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M I N A S D E L T A J O

1906-1916

By George A. Tweedy

The year 1906 marked the commencement of a new epoch in the history of Minas del Tajo. The grade of the ore from the mine had so fallen off that it became imperative to adopt modern ways and means if the mine was to continue in operation at a profit.

The old pan-amalgamation process in use up to and including 1905, while paying a profit on high grade ores, was no longer able to treat profitably the ore in sight at that time. Furthermore, the equipment then in use was wholly inadequate and unsuited for carrying on the search for new ore bodies in the deeper levels of the mine.

With a full knowledge of these conditions, the administration proceeded with the construction of the equipment hereinafter described with what results can best be judged from the following statement:

<u>569,494</u> tons of ore of an average value of \$8.32 per ton yielded bullion to the value of U.S.Cy.		\$4,151,903.63
Receipts from other sources		40,090.10
Total Receipts		<u>\$4,191,993.73</u>
Reserve fund Jan. 31, 1906		166,311.79
Reserve fund	\$104,000.00	
Cash in banks	147,104.40	
Dividends	280,656.84	
Paid for mining claims in Rosario	119,169.30	
Paid for real estate in Rosario	12,350.00	
Paid for timber lands at Matadero	11,150.00	
Bolanos (paid for property and funds on hand)	522,393.13	
New equipment for Tajo	608,951.40	
	<u>\$1,805,775.07</u>	
Upkeep of property during two years shut-down and including \$6000 levied by revolutionists	\$ 141,720.77	
Total cost of mining and milling 569,494 tons of ore and marketing bullion produced from same	<u>\$2,410,809.69</u>	
	<u>\$4,358,305.52</u>	<u>\$4,358,305.52</u>
Average cost per ton including everything	\$4.23	
Average extraction obtained	88.5%	

During the period under consideration the mine was idle two years. The first year was required for the construction of the mill and cyanide plant; the second year's loss of time was caused for the reasons herewith set forth in the following table:

T A B L E

<u>Period</u>	<u>Cause</u>	<u>Time elapsed</u>	<u>Work days lost</u>
May 5-1911-June 19-1911	Revolution	39	39
Apr 4, 5 1912	Fiesta	2	2
Apr. 27, 1912	Battle	1	1
May 1, 1912	Battle	1	1
June 25, 1912	Fiesta	1	1
Sept. 16, 1912	Fiesta	1	1
Dec. 12, 1912	Fiesta	1	1
Dec. 25, 1912	Fiesta	1	1
Jan. 1, 1913	Fiesta	1	1
Mar 20, 21, 22, 1913	Fiesta & Battle	3	3
May 5, 1913	Fiesta	1	1
June 24, 1913	Fiesta	1	1
Sept. 15, 16, 1913	Fiesta	2	2
Oct. 15, 16, 1913	Battle	2	2
Oct. 20, 1913 to October 6, 1914	Revolution	351	300
(Small shift till 11/24/14)			
Nov. 26, 1914/Dec. 2, 1914	Strike	7	6
Dec. 25, 1914	Fiesta	1	1
Feb. 26, 27, 1915	Strike	2	2
Apr. 1, 2, 3, 1915	Fiesta	3	3
Aug. 18, 1915	Heavy Rain	1	1 (small
Sept. 15, 16, 1915	Fiesta	2	2 shift)
Dec. 25, 1915	Fiesta	1	1

S U M M A R Y

Total time lost due to:

Revolution	343 days	
Strikes	8 "	
Fiestas	21 "	
Rains	1 "	
	<u>373</u> "	Total.

During the time of these shut-downs heavy expenses were incurred in order to protect the property from deterioration; (care of surface equipment, mine pumping and timbering required to hold open and accessible the principal roads and stopes.)

Attention is called to the fact that the last five years operations were carried on while Mexico was in a

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state of civil warfare and revolution. Much of this time there were no railroad, telegraph or postal facilities. Supplies, both local and foreign were obtained at great difficulty and expense.

The labor, once so satisfactory, now greatly decreased in efficiency, demanded increased compensation.

THE MINE

Period of Operation

Pending the construction of the new mill and cyanide plant underground operations were suspended from Feb. 1906 until Jan. 1907; during this interval enough men were employed to operate the mine pumps, maintain the tram and man-ways in good condition, and to make some very necessary repairs on the main roads preparatory to handling the projected increase in tonnage. For instance, the double track on the Recompensa Level, in the vicinity of Tiro Real, had lowered to such a degree that it was almost impossible to tram over it. This most important road for tramming ore to the shaft, was entirely retimbered and put on the proper grade. No stoping was carried on at this time but a considerable amount of development work was done. During this interval of suspended operation, the new railroad to the mill and new bins for receiving ore from the mine, were constructed.

Underground work was resumed in January 1907, and was continuous until May 5, 1911, when the Madero Revolution swept through the district and operation was suspended until June 19th, 1911, a total of 39 work days being lost from this cause. In this interval, a sufficient force of men were employed underground to keep the mine tramways

in good condition and to run the pumps.

From June 19th, 1911, until Oct. 20th, 1913, although conditions were very unsettled, the town being attacked on several occasions, the mine operated with the loss of only a day or two.

On Oct. 20, 1913, the district was completely controlled by the rebels and Mazatlan was in the hands of the opposing faction; consequently supplies, funds and bullion could not be shipped out and operation was once more suspended. As in former similar cases, the mine was maintained in proper condition, repair work done, and the pumps kept running. The most important repair work during this period, (which continued until Oct. 6th, 1914) was the retimbering of Tiro Real at the Recompensa and Cincuenta Levels.

Since Oct. 1914, and during the latter part of the same year and throughout 1915, unsettled labor conditions were experienced, due to lack of stable government, political agitation, scarcity of food supplies, high cost of living, etc., and some 14 days were lost through strikes.

To sum up, about two full years of work were lost due to the above mentioned causes.

PRODUCTION

During eight years of actual operation, the mine yielded 569,494 tons of ore averaging \$8.32 U.S.C. per ton. During this same period 158,309 tons of waste were hoisted. In order to keep the mill supplied with its present 220 tons daily capacity, the mine force worked 6 days of one shift each out of the week, the daily output aggregating 257 tons.

ORE BODIES WORKED

With the resumption of underground operation in January 1907, upon the completion of the newmill and cyanide plant, and due to the latter's facility for treating a much lower grade of ore, an enormous quantity of profitable ore

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formerly considered impossible to treat, was placed at our disposal. The following stopes or sections of the mine have been the most important contributors to the production of the 10 years under consideration.

In the early part of 1908 work was started re-opening Zacatecas. This development has steadily gone ahead and at the present time aggregates fifty tons daily. The total production of this section of the mine is estimated at 63,171 tons of ore with an average of \$7.90 per ton. Of this total the so-called 33 Stope, which is just east of the main fault and extends between the No. 1 and No. 2 Levels, has produced 8376 tons of \$8.40 per ton ore. This stope is still working and has in the neighborhood of 5000 tons of ore in sight. Some extensive open-cut work has also been carried on in Zacatecas at a low cost.

76 Dump, the surface ground occupied by the old Patino property and buildings, was worked and 6575 tons of \$6.30 ore were extracted. In connection with this dump, mention should be made of the policy pursued by the company in the 10 year period just passed. Former Managements were loathe to work underground where outside surface property might in any way be injured, thereby tying up several ore bodies. The working of Zacatecas is a fair example of the present policy of the company and the plan is as follows:

Wherever the purchase of any surface property or rights was warranted by profits to be made by working an ore body beneath it, said property has been bought. By the purchase of the Patino property in Zacatecas, not only was all the ore from 76 Dump obtained, but the company can now work the underground ore bodies, which in former days was feared.

Doña Jesus was reopened soon after Zacatecas and has produced up to 1916, 6807 tons of ore averaging \$6.44 per ton, part of which has been cheaply worked by

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open-cut.

In the total production given for Zacatecas, is included, besides Dona Jesus, the production of some of the high grade stringers found also east of the big fault and out in the hanging of the main Zacatecas ore body, such as the Birria, San Pablo, and Corse; San Pablo has produced in the neighborhood of 2000 tons running \$24.00 per ton and Corse 3000 tons of \$14.60 ore.

In 1907 impetus was given to working the large body of oxidized ore of Loma Santiago. Tunnel 2, the name given to the biggest part of the underground work done in Loma Santiago, just back of the church, has yielded more than 18,000 tons of ore averaging \$7.50 per ton. Open-cut work on this hill, including the so-called Caracol cut on the north side of the hill, has produced above 50,000 tons of ore running \$5.34 per ton.

Confianza is the name given to that portion of the mine between the Cero and 40 Levels and in the vicinity of the old Calor and San Vincente Shafts. In fact, part of what is now known as Confianza, was formerly part of the old Calor Stope. This stope has produced some 25,000 tons of an ore averaging better than \$7.50 per ton and has been working since April 1910.

The Flores Stope, in reality a continuation of Confianza, is between the San Vicente and No. 2 Levels and vertically below where the machine shops formerly stood. Underground it occupies the portion of the mine formerly known as Presidio. It has yielded to date 7,500 tons of \$8.50 ore.

Calenturas, a stope with a production of 7,200 tons of better than \$8.50 ore, is on the Recompensa Level in the neighborhood of the old No. 6 Stope and is a continuation of the Flores shoot of ore. It extends from the

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Recompensa Level to the No. 28 Level.

Another good producer was the 31 Stope. This ore body was encountered near the junction of the big fault with the main vein on the No. 2 Level, on the road to Zacatecas, and produced over 7000 tons of a grade exceeding \$10.00.

The old Recorte country has been reworked, yielding 9,700 tons of ore averaging close to \$9.00 per ton. This ore body was on the Cero Level just west of the 4th of July Shaft and extending in depth to the 40 Level. Exceedingly high grade ore was found here.

Just below the Recorte Stope, and a continuation of the same, the old 44 country has produced 7000 tons of better than \$8.00 ore.

San Antonio, on the new 600 Level, produced about 3300 tons of ore of an average assay value of \$15.43 per ton. All of this ore came from what is known as the San Marcos Vein.

In 1912 what was formerly known as the Guadalu-pana Mine, now Comstock, was leased. From November 1912 to October 1913, 550 tons of ore worth \$5.32 per ton, were taken from this mine.

Besides the above mentioned ore bodies, several others might be enumerated which produced much less tonnage but a better grade of ore.

Referring to the surface dumps there was very little ore in them that former managements, using the old pan-amalgamation process, considered of commercial value, but with the advent of the Cyanide Process many tons of ore have been taken from these dumps and treated at a good profit. It has been the policy of the management, wherever the dumps are not in the way, and wherever underground work will not cause them to sink and mix with the waste, and lose in value, to hold such dumps in reserve. The dumps that from year to year are sinking and mixing with waste, have been worked out and the spot filled up to the common level of the yard. The most notable instance of this policy is what is known as the

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the Taller Dumps, occupying the spot upon which rested the old shops and foundry. Due to work underground the shops were moved to a point north of Tiro Real. This excavation yielded 47,500 tons of ore averaging a little less than \$8.00 per ton. The working costs on this being so light, the profits are at once apparent.

The old Salido property produced in the shape of tailings, nearly 4000 tons averaging \$6.30 per ton.

STOPING

Three systems of stoping are in use in the mine, the Sub Level or Caving System of the old Consolidated Mercur Mine, Stope and Fill and Open-Cut.

During 1908 the so-called Sub Level or Caving System was introduced. This system has lately been developed to such a point that filled and heavy ground now cause no trouble. Wherever the surface ground and the nature of the ore deposit will permit of it, this system of mining is applied and we are able to get out practically all the ore. In former work, pillars of fill and timber were left for the sake of safety. It should be added that this system receives its best application where the ore body is wide and consists of fill and shattered pillars. In the Confianza Stope this system has been applied with marked success. Considerable timber must of course be used in these wide stopes.

The Stope and Fill method is used where we have to deal with narrow ore bodies and where workings or surface property require careful watching. Little timber is used in this system of mining.

Open-Cut has been used in Zacatecas, Dona Jesus, and Loma Santiago. The great advantage of this system is the low cost and the large tonnage; wherever it is possible to advantageously push the work vigorously, contracts are let.

Stoping, including development, costs in the

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neighborhood of \$2.25 U.S.C. per ton of ore mined.

DEVELOPMENT

During the 10 year period, 48,070 linear feet of development work were driven, 13,854 feet of which was done in reopening the Comstock Mine, or 34,216 feet of development work in Tajo alone.

Ordinarily development is done at a cost of about \$4.00 U.S.C. per linear foot.

In 1906 San Antonio Shaft was down some 50 feet from the Chusa Level. Later on it was sunk to a point 190' from the same level. From the 600' mark a level was run off to cut the San Marcos Vein. On this level 3,600 feet of drifts, crosscuts, and raises were driven. In Oct. 1910 re-timbering the shaft from the collar down to the Chusa Level was commenced. Sinking was progressing when the Madero Revolution caused the work to be suspended, and it has not been resumed on account of the unsettled condition of the country. It has been planned to sink to the 700', with a new level at this depth, and then on to the 800' mark.

The great part of the development work and also stoping is done by contract.

MINE STAFF

This staff has generally consisted of one foreman, four shift bosses and one surveyor, and this is the present force. One shift boss looks after such work as the management considers can be satisfactorily handled by him, and the mine is divided off accordingly. This system of employing plenty of American miners to handle the native labor has brought good results.

SURVEYING AND SAMPLING

Complete records of stopes and development work are kept. Stopes are surveyed once a month and the work recorded on maps.

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Sampling is done by regularly trained native samplers and complete records are kept of the same. Between 60 and 70 samples are taken daily affording the mine staff with data necessary to economic and successful operation.

The working of so many faces in fill is responsible for the number of assays.

The cost per ton of this service is about \$0.11 U.S.C. per ton.

TIMBERING

Native hard woods, such as ebony, tepemezquite, mora, arellano, amapa, palo prieto and others are used. These vary in size from 8 to 10 inches in diameter for posts and caps and stulls. Lagging and spiling are also made from native timber of 4" and 5" diameter.

Practically the only set used both in stoping and in the manways is the ordinary tunnel set, the posts of which vary from 7' to 9' with 4' caps, and sills from 6'6" to 7'6". Collar braces are used in heavy ground. 7' sets are used mostly in the tram- and manways, while frequently sets as high as 9' are used in stoping, these sets yielding much more ore than the smaller sets. From 3' to 4' cribbing is used for chute work.

The wage of a timberman in normal times is \$1.75. His helper receives \$1.50 Mex. Timbering costs about \$0.70 U.S.C. per ton of ore.

The scarcity of hard rock faces and the reliance to a large extent on the old filled stopes for ore, has caused within the past few years, a great increase in the number of timbermen over miners, or hand drillers, while formerly it was just the reverse.

HAND DRILLING

Double hand work prevails altogether underground, while occasionally in the open-cuts single hand work is used.

The miner's wage in normal times has been \$1.75 Mex. and this service costs in the neighborhood of \$0.19

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U.S.C. per ton of ore.

MACHINE DRILLING

To secure good service in this branch of work, in 1911 an Ingersoll Rand Compound, Belt Driven, Air Compressor with a capacity of 1000 cu. ft. of free air per minute was installed at the San Antonio Shaft. This replaced the old and inadequate Ingersoll Sargent straight line air compressor at the Tiro Real. From the drum the main portion of the air is conducted down the San Antonio Shaft through 700 ft. of 5" line, from which the various pipe lines on the different levels are fed. There are 280 ft. of 3" pipe, 200 ft. of 2½", 5525 ft. of 2", 1850 ft. of 1½", 210 ft. of 1¼", and 2260 ft of 1", in the mine used in this service.

The mine is supplied with four Model 6 #7 water Leyner Drills, seven model 6 #8 Water Leyner Drills, and five Type A #5 Water Leyner Stopers. This equipment took the place of the antiquated piston drills formerly used in the mine.

The regular wage of a machine man when not on contract is \$3.00 Mex. per day in normal times, while his helper receives \$2.50 Mex. per day. Machine drilling ordinarily costs \$0.20 U.S.C. per ton of ore.

MUCKING AND TRAMMING

Ordinarily the wage of a mucker, or peon, is \$1.25 Mex., and wherever it is possible he is worked on "tequio" or task work.

Tramming is done on an 18" gauge track provided with 12# to 16# steel rails, steel cars of about ¾ ton capacity are used. Formerly wooden rails were used quite extensively.

One notable innovation during the period in question was constructing a much larger number of ore and waste chutes, thereby greatly facilitating the handling of ore and waste.

Mucking and tramming costs about \$0.42 U.S.C.

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per ton of ore.

HOISTING

In 1906 the hoist in use at Tiro Real was an old one cylinder steam hoist using a $\frac{3}{4}$ " x 4" flat cable. This was replaced by a much more efficient two cylinder, single drum hoist, using a 1" round steel cable. In 1911, with the introduction of much cheaper power, a Wellman Seaver Morgan Electric Hoist with a single drum of 4'6" diameter x 3' wide, equipped with a 1" steel cable was installed; Tiro Real is still the main hoisting shaft, and at present hoisting is done from the Cero, Uno, Dos, Recompensa, Cincuenta, and Chusa Levels. One cage tender and his helper handle all the cars below, while on top two men receive the cars and empty same into the three bins, two of 175 tons capacity, the other of 112 tons capacity. Most of the ore from the surface dumps near by, is elevated to the bins by a 20" conveyor belt, 210 ft. long, driven by a 5 H.P. electric motor, which is an auxiliary to the main Tiro Real hoist.

When this company worked the Comstock, most of the material from this mine was hoisted through San Antonio Shaft, by means of a Wellman Seaver Morgan Electric Hoist with single drum 2'6" diam. using a $\frac{7}{8}$ " cable and a self-dumping skip of about 1 ton capacity. The skip emptied into a pocket from which the ore was carried by belt conveyor, 2'6" wide, to two bins of 155 tons capacity each.

The head-frame at San Antonio is of recent construction, is 60 ft. high, and of heavy timbers.

Preparatory to further development in the San Antonio Shaft, although it has not yet seen service, due to suspension of work there, is an electric hoist similar to the one doing service at Tiro Real. This is also supplied with a 1" cable.

In normal times hoisting costs about \$0.12 U.S. C. per ton. Up to 1916 two hoistmen were employed with 12

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hour shifts each, and a wage of \$2.50 Mex. per day.

PUMPING

Until 1908 pumping had been done by the old Cornish pump used by former managements. In 1908, however, a Gould's Vertical Triplex single acting Plunger Pump of 7" diam. x 16" stroke, with a capacity of 228 gal. per minute and directly connected to a G. E. Induction motor of 75 H.P. was installed and pumping made a much easier problem than formerly. This pump is placed a few feet above the Chusa Level on the old incline to the Cincuenta Level, and is protected by a heavy concrete bulkhead provided with a water tight door.

Pumping costs approximately \$0.08 U.S.C. per ton of ore, in normal times.

In 1911 when further sinking of the San Antonio Shaft was contemplated and commenced, a Krogh 6 stage 4" horizontal Turbine Pump of 300 gal. capacity at 659' head, 1755 R.P.M., and directly connected to a G.E. Induction Motor of 100 H.P., was installed on the Chusa Level.

LIGHTING

Baldwin Carbide Mine Lamps, Nos. 38 and 39, are used almost exclusively, candles being used only in a few instances.

This service costs in the neighborhood of \$0.05 U.S.C. per ton of ore.

TELEPHONES

All the underground tool-rooms, three in number, as well as the hoist at San Antonio, are provided with telephones connected with the office of the Mine Foreman at Tiro Real.

ORE BINS

During the interval in which the new mill was being constructed, two new ore bins were built at Tiro Real, one of 112 tons capacity, and the other of 175 tons. Along

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with these bins a Gate's Gyratory Rock Breaker Style K #4 was installed. The ore going through this crusher at the rate of about 25 tons per hour was, until recently, elevated by means of a belt conveyor to a bin of 175 tons capacity, built a little later than those mentioned above. With the installation of this Breaker and bins, some 15 - 20 men, formerly employed breaking ore by hand, were dispensed with. In 1912 the breaker here mentioned was moved from Tiro Real to the Mill.

At San Antonio two large bins of 155 tons capacity each, have been built.

All the above bins are provided with bottom discharge doors and so built as to permit the locomotive and ore car to pass under them for loading.

TRANSPORTING ORE FROM MINE TO MILL

From the bins at the mine, the ore is carried to the mill in two 15 to 17 ton ore cars drawn by a small locomotive of 7" diameter cylinder x 12" stroke, and over a 3' gauge track. The flat cars already in the company's possession before 1906 were transformed into ore cars provided with side discharge doors. The two locomotives used in this service, like the flat cars mentioned above, were already in the company's possession although no use had ever been made of them. Sixteen pound rails were originally laid on the track to the mill but these were afterwards replaced by a much more serviceable 50 pound relayer rail, purchased second hand and cheap from the Southern Pacific. The replaced 16 lb. rails were sent to the mine for underground service.

In 1912 the railroad was extended to San Antonio Shaft and about 1080' of track were laid. The track from Tiro Real to the Mill is over 3800' in length, making a total of 4880 ft. of track.

With one man on the locomotive 15 tons of ore can be handled per trip, as against the former method of

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using three 2-ton cars drawn by mules to the old mill and occupying 3 men and 9 mules on the work. In other words, 3 men and 9 mules were formerly used to carry 150 tons per day to the old mill, working over time, Sundays and every "Fiesta" day, while with the locomotive one man in an ordinary day's work can handle 257 tons of ore per day to the new mill, or, to express it somewhat differently, he can keep the new mill going at its present capacity of 220 tons daily by working but 6 days out of the week. These locomotives are fired by chips and ends from the sawing and framing of mine timbers.

In ordinary times, transportation of ore to the Mill costs about \$0.04 U.S.C. per ton of ore.

ACQUISITION OF NEW CLAIMS

Before the 10 year interval in consideration, the mining claims in the company's possession numbered 139 pertenencias. Today, due to the purchase of 150 pertencencias more, the sum total of pertenencias owned by the company is 289. (See accompanying maps.)

ACQUISITION SURFACE PROPERTY

Besides the Patino property mentioned under Zacatecas, other properties known to have ore on the surface have been purchased at very nominal prices. The old Salido property, east of Tiro Real and on the road to Mazatlan, with its production has already been mentioned.

The so-called Patino No. 1 and Patino No. 2 properties, recently purchased, have some fair sized deposits of old tailings upon them. Like other properties, these two have been purchased on exceedingly favorable terms, and the tailings contained thereon, are being held in reserve. They are both located at the western base of Loma Santiago. (See map)

RESERVES

In this mine underground reserves are very difficult to estimate as measured tons of ore of certain grade in

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Sight. As before mentioned, the majority of the stopes are in old fill or shattered zones, and, unless such ore bodies were opened up with numerous drifts, crosscuts and raises, it would be no easy matter to estimate the tonnage and the value. Estimating ore in sight in virgin ore bodies is far more simple than estimating ore in places previously filled. Then, too, the timber expense in opening up these old stopes, solely for the purpose of placing the ore in sight, would be immense, and furthermore, shortly after doing such work, said development work would be of no use for stoping.

STORE

On account of the existing conditions due to the revolution, practically all the local merchants went out of business. It therefore became necessary for the company to supply means of subsistence for its employees; in fact, the company was forced by the authorities to open a store. No attempt has been made to operate the store at a profit, but it has served to hold the workmen we had and attract others.

TIMBERLANDS

Owing to the constantly increasing difficulty in obtaining fuel and mine timber, the lands shown in the accompanying map, were purchased. These lands consist of 10,000 acres and are covered with heavy "monte", which insures an adequate supply of fuel and mine timber for many years to come.

POWER PLANT

The Power Plant consists of two units of 500 H.P. each, Otto Deutz gas engines, using producer gas, made from charcoal. These engines are direct connected to generators, which supply current for the various motors at different places about the property. (See sketch of plant) This plant has been in operation since 1912 and has given results fully up to expectation. Power is generated at a cost of \$5.00

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per H.P. per month, whereas formerly with the old steam plant it cost \$11.50 per H.P. per month.

In addition to the above plant, there is an auxiliary steam plant. This consists of a 200 H.P. Corliss engine driving a 150 K.W. generator.

*2 say 250 HP.
later on in this
report -
which is right?*

CYANIDE MILL AND PRACTICE

Transportation

The mine run of ore as received at the mill bins (A) varies from old tailings to pieces of rock a foot in diameter. The tailings are the product of arrastras and the patio process dating from the period that the mine was worked by the Spaniards. Later on the pan-amalgamation process was used. The residues from these treatments is usually very oxidized and highly acid. From the surface and the upper levels of the mine comes an oxidized ore, soft and friable. The lower levels produce an unoxidized ore, very hard but much less acid.

Gable bottom side dump cars, of seventeen tons capacity, drawn by light locomotives, transport the ore from the mine to the mill a distance of half a mile. It is then unloaded into masonry bins sunk into the ground with the original rock for bottom. Each bin is twenty four feet by thirty seven and of three hundred and fifty tons capacity.

Weighing & Sampling

The ore is automatically discharged through twelve gates upon a Robbins Belt Conveyor, (B), two feet wide and 155 feet long. A movable car, traveling on rails, allows the ore to be drawn by gravity from any section of the bins. The conveyor traveling through a tunnel beneath the bins and then up an incline of twenty three degrees, discharges directly into an Allis Chalmers Gates Gyrotory style K Crusher, (C) and Fig. 2.

After being crushed to the size of inch and

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and half cubes, the ore falls by gravity against a revolving disc, (Fig. 3), slotted so as to divert one-twelfth of the stream. This cut-out then passes automatically through two smaller crushers, a set of rolls and the various samplers until a final sample of thirty pounds is obtained.

All the discards drop upon an eighteen inch Robbins Belt Conveyor, (D), passing over the battery bins (G). A Merrick Weightometer (E, and fig. 4) between the crushing plant and the battery bins automatically weighs all the ore. A moving tripper (F) allows the ore to be discharged to any section of the bins. Their capacity is approximately seven hundred and fifty tons.

CRUSHING

The ore is fed by gravity to sixty stamps (H) by ten shaker feeders. Forty stamps are driven in units of five while the remaining twenty are in units of ten. Stamps of 1100 lbs. with a seven inch drop, falling 105 times per minute are used. The battery screens are punched tin with openings of .027 in. giving a product of which approximately 35% remains on a sixty mesh screen. The ore is crushed in cyanide solution having a strength of .05 KCN. Lime is added hourly to the ore in the bins, passing with it to the stamps. Normally 35 lbs. of lime per ton of ore are needed to maintain the strength of the solution at .07 CaO.

CLASSIFICATION

The flow from all the stamps joins in one launder which conveys the stream to one of four collectors (I) with automatic revolving distributors. (Fig. 5) Here a separation of sand and slime is made. The sand remains in the collectors and the slime passes through a central discharge to the slime plant (J) for its treatment. Approximately 52% of the battery product is sand. Each collector has a capacity of 140 tons dry sand.

When discharged the collectors are allowed to

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drain at least forty eight hours before the bottom discharge doors are opened and the charge transferred to one of the fourteen leaching tanks (K), each having the same capacity as the collectors. The charge is shoveled through the discharge gates into cars holding 1.6 tons each, which pass through tunnels under the collectors. The cars are trammed over the leaching tanks on movable bridges, one of which is driven by an electric motor.

SAND TREATMENT

After the tanks are filled and leveled off, a strong solution, .25 KCN, is run onto the charge and allowed to stand eight hours. At the end of that period the leaching cocks are opened and the pregnant solution drawn off to be sent to the zinc boxes. After the first addition of solution, the leaching cocks are left open for all the succeeding leaches. Treatments are continued for two weeks with solutions of diminishing strengths until a final water wash is applied previous to discharging the tank.

When ready to be discharged the four bottom doors are opened and the charge sluiced into the river. A two and a half inch hose with a head of forty feet is sufficient to clean the tank in sixteen hours.

SLIME TREATMENTS

The slime on leaving the collectors passes to a thickener (J) from the center of which, the pulp is continually drawn off by a plunger pump and sent to a storage tank (M). The clear overflow solution goes back to the batteries. Every seven hours a charge of approximately thirty tons of dry slime is withdrawn from the storage tank and sent to one of the ten treatment tanks (N). The thickened slime has a specific gravity of about 1.18.

The ten treatment tanks (Fig.6) are arranged in two rows of five. A line shaft passes over each row for driving the stirring arms. Each tank is equipped with a

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three inch centrifugal pump which draws the charge from the bottom returning it on top. These pumps are driven by a line shaft running between the two rows of tanks.

For the first four hours the charge is agitated by the stirring arms and also by the circulating pumps. At the end of that period agitation is stopped and the charge allowed to settle for ten hours. The pregnant solution is continually being decanted and sent in to clarifying tanks (R) from which it passes to two storage tanks (S), supplying the zinc boxes. Barren solution replaces the pregnant solution removed and the cycle of agitation and decantation goes on.

FILTRATION

At the end of seventy hours, the charge is withdrawn by a centrifugal pump and elevated to a wooden conical tank (O)(Fig.7) supplying the filters (P). From this tank the pulp flows by gravity to three Oliver Filters, two having eight foot drums and the other nine. After removing the solution and giving a water wash the pulp is discharged into launders leading to the river. The solution goes into the battery circuit (Q).

Three wet vacuum pumps, of local design and made at the company shops, furnish the suction for the filters. One small Ingersoll Rand Compressor furnished the compressed air at ten pounds pressure for dropping the cake from the filters. Normal capacity of the three filters is 125 tons dry slime daily.

PRECIPITATION, MELTING & ASSAYING

Two 24 ft. diam. x 10 ft. deep Redwood tanks (S) one for high grade solutions and the other for low grade, supply eight zinc boxes(T), (six steel boxes of ten compartments each and two wooden boxes of five compartments). From the boxes the barren solutions flow by gravity to four 24' diam. x 10' deep redwood tanks (U). From these tanks the solution flows by gravity to the slime treatment tanks as

well as to the sand plant.

To clean up the zinc boxes the cocks are opened on the bottom of each compartment; the sludge flows through launders to a sixty mesh screen. Passing through the screen, which acts as a seive to detain the zinc shorts, the precipitate drops into a tank which has a false bottom covered with cocoa matting and canvas. The solution drains off leaving the precipitate which is cleaned up, dried, fluxed and melted in Dixon No. 100 graphite crucibles. Three wind furnaces are used.

A small duplex pump drives the solution through a press which catches any precipitate that may have passed through the filter medium. It is necessary to clean the press once every two months.

Zinc is purchased in sheets and cut here as needed. A small lathe in the battery room is driven from a pulley on one of the line shafts of the stamps. Zinc consumption is approximately one pound per ton of ore treated.

A small Krupp Ball Mill is used to regrind the slag from the melting room. The reground slag mixed with solution is then run over riffles and the shot silver recovered.

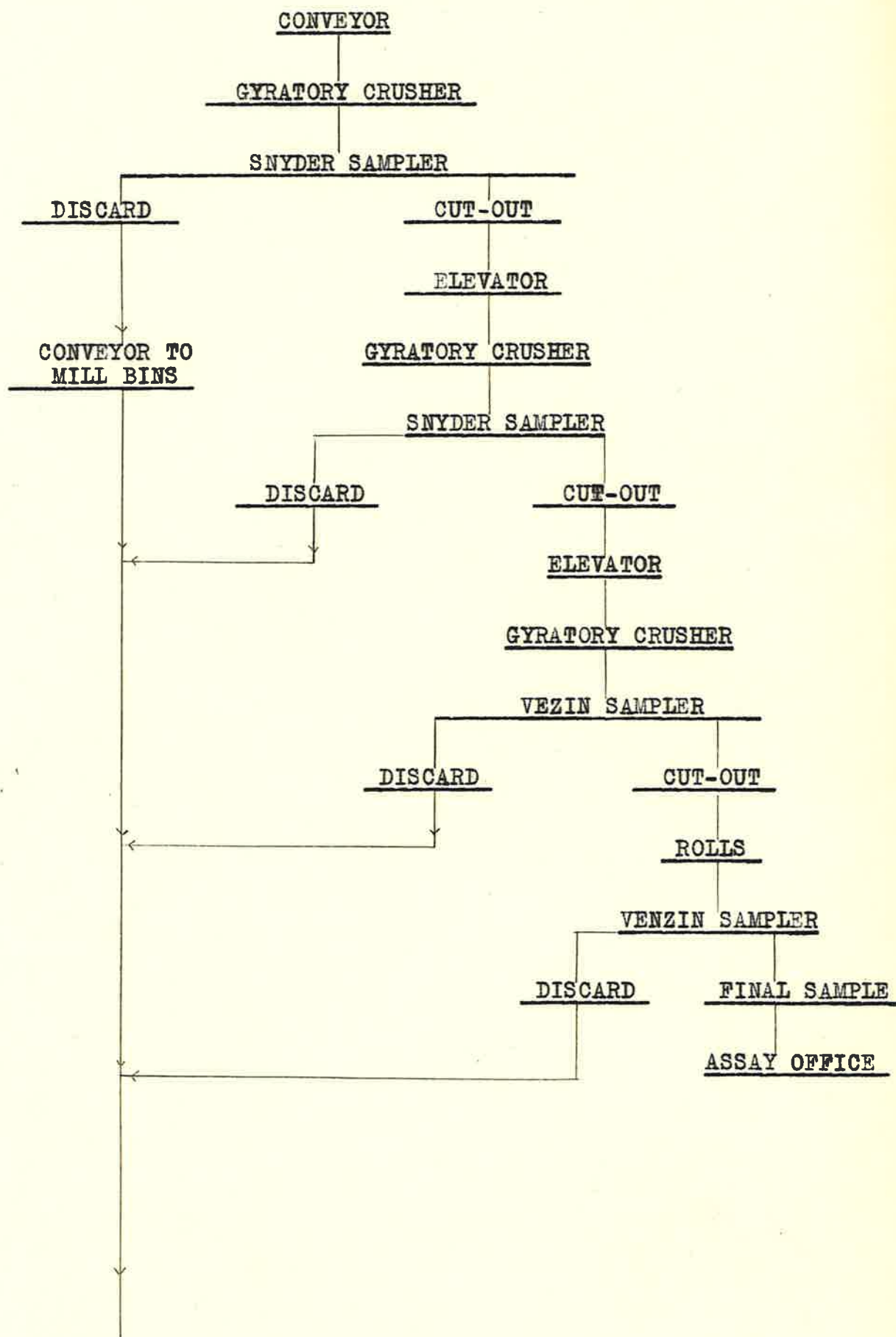
The precipitate room and the assay office for both the mill and the mine are in the same building. Two Dodge crushers and two Braun Disc Pulverizers (Fig.9) are used in preparing the samples. Fusions and cupellations are made in wood fired muffle furnaces (Fig.10). About one hundred assays are made daily in addition to the solution titrations.

Fresh water for mine and mill is drawn through a tunnel under the river bed to a sump from which it is elevated to a 24 ft. redwood tank by two Krough centrifugal pumps, electrically driven.

All machinery is electrically driven. Power

MINAS DEL TAJO

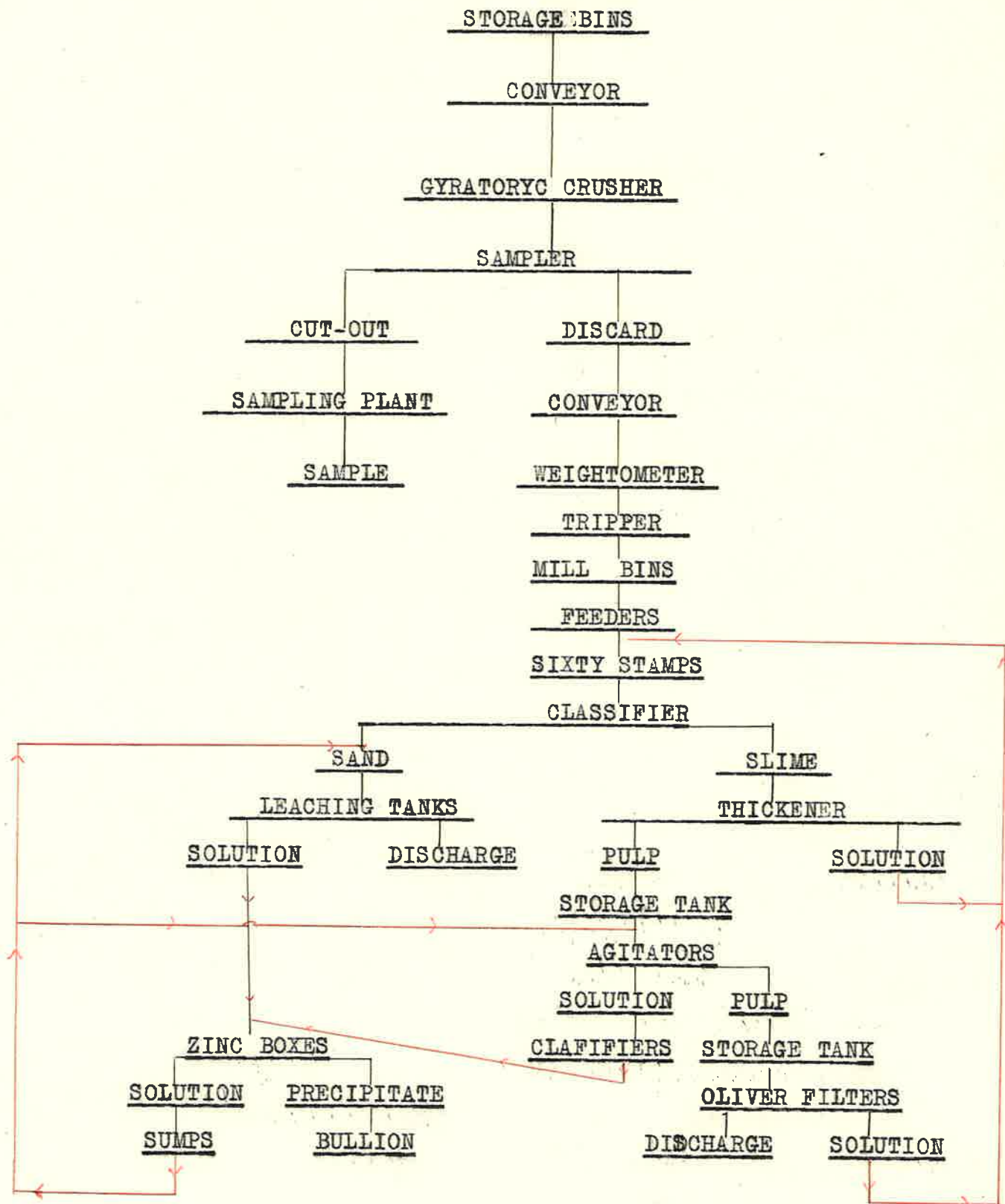
FLOW SHEET SAMPLING PLANT



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is obtained from the central power station.

FLOW SHEET

MINAS DEL TAJO MILL AND CYANIDE PLANT



TOTAL COST OF EQUIPMENT

Mill Equipment	\$ 303945.96
Railroad	\$ 15510.55
General Offices	\$ 30446.98
Mine Tiro Real.	\$ 39164.00
Mine San Antonio	\$ 32216.48
Gas Engine Plant	\$ 105155.93
Auxiliary Steam Plant	\$ 27104.86
General Shops	\$ 24293.38
General Store House	\$ 4370.62
Telephone Sustem	\$ 1781.86
Drainage Canals	\$ 4511.31
Wagon Roads	\$ 6160.00
Mercantile Department	\$ 1713.25
Drafting Offices	\$ 323.41
Water System	\$ 5510.95
Ice Plant	\$ 1252.81
Stables and Haulage	\$ 5489.05
GRAND TOTAL	\$ 608951.40

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MILL EQUIPMENT

<u>No.</u>	<u>Filter Plant</u>	
2	Oliver filters 11' dia 8' long with red-wood containers	\$6281.64
1	Oliver filter 11' dia 9' long with steel container	\$2586.47
1	Vacuum pump G.D.K. design built in Tajo shops 12" dia x 12"	\$ 942.72
1	Vacuum pump G.D.K. design built in Tajo shops 12" x 8"	\$ 412.50
1	Vacuum pump 2 cylinders 14" stroke 10" dia, built in Tajo	\$ 357.50
1	Ingersoll Rand air Compressor type II 2 cylinders 6"x9"; cost included in first two filters.	\$
1	Air receiver for same	\$
1	G.E. Ind. motor type I 20 H.P. 440 volts 900 R.P.M.	\$ 291.31
1	G.E. Ind. motor type I 15 H.P. 440 volts 720 R.P.M.	\$ 218.47
1	Frame building with galvanized iron covering 40' x 60' x 18'	\$

MILL EQUIPMENT

Batteries

No.

8	Batteries of 5 stamps each, weight of stamp 1050 lbs	\$11471.23
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2	Batteries of 10 " " " " stamp 1050 lbs	\$ 5766.03
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Batteries are driven by 12" and 16" belts from line shafts.

2	G.E. Motor Type I 75 H.P. 514 R.P.M. 2200 volts	\$ 1942.60
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1	Fried Krupp Ball Mill	\$ 521.31
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1	Zinc lathe 4'6" centers with 12" swing	\$ 1192.50
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1	Emery Wheel mounted	\$ 41.40
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1	Endless leather belt 73'6" x 16" wide	\$ 282.81
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1	Endless " " 78'6" x 16" "	\$ 301.11
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1	Platform scale for weighing lime	\$ 210.87
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1	Lime house of brick and mortar(old) 40' x 30' x 15'	\$
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1	Lime house of brick and mortar(new) 60' x 33' x 10'	\$
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1	Main mill building frame structure with galvanized iron, 110' x 60' x 20' and 110'x 45'x 20'	\$
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Pipe fittings used in construction

MILL EQUIPMENT (A)

NO. SAMPLING AND CRUSHING PLANT

1	Robbins Belt Conveyor 24" wide, total length 380' handling ore from bins connected by friction drive to	\$1251.53
1	G.E. Ind. Motor type 1 10 H.P. 440 volt 900 R.P.M.	\$ 291.36
1	Gates Gyratory Crusher Style K No.5	\$1992.67
1	Gates Gyratory Crusher style D. No. 1	\$ 616.50
1	Gates Gyratory Crusher style F.	\$ 256.52
1	Snyder Sampler 5 ft. dia.	\$ 99.00
1	Snyder Sampler 2' 6" dia.	\$ 55.00
2	Small Vezin Sampler Tajo pattern 24" x 18" dia	\$ 110.00
1	Set of pulverizer rolls with Vezin sampler	\$ 668.83
1	Belt conveyor 18" wide total length 340' withtroughing	\$ 947.56
1	Merrick Conveyor Weightometer Model E	\$1691.53
1	M & G Automatic self reversing self propelling tripper	\$ 678.65
2	Bucket elevators with steel buckets for elevating cut-out	\$ 104.75
1	G & E Ind. Motor Type I 20 H.P. 440 volt 900 R.P.M.	\$ 291.27
2	Underground bins size 75' x 24' 350 tons capacity complete	\$4400.00
1	Galvanized iron building over the bins 75' x 24' x 12'	\$
1	Galvanized iron building over crushers 26' x 26' x 24'	\$

MILL EQUIPMENT

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NO.	<u>SAND PLANT & SLIME PLANT</u>	
4	Redwood collector tanks 35' dia x 4'6" deep	
14	Redwood leaching tanks " " " "	
10	Redwood slime treatment tanks 24' dia x 9'6" deep	
2	Redwood Slime collecting tanks 35' dia x 9'6" "	
7	Redwood solution tanks 24' x 9'6" deep	\$19906.50
2	Redwood treatment tanks semi pachuchas 40' dia x 20' deep	\$2024.00
1	Redwood conical bottom tank 20' dia x 10' deep	\$ 703.04
2	Hand operated transfer bridges for distributing sand cars	\$ 330.00
1	Electrically driven " " "	\$ 275.00
1	G E Ind. motor type I 5 HP 440 volts 1200 RPM	\$ 210.15
1	G E Ind. motor type I 75HP 440 volts 514 RPM slime	\$1026.00
1	Tajo 6" centrifugal pump for charging conical tank	\$ 264.00
1	Plunger pump 8" for slime (made in Tajo shops)	\$ 178.75
10	Tajo 3" centrifugal pumps for circulating slime	\$1650.00
1	Krogh No.3 pump for cyanide solutions connected to	\$245.88
1	G.E. Ind. Motor type I 20 H.P. 440 volts 1800 R.P.M.	\$ 314.29
1	Krogh No.3 pump for cyanide solutions connected to	\$ 255.98
1	G E Ind. motor type I 10HP 440 volts 1800 RPM	\$ 182.55
1	Tajo pump 4" centrifugal for cyanide solution connected to	\$ 110.00
1	G E Ind. motor type I 10 HP 440 volts 1200 RPM	\$ 155.65
4	G.E.Transformers type H 40KW ratio 2200/488 cycle	\$1117.07
1	Frenier Sand pump 54" dia	\$ 554.95
2	Concentrating cones 5' dia. and 3' dia	\$ 137.50
1	Set of double sluice ways	\$ 68.75
1	G.E.Ind Motor type I 5 HP 440 volts 900 RPM	\$ 210.25
1	Endless rubber belt on slime plant motor	\$ 300.00
1	Frame building covered with galvanized iron 40' x 36' x 8'	\$

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MILL EQUIPMENT

Assay Office

No.

1	No. 3 M.B. Dodge Jaw crusher	\$136.12
1	Sturtevant Roll Jaw crusher	\$134.36
2	Braun Pulverizers	\$215.93
1	G.E. Ind. Motor type I 10 HP 440 volts 900 R.P.M.	\$291.31
1	Sample drying furnace	\$110.00
2	Wood fired muffle furnaces	\$412.50
1	Automatic cupel machine	\$ 45.30
1	Palp Balance	\$ 35.48
1	Dore Silver balance (Yanco Dev. Co)	\$110.00
1	Hauser gold balance for weighing gold	\$347.64
1	Charcoal furnace for bullion assays	\$121.00
1	Analytical balance with glass pans	\$ 55.00
1	Adobe annex covered with tiles 42' x 20' x 14'	

MILL EQUIPMENT

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Precipitation Department

No.	
8	Sets sheet iron Zinc boxes 13" x 27" x 18" 10 compartments, included in plant equipment bill.
4	Sets redwood boxes 24" x 24" x 24" 5 com- partments
	\$ 310.20
1	Filter press 24" x 25" 25 leaves built by Shriver Co.
	507.67
1	Small plunger pump capacity 10 gals per min- ute belted to
	132.00
1	G.E. Ind. Motor type KT 1 HP 440 volts 1800 R P M
	50.18
1	Precipitate drier of sheet iron
	412.50
4	Bullion melting furnaces
	495.00
1	Platform scale for weighing fluxes
	55.00
1	Platform scale for weighing bullion
	49.50
1	Brick mortar galvanized iron covered bldg. 30' x 30' x 12'
1	Adobe building covered with galvanized iron 105' x 42' x 14'

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RESUME OF MILL COSTS

Cost of stamps, crushers, belts, tanks filters, motors, conveyors, piping, pulleys, electrical goods, etc. etc.	\$ 83569.16
Cost of excavations, preliminary work, grading, labor, materials, miscellaneous timber, hardware, etc. etc.	\$ 55000.00
Cost of foundations, retaining walls, brick, building stone, mortar, scaffolds, tools, hardware, etc. etc.	\$ 99000.00
Erection of buildings and machinery, line shafts, pulleys, engine bases, framing timbers, etc. etc.	\$ 41250.00
Building materials, lumber, corrugated iron, spikes, nails, bolts, miscellaneous hardware, etc. etc.	<u>\$ 25126.80</u>
Grand Total	\$303945.96

RESUME OF RAILROAD (B)

Cost of narrow guage railroad from mines to mill approx one mile in length, including spur to San Antonio (50 lb rails)	\$ 8965.55
2 small locomotives cylinders 7" by 12" stroke, made by Pittsburg Locomotive works	6050.00
Two ore cars of 17 ton capacity, 3' guage size 6'6" by 23'8" by 4' deep (remodeling and rebuilding)	<u>495.00</u>
Total	\$ 15510.55

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GENERAL OFFICES (C)

Equipment

No.

1	Underwood typewriter	\$ 154.01
1	Royal Typewriter	\$ 96.25
1	Billiard table	\$ 566.20
1	Piano	\$ 420.69
1	Range, boiler and accessories	\$ 124.59
2	Pedestal Vitware lavatories	\$ 88 82
2	Imperial porcelain bath tubs	\$ 133.68
2	Low tank syphon jet toilets	\$ 33.25
1	Remington typewriter	\$ 119.95
1	Desk	\$ 227.53
1	Chair	\$ 37.94
1	Ice Chest	\$ 177.74
1	Burroughs adding machine	\$ 169.44
	Total for equipment	\$ 2349.09

RESUME OF GENERAL OFFICES (C)

Cost of office equipment, typewriters,
adding machine, desks, household furni-
ture, hardware, etc. etc. \$ 2349.09

Cost of building, cement, brick, lime
cement, tile roof, hardwood, cement floors,
timber, etc. etc. \$28097.89

Grand Total \$30446.98

MINE EQUIPMENT (NEW)

San Antonio Buildings & Structures

No.

- | | | |
|---|---|------------|
| 1 | Redwood tank 16' x 9' high for colling water (erected) | \$ 233.75 |
| 1 | Basin of brick lined with cement 32'x32'x4' | \$ 770.00 |
| 1 | Double ore bin of 2" boards of haba - 28' x 19' x 13'6" deep covered by a galvanized iron house of same size and 12' high, bins equipped with 8 sliding floors for loading cars | \$ 2750.00 |
| | Other buildings, installation Compressor etc | \$ 1821.60 |

MINE EQUIPMENT (NEW)Trio Real ShaftSummary

All pumping, hoisting and other machinery,
including conveyor, belt, mine cars, machine
drills, cables, telephones, pipes, etc. etc. \$35754.00

Structures and Miscellaneous, including ore
bins, locomotive house, and pump installation 3410.00

TOTAL \$39164.00

MINE EQUIPMENT (NEW)

84

No.	<u>Trio Real Shaft</u>	
1	Goulds Vertical Triplex, single acting plunger 7" dia. by 16" stroke, displacement 288 gals per min. direct connected to	\$4294.49
1	G.E. Ind. motor type I 75 HP 440 volts 514RPM	\$1026.30
1	Pipe column 6" pipe, 550 ft. long discharge pump	\$ 816.75
1	Pipe line 3" containing 3 No. 4 B&S gauge rubber covered double braid wires	\$ 322.08
1	Wellman Morgan Seaver Electric Hoist, single drum 4'6" dia by 3' wide, equipped with 1" plow steel hoisting rope and cage with safety device, hoist geared to	\$4498.52
1	G E Motor type ITC 112HP 440 volts speed varied by G E drum controller (included in hoist)	
4	G E transformers type H 40 K.V.A. ratio 2080/460	1364.00
5	G.E. Transformers type H 40 K.V.A. ratio 2200/488	1671.34
119	sheet steel mine cars	6545.00
4	Wooden mine cars	264.00
1	Belt Conveyor 20" wide by 210' long driven by	558.35
1	G.E. Ind. Motor type KT 5 HP 440 volts 1200 RPM	210.25
7	Leyner Drills and accessories	1652.27
3	Leyner stopers No. 5	412.26
1	Cleveland Stoper	55.86
1	Extra Heavy Hoisting sheave	130.04
2	Screw Columns	59.75
3	Mine-a-phones	111.53
1	Belt Conveyor	558.35
1	Steel cable	202.86
	Pipe Lines for air, water, etc.	11000.00

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MINE EQUIPMENT (NEW)

Structures and miscellaneous

No.

1 Ore bin 14' x 15' x 12' deep of heavy frame construction.	
1 Ore bin 19'6" x 15'6" x 13' deep of heavy frame construction	
1 Ore bin 20' x 15'6" x 13' deep of heavy frame construction.	\$1,650.00
1 Locomotive House 30' 9" x 13'3" x 10' of sheet iron.	110.00
Installation Goulds Pump	1,650.00

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MINE EQUIPMENT (NEW)

<u>No.</u>	<u>San Antonio</u>	
1	Krogh 6 stage 6" horizontal turbine pump, capacity 300 gals. at 659' head and 1755 R.P.M. direct connected to	\$ 1327.47
1	G E Ind. motor type I 100 HP 440 volts, 1800 RPM	588.70
1	Timber Head Frame 60' heavy construction equipped with guides for self dumping skip and waste and ore chutes	1650;00
1	Wellman Seaver Morgan Electric Hoist single drum 4'6" dia. 3' wide geared to	4307.62
1	G E Motor Ind. ITC 112 HP 440 volts speed varied by controller - drum equipped with, (included with hoist)	
1	Plow steel hoisting rope 7/8" diam.	190.89
1	Cage and self dumping skip attached below 36" x 36" x 60"	1026.94
1	Ingersoll Rand Compound belt driven Air compressor, with automatic unloading device, capacity 1000' cu. ft. free air per minute	4244.23
1	G E self-starting Synchronous Motor 250 HP 2080 volts 60 cycles 3 phase 600 RPM belted to above compressor	2587.45
1	Slate Panel switch board for control of above motor containing ampere meter, voltmeter, wattmeter, for input to motor	
1	D.C. ampere meter	
1	D.C. Voltmeter for measuring output of exciter	
1	Oil circuit breaker with automatic overload release and all necessary instrument transformers.	335.39
3	Air Receivers 54" by 15' 8" boiler iron 3/8" thick	990.00
1	Leather belt 20" wide by 67 ft. long connecting motor and Air compressor	330.45
1	Pipe line 5" in the shaft for air 700' long	419.65
1	Pipe line in the shaft for electric line 600' long	198.00
1	Electric line 3 No. 1 B&S gauge extra heavy rubber double braid insulation 600' long.	459.59
1	Pipe line 6" in shaft for pump discharge 600' (extra heavy)	2341.21
1	Wellman Seaver Morgan Electric Hoist single drum 2'6" dia.	2341.91

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MINE EQUIPMENT (NEW)

San Antonio--Cont.

1	G.E. Ind. motor type ITC 440 volts 35 HP intermittent 60 cycles 1200 RPM (max) controlled by G E drum controller (included in hoist)	
2	Skips equipped with safeties 4'9" by 3' 8", of boiler iron	\$ 495.00
4	G.E. Transformers type H 40 K.V.A. ratio 2200/488	1337.07
1	Belt conveyor 2'6" wide by 112'8" long equipped with M and G standard troughing pulleys	439.46
1	Belt 30" wide by 110 ft. long	583.35
1	Tajo cent. pump for circulating water	
1	G E Ind. motor type KT 5 HP form C 440 volts 900 RPM	210.25
1	Counter balance skip	236.50

MINE EQUIPMENT (NEW)

San Antonio

Summary

All Pumping, hoisting, compressing machinery, including head frame, conveyor belts, skips, cables, pipe, etc. etc.	\$ 26,641.13
San Antonio Buildings and structures, including bins, tanks, cement basin, houses and installation of compressor	<u>\$ 5,575.35</u>
Total.	\$ 32,216.48

POWER PLANT EQUIPMENT (NEW)Transmission LinesNo.

- | | |
|---|-----------|
| 1 Pole Line 2820 ft. 3 wires 1 No. B & S
Gauge 2 No. 0 B & S gauge from power
plant to mill | \$ 651.39 |
| 1 Pole Line 890 ft. 6 wires No. 4 B & S
gauge from Power Plant to San Antonio
shaft | 207.83 |
| 1 Pole Line 700' of 3 wires. No. 4 B & S
gauge from Power Plant to Tiro Real
shaft | 440.65 |

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POWER PLANT EQUIPMENT (NEW)

Cooling System & Pumps

No.

1	Krogh two stage 3" turbine pump direct connected to	\$ 335.74
1	G E Ind. motor type I 20 HP 440 volts 1800 RPM	\$ 308.79
1	Tajo 4" cent. pump supplying engine cylinders connected to	\$ 143.00
1	G E Ind. motor type I 10 HP 440 volts 1200 RPM	\$ 291.37
1	Tajo 4" cent. pump supplying producers direct connected to	\$ 143.00
1	G E Ind. motor type I 10 HP 440 volts 1200 RPM	\$ 291.37
1	Tajo 4" cent. pump supplying cooling tower connected to	\$ 143.00
1	G E Ind. motor type I 10 HP 440 volts 1200 RPM	\$ 291.37
1	Redwood tank capacity 40,000 gallons	\$ 688.14
✓ 1	Redwood tank capacity 14,000gallons	\$ 357.50
1	Brick lined with cement tank 48'9"x7' deep	\$ 1241.35
1	Wooden cooling tower	\$ 2398.00
1	Brick tank lined with cenent 50'x50' x6'3" deep	
1	Brick tank lined with cement 43'6"x 28'6" x 7'4" deep	\$ 1045.00
1	Traveling crane 10 ton, hand operated, built by Otto Deutz Gas Engine Co.	\$ 1100.00
1	Platform scales, capacity 11,000 kilos(Fairbanks	\$273.02
	Erection - material and labor	\$ 253.00

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POWER PLANT EQUIPMENT (NEW)

Gas Engine & Generators

3	G E Transformers type H, 5 K.W. ratio 2200/122 for lights	\$ 627.00
1	Air receiver 3'5" x 11'4", long 3/8 boiler iron	88.00
1	Tabor Gas Engine indicator	70.40
1	Fairbanks Morse Gas engine 6 HP 350 RPM belted to	362.43
1	Fan of 26" dia.	
1	G E Ind. motor 15 HP 440 volts 720 RPM belted to	218.53
1	Air Compressor	882.72
1	Electric hoist 5 HP and cage built in Tajo shop	534.60
1	G E Motor 5 HP 440 volts 900 R P M type KT	210.25
2	Sheet metal cars capacity of 1/2 ton charcoal	275.00

POWER PLANT EQUIPMENT (NEW)

91

Gas Engines & Generators

- 2 4-cylinder 4 cycle 500 B.H.P. Otto Deutz
Producer Gas Engines
- 3 Otto Deutz 500 HP gas producers with Vapor-
izers and scrubbers.
- 2 Otto Deutz Cent. gas scrubbers direct con-
nected to
- 2 Siemens Schuckert Werke Ind. Motors 210 volts
1730 R P M \$41471.78
- 2 Flywheel type Siemens Schuckert Werke Gener-
ators 408 KVA, 2300 volts 60 cycles 180 RPM
mounted on engine shaft.
- 2 13.5 K.W. Siemens Schuckert Werke direct cur-
rent exciters 65 volt 208 Amperes mounted on
main engine shaft.
- 1 Switchboard consisting of six marble panels
mounted on iron frame work, two panels serv-
ing as generator and four as distributing pan-
els. Each generator panel is equipped with
- 1 Wattmeter (total of 2)
- 1 A.C. 200 ampere meter (total 2)
- 1 3500 voltmeter (total 2)
- 1 D.C. Amperemeter for Exciters (total 2)
- 1 Threepole oil cooled automatic circuit break-
er and synchronizing switches. Distributing
panels are equipped with three pole oil cooled
automatic circuit breakers.
- 2 150 Amp. 2000 volt G E Integrating Wattmeters
are also mounted on these panels and connected o
one to each generator, registering the total out-
put of the station. \$ 18121.99
- 1 G. E. Automatic voltage regulator type T A
90 form 8 regulating bus voltage 710.13
- 1 Siemens Schuckert Werke Lightning Arrester 15.06
- 1 Siemens Schuckert Werke Transformers 3 phase
60 cycle ratio 2300 volts to 225; capacity
16.5 K W 206.25

POWER PLANT EQUIPMENT (NEW)

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SUMMARY

Gas Engines and Generators	\$ 63,794.14
Cooling system and pumps	9,303.65
Transmission Lines	1,299.87
Buildings, hoist, etc. labor and materials (cement, mortar, lumber and brick)	<u>30,758.27</u>
Total	\$105,155.93

AUXILIARY PLANT (N)

93

<u>No.</u>	<u>Equipment</u>	
1	G.E. A.C. Generator Type A.T. B 1/8 150 KVA 2300 V	\$5855.82
1	G.E. Marble switchboard 2 panels equipped with 1 A C ammeter, 1 A.C. Voltmeter, 1 main oil circuit breaker field switch and resis- tance on generator panel. On distributor panel 2 oil circuit breakers and 2 ammeters	
1	G E Direct current 60 KW 250 volt compound generator	
3	G E D C motors 20 HP 225 volts type C shunt wound	\$1543.05
1	G.E. D.C. motor 10 HP 225 volts type C Shunt wound	258.08
1	Edw P. Allis & Co. Corliss steam engine 250 HP bought from the Empresa de Luces de Mazatlan	1658.25
3	Tubular steam boilers 150 HP each and	
1	Iron stack 65' high (steam plant complete)	7903.37
1	Worthington Feed water pump 90 x 114 x 15 7 1/2" by 4 1/2" x 6"	408.74
1	G.E. Ind motor type I 75 Hp 440 volts 514 RPM	1026.60
1	G.E. Ind. " " " 10 HP " " 1800 "	192.55
1	G.E. " " " 50 HP " " 600 "	684.89
1	12 KW Generator 110 volt D.C. used as an ex- citer for 250 H.P. synchronous motor at San Antonio shaft (overhauled)	88.00
1	Ingersoll Seargent straight line compressor at Tiro Real	369.60
1	Frost Heavy Duty Engine 12" x 16"	1081.36
1	Generator D.C. G.E. 50 KW	904.35
1	Edison Bipolar Armature	110.68
1	Rheostat No. 56920	27.50
3	Coils wire	287.39
1	Automatic Circuit breaker	208.46
1	Endless leather belt	476.87
1	Endless leather belt	169.60

AUXILIARY PLANT RESUME (N)

Cost of boilers, generators, motors, pumps, stacks, wire, electrical supplies, belting, switches, etc. etc	\$ 23254.86
Cost of buildings, erection of boilers, engines, pole lines, foundations, etc. etc.	<u>\$ 3850.00</u>
Grand total	\$ 27104.86

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TALLERS (G)

MACHINE SHOP EQUIPMENT

<u>No.</u>		
1	Engine lathe 4' swing 20' centers Putnam Co. (overhauled)	\$ 247.50
1	Engine lathe 3' " 20' " New Haven Mfg. Co.	\$ 137.50
1	Engine lathe 22" " 6' " Geo. Cummings Co.	\$ 110.00
1	Planer bed 3' by 10' built by Gleason Tool Co.	\$ 165.00
1	Slotter 14" stroke built by New Haven Mfg. Co.	\$ 68.75
1	Shaper 12" stroke built by McFarland Nottingham	\$ 41.25
1	Drill press 20" sweep built by General Engine & Biler Co.	\$ 77.00
1	Drill Press 34" " " " Park Lacy Co. (overhauled)	\$ 137.50
1	Pipe cutting machine 6" " " Capitol Mfg. Co.	\$ 71.50
1	Bolt threading machine " " " " "	\$ 33.00
1	Harron Rickard McCone Engine lathe 12" swing, 6' centers	\$663.63
1	G.E. Ind. Motor Type I 35HP 440 volts 900 RPM	\$1250.22
1	Y & T Chain block 3 ton capacity	\$ 89.22
2	Y & T " " 1½ " "	\$ 121.60
1	Tabor Indicator complete	\$ 131.45
1	Weston Portable Wattmeter Model 16 No.4	\$ 84.19
1	A.C. Ammeter model 155	\$ 20.75
1	Mulyplier for Weston Wattmeter	\$ 23.79
1	No. 3 double scale Voltmeter	\$ 83.88
1	No. 5 Ammeter scale voltmeter	\$ 78.23
1	Bristol Recording Watthour meter	\$ 128.07
1	Weston Current Transformer 150 Amps	\$ 15.00
1	" " " 75 "	\$ 14.87
1	" " " 30 "	\$ 14.27
1	" potential " 440/200	\$ 28.25
1	Direct current breat drill	\$ 34.30
1	Wattmeter 20 K.W.	\$ 61.55
1	Wattmeter 30 amps	\$ 20.10
1	Voltmeter	\$ 25.08
1	Multiplier for Voltmeter	\$ 12.60

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TALLERS (G)

Equipment Carpenter Shop

1	Cutoff saw (remodeling)	\$	220.00
1	Circle saw for ripping "	\$	71.50
1	Circle cross cut saw 24" Wetherby Rugg & Richardson (remodeled)	\$	110.00
1	Band saw approx 20' H.B.Smith & Co. (overhauling)	\$	198.00
1	Handle turning lathe 2'6" centers Trevor & Co (overhauled)	\$	79.75
1	Drill press for wood bits 12" sweep	\$	68.75
1	Grindstone 28" dia 6" thick	\$	50.61
1	Wood planer machine 2' 6" wide Cordeson Co. (overhauled)	\$	63.25
1	Rip saw with friction feed 4' (overhauled)	\$	495.00
1	G.E. Ind. motor type I 35 HP 440 volts 600 R.P.M.	\$	1250.22

TALLERS (G)

Foundary Equipment

1	Fan No. 8 built by B.F.Sturtevant Co.	\$	55.80
1	G.E. Ind. motor type I 10 H.P. 440 volts 1200 R.P.M.	\$	145.65
1	Cupulo 26" dia 12' high lined with fire brick	\$	990.00
2	Brass melting furnaces	\$	247.50
1	Platform scale	\$	78.37

TALLERS (G)

Equipment Blacksmith Shop

1	Geo.Leyner drill sharpener No. 186	\$	2183.17
1	Steam Hammer Bo. 312, built by W.Sellers (overhauled)	\$	200.20
1	Tire bending machine Linden Carriage Spring & Axle Co. (repair)	\$	11.00
1	Sheet metal power shears 10" knife, J.B.Jardine Co. (repair)	\$	99.00
1	Set sheet metal bending rolls 4' by 8" dia	\$	44.00
5	Forges	\$	412.50
1	Anvil for blacksmith	\$	6.95
1	Fine grained grindstone	\$	50.61

RESUME OF TAILER COSTS (G)

Equipment of blacksmith shop, drill sharpener, steam hammer, bending machines, rolls, forges, anvils, etc. etc.	\$ 3007.43
Equipment of foundry, fan, motor, cupulo, brass melting furnaces, scales, tools, etc. . .	\$ 1517.32
Equipment of carpenter shop, circle saws, rip saws, planers, drill presses, lathes, motor, etc. etc.	\$ 2607.08
Equipment of machine shop, engine lathes, drill presses, bolt machines, shapers, electrical instruments, etc. etc.	\$ 3989.05
Cost of all buildings housing the various departments of foundry, carpenter shop, machine shop, and blacksmith shop.	<u>\$ 13172.50</u>
Grand total	\$ 24293.38

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ALMACEN GENERAL (H)

Equipment

No.

1 Platform scale (overhauled)	\$ 220.87
1 Small counter scale	<u>\$ 24.75</u>
Total equipment	\$ 245.62

RESUME OF ALMACEN GENERAL (H)

Cost of two scales	\$ 245.62
Cost of building, brick, mortar, galvanized iron, timber, nails, bolts, hardware, etc.	<u>\$ 4125.00</u>
Grand Total	\$ 4370.62

TELEPHONE SYSTEMS (I)

No.

Equipment

1 Telephone line from Ry. station to general offices	\$ 110.00
1 Telephone line from Prefectura to general offices	\$ 51.50
1 Telephone line connecting all the various departments	\$ 550.00
1 Desk Telephone instrument	\$ 14.41
2 Wall telephone instruments	\$ 26.80
10 Telephone instruments and their respective switchboards	<u>\$ 204.15</u>
Total equipment	\$ 956.86

RESUME OF TELEPHONE SYSTEMS (I)

Cost of equipment, telephone instruments, switchboards, wire, batteries, poles, etc.	\$ 956.86
Cost of construction, cross arms, insulators, stringing wires, digging post holes, haulage of materials	<u>\$ 825.00</u>
Grand total	\$ 1781.86

RESUME OF WAGON ROADS (K)

Cost of building road from Ry. station to General Almacén	\$ 5500.00
Cost of wagon road from mine yard to mill and offices	\$ 660.00
Total	\$ 6160.00

RESUME OF DRAINAGE (J)

Cost of drainage canal from mine yard via San Antonio to river	\$ 4236.31
Cost of bridges, rails, miscellaneous tools, etc.	\$ 275.00
Total	\$ 4511.31

DEPARTAMENTO COMMERCCIO (L)

<u>No.</u>	<u>Equipment</u>	
1	Glass show case, counters and shelving	\$ 495.00
2	Galvanized iron tanks for cereals	\$ 55.00
1	Oliver typewriter	\$ 110.00
2	Small counter scales	\$ 49.50
1	Platform counter scale	\$ 41.25
1	Cedar desk	\$ 110.00
1	Sheet iron stove for drying sugar	\$ 27.50
	Total equipment	\$ 888.25

RESUME OF DEPARTAMENTO COMMERCCIO (L)

Cost of equipment, show case, counters, scales, desk, stove, typewriter, stove, etc.	\$ 888.25
Cost of remodeling building for use as store, building, granaries for storage of beans and corn, etc. etc.	\$ 825.00
Grand total	\$ 1713.25

RESUME OF DRAFTING OFFICE (M)

<u>No.</u>	<u>Equipment</u>	
1	Universal drafting machine	\$ 44.71
1	Set of Paragon drafting instruments	\$ 72.45
2	Map racks	\$ 55.00
1	Drafting table	\$ 27.50
1	Top for large drafting table	\$ 13.75
1	Straightedges, scales, triangles, baths, instruments, etc. etc.	<u>\$ 110.00</u>
	Total	\$ 323.41

WATER SYSTEM (O)

<u>No</u>	<u>Equipment</u>	
2	No, 3 Krogh centrifugal pumps direct connected to	\$ 413.67
2	G.E. Ind. Motor type KT 10 HP 440 volts, 1800 RPM	\$ 385.11
1	No.4 Krogh Centrifugal Pump direct connected to	\$ 236.86
1	G.E. Ind. motor type I 20 HP 1800 RPM water for mill	\$ 369.97
1	Redwood tank 24' x 16' deep water supply for mine and plant	\$ 688.05
1	Krogh two stage 3" turbine pump direct connected to	\$ 335.74
1	G.E. Ind. motor type I 20 HP 440 volt 1800 R P M loaned to Empresa de Agua y Hielo de Rosario	\$ 369.97
2	G.E.Transformers type H 10 KW capacity ratio 2200/122 used for lighting mill and general office	\$ 271.12
1	Pipe line 3" of 5200 feet	<u>\$2440.46</u>
	Total	\$5510.95

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ICE PLANT (P)

<u>No.</u>	<u>Equipment</u>	
1	Refrigerating machine complete with compressor	\$ 1036.44
1	Drum of ammonia	\$ 51.37
	Total equipment	\$ 1087.81

RESUME OF ICE PLANT (P)

Cost of equipment, refrigerating machine and compressor	\$ 1087.81
Cost of erecting, labor, foundations, etc.	\$ 165.00
Grand Total	\$ 1252.81

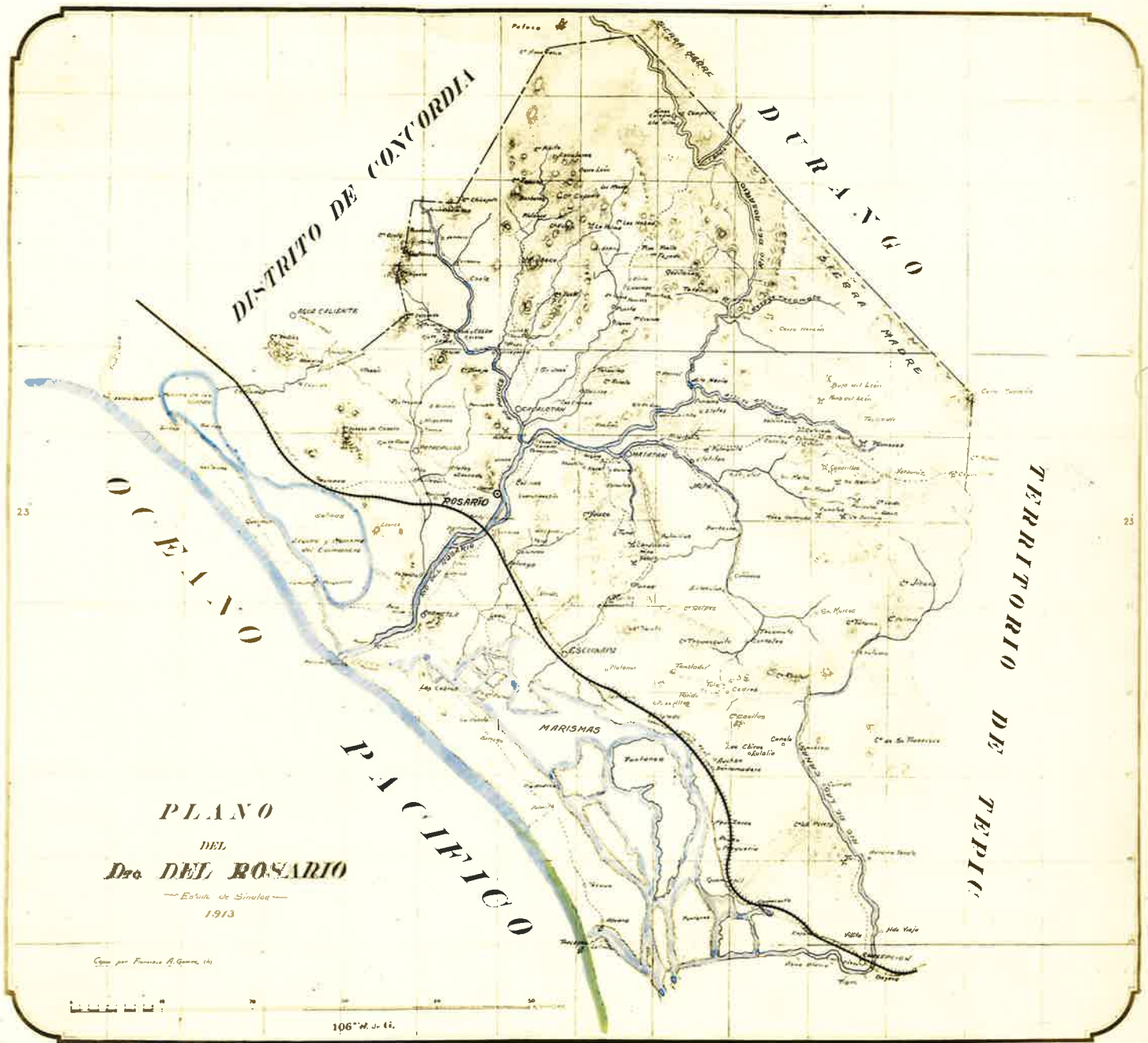
STABLE AND HAULAGE (Q)

Equipment

<u>No.</u>		
2	Large lumber wagons for heavy freight	\$ 550.00
1	Arana	\$ 225.31
1	Light spring wagon	\$ 412.77
4	Carretas	\$ 660.00
39	Mules	\$ 947.66
1	Horse	\$ 275.00
1	Rockford motor car No.2	\$ 278.49
1	Rockford motor car No.4	\$ 366.66
1	Hack	\$ 948.25
	Total	\$ 4664.05

RESUME OF STABLE & HAULAGE (Q)

Cost of equipment including mules, carretas, lumber wagons, carriages, carts, motor cars, etc	\$ 4664.05
Cost of frame building covered with galvanized iron	\$ 825.00
Total	\$ 5489.05



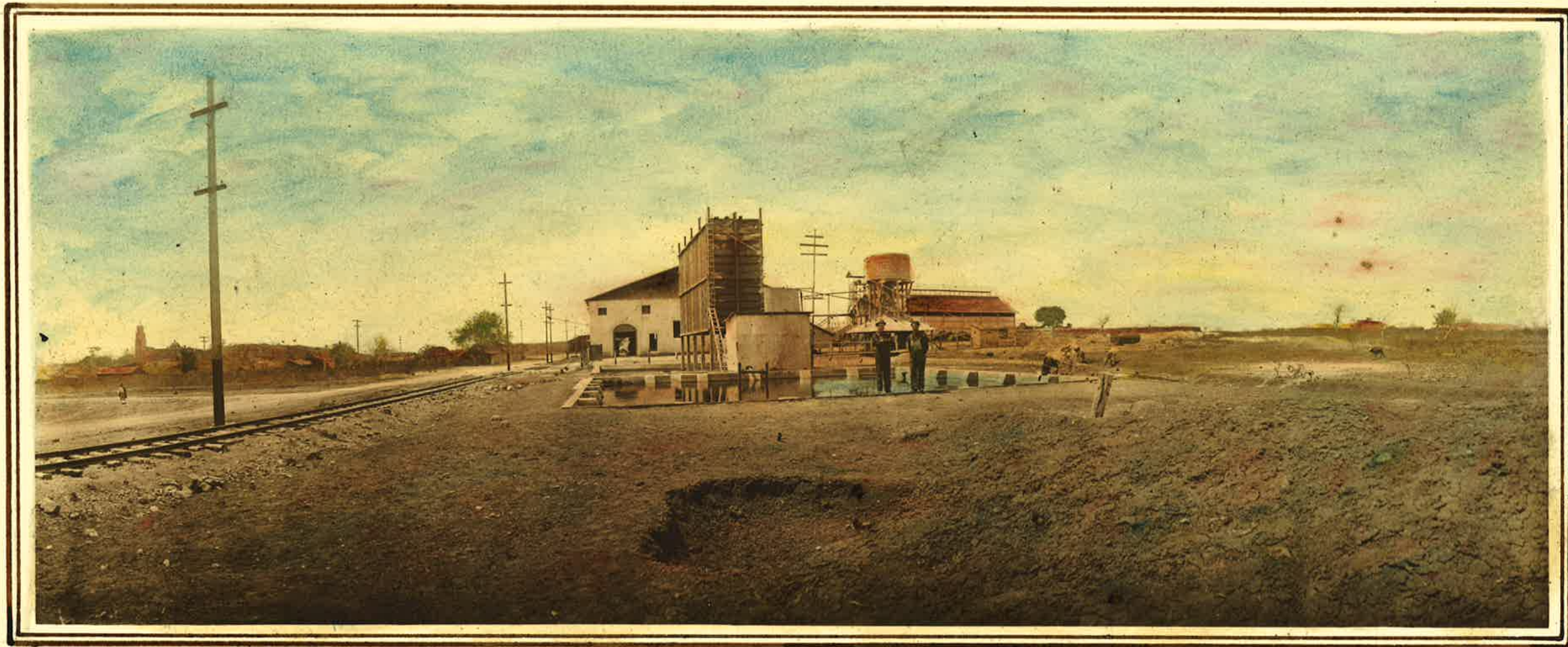
PLANO
DEL
D^{to}. DEL ROSARIO
— Estado de Sonora —
1913

Copia por Francisco A. Gomez, 1913

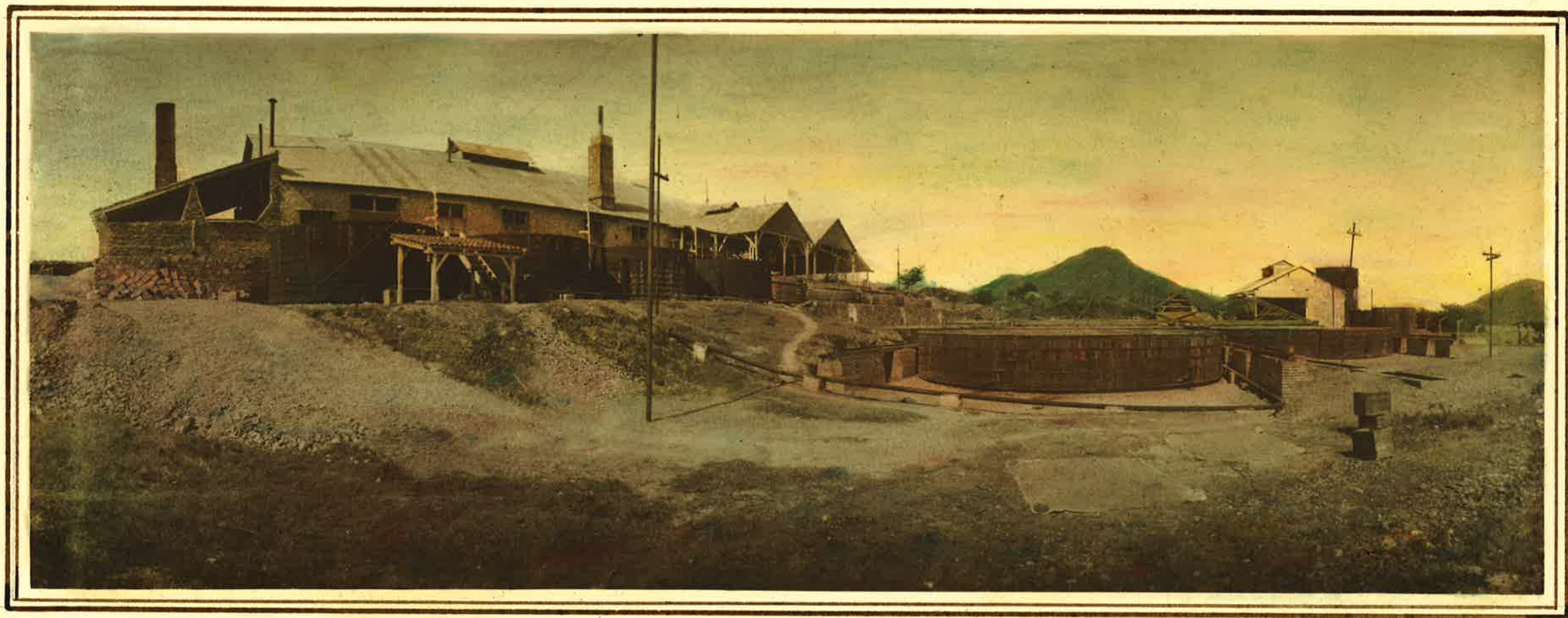
106° W. J. 14.



OFFICE AND MANAGER'S RESIDENCE



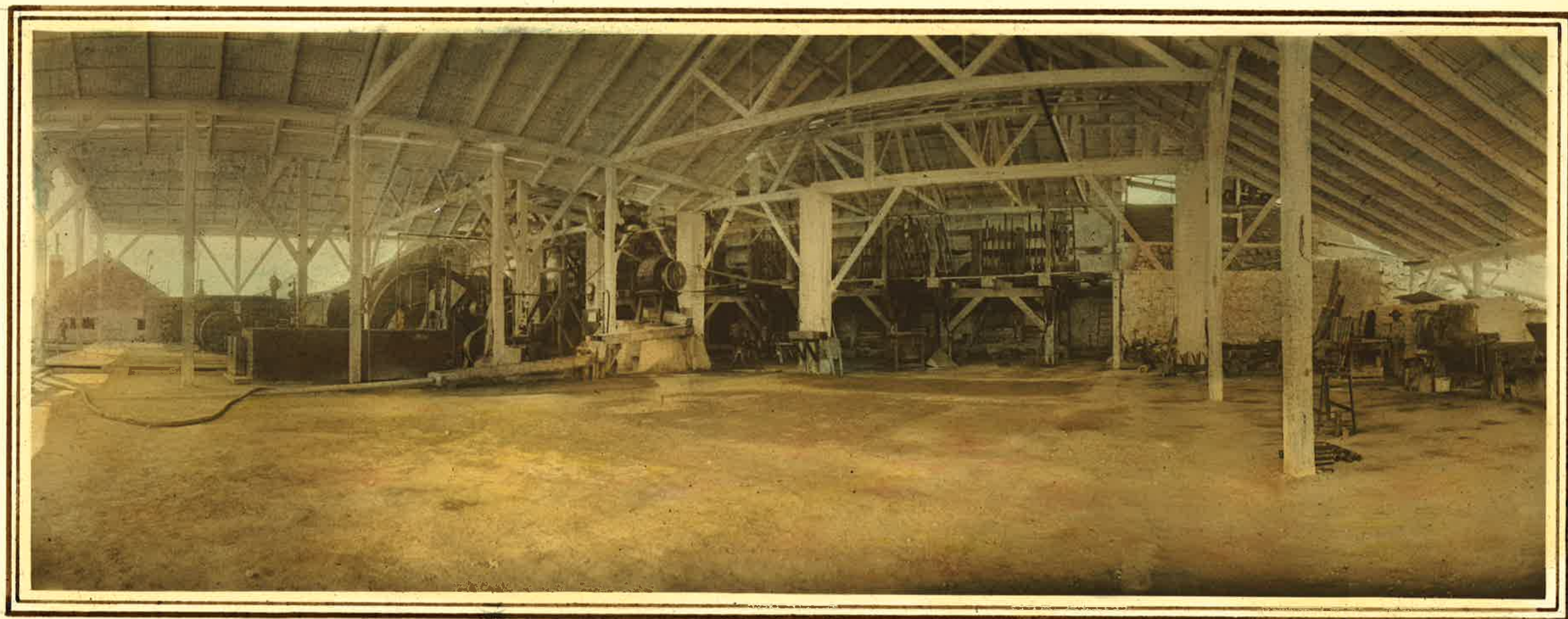
POWER PLANT



CYANIDE PLANT



MAIN TAJO - OPEN CUT



STAMP MILL



ROSARIO RIVER AND MILL IN THE DISTANCE



WRECK OF OLD MILL

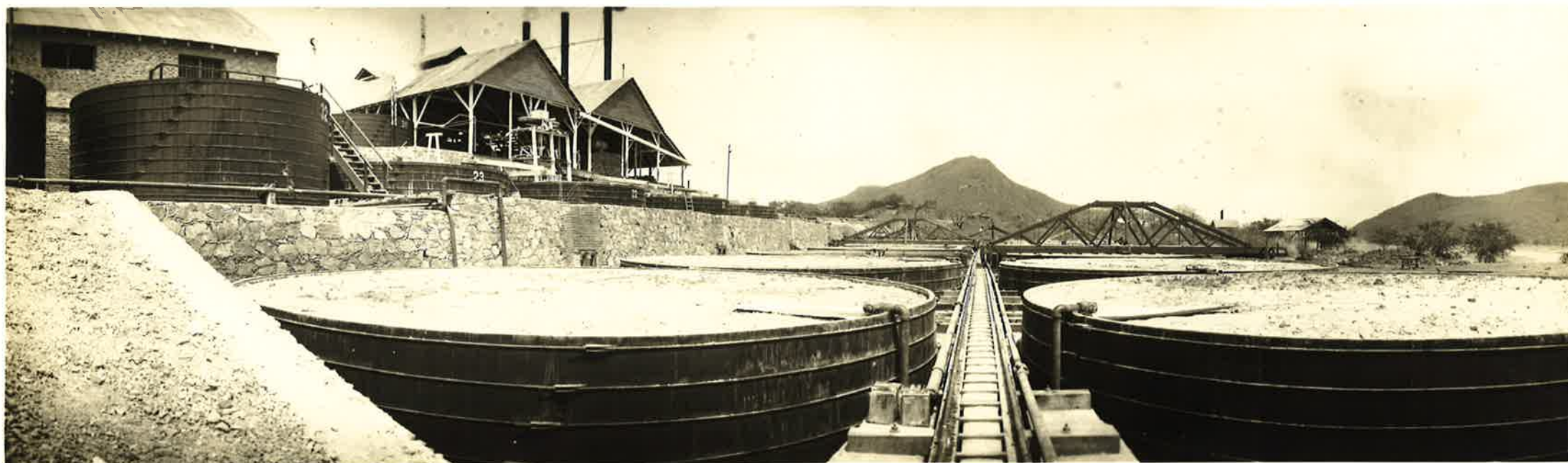




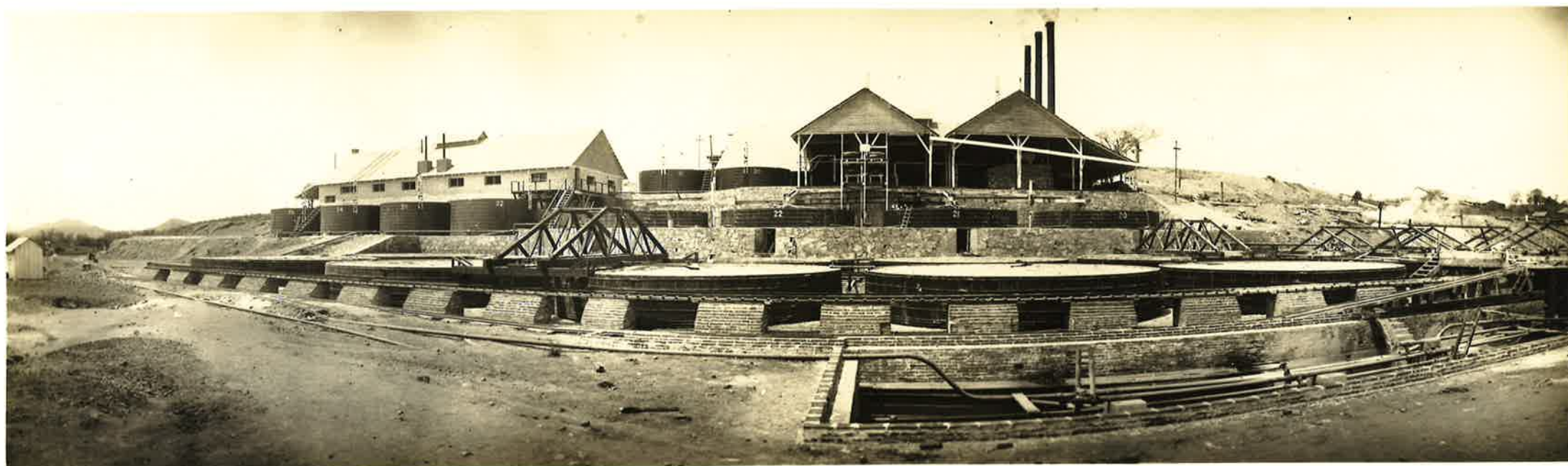
FORMER OFFICES AND MANAGER'S RESIDENCE NOW DISMANTLED



PLAZA IN TOWN OF ROSARIO



CYANIDE TANKS

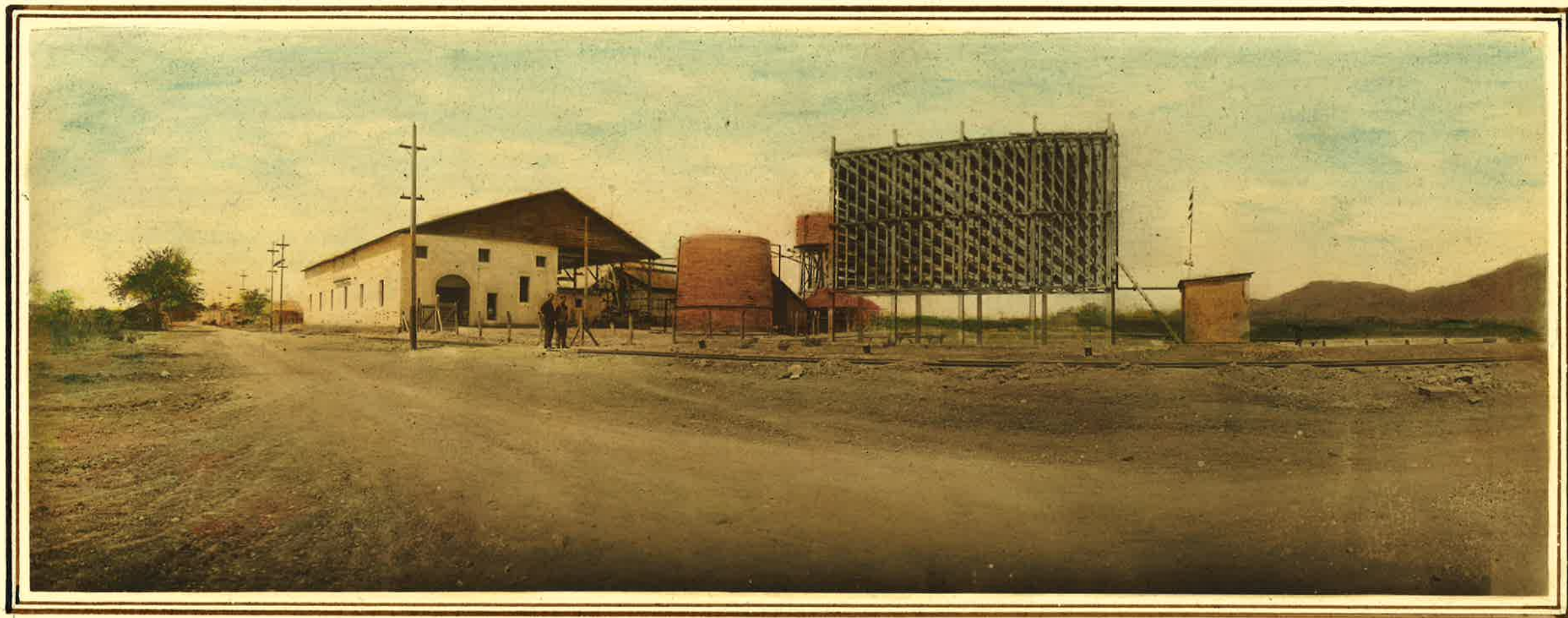




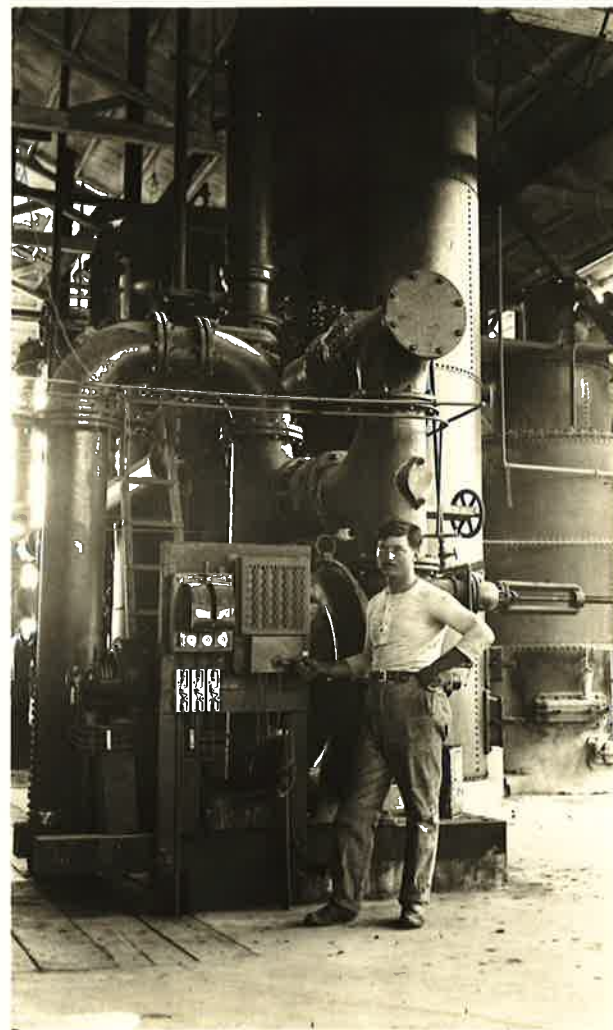
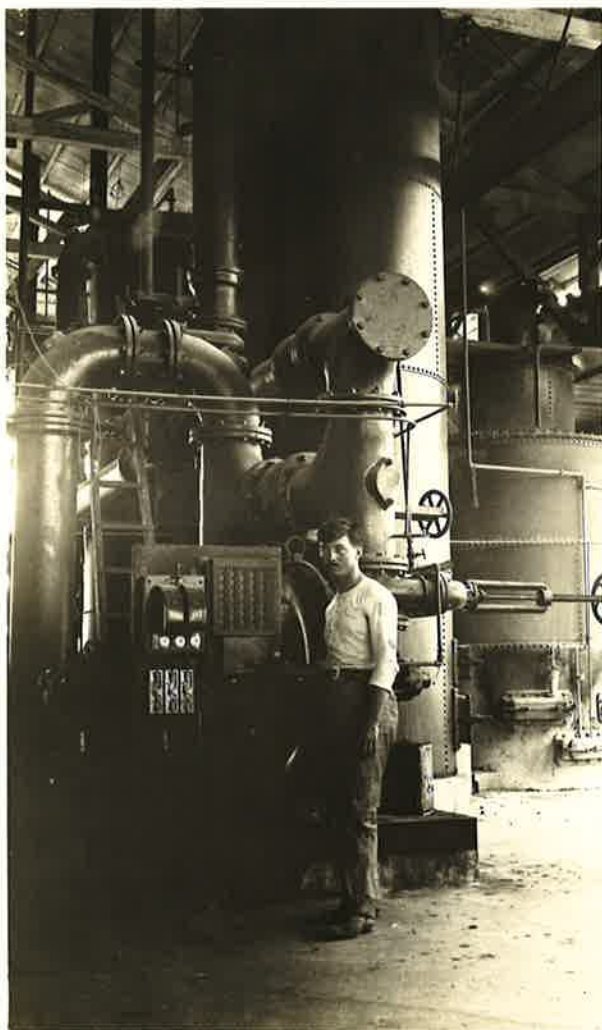
MILL PARTLY ERECTED



WOOD, FORMERLY USED FOR STEAM PURPOSES



POWER PLANT



GAS PRODUCERS, POWER PLANT



GENERAL VIEW SHOWING LOCATION SHOPS 1906



ROSARIO IN THE DISTANCE



MILL CONSTRUCTION







MILL CONSTRUCTION



NEW MILL IN CONSTRUCTION



Batteri foundations Tajo Mill



Ore Train



OPEN CUT



CHURCH



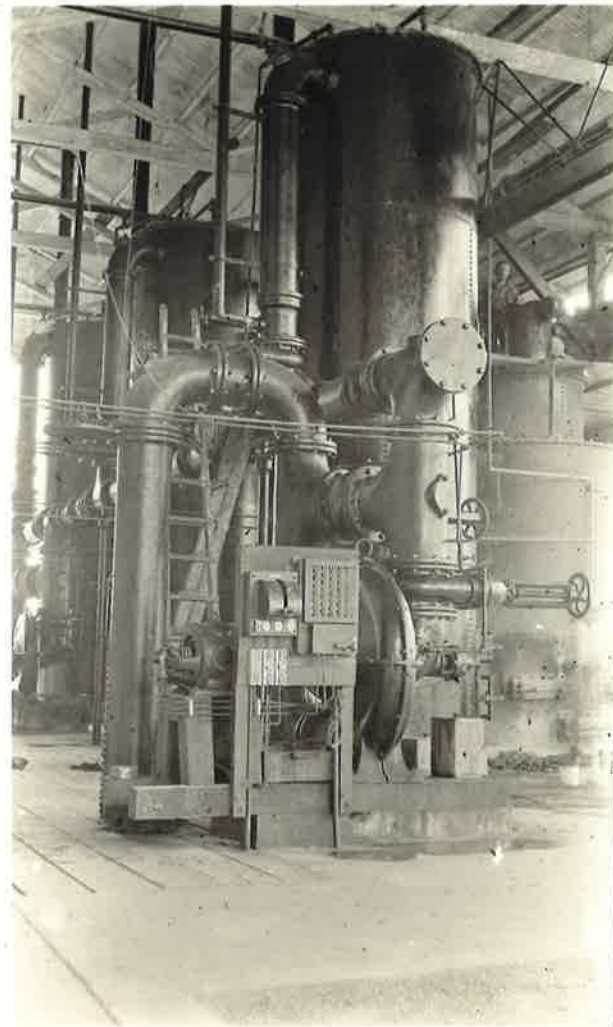
MINERS GOING OFF SHIFT



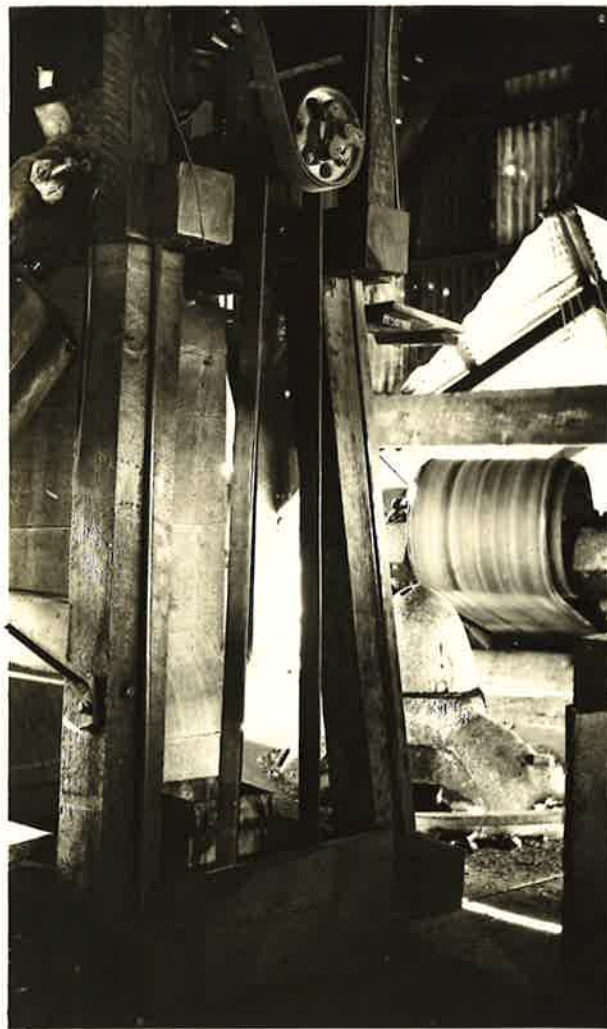
OPEN CUTS



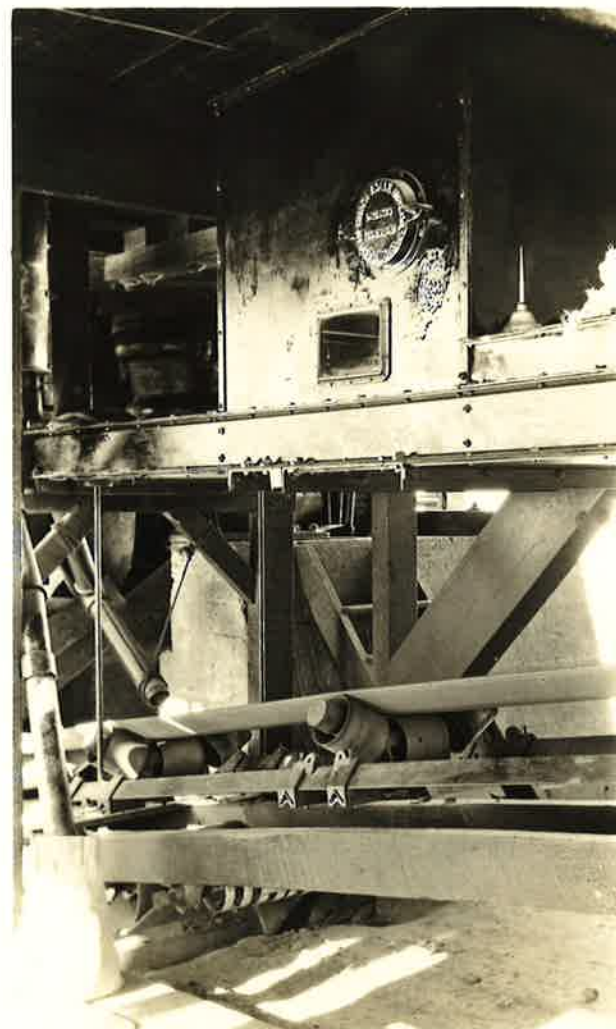
Tajo Mill



GAS PRODUCERS



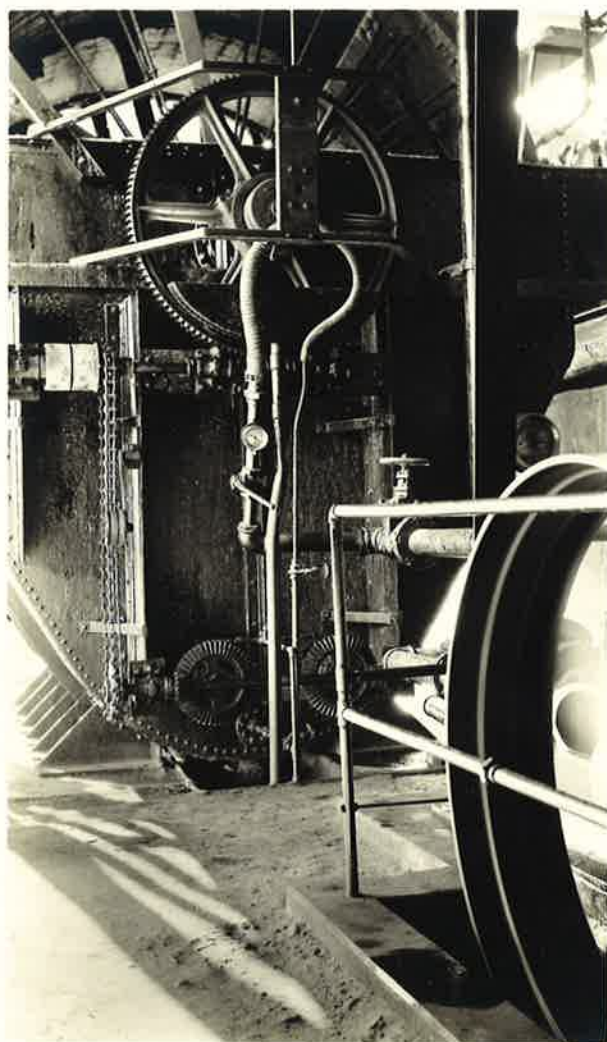
SAMPLING MACHINES



WEIGHING MACHINE



SAMPLING PLANT



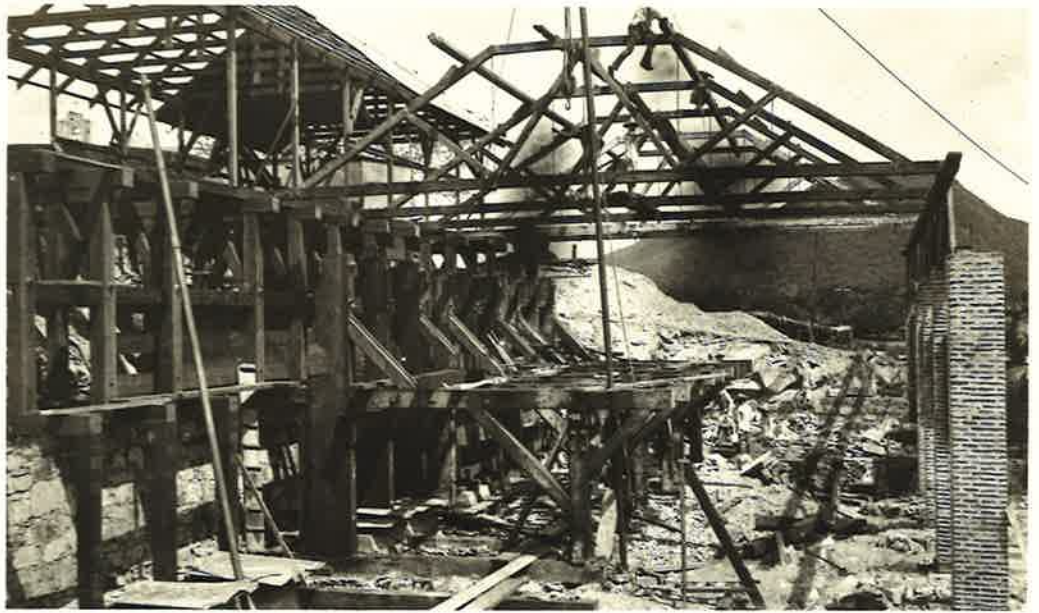
OLIVER FILTER



ASSAY FURNACE



CONE TANK THICKENER



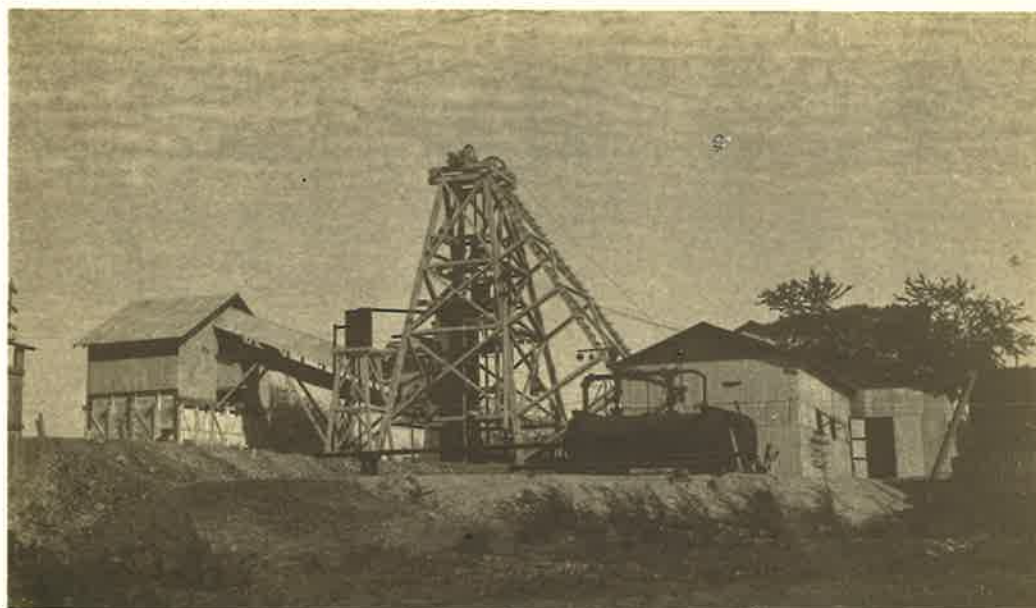
Mill Construction



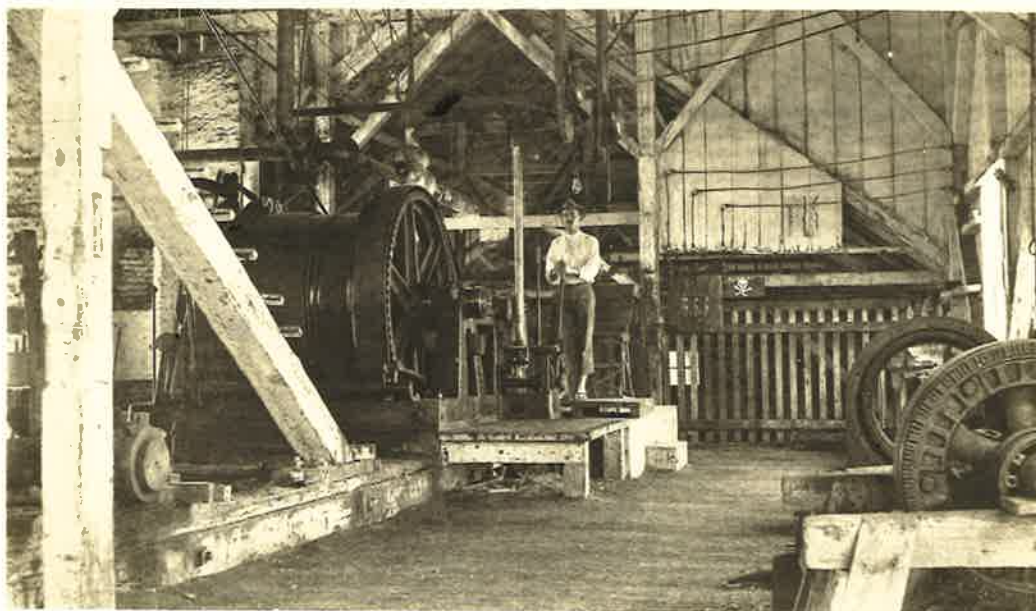


Mill Construction

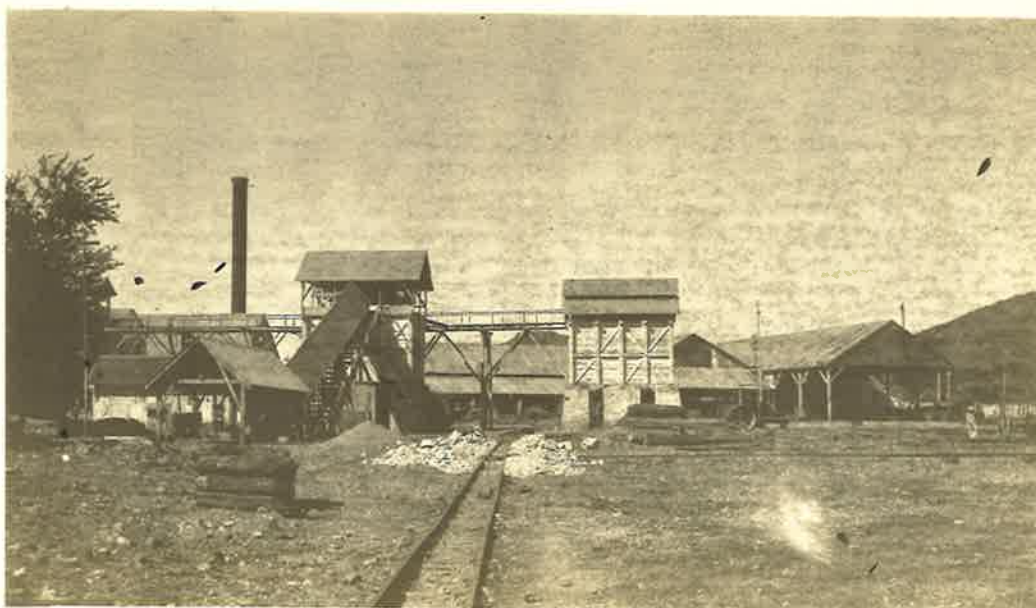




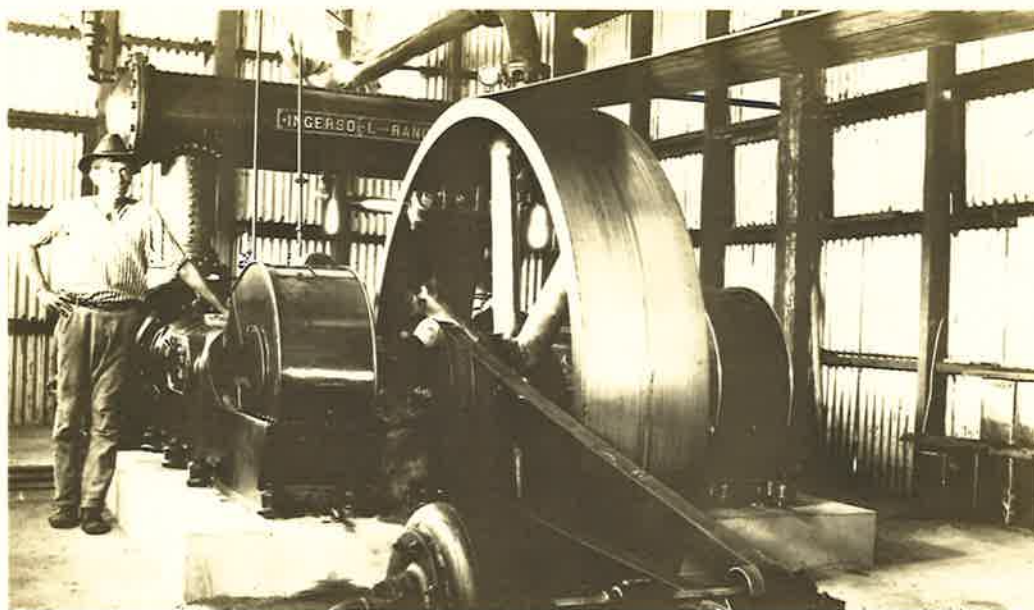
San Antonio Gallows Frame



Electric Hoist Tiro Real



Ore Bins



Air Compressor



San Antonio Gallows Frame



Open Cut



Railroad Construction





Railroad construction



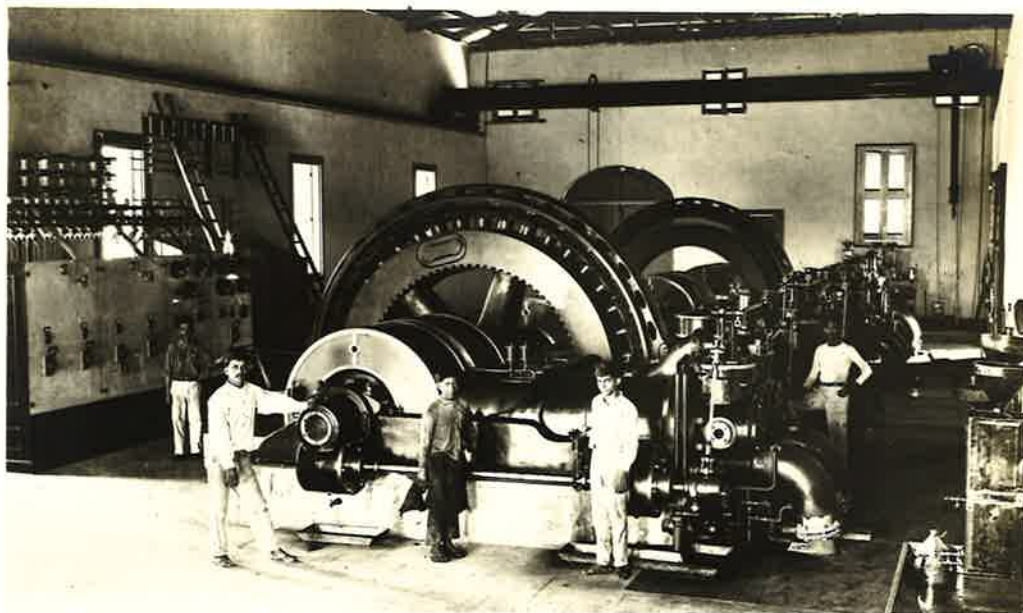


Ore Train

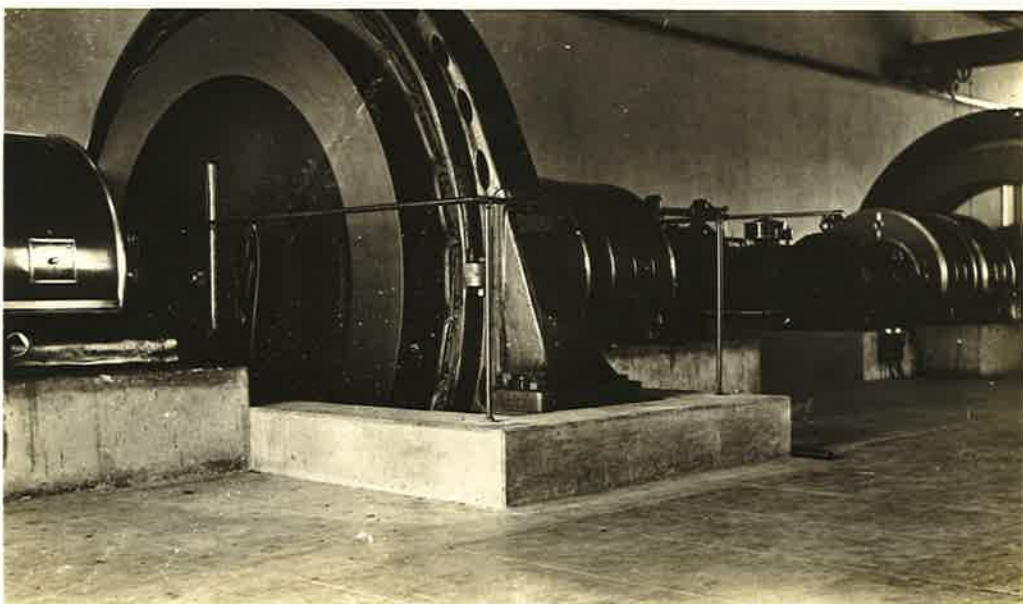
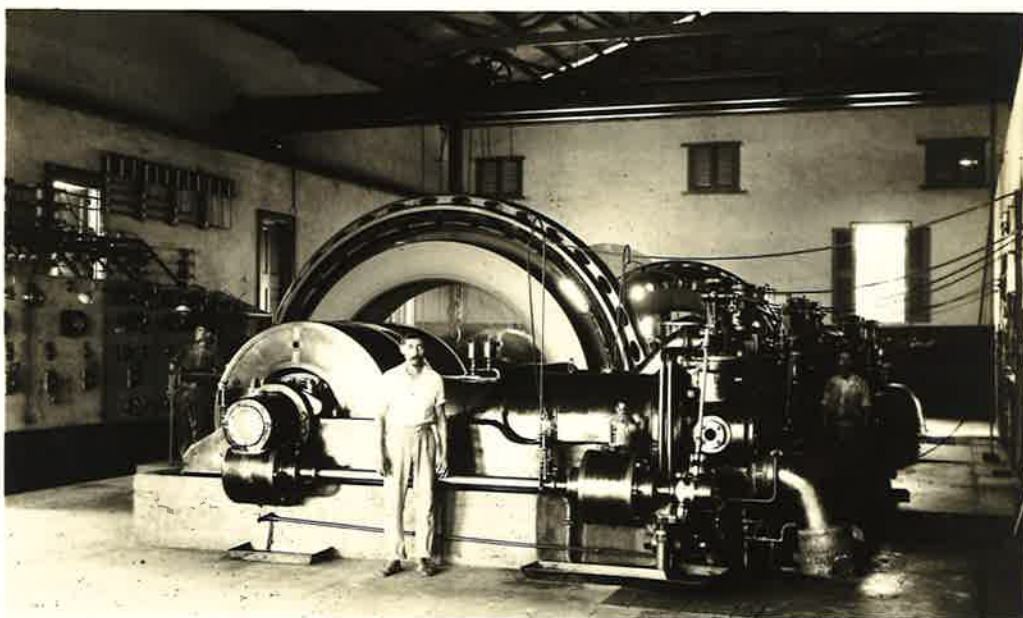


Railroad Construction



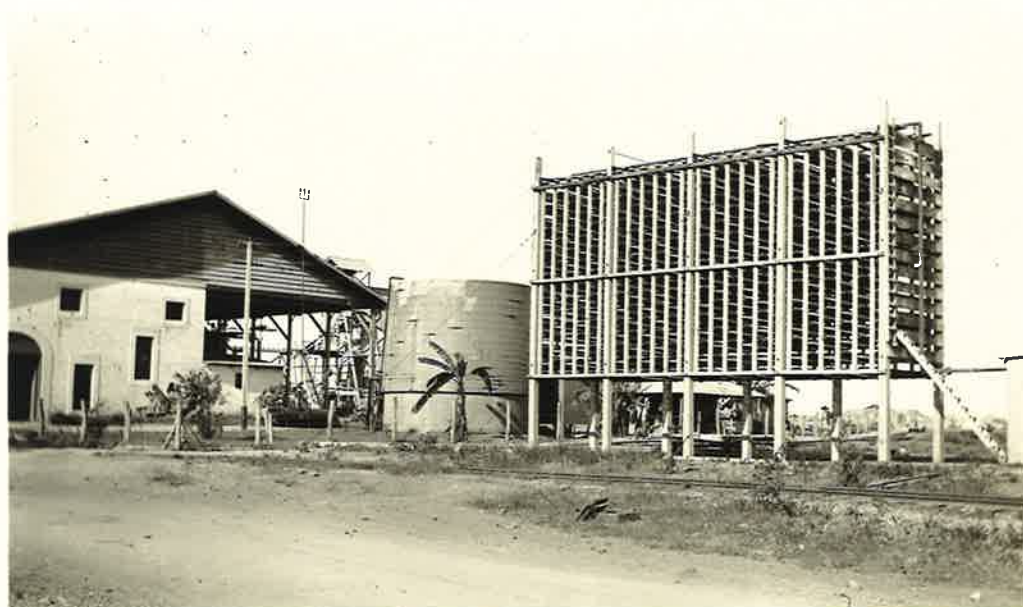


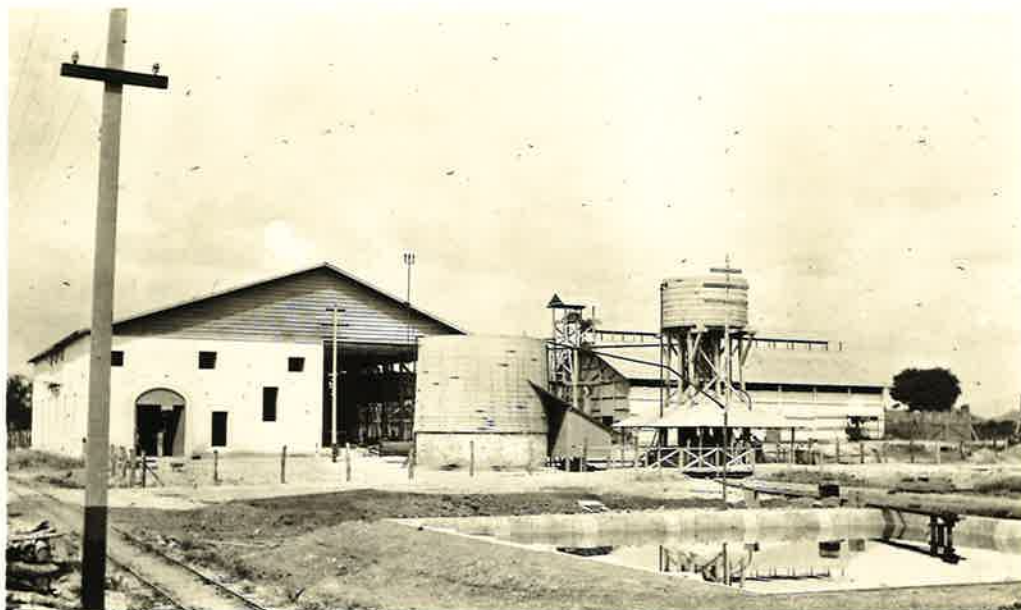
Otto Deutz Gas Engines





Power Plant



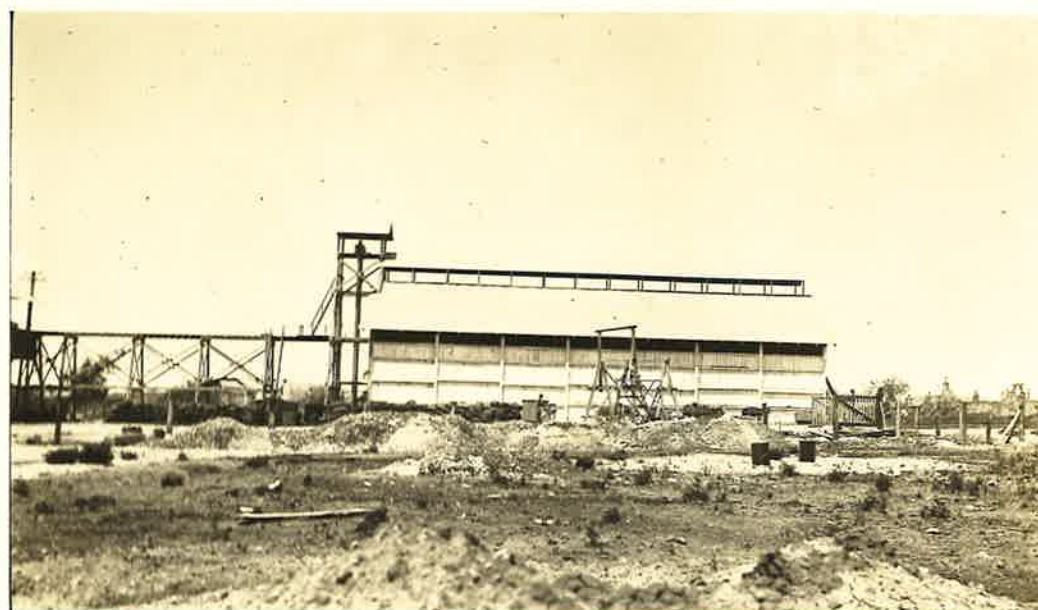


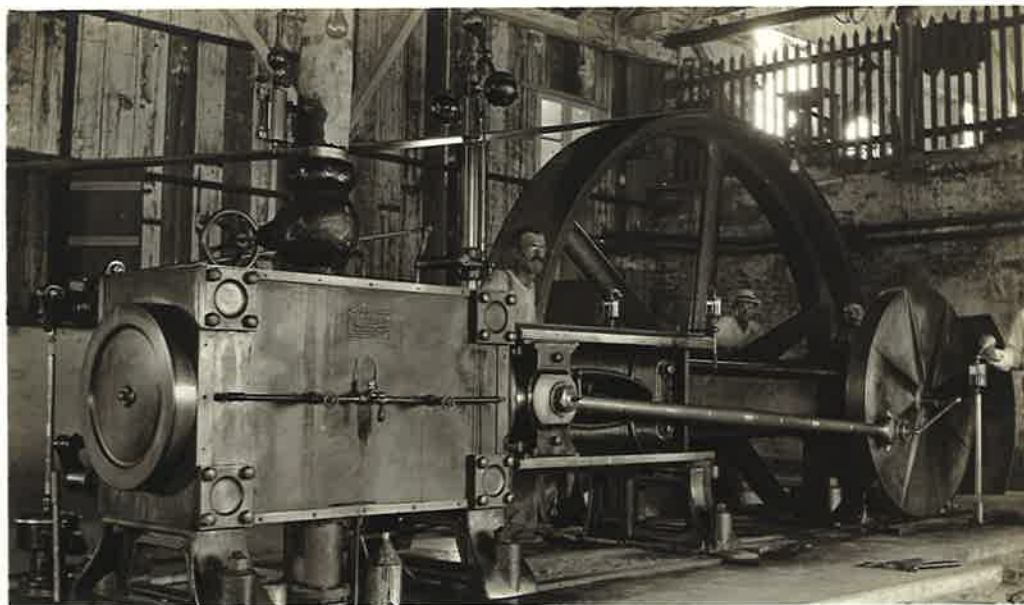
Power Plant





Power Plant



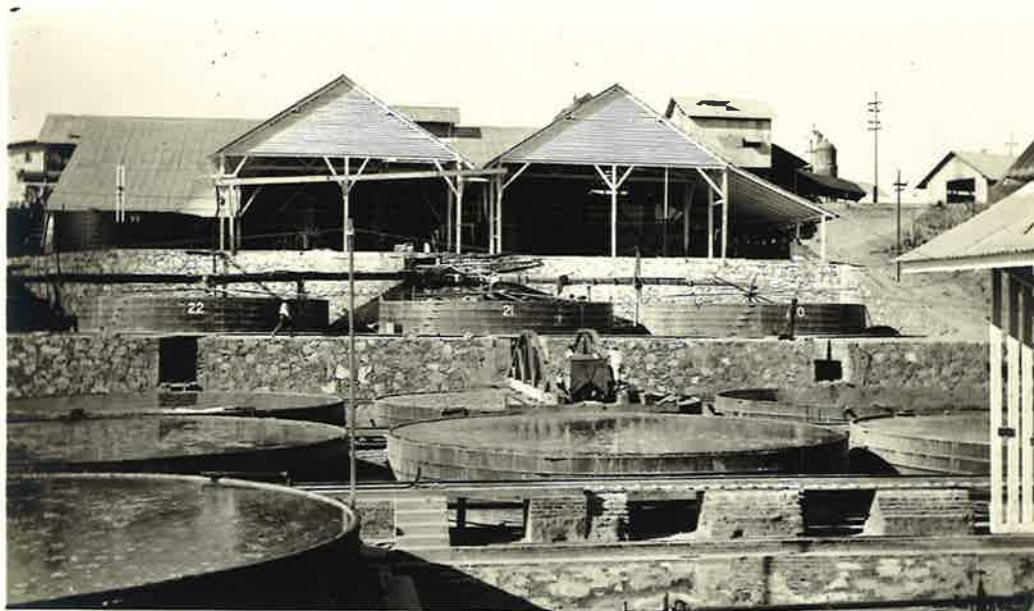


Corliss Steam Engine



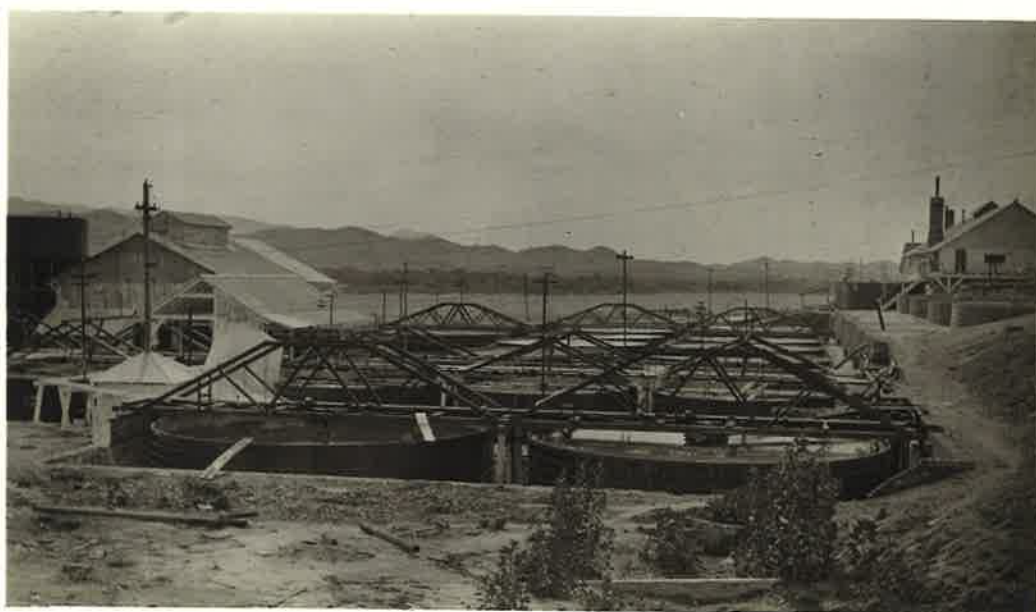


Cyanide Plant



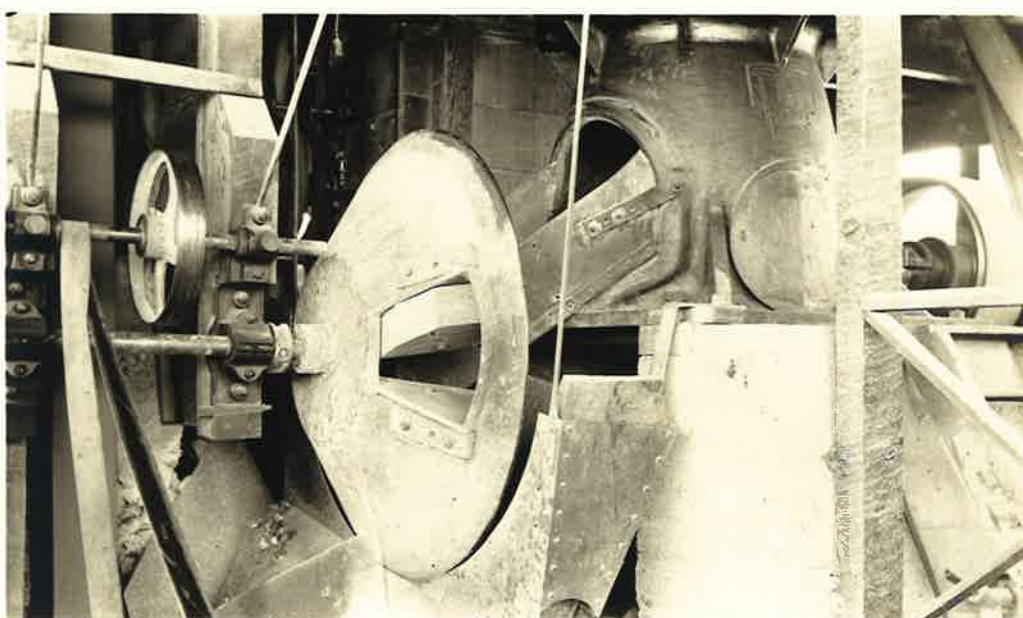


Cyanide Plant





Oliver Filters

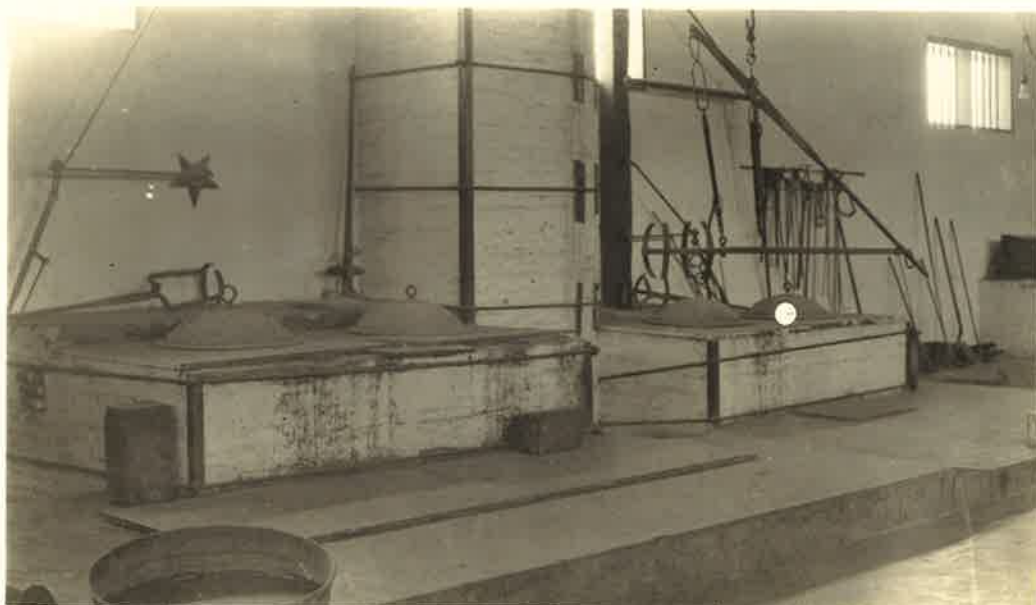


Snyder Samplers





Precipitation Boxes



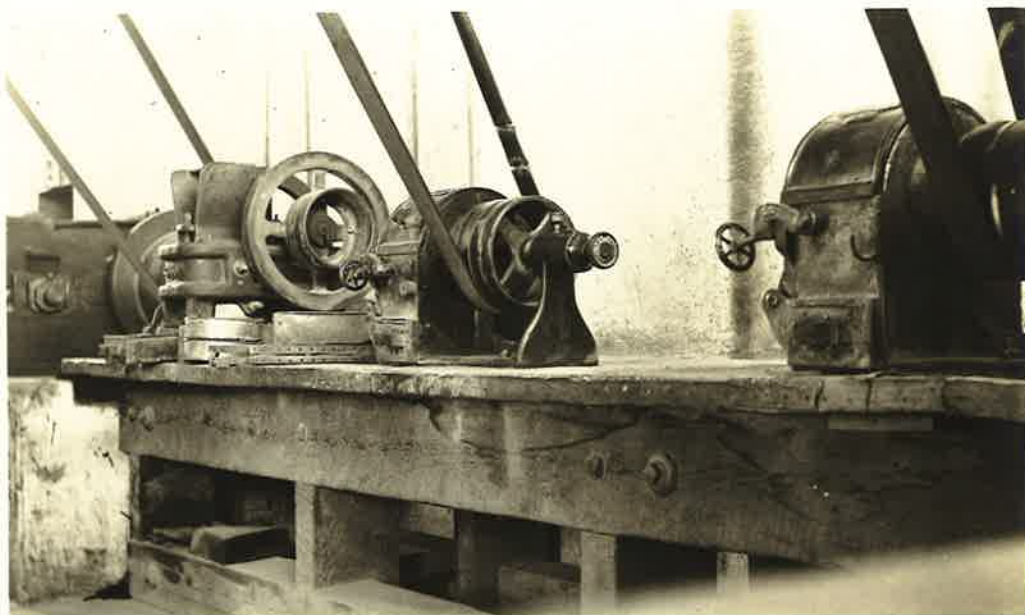
Melting Furnaces



Zinc Boxes



Assaying Department



Machines for gringing samples



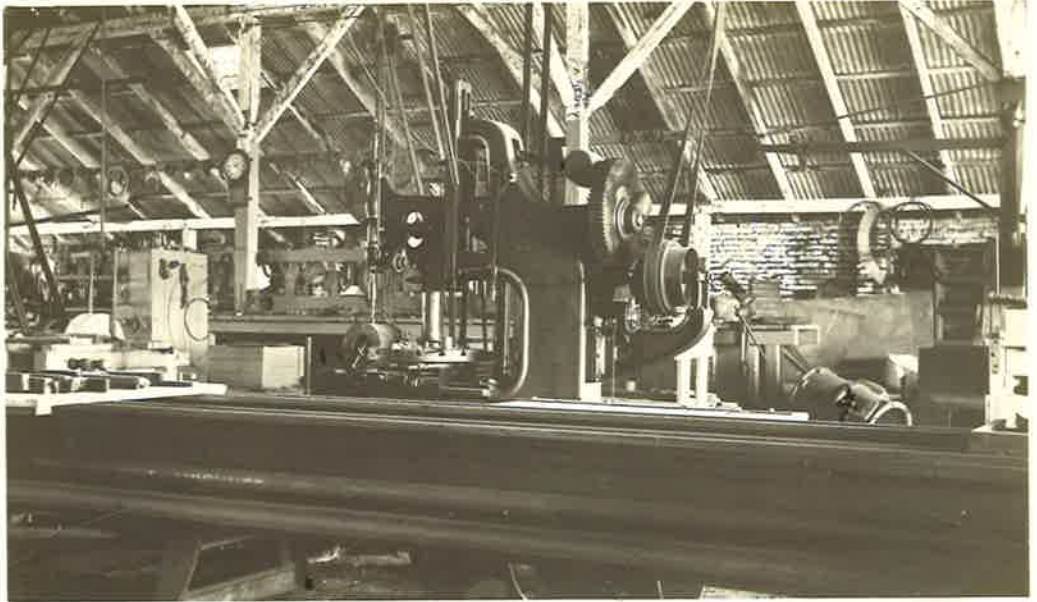


Pay Office

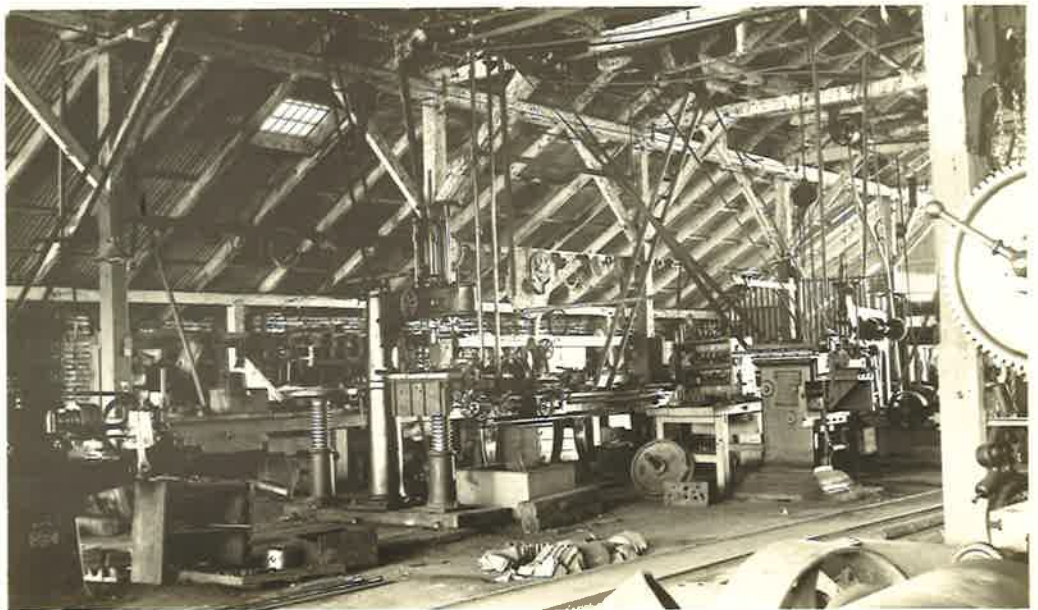
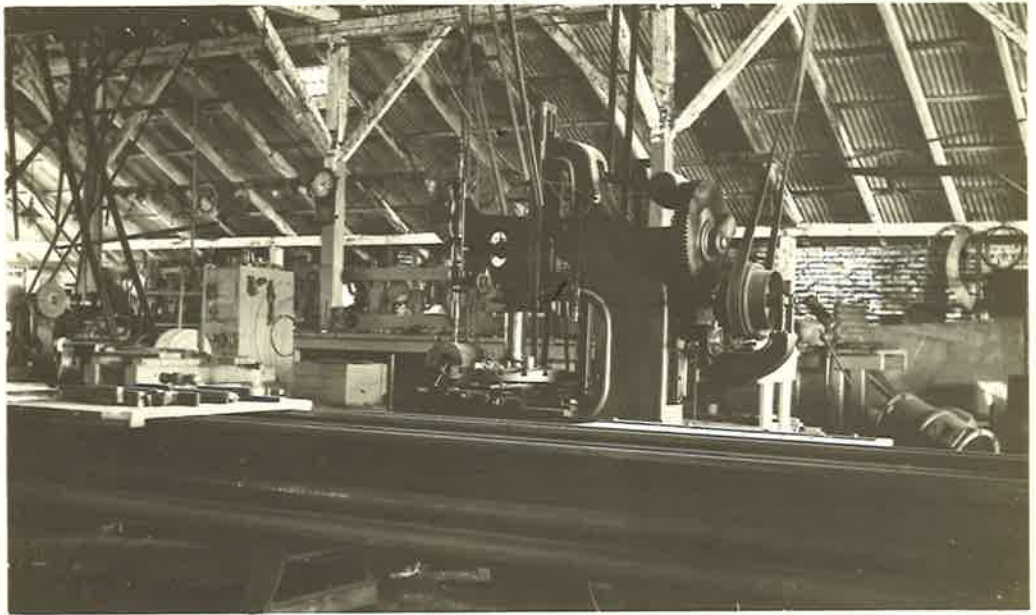


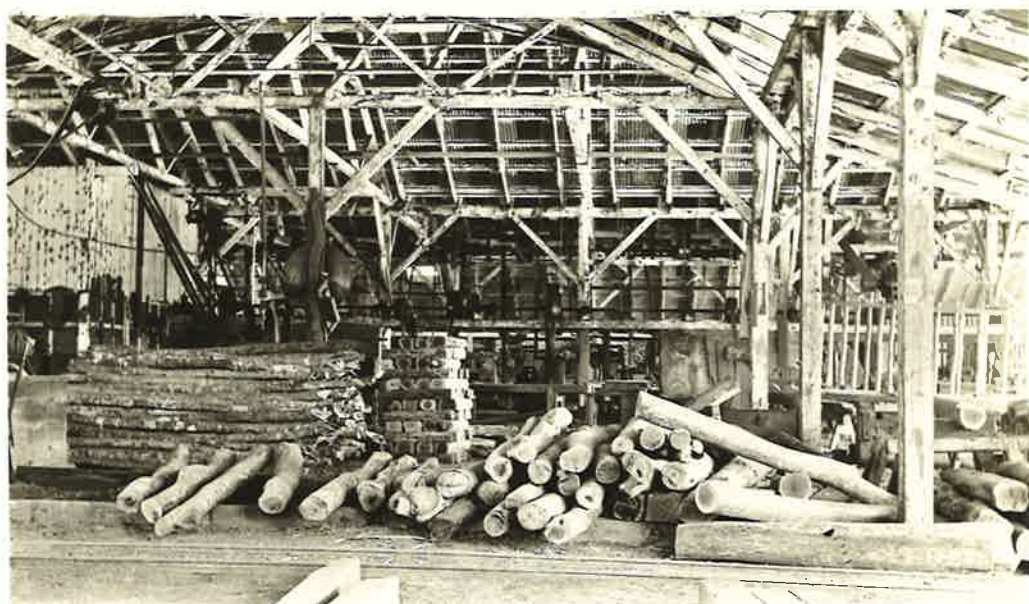
General Almacén





Machine Shops





Timber framing shops





Road between Mill and Mine





Powder Magazine



Chapel



Road to Station



Looking toward Tiro Real from Loma Santiago





Mexican Soldiers



City Reservoir



Storehouse