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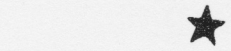
A HISTORY OF THE NORTH STAR MINES

Grass Valley, California
1851-1929



MARIAN F. CONWAY

This history is dedicated to my grand-father, A.D. Foote and to my father, A.B. Foote, whose letters and papers provided most of the information and whose diaries gave me dates for old newspaper articles. Their large collection of photographs helped to bring the story to life.

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1851-1929

Today it is hard to comprehend how California and the far western states could have been over-run so rapidly by gold seekers. This territory was almost completely exploited in the short time between the 1840's and the 1900's. In that brief time, in spite of incredible dangers and hardships the entire area was explored and nearly all worthwhile gold deposits discovered.

Juaquin Miller, lawyer, writer and poet, lived among the Indians and Spaniards of the Pacific slope and his life and writings cover the period of gold exploration. He marveled that during his lifetime it appeared as if California had been struck by a cyclone. Many rivers had been diverted from their channels, some of the hillsides had been washed into the canyons, and great mountains of waste rock were being piled near the many thundering stamp mills where nearby streams often ran milky white from the sand "tailings" dumped into them.

Historians have described how Nevada County stands out as the primary source of mining related "firsts". This county was at the center of all the frenzied activity and it contributed a vast amount toward the development of the mining industry in the west. This was due to the arrival of many Cornish miners with their skills and knowledge of hard rock mining gained in the tin mines of Cornwall. Although Mariposa probably was the site of the first gold quartz discovery in 1849* and had the first successful stamp mill at Coulterville, Nevada County followed closely on its heels and was the site of pioneering methods for recovering the precious metal. It was here that hoses equipped with nozzles were invented for use in hydraulic mining. The first Cornish pump in California was brought to the Gold Hill mine in Grass Valley in 1855. By 1865 this county had the best system of dams and ditches in the state to develop its deep gravel and quartz mines. The richest quartz veins were located here and from this county came the first accepted form of mining law. For many years Nevada County had the deepest gold mines in the country and became the mecca for students of mining from all over the world.

The history of the North Star Mines is a story of hills: Lafayette Hill, Massachusetts Hill, New York Hill, Cincinnati Hill, Gold Hill and Wiemah

* "California Gold" by Rodman Paul

Hill - the last one named after an Indian chief whose tribe had a camp in the valley below.

The North Star quartz vein was first discovered in 1851 on Lafayette Hill, located about 2 miles south of Grass Valley on Old Auburn Road. Boston Ravine, at the south end of town, was already a thriving settlement with many Frenchmen located there as evidenced by the names Lamarque Store, French Quartz Mill (in early records) and the French Avenue and French Ravine still existing today. The discoverer of the quartz vein was said to be named Serrie Lavanche and it was originally called the "French Lead." It was first worked by a group including the two Lavanche brothers, and H. Pallatier. Two other Frenchmen, the Chavanne brothers, later worked a claim nearby, but this did not become part of the North Star until 1894.

In 1852 two men named Conaway and Preston took over the claim and consolidated it with a number of adjacent claims. They owned the Helvetia and Lafayette stamp mill on Wolf Creek in Boston Ravine, and they formed a stock company under the name of "Helvetia and Lafayett Hill Mining Company," with Frank Squire as secretary. The Company included the mill and several claims on Gold Hill and Massachusetts Hill, both in Boston Ravine. The Company worked the incline shaft on the North Star vein from 1852 until September 1857 when the property and mill were sold at a sheriff's sale to Edward McLaughlin for $8,000. The yield was said to have been a total of $250,000.

In February 1860 two brothers, John and Edward Coleman, became principal owners. Other investors were: William, Josiah and John Rodda, Richard Kitto, J.C. Pascoe, William and James Hoskin and Thomas Harper. They paid $15,000 for the mine and changed the name to "North Star Quart Mining Company". They also owned property on the adjoining Weimah Hill. The mill had only 3 stamps so they added 6 more. Professor Benjamin Sillimar a noted geologist, wrote a glowing description a few years later. He described how at last a gold mine was being operated "with an eye for the futur Until this time, most of the mine operators had removed the richest ore as fast as it was discover ed, never keeping any in reserve in case of encour ing a barren zone. Inevitably this caused the

shutdown of the mine, often in a very short time. The Colemans, in addition to holding back reserves, spent large sums on development. The incline shaft reached a depth of 750 feet, a drain tunnel was built at a cost of $15,000 and a perpendicular shaft was sunk about 500 feet east of the collar* of the incline shaft, to strike the vein at about 140 feet from the surface. On an 1861 map this shaft is called the "East Star Shaft". Another $30,000 was spent on a 16-stamp mill in 1866, with all machinery built in the local foundries. Professor Silliman was so impressed he became one of the stockholders!

The San Francisco Merchantile Gazette of January 1867 described the North Star thus:

> "It is estimated that fully 30,000 tons of ore remain untouched...This company has declared dividends at irregular intervals since 1862, and during the past 5 years a net profit of more than $500,000 has been realized."

About 150 men were employed at the mine during this period. The ore, after being crushed in the mill, was treated by a method developed in the Grass Valley area, that is, by utilizing "mercury charged" rocker riffles, followed by blanket-lined sluice boxes over which the crushed mill pulp flowed. In this manner the coarse gold was trapped in the "mercury pools" behind the riffles in the rocker, while the finer gold settled among the blanket fibers from where it was washed at short intervals, into a tank of water with mercury on the bottom. The estimated total yield from 1851 through 1866 was $1,000,000.

Old records show that in 1867 the property sold for about $450,000 to a group of men from San Francisco. They incorporated under the name "North Star Gold Mining Company" with Archibauld Peachy as the president, and three of the investors were named Dean, Bell and Faul. The Company's holdings now included the Independent, Fricot and Rising Sun Claims. In October 1868 they struck a rich vein and the mine continued operation until the main shaft reached a depth of 1,200 feet. Then pumping problems developed and it finally closed down from 1875 to 1884. Production from 1867 to 1875 had been $1,125,000 and the depth reached 1,200 feet on the incline.

This was a depressed period in Nevada County.

*main surface opening

Times were hard in Grass Valley. The mines were said to be "worked out". Only the Empire and Idaho were still producing in any quantity. Many of the miners had been lured to Nevada in the 1860's by the riches of the Comstock Lode. But then bad luck came to the silver mines and the men were tired of working in tunnels where the heat went over 100 degrees. In Nevada county the temperature underground was between 50 and 60 degrees. So the miners began drifting back to California.

In the 1870's dynamite replaced black powder for blasting. Also air operated machine drills came into use, replacing the hand drills. Until then, holes for blasting the rock were drilled by single jacking or double jacking which implies the use of a "hand turned" rock drill with one man and a short handled 4 pound hammer or, with two men, one on the drill and one on the end of a long handled 8 pound sledge. Soon these new methods greatly increased production.

In 1883 John Hayes Hammond (later to become a world-renowned engineer) came to Grass Valley. With the financial backing of William Bourn Jr. of the Empire Mine and Alexander Stoddard, a Grass Valley merchant, the North Star Mining Company was formed. In 1884 they purchased the mine and Bourn put in a new water system to supply both the Empire and North Star mines. The water came in a pipeline from a reservoir on the ridge where the Nevada County Airpark is now located.

Hammond built a new stamp mill at the North Star, equipped with 30 stamps, and it was considered the most modern of its time. The mine was pumped out, using a Cornish pump that was said to have come from the Scotia Mine west of Grass Valley. Originally it was run by a Corliss steam engine, which required 11 cords of wood every 10 hours to heat the boilers. Now it was converted to water power, using a small Pelton water wheel.

The Cornish pump was ideally suited to the meandering tunnels of the gold mines. This one eventually had a pump rod nearly ½ mile long, following the incline shaft which varied in pitch from 10 to 40 degrees. The weight of this rod

was balanced by both the weight of the water lifted in the "column pipe" and the "balance bob" or box. This box was filled with stones and pieces of iron which were added as the shaft became deeper and the pump rod longer and heavier. This great mass of wood and iron moved back and forth on rollers, 6 feet at a stroke, 3 to 4 times per minute - even up to 6 times per minute during heavy rains. Years later, Mary Hallock Foote, wife of A.D. Foote, wrote a description of this North Star pump in her story, "How the Pump Stopped at the Morning Watch". ("Morning Watch" is her story name for the North Star Mine):

> "The pump rod at the 'Morning Watch' is half a mile long, with a measured movement, mighty, conclusive, slow, it crawls a little way up the shaft, waits a breath, then plunges down and you hear subterranean sobs and gulpings where the twelve pumps at their stations are sucking water from the mine. These are the water guard which is never relieved. Nights and Sundays, frost or flood or dry, the pumps never rest. Each lifts its load to the brother above him, sweating cold sweat and smeared with grease and slime, fighting the climbing waters. The stroke of the pump rod is the pulse of the mine. If the pulse should stop and the waters rise, the pumps as they go under are 'drowned'."

Early in 1897 the spur wheel driving this pump broke with a tremendous sound and it then became a race between the rising of the water in the shaft and the time it took to cast a new wheel and have it shipped from San Francisco and set in place!

In 1884 the company included Bourn, John Glasson, W.R. Sherwood, Charles Clinch and David McKay Jr. as directors. By 1886 the main incline shaft was down 1,500 feet and a 40 stamp mill with a capacity of 75 tons a day was thundering on the hill. The noise of the pounding stamps in this mill extending over the county road made a problem for travelers. Needless to say, it terrified their horses as they passed underneath on Old Auburn road.

By this time, maps of the entire area were a crazy-quilt pattern of mining claims. The Grass Valley newspaper "The Morning Union" told of tunnels and diggings all over the hills. There were accounts of many mining accidents - cave-ins, premature powder blasts, and house fires caused when men tried to do their own retorting*, often in their homes. There were accidents from run-away horses, robberies in the homes and on the trails, fights and gun-play in the saloons. There were complaints from citizens who were annoyed by goats running loose in Boston Ravine. There were many trails through the pine woods, well worn by the men walking to and from the mines. One-room schools appeared throughout the county so children in outlying areas could walk or ride their horses to school. One such school was the North Star School on Old Auburn Road, within a stone's throw of the collar of the incline shaft, where from 15 to 25 children were taught until about 1910, when it was consolidated with the Bell Hill school in town.

In July 1885 W. B. Bourn Jr. was in Shingle Springs and chanced to meet James D. Hague, an engineer and financier from the east. Bourn pursuaded Hague to come to Grass Valley to inspect both the Empire and North Star mines. Hague's diary tells how he interviewed McKay, Hammond, Jennings and others to learn what he could about these mines. Though he went on to other areas in search of mining investments, the Grass Valley mines must have intrigued him for he returned in December 1886 to again look over the North Star. By the end of the month he was talking over proposals for buying North Star control. Bourn invited him to his country place near St. Helena for a Christmas party. There were 17 for dinner and each guest received a silver bell as a gift.

In January 1887 there were more meetings and "discussing until we were tired," Hague noted in his diary. Finally, on February 18th., Hague wrote a check for $254,450 for deposit to Bourn's credit. A short time later Hague had pursuaded Hammond to remain at the North Star to help "get it running smoothly," and a water contract was signed with Bourn and the Grass Valley Water Company.

Hague had excellent financial backing. Some of the people he represented included the Agnews and Blisses of New York, the Phelps Dodge people,

*Heating to vaporize the mercury

J.P. Morgan, and Balfour and Guthrie. A San Francisco office was set up at 401 California Street, but later the permanent office was at 22 Williams Street, New York. The fact that Hague was a mining engineer as well as financier gave him a great advantage over most investors of that period, who often pledged their money to mines they knew little about. Hague studied the histories of the smaller claims near the North Star. One report, written by a French mining engineer to the president of the Rocky Bar Mine, dated April 1866, tells of the frustration of following a promising vein only to lose it as it extended into a neighboring claim. Another document of May 1887, written as a report on the promise of the Gold Hill mine, tells how the mines of Grass Valley appear to increase in value as they deepen, and that the Gold Hill vein was a continuation of the Massachusetts Hill and Rocky Bar, site of the famous Brennan shaft where the Watt brothers were reported to have cleared about $750,000 in 18 months!

Hague soon became convinced by these reports that consolidation of many claims was the only way to succeed. During the next few years he acquired the Massachusetts Hill, Rocky Bar, Boston Ravine, Gold Hill, Polkinghorn, New York Hill, Bowery and many other claims. All were now idle, but their combined production had been claimed at a total of over 11 million between 1851 and 1884.

Finally, in 1888, Hague and associates also bought the Empire mine. George Starr was named as manager of the Empire and E.R. Abadie managed the North Star, later being replaced by R.R. Roberts. The North Star had a lot of good ore from the 1,400 foot level down to the 2,300 and production was good until 1899 when it came into a barren zone and the mill was only crushing with a few stamps, most of the mining being done by leasing.

Meanwhile, around 1889, a new process was discovered in Scotland using a weak solution of cyanide that made it possible to extract almost 100 per cent of the gold and silver from the ore after pulverizing in the stamp mills. The metal was dissolved, then precipitated with metallic zinc. The slime was filtered to remove the precious metal and this was melted at very high heat. This meant that many old dumps were re-worked and marginal mines given new impetus.

Hague started pumping out the old Massachusetts Hill workings. This property had a good deal of water and Hague realized he would need a huge power plant to take care of all planned developments. He needed the help of a man who had training in both civil and mining engineering. In 1895 he sent for his brother-in-law, Arthur DeWint Foote, who had worked as an engineer with the pumps of the Sutro Tunnel in Nevada as well as the mines of Colorado and South Dakota and the irrigation projects of Idaho. Foote had also had training in the use of compressed air. He had worked in Virginia City under J.B. Pitchford, who installed the first air compressor in the west. At that time only two others existed in the United States.

Hague requested that Foote first investigate pumping plants driven by electricity, but Foote decided in favor of compressed air as cheaper and more reliable. He did not feel that electricity was safe to use in the wet tunnels of a mine, and equipment and motors run by electric power were not yet well developed. Also, he argued, it was very simple to install a "back-up system" to provide steam power in case there was a failure of air power to run the pumps, drills and hoists. Foote erected a power house on Wolf Creek at the end of Mill St. Water was obtained under high pressure by extending a 20 inch pipe down from the 24 inch pipeline already installed between the Empire and North Star mines. An aqueduct of cement and rock masonry was built across Wolf Creek with the pipe laid in its center. The piers of this acqueduct went down to bed-rock, some 8 to 10 feet below the water level of the creek. Great care had to be taken when filling this new pipe line, as opening the Empire water gate added 180 pounds pressure per square inch the instant the lower 7,000 feet of pipe became full!

The great water wheel to drive the compressors had to be larger than any ever built before. Foote asked for a 30 foot wheel, but the Pelton Water Wheel Company was afraid to try anything so large. So a compromise was reached and, with the help of E.S. Cobb and E.A. Rix of San Francisco, an 18 foot 6 inch wheel was built. It weighed 10,000 pounds and was designed to deliver 226 horse-power. It had spokes in tension like a huge bicycle wheel, with a top speed of

110 r.p.m. Quite a crowd gathered to see the wheel start up and many on-lookers believed it might fly apart. A.D. Foote's eldest daughter, Betty, then in her "teens" wrote a vivid description of the event which reads in part:

> "Built into the bed of the creek with dark water in a swirl about it stood a long, low house of stone. Within, the sound of rushing water echoed through a room of stone and iron. Huge dark shapes of machinery rose against the windows blocking the light that gleamed on the cold wet floors and glistened on smooth surfaces of brass and polished steel. A few workmen were moving silently about. By the great wheel in the center of the room (the engineer) stood with his hand on a delicate lever...The workmen had been grouped about one spot that needed their attention. Their work there was finished and they scattered to their various posts, glancing toward the great wheel expectantly. (The engineer) bent forward slightly and moved the little lever that his hand rested on. There was a thunderous rush of water beneath the wheel and another rushing sound that was not water - a sigh as if some mighty creature stirred and woke... The piston-rods moved smoothly, the great wheel in its dripping case became a whirring blank...The panting breaths grew full and strong and steady, and through them pulsed a deep throbbing like the beating of a mighty heart."

Now a new sound - the steady "thump, thump" of the air compressors was added to the roar of the stamp mill and the crashing of ore cars dumping their loads.

The 18 foot wheel proved so efficient, no matter what the load, that the next year a 30 foot wheel was built, the largest in the world at that time, and it ran continuously for over 30 years. The success of the experiment caused quite a stir in the world of engineering and Foote was asked to write an article on compressed air for the Encyclopedia Britannica, 11th. edition. And in June 1896, Foote

was promoted to superintendent of the North Star, replacing R.R. Roberts.

An old steam traction engine, bought from a logging company was used to haul the ore from Massachusetts Hill to the North Star mill. It frequently broke down, and then Pete Smith, from his nearby ranch on McCourtney Road, was called in with his team to haul the ore.

A rich body of ore was found at the 1,300 foot level and another near where the Watts had taken out their bonanza in 1858. The vein petered out soon after and the shaft was abandoned in 1899 at a depth of 1,800 feet. However, it had paid for itself, with about $800,000 being taken out. Now it was left to fill with water. The total production for the North Star between 1851 and 1896 had been nearly 5 million.

The North Star incline shaft had now become very extensive and in 1896 it was decided to sink a vertical shaft about 3/4 mile north of the collar of the incline shaft. This new shaft was to tap the vein near the end of the incline shaft which now was claimed to be the deepest in the area. The vertical shaft was known as "The Central". Some confusion might be caused by the fact that in 1895 a pamphlet was published entitled "Souvenir of Grass Valley and Vicinity," compiled by J.E. Poingdestre. It described (on page 22) a Central North Star: "This mine is situated about midway between the North Star and Omaha mines. It is 400 feet in depth. The mine is equipped with good hoisting and pumping. Bennallack is the superintendent." It should be noted that this mine was owned by the Weisbein brothers and the North Star Central Shaft, owned by Hague and assosciates, was not started until the following year.

Toward the end of 1897 Mr. Bourn bought back the Empire and now Hague concentrated his efforts on the development of the North Star. The mill now had 40 stamps and 16 concentrators* and a cyanide plant that was extracting far more gold than had been possible with the older methods. The gold was then melted in the furnace, in the bullion room of the assay office building, and poured into molds, forming bricks usually weighing about 70 pounds. These were shipped by express to the Mint in San Francisco.

* Shaking tables that concentrate the heavy gold bearing minerals for separate processing, such as smelting or cyanidation.

In 1899 Hague was named President of the North Star Mines Company. He continued to purchase properties which eventually totaled some 1,465 acres of surface and underground. Foote's son, Arthur Burling (also known as "Sonny") had graduated from college as an engineer and was working at the mine as a surveyor's helper. His diary tells of the excitement when a rich strike was made in March, 1901. He attended an oyster supper given for the shaft men to celebrate striking the ledge. Then young Foote accepted a job with a mine in Korea and he did not return to Grass Valley until May, 1904.

The sinking of the Central Shaft received a great deal of publicity in the local newspapers. It meant the construction of an entire plant: a new hoist, head-frame and bins, a new stamp mill on Allison Ranch road, and eventually a new and larger cyanide plant below the road on Wolf Creek. The rock encountered in the shaft was very hard and heavy piston drills were still being used so the going was slow. Another complication was the great quantities of water encountered. But the ore was very promising as shown in an article in April 1903 in "The Union" under the headline, "Millions Are In Sight In North Star Mines." The article described how a rich ore bed had been discovered below the 1,100 level, some of the rock so rich that it was being carried out in candle boxes instead of being loaded into ore cars, hoisted and dumped into the stamp mill.

Another news article announced:

> "Central Pumps Work Like A Charm. At last it seems superintendent Foote of the North Star Mines has reached a point of perfection in the big pumps in Central Shaft. They are now working smoothly throwing out an immense volume of water and keeping the mine dry with ease."

The old North Star vein had been intersected by the new vertical shaft in March 1902, and the compressed air pumps were now lifting the water

1,400 feet straight up to the drain tunnel, which was no easy matter, Blasting had formerly been done with the fuses lit by hand, but one time the hoist failed to lift the men up after they had lit the fuses with their candles and they had to save their own lives by cutting off the burning ends. After that episode, electric blasting was used, which means the dynamite was exploded by an electric charge at a safe distance. There were no delay-action exploders at that time and all the holes could not be set off at once without knocking out the timbers supporting the excavation. So this was done in two successive groups, but it meant a long delay, waiting for the shaft to clear of smoke and water before loading the second group of holes.

After vertically intersecting the incline vein, 4,000 feet from the collar of the shaft, work began on a "raise" which eventually followed the vein a distance of some 1,700 feet back up to the bottom of the old incline shaft.

Heavy water problems continued to plague the work. The compressed air pumps were now pumping 500 to 700 gallons per minute. Drifts* were extended in both directions from the main incline shaft as they toiled upwards. Finally, toward the end of November the goal was reached. There was great excitement and engineer, Gerald Sherman, who had been doing all the surveying, breathed a sigh of relief as he received congratulations. The Union newspaper headline of November 23, 1903 rejoiced:

> "A GREAT WORK ENDED
> North Star Mines Company finishes one of the greatest engineering feats in mining history... At 5 o'clock yesterday morning the greatest feat in Western mining history was accomplished here when the 1,800 foot raise from the Central Shaft to the North Star Shaft was finished. For two years this work has been in progress. The Central has been sunk vertically to a depth of 1,640 feet. At that depth it struck the North Star ledge, demonstrating that the

* small, exploratory tunnels

> rich vein continued to such a depth that in all probability no man would ever be able to reach the end of it... From the bottom of the Central, Manager Foote started the raise, after engineer Sherman had carefully prepared the figures. The men have contended against bodies of water which at times prevented work, but with the inborn courage of miners, they went back time and again, until they finally triumphed...The management gave the men engaged in this perilous work every assistance and encouragement, paying them a liberal bonus each month for every foot over a certain standard... By thus connecting the two big mines, good air and an easy means of escape are assured, should a fire or explosion occur in either mine."

Later an editorial exulted:

> "The great North Star Mines are coming wonders and are already astonishing the country. The recent report from the Company's main office, to the effect that there is at present blocked out sufficient ore to yield a profit of between two and three million, is unprecedented. The North Star is an example of what money and faith can accomplish here. For years the Company sought for the gold it believed to be hidden somewhere in the bowels of the earth. Its expense was enormous (over one million spent) but it had faith backed by good judgement..."

All this was welcome news for the community because the papers had been full of unhappy events. There were labor troubles in other parts of the country; there had been a terrible coal mine disaster in Wyoming, and the miners had been on strike in the gold mines of Sutter Creek. Local news told how the North San Juan stage had been held up at gun point and driver, Joseph Downey, forced to give up the treasure box. However, the robber was unable to get it open before a wagon approached and he fled in panic after relieving only one passenger of his purse. A more cheerful news event was the story that some boys found gold in the Nevada City

park. Their sudden wealth, in the form of candy and gum, caused suspicion and brought to light the fact that recent rains had exposed gold in some dirt dumped in the park from the site of the Legg and Shaw building nearby.

To return to the story of the North Star, the Company had now declared a dividend of 50¢ per share upon its 250,000 shares. The last dividend had been about 2 years previously. The mine was now earning about $33,000 net per month. So more properties were being aquired: the Irish American, the Vulcan, Hudson Bay, Emmet, Fahey, Victory and Venus and Central properties were added to the holdings. In addition, the old Granite Hill shaft (across Wolf Creek) was being worked after lying idle for many years. It was equipped with a hoist and pumping plant.

The 3,700 incline level in the North Star shaft proved to be the richest in the mine. In one small area about $60,000 was taken out from ore so rich it never went to the mill, but was carried out to be crushed and refined in a separate operation.

The years 1903-04 were mighty busy ones. The new 40 stamp mill at the Central shaft was complete as well as the new cyanide plant nearby on Wolf Cre The old cyanide plant at the incline shaft was to b torn down, but both stamp mills were in use and an electric tramway was being staked out between the two mills. Mr. Hague had specified that the new mill was to last 30 years, so Foote ignored the usual wooden construction and built it of stone masonry and steel. It was run by water power and i cost $74,000, but it saved much expensive repair work in later years. The new cyanide plant was described in the newspaper as "the only plant of the kind in this part of the state". Experiments were being made with a process for extracting gold from cyanide solution by depositing the gold electrolyti cally upon amalgamated copper plates. Edwin Letts Oliver was the metallurgist. This process proved t expensive and was given up.

Then tragedy struck. The local people were shocked to learn of the sudden death of A.D. Foote' 17 year old daughter, Agnes, on May 12th. She had been operated upon for acute appendicitis, but to n avail. A group of Cornish miners lined the road in front of the cottage. They sang her favorite hymn as her rose-covered coffin was carried out. The mi whistles in the area were silent during the funera out of respect for her family.

A few days later, the Foote's son, Arthur B., returned from Korea to replace Gerald Sherman, who had accepted a position in the Copper Queen mine in Arizona.

Young Foote immediately was swept into the new construction work. The design of the electric motor for the new tramway was among his first assignments. The Gold Hill was one of the first mines to use electric power for driving its hoist, compressor and Cornish pump. Foote built the motor from two street car motors that had been used in the Gold Hill hoist. It had 4-wheel drive, using sprocket chains, which gave it the power and traction needed to pull a long string of ore cars. This locomotive design was later copied by other mines in the area. The little tramway wound through the pine woods, over trestles and past the small stone houses marked "Danger! Explosives!" where the dynamite was stored. The newspaper described the project, stating it would require nearly 7,000 feet of rails:

> "The road when completed will do away with the wagons now in use... The line is not for passenger traffic or pleasure, as might be imagined, but is built to haul sulphurets from the North Star mill to the cyanide plant below the Central, and take loads of ore from the Central to the North Star mill....The Central is producing so much ore the overplus will be used to feed the North Star stamps....The outcome of this undertaking will be watched with deep interest as it means a radical departure from the beaten path of mining."

In fact this was just one more in the many innovations originating at the North Star Mines over the years. As other mines in the area enlarged and added equipment they borrowed freely from the ideas developed at the North Star. Young engineers traveled to Grass Valley to study the improved methods of hard rock mining and amalgamation. Among these was Italian prince, Gelasio Caetani. Later when he became a consulting engineer in San Francisco, Caetani corresponded with A.B. Foote inquiring about new designs and ideas and asking for blue prints.

Experiments were continuing at the cyanide plant under Edwin L. Oliver, who was trying a new

process for better and cheaper extraction of the gold from the mill tailings. This finally resulted in the perfection of the Oliver Filter, a revolving drum type filter, which gained much recognition in the mining world. Years later, a letter from the Oliver Continuous Filter Co. requested a written testimonial from the North Star Company as to the excellence of this device, and it stated: "It is not often that we have to resort to these measures to secure orders, but in this case we are meeting the competition of the Portland Filter, which as you well know, was copied directly from our filter."

While developing the Massachusetts Hill shaft A.D. Foote had perfected the use of the "Go-Devil" system of ore cars, using gravity to get the ore out of the stopes* having a pitch of only 30 degre By this system, the lowering of a loaded car would pull up an empty one, and thus save a great deal o labor and money. Foote also designed a very effic light weight, air-operated, one man machine rock drill called the "Torpedo" which would out-drill a other of its weight on the market at the time, and was used until the air hammer drill superceded all piston drills.

Gerald Sherman was credited with developing delayed-action electric exploders which made it possible to dynamite a large number of holes in succession and break the ground more effectively. Some time later, still another innovation, this one by A.B. Foote, was a special bucket designed to transport drills to the surface to be sharpenec It resembled a small ore car and it carried the dr to the surface, to the shop for sharpening, and re turned them underground with minimal handling.

In June of 1904 the Grass Valley Miner's Union received a letter stating: "The North Star Mines Co. and its local officers wish to present t enclosed $100 to the Widow and Orphan Fund of the Miners Union as evidence of their desire to assis the noble work of the Grass Valley miners. With best wishes for the continued prosperity and succ of the Union" signed, A.D. Foote, Arthur Foote, Robert Walker and T. Marshall. The local paper n

> "This is the first time in the history of the Union that any mining company has made a donation to it and may be followed in the future by some of the

* areas where ore is being blasted and removed for processing

> other mines....As one of the miners put it, "Why, here we seem like a great big family. The men are satisfied, the Company's satisfied and we're all pulling together.'"

Perhaps the Company officials were concerned because of a number of accidents during that period. A man had been badly injured when hit by a skip and another was hit by runaway ore cars and crushed against the wall of the tunnel. There was a narrow escape for a group of miners working in the eastern part of the mine. They did not realize they were so near an old shaft known as the "East North Star". They had noticed a lot of draft because they were having trouble keeping their candles from blowing out. Suddenly some rocks gave way and there was a blast of air as a great torrent of water rushed down upon them. One man was badly injured and two were painfully bruised as they were slammed against the wall. The newspaper also recorded a tragedy when young Charles Stock's leg was caught in a belt at the North Star incline concentration plant while trying to repair it. His partner stopped the machinery, but not in time to save his leg. Dr. Jones and nurse, Miss Hansen, arrived but Stocks died several hours later despite their efforts to save him. All the mill men went to the funeral.

Another mishap with a happier ending occured at the Central when Thomas Williams was buried up to his neck in an ore bin. When discovered 1½ hours later he was exhausted and would have sunk beneath the rocks and smothered in a few more minutes. He told how he was first caught about the knees, but gradually sank as he struggled to free himself. The roar of the stamps drowned his cries for help. He was finally missed and soon strong and willing hands removed a large quantity of ore and dragged him to safety.

It should be mentioned that at this particular time the Grass Valley area was described by the New York Engineering & Mining Journal as "a mining camp where strikes are relegated to the past." Conditions here were said to be so much better than those existing in most of the camps of the world that the leading mining journals had taken to pointing out Nevada County as a model of peace and good will between employer and employee. One local paper published an article which illustrates this:

> "Following its annual custom, the North Star Mines Co. yesterday

> afternoon presented every man on the payroll, 350 in all, with a handsome cash Christmas gift. The men in return gave leading officials presents of solid silver...Elsewhere in this great country the rank and file may be mere machines, regarded only for the quantity of work which they may be able to produce, but in this favored section, as one of the speakers yesterday remarked, 'We are treated as men!' ...For several years it has been the custom of the Company through superintendent A.D. Foote, to gather every employee on its payroll, from the assistant superintendent to the newest and youngest lad in the mines, and devote the afternoon to jollity a day or two before Christmas. ...The full fledged miners each received $10 and the others $5 each.... Carol singers in the rear of the storeroom burst into song..." etc.

This custom had been started in the late 1890's when t afternoon shift met the morning shift around the Stock bridge Shaft on Massachusetts Hill on Christmas Eve. The men were treated to beer and soft drinks and they joined in singing Christmas Carols. Then on Christmas morning a group would arrive at the Foote household tc sing and they would be invited in for cake, coffee and beer. The custom of gift giving continued until the North Star Company was no longer making a profit.

In 1905 a third compressor was added in the Power House, this one driven by an electric motor. The new source of power was due to the fact that the Colgate and Alta Hydro-electric Plant had been built, and Geor Scarfe was the head of the Bay Counties Power Company this area. Scarfe was greatly interested in the North Star electric tramway and helped to lay it out.

With a reliable source of electric power assured it was decided to install an electric motor to drive the vanners* in the cyanide plant. A 5-plunger pump, driven by an induction motor, was lowered to the 1400 foot level of the mine, and a 4-stage Turbine pump wa put in at the 2300 level, lifting 700 feet vertically The local paper lauded this latest improvement, declaring it to be the first pump of its kind on the co with a capacity of 350 gallons per minute, and reachi a speed of 1800 r.p.m. without the slightest friction However, A.B. Foote wrote of problems caused by the n electric power system which often slowed down so the pumps would not run fast enough to keep up with the w

* oscillating endless rubber belt concentrators which separate out gold and other heavy minerals

He noted the power sometimes went off entirely during bad storms and then the old air pumps were started up to keep the shafts from filling with water.

It looked as though prosperity had really come to the diggings. The newspapers reported more men were working than ever before:

> "True, the glory of the old days when every man worked for himself, in shallow places in a hundred ravines, gulches and flats, has passed away. But instead has come a more substantial industry in the hands of a number of companies, with millions invested."

The growth had been quite gradual and the people living in the area had become so accustomed to the mines "pouring forth vast riches" that they were often surprised at the stir it caused in other parts of the country. The local paper made a careful estimate and reported that 1,000 men were now employed, a gain of nearly 300 within the previous 3 years. Figures given for the largest mines were:

North Star-------	384	men
Empire----------	175	"
Pennsylvania-----	120	"
Idaho-Maryland---	30	"

As an example of the romantic interest in the Nevada County gold, in November 1905 about 90 people arrived and assembled in the Grass Valley Auditorium to take carriages to the major mines. The crowd was divided so each mine would have an equal number of visitors to entertain. The group conducted to the North Star included such notables as California's Governor Pardee and his wife, Secretary of State Curry, and Professor Christie of Stanford University. A few of the party went underground. Christie, who was professor of mining, was reported to be particularly pleased with the Central mill which he declared to be the finest he had ever seen. Luncheon was served at all the mines. At Central shaft, the store room was converted into "a bower of ferns, evergreens, berries and crepe paper" the Grass Valley Tidings exulted. Governor Pardee and party, the professor and several others were guests of Mr. and Mrs. Foote at their cottage near the incline shaft. The afternoon

was spent viewing the cyanide plant, and then the entire cortege of visitors was entertained at a banquet in town to climax the day.

In 1905 work was started on a larger company house for the convenience of officials and their families when they came out from the east. Julia Morgan (the architect who later designed the Hearst Castle at San Simeon) was commissioned to design it, perhaps because her father had been a mining engineer. Tracks were laid from the old North Star mill to the site so waste rock could be hauled in an ore car to be used as part of the building material. The cottage, which had been built for Abadie in 1886, exactly like George Starr's first house at the Empire, was now turned over to the young bachelor engineers who were gaining experience at the North Star. They were known as the "cottage boys". When the Empire and the North Star mines consolidated in later years, the big house was purchased from the company by the Foote family.

There was a great deal of social activity in the mining camp, especially among the officials of the larger mines. Nearly every afternoon was enlivened by tea parties for their wives, and the younger ones were constantly riding horse-back over the hills and up into the mountains on fishing and picnic outings. At the Empire, Mr. Bourn built a tennis court and a guest house equipped with bowling alley, billiard room and reception hall. It was "christened" with a gala Christmas party in December of 1905. The married engineers entertained frequently at dinners, followed by billiards, cards or music. The new gramaphones and player pianos were used for dancing as well as to accompany local singers. This meant the large living and dining rooms of the new "company house" at the North Star were badly needed for entertaining. A.B. Foote's diary records many hours spent going to Colfax and waiting for the arrival of main line trains carrying company officia and other visitors from out of town.

The end of the year brought troubled times. Th new Central dry house* burned and 150 miners lost their clothing. Only by the fast action of the men who discovered the flames and turned on the fire hydrants nearby, did surrounding buildings escape th conflagration. Somehow the big stove in the center the room, used to dry the clothes, must have started the blaze. A December issue of the Tidings disclose that the miners were reimbursed by the company for their lost clothes, and this was greatly appreciated

* where miners changed clothes

The weather that fall was unusually cold and dry and water became scarce due to freezing of the ditches. This caused many of the mines to close. The North Star sent men to clean the Greenhorn Ditch, hoping to use this water to put its stamps back in operation. Lack of rain meant the reservoirs and storage dams were nearly empty so everyone hoped for a warm rain storm. By December the lack of water to operate the compressed air pumps meant only the North Star and Brunswick mines were still operating. They had some pumps run by electricity so they could keep the underground water in check. There was talk of installing gasoline plants in some of the mines, but finally the rains came and things returned to normal. By the end of the year the mill at the Central Shaft had been changed over from water power to electricity, and the first trial run of the new electric trolley was made.

In 1906 the Mining Reporter of Denver contained an article on the North Star Mines by G.E. Alexander, describing the operation of the new mill:

> "The Central Mill is most beautifully arranged and constructed in that iron and concrete enter almost entirely into its construction and the ore is handled exclusively by gravity. The ore is dumped onto 2 grizzlies * arranged one above each 20 stamps; there are 2 Blake pattern jaw crushers; then 2 large concrete ore bins from which the stamps are fed through Challenge feeders. The stamps are entirely mounted in steel frames, having a weight of 1,150 pounds each, dropping 93 times per minute. The mortars are placed directly upon concrete foundations, with a cushion of 1/16 inch rubber between. The ore is amalgamated inside of the battery and in front of each battery is a 3½ by 20 foot silver plate, also mounted on iron supports. The pulp, after passing over the plates, escapes through a quicksilver trap in pipes leading to 8 Dodd buddle concentrating tables located on the next lower floor. The middlings from each of the 8 tables passes to a 9th. buddle for finishing. The excellent saving of from 85-90% of the values in the ore must in large measure be due

* Coarse screen to sort the rock

> to the ability and skill of the mill superintendent, Frank Provis. Electric power actuates each separate machine in both mills and cyanide plant and is generated from water power, the company owning a very finely equipped generating and compressed air plant, which is located near the cyanide plant. They, however, purchase some power from the Bay Counties Power Co. at the nominal price of $4 per month, per horsepower, meter rate."

The underground work was graphically described by A.B. Foote in THE MINING & SCIENTIFIC PRESS, that same year. He told how for the past 6 months the Company had been extending its main incline shaft from the 4,000 to the 4,700 level. The incline shaft was 18 feet wide by 7 feet high, had an average pitch of a little less than 30 degrees from the horizontal, and was in very hard rock requiring no timber. The work of sinking was carried on by a day and a night shift. The mucking was done by the day shift, consisting of 3 miners and 2 ore car boys working from 7 in the morning until 5 in the afternoon. The drilling was done on the night shift by 4 machine men who went to work at 6 p.m. and worked until they had drilled and blasted a round. This usually took until 4 a.m., but sometimes if they got a late start they did not go home until 7 a.m. when the day shift came on. The miners were paid $3 per day, the machine men $4.50, and the car boys $2.50. Any delay in drilling or mucking was made up by the machine men working "long shift". The holes were blasted at about 4 or 5 a.m. and, by the time the day shift came on, the smoke had cleared out sufficiently for them to go to work. Foote noted that it was learned that, by stopping the sinking pump, "the water rising and covering the face helped to diminish the gas."

The 1906 "Tidings" carried a story of visitors to the North Star and tells what an attraction the new electric railway had become:

> "The management of these properties are very courteous and have thus far tried to accomodate the visitors who have asked for a ride or to be shown through the works. The cyanide plants at both mines are also places of much interest, and are visited every Sunday by hundreds of people. The methods are entirely new and have proved to be a great success."

Another issue tells of Professor Lawson and a group of his students from the University of California visiting the North Star:

> "They were shown the inside workings of what is the biggest gold mine in the state today... The students were handsomely entertained by the management of the mine during their stay. A.D. Foote has always shown a strong sympathy for students anxious to acquire knowledge and he has been ever ready to assist them in a practical manner."

Many years later one engineer wrote, "Like most of us youngsters who were at the North Star we worshipped old A.D. who gave many of us our start in the hard rock business."

An Abbe Tube Mill was added to the Central Cyanide plant. It required a team of 12 horses to haul it from the Narrow Guage Railroad. This mill was reported to grind the stamp mill tailings 50% finer than any other process. The new Waugh drills were being tried also. They were supposed to have far superior penetrating power with half the quantity of compressed air used, and they could be operated by one man. Another new device was the carbide lamp which replaced the candles carried by the underground men. In later years A.B. Foote would delight his children by dropping a bit of carbide into a rain puddle and then igniting it with a match -- thus appearing to make the water burn!

Toward the end of 1906 it became increasingly apparent that the men were not satisfied with their wages. A grievance committee was formed at a meeting of the Grass Valley Miners Union which had been organized in 1894. The car boys, mule drivers and skip tenders wanted an increase from $2.50 to $3.00 per day. The muckers, go-devil men, tool nippers etc. were asking for an increase to $3.50 per day. Meetings were held by the Mine Operators Association, but no decision was made.

At Christmas time there were the usual festivities at Central shaft. The men were hoisted at noon and, after exchanging gifts and singing carols, A.D. Foote announced that, starting January 1, the Company was granting an 8 hour day to their employees. The men would be lowered at 6:45 a.m., have ½ hour for lunch, and the last man would be at the surface by 4:15 p.m. The night shift would go down at 4:15 p.m., have ½ hour to eat, and quit at 12:45. There would be no more "graveyard shift". Instead there would be a separate crew for blasting during the early morning. This news

was greeted with shouts of approval. After speeches of mutual admiration, the men dispersed to their homes.

The town now waited for the results of the Miners Union vote. It was hoped that, if the members voted in favor of Foote's offer, the other major mining companies would join in granting the same hours and conditions. The Union members had previousl voted down the request of the mule drivers and car boys, the general opinion being that it was unreasonab to demand of the companies the same wage for the inexperienced youth as was being paid to skilled miners. So a special meeting was called to decide the question of an increase in wages, making the rate uniform throughout the district. Some dissatisfaction had arisen over A.D. Foote's proposition to reduce the working hours. The newspaper stated:

> "The men appreciate the spirit which prompted the generous offer, but the men say they would like to have a real 8 hour day. The miners contend they would be underground 9 hours, as the Company would compel them to go to and from their work stations on their own time. This would consume ½ hour, then ½ hour for lunch leaves them 9 hours from the time they go into the mine until they return to the surface."

So Foote then agreed they go down at 7 a.m. with the last skip to be up at 4 p.m.

On December 31st. the Miners Union held another meeting. The people waited with baited breath. After the largest vote ever cast, the majority decision was for rejecting Foote's proposal and asking for an 8 hour day total. The question of increased wages to $3 for un-skilled help was narrowly defeated.

M.W. Moor, of the Western Federation of Miners Union, had arrived in town and now did the negotiating between the local union and the mine owners. He directed the miners to strike until the demand for an 8 hour day was met. A.D. Foote pointed out that his company had voluntarily given the men an 8 hour workir day and the instructions he issued required only 7½ hours of actual work. He asked the union to re-consid but the 370 men at the North Star stayed home and the men at the other mines followed suit. Only the pump men stayed on the job. The local paper mourned:

> "The lid is on the mines of the Grass Valley mining district. Not a miner in the whole camp is at work."

No thundering stamps and tooting whistles could be heard and the silence was eerie. Gloom prevailed amongst the shop keepers whose livelihood depended largely upon the mines. Mr. Stafford, the Labor Commissioner, arrived to try to arbitrate the dispute. Editorials in the paper declared Foote's proposition was fair and asked the miners to return to work with the understanding that the difference in conceptions of the 8 hour day be submitted to arbitration and decided within one week. Mayor Charles Clinch appealed to both sides to come to a settlement. But the Miners Union ordered the pumpmen to quit and, on January 17th., the mules were brought to the surface and the North Star brought up the electric motors from the 4,000 station. The water began to creep up in the mine.

On January 19, 1907, the newspaper headline was printed in huge type: MINERS UNION AND OPERATORS AGREE TO PROPOSITION WITH HONOR TO BOTH SIDES -"Labor Commissioner Stafford and Mayor Clinch achieve magnificent triumph in getting both sides together." A unanimous vote of the Miners Union had ratified the following settlement:

Start to work -------- 7 a.m.
Drop tools ---------- 12 noon
Pick up tools -------- 12:30 p.m.
Drop tools ---------- 3:30 p.m.

Men to be hoisted as expeditiously as possible. Some mines had only one cage.

Night shift to be on same number of hours, or hours to be arranged by each superintendent.

This schedule to hold good until 30 days written notice of change is given by either side.

So gloom turned to great rejoicing. There was cheering in the meeting hall where the unanimous vote was counted and fireworks lit up the streets. Once again the pine woods echoed with the pounding roar of the stamp mills and the crashing of the ore as it was dumped from the skips into the bins below. The sheaves at the top of the North Star head-frame were whirring once more as the hoistman followed the signal of the gongs telling him to hoist or lower away.

Except for fire, the fear of flooding is one of the worst disasters for a gold mine. In the spring of 1907 it rained steadily from March 6th. to the 26th. ending with a snow storm. The electricity kept going off and finally stayed off for 13 hours. Only the air driven pumps were now operating so all drilling was stopped to save compressed air, and the men went to work building dams to hold back the water. If the pumps

were flooded it could cause a shut down lasting many months. All available air pumps were started up. Steam was used for hoisting water which was bailed into the bailing skips. Then the Southern Pacific train bridge went out and fuel oil became scarce, Desperately the men began burning shaft timbers under the boilers. Finally, when fuel oil was obtained, it was so thick and heavy the heaters began smoking so badly the pumpmen had to work with air hoses blowing into their faces. But the men's heroic efforts held the water until the electricity came on at last.

Early in 1907 Dr. John Jones opened a hospital on Church Street in Grass Valley. There was a reception to celebrate this event on January 30th., attended by a large crowd. The Campbell residence had been converted into a hospital, open to anyone and to any doctor. Until that time most of those injured apparently were treated on the spot and the victim then taken home. If men hurt in the mines were single and living in a boarding house, they were taken to the County Hospital in Nevada City or even to San Francisco. The newspaper described the new hospital as a boon to the community, but warned that it would require many thousands of dollars a year to maintain, and that outside contributions would be necessary to keep it in operation. At the North Star, $1.00 a month had been taken out of the men's wages to be paid into a fund toward their medical expenses while sick or injured. The Company now endowed a private bed for use of its men. Mr. Bourn of the Empire and many other citizens also gave liberal cash donations. Dr. John installed the first x-ray equipment in the county. After he died, his brother Carl took over the Jones Memorial Hospital, named in honor of their father who also had been a doctor in Grass Valley from 1874 until his death in 1900.

In April of 1907 the North Star Mines Company issued a report. Mr. Hague declared the Company was paying dividends annually at the rate of 10%. From May 1884 to December 1906 there had been a record output of 7½ million dollars. The unworked ground was expected to yield between 7 and 10 million below the 4,000 level in the next 15 to 20 years. Prosperity seemed assured.

Another happy event occured that spring when Nevada County won the medal for the best mineral exhibit at the St. Louis Exposition. Mr. Hague attended the Exposition and was so impressed with the Nevada County display that he promised County

Commissioner, Sam Butler, that - should the County display win the medal - he would have it cast in gold. When this County was presented with the award, Mr. Hague sent gold from the North Star to the mint in Philadelphia and the jubilant Grass Valley newspaper account declared that the medal, containing about $185 in gold bullion, had been placed in the courthouse in Nevada City for all to see. It should be realized that, over the years, gold was valued at between $12 and $20 an ounce, depending on the quality, and did not go over $30 an ounce until 1933.

A news release in July, 1907 disclosed that a new electric compressor had been installed at the North Star Powerhouse. True to form, the paper described it as "one of the best in the country" and made the power plant superior to any in all of California. The mine was now down to the 4,700 foot level on the pitch of the vein. To date, the 3,700 foot level had been the richest level in the mine.

Up until February 1908 A.B. Foote had ridden his horse to work each day and occasionally his steed became impatient. If the noon whistle blew and Foote did not appear soon after, the horse sometimes managed to pull loose, forcing his rider to walk home to lunch! But now Foote's transportation was a Model S Ford car, powered by gasoline he purchased in jugs at the hardware store. George Starr of the Empire Mine was dashing about in a steam powered contraption. Foote's diary mentions an accident when his Ford frightened a horse-and-buggy on the mine road, causing the buggy to tip over. Another time, while driving a young lady, he came around a turn too fast and overturned, fortunately with no injuries resulting. The roads were frightful, muddy in wet weather and always very rough, so even short trips meant flat tires and getting mired in the heavy clay.

In August 1908, at the peak of prosperity, the North Star Company lost its leader with the death of James D. Hague. George B. Agnew of New York took over as President of the Company. Hague's engineer son, William or "Billy" as he was called, became the managing director. The Company felt one of the directors should give "personal attention to the Companies' affairs at Grass Valley". So in 1910 Billy Hague built a home on the hill above the North Star House, and moved in with his wife, Elizabeth.

Young Hague, assisted by Robert Bedford, developed time studies of the various mining operations

to determine their relative importance. He also set up an accounting system to determine the cos of each operation, from drilling the rock underground until it passed out of the mill, and keep meticulous weekly records. Among other things, this brought out the fact that, in hard rock, th efficiency of the drills was very important. Th drilling was found to be one-third of the cost o delivering ore at the mill. By 1910 experiments were going on with the Leyner and Waugh air dril and with drill sharpening machines. Around 1913 drill repair man, William D. Paynter, conceived the idea of a drill testing machine. It made a record of every blow on a strip of paper, like a indicator diagram, and it told more about a mach drill's efficiency than a day of testing by dril the rock. This machine was manufactured in Geor Brother's Foundry in Grass Valley and patented b Paynter. Soon it was being bought by drill manu facturers to emprove the efficiency of their pro

The mine was in very good ore now, so in 19 the company purchased the Cincinnati Hill proper located near Brighton Street, and sank a 400 foo shaft. But only a small patch of ore was found. Tom Gill was foreman at this shaft and A.B. Foot noted he "drove the drifts in hard rock over 300 feet in a month, which was a record for us at th time". Due to poor ore and a large amount of wa the shaft was abandoned in 1912.

In 1911 the company became interested in th Champion group of mines on Deer Creek, 1½ miles of Nevada City. It was full of water below the 1,750 foot level, and there were 5 Cornish pumps 5 different shafts, 3 on one side of the creek a 2 on the other. There was only a foot bridge ac the creek so A.B. Foote designed an unusual stif suspension bridge. Roy Tremoureaux and later Be Stapler were superintendents of the Champion, wi Tom Gill as foreman. The mine did not prove to good investment. Expenses totaled one million d more than was produced during the 11 years it wa operated by the North Star Company.

In 1913, A.D. Foote retired and became a co sultant. His son was promoted to manager under Hague. During the years since A.D. came to the 1895 until his retirement, the incline shaft had the 6,000 foot level and 18 million had been pro

Although there seems to be no record of any stealing gold bullion, some robberies did occur. October 29, 1908 during the night the assay offi broken into, the vault opened, and some precipit

from the cyanide plant were removed. Sheriff Walker investigated and found wagon tracks. He sent to Sacramento for Detective DePue who soon arrived with two bloodhounds from Folsom. This caused quite a stir in town. But rain had started to fall and the hounds could find no scent. The newspaper learned that the loss had been quite small. Apparently the thieves were in a hurry, fearing the approach of the watchman on his rounds, and snatched up only what was easily carried off. However, it was stated that precipitates can easily be retorted by an expert with a gas torch.

Another instance took place on February 26, 1914. On that winter night Percy Glasson and Earl Bennallack were the night shift at the Central cyanide plant. Two masked men, armed with guns, compelled them to deliver a large quantity of precipitate. The loss was estimated at about 100 pounds, valued at nearly $30 per pound. The news item stated that "Glasson was forced to use a hack saw to cut through the iron bars covering the presses and giving access to the valuable accumulation beneath". The material was scooped into canvas bags and the bandits admonished the men that the plant was being watched so not to attempt to leave it for half an hour. One masked man then cut the telephone wires and they hastily departed. Ignoring the warning, Bennallack immediately left the plant by the back door and hastened to the manager's home, about a mile away through the woods. Foote gave the alarm to police officers in town and a search got under way. It was noted in the paper that the next day was "clean-up day" at the cyanide plant so the robbers must be familiar with the routine. The newspaper also stated, "the precipitate must be reduced before it can be disposed of, so it is the general opinion the men are familiar with the mode of reduction".

For two days the robbers eluded police, but fingerprints were found on a light bulb near the telephone in the cyanide plant. Young Glasson kept thinking the voice of one bandit seemed strangely familiar. This, plus the finger prints, finally resulted in establishing identity of one robber. When confronted with the evidence, he confessed and also revealed his accomplice. The cache was located in Wolf Creek - it weighed 40 pounds and proved to be worth $40 per pound. One culprit had been working at the North Star and the other at the Empire.

When the incline shaft reached the 6,300 level it encountered a vein dipping south-west, exactly opposite to the old North Star vein. Later development failed to find the old vein continuing beyond

this intersection. A.B. Foote wrote the following description:

> "The incline shaft extends from the surface to the 6,300 level, following the North Star vein... The vertical shaft connects with the incline at the 4,000 level, at a vertical depth of 1,600 feet. 4-ton skips in 2 compartments of this shaft make a vertical turn of 15 foot radius at the 4,000 level and run down the incline to the 6,300 level. A cage is operated in the third compartment to the 4,000 level. There, men and supplies are transferred to a "truck"* running on a third track down the incline shaft to the 6,300 level, operated by an electric hoist on the 4,000 station. When the shift changes, double deck cages are substituted for the skips in the vertical shaft, but they stop at the 4,000 station. A "truck" carries 22 men to the 6,300 and requires 8 minutes to make a trip down and back. A large amount of the work is within walking distance of the 4,000 level."

This arrangement had been satisfactory for man years, but when the men could no longer walk to the stations (the tunnels now being extended too far) a material had to be transferred at the 4,000 station go on a single "truck" to the 6,300, the congestion and loss of time became serious. The hoisting engi at Central shaft, installed in 1900, was designed f 2,500 feet of cable but was now winding 4,000. Thu the mine had outgrown its equipment and it was now question whether there was ore enough in sight to justify the building of a new plant.

Billy Hague, with the same courage as his fath persuaded the other Directors to agree to finance t huge undertaking. All the ore was now coming from Central shaft, so it was decided to move the rest o buildings - the office, shops, assay office and par the old mill - over to the Central. The old cyanid plant was torn down and the new one enlarged. A ne steel head frame went up and a Nordberg Hoist, driv by compressed air, was installed in 1915. Today it hard for us to realize the problems involved in mov heavy machinery with teams of horses. The new hois

* An open skip

weighed 23 tons and it required three 8-horse teams to pull it from the Narrow Gauge depot up to the mine. The teams had never pulled together before, and one team often started up faster, tried to pull the whole load, and when it failed, the horses quit before the rest could get started. It took two days to move the machinery just two miles!

The new assay office building was completed in November of 1916. Until then all the gold had been melted in the old building at the incline shaft, presided over by Thomas Marshall and his assistant, Thomas Loney. Mr. Loney was amalgamator at the North Star for over 30 years. Mr. Marshall was in charge of melting and pouring the molten metal into bricks. He then transported the gold bricks to the Express Office in Grass Valley. From there they were shipped by railroad to the Mint in San Francisco. Marshall was one of the companies' most valuable employees. A.B. Foote wrote a tribute to him telling how he started work as assayer and accountant in the 1880's and did all the melting and shipping of the bullion --

> "He continued in that position as the company grew larger and more prosperous until 1929. Toward the latter part of this time he had too much to do to attend to the assaying and melting, but I cannot remember the time when he failed to take the cleanup into town for shipment; altogether he must have take over thirty million dollars to town... For many years the company paid out ½ million or more a year, and there was not ten cents of that amount that Mr. Marshall did not account for."

By March 1917 the 40-stamp mill at the Central had been enlarged to 60 stamps. The 1,000 pound stamps were enlarged to 1,500 pounds, so the new mill had the same capacity as both the old and new mills combined in previous years. Also a new form of cam was developed by A.B. Foote which increased the drops per minute and thus increased the crushing capacity by 8%, besides reducing breakage of the cam.

The only equipment left at the incline shaft was the old Cornish pump. "Beecher" Jones looked after it during the 8 hour day shift, and it ran un-attended the rest of the

time. The old dry house became a garage for the Foote cars and the old assay office became a dwelling, and it is still in existence.

Increasing concern for safety measures meant that much effort was finally being made to provide safer working conditions in all the mines. Rescue teams were organized and first aid teams trained. Oxygen equipment was demonstrated, to be used in case of an underground fire. Soon competition arose and the various mines held events to see which teams were the most efficient. The Bureau of Mines held annual Field Meets and awarded prizes to the winners.

World War I brought many difficulties to the gold mines. Supplies became hard to get and wages elsewhere were going up. In April of 1918 the men refused to work at the North Star unless the pay was raised to $3.50 per day for muckers and $4.50 for miners. The officials of the Empire, North Star and Idaho Maryland mines consulted together and agreed to grant the increase. The North Star also decided to try a bonus system based on the number of holes drilled and the tonnage of the shovelers. In July 1918 the local miners formed their own Union, called "The Mine Workers Protective League".

Flu epidemics caused havoc, especially during the winter of 1918. In November, 90 men were off and there were 5 deaths. An emergency hospital was set up in Grass Valley which treated 48 cases. That same year the company lost one of its most gifted engineers, Billy Hague. He had gone to war, and died of pneumonia in a hospital in France. A few years later the "Hague, Thomas, Hegarty Legion Post" in Grass Valley was named in honor of Nevada County service men who died overseas.*

In June 1919 the men again struck for higher pay. The mules were brought up from underground when the pumpmen quit, but, after several meetings of the miner' committee, the men voted to return to work. The older men realized the war had caused prices to rise, but not the price of gold, and all the gold mines suffered as a result.

The news of the terrible Argonaut Mine fire in Amador County shook the mining community in 1919. The North Star sent all the rescue team men it could spare. When the men returned, their harrowing experiences were told and re-told for many weeks, and extra efforts were made to prevent such a disaster in the local mines. One engineer at the North Star, Ray

* Now "Frank Gallino Post"

Parsons, conducted experiments with an idea he originated. He suggested a warning system that could alert all the underground men very rapidly by using a warning stench. The foul-smelling liquid, amyl xanthate, was introduced into the compressed air ventilating system, which conducted the odor throughout the mine in a very short time, alerting the men to an emergency.

In the spring of 1921 the question of wages once again was causing dissent and the operators of the major mines began holding meetings to discuss what to do. The miner's union sent a committee of three to meet with them on June 6th., but rejected all propositions. Soon plans were underway at the North Star to shut down. By July only the pumpmen, hoistmen, and watchmen were working and the mine operators were notified by the union that everyone (except watchmen) would be called "to unite his efforts with the efforts of his brothers to the end of establishing a fair wage for the mine workers of the district..." To prevent flooding of the mine, men from outside the area were brought in to take over the pumps, and cots were set up for them in temporary quarters. Many conferences were held and telegrams sped back and forth between Grass Valley and the New York Office.

By mid July the miners union agreed to permit pumpmen to return to work to prevent damage to the mines during arbitration, so all outside workers were discharged at the North Star on July 16th. and the local men went back to work. Meanwhile, arbitration continued and a great deal was said about the recent reduction in the cost of living. Mr. W.W. Waggoner, noted hydraulic engineer of Nevada City, prepared detailed accounts of costs of food, clothing etc. for the past few years, trying to demonstrate that the men could afford to live on a reduced wage scale. But deadlock continued through September. The mine operators pointed out that they had been operating at one-third to one-half capacity for a year and that they could not continue to "rob" the mines by only taking out the high grade ore. They argued that unemployment, caused by closing the mines, would be far more serious than a wage reduction. Settlement was finally reached on the basis of lowering wages by 10%.

The loss annually during the war years was $250,000 for the North Star. The high cost of materials, plus the federally fixed price of gold ($20.67 per ounce) caused the mine to be partially closed down in 1921. 150 men were discharged and only 110 of the best men retained to do just enough stoping to pay the overhead expenses and the taxes and do some development

work. These men were mostly sons of the Cornishmen who had come to Grass Valley in the early days, and most of whom had built homes in the area. The company, by the way, frequently advanced the money to build them.

In a letter a few years later, A.B. Foote wrote, "The North Star made no profit from 1918 to 1929, although it produced over 9 million dollars, because the expenses were greater, exclusive of the cost of deepening the shafts." At another time he stated, "The production of gold in California declined from about 24 million in 1918 to a little over 8 million dollars in 1929, and I am quite sure that most of that 8 million was not produced at a profit." There were new federal tax laws and also the mines were now required to restrain all tailings, thus adding to the operating costs. Ernest Howe, the consulting geologist for the company, wrote to Foote, "My heart goes out to you and the blessed old mine at this time."

The Empire, North Star and many other mines had always used mules to pull the ore cars underground. Areas were enlarged in the tunnels where hay was stored and they were fed. Many of the mules may have spent their entire lives in the mines, but some were brought up from the North Star from time to time and were in a pasture on the old Loutzenheiser ranch at the southern end of the property. It required a day or two for their eyes to become adjusted to the light, when they were brought up, but, contrary to popular belief, they did not go blind. After the war, electric locomotives began to be used to pull the underground ore cars, Run by storage battery, they could pull 10 cars, but mules continued to be used, pulling 7 to 9 cars.

At about this period the citizens of Grass Valley were treated to the sight of Mrs. George Starr's new electric car. She could be seen driving to town to call on her friends and all would go smoothly during the down-hill trip from the Empire. However, when it became time to retur home, sometimes her car ran out of "juice" and the teamster Tom Leary was hurriedly called to hitch his horses and pull her back up the hill. So the four-footed beasts continued to be useful despite all the new electrical inventions!

The problem of transporting men and supplies from the 4,000 station to the 6,300 became acute by 1924. It was now necessary to decide whether to spend the money to develop more ore, or to shut down for good. In February, George Agnew, Ernest Howe and later Ira Joralemon, came to California to study the problem. By the following year, contracts had been completed with Bedford and Wood and J.F. Johnson to sink a new vertical shaft. The plan was as follows: (1) Sink an incline shaft on the No. 1 vein in line with the main North Star Incline Shaft, which would follow the vein down until it was vertically under the Central Vertical Shaft, cutting stations every 300 feet. The skips operating in this new shaft would dump into the loading pockets at the 6300 station of the North Star Shaft. If the pitch of the vein continued without change, the incline would have to be sunk 2300 feet from the 6300 level. (2) Sink an incline shaft on a promising ore shoot on No. 2 Vein from a point on the 6000 level, about 2700 feet south-east of the 6000 Station of the North Star Shaft. Cut stations every 300 feet. (3) Sink the Central Vertical Shaft approximately 2000 feet to connect with the No. 1 shaft. (4) Connect the bottom of No. 2 shaft with the No. 1 and Vertical Shafts by a drift on the veins. This to be the 8600 level, i.e. the distance measured along the dip of the No. 1 and North Star veins to the surface. And (5) continue stoping as much ore as possible. The men would work in three shifts.

R.W. Parsons was the superintendent at this time and a young engineer, J.R.C. (Jack) Mann did the surveying. It was fully realized that this program would tax the hoisting and compressor capacity to the limit, but to stop production for the time necessary to complete the sinking of the shafts would involve too large a financial outlay even if it should prove cheaper in the end. The time required to complete the program was of great importance. It was estimated that expenses would exceed production by about $1,000 per day until completion.

The contract for sinking both shafts was given to Robert Bedford, who had been superintendent with the company before Parsons. His partner, James Wood, acted as underground foreman.

After completion of this project, A.B. Foote

wrote:

> "With hoisting going on in four shafts at top speed, it was inevitable that wrecks and breakdowns would occur, necessitating long hours of over-time for the repair men and bosses, and too much credit cannot be given for the way they did their work. The track in the main hoisting shaft was none too good, and de-railments caused a lot of damage, especially when a skip off the track was pulled around the turn into the vertical shaft!
> R.W. Parsons and his assistant, Jack Mann, especially deserve credit. It was hard to keep things running smoothly when the shafts were given preference over everything, and the shaft men were paid higher wages than the company bosses. There was not much time to spend surveying, especially in the shafts, but the Vertical and No. 1 Shaft connected within 6 inches; and the connection with the No. 2 Shaft, which involved a traverse of 4,400 feet of crooked drift, plus 4,300 feet of shaft, closed within 3 inches! J. Fred Johnson organized the crew and developed the methods for sinking the Vertical shaft, and deserves credit for the good alignment of the shaft and for his direction of the critical job of connecting up with the shaft above. To R.H. Bedford goes the credit for organizing and directing the sinking of both incline shafts."

The year 1928 was an anguished one for the opera tors of the North Star. The Companies' stock-holders were becoming increasingly uneasy about lack of profi The new shafts had not uncovered the ore that had bee hoped for. It was suggested that the mine be operate through tributors (leases). But Foote and Agnew agre that this was not feasible until they could no longer run the mill at more than $\frac{1}{2}$ capacity. Plans were mad to sell the Cincinnati Hill, Gold Hill and Minnie pro erties. Foote hoped desperately for new "ore shoots" and a vein on the 8600 level appeared promising for a

time. But taxes continued to increase and the mine's machinery was 50 years old and obsolete, requiring a large force of mechanics and electricians on the pay-roll to keep up with repairs and maintenance. The incline shaft was now down to 9,000 feet and the vertical down to 3600. The ore was marginal and the mine had been operating at a loss for 6 years. In 1916 an agreement had been reached between the Empire, Pennsylvania and North Star, but for some time there had been continuing problems, ending with a law-suit between the North Star and Empire mines over proximity of the veins - each mine owned property which was only accessible to the other.

Finally, in April 1929, the Empire Star Mines Company Ltd. was incorporated in Delaware, to take over and operate the Empire, the Pennsylvania, and adjacent holdings, plus the North Star Mines Company and its holdings. Fred Searls Jr. was named President, George B. Agnew, Vice-President, and H.E. Dodge, Secretary-Treasurer. The final chapter in the history of the North Star Mines as an independent mine came to a close.

Under the new ownership the North Star again became productive. The incline shaft, as measured vertically from the surface, ultimately reached a depth of approximately a mile when closed down in 1956.

SOME PRODUCTION FIGURES

Production for 1916	$1,160,007.44
" " 1917	1,148,684.89
" " 1918	775,688.18
" " 1919	919,799.93
" " 1920	718,286.33
" " 1921	922,769.58
" " 1922	1,087,705.99

Production from 1884 to 1923: $25,793,689.49

NATIONALITIES OF MEN EMPLOYED IN 1923

U. S. Born	362
English	63
Irish	5
German	3
Italian	55
Austrian	10
Scotch	4
Spanish	8
Danish	1
Swiss	3
Finnish	1
French	4
Montenegro	1
Luxembourg	1
Greece	1
Norway	1
Australian	1
	524

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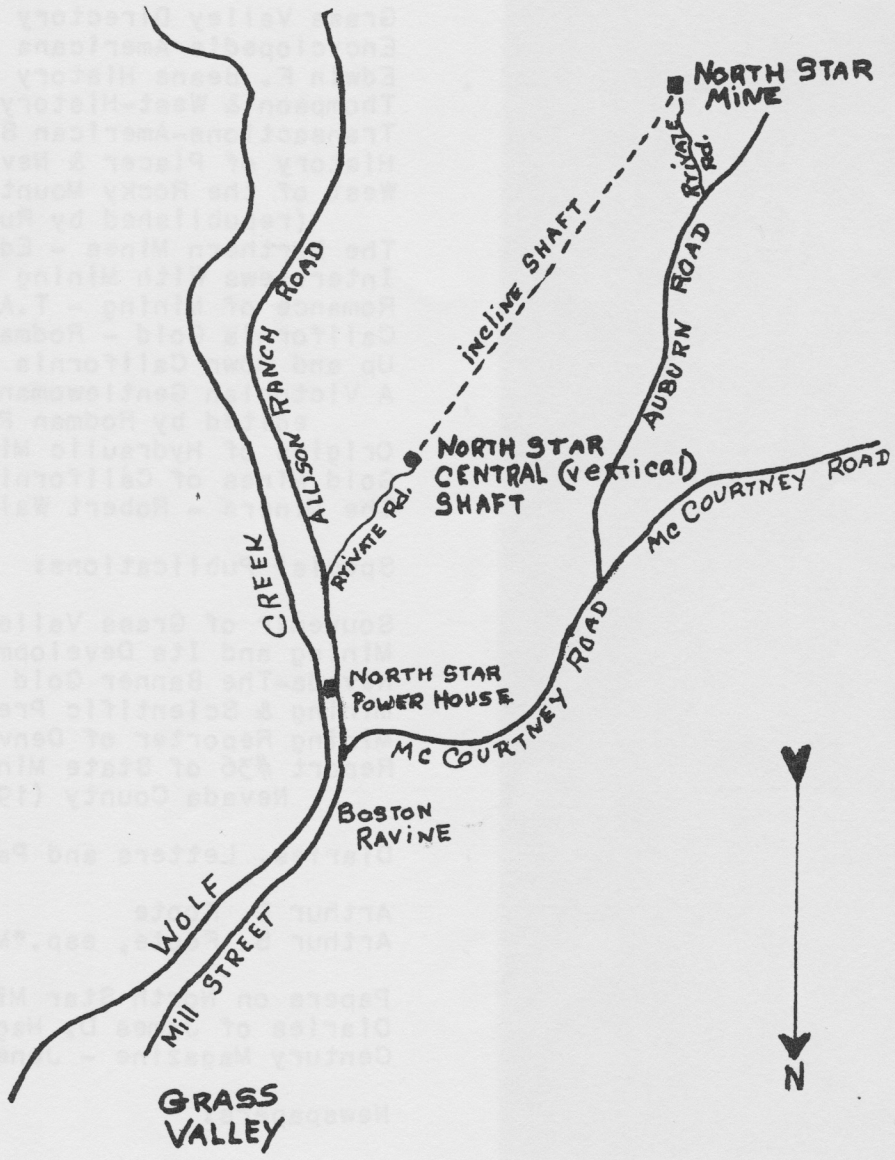
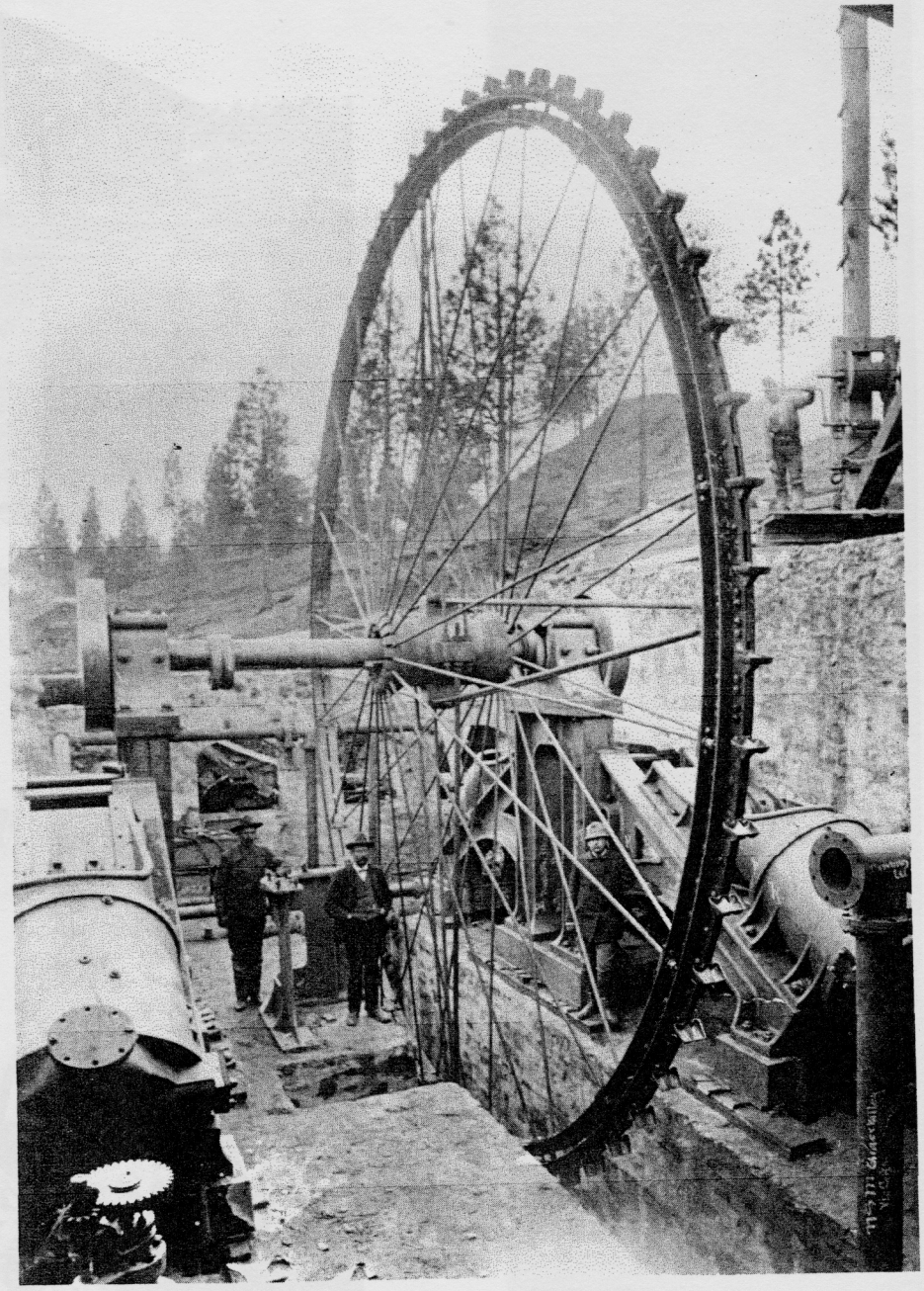


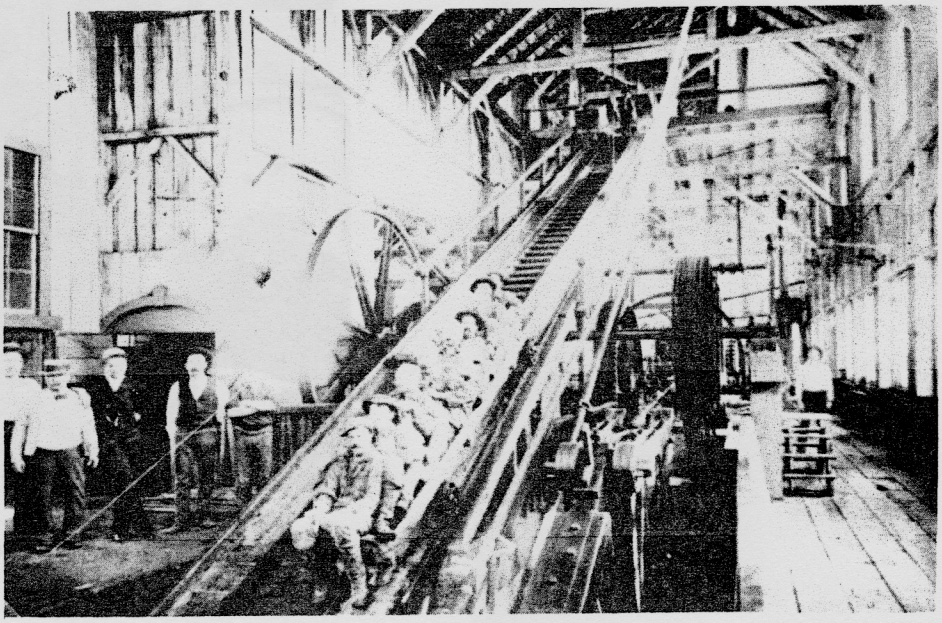
The North Star vein surfaced on Lafayette Hill, on Aubur Road south-west of Grass Valley. Here an incline shaft was sunk which followed the vein in a north-easterly direction. The Central vertical shaft intercepted the incline shaft twic once 1600 feet below the surface, and again at 3500 feet, bec the incline shaft angled back south-west as it went deeper.

By 1929 the shaft reached a vertical depth (as measured the incline) of over 4,000 feet at the 9,800 level, and the m had produced over $33,000,000.

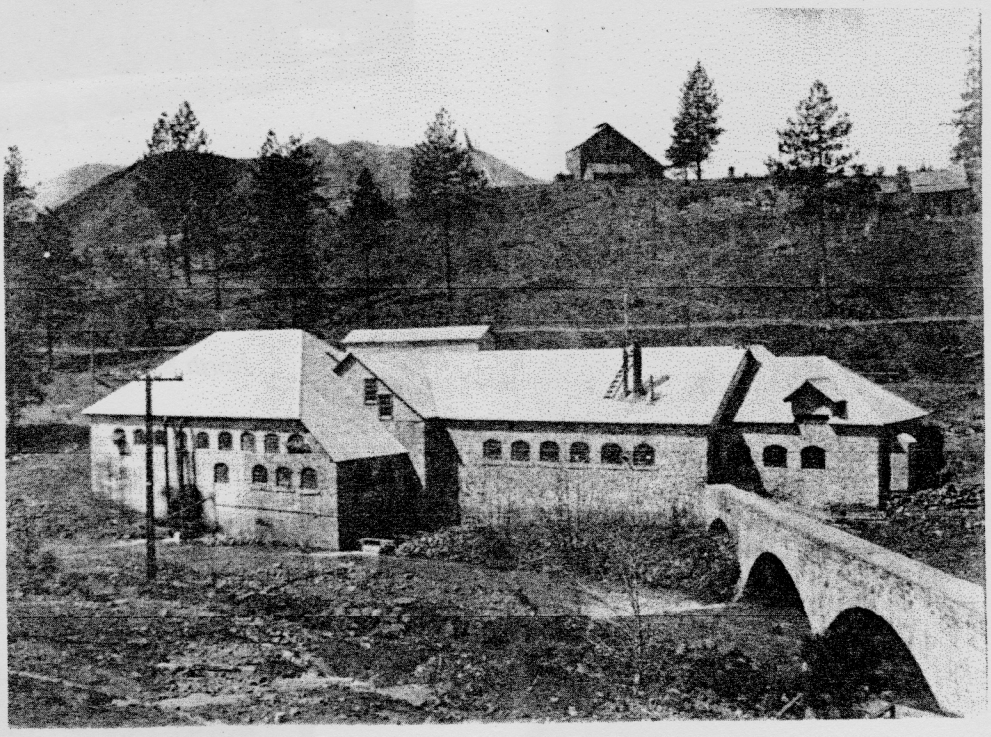


Installing Pelton wheel in North Star Powerhouse

North Star Incline Shaft, June 1889 *Photo Courtesy Marian Padgett*



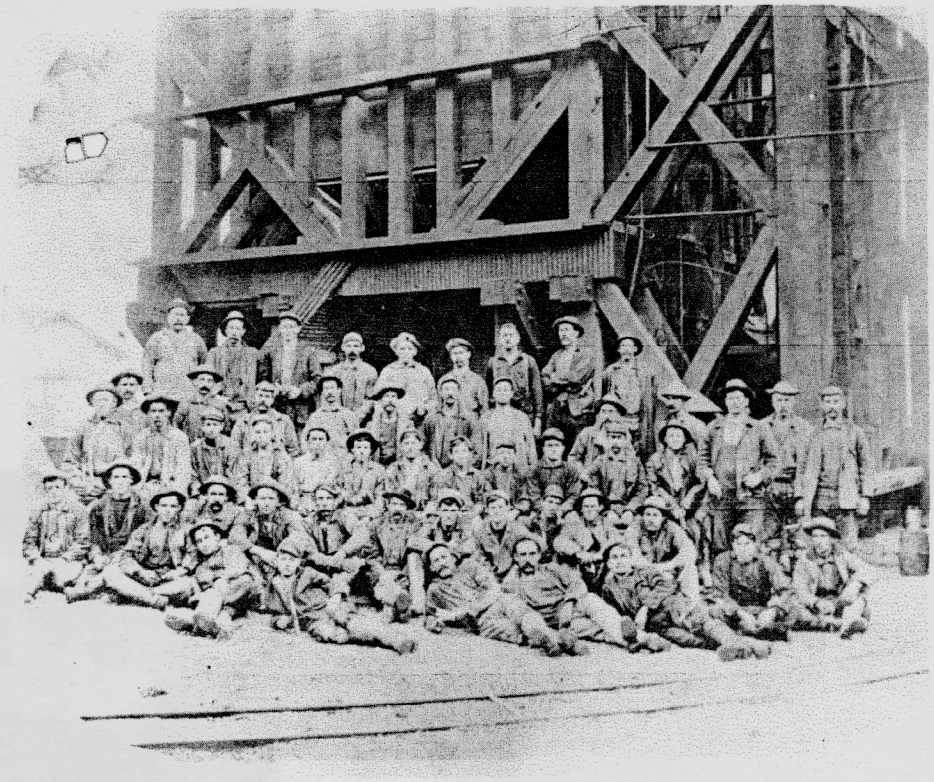
"Truck" and Cornish Pump, North Star Incline Shaft *Photo Courtesy Al Diltz*



North Star Powerhouse showing Massachusetts Hill in background

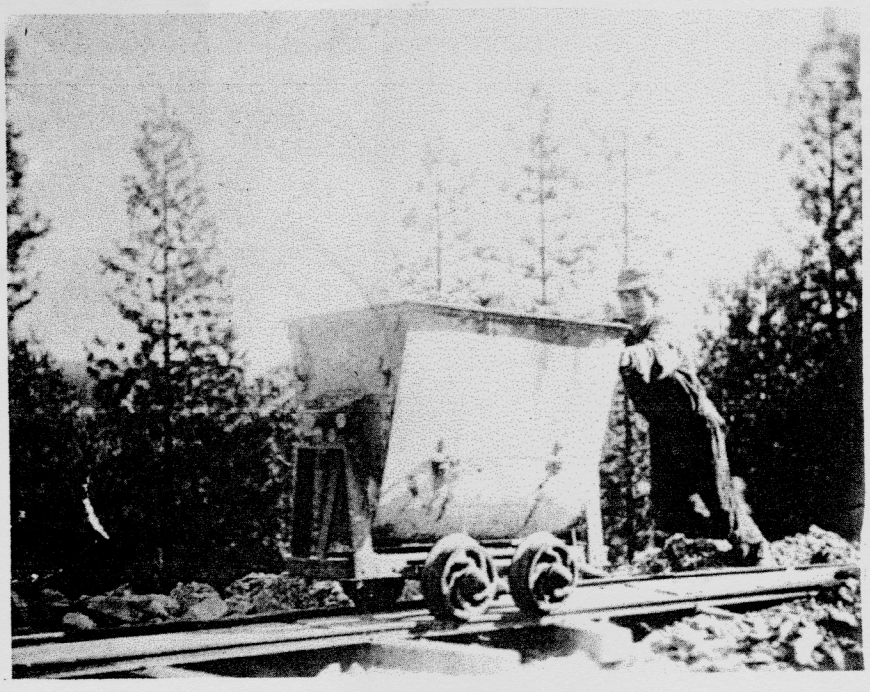
North Star Assay Office at Incline Shaft. Note leaded windows.

Collecting Amalgam on Clean-up Day in Stamp Mill

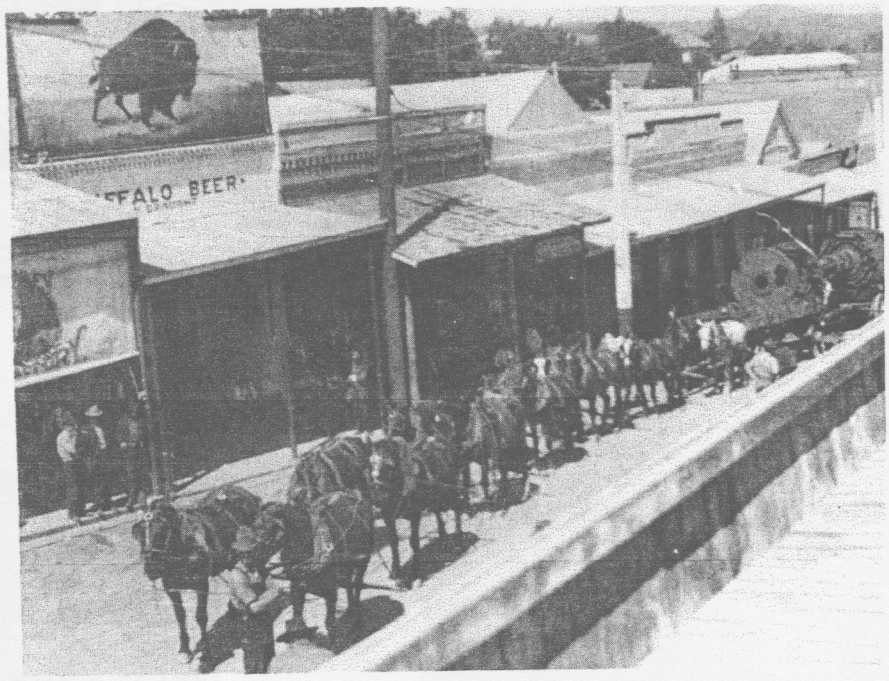


North Star Central, 1904

Photo Courtesy Joe B

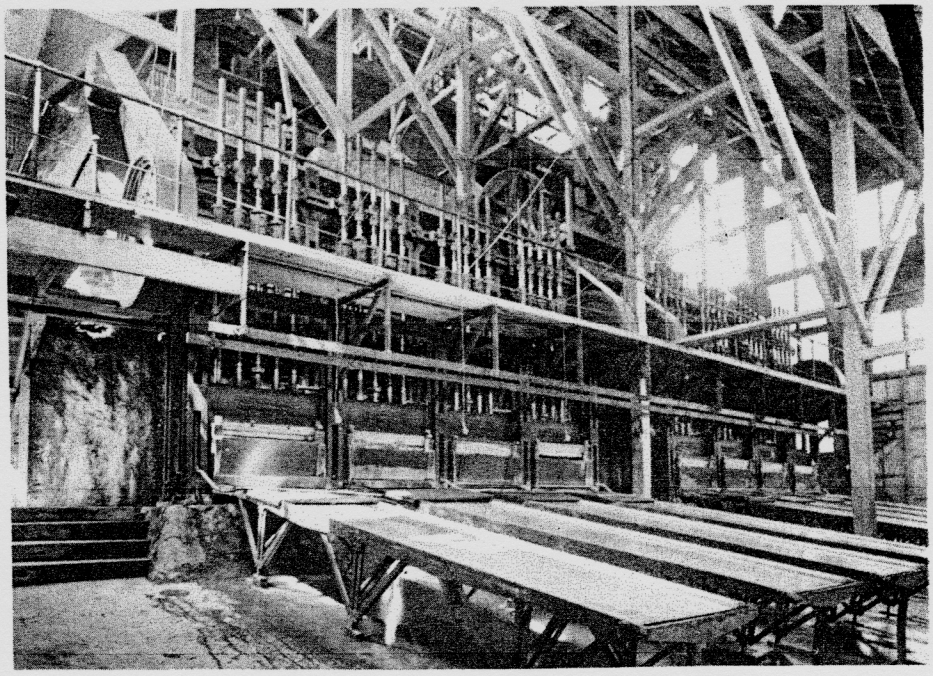


Car Boy, 1901



Hauling Crankshaft to New North Star Central Hoist

Overall View of Central Shaft. Headframe, Mill, and Cyanide Plant.



Central Mill Interior, Stamp and Mercury Plates