

tions the fact that three of these properties were being worked profitably in 1867. They are now under bond to an Eastern corporation, and are being developed by tunnels and shafts. It is the opinion of most mining men who have examined this section of the Mother Lode, that with the opportunities for cheap power, ore can be mined and



THE HOIST AT THE MELONES.

from this property the largest piece of gold ever taken out of a mine in the United States, was extracted. On the south, and adjoining the Morgan mine, lies the mines belonging to the Melones Consolidated Mining Company. This group, which consists of the "Reserve," "Enterprise," "Melones," "Keystone," "Mineral Mountain" and "Stanislaus," extends to the Stanislaus river. In J. Ross Browne's report, made for the Secretary of the Treasury in 1868, he men-

milled at a profit, which will yield \$3 per ton. The "Iron Rock Mine," the "Finnigan," the "Carson Mine," known as the "South Carolina," and the "Adelaide Mine" are situated also on Carson Hill, on the middle and east veins of the Mother Lode. On the west vein, to the west of Carson Hill, lie the properties belonging to the Calaveras Gold Mining Company, Ltd. The East Lode had a dip on the surface of about fifty degrees, but at a depth of two hundred feet on



THE INCLINE AT THE MELONES.

the Reserve Mine, it straightens up to sixty-seven degrees. A strange condition exists on the East vein, in that the vein proper (which varies from five to ten feet in width) carries little, if any, value; but the talc slate in the footwall country, which is impregnated with sulphurets, carries values to a width of forty feet and over, similar to the Utica Stickle Mines, and which will pay to mill. In fact, on the Reserve Mine, ore was extracted in open cut work to a

width of one hundred feet, and milled at a profit. A green stone belt lies on the east side of the East lode, several hundred feet distant from the vein on the Adelaide mine on the Stanislaus river. Very rich telluride ores have been extracted from the Stanislaus Mine, and scientific investigation by mineralogists has failed to determine what kind of tellurium it really is. Assays made of this telluride of gold show a value of over \$10,000 per ton.



THE UTICA HOIST.

COMPRESSED AIR IN CALAVERAS COUNTY

Calaveras county possesses not only one but both of the largest Air Compressors in the State of California. The first one was installed at the Utica Mine, at Angels Camp, and consists of four 18x24-in. air cylinders, placed tandem to each other and driven from a water wheel under a head of about 565 feet. This compressor furnishes air for the rock drills and pumps of the Utica Mine.

The second Compressor has been recently installed at the Gwin Mine, in Calaveras county, and is an extremely interesting and economic installation of compressed air for mining purposes.

The situation of the Gwin Mine is such that it naturally suggested a power plant either electrical or compressed air. The Gwin Mine is situated in a canyon, about 5,000 feet distant from the Mokelumne River and 425 feet vertically therefrom.

The mechanical operations at the Gwin Mine are actuated by water power from a ditch running on the hillside above the mine, at an elevation of somewhat over 400 feet. This water drives the 40-stamp mill, and the hoisting works at the new shaft, and supplies such other uses of the water as are necessary around the mine, amounting in all to about 230 inches.

The Gwin mine shaft is a new vertical shaft, about 1450 feet deep and it is about 100 feet distant from the old shaft, through which a veritable bonanza was taken by the early day miners.

The drifts from the new shaft have approached dangerously near the old workings and I believe in some instances the new drifts are beneath the old mine which has been full of water for the last twenty years.

The desirability of draining this mine, both for matters of safety, and to turn it into an air shaft, brought forward the problem of utilizing the tail-water running from the various workings about the mine down the canyon to the Mokelumne river. It was evident that here was a splendid opportunity to pick up a considerable amount of power with the simple cost of the investment in the plant. 230 inches of water falling the distance to the Mokelumne river has a potential of not less than 230 h. p., just about the same amount that was used around the mine. After taking estimates and bids and considering the situation in general, the Gwin Mine Development Co. decided upon compressed air as being the most flexible power for the purposes intended, and the installation has been completed in what I believe to be a thoroughly satisfactory manner to the company. The water is first caught up from the mill and hoisting works, in a large redwood tank, holding 75,000 gallons, situated just below the tail water of the mill. From this tank a 15-inch steel pipe conveys the water 4500 feet to the power house, situated on the bank of the Mokelumne river. It is here applied under a pressure of about 181 pounds to the square inch, upon a Pelton water wheel nineteen feet in diameter, making eighty revolutions per minute at its normal speed.

The compressor is the same size as the Utica, viz., a Rix Horizontal Compressor, having four 18x24 air cylinders. The last two cylinders, however, have not been placed in position, the work at present simply requiring the use of the

first two cylinders. The air is compressed to about 85 pounds to the inch and carried through 6500 feet of 6-inch steel pipe to the old shaft, following the old pipe line grade. At the old shaft the air enters two large air receivers four feet in diameter and twenty feet long each, and is distributed from there down the shaft to the pumps, and to a double 10-inch hoist which was installed at the same time for the purpose of clearing out the old shaft.

The water from the old shaft stood within a few feet of the surface. A Worthington Duplex Sinking Pump, of a capacity of 150 gallons a minute, was put to work as soon as the compressor plant started, and at the present time of writing the water has been lowered considerably below the 600 foot level, and the large compound Worthington station pump is about in position and ready to start. This compound pump will handle all the water of the 600, and the sinking pump will follow along down the shaft delivering water to the 600 foot level. At the 1200 foot level there will be another station pump from the upper station to handle the water, which accumulates below the upper station.

The pumps started on or about November 8th of last year, and have been continuously working during these past ninety days, and the ease with which the whole work has been accomplished and the small amount of power it comparatively has taken, should be good evidence that compressed air is the proper thing for this character of work.

The compressor has been making an average of from 30 to 45 revolutions, increasing gradually as the sinking pump lowered the water. At the same time the hoist has been doing the work of clearing out the shaft, lowering new timbers,

men, pipes, pumps, etc. There is an ample quantity of power, generously applied, and there has not been in connection with this work the usual delays, mishaps and disappointments.

It is the intention of the Mine to reheat the air in the compound pump at the 600 foot level, and also to reheat the air for the hoist, or any other work it may be compelled to do, so as to make the matter an economical one at the time when the compressor reaches somewhere the limit of its capacity. This, however, will be somewhere in the future.

After the old shaft is drained and connection made with the new shaft, it will be used as an air shaft and compressed air will be used to run the main hoist of the mine, thus saving the water now being purchased for that purpose. There is no appreciable loss from one end of this system to the other, the gauges registering practically the same. There is, however, a slight difference, due principally to the difference of elevation.

It would seem to me, that an inspection of this plant by mine owners who have water power and contemplate using it in their mine, would satisfy them as to its desirability and utility.

The economic power is not that power which shows a high rate of economy for a two minute measurement; it is the power which costs less for a 24-hour service wherein a proper credit has been given for its utility. No power can be made to yield a high economy until it is properly used. A tangential water wheel must be speeded to 50 per cent of the spouting velocity of the water in order to give the 85 per cent efficiency claimed by the builders, and it would be as sensible to judge of the economy of this wheel when running at 25 per cent of the spouting velocity as it would to

judge of the economy of compressed air where it is not used expansively. Unfortunately, utility demands the service of air at all prices and hazards, and while the results have justified the means, still a little patience and investigation might result, where the inauguration of a compressed air plant is concerned, in obtaining a plant that, over and beyond the question of utility, would be extremely economical. Perhaps it is because air, as we find it in Nature, is so abundant and free, that it suggests the carelessness with which it is used in ordinary operations, but certain it is that if more air is wanted underground, the compressor is speeded to all it will stand, but little thought is given to stopping the waste in the air being used. It is only recently that mine owners are beginning to ask about economic machines for the use of compressed air.

In the installation of a compressed air plant, the duty of the purchaser does not end in selecting a compressor which he believes to be best adapted for his purposes. His duty really begins when he commences to install it and to use the air which it supplies. There cannot be a difference of more than ten per cent between the relative economies of most of the compressors manufactured by the standard builders throughout the United States, but there can be a difference of more than this amount made in simply piping the compressor to the receivers, if it is done improperly, let alone sending the air two or three thousand feet underground.

Too much attention cannot be properly given to the installation of the plant. A little less money spent on the compressor, and a little more on the receivers would often give a better power result.

It has been considered good practice

until recently, to establish with a single 10-inch compressor an air receiver 3 feet in diameter by 12 feet long, holding about 85 cubic feet, but this is far too small as a general rule, and with this compressor there should go a receiver about 4 feet in diameter by 20 feet long, holding 240 cubic feet, which is about three times the former capacity. The difference between these two receivers would enable the 10-inch compressor that is limited ordinarily to driving two rock drills, to have a capacity for about three.

It is an important thing to have large conduits throughout the mine, and down the shaft, and no one-inch pipe conveying air.

The difference in economy between using air cold and reheated is about 50 per cent. This tells its own story, and if by using air cold one has nearly reached his power limit, by properly reheating it can be increased to that extent.

Many suppose that reheating cannot be done underground. A very little investigation into the matter will show that there are few mines in the State, where underground reheating cannot be successfully installed. There are mines in this State reheating at 1600 feet, and at a thousand feet, and many below five hundred feet. This reheating can either be done with oil, or coke or wood, depending entirely upon the nature of the air currents in the mine. The users of compressed air for pumping in mines have been compelled to employ the direct acting steam pump, which is an extremely wasteful engine, because the compound pump would freeze up. In the present method of reheating, compound pumps can easily be employed, saving fully 50 per cent

of the air used for actuating them.

The use of compressed air in mines is constantly expanded. A very interesting and novel proposition is now being demonstrated by the writer, for one of the principal mines in this State, on the subject of mine haulage. Compressed air

motors will be installed on the 2,000, 1,800 and 1,600 ft. levels of the mine, to haul trains of ore cars from the face of the workings about one-half mile to the shaft, reducing the expense of hauling, from twenty-five cents per ton to five cents.



HEADQUARTERS OF MOKELUMNE RIVER.

WATER SUPPLY

Water forms the agency of greater utility than any other in mining operations. It is equally indispensable in the primitive processes of panning and cradling, as it is in the more modern methods of hydraulicing, concentrating or chlorinating. More than these, it at once furnishes power for the operation of hoists, rock breakers, stamps, concentrators, and every other power consuming device about a mill, in addition to its absolute imperative uses for domestic irrigation, or fire protection purposes. Indeed, mining forms no exception to the inflexible truth that existence without water is impossible.

Calaveras county, with its many

square miles of area, constitutes a territory that is considerably diversified topographically, and within its confines the low lands of the valley, the rolling country of the foothills, or the wild rugged grandeur of the mighty Sierras. It has the finest of farm and orchard lands, the densest of forests, and, during the months of Summer and Fall, what appears to be the dryest and most barren of soils, and indeed, its diversification is such, that while some portions of the country have only sufficient water for domestic purposes, its supply being inadequate for power, other and more favorable sections of the county have an abundance of water for every imaginable pur-

pose and, better still, the water is carried in canals that are uniformly run on the crests of mountain ridges, so as to enable every point of land to be reached and so as to be in a position to furnish water at the highest possible head for power purposes. The northern border of Calaveras county, which is separated from Amador county by the Mokelumne river, is the most fortunate of any section of the county in the matter of water supply, and it is this section especially that is noted. In fact, from many points of view, the water supply of northern Calaveras county seems ideal, particularly in the feature just presented, of always delivering water at maximum possible head, as well as in the absolute permanency and reliability of supply. Practically the whole of central and northern California derives its water directly or indirectly from the Sierra Nevadas, and the portion of Calaveras county noted, secures its water supply from the head waters of the Mokelumne and Calaveras rivers, two of the largest water ways of California. In the northern portion of the county, bounded by the Mokelumne river, the Mokelumne and Campo Seco Canal and Mining Company has a system of ditches supplying water to that section of the county bounded by the Mokelumne river on the north, the Calaveras river on the south, Sandy Gulch district on the east and Camanche district on the west. The main canal of the system is forty miles long and extends from the south fork of the Mokelumne river a half mile below Sawyer's bridge to Camanche, and the lateral ditches run southerly to all the mining districts, such as Rich Gulch, Mokelumne Hill, Gwin Mine, Central Hill, Pine Peak, Campo Seco, Valley Springs and Camanche, in all covering over sixty-five miles of ditches.

By this, one can see the whole northern district of Calaveras county can readily be supplied with that most necessary power and element in mining. The Sandy Gulch district is so located, that they draw their supply from a separate system heading far up in the mountains, and near the headwaters of the middle fork of the Mokelumne river and is connected to the main canal by dropping the water through the Licking Fork and South Fork of the Mokelumne, this system acting as a feeder to the main canal.

The Mokelumne and Campo Seco Canal and Mining Co. is one of the fixtures of Calaveras county, and one of the oldest water companies in the State, having been incorporated in 1858 by a company of old pioneers who have made the history of the county and State. Mr. S. Foorman has been president and manager of the company for many years, and under his supervision has been due the forty years of continued activity and improvement to this most essential power in the county. This series of reservoirs and system of ditches have been so constructed that the supply of water is continuous the year around, and the importance of the water rights held being the first and amounting to more than 3000 inches, can readily be appreciated by a mining community. The main canal being situated on the south slope of the Mokelumne ridge and being surveyed on a very high grade makes it most advantageous for mines situated in the district traversed by the same, as it enables them to use water at a very nominal cost. As, for example, they have 650 feet fall at the Esperanza or Old Boston Mine and almost 400 feet at the Gwin Mine. The surrounding districts supplied by the lateral ditches, are equally favored, and, in brief, it is very conserva-

tive to state, that the canals of the system are at such an elevation, that the use of water therefrom by mines for power purposes, will be at such a head, that a consumption of but one and a half inches of water will deliver one horse power as an average condition. Of course, water is sold by the miner's inch regardless of head, hence the location of a mine with reference to the canal, determines the consumption of water that will be required to deliver the power necessary

a most interesting example of this secondary use of water is found at the Gwin Mine, fully described in Mr. Rix's article elsewhere in this pamphlet, and from which it will be seen that water from the main canal operates the mine and mill at a head of about 400 feet, and that this water is again picked up and piped further down the hill to the Mokelumne river, where the air compressor is driven by water wheels at a head of about 400 feet. This is the greatest head at pres-



A RESERVOIR HIGH UP IN THE SIERRAS.

to operate it, and for this reason a definite idea as to the cost of water power cannot be given until the local conditions are determined. As stated, however, consumption of one and a half miner's inches per horsepower delivered, is believed to be a fair estimate on the conditions which prevail, and oftimes the re-use of water may be done to the great advantage of the mine owner, and

ent utilized in northern Calaveras county, and being, as one might say, in two units of about 400 feet, the elevation of the main canal at the Gwin Mine is such as to give a head of about 800 feet. Elsewhere on the system, heads of about 1000 feet and over are available and will be utilized for power purposes when necessity demands.



THE USE OF OREGON PINE IN MINING OPERATIONS

The first step in the evolution of improved methods in mining, was the rocker; then followed the sluice-box, the material for both being whip-sawed at great expense from timber adjoining the claim; these being used on the surface of the ground, and having no weight to sustain, excepting their own, generally lasted as long as the claim paid. After the surface diggings were exhausted, miners naturally turned to the gold bearing quartz veins as a field promising great returns for the amount invested. In the pursuance of this theory, the shafts were timbered and lagged with hewn or sawn timbers, cut from trees in the immediate vicinity; these trees, in the majority of cases, being the "pinus ponderosa," commonly known as bull pine; the mines being located in the heart of the Sierra Nevada mountains, with no method of communication with the valley and coast country save by wagon, the thought very naturally never occurred to the operators, to ascertain if there was any other timber more suitable for the purpose, having more strength, more life, and in fact, more durability in every way.

In the majority of cases, they found the vein growing richer as the mine be-

came deeper, and as a consequence, the timbering at the head of the shaft, supposedly put in place temporarily, was found too light, or else decayed in from one to two years, necessitating re-timbering at a great expense. For stoping and tunnels, round timbers were used, and are in use at the present time, although their life is of short duration, and in loose, shaley or schistose rocks at any great depth, they have to be very massive, and set close together, in order to carry their load. A round timber, even though a small one, is a slippery and awkward thing to handle, and when one is from 20 inches to 24 inches in diameter, the difficulty of handling is correspondingly greater.

Quite a number of mining companies are still using these old-time methods from the probable reason that the value of the Douglas spruce or "pseudotsuga douglasii," commonly known as Oregon pine, has never been presented to their notice in such a manner as to sufficiently impress them with the economy of using it for their permanent work.

The purpose of this article is to demonstrate the superior quality of Oregon pine, over any other available timber on the Pacific Coast or elsewhere, for permanent use in mining operations.

ABSTRACT OF THE RESULTS OF TESTS UPON BULL PINE (PINUS PONDEROSA) AND UPON OREGON PINE (DOUGLAS SPRUCE OR PSEUDOTSUGA DOUGLASTI).

(Made by the University of California.)

1—MODULUS OF STRENGTH AT ELASTIC LIMIT.		Average Results
a. Bull Pine, seasoned log and sawed timber.....	3 expts.	4,500 lbs. to sq. in.
b. Bull Pine, green log.....	1 "	4,000 " "
c. Oregon Pine.....	4 "	7,750 " "
2—MODULUS OF STRENGTH AT RUPTURE.		
a. Bull Pine, seasoned log and sawed timber.....	3 "	5,400 " "
b. Bull Pine, green log.....	1 "	4,580 " "
c. Oregon Pine.....	4 "	10,180 " "
3—MODULUS OF ELASTICITY.		
a. Bull Pine, seasoned log and sawed timber.....	3 "	1,104,200 " "
b. Bull Pine, green log.....	1 "	836,300 " "
c. Oregon Pine.....	4 "	2,449,200 " "

4—PER CENTAGE OF MOISTURE.			
a. Bull Pine, seasoned log and sawed timber.....	3	"23.28 per cent
b. Bull Pine, green log.....	1	"69.60 "
c. Oregon Pine.....	4	"25.08 "
5—WEIGHT PER CUBIC FOOT.			
a. Bull Pine, seasoned log and sawed timber.....	3	"31.00 lbs.
b. Bull Pine, green log.....	1	"45.80 "
c. Oregon Pine.....	4	"40.71 "
II. TENSION TESTS			
a. Bull Pine, seasoned log.....	8	"	5,332 lbs. to sq. inch.
b. Bull Pine, green log.....	6	"	9,083 " "
c. Oregon Pine.....	5	"	17,049 " "
III. CRUSHING ENDWISE TESTS			
a. Bull Pine, seasoned log.....	11	"	3,335 " "
b. Bull Pine, green log.....	5	"	2,943 " "
c. Oregon Pine.....	8	"	5,849 " "
IV. CRUSHING ACROSS THE GRAIN TESTS			
1—CRUSHING 3 PER CENT OF THE HEIGHT.			
a. Bull Pine, seasoned log.....	12	"	598 " "
b. Bull Pine, green log.....	10	"	356 " "
c. Oregon Pine.....	8	"	741 " "
2—CRUSHING 15 PER CENT OF THE HEIGHT.			
a. Bull Pine, seasoned log.....	12	"	908 " "
b. Bull Pine, green log.....	10	"	594 " "
c. Oregon Pine.....	8	"	1,048 " "
V. LONGITUDINAL SHEAR			
a. Bull Pine, seasoned log.....	30	"	327 " "
b. Bull Pine, green log.....	21	"	375 " "
c. Oregon Pine.....	16	"	574 " "

By carefully examining this table, it will be seen that the Oregon pine will stand, in most cases, double the load of the bull pine, which in turn, demonstrates that additional cost for the Oregon pine would be more than made up by the decreased size of timber required to stand a certain strain, and as an illustration of this, prominent mining men are now using 14x14 sawed Oregon pine timbers, where they formerly used round timbers of bull pine 22 inches and 24 inches in diameter.

Among the first to use Oregon pine for their operations was the Gwin Mining and Development Company of Calaveras County, who sunk a three-compartment shaft 1300 feet before they attempted to take out any ore for milling purposes. Others followed in rapid succession, and it is safe to say that the majority of the leading mining companies in Mariposa, Tuolumne, Calaveras and Amador coun-

ties, use no other timber in their mining operations.

Up to two or three years ago, there was a reasonable excuse and argument against the use of Oregon pine, on account of the great cost of freighting it from terminal railroad points in the valley to the mines. This obstacle has now been done away with, as lumber companies with vast holdings have established distributing points at the terminals of all mountain railroads, and can on short notice supply any size timber up to a mortar block, at a very slight advance in price over the mountain or bull pine.

The idea of this article, is to bring to the notice of mining men the economic advantages of the use of Oregon pine, which will stand the closest scrutiny and the hardest tests, and one trial will convince the user thereof of its superior value over any other known timber for mining operations.

The grade of Oregon pine best suited for mining purposes is known to the trade as merchantable or No. 1 building lumber, and does not require the service of a lumber expert to determine whether or no a timber is of standard grade and suitable for a certain purpose.

Admitting the lasting quality of the material, the next question to answer is what constitutes merchantable Oregon pine? Coarse grain or wide spaces showing between the annual rings is not proof positive that a timber is lacking in strength, unless, as sometimes happens, the growth between the rings is of a spongy nature, lacking fibre and easily picked out. When Oregon pine timbers 8x6 and up have been exposed to the action of the weather for any considerable length of time, they become what is termed "season-checked." This does not impair the strength, when the checks are parallel with the grain; where the checkcuts across the grain, it is in reality a feature produced when the tree was felled, and the timber would be no stronger than the weakest point, which would be that portion not touched by the fracture. Pitch seams affect the strength of a timber in the same manner as "season checks," and where they are not very long, and run parallel with the grain they do not in any way affect the strength. Tight knots are allowable in this grade, and small loose knots when they do not materially affect the strength of timber. Large loose or rotten knots or fractures which materially impair the strength, should condemn a timber at once, and it should not be used under any circumstances. It does not matter what size trees the lumber is cut from, or in other words, whether the grain of the timber or plank is slash or vertical,

as long as the grain shows the length of the piece. Cross grain, or grain that shows both ends running out of the piece or opposite even at intervals of 6 inches, is not desirable and could not be used for any purpose excepting logging.

Mining companies who are constantly extending their works should keep at least six months' supply of lumber on hand, and when same is to be exposed to the weather for any considerable period, it is advisable to stick same, allowing a free circulation of air, and the ends should be painted with "Prince's Metallic and Fish Oil," which will to a great extent prevent checking. Where timbers are constantly exposed to dripping water or clouds of steam, it is advisable to dip same either in coal tar or a composition of which asphaltum is the main ingredient. By so doing the pores are closed so that no moisture of any kind can enter the wood. This is only necessary in extreme cases, as under ordinary circumstances timber will last the lifetime of a mine. It is, however, advisable to heed the ancient proverb, "An ounce of prevention is worth a pound of cure," and a brick or stone furnace with an iron vat and derrick to be used for dipping purposes could be erected at a very small expense, and it would permanently insure material thus treated from decay, as Oregon pine has never been known to decay or dry rot from the interior of the timber.

The chemical treatment of structural timber has been described by Mr. John D. Isaacs, of the Southern Pacific Company, and will be found in a pamphlet written by him and published by the State Minerologist in the thirteenth report, 1896.

EXTRACT FROM ELECTRICITY AND MINING

Though Calaveras County is bountifully supplied with electric power from the electric plant of the Blue Lakes Water Company, situated on the Mokelumne River, and although several water powers are eligible for electric transmission plants, there is but one electric station of importance within the county, and this is that of the Utica Mining Company of Angels Camp. This plant,

world. The company owns the water power of 2000 miners inches, from which is obtained a fall of 570 feet in 1750 feet of pipe line. The present electrical plant uses about 150 inches of water of the 3000 horse power available. The power derived from a 6-foot tangential Dodd wheel is belted to a 1500-light 2500-volt Westinghouse alternator, whence the current is carried over a cir-



BUILDINGS AT BLUE LAKE CITY.

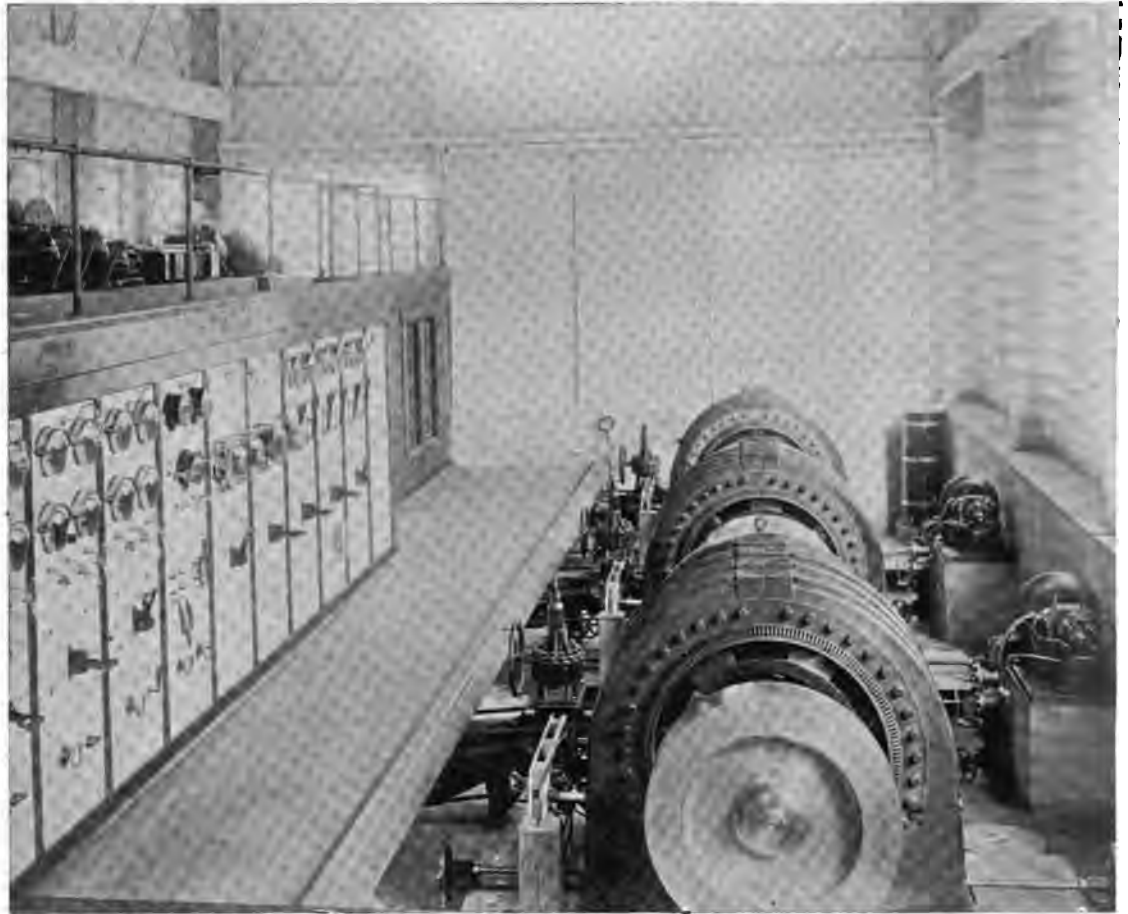
which is illustrated herewith, was installed in January, 1895, largely for the purpose of deriving experience in the application of electricity for lighting and power purposes in the Utica Mine before making expenditures that would be necessary for the installation of a new plant that would fully satisfy the company's requirements. Though this original plant is simple in the extreme, it has fulfilled its purposes, and will probably be shortly superseded by one of the largest mining electrical installations in the

cuit of 1 B. & S. gauge, bare copper wire to the mine situated about 1000 feet below the plant, where it used for lighting purposes, there being 25 alternating current constant potential arc lamps and 1250 incandescents. The exciter is driven by a separate 12-inch Dodd wheel. It is probable that at an early date the large installation referred to will be undertaken, when 3000 horsepower will be generated and transmitted to the mine and thereabouts. The length of transmission will be about 8½ miles,

and the system will consist of 2-phase generation, 3-phase transmission, and various distributions. Five hundred horse-power will be utilized in air compression, two 20-stamp mills will require 150 horse-power each, and one 250-

horse-power rotary transformer will generate low potential direct current to be used for power purposes down the shaft. Six 500 horse-power units to operate in parallel or singly, as deemed advisable, will be installed, and the transmission will be at 10,000 volts. In addition to the

purposes named, two sawmills, together with machine shops, rock breakers, etc., will be operated by electric power. The entire output of the transmission plant just described will, as stated, be used in and about the Utica Mine; but



INTERIOR OF BLUE LAKES ELECTRIC PLANT.

horse-power rotary transformer will generate low potential direct current to be used for power purposes down the shaft. Six 500 horse-power units to operate in parallel or singly, as deemed advisable, will be installed, and the transmission will be at 10,000 volts. In addition to the

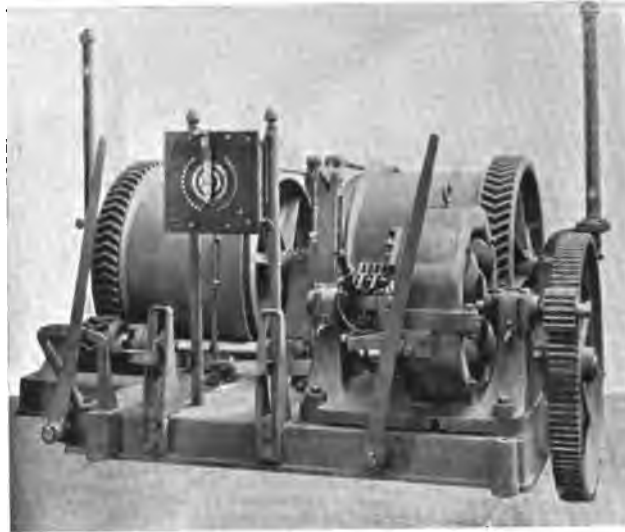
needs of the other mining interests throughout Calaveras County for electric power are amply satisfied by the electric transmission line of the California Exploration Company, which is supplied with electric current from the power plant of the Blue Lakes Water Com-

pany by contract. This plant was exhaustively described in a profusely illustrated and authorized article appearing in the Journal of Electricity for October, 1896. In general, however, it consists of three 600 horse-power, Stanley, 2-phase inductor type generators, driven by 40-inch Doble tangential water wheels operated under a head of 1042 feet, water for the same being taken from the Amador Canal by the Blue Lakes Water Company.

The cost of mining development in

electricity as the most feasible power, and entered into a thirty years' contract with the Blue Lakes Water Company, under which the Exploration Company has the exclusive right for the transmission and distribution of electric power and light from the Blue Lakes plant in Calaveras County. This contract contemplates the use of from 1000 horse-power up, and really forms the basis for the building of the Blue Lakes plant.

The Calaveras pole line is of the most substantial type. Thirty-five foot se-



FRONT VIEW OF THE GOTTSCHALK HOIST.

Calaveras County has been high on account of the expense of fuel, which ranges from \$4.50 to \$5.50 per cord, and without water power, and with high charges for wood, mine development has been possible only for wealthy corporations, but after an exhaustive study of the means available for furnishing power for the exploration and operation of its mines, and after a thorough canvass of the various water powers available, the California Exploration Company resolved upon

lected redwood poles are used throughout, measuring 10x10 at the butt by 6x6 at the top, and being sunk 6 feet in the ground. Two 22-inch cross arms, gained 18 inches between centers, are used, and at curves these cross arms are doubled and framed together. All poles on curves are firmly guyed to inverted "T" guy stubs consisting generally of 8x8 redwood. Two No. 3 B. & S. gauge wires are placed on each cross car at a separation of 18 inches, and of the 4 wires car-

ried by the 2 cross arms, the diagonal wires are phases. Locke triple petticoat china insulators are used throughout. The line is not transposed. At the tops of the poles, supported by porcelain knobs, and grounded at irregular intervals, is run a close-barbed galvanized iron fence wire. This ground wire continues over the entire pole line, and its object is to facilitate the grounding and dispersion of static charges, thereby minimizing liability of lightning stroke. From the power house, which is situa-

line continues on a distance of 7.05 miles to the Bund Mine, to which the high potential circuit is now completed. The total length of the Exploration Company's transmission line is at present 19.11 miles, and in all probability the circuit will soon be extended to Angels Camp, which is about five miles beyond the Bund mine.

One of the most interesting electrical features in connection with the transmission circuit of the California Exploration Company is the mode of operating the



REAR VIEW OF THE GOTTSCHALK HOIST.

ted on the north side of the Mokelumne River, the line is taken up a mountain side for a distance of one mile to the Exploration Company's sub-station in Mokelumne Hill, in which town there is nine-tenths of a mile of pole line for lighting distribution purposes. The next sub-station is in the town of San Andreas, which is 7.7 miles distant by way of the pole line from the sub-station in Mokelumne Hill. The town lighting in San Andreas embraces 2.03 miles of pole lines for low tension distribution, and from the sub-station the transmission

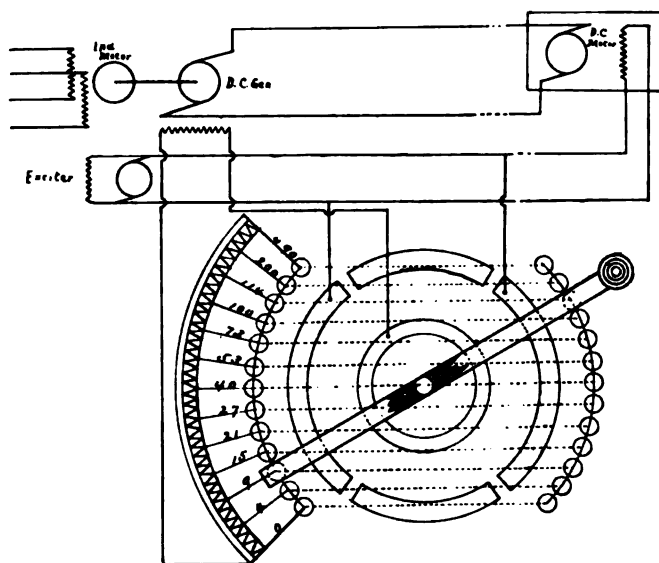
double compartment electric hoist in operation at the Gottschalk mine near San Andreas. This hoisting installation is so unique that it is believed a detailed technical description of its modus operandi will be of interest.

A twenty horse-power General Electric two-phase induction motor is direct connected to a 15-kilowatt, direct current multipolar generator, having 125-volt fields and a 500-volt armature and from the shaft of which is belted a one-kilowatt 125-volt shunt wound, bi-polar exciter. The equipment thus far de-

scribed, together with the necessary step-down transformers, is placed in a small sub-station at the entrance of the mine tunnel, and within the mine is a 20 horse-power, multipolar, direct current motor, having fields and armature corresponding to those of the generator, and which is geared through a double reduction to a two-drum hoist as shown in the accompanying illustrations. Conveniently located on the hoist is a controlling field regulator by means of

direct current generator, such current being of either polarity as required and of a wide range of amperage due to the introduction of a graduated resistance into the exciting current. The value of this resistance in ohms is expressed on the diagram.

Inasmuch as the fields of the motor are under constant excitation at a fixed polarity, and as the armature of the generator is permanently connected with that of the hoist, and as, moreover, the



ELECTRICAL CONNECTIONS OF THE GOTTSCHALK HOIST.

which, as will be detailed, perfect control of the skips is had.

The circuit connections of the equipment appear in the accompanying outline diagram, in which the field regulator is shown in exaggerated size that its construction may be more fully understood. From this diagram it is clear that the shunt wound exciter maintains a constant excitation of the fields of the motor and that from it also derived current for the excitation of the fields of the

generator is normally running with no field, it is evident that the creation of any field in the generator will be instantly manifested in the armature of the hoisting motor and also that the direction of rotation of the motor armature will depend upon the polarity of excitation of the generator fields. These conditions are effected with the utmost celerity by the simple manipulation of the reversing field regulator, which is, as stated, merely a pole changing and resistance

device controlling the generator fields. The motor gearing engages with either drum at will and the usual mechanical band breaks are provided to hold the skip at any level and in lowering. The hoist has a capacity of raising 2,000 pounds net, at a speed of 200 feet per

minute. Whatever may be said of the first cost, complication or efficiency of the Gottschalk hoist, it is certain that in matters of ease of control and reliability of operation, it stands pre-eminently superior to any polyphase driven two-drum hoist yet installed in the West.



THE GOTTSCHALK ELECTRIC HOIST.

THE COPPER BELT

Besides the gold mines, the developments on the copper belt in metamorphic slates to the west of the gold belt marks quite a feature of the mining interests of the county, and show what may be looked for in the future, when the price of this metal stands in better relation to its cost of production.

In visiting Copperopolis, where extensive copper mines and reduction works are located, the road from the south crossing Reynold's Ferry over the Stanislaus was traveled. Entering the county at the Bear Mountain range, which in its northerly trend separates the gold-

bearing slates around Angel Camp, from the copper-bearing ones of Copperopolis and Campo Seco, the road from the river bank climbs up and across this range, and up Black Creek to the depression running parallel with the mountain range on which the mines and town of Copperopolis are situated. The belt of slates running northwest and southwest that form the country rock lies from 8 to 12 miles west of the Mother Lode proper, dipping almost vertical and showing a distinct iron head by which the copper-bearing strata can be distinctly traced, which is found to contain pure sulphide

ores, often in large, solid masses. Following it north, it arrives out to the west, where it is bounded by serpentine north and west of which another small gold-bearing belt is found, which indicates that there are paying gold veins west of the Mother Lode belt. One peculiarity of these copper ores around Copperopolis, is the fact that they contain neither gold nor silver in their make-up, while further north at the Campo Seco mines, where the copper belt and the gold belt approach one another closer, the ores contain both. Along the croppings, some carbonate ore, also red oxide and even native copper in small quantities, are occasionally found, but the main masses are sulphides. A series of shafts have been sunk, but the depth has never reached more than 200 feet. The poorer ores are piled in large heaps, and roasted in the open air and leached. The saturated lead waters are conveyed to tanks. With the liquor a certain amount of scrap-sheet iron is charged. After a sufficient length of time, which depends on the degree of saturation of the copper solution, the man holes of the drum are opened, and the mass discharged through wire screens placed over them, into tanks immediately below, the scrap iron being detained on the screens.

From the tanks, the current copper that had formed in the drum, after settling, is shovelled onto heated drying floors, and stirred till the moisture is evaporated, when it is sacked and shipped to be used for paint.

The matter is passed through a crusher before being sacked.

The copper mine at Campo Seco called Penn Chemical Works, has not been worked for some years, although

quantities of good grade copper ore exist there. Under the superintendence of Mr. C. Borger, the works were systematically arranged with a view to permanency, but have been idle now for some time.

Two and a half miles southwest of Copperopolis, after crossing an extensive belt of serpentine, a small group of gold mines is reached, and upon some of them, particularly the Pine Log Mine, considerable development has been done.

Considerable work has also been done on the Plymouth at Jenny Lind.

The Napoleon mine is situated near Telegraph City, Calaveras county, Cal., eight miles west of Copperopolis.

This famous copper mine was worked in 1861, 1862, 1863, 1864 and 1865. Thousands and tens of thousands of tons good No. 1 shipping ore were hauled to Stockton, Cal., by mule teams, thence shipped to Swansea, England. Notwithstanding this heavy expense in shipping and extracting the ore when labor was very high and scarce, this mine paid a handsome dividend to the owners. Shaft is down perpendicular about 500 feet and numerous levels run in every direction. It is said by those who are well acquainted with property that there still remains thousands of tons of good shipping ore that carries a large percentage in copper, as well as gold and silver. It has remained idle 32 years. Owned by R. B. Packs, Copperopolis, Calaveras Co., Cal., (U. S. Patent for 16 acres).

The Star and Excelsior mine is situated near Telegraph City, eight miles west of Copperopolis in Calaveras County, California. Work was commenced on this mine in 1861, and worked more or less until 1867. Shaft

125 feet and 80 feet deep, perpendicular. One tunnel 225 feet, all in No. 1 condition and good working order. This mine prospects well in copper, gold and silver. Average width of vein, about 12

feet. Title U. S. Patent, 20 acres. Owing to lack of capital, this mine remains idle. Owned by J. H. B. Wellman, P. O. address, Copperopolis, Calaveras County, California.

LIST OF MINES SENDING ORE TO THE MINING EXHIBIT

MINE.	OWNER.	ADDRESS.
Gwin.	Gwin Mine Developing Co.	Gwin.
South Paloma.	South Paloma Co.	Paloma.
Esperanza.	Esperanza Mining Co.	Mokelumne Hill.
Utica-Stickels.	Utica Mining Co.	Angels Camp.
Hobart.	Wilson & Binum.	San Andreas.
Schirley Queen.	Oxindine & Hendsch.	Copperopolis.
Blue Bird.	R. B. Parks.	Copperopolis.
Star and Excelsior.	Hank Willman.	Copperopolis.
Nye Slate Quarry.	B. P. Nye.	Campo Seco.
Wise.	Alex. Wise.	Valley Springs.
Carey.	Manus & Carey.	West Point.
Maria.	A. G. Suaraz.	San Andreas.
McCormick.	J. J. McCormick.	Copperopolis.
Watson.	Wm. and J. B. Watson.	Copperopolis.
Weich.	Weich and Mobley Bros.	Milton.
Linderaxa.	Vandell & Tinan.	Mokelumne Hill.
Bulger Consolidated.		
Golden West.	J. M. Bailey.	San Francisco.
Golden Bell.		
Sugar Pine.	J. McClay.	Murphys.
Sand Stone.	E. A. Hill (Mrs.).	Telegraph City.
Coralie.	H. W. H. Penniman.	San Andreas.
Midway.	N. M. Flower.	Copperopolis.
Excelsior.	Myers & Carlon.	Angels.
Gypsum.	E. Thompson.	Murphys.
Bonanza.	W. H. Maltman.	Nassau.
Secret Treasure.	R. Hansen.	Esmeralda.
Grace Darling.	E. Moore.	Esmeralda.
Sheep Ranch.	Haggin & Tevis.	San Francisco.
Gold Hill.	Sanders & Saltman.	Esmeralda.
Philopoena and Rose.	(Guerin & Sanders.	Esmeralda.
Grape Brandy.	Smith & Sanders.	Esmeralda.
Red Hill.	W. Moyle.	Vallecito.
Blue Fox.	Fricot & Moore.	San Andreas.
Midwinter.	Board Bros.	Milton.
Pumice.	W. Titherington.	Valley Springs.
Greek.	M. S. Feinberg.	San Francisco.
Gopher-Canepa.	J. Canepa.	Carson Hill.
Chaparel Hill.	W. Hamilton.	San Francisco.
Quail Hill.	Eagle C. & G. M. Co.	Copperopolis.
Pioneer.	E. McCarthy.	Copperopolis.
Napoleon C. G. & S. M. Co.	R. B. Parks.	Copperopolis.
Black Marble Quarry.	E. Caldwell.	Valley Springs.
Eureka.		
Bonanza.	W. F. and E. L. Binum.	San Andreas.
Gray Eagle.	F. Vanciel.	Milton.
Smuggler.	Mibberbauer & Carlison.	West Point.
Sperry Iron.	Sperry.	Murphys.
Flour Sack.	J. Fincke.	San Francisco.
Cal. Ophir.	E. K. Stevenot.	Carson Hill.
Silver Queen.	J. Klein.	West Point.

MINE.	OWNER.	ADDRESS.
Hamby.	J. Fincke.	San Francisco.
Marble.	Page Cutting Quarry.	Murphys.
Good-enough Slate.	M. M. Flower.	Copperopolis.
Burgess.	Cal. Exploration Co., Limited.	San Andreas.
Ford.	Ford Mining Co.	San Andreas.
Royal Consolidated.	Wilbur, Castle & Peters.	Copperopolis.
Big Bonanza.	W. M. Womble.	Copperopolis.
Keystone.	Keystone M. Co.	Angels.
Gold Hill.	Gold Hill M. Co.	Angels.
Mountain King.	W. R. Womble.	Copperopolis.
Vall. Sp'gs Sandst'n Quar.		
Curtis Consolidated.	Curtis Cons. M. Co.	Angels.
Great Western.	Scieffard & Baumbogger.	Angels.
Reserve.	Ralston & Grayson.	San Francisco.
Alison.	Alison & Merack.	Angels.
Lava B—stone.	J. B. Gasola.	Angels.
Bund.	Cal. Exploration Co., Limited.	San Andreas.
Rochester.	D. Fricot.	San Andreas.
Kaolin.	J. Jackson.	Wallace.
Gold Crystal.	Redmond & Thompson.	West Point.
Hog Pen.	E. Peachy.	Angels.
Blood.	H. S. Blood.	Angels.
German Ridge.	Wm. Steffler.	San Andreas.
Hill Top.	J. D. McCarthy.	Copperopolis.
Gold Cliff.	Utica Mining Co.	Angels.
Jones.	San Justo.	Angels.
Treat Marble Quarry.	J. F. Treat.	San Andreas.
Lamphere.	Roanoke M. Co.	Mok. Hill.
Plymouth Rock.	Plymouth Rock M. Co.	Milton.
Lightner.	Lightner M. Co.	Angels.
Illinois.	B. K. Thorn.	San Andreas.
Valle.	Mrs. E. Valle.	San Andreas.
Belitha.	Lynch & Butts.	Angels.
Cape Horn.	M. Kennedy.	Copperopolis.
Tip Top.	J. H. Wells.	Forth Crossing.
Democrat.	P. Vinole.	Copperopolis.
Brunner.	F. Brunner.	Angels.
Bright Star.	Jackson Bros. & Bright.	North Branch.
Pine Log No. 2.	J. D. McCarthy.	Copperopolis.
Yellow Pine.	Vanciel Bros.	Milton.
Big Bonanza.	Oriole M. Co.	Angels.
Diamond Jack.	J. W. Howard.	Felix.
Bullion.	Binum, Wilson & Priestly.	San Andreas.
Live Oak.	Tiscornia & Co.	San Andreas.
Wanderer.	W. F. & E. L. Binum.	San Andreas.
Shady Side.	Doe & Jackson.	Railroad Flat.
Little Hero.	A. L. Wyllie.	San Andreas.
Keltz.	John Morgan.	San Francisco.
Roblea.	Baratini & Segale.	Murphys.
Morpheus.	E. G. Keen.	San Andreas.
Deep Gulch.	H. Dory.	Mok. Hill.
Minnie.	Coulter & Shims.	San Andreas.
Beatrice.	Matteson & Co.	Murphys.
Bigney.	Wm. Casey, Jr., & Co.	San Andreas.
Ella Mayer.	J. Hinsdorff.	Murphys.
Santa Cruz.	P. Vinole.	Copperopolis.
Big Horn.	Taylor Bros.	Murphys.
Alpine.	Wm. Casey, Jr.	San Andreas.
Blue Stain.	T. Logamoseno.	Mok. Hill.
Howard.	Sebreau & Co.	San Andreas.
Bald Hill.	Fred. Brunner.	Angels.
Scorpion.	C. Hanselt.	Murphys.
Mayflower.		Murphys.
Alameda.	Tramontin & Bozovich.	Esmeralda.
Summit Blue.	C. Hanselt.	Murphys.
Antelope.	D. A. Black.	Murphys.

MINE.	OWNER.	ADDRESS.
Mester.	J. Mester.	North Branch.
Washington.	W. F. and E. L. Binum.	San Andreas.
Elephant.	N. Barrow.	Murphys.
Manna.	Manna Bros.	Jesus Maria.
Mountain Boy.	Sargent & Crawford.	San Andreas.
Yaller Kid.	N. Barrow.	Murphys.
Sparrow Hawk.	A. Laidet.	Mok. Hill.
Garribaldi.	Cassinelli & Co.	San Andreas.
Mountain Top.	Stone Bros. & Bragger.	Copperopolis.
Sunny Side.	Cook & Lamb.	Railroad Flat.
Dalmazia.	Tramontin & Bozovich.	Esmeralda.
Culbertson.	Culbertson & Strough.	San Andreas.
Fomiston.	Fomiston G. M. Co.	West Point.
Lampson.	J. Lampson.	Railroad Flat.
Gold Run.	A. & J. Jackson.	North Branch.
Soapstone.		Murphys.
Carbonate of Lime.	Page Cutting.	Murphys.
Golden Star.	Binum, Brown & Wilson.	San Andreas.
Chrome Iron.	Page Cutting.	Murphys.
Mariturious.	J. D. McCarthy.	Copperopolis.
Starvation.	F. Maxwell.	San Andreas.
Swiss.	L. Ponge.	Railroad Flat.
Keystone.	W. T. Robinson.	Mok. Hill.
Exhibit of Minerals and Indian Relics,	Prof. J. W. Glass,	Nassau.
Green Mountain Quartz Crystals,	John E. Burton,	Mokelumne Hill.
Specimens from the "Brown Pocket,"	C. D. Fontana,	Copperopolis.
Specimens from Marteen Mine,	C. D. Fontana.	
Murrietta Knives, Indian Spear Head and Mark Twain Frogs,	J. Ayala,	Angels.
Gold-bearing Placer Specimen,	J. H. Southwick,	Milton.
Specimens from Gaston Hill, Rodesino Estate,		San Andreas.

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W. A. Gray.....	2.50.....	San Andreas
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Mrs. M. O'Connell.....	1.00.....	San Andreas
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T. A. Wilson.....	2.50.....	West Point
F. Rechenbach.....	2.50.....	West Point
E. P. Condgon.....	.50.....	West Point
N. R. Gregory.....	1.00.....	West Point
G. W. Morrow.....	1.00.....	West Point

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J. S. Morris50	West Point
Chas. Zavalla	1.00	West Point
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Esperanza Mining Company	20.00	Mokelumne Hill
Mokelumne Hill, by W. T. Robinson	10.00	
Mokelumne Hill, by W. T. Robinson	80.00	
Mok. & Campo Seco Canal and M. Co.	20.00	
Subscription from Angels Camp	378.90	
D. D. Demarest	5.00	Angels Camp
H. C. Hogate	5.00	Angels Camp
Demarest & Fullen	10.00	Angels Camp
Sub. from D. Jutton, Copperopolis	49.00	
C. B. Weigland	5.00	Vallecita
Gwin Mine Development Co.	25.00	Gwin Mine
South Paloma Gold Mining Co.	25.00	Gwin Mine
L. B. Pine & Julius Fink	10.00	Gwin Mine
Greek Mine	20.00	Mountain Ranch
C. Borger	10.00	Campo Seco
J. Burt	5.00	Glencoe
Ralston & Grayson	50.00	San Francisco
Calaveras County	500.00	
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Subscription from D. Jutton	49.00	Copperopolis
Third Prize for Jubilee Float	75.00	



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